CALIFORNIA WATER FIX

South Delta Water Agency Parties
Case-In-Chief Part 1b

TESTIMONY OF
DANTE JOHN NOMELLINI, SR.
(WITNESS)

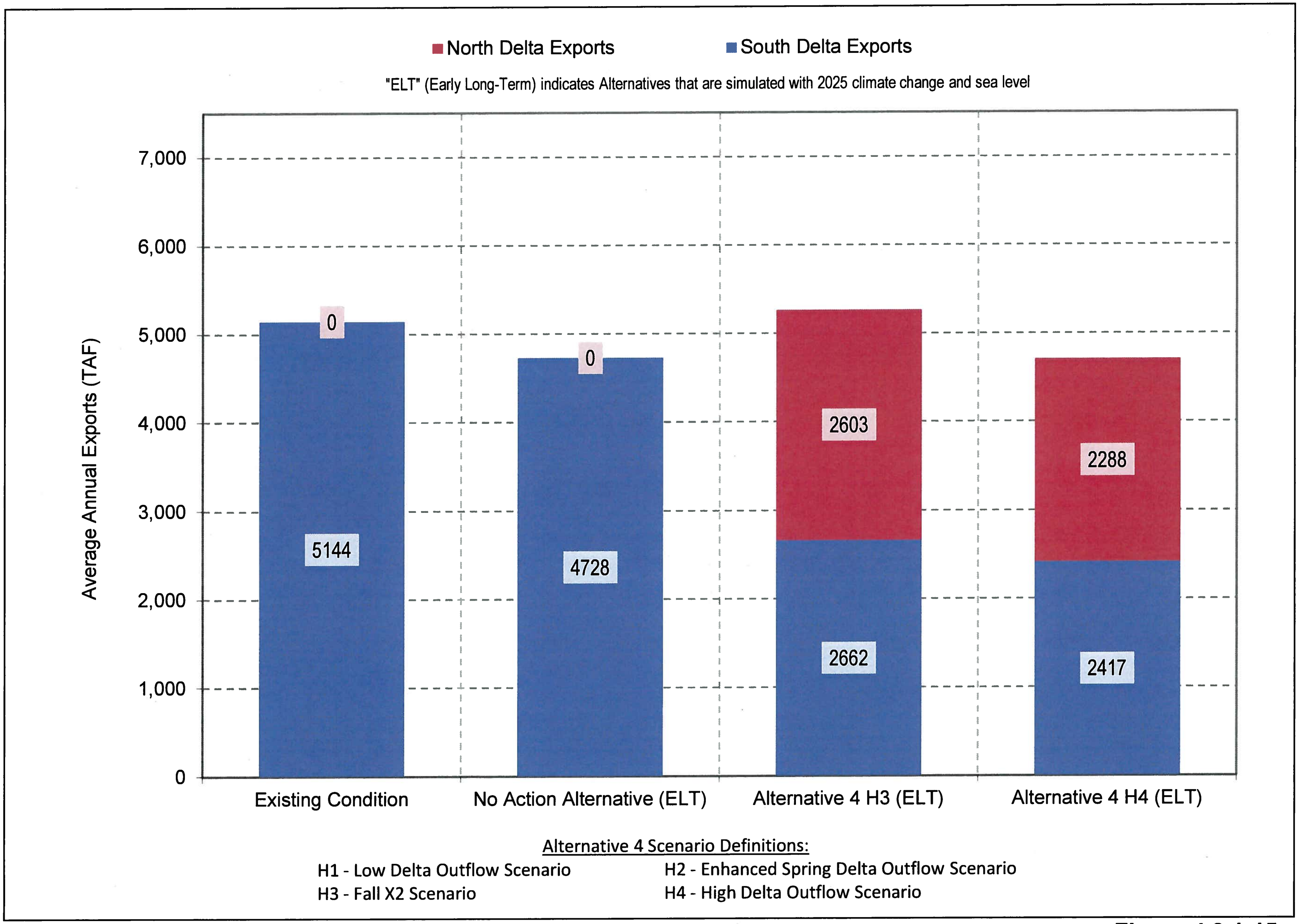


Figure 4.3.1-15
North and South Delta Exports for Alternative 4A Long-Term Average

