Appendix B

San Joaquin River Exchange Contractors Water Authority, 25-Year Water Transfer Program Water Resources Analysis

Water Transfer Program for the San Joaquin River Exchange Contractors Water Authority, 2014–2038

Draft
May 2012

San Joaquin River Exchange Contractors Water Authority 25-Year Water Transfer Program Water Resources Analysis

Prepared for
San Joaquin River Exchange Contractors Water Authority

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March 2012

San Joaquin River Exchange Contractors Water Authority 25-Year Water Transfer Program Water Resources Analysis

1. Introduction

The San Joaquin River Exchange Contractors Water Authority[1] (Exchange Contractors) proposes to transfer up to 150,000 acre-feet of substitute water to several potential users over a 25-year timeframe. The water could provide a supply for the following uses:

- Temporary water supplies for Incremental Level 4 requirements for the San Joaquin Valley and Tulare Basin wildlife refuges;
- Temporary water supplies for Central Valley Project (CVP) agricultural service and M&I contractors as supplemental water supplies to support agriculture and/or M&I uses when full contract deliveries cannot otherwise be made;
- Temporary water supplies to Friant Division CVP repayment contractors for the production of agricultural crops or livestock because of water supply shortages or when full contract deliveries cannot otherwise be made;
- Temporary water supplies to State Water Project (SWP) contractors (Kern County Water Agency - KCWA) for agricultural and/or M&I supply; and
- Seasonal flexibility of deliveries to the Exchange Contractors through exchange with CVP agricultural service and M&I contractors and SWP contractors wherein water would be delivered and then returned at a later date.

The Exchange Contractors are currently (March 1, 2005, through February 28, 2014) transferring water under a 10-year water transfer program ("Current Program"). The Current Program consists of the annual transfer of up to 130,000 acre-feet of substitute water, with the Exchange Contractors temporarily reducing their deliveries from Reclamation through various means, including a maximum of 80,000 acre-feet of developed water from conservation measures, including tailwater recovery and groundwater pumping and a maximum of 50,000 acre-feet from temporary land fallowing. This analysis and report describes the proposed action of the Exchange Contractors to substantially continue the Current Program for the transfer or exchange of their CVP water (up to 130,000 acre-feet total per year without use of groundwater for the transfer) and expand the transfer by up to 20,000 acre-feet of conserved water (up to a total of l00,000 acre-feet of conserved water and up to a total of 50,000 acre-feet of water from fallowed land or a total of up to 150,000 acre-feet). The proposed action also includes authorization to transfer portions of the water to not only those CVP contractors who were included in the existing program but also to additional CVP and SWP contractors in Alameda, Contra Costa, Monterey, Santa Cruz, and Kern counties.

2. Hydrologic Setting

2.1 Exchange Contractors

The Exchange Contractors provide water deliveries to over 240,000 acres of irrigable land on the west-side of the San Joaquin Valley, spanning a distance roughly from the town of Mendota in the south to the town of Crows Landing in the north. Through the contract titled Second Amended Contract for Exchange of Waters (the "Exchange Contract")(USBR1967), Reclamation provides a substitute water supply to the Exchange Contractors in exchange for waters of the San Joaquin River. This water amounts to a supply not to exceed 840,000 acre-feet per year in accordance with monthly and seasonal maximum entitlements. During years defined as critical the annual supply is not to exceed 650,000 acre-feet. Reclamation must plan for and operate the CVP to meet its obligations under the Exchange Contract. The four entities of the Exchange Contractors each have separate conveyance and delivery systems operated independently although integrated within a single operation for performance under the Exchange

[1] The San Joaquin River Exchange Contractors Water Authority consists of Central California Irrigation District (CCID), San Luis Canal Company (SLCC), Firebaugh Canal Water District (FCWD), and Columbia Canal Company (CCC).

Contract. These conveyance and delivery systems generally divert water from the CVP Delta-Mendota Canal (DMC) and the Mendota Pool, convey water to customer delivery turnouts, and at times discharge to tributaries of the San Joaquin River. Deliveries include the conveyance of water to the wildlife management areas. Figure 1 is a vicinity map of the Exchange Contractors' physical setting.

Although unique for each entity, operations generally consist of diverting sufficient flow from the DMC and Mendota Pool to maintain relatively constant water surface elevations within the canal pools throughout the Exchange Contractors' main distribution systems. Depending on the Exchange Contractor entity, water is either directly delivered to community ditch systems of the customers from the main canal systems or water is further conveyed through entity-owned and maintained community ditch systems to ultimate points of delivery. Once delivered, the entities lose control of the water until the farmers' runoff, if any, is intercepted by district facilities.

Groundwater pumping is used to supplement the Exchange Contractors' CVP substitute water supply and to provide delivery capacity. Groundwater pumping is also being used to improve the operational flexibility of the distribution systems. Prior to concerted efforts to recapture drainage, at times runoff would incidentally re-enter an entity's supply system through canals that serve as both supply and drainage conveyance systems. Subsequent to the development of tailwater recapture facilities, the water reused from these facilities has become an important and noticeable component of the Exchange Contractor's water supply.

2.1.1 Exchange Contractors Deliveries

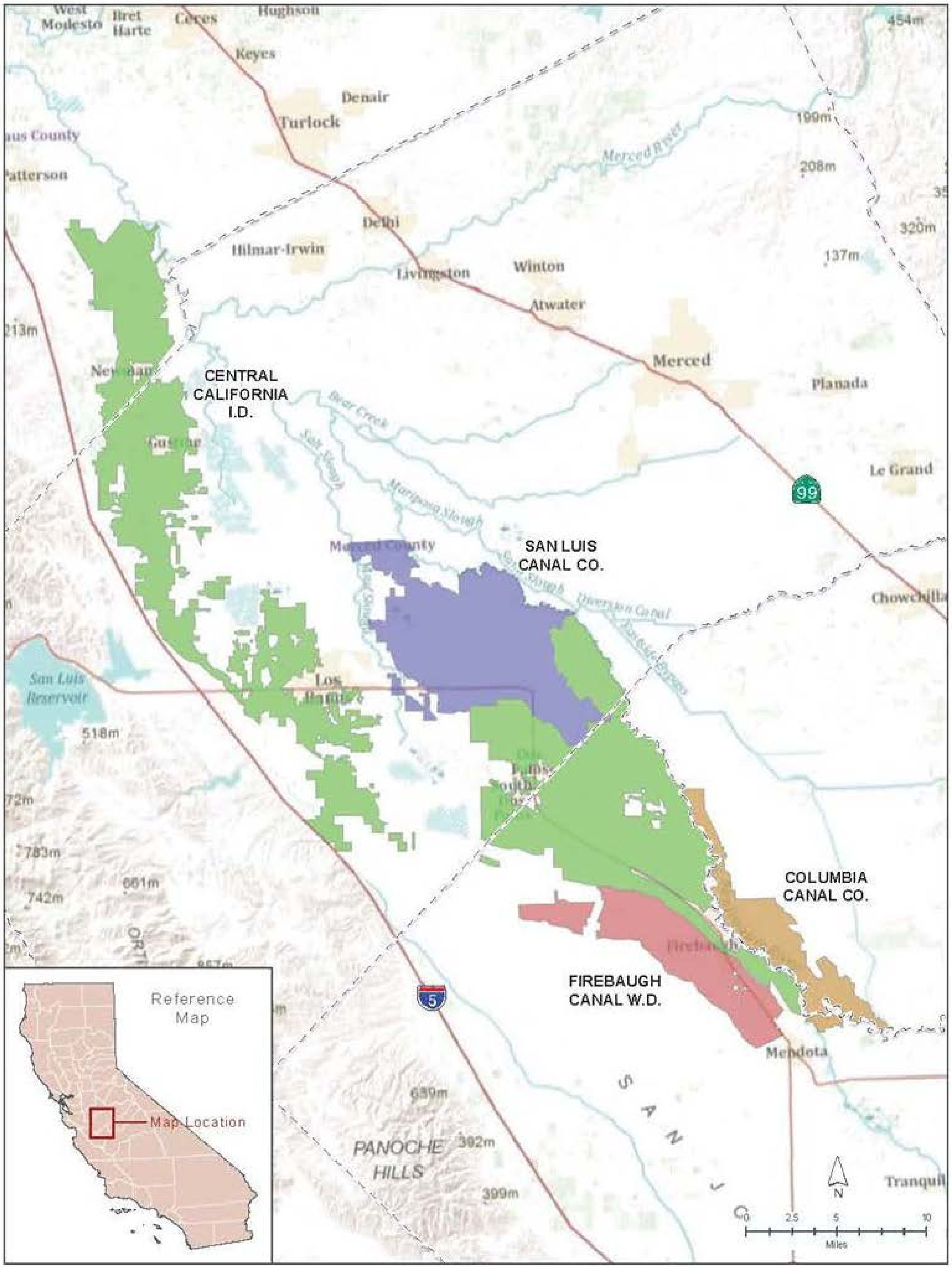
Table 1 illustrates the monthly water deliveries to the Exchange Contractors since 1984. Historically, the summer monthly and season limitations for deliveries under the exchange contract have been a limiting factor to deliveries. Many factors, including flood events within the San Joaquin River Basin, affect the delivery of water during the non-summer period whereby less-than-full delivery of Exchange Contract entitlements may occur; however, the historical record illustrates that the full substitute water supply entitlements are required. The historical record also illustrates the effects of the agreement

Table 1 Exchange Contractors Exchange Contract Delivery Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1984	5,960	44,208	52,291	82,277	119,629	135,253	153,674	142,130	64,501	35,294	2,227	0	837,444
1985	2,949	36,373	79,808	83,265	108,144	131,492	152,868	133,168	70,611	33,771	5,161	0	837,610
1986	5,786	10,215	26,549	66,491	106,329	131,734	156,748	142,758	72,260	33,418	30,346	1,291	783,925
1987	13,234	28,785	50,218	92,646	115,795	135,449	150,883	139,414	61,837	36,391	13,726	93	838,471
1988	9,935	42,829	70,600	61,574	106,265	134,164	154,120	142,195	80,996	36,389	593	0	839,660
1989	3,342	23,624	69,313	83,386	107,746	135,189	149,445	138,555	82,054	31,862	5,001	460	829,977
1990	8,600	32,964	69,419	62,354	71,888	122,902	166,373	142,584	56,997	42,120	9,058	961	786,220
1991	13,979	36,506	39,508	41,939	72,107	110,920	133,257	113,157	41,785	15,827	30,549	412	649,946
1992	4,065	13,341	56,414	54,429	79,337	109,873	125,470	106,320	41,913	19,032	20,308	1,450	631,952
1993	811	5,501	72,107	88,763	105,734	114,534	140,568	147,132	81,000	38,000	25,000	15,000	834,150
1994	6,763	24,142	76,531	56,381	55,990	125,301	145,211	110,615	30,218	28,188	12,839	62	672,241
1995	282	35,995	30,982	41,477	50,972	121,598	150,910	175,519	79,329	83,340	28,805	13,759	812,968
1996	3,399	25,499	45,415	70,430	84,084	136,503	163,583	142,760	45,810	75,830	11,299	7,517	812,129
1997	59	17,527	86,465	63,748	112,579	132,073	179,624	133,050	53,488	44,233	16,489	460	839,795
1998	1,038	3,298	38,727	19,496	29,483	90,258	163,706	162,905	84,592	33,673	14,402	4,559	646,137
1999	11,836	30,430	52,902	52,736	119,251	137,548	167,574	148,129	62,178	32,032	20,972	4,634	840,222
2000	8,177	26,845	50,474	70,088	121,938	142,483	147,989	142,834	57,772	35,497	12,879	15,123	832,099
2001	7,399	39,396	48,906	69,085	125,768	147,853	151,543	131,991	29,647	62,881	20,207	796	835,472
2002	1,908	39,225	65,058	63,889	114,824	148,718	153,196	155,077	49,156	34,045	12,168	1,571	838,835
2003	2,941	51,733	58,557	53,628	92,314	157,616	168,468	144,514	59,127	43,307	6,990	347	839,542
2004	1,425	42,133	66,415	75,363	114,601	138,221	168,255	131,811	49,223	41,526	8,138	2,489	839,600
2005	254	19,980	40,766	51,556	73,298	142,335	182,310	163,237	68,813	37,451	32,635	4,801	817,436
2006	1,025	51,661	28,314	8,191	82,416	144,426	192,203	167,343	73,953	50,468	21,151	18,849	840,000
2007	10,794	58,401	47,074	62,159	125,168	148,099	163,524	121,873	49,252	48,878	2,475	2,256	839,953
2008	1,188	29,074	78,992	76,824	137,355	115,466	142,816	132,515	66,438	47,536	7,906	1,739	837,849
2009	1,026	12,825	64,935	80,080	121,168	135,577	161,002	137,818	77,234	31,618	14,081	711	838,075
2010	435	8,490	48,091	39,424	120,848	149,179	172,664	157,634	81,839	29,629	15,709	10,039	833,981

Units: Acre-feet

Figure 1 Exchange Contractors Service Area



Original figure from Cardno ENTRIX, 2011 between Reclamation and members of the Exchange Contractors that allows flexibility among the monthly maximum delivery entitlements in exchange for the conveyance of water to the wildlife areas (USBR1998a, USBR1998b). The record from 1993, forward, includes transfers made by the Exchange Contractors and counted towards their delivery under the Exchange Contract.

2.1.2 Exchange Contractors Water Transfers

The Exchange Contractors, Reclamation and CVP agricultural contractors conducted a series of one-year transfers during the early 1990s for water developed by Exchange Contractor conservation projects. Reclamation purchased water from the Exchange Contractors for delivery to wildlife areas and water was also sold to CVP SOD contractors. In 1995, Reclamation and the U.S. Fish and Wildlife Service (the Service) initiated a 3-year Interim Water Acquisition Program (WAP) to acquire Incremental Level 4 water for the refuges designated in the CVPIA. In 2000, the Exchange Contractors provided transfer water to Reclamation and CVP SOD contractors under a 5-year program (USBR2000) similar to the Current Program. The amount of water made available for the transfers generally increased with time as additional conservation projects were completed. Revenues from the transfers have been used by the Exchange Contractors to fund, among other items, additional conservation projects, drainage projects and water quality improvement projects. The Exchange Contractors have transferred varying amounts of water to the combination of refuges, agricultural users and urban water users. The WAP continues and is administered by Reclamation and the Service. Table 2 shows water transfers conducted by the Exchange Contractors in recent years, categorized among the Current Program, its predecessor programs, and other transfers.

Table 2 Exchange Contractors Exchange Water Transfer Summary

	Within Exchange Contractors' 10-yr Transfer Program (and similar predecessor programs)			Other Transfers	Total Transfers
Year	To CVP Agricultural and M&I Users (acre-feet)	To Reclamation for Refuges (acre-feet)	Total (acre-feet)	Warren Act, Grower to Grower and VAMP (acre-feet)	(acre-feet)
1993	18,000	0	18,000	0	18,000
1994	0	0	0	0	0
1995	0	25,000	25,000	2,596	27,596
1996	0	30,348	30,348	2,100	32,448
1997	0	40,000	40,000	12,160	52,160
1998	0	0	0	0	0
1999	40,000	20,000	60,000	1,260	61,260
2000	43,000	21,500	64,500	1,360	65,860
2001	15,500	49,000	64,500	5,786	70,286
2002	2,134	63,500	65,634	6,414	72,048
2003	11,637	60,000	71,637	7,402	79,039
2004	30,000	50,210	80,210	10,900	91,110
2005	72,795	7,800	80,595	1,483	82,048
2006	30,417	49,583	80,000	0	80,000
2007	50,228	30,000	80,228	6,841	87,069
2008	61,026	24,132	85,158	15,071	100,229
2009	69,445	18,687	88,132	23,661	111,793
2010	56,981	27,714	84,695	10,798	95,493

Source: J. White, personal communication, 2011.

The Current Program is very simple in function. The Exchange Contractors develop sources of water to temporarily reduce the need for delivery of substitute water by Reclamation. The sources of water developed by the Exchange Contractors include conservation, tailwater recapture, groundwater and voluntary temporary land fallowing. For each acre-foot of water developed by the Exchange Contractors, an in-kind amount of water is considered acquired and left within the CVP for Reclamation to deliver to CVP contractors or wildlife areas. Physically, for each acre-foot of water transferred, a reduction of one acre-foot diversion occurs at the delivery points of the Exchange Contractors. For purposes of accounting water delivered to the Exchange Contractors under the Exchange Contract, water counted as transferred appears as water delivered to the Exchange Contractors (USBR2004).

Various components of water have been developed and used by the Exchange Contractors for the Current Program:

- Evaporation/seepage of tailwater: the reduction of water to the atmosphere/ground associated with runoff to the end of fields that is now not occurring because of tailwater recapture facilities and improvements in irrigation efficiencies;
- Runoff spills to non-district lands: the reduction of tailwater leaving the districts' boundaries to the refuges and non-district lands;
- Discharge to Mud/Salt Sloughs: reductions of surface water escapes to San Joaquin River-connected streams, developed by the tailwater recapture pumps;
- Tailwater recovery upstream of Sack Dam: tailwater recaptures occurring in CCC that reduces escapes back to the reach below Mendota Dam;
- Groundwater substitution: District pumping used to offset substitute supply deliveries from Reclamation; and,
- Temporary Rotational Land Fallowing: land temporarily idled to reduce water demand.

The environmental documentation (USBR2004) of the Current Program identified the effect of the transfers (development of the water) upon San Joaquin River hydrology. A mathematical protocol was developed between each component of developed water and the potential hydrologic impact in the San Joaquin River. In the end, only a portion of the actions affecting tailwater would affect flow in the San Joaquin River. The other components were effectively "unconnected" to San Joaquin River flow. Even with potential flow changes identified for the San Joaquin River, no significant environmental impacts were cited. However, it was identified that the water supply of the CVP may be affected by changes in San Joaquin River flows.

Each year, analysis and documentation of the Current Program is provided to Reclamation for review of potential hydrologic and water supply effects the transfers might have had upon San Joaquin River hydrology and the CVP water supply (Steiner1-11). Table 3 illustrates the components of water and annual amount of water that has been developed by the Exchange Contractors with the Current Program and its predecessor program since 2000.

Table 3 Exchange Contractors Developed Water

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Components of Developed Transfer Water											
Tailwater Recapture											
Evaporation/Seepage to Groundwater	15.0	15.0	15.0	15.0	15.0	15.0	15.0	12.9	14.3	14.3	14.3
Spills to Adjacent Lands/Refuges	14.0	14.0	14.0	14.0	14.0	14.0	14.0	12.1	13.3	13.3	13.3
Dischage to SJR-connected streams	26.0	25.4	24.4	31.6	32.2	38.9	31.9	35.5	34.1	40.6	40.6
Dischage to SJR u/s Sack Dam	4.5	5.1	6.1	5.0	7.0	6.1	7.7	6.7	5.3	5.8	5.8
Total	59.5	59.5	59.5	65.6	68.2	74.0	68.5	67.1	67.0	74.0	74.0
Temporary Land Fallowing	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.2	5.2	8.1	4.7
Groundwater Substitution *	5.0	5.0	6.0	6.0	12.0	6.0	11.5	12.9	13.0	6.0	6.0
Total (1,000 acre-feet)	64.5	64.5	65.5	71.6	80.2	80.6	80.0	80.2	85.2	88.1	84.7

* Assumed during annual post-accounting.

The transfers have been provided to several CVP entities, including CVP SOD agricultural and municipal contractors and Reclamation for delivery to refuges and wildlife management areas. Table 4 shows the amount of water transferred since 2000, and the entity to which it was delivered.

Table 4 Transferees of Exchange Contractors' Developed Water

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
USBR (Refuges)	21,500	49,000	63,500	60,000	50,210	7,800	49,583	30,000	24,132	18,687	27,714
Water Districts											
Westlands WD						53,958	24,869	41,994	42,021	43,540	46,496
San Luis WD						6,992	2,303	4,584	7,957	9,538	3,455
Panoche WD						4,411		3,650	4,969	4,851	1,443
Pacheco WD						473			309	865	
Del Puerto WD						4,000	2,602		4,623	4,970	
Mercy Springs - Panoche						133					
Santa Clara Valley WD						2,828	643	0	1,147	5,681	5,587
Total	43,000	15,500	2,000	11,637	30,000	72,795	30,417	50,228	61,026	69,445	56,981
Total Developed/Transferred (acre-feet)	64,500	64,500	65,500	71,637	80,210	80,595	80,000	80,228	85,158	88,132	84,695

The hydrologic effect of the transfers upon San Joaquin River hydrology and CVP water supply has varied from year to year as a consequence of the components used to develop the transfer water, the volume developed, the pattern of development, the disposition of the water, and the hydrologic and operational state of the San Joaquin River and Sacramento-San Joaquin River Delta. After each year, a post-assessment of the transfer occurs. Analysis of the potential effects of the transfers involves estimating the linkage between the past year's development of transfer water (e.g., tailwater recapture) and San Joaquin River hydrology. As stated above, it was concluded in previous analysis tailwater recapture is the primary component that directly affects San Joaquin River hydrology. It is assumed that a portion of temporary land fallowing could affect San Joaquin River hydrology to a minor extent.

Although mathematically derived by assumed protocols that link the Exchange Contractors' actions to hydrologic effects to the San Joaquin River, the results should be viewed in a context of the magnitude of the flow regime within which the estimated change is compared, The estimated change in flow or quality can be one or two orders of magnitude smaller than the flow or quality being affected, arguably less than could be accurately measured or influential in causing a change to CVP operations. However, once a change in flow attributed to the developed water is estimated, both in magnitude and pattern, a layering of the estimated effect of the developed water (the change in flow) is layered into the past year's record of San Joaquin River hydrology. Several steps of analyses occur. First, an estimate of the affect to San Joaquin flow upstream of the Stanislaus River confluence is determined. That affect is then used to determine if the operation of Reclamation's New Melones Project might have been affected by the development of the transfer water. The New Melones Project, at times, operates for San Joaquin River flow and water quality objectives and a change in San Joaquin River hydrology upstream of the confluence may affect, positively or negatively, that operation. Subsequent to estimating the change in San Joaquin River hydrology including the potential change in the New Melones Project operation, the CVP's Delta water supply is evaluated in the context of a potentially modified San Joaquin River hydrology.

The year by year transfer approval process with Reclamation addresses the previous years' potential effect on CVP supplies and the New Melones Project operation, and to date no net water supply impact has occurred.

The water shown as developed as "tailwater recapture" in Table 3 is only a portion of the water conserved by the Exchange Contractors' tailwater facilities. The Exchange Contractors have invested in over 250 low lift stations for the purpose of tailwater recapture. These facilities improve the Exchange Contractors' ability to meet water delivery capacity needs and offset volumetric diversion requirements. A total installed capacity of over 600 cfs exists within the direct control of the Exchange Contractors. Additional facilities are, or will be available to facilitate the transfers. This stated capacity does not include the on-farm facilities controlled by customers. Table 5 shows the volume of tailwater recapture exercised by the Exchange Contractors since 2003. The exercise of the tailwater recapture facilities affects several aspects of the Exchange Contractors' operations. In summary: 1) less water will evaporate, or seep to the groundwater basin, 2) less water will be inadvertently discharged to non-district lands, and 3) less water will be discharged to Salt Slough and Mud Slough or other runoff escape locations.