SDWA-184

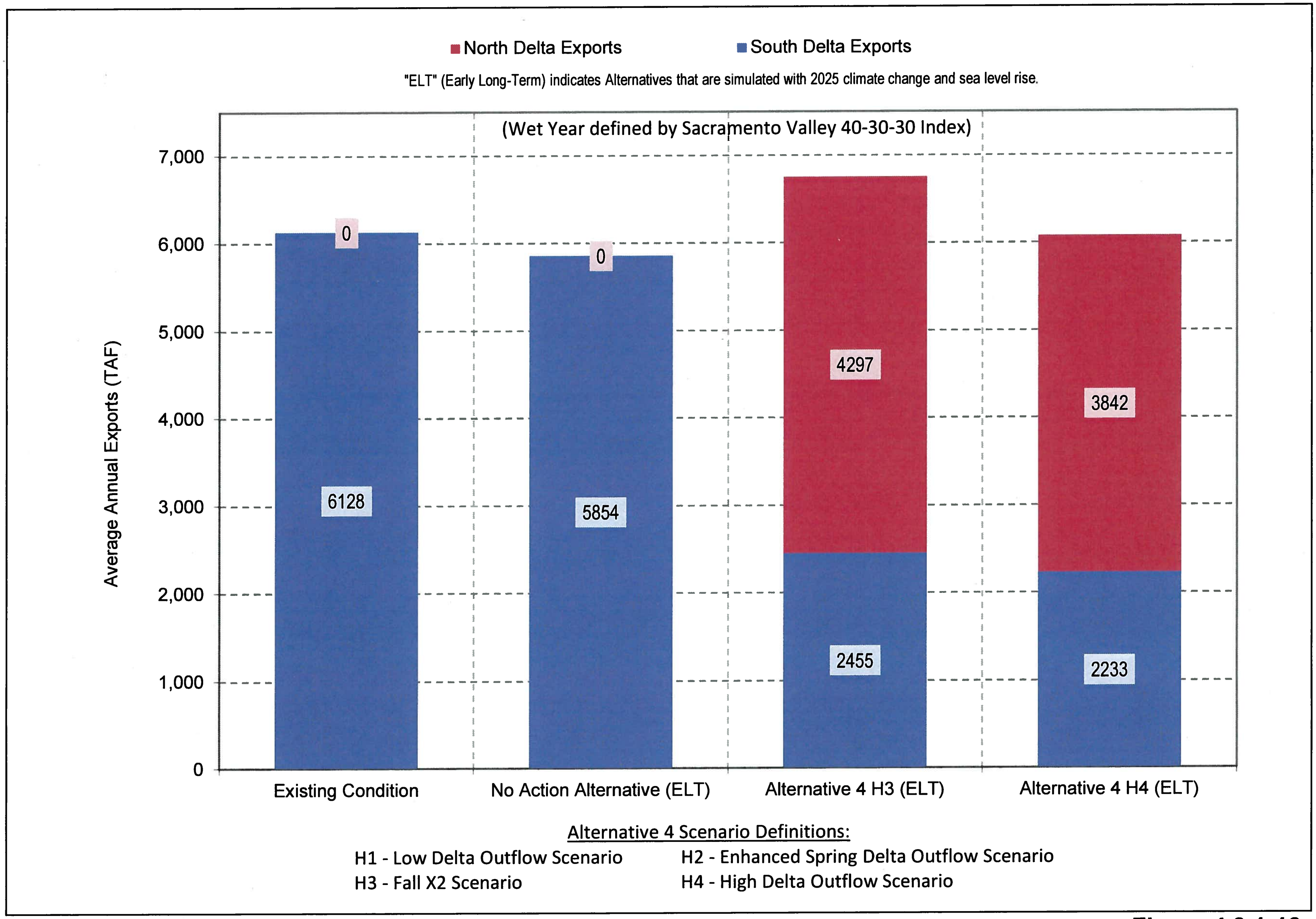


Figure 4.3.1-16

North and South Delta Exports for Alternative 