Table 5 Relift Pumping by Exchange Contractors

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2003	455	9,104	12,469	10,456	12,755	24,435	29,797	24,448	13,789	7,067	1,604	246	146,626
2004	88	7,139	9,705	8,491	11,308	23,134	27,941	20,573	8,583	6,365	1,342	169	124,838
2005	895	3,293	5,073	10,229	10,401	21,712	25,724	25,198	8,277	4,919	4,328	1,828	121,876
2006	2,116	13,304	4,719	1,898	9,973	21,151	28,958	25,278	9,817	4,133	126	0	121,473
2007	4,169	15,333	9,386	8,876	16,458	26,747	30,186	24,348	9,666	7,054	0	0	152,223
2008	4,018	9,978	13,273	12,432	16,593	20,702	22,913	21,636	8,117	4,461	3,402	405	137,930
2009	1,944	8,071	11,688	10,592	13,155	20,876	23,365	18,029	8,336	3,074	2,831	12	121,973
2010	2,946	6,063	6,921	5,307	10,780	19,620	24,975	22,959	10,421	2,330	1,023	0	113,345
Average	1,957	9,692	9,104	8,730	12,915	22,980	27,586	23,580	9,708	5,667	1,800	441	134,161

Units: Acre-feet

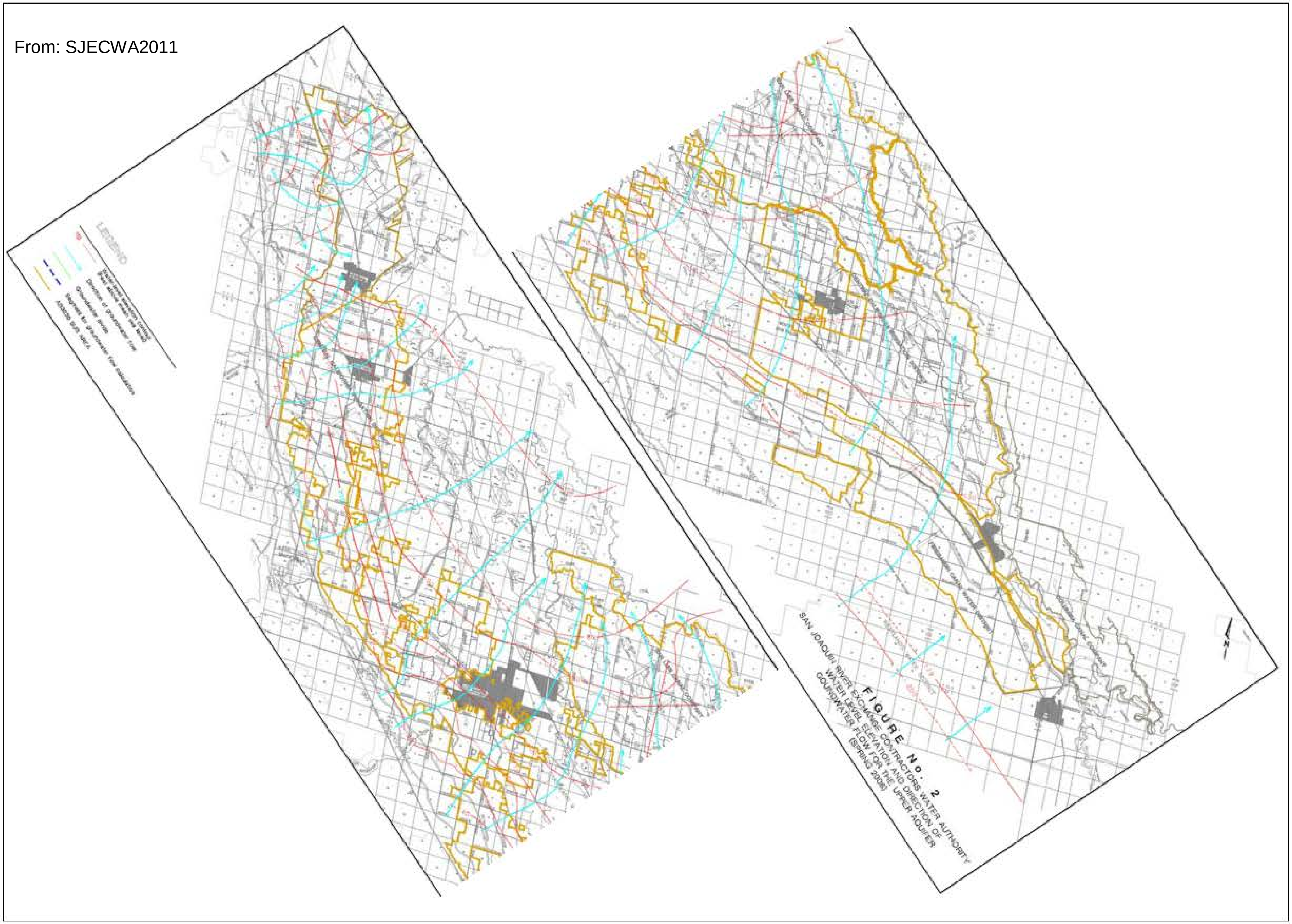
Analysis by CCID and the Exchange Contractors has identified the general movement of groundwater in the upper aquifers (the aquifers used by the Exchange Contractors for “deep well” pumping) that underlie the service area of the Exchange Contractors (CCID1997, SJRECWA2008, SJRECWA2011). Figure 2 depicts water-level contours and direction of groundwater flow above the Corcoran Clay for conditions existing during Spring 2006. In general terms by review of groundwater levels of Spring 1992 and Spring 2006, groundwater was found to enter the service area from upslope areas virtually the entire length of the Exchange Contractors’ boundary. The exception to the circumstance was in the northern end of the boundary where a pumping depression had developed near an area northwest of Newman and south of Crows Landing. This depression had developed from heavy groundwater pumping in the area during the drought of 1987-1992. Review of previous groundwater contours did not indicate an occurrence of such a depression.

West of a north-south line, located about 3 miles west of the San Joaquin River on Highway 152, groundwater flow was primarily to the northeast or north towards the San Joaquin River. In the reach north of an east-west line passing through Gustine, water-level elevation contours on both sides of the river indicates groundwater flow into the river. A general change in direction for groundwater movement is apparent east and west of the north-south line identified above. East of this location groundwater was moving northeasterly beneath the San Joaquin River. This direction of flow is due to extensive pumping that is occurring east of the San Joaquin River in Madera County. The San Joaquin River downstream of Sack Dam and upstream of Bear Creek is normally non-flowing except during flood flow. The location of where the change in direction occurs for migrating groundwater and the point of accreting or depleting San Joaquin River will move along the San Joaquin River depending on year to year changes in the underlying aquifer’s elevation.

For general guidance concerning the magnitude of groundwater accretion that may occur to the San Joaquin River in the vicinity of Lander Avenue, and downstream to the boundary of the Exchange Contractors, Appendix C of the SWRCB Technical Committee Report titled “Regulation of Agricultural Drainage to the San Joaquin River”, estimated that accretions to the river will begin approximately near the Lander Avenue bridge. For the entire length of San Joaquin River channel from Lander Avenue to its confluence with Orestimba Creek, the report estimated that an average annual accretion of 13 cfs occurs from groundwater lateral flow. This estimate includes accretion and depletion affects from both sides of the river.

As described above, groundwater pumping has in the past been identified as a portion of water developed for the Current Program. Since 2000 groundwater has provided, in varying amounts (Table 3), a substitute supply for the Exchange Contractors although it has not been preferred as a source of transfer supply due to its cost of development.

Figure 2 Groundwater Levels and Movement in the Vicinity of the Exchange Contractors Service Area



2.2 San Joaquin River

The San Joaquin River originates in the Sierra Nevada, north and east of Fresno, and empties into the Sacramento-San Joaquin Delta. Numerous tributaries join the San Joaquin River, including three major rivers; the Merced River, the Tuolumne River and the Stanislaus River. Figure 3 illustrates the San Joaquin River Basin and the vicinity of the Exchange Contractors.

The San Joaquin River upstream of Friant Dam is impaired by the operation of several hydropower generation projects. Once reaching Millerton Lake the inflow is then regulated for release to the Friant-Kern Canal, Madera Canal and the San Joaquin River. Currently the operation of the Friant Division (Friant) is transitioning towards the requirements of the Stipulation of Settlement in NRDC, et al., v. Kirk Rodgers, et al. The San Joaquin River Restoration Program (SJRRP) was established in late 2006 to implement Public Law 111-11 which authorizes and directs the Secretary of the Interior to implement the Settlement. (USBR2011)

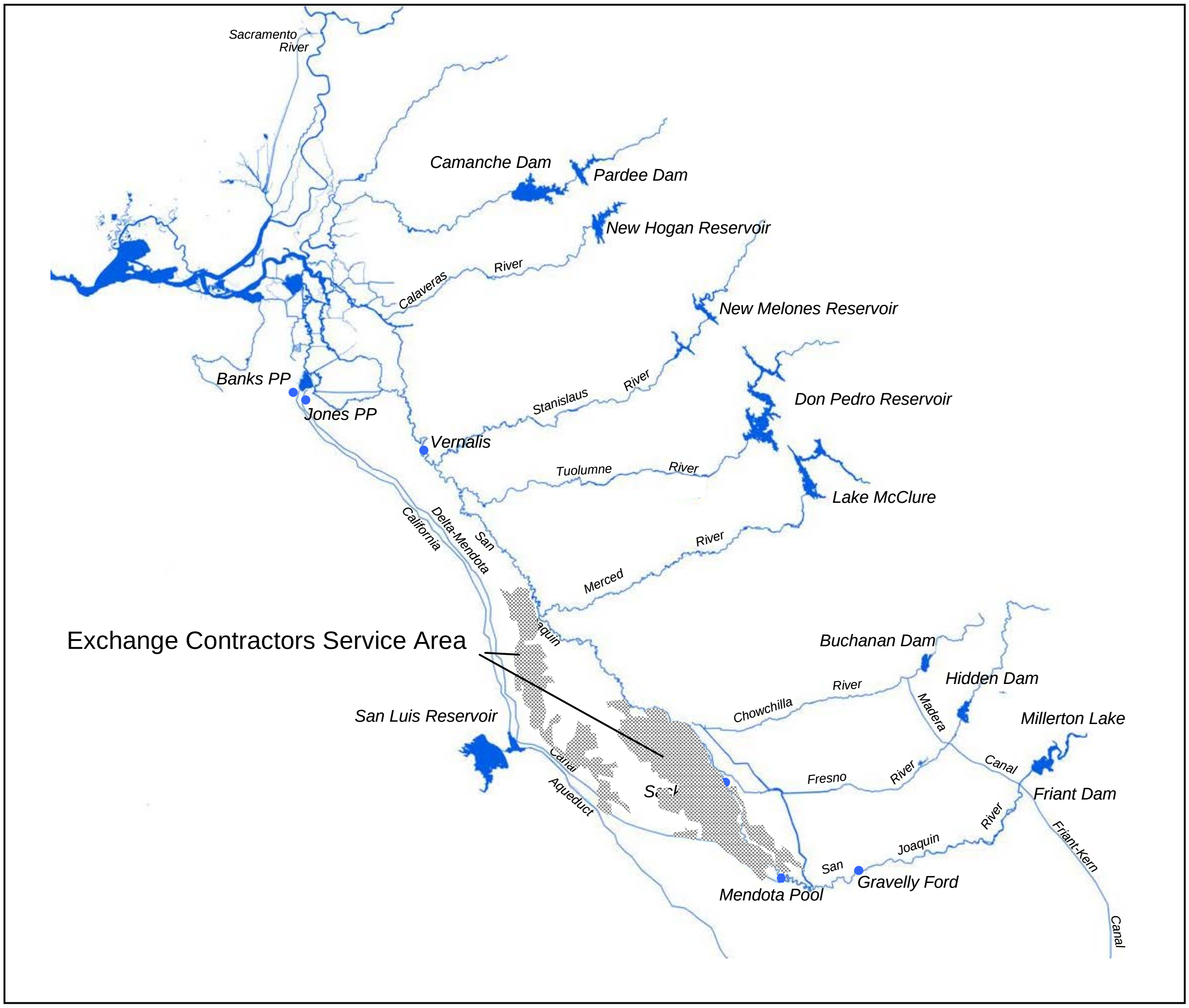
The San Joaquin River from Friant Dam to the Merced River is influenced by the operation of Friant Dam, numerous diversions and depletions, seepage, and runoff and return flows into the stream. Prior to the SJRPP, flow would often end a short distance below Gravelly Ford except during large below-Friant watershed runoff events and during flood control release events at Friant. Water is delivered from the Delta-Mendota Canal and impounded and regulated at Mendota Dam for diversion by the Exchange Contractors and others. During high runoff events on the San Joaquin River and the Kings River Basin, the Delta-Mendota Canal supply is at least partially offset by river flows. The Exchange Contractors release water to conveyance facilities adjoining Mendota Pool and to the river for diversion at Sack Dam. Prior to the SJRRP, Exchange Contractor flows would not move any further than SLCC's diversion at Sack Dam. Flow in the San Joaquin River again would typically cease at this location. Flows would then begin again several miles downstream of Sack Dam as groundwater accretion and return flows would wet the river. One of the directives of the SJRRP is to provide a continuous thread of flow below Friant Dam to the confluence with the Merced River.

The Exchange Contractors' service area is adjacent to the San Joaquin River, and the operation of the Exchange Contractors affect San Joaquin River hydrology. As described earlier, analysis and inspection indicate that applied water can return to the San Joaquin River through surface water runoff including flows through Mud and Salt Sloughs. San Joaquin River flow upstream of the Merced River confluence is also affected by the operation of the Chowchilla Bypass, Eastside Bypass, local tributaries and flows from the Kings River Basin.

The San Joaquin River downstream of the Merced River confluence is significantly influenced by inflows from the Merced River, Tuolumne River and Stanislaus River. All three tributaries originate from the Sierra Nevada east of the San Joaquin River. The rivers operate almost exclusively of each other for their own local objectives. The New Melones Project, operated by Reclamation, also has requirements for San Joaquin River flow and water quality objectives. Although no longer in effect after 2011, the three tributaries and the Exchange Contractors provided coordinated operations during April and May for compliance to flow objectives at Vernalis for the last 13 years. Numerous diversions occur along this reach of the San Joaquin River and flows are also affected by inflows from relatively smaller streams originating from both east and west of the river, and from return flows from numerous entities upslope of the river.

The primary focus of this evaluation is the San Joaquin River as it may be affected by the Proposed Program. A hydrologic baseline is needed to provide the setting to which the proposed transfer program is compared. For CEQA purposes of identifying the hydrologic effects of Proposed Program alternatives and the No Project alternative, the Existing Conditions setting will be the hydrologic baseline for comparison. For NEPA purposes, a future No Action setting will provide this hydrologic baseline.

Figure 3 San Joaquin River Basin and Exchange Contractors Service Area



The Existing Conditions baseline setting of the San Joaquin River represents recent hydrology and circumstances. The recent hydrology of the San Joaquin River has been somewhat dynamic due to changes in regulatory requirements, but overall generally stable other than the effect of varying wetness in the basin. The hydrology includes the effect of Current Program water transfers by the Exchange Contractors and the delivery of that water to wildlife areas and CVP contractors. The wildlife areas' utilization of available water and transfer water represents a condition that includes the existence and operation of the Grassland By-pass Project. The effects of the Grassland By-pass Project itself have been previously documented by Reclamation and the San Luis & Delta-Mendota Water Authority. Other hydrologic circumstances that depict the Existing Condition setting concern the San Joaquin River at Vernalis and the operation of New Melones Reservoir and the Sacramento-San Joaquin Delta (Delta). For each of these items, the then-current regulatory and institutional constraints are included in recorded data. Such constraints include Decision 1641 and varying requirements for Biological Opinions and Court Decisions for Delta operations, and the Interim Plan of Operations for New Melones Reservoir, with a slight change in operation due to recent application of a Biological Opinion for the Stanislaus River. Recent hydrology also includes coordination of flow operations during April and May for the San Joaquin River Agreement (through 2011), and a minor occurrence of flow from the upper San Joaquin River provided by the SJRRP.

The NEPA No Action setting (which serves as the hydrologic baseline for the NEPA comparison of alternatives) and the CEQA No Project setting (collectively referred to as the No Action/No Project setting) depicts a San Joaquin River similar to the circumstances that depict the Existing Conditions setting, only with reasonably foreseeable other actions added and the exception that there are no transfers of water (associated with the Current Program) from the Exchange Contractors. Removed from the Existing Conditions is the recently experienced 8,000 acre-feet of water developed through fallowing which occurred under the Current Program. The level of recent deliveries to the wildlife areas is assumed to continue through purchases of water by Reclamation from entities other than the Exchange Contractors. Additionally, the No Action/No Project setting includes an assumption of full releases of SJRRP flows from Friant Dam.

2.2.1 Existing Conditions

The following is a description of the several elements describing or affecting the CEQA hydrologic baseline condition (Existing Conditions) used in this analysis. Due to evolving development and regulatory circumstances the historical long-term record of hydrology does not provide a constant level of development depiction of the San Joaquin River, Sacramento-San Joaquin Delta and CVP and SWP operations. However, recent hydrology does provide guidance for a description.

2.2.1.1 San Joaquin River at Vernalis. The last 11 years of San Joaquin River hydrology has included a wide range of wetness within the basin. While on average the annual flow volume at Vernalis (2,330,000 acre-feet) has been less than the projected long term average of flow volume (3,000,000 acre-feet per year)[2], the recent period has demonstrated each of the year types defined by the San Joaquin Valley Water Year Hydrologic Classification index (SJRBI)[3], including unique sequences for their occurrence.

Table 6 shows the recorded flow at Vernalis since year 2000, in terms of average monthly flow (cubic feet per second – cfs) and monthly volume (acre-feet). Shown in Table 7 is the record of electrical conductivity (EC) for the same period. Although many factors affect the resultant water quality at Vernalis such as the relative mix of runoff flows and tributary releases and the specific operation of New Melones Reservoir for water quality compliance at Vernalis, there is a general relationship between flow and water quality. Higher tributary releases and lower return flows provide better quality at Vernalis.

The recent historical flow and water quality of the San Joaquin River at Vernalis are additionally illustrated by Figure 4 for an above normal year (as defined by the SJRBI), Figure 5 for a dry year and Figure 6 for a wet year. The hydrology at Vernalis in any particular year is not only dependent upon the current year's

[2] USBR CalSim II studies supporting SJRRP DEIR/S, adapted by Daniel B. Steiner, Consulting Engineer using models depicting current Stanislaus River operations. 2011.
[3] State Water Resources Control Board Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, December 13, 2006.

Table 6 San Joaquin River at Vernalis - Flow

	San Joaquin River Flow at Vernalis (CFS)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	SJRBI
2000	2,136	7,559	12,098	5,013	4,814	2,772	1,898	2,171	2,330	2,826	2,526	2,238	AN
2001	2,442	3,092	3,430	3,008	3,527	1,549	1,400	1,330	1,376	2,003	2,096	2,064	D
2002	2,662	1,898	2,134	2,598	2,739	1,407	1,227	1,116	1,175	1,705	1,715	1,988	D
2003	1,913	1,879	2,193	2,668	2,625	2,034	1,321	1,281	1,308	1,999	1,647	1,503	BN
2004	1,792	2,201	3,361	2,751	2,647	1,404	1,147	1,125	1,121	1,753	1,632	1,578	D
2005	4,918	5,303	8,065	10,153	10,408	9,922	4,160	2,615	2,411	2,619	2,044	3,508	W
2006	13,162	6,458	11,705	27,937	26,055	15,690	5,547	3,697	3,316	3,851	2,538	2,354	W
2007	2,587	2,534	2,555	2,313	3,015	1,640	1,093	1,007	1,013	1,497	1,608	1,518	C
2008	2,230	2,392	2,115	2,409	2,775	1,024	852	853	902	1,235	1,136	1,107	C
2009	1,067	1,405	1,422	1,486	2,130	1,099	606	609	944	1,822	1,400	1,314	BN
2010	2,067	2,528	2,878	4,148	4,890	3,895	1,919	1,288	1,842	2,390	1,902	6,942	AN

	San Joaquin River Flow at Vernalis (Acre-feet)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	131,347	434,783	743,872	298,279	295,978	164,968	116,729	133,470	138,647	173,774	150,290	137,615	2,919,752
2001	150,131	171,731	210,925	178,991	216,896	92,173	86,084	81,760	81,879	123,136	124,722	126,884	1,645,313
2002	163,659	105,383	131,189	154,614	168,399	83,724	75,472	68,649	69,920	104,828	102,031	122,263	1,350,131
2003	117,622	104,352	134,858	158,740	161,417	121,013	81,204	78,745	77,852	122,917	98,005	92,391	1,349,117
2004	110,183	126,627	206,641	163,678	162,746	83,525	70,504	69,192	66,685	107,783	97,092	97,033	1,361,691
2005	302,404	294,530	495,895	604,154	639,976	590,428	255,812	160,822	143,467	161,026	121,614	215,686	3,985,815
2006	809,288	358,637	719,713	1,662,371	1,602,073	933,633	341,063	227,329	197,319	236,770	151,024	144,756	7,383,975
2007	159,077	140,709	157,093	137,655	185,358	97,592	67,201	61,911	60,261	92,054	95,674	93,324	1,347,909
2008	137,100	137,566	130,078	143,328	170,601	60,941	52,372	52,442	53,646	75,920	67,618	68,064	1,149,674
2009	65,616	78,031	87,453	88,444	130,951	65,374	37,264	37,429	56,153	112,048	83,287	80,768	922,817
2010	127,103	140,412	176,968	246,827	300,679	231,752	117,998	79,201	109,628	146,977	113,159	426,869	2,217,573
Average	206,684	190,251	290,426	348,826	366,825	229,557	118,337	95,541	95,951	132,476	109,501	145,968	2,330,343

Table 7 San Joaquin River at Vernalis – Water Quality

	San Joaquin River Flow at Vernalis (EC - µmhos)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	SJRBI
2000	766	565	226	332	352	537	594	497	467	405	569	685	AN
2001	752	712	834	583	387	639	627	651	610	512	627	740	D
2002	734	888	917	521	380	679	582	635	623	532	722	784	D
2003	956	948	966	601	462	448	588	632	627	475	679	773	BN
2004	821	813	702	464	438	613	625	658	690	520	723	852	D
2005	521	612	460	263	167	199	382	475	482	507	703	580	W
2006	198	319	198	128	95	110	359	367	358	297	614	619	W
2007	569	657	653	554	350	490	638	625	654	580	601	759	C
2008	682	750	848	479	365	669	612	599	686	600	763	871	C
2009	961	945	951	553	302	454	532	526	502	415	691	851	BN
2010	814	457	745	409	234	260	429	568	448	434	671	262	AN

Figure 4 San Joaquin River at Vernalis – Above Normal Year

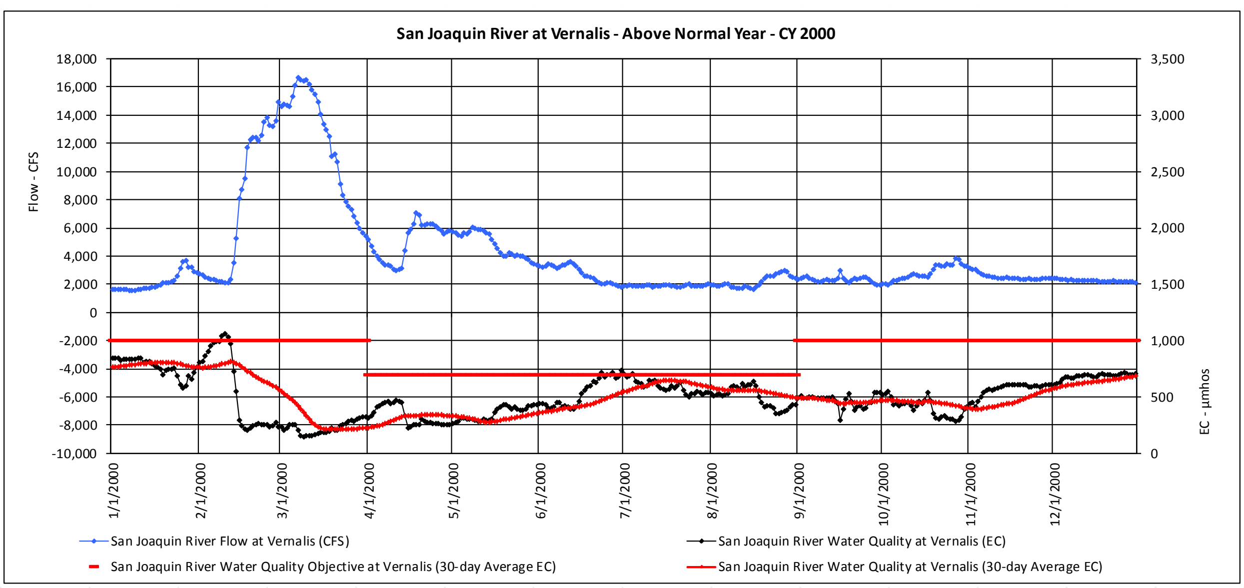


Figure 5 San Joaquin River at Vernalis – Dry Year

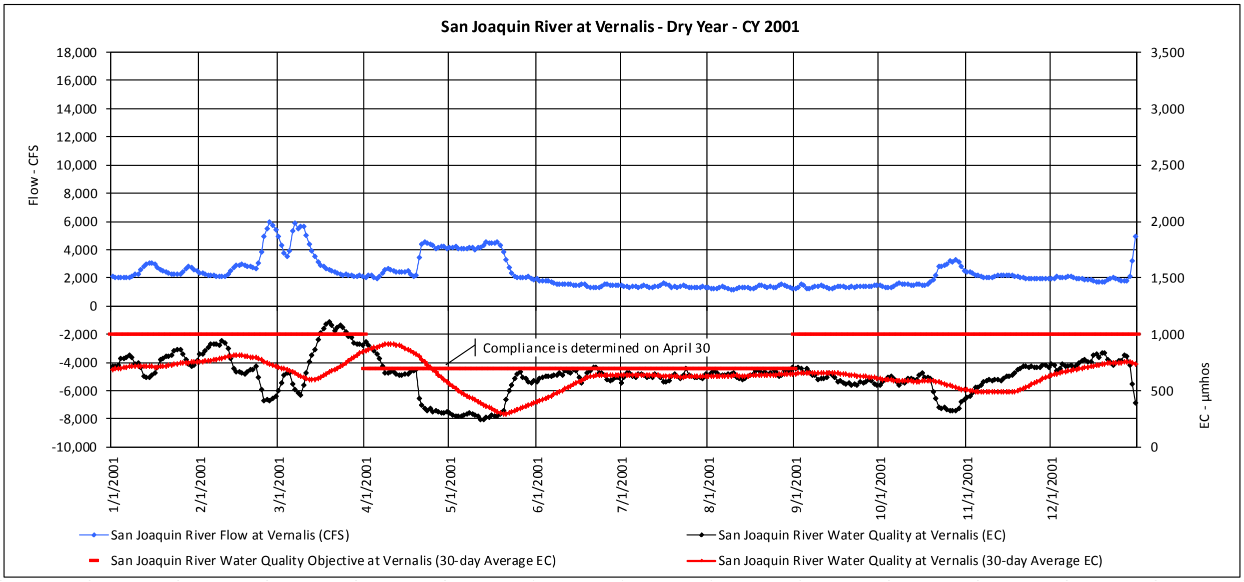
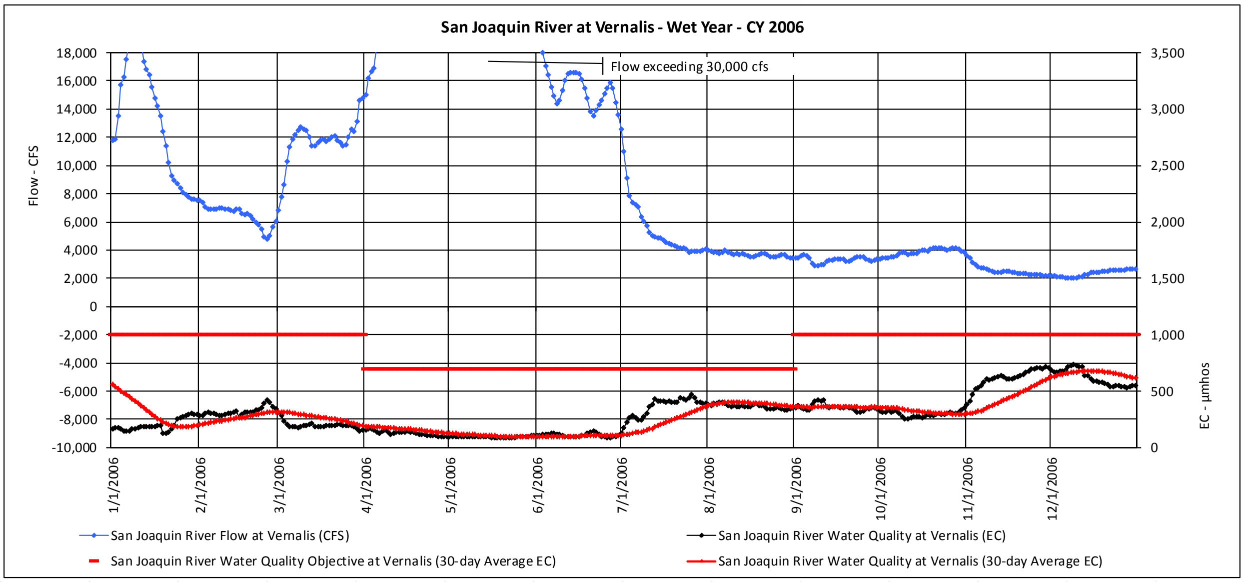


Figure 6 San Joaquin River at Vernalis – Wet Year



wetness, but partially dependent upon previous years' hydrology. Flow and quality conditions of years defined by the SJRBI may differ within a year type due to reservoir conditions carried over from the previous year(s). CY2000 (Figure 4) represents an above normal year following an above normal year, with winter and spring flows indicative of reservoir operations following full carryover storage from the previous year. CY2001 (Figure 5) represents a dry year following an above normal year. Reservoir carryover from CY 2000 was near full, but the subsequent dry year basin runoff was essentially managed through reservoir operations maintaining minimum tributary stream releases the rest of the year. During both CY2000 and CY2001 the explicit flow operation for VAMP is seen by the appearance of elevated flow during April and May. CY2006 (Figure 6) illustrates a significantly large wet year that follows a wet year that produced full reservoir carryover conditions.