4A -Wet Year Average

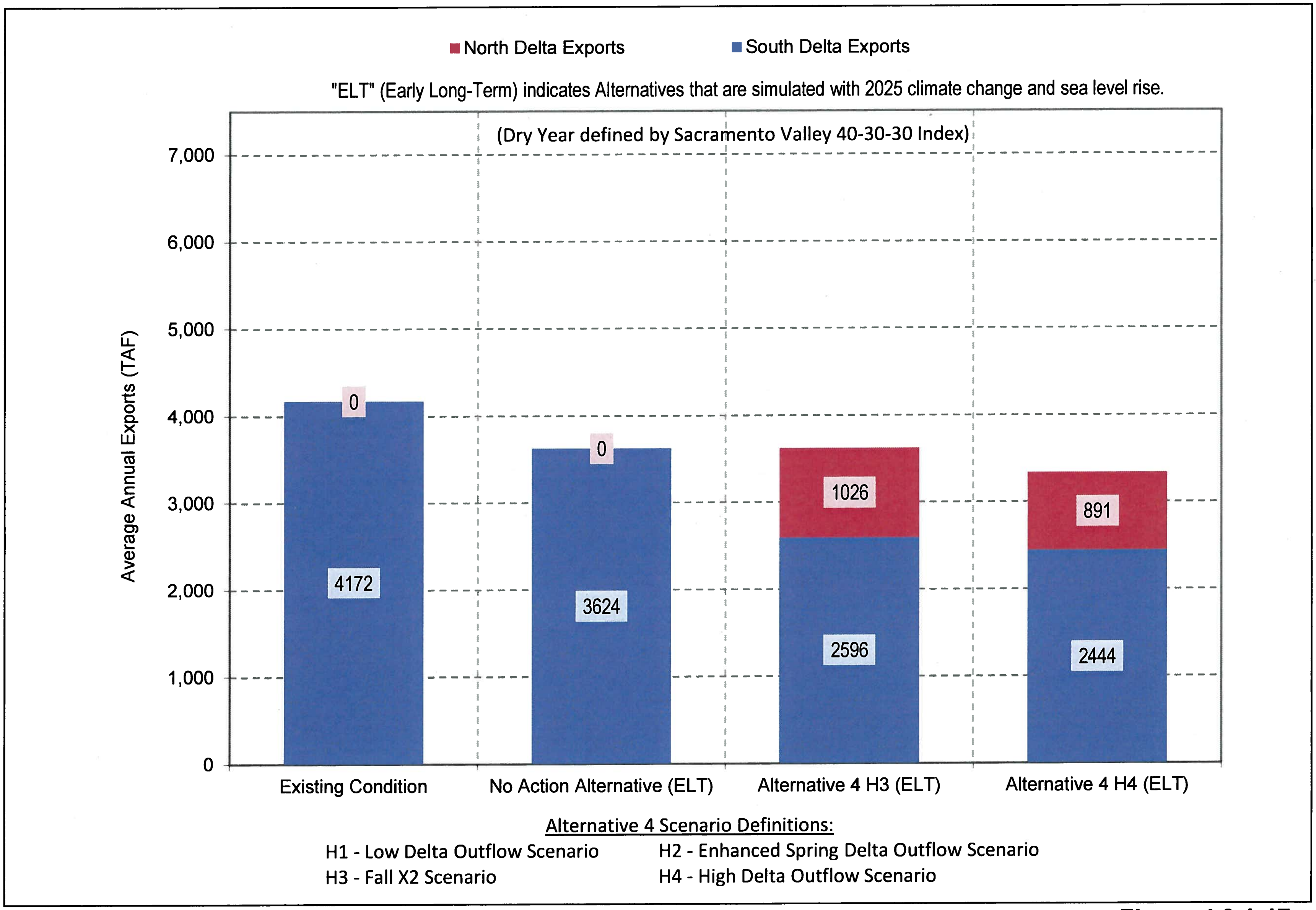
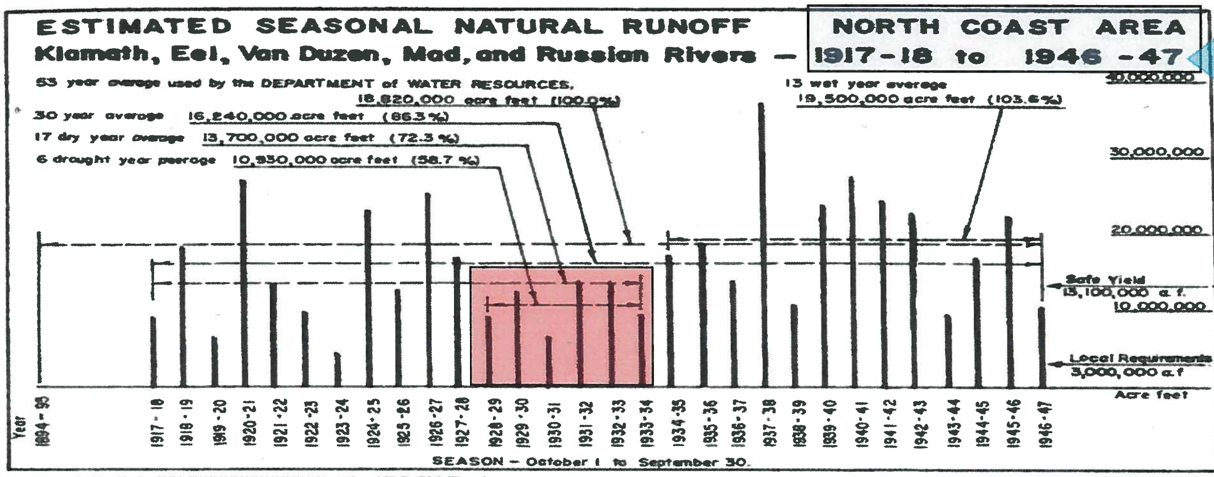