A critical year (CY2007) is illustrated in Figure 7. Similar to the dry year illustration (CY2001), following a year with normal carryover reservoir storage, Vernalis flow will typically become the result of tributary operations that manage the current year's runoff with reservoir operations maintaining minimum required stream releases. Two below normal years occurred during the recent 11 years, CY2003 and CY 2009. Both of these years followed dry or critical years which produced conditions for those years appearing much like conditions during dry and critical years. Figure 8 illustrates CY 2003.

Figure 7 San Joaquin River at Vernalis – Critical Year

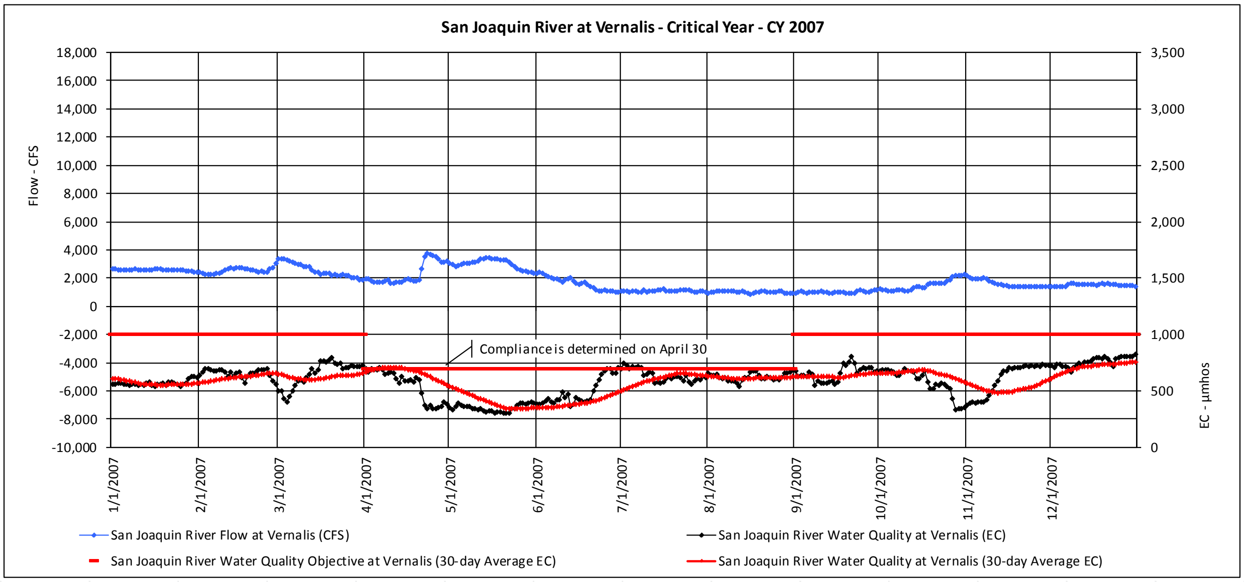
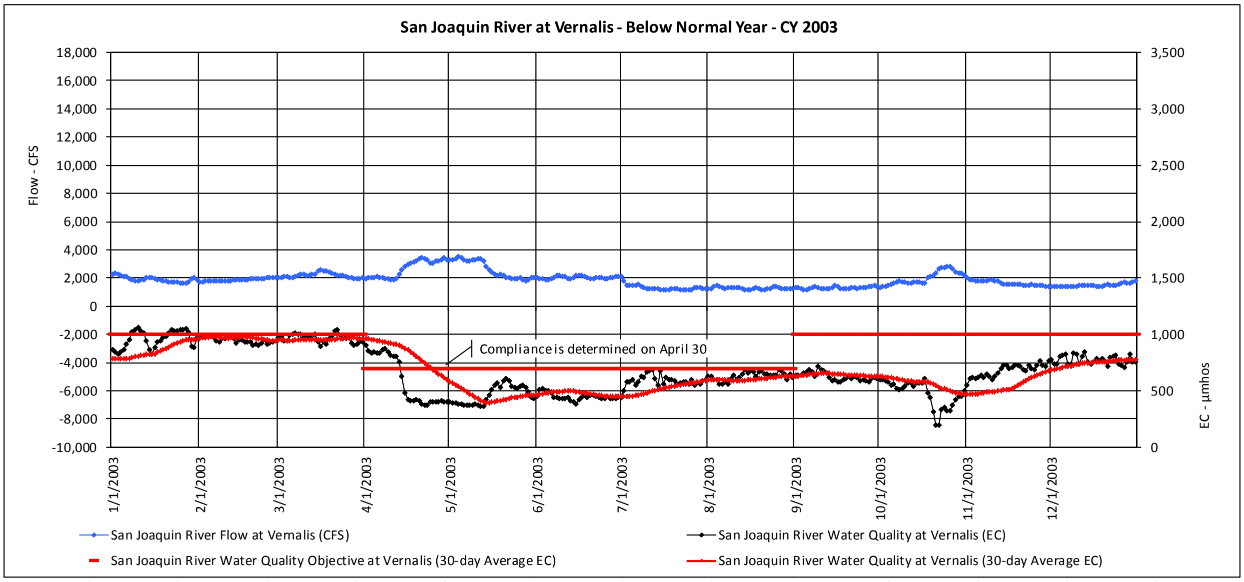


Figure 8 San Joaquin River at Vernalis – Below Normal Year



The depiction of flow and quality conditions for the San Joaquin River at Vernalis, by year-type, was synthesized by review of the recent historical records and several computer generated simulations of San Joaquin River operations.[4] Table 8 depicts flow conditions for the San Joaquin River at Vernalis for each of the year-types used in this analysis.

[4] Unpublished CalSim II and companion spreadsheet analyses performed by Daniel B. Steiner, Consulting Engineer, 2010/2011.

A long-term record of water quality conditions at Vernalis consistent with recent operations also does not exist. Recent historical records were reviewed and analyzed in concert with the same computer simulations described for the flow analysis for Vernalis. Table 9 reflects the results of that analysis and includes the recognition of water quality objectives and conditions at Vernalis, at times including specific releases from New Melones Reservoir.

Table 8 San Joaquin River at Vernalis – Flow Conditions

	San Joaquin River Flow at Vernalis (CFS)											
Yr Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Avg	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
AN Avg	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
BN Avg	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
D Avg	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
C Avg	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650

Table 9 San Joaquin River at Vernalis – Water Quality (EC)

	San Joaquin River Water Quality at Vernalis (EC - µmhos)											
Yr Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Avg	600	425	350	275	275	375	475	425	450	450	550	750
AN Avg	725	525	500	400	375	550	600	550	550	500	600	825
BN Avg	825	875	850	450	475	600	650	600	600	550	675	850
D Avg	850	925	925	525	550	650	675	625	600	575	675	850
C Avg	900	975	975	625	625	675	675	675	650	700	725	875

Note: April and May values include averaging water quality during the pulse and non-pulse flow periods.

2.2.1.2 New Melones Release Condition. Reclamation operates New Melones Reservoir to the 2009 Biological Opinion with guidance from the Interim Plan of Operations (IPO). Based on a forecast of annual water supply, including reservoir storage, Reclamation allocates releases among water rights settlement holders, CVP contractors, and fish and water quality objectives. Included in the procedure are releases for water quality and flow objectives at Vernalis. Changes in the flow or quality of the San Joaquin River upstream of the Stanislaus River (upstream) can at times affect the releases from New Melones Reservoir to the lower Stanislaus River for the purpose of meeting flow and water quality objectives at Vernalis. The previously cited studies of San Joaquin River operations were reviewed to provide an indication of the months, by year-type, when New Melones Reservoir releases are projected to occur for either water quality or flow objectives at Vernalis. Recent records for the operation of New Melones Reservoir were also reviewed.

Table 10 depicts the periods that water quality releases are assumed to be required from New Melones Reservoir. The frequency is displayed as “Min” and “Max”. Within the studies reviewed there is sometimes a wide variation of results within a specified year type. In some year types, during some months, the results might show a consistent need for releases for all the years grouped within that year type, or sometimes never a need for releases. However sometimes the results are mixed without a consistent need for releases for all years within the grouping, The Min/Max tables illustrate a judgment regarding the range of control conditions that may occur, whereby in the minimum (Min) estimate, if indicted with a mark, a need for release during the month occurs even in the low-end estimate of frequency. A mark in the maximum (Max) table indicates periods when a release is needed in the high-end estimate of frequency. No mark in a period indicates that a water quality release is not anticipated to be required.

Table 10 Periods of Vernalis Water Quality Objective Releases from New Melones

CY	Jan	Feb	Mar	Apr - 1	Apr - 2	May - 1	May - 2	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Min														
AN Min														
BN Min														
D Min														
C Min			X	X			X							
W Max														
AN Max														
BN Max		X	X	X			X							
D Max		X	X	X			X							
C Max	X	X	X	X			X	X	X	X				

Similar to the analysis of required water quality releases from New Melones Reservoir, releases for flow objectives at Vernalis were also analyzed. Table 11 depicts the periods assumed in this analysis that releases for flow objectives at Vernalis are projected to be required from New Melones Reservoir.

Table 11 Periods of Vernalis Flow Objective Releases from New Melones

CY	Jan	Feb	Mar	Apr - 1	Apr - 2	May - 1	May - 2	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Min														
AN Min							X							
BN Min				X			X							
D Min				X			X							
C Min				X			X							
W Max				X	X	X	X							
AN Max		X	X	X	X	X	X	X						
BN Max		X	X	X	X	X	X	X						
D Max		X	X	X		X	X	X						
C Max				X	X	X	X							

2.2.2 No Action/No Project Conditions

The No Action/No Project setting represents a future San Joaquin River setting with reasonably foreseeable events occurring, in this instance a portrayal of operations and hydrology associated in the near term. Many circumstances that represent the Existing Conditions setting also represent the future setting, except that the transfers of water under the Current Program from the Exchange Contractors do not occur. Several hydrologic changes could occur in the future. Most significant of these changes and incorporated in the hydrologic modeling is the assumption of full releases of SJRRP flows from Friant Dam. The only change that occurs to the San Joaquin River due to the absence of the transfers is the hydrologic effects associated with the Current Program's 8,000 acre-feet of developed fallowing water.

2.2.2.1 San Joaquin River at Vernalis. Flow and quality at Vernalis will change in the future due to implementation of the SJRRP. These changes will occur as the combined result of additional Sierra Nevada source water being introduced to the river from Friant Dam, and the reaction of the New Melones Project to changes in flow and quality upstream of the Stanislaus River. For a depiction of flow and quality that may occur in the future a set of basin-wide operation simulations depicting the San Joaquin River with and without the SJRRP flows was analyzed. The effect of the SJRRP upon flows and quality in the San Joaquin River upstream of the Stanislaus River is shown in Figure 9 (flow at Node 636) and Figure 10 (water quality at Node 636). These representations provide insight to the underlying changes in San Joaquin River hydrology that may occur due to the SJRRP absent reaction by Reclamation through operation of the New Melones Project.

Figure 9 San Joaquin River Flow at Node 636 with and without SJRRP Flows

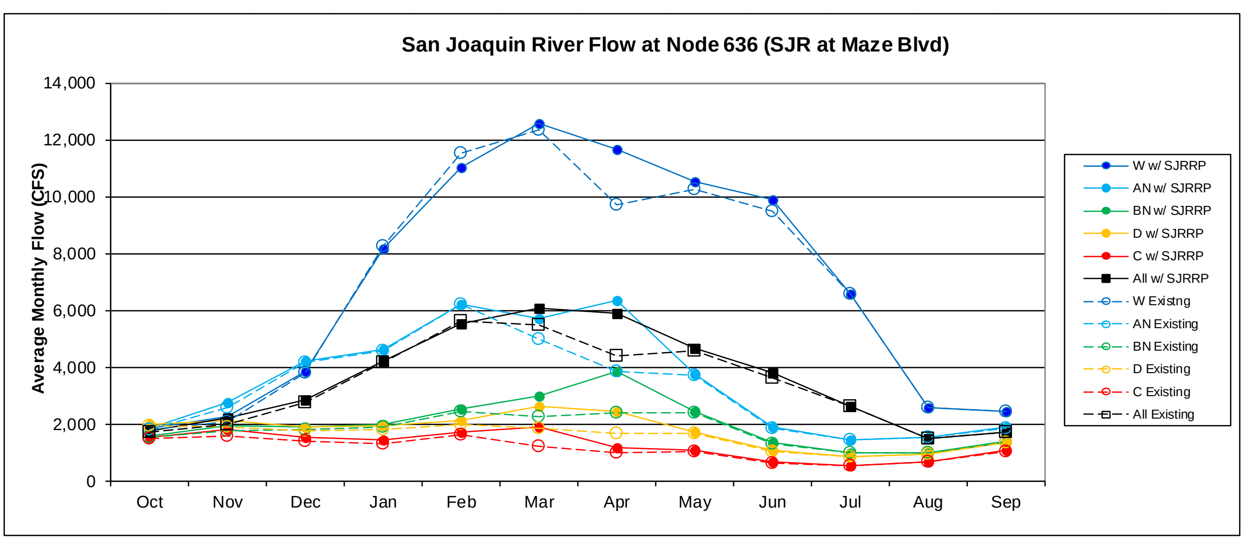
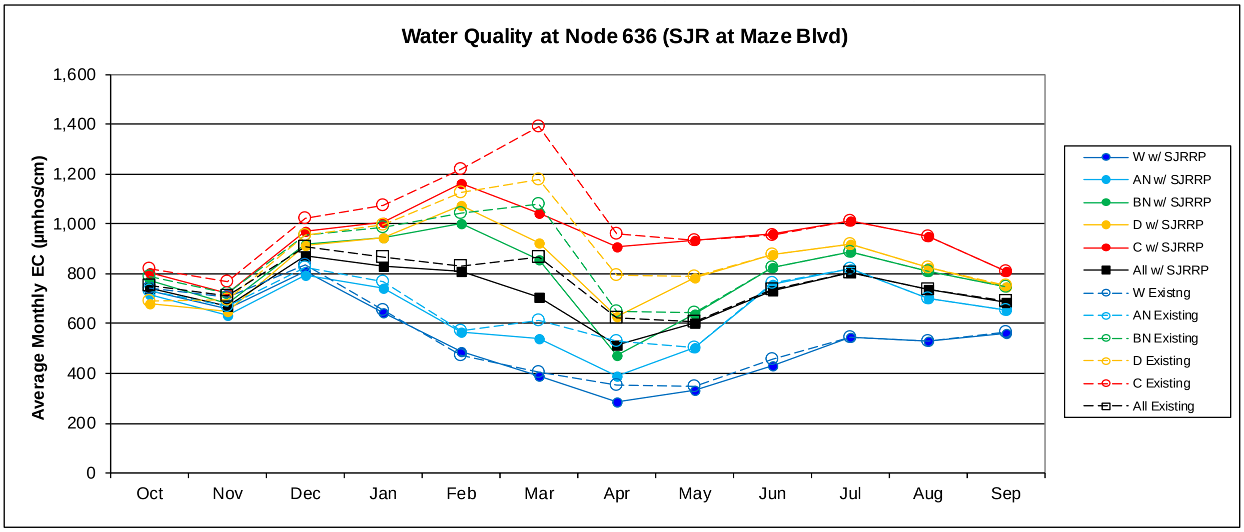


Figure 10 San Joaquin River Water Quality (EC) at Node 636 with and without SJRRP Flows



The flow results are presented in terms of average monthly flow, averaged within SJRBI year type groupings. Increased flow occurs almost all the time with the most noticeable increases occurring during March and April consistent with the period of large increased flows provided by the SJRRP. For the 82-year simulation period, flows are anticipated to increase by an annual average 160,000 acre-feet. Commensurate with additional flow in the San Joaquin River originating from the upper San Joaquin River will be an improvement in water quality. This depiction of water quality assumes the construction of a bypass channel to route flows around the Mendota Pool.

Studies similar to those depicting the Existing Condition setting at Vernalis have also been performed anticipating flows from the SJRRP. The studies incorporate a New Melones Project operation inclusive of recent Biological Opinions, the IPO and the occurrence of SJRRP flows. Table 12 depicts flow conditions for the San Joaquin River at Vernalis for the No Action/No Project setting for each of the year-types used in this analysis. Table 13 reflects the water quality results of the same analysis and includes the recognition of water quality objectives at Vernalis including specific releases for water quality from New Melones Reservoir.

Table 12 San Joaquin River at Vernalis – Flow Conditions (No Action/No Project)

	San Joaquin River Flow at Vernalis (CFS)											
Yr Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Avg	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
AN Ave	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
BN Avg	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
D Avg	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
C Avg	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750

Table 13 San Joaquin River at Vernalis – Water Quality (EC) (No Action/No Project)

	San Joaquin River Water Quality at Vernalis (EC - µmhos)											
Yr Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Avg	600	425	350	250	250	375	475	425	450	450	525	730
AN Avg	700	525	450	350	375	550	600	550	550	500	575	800
BN Avg	800	850	750	375	475	600	650	600	600	550	650	825
D Avg	800	900	800	450	550	650	675	625	600	575	650	825
C Avg	850	950	875	625	625	675	675	675	650	700	700	850

Note: April and May values include averaging water quality during the pulse and non-pulse flow periods.

2.2.2.2 New Melones Release Condition. The controlling release requirement for New Melones Project releases to the Stanislaus River is also anticipated to change subsequent to SJRRP releases. With SJRRP flows there will be fewer instances when Reclamation will be required to release from the New Melones Project for Vernalis flow and water quality objectives. The reduction in required releases primarily occurs during the spring time. Table 14 and Table 15 depict the periods when it is assumed that Vernalis flow and water quality objectives control releases in the No Action/No Project setting.

Table 14 Periods of Vernalis Water Quality Objective Releases from New Melones (No Action/No Project)

CY	Jan	Feb	Mar	Apr - 1	Apr - 2	May - 1	May - 2	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Min														
AN Min														
BN Min														
D Min														
C Min							X							
W Max														
AN Max														
BN Max		X					X							
D Max		X					X							
C Max		X	X	X			X	X	X	X				

Table 15 Periods of Vernalis Flow Objective Releases from New Melones (No Action/No Project)

CY	Jan	Feb	Mar	Apr - 1	Apr - 2	May - 1	May - 2	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Min														
AN Min							X							
BN Min							X							
D Min				X			X							
C Min				X			X							
W Max							X							
AN Max		X				X	X	X						
BN Max		X		X	X	X	X	X						
D Max		X		X	X	X	X	X						
C Max				X	X	X	X							

2.3 Sacramento-San Joaquin River Delta

Encompassing almost 750,000 acres the Sacramento-San Joaquin River Delta (Delta) is a network of islands and channels at the confluence of the Sacramento and San Joaquin rivers. Runoff into the Delta approaches an average 28,000,000 acre-feet per year from a watershed that includes the Sacramento, San Joaquin, Mokelumne, Cosumnes, and Calaveras rivers as tributaries. (DWR1993) Inflow to the Delta can be described by components of flow from Sacramento River/Yolo Bypass, East Side Streams (e.g., Mokelumne and Calaveras Rivers), and the San Joaquin River Basin. Precipitation on Delta lands also contributes to flow in the Delta. Table 16 illustrates the historical record of flows that have occurred during the last three decades. (DWR2011a)

Table 16 Delta Inflows

San Joaquin River Flow Volumes - TAF													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980s	259	211	346	468	491	747	627	506	333	256	176	213	4,635
1990s	158	107	172	351	570	494	415	416	278	206	124	134	3,424
2000s	133	114	118	210	202	296	358	363	230	116	95	94	2,330
All	183	144	212	343	421	512	467	428	280	193	132	147	3,463
Eastside Streams Flow Volumes - TAF													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980s	30	37	50	58	59	90	63	54	42	30	17	19	550
1990s	10	14	24	44	71	68	49	49	51	43	25	12	461
2000s	10	15	15	31	29	31	44	46	36	18	10	9	294
All	17	22	30	44	53	63	52	50	43	30	18	13	435
Sacramento River/Yolo Bypass Flow Volumes - TAF													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980s	810	1,309	2,542	2,689	3,515	3,886	2,029	1,321	1,062	1,138	1,040	988	22,327
1990s	709	726	1,518	3,472	3,690	3,402	1,837	1,584	1,324	1,138	1,039	937	21,375
2000s	674	717	1,370	2,487	2,271	2,505	1,838	1,406	1,065	1,170	1,029	884	17,416
All	731	918	1,810	2,882	3,158	3,264	1,901	1,437	1,151	1,149	1,036	936	20,373
Computed Delta Total Flow Volumes - TAF													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980s	1,099	1,558	2,938	3,215	4,064	4,723	2,719	1,881	1,438	1,424	1,233	1,220	27,512
1990s	878	848	1,714	3,866	4,331	3,963	2,301	2,049	1,654	1,386	1,189	1,082	25,260
2000s	817	846	1,503	2,728	2,502	2,832	2,239	1,815	1,331	1,305	1,135	987	20,040
All	931	1,084	2,052	3,270	3,632	3,839	2,420	1,915	1,474	1,372	1,185	1,096	24,271

Water development projects dependent upon Delta waterways include the CVP's C.W. "Bill" Jones Pumping Plant (Jones Pumping Plant), the SWP's Harvey O. Banks Delta Pumping Plant (Banks

Pumping Plant), and the Contra Costa Canal. The Jones Pumping Plant and Banks Pumping Plant convey water from the Delta to a system of canals and reservoirs for agriculture, municipal and industrial (M&I), and environmental uses in the San Joaquin Valley; the San Francisco Bay Area (Bay Area), along the Central Coast; and portions of Southern California. Delta flows and quality are influenced by the interaction of tributary inflows, tides, in-Delta diversions, channel hydrodynamics, and water management actions including operations to meet regulatory requirements. The Delta also provides habitat for numerous plant, animal, and fish species, including several threatened or endangered species. The Delta serves as a migration path for all Central Valley anadromous species returning to their natal rivers to spawn. The condition of the Delta ecosystem and presence of several threatened or endangered fish species, most notably the delta smelt and Chinook salmon, have led to recent requirements that substantially limit water exports at times. (USBR2011) (WEF1995). A number of agreements exist between the CVP and SWP operators regarding how they to meet shared responsibilities for in-basin flow and water quality requirements in the Delta.

2.3.1 Existing Conditions

The transfer program can affect inflows to the Delta from the San Joaquin River. At different times the change in inflow can increase, decrease or be neutral to the water supplies of the CVP and SWP, collectively referred to as the “CVP/SWP”, and could affect their operations. The potential effects (increases or decreases) to the CVP/SWP Delta water supply occur when either the Delta is in “balanced conditions” or when the Delta is in “excess conditions” and CVP/SWP exports are limited by inflow-related constraints. Although no systematic rule completely describes periods when each of these Delta conditions occur, review of a multiple-year operation study[5] of CVP/SWP operations provides guidance. The study was developed by the State of California, Department of Water Resources for an estimation of the reliability of SWP water deliveries. The study includes incorporation of assumed operations required to comply with recent Biological Opinions issued by the National Marine Fisheries Service and the Fish and Wildlife Service.

Table 17 depicts the periods, by SJRBI year-type, during which the Delta is assumed to be in balanced conditions. Review of simulated operation studies also indicates when the inflow-related export constraints of Decision 1641 or assumed Biological Opinions control CVP/SWP export operations. Table 18 depicts the periods during which it is assumed that inflow from the San Joaquin River could affect CVP/SWP export operations due to inflow-related export constraints.

Table 17 Periods of Balanced Delta Outflow Conditions

CY	Jan	Feb	Mar	Apr - 1	Apr - 2	May - 1	May - 2	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Min									X	X	X	X	X	
AN Min								X	X	X	X	X	X	
BN Min								X	X	X	X	X	X	
D Min								X	X	X	X	X	X	
C Min								X	X	X	X	X	X	X
W Max								X	X	X	X	X	X	X
AN Max								X	X	X	X	X	X	X
BN Max								X	X	X	X	X	X	X
D Max		X	X					X	X	X	X	X	X	X
C Max	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 18 Periods of Export-Ratio Conditions

CY	Jan	Feb	Mar	Apr - 1	Apr - 2	May - 1	May - 2	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Min	OMR	OMR	OMR	SJR-EI	SJR-EI	SJR-EI	SJR-EI	OMR						OMR
AN Min	OMR	OMR	OMR	SJR-EI	SJR-EI	SJR-EI	SJR-EI	OMR						OMR
BN Min	OMR	OMR	OMR	SJR-EI	SJR-EI	SJR-EI	SJR-EI	OMR						OMR
D Min	OMR	OMR	OMR	SJR-EI	SJR-EI	SJR-EI	SJR-EI	OMR						OMR
C Min	OMR	OMR	OMR	SJR-EI	SJR-EI	SJR-EI	SJR-EI	OMR						OMR
W Max	OMR	OMR	OMR	SJR-EI	SJR-EI	SJR-EI	SJR-EI	OMR						OMR
AN Max	OMR	OMR	OMR	SJR-EI	SJR-EI	SJR-EI	SJR-EI	OMR						OMR
BN Max	OMR	OMR	OMR	SJR-EI	SJR-EI	SJR-EI	SJR-EI	OMR						OMR
D Max	OMR	OMR	OMR	SJR-EI	SJR-EI	SJR-EI	SJR-EI	OMR						OMR
C Max	OMR	OMR	OMR	SJR-EI	SJR-EI	SJR-EI	SJR-EI	OMR						OMR

Note: “OMR” represents period s when flow through Old and Middle Rivers constrain exports; “SJR-EI” represents periods when exports are constrained as a percentage of San Joaquin River flow.

[5] State of California, Department of Water Resources. The State Water Project Delivery Reliability Report 2009 (Draft), December 2009.

2.3.2 No Action/No Project Conditions

The Department of Water Resources also prepared a companion study to its existing condition reliability estimate based on anticipated "future level" actions and hydrology. The future level study analysis assumed the same institutional requirements and limitations as the existing level simulations regarding Delta water quality flows and fish protection, and generally no facility improvements or expansions. Assumptions were made regarding the effect of climate change in the future on hydrology.

A comparison of the results of both studies showed an absence of significant change in the frequency for which balanced Delta outflow conditions or flow-related export constraints occurred. Therefore, the periodicity of those parameters assumed for Existing Conditions is assumed to occur also in the No Action/No Project condition.

2.4 CVP/SWP Service Areas and Facilities

The CVP provides water to Settlement Contractors in the Sacramento Valley, Exchange Contractors in the San Joaquin Valley, agricultural and M&I water service contractors in both the Sacramento and San Joaquin valleys, and wildlife refuges both north and south of the Delta. The CVP operates several reservoirs with a combined storage capacity of about 12 MAF. Facilities associated with south of the Delta (SOD) operations include the Delta-Mendota Canal (DMC) that carries water from the Jones Pumping Plant in the Delta along the west side of the San Joaquin Valley for use by Delta Division and San Luis Unit contractors, and to replace San Joaquin River flows to the Exchange Contractors. The initial diversion capacity of the DMC is 4,600 cfs, and decreases to about 3,200 cfs at the terminus.

The California State Water Project (SWP) provides water supplies for 25 million Californians and 750,000 acres of irrigated farmland. The SWP is a water storage and delivery system of reservoirs, aqueducts, power plants and pumping plants. Its main purpose is to store water and distribute it to 29 urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California. Of the contracted water supply, 70 percent goes to urban users and 30 percent goes to agricultural users. The SWP is also operated to improve water quality in the Delta, control Feather River flood waters, provide recreation, and enhance fish and wildlife. The SWP includes 34 storage facilities, reservoirs and lakes; 20 pumping plants; 4 pumping-generating plants; 5 hydroelectric power plants; and about 701 miles of open canals and pipelines. (DWR2011b)

Long-term contracts with public water agencies, known as the State Water Project contractors, provide for deliveries from the SWP. Water deliveries have ranged from 1.4 million acre-feet in dry years to almost 4.0 million acre-feet in wet years. Five contractors including the Kern County Water Agency, use SWP water primarily for agricultural purposes (mainly southern San Joaquin Valley); the remaining 24 primarily for municipal purposes.

The SWP's Banks Pumping Plant has a nominal installed pumping capacity of 10,300 cfs. However, flow diverted from the Delta is limited by permit to 6,680 cfs during much of the year. San Luis Reservoir, with a total capacity of about 2.0 MAF, is shared 970 TAF for the CVP and 1,100 TAF for the SWP. The O'Neill Forebay serves as a regulatory body for San Luis Reservoir; the William R. Gianelli Pumping-Generating Plant (Gianelli Pumping-Generating Plant), also a joint CVP/SWP facility, can pump flows from the O'Neill Forebay into San Luis Reservoir, and also make releases from San Luis Reservoir to the O'Neill Forebay for routing to either the DMC or the California Aqueduct. (USBR2000)

CVP and SWP diversions from the Delta for the last three decades are shown in Table 19. These diversions include the major CVP and SWP diversions from the South Delta, the Contra Costa Canal, and the North Bay Aqueduct. (DWR2011a)

2.4.1 Contra Costa Water District

The Contra Costa Water District (CCWD) serves a population of about 550,000 people in central and east Contra Costa County. About 265,000 people receive treated water directly from CCWD, and the other

Table 19 CVP/SWP Delta Diversions

CVP Diversion Volumes (Jones Pumping Plant) - TAF													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980s	203	175	180	191	214	212	224	183	180	265	272	219	2,519
1990s	195	181	182	202	183	196	148	113	161	214	212	215	2,203
2000s	251	233	208	219	217	201	110	67	172	253	257	253	2,440
All	216	196	190	204	205	203	161	121	171	244	247	229	2,387

SWP Diversion Volumes (Clifton Court Forebay) - TAF													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980s	160	167	246	254	217	200	201	141	130	195	288	226	2,425
1990s	242	182	219	257	163	191	123	76	112	224	265	258	2,313
2000s	208	239	272	297	275	255	136	67	153	349	349	293	2,894
All	203	196	246	270	218	215	153	95	132	256	301	259	2,544

Contra Costa Canal Diversion Volumes - TAF													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980s	9	7	5	5	5	6	7	11	12	14	14	11	107
1990s	11	8	8	7	5	7	8	10	12	13	14	12	116
2000s	6	5	3	8	10	10	9	11	20	18	11	8	119
All	9	7	5	7	7	8	8	11	15	15	13	10	114

North Bay Aqueduct Volumes - TAF													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980s	0	0	0	0	0	0	0	0	0	1	1	1	4
1990s	3	2	2	2	2	2	2	3	4	5	5	4	35
2000s	5	4	3	2	2	1	2	4	6	6	6	6	48
All	3	2	2	1	1	1	2	3	3	4	4	3	29

Total Diversion Volumes - TAF													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980s	373	349	432	451	436	418	432	336	323	475	574	457	5,056
1990s	451	374	411	468	353	396	282	202	290	456	495	489	4,667
2000s	469	481	486	526	503	467	258	149	351	628	623	559	5,501
All	431	401	443	482	431	427	324	229	321	520	564	502	5,075

285,000 receive water the district delivers to six local agencies. CCWD draws its water from the Sacramento-San Joaquin Delta under a contract with the CVP (up to 195,000 acre-feet). CCWD is the CVP's largest urban contractor. CCWD has four intakes from the Delta. Major facilities of CCWD include the Contra Costa Canal, delivering water from the Delta to the District's treatment facilities and raw-water customers. The canal is a 48-mile long facility that starts at Rock Slough in East Contra Costa County and ends at the Terminal Reservoir in Martinez. CCWD draws water from Rock Slough near Knightsen (eight miles east of Antioch) and Old River near Discovery Bay into the Contra Costa Canal. Old River water is delivered by pipeline either to the Los Vaqueros Reservoir or to the Contra Costa Canal in Antioch. Los Vaqueros Reservoir has storage capacity of 100,000 acre-feet and provides water quality improvement to CCWD’s customers. The project improves water quality by storing higher-quality Delta water from wet seasons for blending with the Delta supply during dry periods. The project also provides a 1-to-3 month supply of emergency water storage, recreation, flood control, and protection of rare natural and historic resources within the watershed. (CCWD2011)

2.4.2 East Bay Municipal Utility District

The East Bay Municipal Utility District (EBMUD) is a multipurpose, regional agency that serves as a water purveyor to an estimated 1.3 million municipal and industrial water users throughout portions of Contra Costa and Alameda counties in the East Bay region of the San Francisco Bay Area. Currently, EBMUD is dependent on the Mokelumne River system to meet almost all of its customer needs. EBMUD's Mokelumne River water supply is adequate to meet the needs of the District's customers in normal and wet years, but in prolonged droughts, customers face severe water cutbacks of up to 50 percent.
In 1970, EBMUD signed a water services contract with Reclamation for the delivery of American River water from the Folsom South Canal. In 2001, this contract was amended to provide for delivery of water from three possible diversion points with defined water amounts for each location; at Freeport on the Sacramento River, on the American River (upstream of I-5 crossing), and from the Folsom South Canal

diverting water from the Nimbus Dam. The contract details the required conditions specific to each diversion point that must be met before taking delivery of the CVP water (FPWA2003).

EBMUD and the Sacramento County Water Agency (SCWA) partnered to build the Freeport Regional Water Project (FRWP). EBMUD anticipates using up to 100 mgd of water during dry years only, estimated to be three out of every 10 years, drawn from the Sacramento River near the town Freeport and conveyed to the Mokelumne Aqueducts in San Joaquin County. The Freeport Regional Water Agency (FRWA) and its member agencies have signed agreements with CCWD and Santa Clara Valley Water District for use of the project facilities to wheel or exchange CVP water. EBMUD's CVP contract amount is 133,000 acre-feet.

2.4.3 Kern County Water Agency

The Kern County Water Agency was created in 1961 by a special act of the California State Legislature and serves as the local contracting entity for the State Water Project. KCWA has long-term contracts with 13 local water districts, called Member Units, and Improvement District No. 4 for SWP water. Since 1968, the Member Units have received over 31 million acre-feet of SWP water. Its SWP contract is for approximately 1,150,000 acre-feet. KCWA Member Units include:

- Belridge Water Storage District
- Berrenda Mesa Water District
- Buena Vista Water Storage District
- Cawelo Water District
- Henry Miller Water District
- Kern Delta Water District
- Lost Hills Water District
- Rosedale-Rio Bravo Water Storage District
- Semitropic Water Storage District
- Tehachapi-Cummings County Water District
- Tejon-Castac Water District
- West Kern Water District
- Wheeler Ridge-Maricopa Water Storage District

The Cross Valley Canal (CVC) serves KCWA members as a conduit for water deliveries to and from the California Aqueduct. With an average of less than six inches of rainfall per year, Kern County is a semi-desert region. Surface water supplies are not enough to meet the needs in the area, so groundwater plays an integral part in how water is managed in Kern County. Since the 1980s, numerous groundwater banking programs have been developed to supplement inconsistent water supplies and provide more reliable supplies during dry years. Area projects now include:

- City of Bakersfield 2,800 Acres Spreading Area
- Kern Water Bank
- Pioneer Banking Project
- Kern Fan Area Operations
- The Berrenda Mesa Water District/Kern County Water Agency Joint Groundwater Banking Project
- Semitropic Water Storage District's groundwater banking project
- Arvin-Edison Water Storage District's groundwater banking project
- The West Kern Water District/Buena Vista Water Storage District groundwater banking project
- Rosedale-Rio Bravo/Improvement District No. 4 Joint Use Recovery Project
- Cawelo Water District
- Kern Delta Water District

3. Overview of Program and Analysis

The Proposed Program by the Exchange Contractors is essentially an extension, and possibly an expansion of the transfer program currently in place but with the exclusion of the historical groundwater component. The Exchange Contractors will employ conservation programs to temporarily reduce the amount of CVP exchange water provided to them from the DMC. That water will in turn be delivered to other entities.

The alternatives being evaluated range from developing the full program of temporary land fallowing (50,000 acre-feet), continuing the existing program (essentially developing the same amount of water, approximately 88,000 acre-feet using the same measures, absent groundwater substitution), to fully exercising the previous program (fully exercising temporary land fallowing up to 50,000 acre-feet for a total program up to 130,000 acre-feet), to expanding the previous program by 20,000 acre-feet of conserved water (for a Proposed Program of up to 150,000 acre-feet).

Each year different hydrologic circumstances, water needs and supply opportunities present themselves. Water management decisions, unique to each year, occur in terms of how much water is transferred, to which entities, and from what sources the transfer water is developed. This analysis identifies a range of potential hydrologic effects that may occur as a result of the transfers. The analysis provides sufficient information to identify the difference in the types and relative magnitude of hydrologic effects that may occur between one alternative as compared to another, and compared to the baseline. The results of the analysis also provide guidance for implementation strategies or measures that can lessen or avoid impacts.

The analysis presented in this report evaluates the alternatives of developed water and their potential hydrologic impact upon the affected environment. Although the disposition and use of the transferred water itself can lead to hydrologic affects to the affected environment, that analysis is the subject of other environmental documentation and is not provided in this report. The potential changes to San Joaquin River hydrology are identified in terms of flow and quality conditions at Vernalis, and incorporate the relationship between flow and quality objectives at Vernalis and New Melones Reservoir operations. Potential CVP/SWP Delta water supply effects are also identified. The analysis evaluates potential hydrologic effects using five snapshots of hydrology, one representative of five different year-types in the San Joaquin River Basin.

3.1 Components of Developed Water

Water is developed for the Proposed Program by the Exchange Contractors. In recent years (included in the Existing Conditions setting) the Exchange Contractors estimate that for the Current Program there has been 15,000 acre-feet of water developed through reductions in seepage and evaporation of tailwater, 14,000 acre-feet of water developed through reductions of spills to non-district lands, over 40,000 acre-feet of water developed through recovery of tailwater otherwise discharged to Mud and Salt sloughs, almost 8,000 acre-feet of recovered tailwater developed that otherwise would discharge to the San Joaquin River above Sack Dam, over 8,000 acre-feet developed through temporary land fallowing, and a varying amount developed through groundwater substitution.

For the Proposed Program the Exchange Contractors will continue to use the water conserved by the projects that developed reductions in seepage and evaporation of tailwater, reductions of spills to non-district lands, reductions of tailwater otherwise discharged to Mud and Salt Sloughs (or other watercourses connected to the San Joaquin River) and reductions in tailwater that otherwise would discharge to the San Joaquin River above Sack Dam. The Exchange Contractors will also continue to use temporary land fallowing to develop water for transfer. The Proposed Program will also develop water through reduction of deep percolation or other projects that have no hydrologic connectivity to surface water. This reduction will be accomplished by implementing programs for the conversion from surface or surface/sprinkler irrigation to micro or micro/sprinkler systems, and the reduction of seepage from canals that would otherwise become deep percolation. The Exchange Contractors will not use groundwater substitution to develop water for the transfer.

The components of conserved water considered in this analysis are shown in Table 20, and include a designation between developed water that is already included in the Existing Conditions setting and water to be additionally developed.

Table 20 Exchange Contractors Developed Water for Proposed Program

Component	Included in Existing Conditions	Maximum Evaluation
Tailwater Recapture		
Reduction in seepage and evaporation of tailwater	15,000	15,000
Reduction in spills to non-district lands	14,000	14,000
Reduction in discharges to SJR above Sack Dam	7,700	7,700
Reduction in discharges to SJR	43,300	43,300
Tailwater Total	80,000	80,000
Temporary Land Fallowing	8,000	50,000
Deep Water Percolation / Applied water efficiency and seepage reduction	0	20,000
Total (acre-feet)	88,000	150,000

3.1.1 Tailwater Recapture

The tailwater recapture component of the program recovers water that would otherwise exit the control or use of the Exchange Contractors. The Exchange Contractors have been developing conserved water through tailwater recapture for years. Examples of efforts have included the capture of discharges from community ditches and drainage systems. If not recaptured by the Exchange Contractors, at times, these would exit the boundaries of the Exchange Contractors. These flows would sometimes be captured for use on non-district lands (including the wildlife areas), although often occurring unscheduled and unpredictable, downslope of the Exchange Contractors and upslope of the San Joaquin River. The water was typically fully depleted by consumptive use or evaporation and deep percolation.

In other instances, tailwater would ultimately escape the customers' on-farm and community systems to Salt Slough, Mud Slough, and other conveyances and would, sometimes if not depleted, reach the San Joaquin River. The primary discharge locations of water exiting this geographical area are Sand Dam (Salt Slough), Boundary Drain (Mud Slough "South"), Mueller Weir (Arroyo/Santa Fe Canal) and Hereford Drain (Salt Slough). Flows in Hereford Drain are comprised mostly of tailwater which unless otherwise recaptured is discharged into Salt Slough. Other than Hereford Drain, the origination of flows exiting at these locations is a complicated and highly varying mixture of tailwater drainage and operational spill. During the early 1990s and prior, FCWD discharged minor amounts of tailwater to the Firebaugh Wasteway.

Through the early 1990s, tilewater drainage and tailwater were intermingled as they left the Exchange Contractors' boundaries (e.g., discharges from FCWD and the Camp 13 area of CCID to the Agatha and Camp 13 canals of GWD). Actions have substantially provided a separation of tailwater and tilewater drainage. A portion of that previously intermingled tilewater drainage continues to exit the Exchange Contractors' boundaries and is conveyed by the Grassland By-pass Project for discharge to Mud Slough (North) which is tributary to the San Joaquin River. The remainder of the tilewater drainage and tailwater that would have otherwise intermingled with that tilewater drainage is now part of the tailwater recapture program.

Tailwater would also regularly pond at the lower ends of fields or pond in un-farmed sloughs and drains. This water would dissipate through evaporation, consumptive use or seepage into the groundwater basin. Several tailwater recapture projects geographically associated with this circumstance reduce this fate of such water.

Unique to CCC's operations was the disposition of tailwater exiting from the entity's service area. In the case of CCC, tailwater used to exit the system through community drains or farmer drains that would flow back to the San Joaquin River below Mendota Pool. This water would join with releases from Mendota Pool for satisfaction of Exchange Contractor deliveries at Sack Dam. Presently, on-farm practices and conservation efforts of CCC have essentially eliminated all of these tailwater flows.

3.1.2 Temporary Land Fallowing

Developing transfer water for the program through temporary land fallowing requires an Exchange Contractor customer to withhold irrigation water from land that would otherwise be irrigated, normally for an entire irrigation season. A computation of water that would otherwise have been used to irrigate a designated parcel of land is made, and the reduction in prospective consumptive use is allowed to be transferred from one of the Exchange Contractor entities to another district (only district-to-district transfers are allowed).

The amount of water transferred through fallowing under the Proposed Program is limited to the consumptive use portion of the water applied to the parcel of land to be fallowed, and the computation process is consistent with Reclamation guidelines. That water use is computed by averaging the consumptive use of the crops grown on the parcel during the previous 3 years. Each transfer proposal identifies the "crop history" of the parcel. Parcels that have historically been fallowed under the Current Program have included lands that have supported crops such as alfalfa, cotton, tomatoes, corn, beets, melons, pasture and rice. While the crop history of a parcel is used for the determination of transferable water, it is not a determination of what crop might have been planted in the year of fallowing. The land will simply not be planted and unless "dry farmed" will remain barren subsequent to the end of the previous year's planting. Land that is to be fallowed typically is "rotated" so as to not result in a parcel continually being fallowed. This circumstance typically occurs because of the computational process using 3 years of crop history to determine transferrable water. If the parcel is fallowed consecutively, resulting in a smaller history of water use, less water will be transferable from that parcel. To achieve the greatest amount of transferrable water from a particular parcel, it is mathematically advantageous to not have fallowing within the parcel's 3-year crop history.

3.1.3 Conservation of Deep Percolation

This component of proposed transfer water will be derived from water that has historically deep percolated below the root zone from the on-farm application of water, and the reduction of deep percolation from seepage of canals. The conservation actions will be restricted to FCWD, CCID, and SLCC and will include water that is not already collected within the Exchange Contractors as flow that goes into open drains and is recirculated, and has not supplied water to the San Joaquin River via subsurface flow. (ITRC2010) This component of transfer water will primarily involve the conversion from surface or surface/sprinkler irrigation to micro or micro/sprinkler systems where a reduction in applied water will occur, and from lining or compaction of canals. This action may also include projects that reduce subsurface discharge to unusable aquifers.

3.2 Modeling Approach

The potential hydrologic effects of the transfer program are evaluated through the use of a spreadsheet model. The model accounts for changes in flow in the San Joaquin River attributable to the diminishment in flow due to the development of water for the transfer. The model accounts for hydrologic processes over a 12-month period from January of a year through December. This length of trace reflects the nexus of the period when water will be developed and be made available by the Exchange Contractors, January through December of a year. It is also coincident with the accounting year for the Exchange Contract. The analysis is performed with a monthly time-step with certain components of analysis additionally addressing the April and May periods of a year.

As described previously, five different snapshots of San Joaquin River hydrology are evaluated. Each snapshot reflects a different year-type within the San Joaquin River basin: wet, above normal, below normal, dry and critical. Year-type related information is entered into the model based on the San Joaquin Valley Water Year Hydrologic Classification. The salient underlying hydrology within the model (e.g., flow and water quality at Vernalis) is described previously in the discussion of the Hydrologic Setting. Upon these parameters the hydrologic processes associated with incrementally developing the transfer water is layered. These processes are described below.

3.2.1 Hydrologic Effect of Developing Water through Tailwater Recapture

Tailwater recapture is defined as the reuse of tailwater in the act of reclaiming surface water from irrigated lands into a surface supply system. This can be achieved either by gravity or by low-lift pumps. The Exchange Contractors have invested in over 250 low lift stations with a total installed capacity of over 600 cfs for the primary purpose of tailwater recapture. These facilities improve the Exchange Contractors' ability to meet water delivery capacity needs and offset volumetric diversion requirements. The Exchange Contractors have recorded relift pumping exceeding 150,000 acre-feet in a year, all already included in the Existing Conditions setting, which will continue in the future. The Exchange Contractors will be using up to approximately 80,000 acre-feet of this pumping for transfer purposes. The effect of the historical pumping is already evident in San Joaquin River hydrology. The description of this pumping follows.

3.2.1.1. Evaporation, or seepage to the groundwater basin. As described earlier, an inefficiency in on-farm and community system water use practice occurs when waters pond at the tail end of fields, accumulate in drainage collection sloughs or ditches, or drain to non-district lands which do not have an immediate or direct hydraulic connectivity with Mud or Salt Sloughs or the San Joaquin River. The effect of reusing this component of tailwater may cause diminishment of deep percolation to the groundwater basin or less water lost to the atmosphere. Concerning diminishment of deep percolation, as described earlier, the upper aquifer of the Exchange Contractors' service area generally flows in two different directions, with the direction of flow affecting the continuity of a flow to accretion flow in the San Joaquin River. Tailwater ponding and seepage to the groundwater basin that occurs in the southeastern portion of the Exchange Contractors' service area will not affect the San Joaquin River. This water could migrate to the northeast, under the San Joaquin River into Madera and Merced counties. The remainder of tailwater ponding and seepage to the groundwater basin could, in theory, migrate to the San Joaquin River at the northern boundary of the Exchange Contractors.

Also described earlier, groundwater accretions to the San Joaquin River only appear to begin at a location near Lander Avenue Bridge, and then generally increase as the river proceeds downstream. The SWRCB Technical Committee Report estimated the occurrence of accretion flow to the San Joaquin River through an analysis that considered, among other factors, the effect of groundwater water surface elevation adjacent to the river. Results of the analysis indicate the total groundwater accretion to the San Joaquin River below Lander Avenue to Orestimba Creek amounts to an annual average of 13 cfs, inclusive of groundwater accretion and depletion from both sides of the river. The effect of removing tailwater ponding within the Exchange Contractors' service area will affect the amount of water seeping to the upper groundwater basin aquifer. In theory the hydraulic gradient from the point of seepage to the river would be slightly reduced. However, in recognition of the insignificant amount of groundwater seepage to the San Joaquin River that occurs in the existing setting, the incremental effect of removing the tailwater ponding would be un-measurable.

For all the alternatives it is assumed that 15,000 acre-feet of water is developed through the conservation of flows that would otherwise evaporate or seep to the groundwater basin. This element of water is already developed and is included in the Existing Conditions setting and does not change within any of the alternatives.

3.2.1.2 Water inadvertently discharged to non-district lands. A second component of tailwater recapture is an amount of water that may have otherwise been discharged to non-district lands (e.g., particularly GWD) and used as a water supply and then partially returned to Mud and Salt Sloughs as a matter of wildlife area water management. This water was unreliable in terms of a water supply in pattern or quantity.

For all the alternatives it is assumed that 14,000 acre-feet of water is developed through the conservation of flows that would otherwise spill to non-district lands. This element of water is already developed and is included in the Existing Conditions setting and does not change within any of the alternatives.

3.2.1.3 Tailwater Discharges to Mud Slough, Salt Slough and other San Joaquin River conveyances. Tailwater recapture facilities that can potentially reduce Exchange Contractor deliveries can produce in excess of 150,000 acre-feet of water in a year. The exercise of some of these facilities can reduce discharges at Sand Dam and Boundary Drain and other locations that have direct hydrologic connectivity with the San Joaquin River. Included in the Existing Conditions setting is 43,300 acre-feet of tailwater water recapture for transfer purposes that has already affected flows in the San Joaquin River.

3.2.1.4 Discharges upstream of Sack Dam. CCC's tailwater recapture system and on-farm practices recover flows that would otherwise drain back to the San Joaquin River below Mendota Pool. For the Existing Conditions setting the amount of recovery has been assumed to equal 7,700 acre-feet per year, consistent with historical pumping records of the district. The development of this water has no impact upon downstream San Joaquin River flows, and its affect upon Mendota Pool operations has already occurred.

3.2.2 Hydrologic Effect of Developing Water through Temporary Land Fallowing

The model assumes water developed by the land fallowing component will occur on a monthly pattern associated with the recent record of fallowing programs that occurred during 2010. Table 21 illustrates two sample fallowing programs that occurred separately within CCID and FCWD during 2010. The table illustrates both the annual volume (e.g., 2.45 Ft/acre) of water developed and transferred in that particular program, and the monthly distribution (e.g., during January, 0.45% of the annual volume was developed) of the developed water. A difference in volumes and monthly distributions can occur between areas and individual transfers due to differences in assumed crops and irrigation practices.