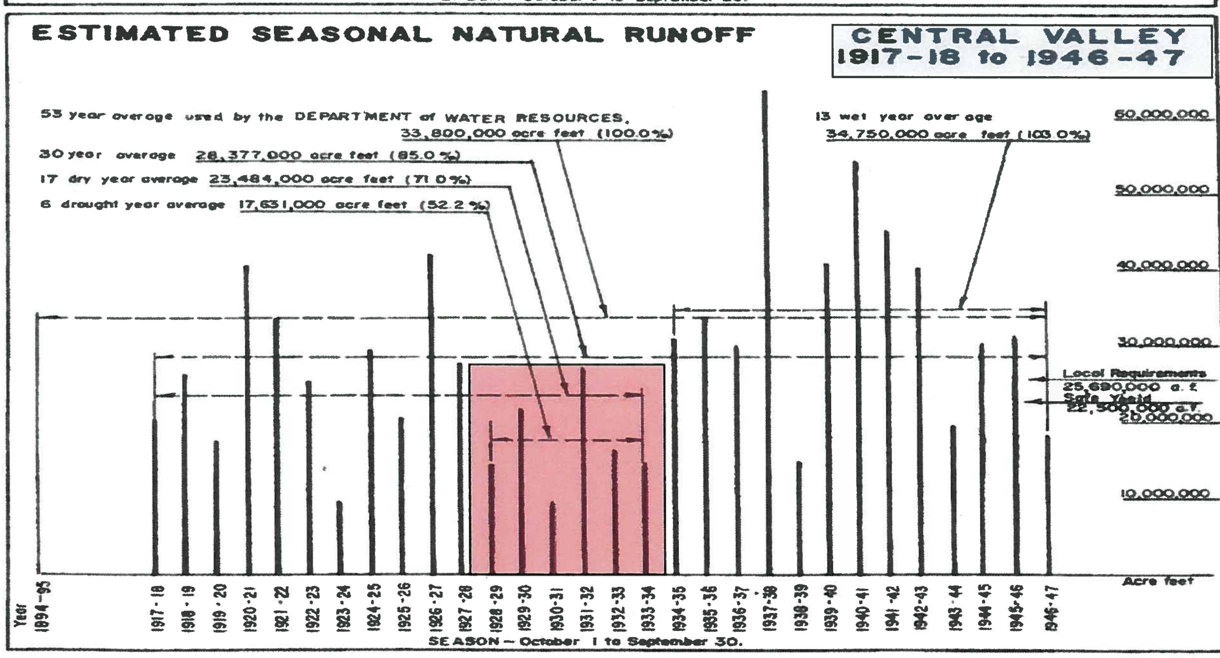
Figure 4.3.1-17

North and South Delta Exports for Alternative 4A –Dry and Critical Year Average

WEBER FOUNDATION STUDIES

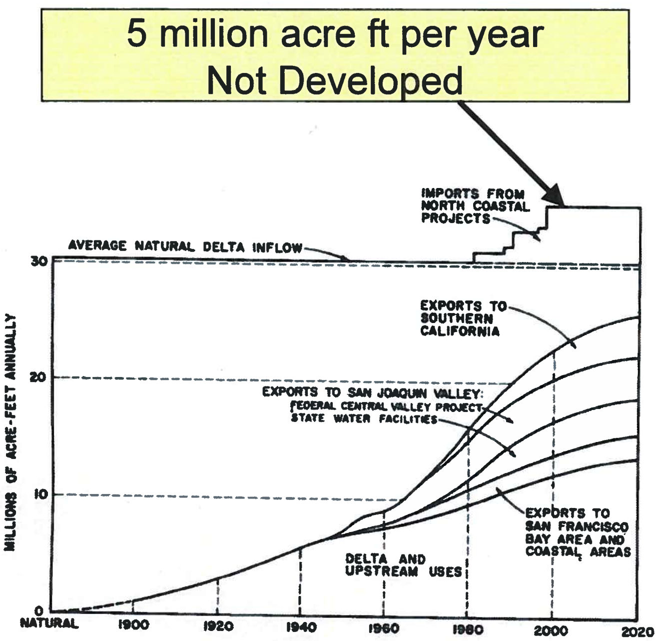


Surplus
7,930,000 AF/ YR

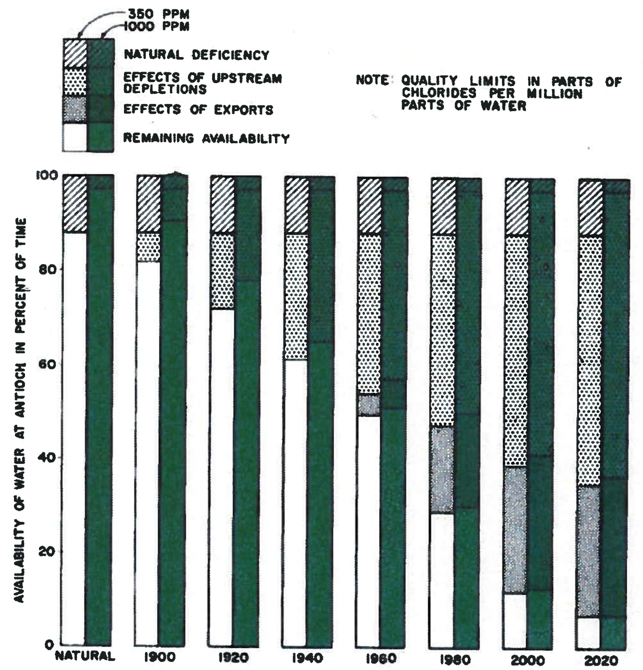


SHORTAGE
8,049,000 AF/Y

The natural availability of good quality water in the Delta is directly related to the amount of surplus water which flows to the ocean. The graph to the right indicates the historic and projected availability of water in the San Joaquin River at Antioch containing less than 350 and 1,000 parts chlorides per million parts water, under long-term average runoff and *without* specific releases for salinity control. It may be noted that even under natural conditions, before any significant upstream water developments, there was a deficiency of water supplies within the specified quality limits. It is anticipated that, without salinity control releases, upstream depletions by the year 2020 will have reduced the availability of water containing less than 1,000 ppm chlorides by about 60 percent, and that exports will have caused an additional 30 percent reduction.



USE OF DELTA WATER SUPPLIES



DELTA WATER QUALITY WITHOUT SALINITY CONTROL

The magnitude of the past and anticipated future uses of water in areas tributary to the Delta, except the Tulare Lake Basin, is indicated in the diagram to the left. It may be noted that, while the present upstream use accounts for reduction of natural inflow to the Delta by almost 25 percent, upstream development during the next 60 years will deplete the inflow by an additional 20 percent. By that date about 22 percent of the natural water supply reaching the Delta will be exported to areas of deficiency by local, state, and federal projects. In addition, economical development of water supplies will necessitate importation of about 5,000,000 acre-feet of water seasonally to the Delta from north coastal streams for transfer to areas of deficiency.

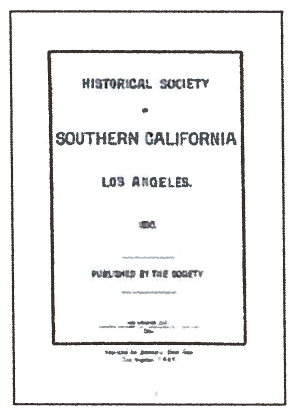
Table 2.1: Dry Periods in Combined Reconstructed and Instrumental Periods

Klamath River at Keno		Sacramento River Runoff		San Joaquin River Runoff	
Years	Length, years	Years	Length, years	Years	Length, years
1515-1522	8	921-924	4	946-950	5
1540-1543	4	945-950	6	977-981	5
1547-1552	6	975-981	7	1072-1075	4
1578-1582	5	1072-1075	4	1143-1148	6
1592-1597	6	1130-1136	7	1155-1158	4
1642-1646	5	1143-1148	6	1172-1177	6
1648-1668	21	1150-1158	9	1210-1213	4
1738-1744	7	1170-1177	8	1233-1239	7
1756-1761	6	1233-1239	7	1294-1301	8
1764-1767	4	1292-1301	10	1395-1402	8
1775-1779	5	1390-1393	4	1407-1410	4
1783-1787	5	1395-1400	6	1425-1428	4
1792-1798	7	1407-1410	4	1450-1461	12
1843-1846	4	1425-1432	8	1463-1466	4
1848-1852	5	1451-1457	7	1471-1483	13
1873-1876	4	1475-1483	9	1505-1508	4
1880-1884	5	1515-1521	7	1518-1523	6
1912-1915	4	1540-1543	4	1540-1545	6
1917-1920	4	1569-1572	4	1569-1572	4
1924-1935	12	1578-1582	5	1578-1582	5
1987-1992	6	1592-1595	4	1592-1595	4
		1636-1639	4	1629-1632	4
		1645-1648	4	1645-1648	4
		1652-1655	4	1652-1655	4
		1753-1760	8	1688-1691	4
		1780-1783	4	1753-1757	5
		1783-1846	4	1780-1783	4
		1856-1859	4	1793-1796	4
		1917-1922	6	1843-1846	4
		1926-1935	10	1855-1859	5
		1946-1951	6	1928-1931	4
		1959-1962	4	1946-1950	5
		1987-1992	6	1959-1962	4
				1987-1992	6
				2000-2004	5

Data courtesy of Dave Meko, University of Arizona

The Medieval Climate Anomaly

The Medieval Climate Anomaly in North America (sometimes called the medieval warm period or medieval climate optimum) is considered to span from as early as about 800 AD to as late as 1300 AD depending on the specific location. The warmer (and in some places, drier, climate) has been linked with historical events such as Norse settlement of Greenland and Iceland and changing settlement patterns in some Southwestern ancestral Pueblo communities whose agricultural production may have been affected by drought conditions. This time period is associated with severe droughts in the Southwest and California. Paleoclimate data and climate modeling suggest that this period was characterized by cool surface waters in the eastern Pacific Ocean, or La Niña-like conditions (e.g., Seager et al. 2007).


HISTORICAL SOCIETY

SOUTHERN CALIFORNIA

LOS ANGELES.