As shown in Table 3 previously, under the Current Program the Exchange Contractors have transferred up to approximately 8,000 acre-feet of water developed through temporary land fallowing, and that water is included in the Existing Conditions setting. Table 22 illustrates the disaggregation of historical transfers from temporary land fallowing under the Current Program and the entities associated with the transfers. The disaggregation is provided to show that a portion of fallowing transfer water may be associated with FCWD which operations and tailwater runoff are assumed to have no hydrologic continuity with the San Joaquin River; therefore, temporary land fallowing in FCWD would have no hydrologic affect upon San Joaquin River hydrology. Transfer water developed through temporary land fallowing by the other entities may also be from areas unconnected to San Joaquin River hydrology.

Table 21 Example of Computation of Transferrable Water from Fallowing

Year 2010 Sample Transfers													
Entity: CCID (Assumed connected to San Joaquin River)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
% Distribution	0.45	1.35	5.85	17.13	17.85	17.75	18.48	17.66	1.48	1.64	0.36	0.00	100.00
Transferable Water (Ft/Acre)	0.01	0.03	0.14	0.42	0.44	0.43	0.45	0.43	0.04	0.04	0.01	0.00	2.45
Entity: FCWD (Assumed not connected to San Joaquin River)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
% Distribution	3.14	3.86	6.40	13.27	14.09	14.92	16.59	15.77	4.96	2.50	4.51	0.00	100.00
Transferable Water (Ft/Acre)	0.08	0.10	0.16	0.34	0.36	0.38	0.43	0.41	0.13	0.06	0.12	0.00	2.58

Table 22 Historical Temporary Land Fallowing Transfers under Current Program

Year	FCWD	CCID/SLCC	Total	Total
	Acre-feet	Acre-feet	Acre-feet	Acres
2010	1,971	2,724	4,695	1,929
2009	5,958	2,174	8,132	3,342
2008	3,475	1,683	5,158	2,283
2007	228	0	228	101
2006	0	0	0	0
2005	595	0	595	305

Units: Acre-feet. Note: Additional fallowing may have occurred through other programs and not reported above.

3.2.2.1 Review of Surface Disposition of Water that would have Been Delivered

A detailed review of the parcels fallowed under the Current Program was performed to identify the likely disposition of applied water had the parcels not been fallowed. This information is used later in this analysis to assist in projecting hydrologic effects of the Proposed Program.

Fallowing occurred under the Current Program during 2005 and 2007 only within FCWD. The parcels were developed farmland, with non-vegetated perimeters, surrounded by roads, canals or other cultivated fields. Any tailwater runoff that would have occurred would have remained on-field.

During 2008, numerous parcels were fallowed within FCWD, and their field characteristics were in most instances that same as previously described parcels. Tailwater runoff, if occurring would have mostly remained on-field, or possibly escaped to collection ditches. All parcels were located upslope of major canal channels, including the Delta-Mendota Canal. The remainder of the fallowed land was located within CCID, dispersed in an area encompassing from Dos Palos, upslope to Interstate 5. One parcel was upstream of the San Luis Canal. Tailwater runoff from these parcels within CCID, if it had occurred, would have likely remained mostly on-field, with some parcels having a potential of runoff escape to drainage ditches. These ditches meandered throughout the area and appear to have no continuity with the San Joaquin River.

During 2009 FCWD and CCID continued to facilitate fallowing transfers under the Current Program. Again, parcels within FCWD would not have tailwater runoff connected to downslope or adjacent areas, or tributaries. Fallowed parcels in CCID included land upslope and downslope of the CCID Main Canal, an area upslope of the San Luis Canal (near Interstate 5), and land near Crows Landing. SLCC facilitated a transfer from land that is within the Poso Drain area, complex with ditches, canals and drains. For lands other than included in the SLCC transfer, tailwater runoff would have likely remained on-field. Tailwater runoff from the SLCC land, if it had occurred, would have remained on-field or possibly entered a drainage ditch where it would have become subject to reuse downstream or potentially became an escape to the San Joaquin River through Sand Dam.

During 2010, FCWD and CCID provided transfers for temporary land fallowing. Lands associated with FCWD transfers were in areas previously described, with no effect on downslope or adjacent lands or tributaries. CCID transfers were associated with lands near the areas previously described, with tailwater runoff, had it occurred, not expected to affect adjacent lands or downslope hydrology.

The above described parcels and drainage circumstances indicate that land fallowing that has occurred under the Current Program has likely resulted in very little, if any hydrologic effect to San Joaquin River hydrology. The only transfer that might have had hydrologic connectivity with the San Joaquin River was the transfer from SLCC during 2009. The transfer involved 314 acre-feet of transferrable water (less than 4% of the total transferrable water from fallowing that year, and less than 15% of the fallowing water transferred from others than FCWD from about 113 acres of land. This parcel may have partially drained to ditches tributary to Sand Dam, where it may have dissipated, been reused, or escaped to the San Joaquin River. In recent years, flow at Sand Dam existing SLCC has always been continuous, typically flowing 30-70 cfs during the irrigation season.[6] This review also concludes that none of the parcels would have provided tailwater runoff to adjacent uncultivated lands. In each instance, the parcels were surrounded by several additional fetches of farmed fields, or immediately bounded by roads, canals or ditches.

3.2.2.2 Effects of Water not Delivered

Only the consumptive use portion of the water that would have otherwise been used on a parcel is allowed to be transferred. This water is recognized as a reduced delivery to the Exchange Contractors at their “headgates” with Reclamation. The amount of water that would have effectively been delivered to the parcel by one of the Exchange Contractors is normally larger, and is associated with the total applied

[6] SLCC records.

water for the parcel which would include use for irrigation inefficiencies. Compared to the transferrable water for CCID shown in Table 21 (2.45 Ft/acre), the computed water that would have been delivered to the parcels amounted to approximately 3.37 Ft/acre. From the parcel's perspective, the difference represents the portion of delivery that has a disposition of deep percolation or other loss. From the Districts' perspective, the difference is absorbed into their systems and becomes additional supply to offset other supply resources (groundwater pumping) or is used in part to replace the supply for another parcel that uses the tailwater runoff from the fallowed parcel as a supply.

A portion of the delivery that is greater than the consumptive use of the parcel could be associated with tailwater runoff. Using a computation method that will be described in Section 3.2.2.3, the estimated runoff associated with the lone SLCC parcel in 2009 that may have had hydrologic continuity with the San Joaquin River would have been less than 0.1 cfs during the irrigation season, if any at all.

3.2.2.3 Modeling Assumption

An additional 42,000 acre-feet increment of transfer from temporary land fallowing will be included in several of the alternatives when comparing to Existing Conditions. Existing Conditions include 8,000 acre-feet of transfer from temporary land fallowing, which makes these alternatives cognizant of 50,000 acre-feet of transfer from land fallowing. When comparing to the No Action setting (which does not include land fallowing associated with the Current Program), 50,000 acre-feet of transfer from temporary land fallowing will be included in the applicable alternatives.

As illustrated above, water developed from temporary land fallowing may not affect San Joaquin River hydrology. For the portion of transfer water assumed to be developed through fallowing from lands with hydrologic connectivity with the San Joaquin River, it is assumed that reducing deliveries will potentially cause a reduction in agricultural return flows. The affect upon agricultural return flows due to an increase or decrease in supply is assumed to be a function of the month during which the change in delivery occurs, and the amount of change in delivery. Table 23 shows the monthly return flow factors assumed in this analysis for agricultural deliveries. These values are consistent with modeling assumptions currently used in the Department of Water Resources and Reclamation state-wide simulation model CALSIM II. The return flow factor is multiplied by the amount of water delivered to an entity in that month to estimate the amount of return flow to the San Joaquin River. In this case of developing water from land fallowing, the monthly return flow factor is multiplied times the distribution factor shown in Table 21 and then multiplied times the total annual water delivered to lands assumed to have hydrologic continuity with the San Joaquin River. The water quality associated with reductions in return flows due to crop fallowing is assumed to be the same as the water quality of flows occurring at Sand Dam and Boundary Drain. These assumed values are also shown in Table 23.

Table 23 Monthly Return Flow Factor for Agricultural Deliveries and Water Quality Assumed

Percent of Annual Total												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Percent	20	20	7	7	7	7	7	7	20	20	20	20
Fallowing Return Flow Quality Assumption												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
µmhos	1650	1475	1375	1250	1175	1025	925	900	950	850	925	1375

Assumptions are made concerning the amount of fallowed land that may have hydrologic connection to the San Joaquin River. The maximum 50,000 acre-feet of transfer water from fallowing is assumed to be developed within FCWD, CCID and SLCC. The Existing Condition includes 5,000 acre-feet of transfer water developed within FCWD, with no hydrologic connection with the SJR. The remaining 3,000 acre-feet of transfer water occurs within CCID and FCWD. For the full 50,000 acre-feet of fallowing water it is assumed that an additional 500 acre-feet will be developed within FCWD with the remaining amount developed within CCID and SLCC in proportion to their water entitlements to Exchange Contractor substitute water. The amount of transfer water developed by fallowing within modeled Existing Conditions, the No Action and maximum Proposed Project alternative is shown in Table 24. Also shown is a comparison of the incremental change in fallowing parameters between the maximum Proposed Project setting and the Existing Conditions and No Action settings. The acreage associated with the distribution of developed water assumes an average 2.50 Ft/acre of consumptive use in developing the transfer water.

Table 24 Assumed Land Fallowing Distribution among Exchange Contractors (Modeled)

	Acre-feet				Acres			
	Total	FCWD	CCID	SLCC	Total	FCWD	CCID	SLCC
Existing Setting	8,000	5,000	2,295	705	3,200	2,000	918	282
No Action Setting	0	0	0	0	0	0	0	0
Maximum Total Proposed	50,000	5,500	34,042	10,458	20,000	2,200	13,617	4,183
Incrmental Change								
Max Proposed v. Existing	+42,000	+500	+31,747	+9,753	+16,800	+200	+12,699	+3,901
Max Proposed v. No Action	+50,000	+5,500	+34,042	+10,458	+20,000	+2,200	+13,617	+4,183

As described previously, the amount of tailwater runoff associated with a parcel to be fallowed is assumed to be computed from the amount of water delivered to the parcel. This analysis assumes that 0.90 Ft/acre in addition to the consumptive use (2.45 Ft/acre) is delivered, which results in a 3.4 Ft/acre delivery for each acre used for developing a fallowing transfer. An additional assumption is made that when distributing the potential fallowing within CCID and SLCC only 10 percent of fallowed land within CCID will have hydrologic connection with the SJR, and 50 percent of land fallowed within SLCC will have hydrologic connection with the San Joaquin River.

For an illustrative example of the potential effect that a maximum exercise of the temporary land fallowing may have upon San Joaquin River hydrology, the maximum 50,000 acre-feet of transfer water developed through fallowing was evaluated with the tailwater runoff evaluation protocols, and compared to the No Action setting. The objective of this example is to illustrate the magnitude of the change in flow in the San Joaquin River (at the Exchange Contractors' boundary) that may occur if the maximum exercise of land fallowing occurs. Distributing the 50,000 acre-feet of transfer among FCWD, CCID and SLCC as described above would result in about 13,600 acres of fallowed land within CCID. That fallowing would have led to about 46,300 acre-feet less delivery to that land. Assuming only 10 percent of this land had hydrologic connection to the San Joaquin River, and that the delivery during the summer irrigation season is about 17.8 percent of the annual delivery each month, and that tailwater runoff amounts to about 7 percent of the delivery, less than 1 cfs would potentially escape to the San Joaquin River during the irrigation season. The same protocols would result in the computed potential escapes from SLCC of less than 1.5 cfs during the irrigation season.[7]

Based on a review of the lands representing the downslope boundary of CCID and SLCC, and the assumed distribution of potential fallowed land within the districts, it is concluded that little, if any potential exists for fallowing under the Proposed Program to occur on parcels that would have provided tailwater runoff to adjacent uncultivated lands. The parcels at the district's boundary are typically surrounded by several additional fetches of farmed fields, or immediately bounded by roads, canals or ditches.[8]

3.2.3 Hydrologic Effect of Developing Water through Conserved Deep Percolation

One of the alternatives assumes water will be developed by reducing applied water to crops through the conversion of irrigation practices to micro or micro/sprinkler technology, or reducing diversions through the reduction of canal seepage. The reduction in applied water and seepage (up to 20,000 acre-feet) will lead to a reduction in deep percolation. As described by the discussion of reduced ponding (Section 3.2.1.1) the reduction of deep percolation will have little, if no hydrologic effect on San Joaquin River hydrology.

[7] To test the sensitivity of the results to the assumption of assumed tailwater runoff connection to San Joaquin River hydrology, a 100 percent land-connectivity factor was applied within the protocols. The flow difference due to fallowing, which is considered not possible, would be up to 12 cfs during the irrigation season.
[8] Personal communication with Chris White, General Manager of CCID, and Chase Hurley, General Manager of SLCC, 2012.

3.3 No Action/No Project and Action/Project Alternatives

Settings have been developed to represent the several environmental scenarios needed for the EIS/EIR. These settings include depictions of the No Action/No Project alternative and several project (action) alternatives.

3.3.1 No Action / No Project Alternative

For the Exchange Contractors' water transfer program the No Action/ No Project Alternative is described as follows.

The No Action/No Project Alternative assumes the project does not proceed (no transfer program) in the future (for water service years 2014–2038). The No Action/No Project Alternative is evaluated against the Existing Conditions setting for CEQA purposes. The No Action/No Project alternative (setting) is used as the basis of comparison for NEPA purposes for each of the Proposed Program alternatives.

The No Action/No Project Alternative projects conditions that could reasonably occur within the time period associated with the extended proposed transfer, water service years 2014–2038, but without any of the action alternatives being implemented after the Current Program expires (water year 2014). This setting is substantially the same as the Existing Conditions setting except SJRRP flows from Friant are assumed to occur and the 8,000 acre-feet of transfer water developed through temporary land fallowing (under the Current Program) does not occur.

3.3.2 Alternative A: 50,000 Acre-Feet

As stated previously, each year different hydrologic circumstances, water needs and supply opportunities present themselves. Unique to each year, how much water is transferred may vary. Ultimately at the discretion of the Exchange Contractors and willing buyers the transfer amount may vary from zero, up to the full Proposed Program amount in any year. Alternative A is the smallest level of program implementation framed as an alternative. All of the water would be developed from temporary land fallowing. Of the maximum amount of 50,000 acre-feet in a year, 8,000 acre-feet has occurred in recent years (and included in the Existing Conditions setting), while 42,000 acre-feet would be additional development not yet experienced. Water developed by temporary land fallowing will be the only water available for transfer during years when the Exchange Contractors experience their critical year water supply as defined by the Exchange Contract. When casting this alternative against the No Action setting, the full 50,000 acre-feet of water would be additionally developed.

3.3.3 Alternative B: Alternative B: 88,000 Acre-Feet

Alternative B represents an intermediate level of program implementation, and is similar to the level of implementation currently underway and experienced. For this alternative, the Exchange Contractors would provide up to 88,000 acre-feet of water during any non-critical Exchange Contract year through a combination of conservation and temporary land fallowing sources. The conservation measures include those components of tailwater recapture previously described affecting evaporation and seepage to groundwater, water inadvertently discharged to non-district lands, water discharged to the San Joaquin River, and tailwater discharged above Sack Dam. These components of conservation account for up to 80,000 acre-feet of the total developed supply. Temporary land fallowing would contribute up to 8,000 acre-feet of developed water.

Flexibility exists in the development of 88,000 acre-feet of water for transfer during any type of water year. The Exchange Contractors have the availability of up to 50,000 acre-feet of water from temporary land fallowing. This source of water in combination with conservation opportunities can provide flexibility in the decision of transfer water source. For example, if 50,000 acre-feet were developed through conservation programs, up to 38,000 acre-feet would be developed from temporary land fallowing.

3.3.4 Alternative C: 130,000 Acre-Feet

Alternative C makes available up to 130,000 acre-feet of water annually during any non-critical exchange contact supply year. Under this alternative, up to 80,000 acre-feet of water is made available through conservation and up to 50,000 acre-feet of water is made available through temporary land fallowing.

3.3.5 Alternative D: 150,000 Acre-Feet

Alternative D expands upon Alternative C water of 130,000 acre-feet (from conservation and temporary land fallowing) with an additional 20,000 acre-feet from additional conservation measures not already considered in the other alternatives. These additional measures include the reduction of deep percolation by decreasing applied water by mirco and micro/sprinkler technology, and the reduction of deep percolation in canal seepage. Alternative D represents the maximum water transfer by adding an additional increment of conservation water. This amount of water could be available during any non-critical Exchange Contract supply year.

4. Analysis and Results

The potential hydrologic effects of the proposed program vary between some of the alternatives, and within an alternative depending upon year-type and the source of developed water. A tabular summary of the results, by scenario, is included in Attachment 1. Each study is identified by alternative and scenario-specific identifiers regarding the source and quantity of developed water. Table 25 illustrates the protocol for identifying the studies. For instance, Study A-50-0-50-0 High Control depicts Alternative A (50,000 acre-feet) with a source emphasis of temporary land fallowing, and assumes a high frequency of controlling conditions within Stanislaus River and Delta operations.

Table 25 Study Name Protocol

			Water Source - Acre-feet		
Study Name	Alternative	Total Transfer	Conservation (Tailwater)	Temporary Land Fallowing	onservation - Deep Percolatio
A-50-0-50-0 High Control	A	50,000	0	50,000	0
A-50-0-50-0 Low Control	A	50,000	0	50,000	0
B-88-80-8-0	B	88,000	80,000	8,000	0
B-88-38-50-0	B	88,000	38,000	50,000	0
C-130-80-50-0	C	130,000	80,000	50,000	0
D-150-80-50-20	D	150,000	80,000	50,000	20,000
No Action/No Project	NA/NP	0	0	0	0

Study results are presented in a hierarchal format, sequentially stepping through the reporting of the development of transfer water, Vernalis effects, adjustments to New Melones Reservoir operations, and potential effects to the CVP/SWP Delta water supply. First illustrated is a section of data (“Basic Hydrologic Accounting”) that shows the potential net flow effects to the San Joaquin River at a conceptual location downstream of the Exchange Contractors. Table 26 below illustrates a portion of this data, referencing the results particular to Study A-50-50-0 High Control for the comparison. Reported first in the data are the sources of the transfer water (e.g., fallowing) and the monthly distribution of incrementally developed water. Since the tailwater recovery components of this study already exist in the Existing Conditions setting, no incremental development of the water is shown. The second section of data concerns the calculated potential affect upon San Joaquin River flows due to the exercise of each of the source-water components that have hydrologic connectivity with the San Joaquin River. Source-water components other than those directly reducing tailwater discharges to tributaries of the San Joaquin River will have less than a one-to-one (and possibly zero) effect upon San Joaquin River flows. The last section of data provides the potential net effect to San Joaquin River flows due to the development of transfer water. These values represent the net effect prior to any adjustment for changes in New Melones Reservoir operations in reaction to the transfer. Two separate results are provided for Table 26, one representing the change in conditions in comparison to the Existing Condition baseline, and the other represents the comparison to No Action baseline.

Table 26 Basic Hydrologic Accounting (Illustration from Study A-50-0-50-0 High Control))

All Values Relative to Existing Condition													Basic Hydrologic Accounting
Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	10	30	45	131	137	136	142	135	32	36	8	0	842
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	10	30	45	131	137	136	142	135	32	36	8	0	842
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

All Values Relative to No Action													Basic Hydrologic Accounting
Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	11	32	48	141	147	146	152	145	35	39	8	0	902
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	11	32	48	141	147	146	152	145	35	39	8	0	902
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

The next section of data provided in the tabular summary of results illustrates flow and quality conditions at Vernalis, prior to and subsequent to the transfer. Table 27 provides an example of these data. Reported are the baseline Vernalis flow and quality conditions and the simulated flow and quality at Vernalis subsequent to the transfer, including the effects of changes in New Melones Reservoir operations that are simulated to occur in reaction to the changes in flow described by the "basic hydrologic accounting". The notation regarding the water quality values reported for April and May concern the modeling and calculation approach used to represent the split-month operations (pulse and non-pulse periods) that occur during that period. The results are again presented for two baselines of comparison. Proposed Project effects are compared to an Existing Condition baseline and separately to a No Action baseline.

The potential change in New Melones Reservoir storage is reported in the next section of tabular results. Table 28 illustrates the reported data. Illustrated are the changes in New Melones Reservoir storage due to changes in either water quality or flow releases attributable to the changes in flow and water quality at Vernalis resulting from the transfers. The changes in New Melones Reservoir storage are directly equal and opposite of projected changes in releases to the lower Stanislaus River for the Vernalis flow and quality objectives. Results for the two different baseline comparisons are provided.

The last section of data provided in the tabular summary reports the potential change in water supply within the Delta from the perspective of CVP/SWP operations. Table 29 illustrates an example of the data using Study A-50-0-50-0 High Control results. The data illustrate the potential effect of the transfers upon the CVP/SWPs' Delta operations first from a perspective of flow changes attributable to the transfers during periods when changes to inflow potentially affect CVP/SWP operations. The second section of data reports the changes in New Melones Reservoir releases that occur coincidentally with the periods of potential Delta impact. The third section of data reports the potential net effect of the transfers to CVP/SWP Delta supply. Results for the two different baseline comparisons are provided.

Table 27 Vernalis Results (Illustration from Study A-50-0-50-0 High Control)

All Values Relative to Existing Condition												Vernalis
Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	0	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	0	-1	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,550	10,699	13,049	10,850	11,600	11,048	7,698	3,498	3,449	3,499	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,948	1,998	2,399	2,899	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,498	1,498	1,899	2,399	2,100	2,100
Dry	2,300	2,500	2,350	2,699	2,700	1,450	1,248	1,348	1,749	2,149	1,900	1,900
Critical	1,800	2,049	1,749	1,800	1,800	996	897	897	1,349	1,549	1,650	1,650
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	549	600	550	550	500	600	825
Below Normal	825	875	850	449	474	599	650	600	600	550	675	850
Dry	850	925	925	524	549	648	675	625	600	575	675	850
Critical	900	975	975	624	624	675	675	675	650	700	725	875

Table 27 Vernalis Results (Illustration from Study A-50-0-50-0 High Control), continued

All Values Relative to No Action												Vernalis
Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	-2	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	-1	-2	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,450	10,249	13,299	12,848	11,850	11,398	7,748	3,498	3,499	3,599	2,850	3,000
Above Normal	4,150	6,250	7,049	7,898	5,100	2,900	1,948	1,998	2,449	2,999	2,550	2,450
Below Normal	2,450	3,100	3,599	5,000	3,550	2,050	1,498	1,498	1,949	2,449	2,300	2,200
Dry	2,450	2,600	3,099	3,500	2,750	1,500	1,248	1,348	1,799	2,199	2,100	1,950
Critical	1,950	2,149	2,249	1,950	1,800	996	897	897	1,349	1,549	1,800	1,750
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	625	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-1	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	374	549	599	549	550	500	575	800
Below Normal	800	850	750	374	474	599	650	600	600	550	650	825
Dry	800	900	800	449	549	648	675	625	600	575	650	825
Critical	850	950	875	624	624	675	675	675	650	700	700	850

Table 28 New Melones Reservoir Operations (Illustration from Study A-50-0-50-0 High Control)

All Values Relative to Existing Condition													New Melones
Incremental Change in NM Storage due to WQ Release Change - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	9	16	19	0	0	76	57	49	0	0	0	0	226
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Above Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Below Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Dry	0	-30	-41	-66	-137	-136	0	0	0	0	0	0	-409
Critical	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Above Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Below Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Dry	0	-30	-41	-66	-137	-136	0	0	0	0	0	0	-409
Critical	9	16	19	-131	-137	76	57	49	0	0	0	0	-42

All Values Relative to No Action													New Melones
Incremental Change in NM Storage due to WQ Release Change - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	18	29	0	0	82	61	52	0	0	0	0	242
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	0	-147	0	0	0	0	0	0	0	-147
Above Normal	0	-32	0	0	-147	-146	0	0	0	0	0	0	-324
Below Normal	0	-32	0	-141	-147	-146	0	0	0	0	0	0	-465
Dry	0	-32	0	-145	-147	-146	0	0	0	0	0	0	-470
Critical	0	0	0	-141	-147	0	0	0	0	0	0	0	-288
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	0	-147	0	0	0	0	0	0	0	-147
Above Normal	0	-32	0	0	-147	-146	0	0	0	0	0	0	-324
Below Normal	0	-32	0	-141	-147	-146	0	0	0	0	0	0	-465
Dry	0	-32	0	-145	-147	-146	0	0	0	0	0	0	-470
Critical	0	18	29	-141	-147	82	61	52	0	0	0	0	-45

Table 29 Delta CVP/SWP Potential Effect (Illustration from Study A-50-0-50-0 High Control)

All Values Relative to Existing Condition													Project Delta Supply
Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Below Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Dry	0	-30	-45	0	0	-136	-142	-135	-32	-36	-8	0	-564
Critical	-10	-30	-45	-131	-137	-136	-142	-135	-32	-36	-8	0	-842
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	136	0	0	0	0	0	0	136
Below Normal	0	0	0	0	0	136	0	0	0	0	0	0	136
Dry	0	30	41	0	0	136	0	0	0	0	0	0	206
Critical	-9	-16	-19	131	137	-76	-57	-49	0	0	0	0	42
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Below Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Dry	0	0	-4	0	0	0	-142	-135	-32	-36	-8	0	-357
Critical	-19	-46	-64	0	0	-212	-198	-184	-32	-36	-8	0	-799

All Values Relative to No Action													Project Delta Supply
Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Below Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Dry	0	-32	-48	0	0	-146	-152	-145	-35	-39	-8	0	-604
Critical	-11	-32	-48	-141	-147	-146	-152	-145	-35	-39	-8	0	-902
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	146	0	0	0	0	0	0	146
Below Normal	0	0	0	0	0	146	0	0	0	0	0	0	146
Dry	0	32	0	0	0	146	0	0	0	0	0	0	178
Critical	0	-18	-29	141	147	-82	-61	-52	0	0	0	0	45
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Below Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Dry	0	0	-48	0	0	0	-152	-145	-35	-39	-8	0	-427
Critical	-11	-50	-77	0	0	-228	-213	-197	-35	-39	-8	0	-857

Overarching results, conclusions and sensitivities regarding the alternatives are described below.

4.1 Alternative A: 50,000 Acre-Feet

This alternative provides an evaluation of a transfer solely reliant upon voluntary temporary land fallowing as the source of transfer water. Up to 50,000 acre-feet of water will be transferred in any year. The Exchange Contractors would use land fallowing as the means to reduce their need for delivery of water.

Only temporary land fallowing develops transfer water in this alternative. The Exchange Contractors would develop 50,000 acre-feet of water for transfer during all year types. The Existing Conditions setting includes 8,000 acre-feet of transfer from temporary land fallowing, with 5,000 acre-feet of that water associated with lands not affecting San Joaquin River hydrology. The alternative incorporates an additional 42,000 acre-feet of water developed through temporary land fallowing, with the 500 acre-feet originating from FCWD (not connected to San Joaquin River hydrology) and the remaining 41,500 acre-foot increment to be developed from lands assumed within CCID and SLCC, and only some of those lands connected to San Joaquin River hydrology. The effect on San Joaquin River hydrology occurs as irrigated acres are reduced due to land fallowing and less tailwater runoff would occur. To the extent that the incremental fallowing that is assumed to be connected to San Joaquin River hydrology does not have drainage to the San Joaquin River the affects would be less than illustrated.

The analysis is performed for two different sets of assumed circumstances concerning controlling operating criteria for New Melones Reservoir and the Delta. The first study assumes “high control” circumstances; that is, an assumption that Vernalis water quality and flow releases from New Melones Reservoir occur often and are associated with lesser flow and water quality conditions in the San Joaquin River (in any year type). The high control study also assumes a greater number of periods of balanced Delta flow. These conditions correspond to assuming the “Max” control conditions developed for Table 10 and Table 11 for New Melones Reservoir operations, and Table 17 and Table 18 for Delta operations. The second study assumes “low control” circumstances, representing an assumption of less frequent controlled conditions for each parameter. Simulated hydrologic effects at Vernalis resulting from the high control study in each year type are shown in Table 30A, which includes the assumed Existing Conditions baseline Vernalis flows. Table 30B shows the results for the change in Vernalis flows when incorporating the No Action baseline.

For each acre-foot of water developed, only a small portion of that water diminishes flow in the river. This alternative results in a relatively small effect to Vernalis flows. Certain months (e.g., May of all years) show no change in flow. This is due to the New Melones Reservoir releases being controlled by flow criteria at Vernalis; thus, a decrease in runoff from the Exchange Contractors is counteracted with an additional release from New Melones Reservoir thereby leaving Vernalis flow neutral to the transfer. During certain other months, when New Melones Reservoir operations are maintaining required water quality conditions at Vernalis (e.g., June of a critical year), the flow change at Vernalis is the combination of both the effects of the Exchange Contractors developing the transfer water and the counteraction by New Melones Reservoir releasing less dilution flow to maintain the water quality conditions at Vernalis.

Table 30A Vernalis Flow Conditions – Alternative A (High Control) – Existing Conditions Baseline

Benchmark Vernalis Flow - cfs												A-50-0-50-0 (High)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Change in Vernalis Flow with Action - cfs												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	0	-1	-1	0	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	0	-1	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0

Table 30B Vernalis Flow Conditions – Alternative A (High Control) – No Action Baseline

Benchmark Vernalis Flow - cfs												A-50-0-50-0 (High)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Change in Vernalis Flow with Action - cfs												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	0	-1	-1	-2	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	-1	-2	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0

Water quality at Vernalis may also change due to the development of transfer water by the Exchange Contractors. Table 31A and Table 31B show the change in water quality at Vernalis for Alternative A. Water quality changes at Vernalis trend with the changes in flow at Vernalis. The water quality associated with the flows affected by temporary land fallowing is assumed to have the same water quality as tailwater recapture. Since this quality is worse than the melded water quality at Vernalis, the removal of runoff by the Exchange Contractors would improve water quality at Vernalis. For those months with no change in water quality but with a change in flow, New Melones Reservoir releases are maintaining the water quality requirement at Vernalis.

Table 31A Vernalis Water Quality Conditions – Alternative A (High Control) – Existing Conditions Baseline

Benchmark Vernalis Water Quality - µmhos												A-50-0-50-0 (High)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875
Change in Vernalis Water Quality with Action - µmhos												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0

Table 31B Vernalis Water Quality Conditions – Alternative A (High Control) – No Action Baseline

Benchmark Vernalis Water Quality - µmhos												A-50-0-50-0 (High)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	625	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850
Change in Vernalis Water Quality with Action - µmhos												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-1	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0

New Melones Reservoir operations may be affected by the Exchange Contractors' development of transfer water due to the linkage between its operations and San Joaquin River hydrology. The potential changes in the net releases from New Melones Reservoir, for either Vernalis water quality or flow purposes, are shown in Table 32A and Table 32B. The values are depicted as a change in New Melones Reservoir storage, and can be directly equated to changes in flow to the lower Stanislaus River at Goodwin Reservoir. Positive values indicate an increase in storage and a decrease in flow to the lower Stanislaus River.

Table 32A Change in New Melones Reservoir Storage – Alternative A (High Control) – Existing Condition Baseline

Incremental Change in New Melones Reservoir Storage due to Vernalis Flow & Quality Release Change - Acre-feet													A-50-0-50-0 (High)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Above Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Below Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Dry	0	-30	-41	-66	-137	-136	0	0	0	0	0	0	-409
Critical	9	16	19	-131	-137	76	57	49	0	0	0	0	-42

Table 32B Change in Storage in New Melones Reservoir – Alternative A (High Control) – No Action Baseline

Incremental Change in New Melones Reservoir Storage due to Vernalis Flow & Quality Release Change - Acre-feet													A-50-0-50-0 (High)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	-147	0	0	0	0	0	0	0	-147
Above Normal	0	-32	0	0	-147	-146	0	0	0	0	0	0	-324
Below Normal	0	-32	0	-141	-147	-146	0	0	0	0	0	0	-465
Dry	0	-32	0	-145	-147	-146	0	0	0	0	0	0	-470
Critical	0	18	29	-141	-147	82	61	52	0	0	0	0	-45

The changes shown in Table 32A and Table 32B indicate the releases from New Melones Reservoir that would be required to counter the effect of developing the transfer water. These changes reflect Reclamation maintaining Vernalis flow and quality conditions at assumed Vernalis objective compliance levels. Accumulated changes in New Melones Reservoir storage vary by year type, but the change in storage within a year is less than 500 acre-feet. The potential changes in flow to the lower Stanislaus River mirror the changes in the New Melones storage. The change in flow ranges from an increase of 3 cfs during many Aprils and Mays (for flow objectives at Vernalis) to a decrease of up to 2 cfs during June in a critical year. However, when a reduction in flow is calculated, the reduction may not actually occur because another release objective may require the continuation of some level of that release.

The development of transfer water could affect inflows to the Delta from the San Joaquin River. The total net Delta water supply balance to the CVP/SWP is shown in Table 33A and 33B. The decrease in net supply ranges from about 350 to 525 acre-feet in non-critical years, to about 850 acre-feet during a critical year. These changes occur due to the development of the transfer water and also include counteractions in New Melones Reservoir releases to changes in the river system.

Table 33A Delta CVP/SWP Water Supply Effect – Alternative A (High Control) – Existing Conditions Baseline

Incremental Change in Project Delta Supply due to Action - Acre-feet													A-50-0-50-0 (High)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Below Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Dry	0	0	-4	0	0	0	-142	-135	-32	-36	-8	0	-357
Critical	-19	-46	-64	0	0	-212	-198	-184	-32	-36	-8	0	-799

Table 33B Delta CVP/SWP Water Supply Effect – Alternative A (High Control) – No Action Baseline

Incremental Change in Project Delta Supply due to Action - Acre-feet													A-50-0-50-0 (High)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Below Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Dry	0	0	-48	0	0	0	-152	-145	-35	-39	-8	0	-427
Critical	-11	-50	-77	0	0	-228	-213	-197	-35	-39	-8	0	-857

Over the past several years the federal biological opinions issued under the Endangered Species Act for the operation of the CVP and SWP in the Delta have become more and more restrictive concerning constraints on Delta pumping. The USFWS Biological Opinion (BO) includes requirements from December to June for an adaptively managed flow restriction for the average Old River and Middle River (OMR) flow. The flow restriction can begin as early as December 1 and is intended to protect delta smelt at various life stages. The OMR flow target is dependent on delta smelt survey information with the flow target achieved primarily by managing CVP and SWP exports. NMFS' BO also added an OMR requirement for the listed species under its biological opinion which is assumed to be met by the USFWS requirements. The NMFS' BO also additionally constrained exports during April and May through a Vernalis flow to export ratio requirement, effectively reducing exports to 1,500 cfs during the period except during extremely wet San Joaquin River conditions.

Estimating the potential effect of the transfers upon CVP/SWP exports is complicated and dependent upon the assumed operational condition of the CVP/SWP, Delta and the San Joaquin River. For this analysis it is assumed that for all years during the months of December through March, and during June, exports will be constrained by OMR flow. An assumption of 50% flow effect is used to estimate the change in allowable export caused by a change in San Joaquin River inflow, that is, for a change in 1 cfs flow at Vernalis exports could correspondingly change by ½ cfs and OMR flow would remain the same. During April and May it is assumed that the San Joaquin River flow to export ratio constrains exports for all years. The BO ratio is 1:1 in critical years, 2:1 in dry years, 3:1 in below normal years and 4:1 in above normal and wet years. For instance, in critical years a change of 1 cfs at Vernalis would result in a change in allowable export of 1 cfs. During a wet year, a change of 1 cfs at Vernalis would result in a change in allowable export of ¼ cfs. The BO allows export pumping for health and safety reasons which would allow exports greater than calculated by the ratio.

Table 34A and Table 34B illustrate the estimation of change in allowable exports (acre-feet) by the CVP/SWP assuming the above stated metrics are applied to the estimated change in Vernalis flows caused by developing water for the transfers. There are no computed effects during July through November due to assuming no constraints occur, and during December there are no estimated changes in Vernalis flows due to the development of transfer water. The potential effects may not occur in some instances in some years if the particular export constraint is not actually controlling export operations due to such a circumstance as health and safety pumping establishing an absolute level of export regardless of San Joaquin River flow; however, the estimates serve as an illustration of a conservatively high estimate of potential effect. These potential effects could at times be inclusive or sometimes additive to the potential supply effects shown for the CVP/SWP Delta water supply effect shown in Table 33A and 33B.

Table 34A Potential Delta Export-Specific Effect – Alternative A (High Control) – Existing Conditions Baseline

Change in Potential Allowable Export with Action - Acre-feet													A-50-0-50-0 (High)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	-5	-15	-22	0	0	-68	0	0	0	0	0	0	-110
Above Normal	-5	0	-2	0	0	0	0	0	0	0	0	0	-7
Below Normal	-5	0	-2	0	0	0	0	0	0	0	0	0	-7
Dry	-5	0	-2	-33	0	0	0	0	0	0	0	0	-40
Critical	-9	-23	-32	0	0	-106	0	0	0	0	0	0	-170

Table 34B Potential Delta Export-Specific Effect – Alternative A (High Control) – No Action Baseline

Change in Potential Allowable Export with Action - Acre-feet													A-50-0-50-0 (High)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	-5	-16	-24	-35	0	-73	0	0	0	0	0	0	-153
Above Normal	-5	0	-24	-35	0	0	0	0	0	0	0	0	-65
Below Normal	-5	0	-24	0	0	0	0	0	0	0	0	0	-29
Dry	-5	0	-24	2	0	0	0	0	0	0	0	0	-27
Critical	-5	-25	-39	0	0	-114	0	0	0	0	0	0	-183

The results above are associated with underlying New Melones Reservoir and Delta operations that assume reasonable maximum controlling conditions. The assumption manifests itself within the spreadsheet analysis as the number of periods/days that flows are required from New Melones Reservoir for flow or water quality objectives at Vernalis. Similarly, the spreadsheet analysis is provided an estimate of the periods/days that Delta flow is in balanced conditions. These estimates are derived through review of other modeling simulations (e.g., CalSim II). The high control study is indicative of results that show a possibility that a specific controlling condition could occur for a year type, even though it may not consistently occur. The alternative, low control study, illustrates that a controlling condition may not occur in a year type. Thus, interpretation of both sets of results provides a range of potential hydrologic effects to be anticipated.

Table 35 through Table 39 (both “A” and “B” sets) provides the comparable San Joaquin River, New Melones Reservoir and Delta results for the low control study assumptions.

Table 35A Vernalis Flow Conditions – Alternative A (Low Control) – Existing Conditions Baseline

Benchmark Vernalis Flow - cfs												A-50-0-50-0 (Low)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Change in Vernalis Flow with Action - cfs												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0
Above Normal	0	-1	-1	-2	-1	-2	-2	-2	-1	-1	0	0
Below Normal	0	-1	-1	-1	-1	-2	-2	-2	-1	-1	0	0
Dry	0	-1	-1	-1	-1	-2	-2	-2	-1	-1	0	0
Critical	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0

Table 35B Vernalis Flow Conditions – Alternative A (Low Control) – No Action Baseline

Benchmark Vernalis Flow - cfs												A-50-0-50-0 (Low)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Change in Vernalis Flow with Action - cfs												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0
Above Normal	0	-1	-1	-2	-1	-2	-2	-2	-1	-1	0	0
Below Normal	0	-1	-1	-1	-1	-2	-2	-2	-1	-1	0	0
Dry	0	-1	-1	-1	-1	-2	-2	-2	-1	-1	0	0
Critical	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0

Table 36A Vernalis Water Quality Conditions – Alternative A (Low Control) – Existing Conditions Baseline

Benchmark Vernalis Water Quality - µmhos												A-50-0-50-0 (Low)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875
Change in Vernalis Water Quality with Action - µmhos												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	0	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-1	0	0	0	0	0	0
Critical	0	0	0	-1	-1	-1	-1	-1	0	0	0	0

Table 36B Vernalis Water Quality Conditions – Alternative A (Low Control) – No Action Baseline

Benchmark Vernalis Water Quality - µmhos												A-50-0-50-0 (Low)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	625	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850
Change in Vernalis Water Quality with Action - µmhos												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-1	0	0	0	0	0	0
Critical	0	0	0	-1	-1	-1	-1	-1	0	0	0	0

Table 37A Change in Storage in New Melones Reservoir – Alternative A (Low Control) – Existing Conditions Baseline

Incremental Change in New Melones Reservoir Storage due to Vernalis Flow & Quality Release Change - Acre-feet													A-50-0-50-0 (Low)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-66	0	0	0	0	0	0	0	-66
Below Normal	0	0	0	-66	-66	0	0	0	0	0	0	0	-132
Dry	0	0	0	-66	-66	0	0	0	0	0	0	0	-132
Critical	0	0	19	6	-3	0	0	0	0	0	0	0	22

Table 37B Change in Storage in New Melones Reservoir – Alternative A (Low Control) – No Action Baseline

Incremental Change in New Melones Reservoir Storage due to Vernalis Flow & Quality Release Change - Acre-feet													A-50-0-50-0 (Low)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-71	0	0	0	0	0	0	0	-71
Below Normal	0	0	0	-70	-71	0	0	0	0	0	0	0	-141
Dry	0	0	0	-70	-71	0	0	0	0	0	0	0	-141
Critical	0	0	29	6	-3	0	0	0	0	0	0	0	32

Table 38A Delta CVP/SWP Water Supply Effect – Alternative A (Low Control) – Existing Conditions Baseline

Incremental Change in Project Delta Supply due to Action - Acre-feet													A-50-0-50-0 (Low)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Below Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Dry	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Critical	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489

Table 38B Delta CVP/SWP Water Supply Effect – Alternative A (Low Control) – No Action Baseline

Incremental Change in Project Delta Supply due to Action - Acre-feet													A-50-0-50-0 (Low)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Below Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Dry	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Critical	0	0	-29	-6	3	-146	-152	-145	-35	-39	-8	0	-557

Table 39A Potential Delta Export-Specific Effect – Alternative A (Low Control) – Existing Conditions Baseline

Change in Potential Allowable Export with Action - Acre-feet													A-50-0-50-0 (Low)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	-5	-15	-22	-33	-34	-68	0	0	0	0	0	0	-177
Above Normal	-5	-15	-22	-33	-18	-68	0	0	0	0	0	0	-161
Below Normal	-5	-15	-22	-22	-23	-68	0	0	0	0	0	0	-155
Dry	-5	-15	-22	-33	-35	-68	0	0	0	0	0	0	-178
Critical	-5	-15	-32	-137	-134	-68	0	0	0	0	0	0	-391

Table 39B Potential Delta Export-Specific Effect – Alternative A (Low Control) – No Action Baseline

Change in Potential Allowable Export with Action - Acre-feet												A-50-0-50-0 (Low)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	-5	-16	-24	-35	-37	-73	0	0	0	0	0	0	-190
Above Normal	-5	-16	-24	-35	-19	-73	0	0	0	0	0	0	-172
Below Normal	-5	-16	-24	-23	-25	-73	0	0	0	0	0	0	-166
Dry	-5	-16	-24	-35	-38	-73	0	0	0	0	0	0	-191
Critical	-5	-16	-39	-147	-144	-73	0	0	0	0	0	0	-423

In summary, flows in the San Joaquin River at Vernalis would be reduced by development of transfer water through land fallowing, arguably almost an immeasurable amount. Water quality at Vernalis does not become less. This alternative would have a minor effect on storage in New Melones Reservoir (and commensurately Goodwin releases to the Stanislaus River). Storage could be affected (lowered) by up to about 500 acre-feet in a year, or could possibly increase. The Delta supply for the CVP/SWP may be slightly reduced but by a minor amount, no more than about 850 acre-feet.

4.2 Alternative B: Alternative B: 88,000 Acre-Feet

Alternative B represents an intermediate level of program implementation, and is similar to the level of implementation currently underway and experienced. For this alternative, the Exchange Contractors would provide up to 88,000 acre-feet of water during any non-critical Exchange Contract year through a combination of conservation and temporary land fallowing sources. The conservation measures include those components of tailwater recapture previously described affecting evaporation and seepage to groundwater, water inadvertently discharged to non-district lands, water discharged to the San Joaquin River and tailwater discharged above Sack Dam. These components of conservation account for up to 80,000 acre-feet of the total developed supply. Temporary land fallowing would contribute up to 8,000 acre-feet of developed water.

Flexibility exists in the development of 88,000 acre-feet of water for transfer during any type of water year. The Exchange Contractors have indicated the availability of up to 50,000 acre-feet of water from temporary land fallowing. This source of water in combination with conservation opportunities can provide flexibility in the decision of transfer water source. For example, if 50,000 acre-feet were developed through temporary land fallowing programs, up to 38,000 acre-feet would be developed from conservation programs.

The hydrologic effect of this alternative is evaluated under two scenarios. First, the alternative is evaluated under an assumption of 80,000 acre-feet developed through conservation including tailwater recapture and 8,000 acre-feet developed through temporary land fallowing. The second scenario, as illustrated above, assumes that the transfer maximizes temporary land fallowing (50,000 acre-feet) and provides the remainder of the transfer through conservation including tailwater recapture.

Under the first scenario and with the Existing Conditions baseline, transfer water would be developed through the conservation and tailwater recapture components and temporary land fallowing currently embedded in the recent operations. This scenario would be a continuation of operations already experienced. The San Joaquin River hydrology, New Melones Project operations and Delta water supply would continue occurring as represented by the Existing Conditions setting. No change in these parameters would occur.

As has been touched upon previously (Section 3.2.2.2) and which will be more fully discussed later, in terms of the embedded fallowing assumption, the difference between the Existing Conditions baseline and the No Action baseline is the removal of 8,000 acre-feet of transfer developed from fallowing from the Existing Conditions setting. In effect, removal of fallowing from a setting will add tailwater runoff to San Joaquin River hydrology. However, as described previously, the recent historical fallowing essentially did not alter San Joaquin River hydrology (<0.1 cfs). Therefore, the No Action baseline is not changed from that assumed attributable to other changed conditions for the setting, namely changes due to SJRRP flows. Also, when comparing the effect of a change in transfer of an incremental 8,000 acre-feet among CCID and SLCC (see Table 26) the downstream San Joaquin River hydrology does not show a change from the rounded 2 cfs. Therefore, under the first scenario and with the No Action setting as the baseline, the San Joaquin River hydrology, New Melones Project operations and Delta water supply would continue to occur as represented by the No Action baseline.

Under the second scenario and with the Existing Conditions baseline, an increment of additional temporary land fallowing would be developed for the transfer. To achieve a 50,000 acre-feet component of transfer from temporary land fallowing, an additional 42,000 acre-feet of water would be developed through temporary land fallowing. The incremental 42,000 acre-feet of fallowing would be developed with the same distribution and characteristics as described for Alternative A, with the resulting effects on San Joaquin River hydrology the same as described for Alternative A.

When casting the second scenario against the No Action baseline, an increment of 50,000 acre-feet of fallowing transfer is developed. The incremental 50,000 acre-feet of transfer through fallowing would be developed with the same distribution and characteristics as described for Alternative A, with the resulting effects on San Joaquin River hydrology the same as described for Alternative A.

4.3 Alternative C: 130,000 Acre-Feet

Alternative C makes available up to 130,000 acre-feet of water annually during any non-critical Exchange Contract year. Under this alternative, up to 80,000 acre-feet of water is made available through conservation and up to 50,000 acre-feet of water is made available through temporary land fallowing.

This alternative is representative of the adopted transfer plan for the Current Program, although not yet fully implemented. Up to 130,000 acre-feet of water will be transferred. Water would be developed through 80,000 acre-feet from conservation including tailwater recapture already in the Existing Conditions setting, and 50,000 acre-feet developed from temporary land fallowing. For the comparison to the Existing Conditions baseline, 8,000 acre-feet is already in the Existing Conditions setting. An additional 42,000 acre-feet of water would be developed through temporary land fallowing, consistent with the same distribution and characteristics as described for Alternative A.

For the comparison to the No Action baseline, an increment of 50,000 acre-feet of transfer is developed through temporary land fallowing. The incremental 50,000 acre-feet of transfer would be developed with the same distribution and characteristics as described for Alternative A.

The effect of Alternative B on San Joaquin River hydrology against either the Existing Conditions baseline or the No Action baseline is the same as described for Alternative A, respectively for each baseline setting, and occurs as an increment of irrigated acres reduces runoff.

4.4 Alternative D: 150,000 Acre-Feet

Alternative D expands upon the Alternative C transfer of 130,000 acre-feet (from conservation and temporary land fallowing) with an additional 20,000 acre-feet from additional conservation measures not already considered in the other alternatives. These additional measures will reduce deep percolation by decreasing applied water by mirco and micro/sprinkler technology, or by reducing deep percolation for canal seepage, and are associated with projects that do not have hydrologic continuity with the San Joaquin River. Alternative D represents the maximum water transfer during any non-critical Exchange Contract year by adding an additional increment of conservation water.

130,000 acre-feet of water would be developed through 80,000 acre-feet from conservation including tailwater recapture already in the Existing Conditions setting, and 50,000 acre-feet of transfer from temporary land fallowing. For the comparison to the Existing Conditions baseline, an additional 42,000 acre-feet of water would be developed through temporary land fallowing, consistent with the same distribution and characteristics as described for Alternative A.

For the comparison to the No Action baseline, an increment of 50,000 acre-feet of transfer is developed from fallowing. The incremental 50,000 acre-feet of water developed from fallowing would be developed with the same distribution and characteristics as described for Alternative A.

The new increment of conserved water (20,000 acre-feet) will be derived from water that has historically deep percolated below the root zone from on-farm applications of water or reduced deep percolation of canal seepage. This will be water that is not recovered by well pumping within the Exchange Contractors boundaries and is not presently collected and recirculated within the Exchange Contractors as tailwater flow or goes into open drains and is recirculated, and has not supplied water to the San Joaquin River via subsurface flow.

As described in Section 2 concerning groundwater conditions, varying the groundwater aquifer in the area of the Exchange Contractors by reducing the amount of recharge percolation will not alter San Joaquin River hydrology. The only effect of Alternative D on San Joaquin River hydrology against either the Existing Conditions baseline or the No Action baseline will be associated with the temporary land fallowing component, and will be the same as described for Alternative A, respectively for each baseline setting. This effect occurs as an increment of irrigated acres is reduced due to land fallowing and less runoff occurs.

4.5 No Action/No Project

The No Action/No Project Alternative projects conditions that could reasonably occur within the time period associated with the extended proposed transfer without any of the action alternatives being implemented after the Current Program expires. This setting is substantially the same as the Existing Conditions setting except SJRRP flows from Friant are assumed to occur and the 8,000 acre-feet of water developed through temporary land fallowing does not occur.

The Exchange Contractors have progressively developed conservation and tailwater recapture with the express purpose of providing for (1) more efficient use of the irrigation water within the Exchange Contractors service area, (2) management of drainage water, (3) drought contingency supply, and (4) the additional purpose, when conditions permit, of providing quantities of water for transfer. Absent transfers, the Exchange Contractors anticipate the continuation of the use of the existing facilities for their own internal operation and supply needs.

Absent the transfers, the Exchange Contractors would return to requesting and using their full entitlement to substitute water from the CVP. Water developed by their conservation and tailwater recapture programs is less costly in providing a water supply than utilizing their groundwater resources. Therefore, under the No Action/No Project Alternative it is concluded that the Exchange Contractors will continue to operate their conservation facilities to the extent previously used during periods in which transfers were occurring. The reused tailwater would be integrated into the Exchange Contractors' water supply and reduce deep well groundwater pumping that currently helps meet irrigation demands. The Exchange Contractors would not modify their operations relative to the San Joaquin River as their supply operations would merely shift from groundwater pumping (with no hydrologic connection to the San Joaquin River) back to the DMC. As described in Section 2 concerning groundwater conditions, varying groundwater pumping from the aquifer does not affect San Joaquin River hydrology.