The Great Drought of 1863-64

An excerpt from ***Exceptional Years: A History of California Floods and Droughts*** J.M. Guinn, 1890

1862-63 did not exceed four inches, and that of 1863-64 was even less. In the fall of 1863 a few showers fell, but not enough to start the grass. No more fell until March. The cattle were dying of starvation.... The loss of cattle was fearful. The plains were strewn with their carcasses. In marshy places and around the cienegas, where there was a vestige of green, the ground was covered with their skeletons, and the traveler for years afterward was often startled by coming suddenly on a veritable Golgotha – a place of skulls – the long horns standing out in defiant attitude, as if protecting the fleshless bones.

drought on record was the 1929–1934 drought, although the brief drought of 1976–1977 was more intensely dry.

The results of modeling existing conditions under historical drought scenarios indicate that SWP Table A water deliveries during dry years can be estimated to range between yearly averages of 454 and 1,356 taf.

On average, the dry-period deliveries of Table A water are higher in this 2015 Report than in the 2013 Report because of model refinements (discussed in detail in Appendix B).

Table 6-4. Estimated Average and Dry-Period Deliveries of SWP Table A Water (Existing Conditions, in taf/year) and Percent of Maximum SWP Table A Amount, 4,132 taf/year

	Long-term Average (1921–2003)		Single Dry Year (1977)		Dry Periods							
					2-Year Drought (1976–1977)		4-Year Drought (1931–1934)		6-Year Drought (1987–1992)		6-Year Drought (1929–1934)	
2013 Report	2,553	62%	495	12%	1,269	31%	1,263	31%	1,176	28%	1,260	30%
2015 Report	2,550	62%	454	11%	1,165	28%	1,356	33%	1,182	29%	1,349	33%

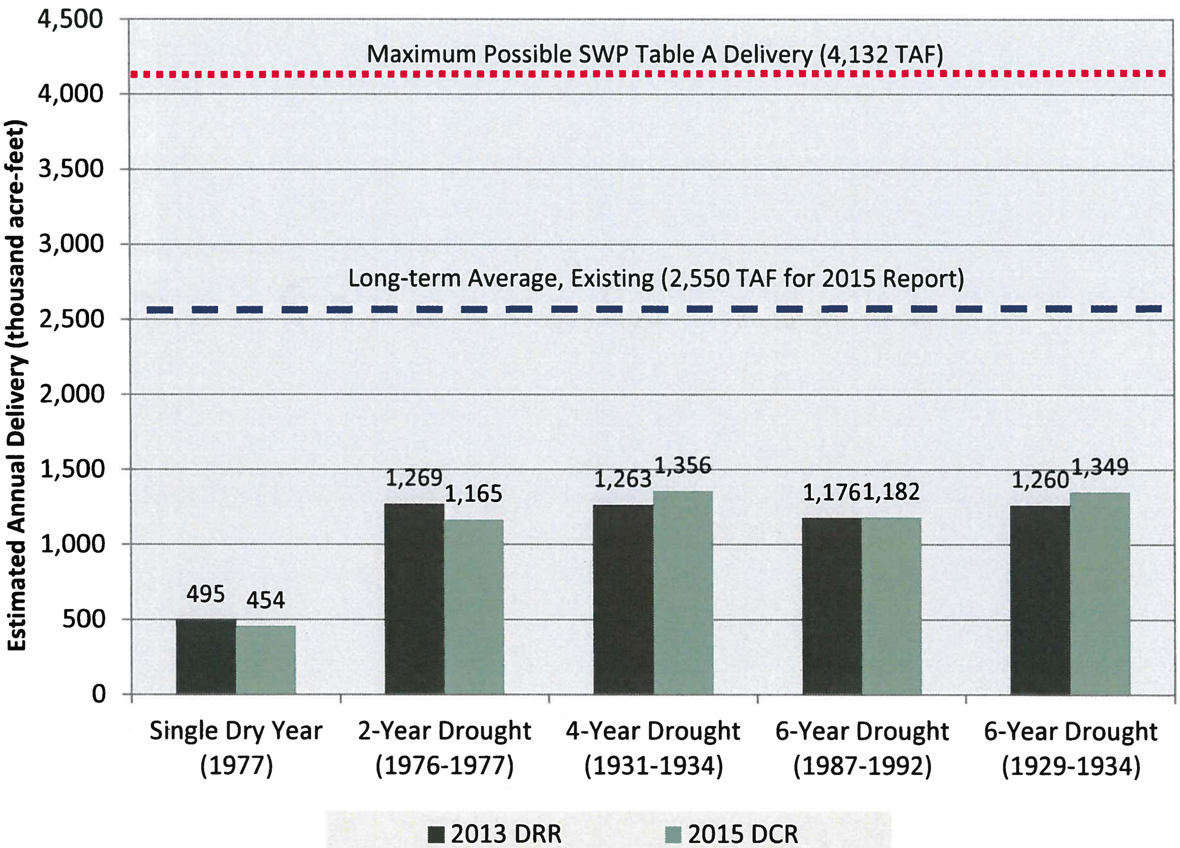
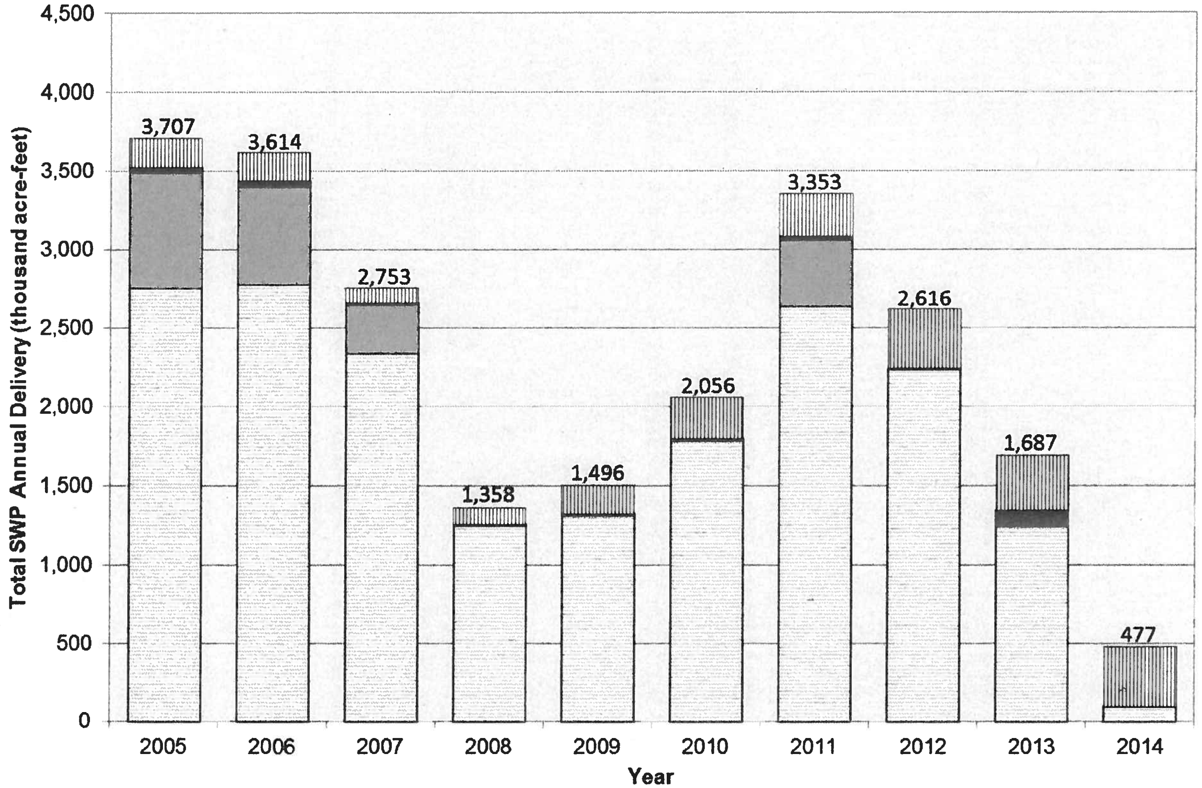