A change in San Joaquin River hydrology is anticipated in the No Action/No Project setting due to the implementation of the San Joaquin River Restoration Program (SJRRP). The effect of the SJRRP is described in Section 2.2.2 (San Joaquin River). These projected changes, when compared to the Existing Condition setting are described as follows.

Flow at Vernalis. Table 40 illustrates the anticipated future change in flow at Vernalis as compared to the Existing Setting condition. The estimation of flow at Vernalis under the Existing Condition and No Action/No Project settings has been shown in Section 2.2.2 (Table 8 and Table 12, respectively). Increased flow occurs almost all the time with the most noticeable increases occurring during March and April consistent with the period of large increased flows required by the SJRRP. The estimated changes include the influence on flows attributed to the New Melones Project reacting to flow and water quality changes in the San Joaquin River upstream of the Stanislaus River's confluence. During some circumstances, in wetter years, there may be decreases in San Joaquin River flows due to changes in Friant Dam operations due to the SJRRP causing different refill operations at Friant Dam.

Water Quality at Vernalis. Table 41 illustrates changes in water quality anticipated at Vernalis due to SJRRP flows. The estimation of water quality at Vernalis under the Existing Condition and No Action/No Project settings has been shown in Section 2.2.2 (Table 9 and Table 13, respectively). Commensurate with additional flow in the San Joaquin River originating from the upper San Joaquin River will be an improvement in water quality. This depiction of water quality assumes the construction of a bypass channel to route flows around the Mendota Pool. Negative values in Table 41 indicate an improvement in water quality.

Table 40 Change in Vernalis Flow – Future No Action Compared to Existing Condition Setting

	Change in San Joaquin River Flow at Vernalis (CFS)											
Yr Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Avg	-100	-450	250	2,000	250	350	50	0	50	100	200	50
AN Ave	100	0	800	2,500	50	50	0	0	50	100	200	100
BN Avg	100	100	700	1,450	50	50	0	0	50	50	200	100
D Avg	150	100	750	800	50	50	0	0	50	50	200	50
C Avg	150	100	500	150	0	0	0	0	0	0	150	100

Table 41 Change in Vernalis Quality – Future No Action Compared to Existing Condition Setting

	Change in San Joaquin River Water Quality at Vernalis (EC - µmhos)											
Yr Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W Avg	0	0	0	-25	-25	0	0	0	0	0	-25	-20
AN Ave	-25	0	-50	-50	0	0	0	0	0	0	-25	-25
BN Avg	-25	-25	-100	-75	0	0	0	0	0	0	-25	-25
D Avg	-50	-25	-125	-75	0	0	0	0	0	0	-25	-25
C Avg	-50	-25	-100	0	0	0	0	0	0	0	-25	-25

The results shown in Table 40 and Table 41 are expressed in monthly average flows and quality. Values for a month within a particular year type may vary from the average values. Also, in some circumstances in a particular period flow or quality at Vernalis may not change due to the New Melones Project maintaining conditions at Vernalis equal to required objectives.

New Melones Project Required Vernalis Water Quality Releases. Table 10 and Table 14, described earlier, illustrate the periods when water quality releases would be required to comply with Vernalis water quality objectives. Results are shown for both a high and low control condition. Periods of required releases from New Melones Reservoir are reduced during winter and early spring due to the dilution effect of SJRRP flows. Required releases during late spring (e.g., last half of May) and the summer remain needed.

New Melones Project Required Vernalis Flow Releases. Table 11 and Table 15, described earlier, illustrate the periods when flow from the New Melones Project would be required to comply with Vernalis flow objectives. Results are shown for both a high and low control condition. Periods of required releases from New Melones Reservoir are reduced during late winter and early spring due to the effect of SJRRP flows. Required releases during late spring (e.g., last half of May) and June remain needed. The Vernalis flow requirements occur for the period February through June.

Delta Water Supply. The SJRRP flows would affect inflows to the Delta from the San Joaquin River, mostly adding flow (Table 40). It was stated earlier that the 82-year annual average additional flow in the San Joaquin River upstream of the Stanislaus River confluence would increase by about 160,000 acre-feet. While the estimation procedure used for the primary analysis of the Proposed Program alternatives (involving relatively small differences in flow rates and water quality within the San Joaquin River) is adequate for evaluating the Proposed Program alternatives, estimating the change in Delta water supply conditions due to the large differences in flow and water quality attributable to the SJRRP is beyond the scope of this analysis using the same tools. Several additional refined assumptions would be required including a long-term operating plan for the New Melones Project including operational/allocation considerations for Stanislaus River water users, instream flow and Vernalis flow and water quality objectives including Biological Opinions. Additional assumptions and modeling would be required to address the operation plan of CVP/SWP facilities and the Delta which include the constraints of recent Biological Opinions. Such plans do not currently exist. However, it can be concluded that under current operation objectives the addition of flow from the SJRRP will provide additional water to the Delta, some of which will be available for export, possibly constrained by flow ratio limits.

A minor difference in the San Joaquin River conditions as described above would occur due to the removal of the effects caused by the currently occurring 8,000 acre-feet of transfer water developed by temporary land fallowing. The effect of removing the temporary land fallowing would be an increase in tailwater return flows from the lands that have been assumed to be fallowed. The general calculation of the effect would be similar to that used to estimate the effect of increasing temporary land fallowing used previously, but with an anticipation that the results would be opposite in sign. That is, rather than diminishing flow to the San Joaquin River, flow would be added.

The estimated difference in San Joaquin River conditions due to this adjustment would be minimal, and not large enough to influence the results described by Table 40 and Table 41. The temporary land fallowing assumed in the Existing Conditions setting was described previously in Section 3.2.2.2. Relying on the detailed analysis of recent historical fallowing, the increment of flow that would be added back to San Joaquin River hydrology had the fallowing not occurred would result in less than 0.1 cfs of increased tailwater flow in a month.

4.6 Assessment of EBMUD Transfer Needs and Opportunity to Serve with SJRECWA Transfers

The East Bay Municipal Utility District is identified as a potential transferee within the Exchange Contractors' 25-year program. The provision of water to EBMUD under a transfer arrangement with the Exchange Contractors' is physically different than would occur to the transferees which are located "south of the Delta", downstream of Delta export facilities. The provision of water to EBMUD is assumed to occur at the Freeport Regional Water Project (FRWP) located along the Sacramento River below the City of Sacramento near the community of Freeport. The FRWP enables EBMUD to take delivery of its CVP water under contract with Reclamation and would also be used for diversion of the transfer water. Conveyance facilities will transport water diverted from the Sacramento River to EBMUD's Mokelumne Aqueducts, where it will subsequently be delivered to the district's service area for treatment and distribution.

The FRWP includes shared facilities between EBMUD and the Sacramento County Water Agency (SCWA) and separate facilities owned by EBMUD. The shared FRWP intake facilities will divert up to 185 MGD (approximately 286 cfs) to the Turnout Facility where a pipeline capable of transporting up to 100 MGD (approximately 155 cfs, and assumed to be the limit of EBMUD's diversion) to the Folsom South Canal. From there flow will continue to the end of canal and then will be pumped through pipelines to connecting facilities with the Mokelumne Aqueducts.

4.6.1 EBMUD Need for Transfer Water

EBMUD performs its water supply planning based on several considerations including reliability goals for customer deliveries. That planning process includes an assessment of water demands including conservation and planned deficiencies and water supplies. During its recent analysis leading to its Water Supply Management Program 2040 (WSMP), EBMUD identified a current and future need for supplemental water resources (EBMUD2009). EBMUD developed several alternative portfolios of actions and programs/projects to address the supplemental need. A component of supply that was included in each of its portfolios was a water transfer program, which was assumed to occur through the FRWP. These transfers would provide a dry-year component of water supply through the FRWP in addition to limited CVP water already assumed incorporated through the facility. A unique characteristic of this component of supply is that there would be early implementation of water transfers due to the availability of existing facilities.

EBMUD has identified a planning assumption of up to 15,000 acre-feet of supplemental water diversion through the FRWP developed through water transfers. This need occurs during drought years/cycles when other EBMUD water supply resources such as its Mokelumne River supply and Reclamation supply become constrained. Typically during these periods EBMUD would be diverting its Reclamation supply up to its reduced CVP water delivery allocation, and EBMUD has assumed that the diversion would occur as soon as the allocation is known (beginning in March); however, there is annual capacity within EBMUD's share of FRWP facilities which is in excess of that required to divert the Reclamation supply. Thus, there is flexibility within the seasonal pattern of diverting the Reclamation supply which would allow transfer water to be diverted most any time of the year, allowing consideration for the timing of availability and potential impact avoidance (EBMUD2011).

4.6.2 Transfers

Water would be made available by the Exchange Contractors as described before, generally throughout their contract year (January through December), by reducing their need for deliveries from the DMC. Through change in CVP operations this reduced delivery could manifest as a reduction in exports at Jones coincident with a diversion at FRWP either incrementally adding to diversions at FRWP or displacing other diversions, in the later circumstance leading to an increase in EBMUD's diversions of other supplies to another period. Although relatively small in comparison to flow rates within the context of Sacramento River and Sacramento-San Joaquin Delta flows, potential changes in CVP operations and its affected environment would require identification. Potential transfer-specific effects to the affected environment have not been identified. Within its WSMP EBMUD recognized that project-level environmental documentation would be required prior to implementation of a transfer project.

4.7 Assessment of CCWD Transfer Needs and Opportunity to Serve with SJRECWA Transfers

The Contra Costa Water District is also identified as a potential transferee within the Exchange Contractors' 25-year program. A transfer to CCWD would also be different in physical operation than transfers to entities south of the Delta. The provision of water to CCWD could potentially occur at the District's four intakes in the Sacramento-San Joaquin Delta. The intakes are located at Rock Slough, on Old River, on Victoria Canal and at Mallard Slough.

4.7.1 CCWD Need for Transfer Water

The CCWD conducted a long-range water supply planning effort in coordination with its wholesale customers and the cities to which it provides retail water service. The Future Water Supply Study (FWSS) identifies the sources and programs CCWD plans to implement in the future (CCWD1996). In addition to supplies obtained through its CVP contract and its Los Vaqueros and Mallard Slough Water Rights, CCWD has identified conservation, recycled water, and water transfers as other sources of supply. Recent analysis for the Los Vaqueros Expansion Project incorporates an average 19 TAF per year of supplemental transfer water in multiyear droughts. Transfers could occur during these periods when CCWD's CVP delivery allocation is less than 100 percent.

4.7.2 Transfers

Water would be made available by the Exchange Contractors for the entire program generally throughout their contract year (January through December), by reducing their need for deliveries from the DMC. A portion of the developed water would be identified for transfer to CCWD. Through change in CVP operations this reduced delivery could manifest as a reduction in exports at Jones coincident with a diversion at CCWD diversion facilities either incrementally adding to CCWD diversions or displacing other diversions, in the later circumstance leading to an increase in CCWD's diversions of other supplies to another period. Although relatively small in comparison to flow rates within the context of Sacramento River and Sacramento-San Joaquin Delta flows, potential changes in CVP operations and its affected environment have not been identified.

Subsequent to the FWSS, CCWD prepared and certified a program-level Environmental Impact Report addressing the impacts of implementing the FWSS (CCWD1998). The document did not address the effects of individual implementation projects such as specific water transfers.

4.8 Water Banking/Exchange Opportunities

There may be occasions when the Exchange Contractors develop conserved water but are unable to secure a willing buyer, or are precluded from transferring to a willing buyer due to constraints of the transfer program such as not allowing a transfer of water to a buyer if, when combining the transfer and its CVP allocated contract supply, the entity's CVP total quantity would exceed the entity's full contract amount. Also, the Exchange Contractors may desire to bank developed water for their own water delivery reliability needs. Water could be banked by the Exchange Contractors with entities included in this 25-year program for subsequent transfer to willing buyers or for subsequent return to the Exchange Contractors themselves.

Another opportunity may the transfer/exchange of water to an entity during one season of the year for return in another season. An example would be developing water prior to a San Luis Reservoir "low point" constraint period, with return of the water after the constraint occurred.

The conveyance and storage components of each of these banking/exchange opportunities are anticipated to be facilitated by already existing programs, such as the Kern Water Bank. Effects due to the development of the water would be the same as described for the Alternatives.

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Attachment 1
Modeling Results

A-50-0-50-0 (High)

All Values Relative to Existing Condition													Basic Hydrologic Accounting
Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	10	30	45	131	137	136	142	135	32	36	8	0	842
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	10	30	45	131	137	136	142	135	32	36	8	0	842
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

All Values Relative to Existing Condition												Vernalis
Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	0	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	0	-1	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,550	10,699	13,049	10,850	11,600	11,048	7,698	3,498	3,449	3,499	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,948	1,998	2,399	2,899	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,498	1,498	1,899	2,399	2,100	2,100
Dry	2,300	2,500	2,350	2,699	2,700	1,450	1,248	1,348	1,749	2,149	1,900	1,900
Critical	1,800	2,049	1,749	1,800	1,800	996	897	897	1,349	1,549	1,650	1,650
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	549	600	550	550	500	600	825
Below Normal	825	875	850	449	474	599	650	600	600	550	675	850
Dry	850	925	925	524	549	648	675	625	600	575	675	850
Critical	900	975	975	624	624	675	675	675	650	700	725	875

All Values Relative to Existing Condition													New Melones
Incremental Change in NM Storage due to WQ Release Change - Acre	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	9	16	19	0	0	76	57	49	0	0	0	0	226
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Above Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Below Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Dry	0	-30	-41	-66	-137	-136	0	0	0	0	0	0	-409
Critical	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Above Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Below Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Dry	0	-30	-41	-66	-137	-136	0	0	0	0	0	0	-409
Critical	9	16	19	-131	-137	76	57	49	0	0	0	0	-42

All Values Relative to Existing Condition													Project Delta Supply
Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Below Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Dry	0	-30	-45	0	0	-136	-142	-135	-32	-36	-8	0	-564
Critical	-10	-30	-45	-131	-137	-136	-142	-135	-32	-36	-8	0	-842
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	136	0	0	0	0	0	0	136
Below Normal	0	0	0	0	0	136	0	0	0	0	0	0	136
Dry	0	30	41	0	0	136	0	0	0	0	0	0	206
Critical	-9	-16	-19	131	137	-76	-57	-49	0	0	0	0	42
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Below Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Dry	0	0	-4	0	0	0	-142	-135	-32	-36	-8	0	-357
Critical	-19	-46	-64	0	0	-212	-198	-184	-32	-36	-8	0	-799

A-50-0-50-0 (High)

All Values Relative to No Action — Basic Hydrologic Accounting

Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	11	32	48	141	147	146	152	145	35	39	8	0	902
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	11	32	48	141	147	146	152	145	35	39	8	0	902
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

All Values Relative to No Action — Vernalis

Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	-2	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	-1	-2	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,450	10,249	13,299	12,848	11,850	11,398	7,748	3,498	3,499	3,599	2,850	3,000
Above Normal	4,150	6,250	7,049	7,898	5,100	2,900	1,948	1,998	2,449	2,999	2,550	2,450
Below Normal	2,450	3,100	3,599	5,000	3,550	2,050	1,498	1,498	1,949	2,449	2,300	2,200
Dry	2,450	2,600	3,099	3,500	2,750	1,500	1,248	1,348	1,799	2,199	2,100	1,950
Critical	1,950	2,149	2,249	1,950	1,800	996	897	897	1,349	1,549	1,800	1,750
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	625	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-1	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	374	549	599	549	550	500	575	800
Below Normal	800	850	750	374	474	599	650	600	600	550	650	825
Dry	800	900	800	449	549	648	675	625	600	575	650	825
Critical	850	950	875	624	624	675	675	675	650	700	700	850

All Values Relative to No Action — New Melones

Incremental Change in NM Storage due to WQ Release Change - Acre	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	18	29	0	0	82	61	52	0	0	0	0	242
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	0	-147	0	0	0	0	0	0	0	-147
Above Normal	0	-32	0	0	-147	-146	0	0	0	0	0	0	-324
Below Normal	0	-32	0	-141	-147	-146	0	0	0	0	0	0	-465
Dry	0	-32	0	-145	-147	-146	0	0	0	0	0	0	-470
Critical	0	0	0	-141	-147	0	0	0	0	0	0	0	-288
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	0	-147	0	0	0	0	0	0	0	-147
Above Normal	0	-32	0	0	-147	-146	0	0	0	0	0	0	-324
Below Normal	0	-32	0	-141	-147	-146	0	0	0	0	0	0	-465
Dry	0	-32	0	-145	-147	-146	0	0	0	0	0	0	-470
Critical	0	18	29	-141	-147	82	61	52	0	0	0	0	-45

All Values Relative to No Action — Project Delta Supply

Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Below Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Dry	0	-32	-48	0	0	-146	-152	-145	-35	-39	-8	0	-604
Critical	-11	-32	-48	-141	-147	-146	-152	-145	-35	-39	-8	0	-902
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	146	0	0	0	0	0	0	146
Below Normal	0	0	0	0	0	146	0	0	0	0	0	0	146
Dry	0	32	0	0	0	146	0	0	0	0	0	0	178
Critical	0	-18	-29	141	147	-82	-61	-52	0	0	0	0	45
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Below Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Dry	0	0	-48	0	0	0	-152	-145	-35	-39	-8	0	-427
Critical	-11	-50	-77	0	0	-228	-213	-197	-35	-39	-8	0	-857

A-50-0-50-0 (Low)

All Values Relative to Existing Condition												Basic Hydrologic Accounting
Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	10	30	45	131	137	136	142	135	32	36	8	0	842
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	10	30	45	131	137	136	142	135	32	36	8	0	842
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

All Values Relative to Existing Condition												Vernalis
Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0
Above Normal	0	-1	-1	-2	-1	-2	-2	-2	-1	-1	0	0
Below Normal	0	-1	-1	-1	-1	-2	-2	-2	-1	-1	0	0
Dry	0	-1	-1	-1	-1	-2	-2	-2	-1	-1	0	0
Critical	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,550	10,699	13,049	10,848	11,598	11,048	7,698	3,498	3,449	3,499	2,650	2,950
Above Normal	4,050	6,249	6,249	5,398	5,049	2,848	1,948	1,998	2,399	2,899	2,350	2,350
Below Normal	2,350	2,999	2,899	3,549	3,499	1,998	1,498	1,498	1,899	2,399	2,100	2,100
Dry	2,300	2,499	2,349	2,699	2,699	1,448	1,248	1,348	1,749	2,149	1,900	1,900
Critical	1,800	2,049	1,749	1,798	1,798	998	898	898	1,349	1,549	1,650	1,650
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	0	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-1	0	0	0	0	0	0
Critical	0	0	0	-1	-1	-1	-1	-1	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	449	474	600	650	600	600	550	675	850
Dry	850	925	925	524	549	649	675	625	600	575	675	850
Critical	900	975	975	624	624	674	674	674	650	700	725	875

All Values Relative to Existing Condition												New Melones
Incremental Change in NM Storage due to WQ Release Change - Ac	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	19	71	63	0	0	0	0	0	0	0	154
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-66	0	0	0	0	0	0	0	-66
Below Normal	0	0	0	-66	-66	0	0	0	0	0	0	0	-132
Dry	0	0	0	-66	-66	0	0	0	0	0	0	0	-132
Critical	0	0	0	-66	-66	0	0	0	0	0	0	0	-132
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-66	0	0	0	0	0	0	0	-66
Below Normal	0	0	0	-66	-66	0	0	0	0	0	0	0	-132
Dry	0	0	0	-66	-66	0	0	0	0	0	0	0	-132
Critical	0	0	19	6	-3	0	0	0	0	0	0	0	22

All Values Relative to Existing Condition												Project Delta Supply
Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Below Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Dry	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Critical	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Below Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Dry	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Critical	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489

A-50-0-50-0 (Low)

All Values Relative to No Action													Basic Hydrologic Accounting
Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	11	32	48	141	147	146	152	145	35	39	8	0	902
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	11	32	48	141	147	146	152	145	35	39	8	0	902
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

All Values Relative to No Action												Vernalis
Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0
Above Normal	0	-1	-1	-2	-1	-2	-2	-2	-1	-1	0	0
Below Normal	0	-1	-1	-1	-1	-2	-2	-2	-1	-1	0	0
Dry	0	-1	-1	-1	-1	-2	-2	-2	-1	-1	0	0
Critical	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,450	10,249	13,299	12,848	11,848	11,398	7,748	3,498	3,499	3,599	2,850	3,000
Above Normal	4,150	6,249	7,049	7,898	5,099	2,898	1,948	1,998	2,449	2,999	2,550	2,450
Below Normal	2,450	3,099	3,599	4,999	3,549	2,048	1,498	1,498	1,949	2,449	2,300	2,200
Dry	2,450	2,599	3,099	3,499	2,749	1,498	1,248	1,348	1,799	2,199	2,100	1,950
Critical	1,950	2,149	2,249	1,948	1,798	998	898	898	1,349	1,549	1,800	1,750
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	625	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-1	0	0	0	0	0	0
Critical	0	0	0	-1	-1	-1	-1	-1	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	599	549	550	500	575	800
Below Normal	800	850	750	375	474	599	650	600	600	550	650	825
Dry	800	900	800	449	549	649	675	625	600	575	650	825
Critical	850	950	875	624	624	674	674	674	650	700	700	850

All Values Relative to No Action													New Melones
Incremental Change in NM Storage due to WQ Release Change - Ac	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	29	77	68	0	0	0	0	0	0	0	174
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-71	0	0	0	0	0	0	0	-71
Below Normal	0	0	0	-70	-71	0	0	0	0	0	0	0	-141
Dry	0	0	0	-70	-71	0	0	0	0	0	0	0	-141
Critical	0	0	0	-70	-71	0	0	0	0	0	0	0	-141
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-71	0	0	0	0	0	0	0	-71
Below Normal	0	0	0	-70	-71	0	0	0	0	0	0	0	-141
Dry	0	0	0	-70	-71	0	0	0	0	0	0	0	-141
Critical	0	0	29	6	-3	0	0	0	0	0	0	0	32

All Values Relative to No Action													Project Delta Supply
Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Below Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Dry	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Critical	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	-29	-6	3	0	0	0	0	0	0	0	-32
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Below Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Dry	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Critical	0	0	-29	-6	3	-146	-152	-145	-35	-39	-8	0	-557

B-88-80-8-0 (High)(Existing)

All Values Relative to Existing Condition — Basic Hydrologic Accounting

Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	0	0	0	0	0	0	0	0	0	0	0	0	0
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	0	0	0	0	0	0	0	0	0	0	0	0	0
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	0	0	0	0	0	0	0	0	0	0	0	

All Values Relative to Existing Condition — Vernalis

Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Change in Vernalis Flow with Action - cfs												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
With-Action Vernalis Flow - cfs												
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875

All Values Relative to Existing Condition — New Melones

Incremental Change in NM Storage due to WQ Release Change - Ac	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0

All Values Relative to Existing Condition — Project Delta Supply

Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0	0

B-88-80-8-0 (High)(No Action)

All Values Relative to No Action — Basic Hydrologic Accounting

Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	170	234	495	1,178	1,240	1,278	1,384	1,318	292	174	236	0	8,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	170	234	495	1,178	1,240	1,278	1,384	1,318	292	174	236	0	8,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	1	2	3	9	10	10	10	10	2	3	1	0	61
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	1	2	3	9	10	10	10	10	2	3	1	0	61
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	0	0	0	0	0	0	0	0	0	0	0	

All Values Relative to No Action — Vernalis

Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Change in Vernalis Flow with Action - cfs												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
With-Action Vernalis Flow - cfs												
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	625	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	625	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850

All Values Relative to No Action — New Melones

Incremental Change in NM Storage due to WQ Release Change - Ac	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	1	2	0	0	6	4	4	0	0	0	0	16
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	0	-10	0	0	0	0	0	0	0	-10
Above Normal	0	-2	0	0	-10	-10	0	0	0	0	0	0	-22
Below Normal	0	-2	0	-9	-10	-10	0	0	0	0	0	0	-31
Dry	0	-2	0	-10	-10	-10	0	0	0	0	0	0	-32
Critical	0	0	0	-9	-10	0	0	0	0	0	0	0	-19
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	0	-10	0	0	0	0	0	0	0	-10
Above Normal	0	-2	0	0	-10	-10	0	0	0	0	0	0	-22
Below Normal	0	-2	0	-9	-10	-10	0	0	0	0	0	0	-31
Dry	0	-2	0	-10	-10	-10	0	0	0	0	0	0	-32
Critical	0	1	2	-9	-10	6	4	4	0	0	0	0	-3

All Values Relative to No Action — Project Delta Supply

Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-10	-10	-10	-2	-3	-1	0	-35
Above Normal	0	0	0	0	0	-10	-10	-10	-2	-3	-1	0	-35
Below Normal	0	0	0	0	0	-10	-10	-10	-2	-3	-1	0	-35
Dry	0	-2	-3	0	0	-10	-10	-10	-2	-3	-1	0	-41
Critical	-1	-2	-3	-9	-10	-10	-10	-10	-2	-3	-1	0	-61
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	10	0	0	0	0	0	0	10
Below Normal	0	0	0	0	0	10	0	0	0	0	0	0	10
Dry	0	2	0	0	0	10	0	0	0	0	0	0	12
Critical	0	-1	-2	9	10	-6	-4	-4	0	0	0	0	3
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-10	-10	-10	-2	-3	-1	0	-35
Above Normal	0	0	0	0	0	0	-10	-10	-2	-3	-1	0	-26
Below Normal	0	0	0	0	0	0	-10	-10	-2	-3	-1	0	-26
Dry	0	0	-3	0	0	0	-10	-10	-2	-3	-1	0	-29
Critical	-1	-3	-5	0	0	-15	-14	-13	-2	-3	-1	0	-58

B-88-38-50-0 (High) (Existing)

All Values Relative to Existing Condition — Basic Hydrologic Accounting

Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	10	30	45	131	137	136	142	135	32	36	8	0	842
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	10	30	45	131	137	136	142	135	32	36	8	0	842
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

All Values Relative to Existing Condition — Vernalis

Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	0	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	0	-1	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,550	10,699	13,049	10,850	11,600	11,048	7,698	3,498	3,449	3,499	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,948	1,998	2,399	2,899	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,498	1,498	1,899	2,399	2,100	2,100
Dry	2,300	2,500	2,350	2,699	2,700	1,450	1,248	1,348	1,749	2,149	1,900	1,900
Critical	1,800	2,049	1,749	1,800	1,800	996	897	897	1,349	1,549	1,650	1,650
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	549	600	550	550	500	600	825
Below Normal	825	875	850	449	474	599	650	600	600	550	675	850
Dry	850	925	925	524	549	648	675	625	600	575	675	850
Critical	900	975	975	624	624	675	675	675	650	700	725	875

All Values Relative to Existing Condition — New Melones

Incremental Change in NM Storage due to WQ Release Change -	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	9	16	19	0	0	76	57	49	0	0	0	0	226
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Above Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Below Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Dry	0	-30	-41	-66	-137	-136	0	0	0	0	0	0	-409
Critical	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Above Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Below Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Dry	0	-30	-41	-66	-137	-136	0	0	0	0	0	0	-409
Critical	9	16	19	-131	-137	76	57	49	0	0	0	0	-42

All Values Relative to Existing Condition — Project Delta Supply

Total Potential Delta supply Impact w/o NM Adjustments - Acre-fe	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Below Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Dry	0	-30	-45	0	0	-136	-142	-135	-32	-36	-8	0	-564
Critical	-10	-30	-45	-131	-137	-136	-142	-135	-32	-36	-8	0	-842
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	136	0	0	0	0	0	0	136
Below Normal	0	0	0	0	0	136	0	0	0	0	0	0	136
Dry	0	30	41	0	0	136	0	0	0	0	0	0	206
Critical	-9	-16	-19	131	137	-76	-57	-49	0	0	0	0	42
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Below Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Dry	0	0	-4	0	0	0	-142	-135	-32	-36	-8	0	-357
Critical	-19	-46	-64	0	0	-212	-198	-184	-32	-36	-8	0	-799

B-88-38-50-0 (High)(No Action)

All Values Relative to No Action													Basic Hydrologic Accounting
Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	11	32	48	141	147	146	152	145	35	39	8	0	902
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	11	32	48	141	147	146	152	145	35	39	8	0	902
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

All Values Relative to No Action												Vernalis
Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	-2	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	-1	-2	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,450	10,249	13,299	12,848	11,850	11,398	7,748	3,498	3,499	3,599	2,850	3,000
Above Normal	4,150	6,250	7,049	7,898	5,100	2,900	1,948	1,998	2,449	2,999	2,550	2,450
Below Normal	2,450	3,100	3,599	5,000	3,550	2,050	1,498	1,498	1,949	2,449	2,300	2,200
Dry	2,450	2,600	3,099	3,500	2,750	1,500	1,248	1,348	1,799	2,199	2,100	1,950
Critical	1,950	2,149	2,249	1,950	1,800	996	897	897	1,349	1,549	1,800	1,750
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	625	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-1	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	374	549	599	549	550	500	575	800
Below Normal	800	850	750	374	474	599	650	600	600	550	650	825
Dry	800	900	800	449	549	648	675	625	600	575	650	825
Critical	850	950	875	624	624	675	675	675	650	700	700	850

All Values Relative to No Action													New Melones
Incremental Change in NM Storage due to WQ Release Change -	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	18	29	0	0	82	61	52	0	0	0	0	242
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	0	-147	0	0	0	0	0	0	0	-147
Above Normal	0	-32	0	0	-147	-146	0	0	0	0	0	0	-324
Below Normal	0	-32	0	-141	-147	-146	0	0	0	0	0	0	-465
Dry	0	-32	0	-145	-147	-146	0	0	0	0	0	0	-470
Critical	0	0	0	-141	-147	0	0	0	0	0	0	0	-288
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	0	-147	0	0	0	0	0	0	0	-147
Above Normal	0	-32	0	0	-147	-146	0	0	0	0	0	0	-324
Below Normal	0	-32	0	-141	-147	-146	0	0	0	0	0	0	-465
Dry	0	-32	0	-145	-147	-146	0	0	0	0	0	0	-470
Critical	0	18	29	-141	-147	82	61	52	0	0	0	0	-45

All Values Relative to No Action													Project Delta Supply
Total Potential Delta supply Impact w/o NM Adjustments - Acre-fe	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Below Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Dry	0	-32	-48	0	0	-146	-152	-145	-35	-39	-8	0	-604
Critical	-11	-32	-48	-141	-147	-146	-152	-145	-35	-39	-8	0	-902
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	146	0	0	0	0	0	0	146
Below Normal	0	0	0	0	0	146	0	0	0	0	0	0	146
Dry	0	32	0	0	0	146	0	0	0	0	0	0	178
Critical	0	-18	-29	141	147	-82	-61	-52	0	0	0	0	45
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Below Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Dry	0	0	-48	0	0	0	-152	-145	-35	-39	-8	0	-427
Critical	-11	-50	-77	0	0	-228	-213	-197	-35	-39	-8	0	-857

C-130-80-50-0 (High)(Existing)

All Values Relative to Existing Condition — Basic Hydrologic Accounting

Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	10	30	45	131	137	136	142	135	32	36	8	0	842
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	10	30	45	131	137	136	142	135	32	36	8	0	842
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

All Values Relative to Existing Condition — Vernalis

Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	0	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	0	-1	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,550	10,699	13,049	10,850	11,600	11,048	7,698	3,498	3,449	3,499	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,948	1,998	2,399	2,899	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,498	1,498	1,899	2,399	2,100	2,100
Dry	2,300	2,500	2,350	2,699	2,700	1,450	1,248	1,348	1,749	2,149	1,900	1,900
Critical	1,800	2,049	1,749	1,800	1,800	996	897	897	1,349	1,549	1,650	1,650
Benchmark Vernalis Water Quality - μmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875
Change in Vernalis Water Quality with Action - μmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - μmhos (April and May values include split-month operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	549	600	550	550	500	600	825
Below Normal	825	875	850	449	474	599	650	600	600	550	675	850
Dry	850	925	925	524	549	648	675	625	600	575	675	850
Critical	900	975	975	624	624	675	675	675	650	700	725	875

All Values Relative to Existing Condition — New Melones

Incremental Change in NM Storage due to WQ Release Change - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	9	16	19	0	0	76	57	49	0	0	0	0	226
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Above Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Below Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Dry	0	-30	-41	-66	-137	-136	0	0	0	0	0	0	-409
Critical	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Above Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Below Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Dry	0	-30	-41	-66	-137	-136	0	0	0	0	0	0	-409
Critical	9	16	19	-131	-137	76	57	49	0	0	0	0	-42

All Values Relative to Existing Condition — Project Delta Supply

Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Below Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Dry	0	-30	-45	0	0	-136	-142	-135	-32	-36	-8	0	-564
Critical	-10	-30	-45	-131	-137	-136	-142	-135	-32	-36	-8	0	-842
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	136	0	0	0	0	0	0	136
Below Normal	0	0	0	0	0	136	0	0	0	0	0	0	136
Dry	0	30	41	0	0	136	0	0	0	0	0	0	206
Critical	-9	-16	-19	131	137	-76	-57	-49	0	0	0	0	42
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Below Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Dry	0	0	-4	0	0	0	-142	-135	-32	-36	-8	0	-357
Critical	-19	-46	-64	0	0	-212	-198	-184	-32	-36	-8	0	-799

C-130-80-50-0 (High)(No Action)

All Values Relative to No Action													Basic Hydrologic Accounting
Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	11	32	48	141	147	146	152	145	35	39	8	0	902
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	11	32	48	141	147	146	152	145	35	39	8	0	902
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

All Values Relative to No Action												Vernalis
Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	-2	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	-1	-2	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,450	10,249	13,299	12,848	11,850	11,398	7,748	3,498	3,499	3,599	2,850	3,000
Above Normal	4,150	6,250	7,049	7,898	5,100	2,900	1,948	1,998	2,449	2,999	2,550	2,450
Below Normal	2,450	3,100	3,599	5,000	3,550	2,050	1,498	1,498	1,949	2,449	2,300	2,200
Dry	2,450	2,600	3,099	3,500	2,750	1,500	1,248	1,348	1,799	2,199	2,100	1,950
Critical	1,950	2,149	2,249	1,950	1,800	996	897	897	1,349	1,549	1,800	1,750
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	625	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-1	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	374	549	599	549	550	500	575	800
Below Normal	800	850	750	374	474	599	650	600	600	550	650	825
Dry	800	900	800	449	549	648	675	625	600	575	650	825
Critical	850	950	875	624	624	675	675	675	650	700	700	850

All Values Relative to No Action													New Melones
Incremental Change in NM Storage due to WQ Release Change - Acre	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	18	29	0	0	82	61	52	0	0	0	0	242
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	0	-147	0	0	0	0	0	0	0	-147
Above Normal	0	-32	0	0	-147	-146	0	0	0	0	0	0	-324
Below Normal	0	-32	0	-141	-147	-146	0	0	0	0	0	0	-465
Dry	0	-32	0	-145	-147	-146	0	0	0	0	0	0	-470
Critical	0	0	0	-141	-147	0	0	0	0	0	0	0	-288
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	0	-147	0	0	0	0	0	0	0	-147
Above Normal	0	-32	0	0	-147	-146	0	0	0	0	0	0	-324
Below Normal	0	-32	0	-141	-147	-146	0	0	0	0	0	0	-465
Dry	0	-32	0	-145	-147	-146	0	0	0	0	0	0	-470
Critical	0	18	29	-141	-147	82	61	52	0	0	0	0	-45

All Values Relative to No Action													Project Delta Supply
Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Below Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Dry	0	-32	-48	0	0	-146	-152	-145	-35	-39	-8	0	-604
Critical	-11	-32	-48	-141	-147	-146	-152	-145	-35	-39	-8	0	-902
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	146	0	0	0	0	0	0	146
Below Normal	0	0	0	0	0	146	0	0	0	0	0	0	146
Dry	0	32	0	0	0	146	0	0	0	0	0	0	178
Critical	0	-18	-29	141	147	-82	-61	-52	0	0	0	0	45
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Below Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Dry	0	0	-48	0	0	0	-152	-145	-35	-39	-8	0	-427
Critical	-11	-50	-77	0	0	-228	-213	-197	-35	-39	-8	0	-857

D-150-80-50-20 (High)(Existing)

All Values Relative to Existing Condition — Basic Hydrologic Accounting

Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	203	580	2,460	7,176	7,480	7,443	7,751	7,406	638	694	171	0	42,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	10	30	45	131	137	136	142	135	32	36	8	0	842
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	10	30	45	131	137	136	142	135	32	36	8	0	842
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

All Values Relative to Existing Condition — Vernalis

Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	0	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	0	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	0	-1	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,550	10,699	13,049	10,850	11,600	11,048	7,698	3,498	3,449	3,499	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,948	1,998	2,399	2,899	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,498	1,498	1,899	2,399	2,100	2,100
Dry	2,300	2,500	2,350	2,699	2,700	1,450	1,248	1,348	1,749	2,149	1,900	1,900
Critical	1,800	2,049	1,749	1,800	1,800	996	897	897	1,349	1,549	1,650	1,650
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	549	600	550	550	500	600	825
Below Normal	825	875	850	449	474	599	650	600	600	550	675	850
Dry	850	925	925	524	549	648	675	625	600	575	675	850
Critical	900	975	975	624	624	675	675	675	650	700	725	875

All Values Relative to Existing Condition — New Melones

Incremental Change in NM Storage due to WQ Release Change - Acre	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	9	16	19	0	0	76	57	49	0	0	0	0	226
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Above Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Below Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Dry	0	-30	-41	-66	-137	-136	0	0	0	0	0	0	-409
Critical	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	-131	-137	0	0	0	0	0	0	0	-268
Above Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Below Normal	0	-30	-41	-131	-137	-136	0	0	0	0	0	0	-474
Dry	0	-30	-41	-66	-137	-136	0	0	0	0	0	0	-409
Critical	9	16	19	-131	-137	76	57	49	0	0	0	0	-42

All Values Relative to Existing Condition — Project Delta Supply

Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Below Normal	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Dry	0	-30	-45	0	0	-136	-142	-135	-32	-36	-8	0	-564
Critical	-10	-30	-45	-131	-137	-136	-142	-135	-32	-36	-8	0	-842
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	136	0	0	0	0	0	0	136
Below Normal	0	0	0	0	0	136	0	0	0	0	0	0	136
Dry	0	30	41	0	0	136	0	0	0	0	0	0	206
Critical	-9	-16	-19	131	137	-76	-57	-49	0	0	0	0	42
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-136	-142	-135	-32	-36	-8	0	-489
Above Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Below Normal	0	0	0	0	0	0	-142	-135	-32	-36	-8	0	-353
Dry	0	0	-4	0	0	0	-142	-135	-32	-36	-8	0	-357
Critical	-19	-46	-64	0	0	-212	-198	-184	-32	-36	-8	0	-799

D-150-80-50-20 (High)(No Action)

All Values Relative to No Action — Basic Hydrologic Accounting

Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	373	813	2,956	8,353	8,720	8,721	9,135	8,724	930	868	407	0	50,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	11	32	48	141	147	146	152	145	35	39	8	0	902
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	11	32	48	141	147	146	152	145	35	39	8	0	902
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	-1	-1	-2	-2	-2	-2	-2	-1	-1	0	0	

All Values Relative to No Action — Vernalis

Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Change in Vernalis Flow with Action - cfs												
Wet	0	-1	-1	-2	0	-2	-2	-2	-1	-1	0	0
Above Normal	0	0	-1	-2	0	0	-2	-2	-1	-1	0	0
Below Normal	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Dry	0	0	-1	0	0	0	-2	-2	-1	-1	0	0
Critical	0	-1	-1	0	0	-4	-3	-3	-1	-1	0	0
With-Action Vernalis Flow - cfs												
Wet	6,450	10,249	13,299	12,848	11,850	11,398	7,748	3,498	3,499	3,599	2,850	3,000
Above Normal	4,150	6,250	7,049	7,898	5,100	2,900	1,948	1,998	2,449	2,999	2,550	2,450
Below Normal	2,450	3,100	3,599	5,000	3,550	2,050	1,498	1,498	1,949	2,449	2,300	2,200
Dry	2,450	2,600	3,099	3,500	2,750	1,500	1,248	1,348	1,799	2,199	2,100	1,950
Critical	1,950	2,149	2,249	1,950	1,800	996	897	897	1,349	1,549	1,800	1,750
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	625	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	-1	-1	0	0	0	0	0	0
Below Normal	0	0	0	-1	-1	-1	0	0	0	0	0	0
Dry	0	0	0	-1	-1	-2	0	0	0	0	0	0
Critical	0	0	0	-1	-1	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	374	549	599	549	550	500	575	800
Below Normal	800	850	750	374	474	599	650	600	600	550	650	825
Dry	800	900	800	449	549	648	675	625	600	575	650	825
Critical	850	950	875	624	624	675	675	675	650	700	700	850

All Values Relative to No Action — New Melones

Incremental Change in NM Storage due to WQ Release Change - Acre	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	18	29	0	0	82	61	52	0	0	0	0	242
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	0	-147	0	0	0	0	0	0	0	-147
Above Normal	0	-32	0	0	-147	-146	0	0	0	0	0	0	-324
Below Normal	0	-32	0	-141	-147	-146	0	0	0	0	0	0	-465
Dry	0	-32	0	-145	-147	-146	0	0	0	0	0	0	-470
Critical	0	0	0	-141	-147	0	0	0	0	0	0	0	-288
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	0	-147	0	0	0	0	0	0	0	-147
Above Normal	0	-32	0	0	-147	-146	0	0	0	0	0	0	-324
Below Normal	0	-32	0	-141	-147	-146	0	0	0	0	0	0	-465
Dry	0	-32	0	-145	-147	-146	0	0	0	0	0	0	-470
Critical	0	18	29	-141	-147	82	61	52	0	0	0	0	-45

All Values Relative to No Action — Project Delta Supply

Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Below Normal	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Dry	0	-32	-48	0	0	-146	-152	-145	-35	-39	-8	0	-604
Critical	-11	-32	-48	-141	-147	-146	-152	-145	-35	-39	-8	0	-902
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	146	0	0	0	0	0	0	146
Below Normal	0	0	0	0	0	146	0	0	0	0	0	0	146
Dry	0	32	0	0	0	146	0	0	0	0	0	0	178
Critical	0	-18	-29	141	147	-82	-61	-52	0	0	0	0	45
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	-146	-152	-145	-35	-39	-8	0	-525
Above Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Below Normal	0	0	0	0	0	0	-152	-145	-35	-39	-8	0	-379
Dry	0	0	-48	0	0	0	-152	-145	-35	-39	-8	0	-427
Critical	-11	-50	-77	0	0	-228	-213	-197	-35	-39	-8	0	-857

No Action/No Project (Existing Conditions High)

All Values Relative to Existing Condition — Basic Hydrologic Accounting

Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	-170	-234	-495	-1,178	-1,240	-1,278	-1,384	-1,318	-292	-174	-236	0	-8,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	-170	-234	-495	-1,178	-1,240	-1,278	-1,384	-1,318	-292	-174	-236	0	-8,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	-1	-2	-3	-9	-10	-10	-10	-10	-2	-3	-1	0	-61
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	-1	-2	-3	-9	-10	-10	-10	-10	-2	-3	-1	0	-61
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	0	0	0	0	0	0	0	0	0	0	0	

All Values Relative to Existing Condition — Vernalis

Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Change in Vernalis Flow with Action - cfs												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
With-Action Vernalis Flow - cfs												
Wet	6,550	10,700	13,050	10,850	11,600	11,050	7,700	3,500	3,450	3,500	2,650	2,950
Above Normal	4,050	6,250	6,250	5,400	5,050	2,850	1,950	2,000	2,400	2,900	2,350	2,350
Below Normal	2,350	3,000	2,900	3,550	3,500	2,000	1,500	1,500	1,900	2,400	2,100	2,100
Dry	2,300	2,500	2,350	2,700	2,700	1,450	1,250	1,350	1,750	2,150	1,900	1,900
Critical	1,800	2,050	1,750	1,800	1,800	1,000	900	900	1,350	1,550	1,650	1,650
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	275	275	375	475	425	450	450	550	750
Above Normal	725	525	500	400	375	550	600	550	550	500	600	825
Below Normal	825	875	850	450	475	600	650	600	600	550	675	850
Dry	850	925	925	525	550	650	675	625	600	575	675	850
Critical	900	975	975	625	625	675	675	675	650	700	725	875

All Values Relative to Existing Condition — New Melones

Incremental Change in NM Storage due to WQ Release Change - Acre	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	-1	-1	-1	0	0	-6	-4	-4	0	0	0	0	-16
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	9	10	0	0	0	0	0	0	0	19
Above Normal	0	2	3	9	10	10	0	0	0	0	0	0	34
Below Normal	0	2	3	9	10	10	0	0	0	0	0	0	34
Dry	0	2	3	5	10	10	0	0	0	0	0	0	30
Critical	0	0	0	9	10	0	0	0	0	0	0	0	19
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	9	10	0	0	0	0	0	0	0	19
Above Normal	0	2	3	9	10	10	0	0	0	0	0	0	34
Below Normal	0	2	3	9	10	10	0	0	0	0	0	0	34
Dry	0	2	3	5	10	10	0	0	0	0	0	0	30
Critical	-1	-1	-1	9	10	-6	-4	-4	0	0	0	0	3

All Values Relative to Existing Condition — Project Delta Supply

Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	10	10	10	2	3	1	0	35
Above Normal	0	0	0	0	0	10	10	10	2	3	1	0	35
Below Normal	0	0	0	0	0	10	10	10	2	3	1	0	35
Dry	0	2	3	0	0	10	10	10	2	3	1	0	41
Critical	1	2	3	9	10	10	10	10	2	3	1	0	61
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-10	0	0	0	0	0	0	-10
Below Normal	0	0	0	0	0	-10	0	0	0	0	0	0	-10
Dry	0	-2	-3	0	0	-10	0	0	0	0	0	0	-15
Critical	1	1	1	-9	-10	6	4	4	0	0	0	0	-3
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	10	10	10	2	3	1	0	35
Above Normal	0	0	0	0	0	0	10	10	2	3	1	0	26
Below Normal	0	0	0	0	0	0	10	10	2	3	1	0	26
Dry	0	0	0	0	0	0	10	10	2	3	1	0	26
Critical	1	3	5	0	0	15	14	13	2	3	1	0	58

No Action/No Project (No Action High)

All Values Relative to No Action													Basic Hydrologic Accounting
Water Developed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	-170	-234	-495	-1,178	-1,240	-1,278	-1,384	-1,318	-292	-174	-236	0	-8,000
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	-170	-234	-495	-1,178	-1,240	-1,278	-1,384	-1,318	-292	-174	-236	0	-8,000
Effects to SJR Flows due to Developing Water													
Change in Evaporation/Seepage to Groundwater (Ponding)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Drain Spills to Wildlife Areas and Non-district Lands	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Discharge to SJR Streams	0	0	0	0	0	0	0	0	0	0	0	0	0
Change to Flows Upstream of Sack Dam	0	0	0	0	0	0	0	0	0	0	0	0	0
Crop Fallowing	-1	-2	-3	-9	-10	-10	-10	-10	-2	-3	-1	0	-61
Deep Water Percolation / Applied Water Efficiencies	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (Positive value means volume diminished)	-1	-2	-3	-9	-10	-10	-10	-10	-2	-3	-1	0	-61
Net Effect to San Joaquin River Flow Before NM Adjustment													
(Positive value means flow added) (cfs)	0	0	0	0	0	0	0	0	0	0	0	0	

All Values Relative to No Action												Vernalis
Benchmark Vernalis Flow - cfs	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Change in Vernalis Flow with Action - cfs												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
With-Action Vernalis Flow - cfs												
Wet	6,450	10,250	13,300	12,850	11,850	11,400	7,750	3,500	3,500	3,600	2,850	3,000
Above Normal	4,150	6,250	7,050	7,900	5,100	2,900	1,950	2,000	2,450	3,000	2,550	2,450
Below Normal	2,450	3,100	3,600	5,000	3,550	2,050	1,500	1,500	1,950	2,450	2,300	2,200
Dry	2,450	2,600	3,100	3,500	2,750	1,500	1,250	1,350	1,800	2,200	2,100	1,950
Critical	1,950	2,150	2,250	1,950	1,800	1,000	900	900	1,350	1,550	1,800	1,750
Benchmark Vernalis Water Quality - µmhos (April and May values include split-month averaging of operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	625	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850
Change in Vernalis Water Quality with Action - µmhos (April and May values include split-month operations)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	0	0	0	0	0	0	0	0	0	0	0
With-Action Vernalis Water Quality - µmhos (April and May values include split-month operations)												
Wet	600	425	350	250	250	375	475	425	450	450	525	730
Above Normal	700	525	450	350	375	550	600	550	550	500	575	800
Below Normal	800	850	750	375	475	600	650	600	600	550	650	825
Dry	800	900	800	450	550	650	675	626	600	575	650	825
Critical	850	950	875	625	625	675	675	675	650	700	700	850

All Values Relative to No Action													New Melones
Incremental Change in NM Storage due to WQ Release Change - Acre	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Below Normal	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0	0
Critical	0	-1	-2	0	0	-6	-4	-4	0	0	0	0	-16
Incremental Change in NM Storage due to Vernalis Flow Release Change - Acre-feet													
Wet	0	0	0	0	10	0	0	0	0	0	0	0	10
Above Normal	0	2	0	0	10	10	0	0	0	0	0	0	22
Below Normal	0	2	0	9	10	10	0	0	0	0	0	0	31
Dry	0	2	0	10	10	10	0	0	0	0	0	0	32
Critical	0	0	0	9	10	0	0	0	0	0	0	0	19
Net Incremental Change in NM Storage due to Vernalis Flow & Quality Release Change - Acre-feet													
Wet	0	0	0	0	10	0	0	0	0	0	0	0	10
Above Normal	0	2	0	0	10	10	0	0	0	0	0	0	22
Below Normal	0	2	0	9	10	10	0	0	0	0	0	0	31
Dry	0	2	0	10	10	10	0	0	0	0	0	0	32
Critical	0	-1	-2	9	10	-6	-4	-4	0	0	0	0	3

All Values Relative to No Action													Project Delta Supply
Total Potential Delta supply Impact w/o NM Adjustments - Acre-feet	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wet	0	0	0	0	0	10	10	10	2	3	1	0	35
Above Normal	0	0	0	0	0	10	10	10	2	3	1	0	35
Below Normal	0	0	0	0	0	10	10	10	2	3	1	0	35
Dry	0	2	3	0	0	10	10	10	2	3	1	0	41
Critical	1	2	3	9	10	10	10	10	2	3	1	0	61
New Melones Adjustments - Acre-feet (positive means increase in supply)													
Wet	0	0	0	0	0	0	0	0	0	0	0	0	0
Above Normal	0	0	0	0	0	-10	0	0	0	0	0	0	-10
Below Normal	0	0	0	0	0	-10	0	0	0	0	0	0	-10
Dry	0	-2	0	0	0	-10	0	0	0	0	0	0	-12
Critical	0	1	2	-9	-10	6	4	4	0	0	0	0	-3
Incremental Change in Project Delta Supply due to Action - Acre-feet													
Wet	0	0	0	0	0	10	10	10	2	3	1	0	35
Above Normal	0	0	0	0	0	0	10	10	2	3	1	0	26
Below Normal	0	0	0	0	0	0	10	10	2	3	1	0	26
Dry	0	0	3	0	0	0	10	10	2	3	1	0	29
Critical	1	3	5	0	0	15	14	13	2	3	1	0	58