Figure 6-4. Estimated Dry-Period SWP Table A Water Deliveries (Existing Conditions)



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Carryover	185	182	95	110	180	264	268	381	351	383
Tumback	38	34	16	3	2	11	31	8	99	1
Article 21	731	621	310	3	6	8	421	0	0	1
Table A	2753	2776	2332	1242	1308	1774	2633	2227	1238	92

Note: The differences in historical deliveries from the State Water Project Delivery Reliability Report 2013 are due to reclassification of the various components of water delivered to SWP contractors

Figure 5-2. Total Historical SWP Deliveries, 2005–2014 (by Delivery Type) executed. The criteria in the draft agreement were recommended by Fish and Game and endorsed by the Department, and were extensively analyzed by the Board staff. Based on our most current assessment, the fishery standards provide significantly higher protection than existing basin plans. The Striped Bass Index is a measure of young bass survival through their first summer. The Striped Bass Index would be 71 under without project conditions (i.e., theoretical conditions which would exist today in the Delta and Marsh in the absence of the CVP and SWP), 63 under the existing basin plans, and about 79[3/] under this decision.

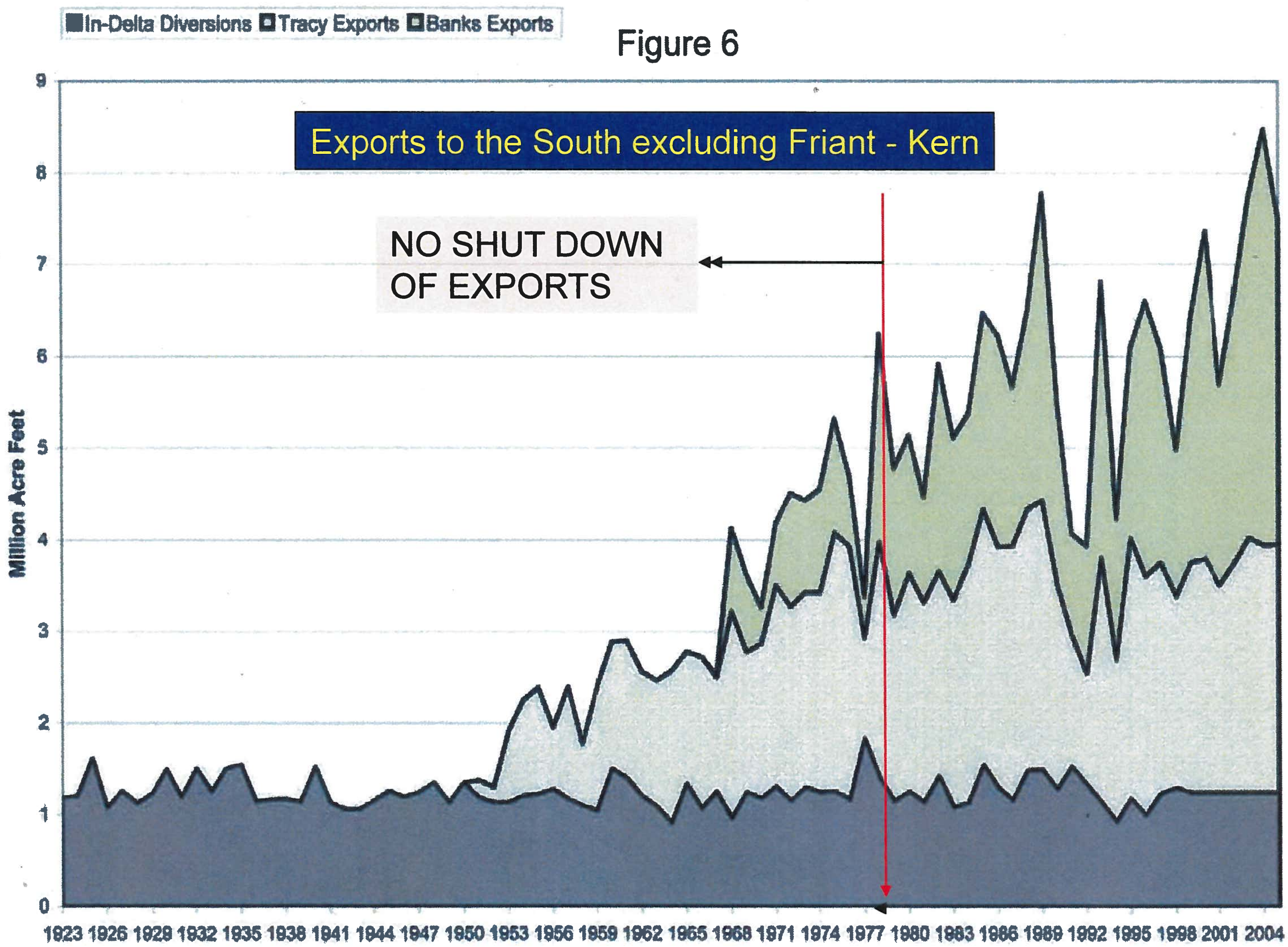
D 1485
1978

While the standards in this decision approach without project levels of protection for striped bass, there are many other species, such as white catfish, shad and salmon, which would not be protected to this level. To provide full mitigation of project impacts on all fishery species now would require the virtual shutting down of the project export pumps. The level of protection provided under this decision is nonetheless a reasonable level of protection until final determinations are made concerning a cross-Delta transfer facility or other means to mitigate project impacts.

NO SHUT DOWN
INSTEAD
INCREASED EXPORT

3/ There is some indication that factors other than those considered in the Board's analysis of without project levels may also affect striped bass survival. The effects of these factors are such that the without project levels would be greater than 71. However, the magnitude of this impact is unknown and cannot be quantified at this time.

Figure 6


In-Delta Diversions
Tracy Exports
Banks Exports
Exports to the South excluding Friant - Kern
NO SHUT DOWN OF EXPORTS
Million Acre Feet
0
1
2
3
4
5
6
7
8
9
1923 1926 1929 1932 1935 1938 1941 1944 1947 1950 1953 1956 1959 1962 1965 1968 1971 1974 1977 1980 1983 1986 1989 1992 1995 1998 2001 2004

"As viewed by the Bureau, it is the intent of the statute that no water shall be diverted from any watershed which is or will be needed for beneficial uses within that watershed. The Bureau of Reclamation, in its studies for water resources development in the Central Valley, consistently has given full recognition to the policy expressed in this statute by the legislature and the people. The Bureau has attempted to estimate in these studies, and will continue to do so in future studies, what the present and future needs of each watershed will be. The Bureau will not divert from any watershed any water which is needed to satisfy the existing or potential needs within that watershed. For example, no water will be diverted which will be needed for the full development of all of the irrigable lands within the watershed, nor would there be water needed for municipal and industrial purposes or future maintenance of fish and wildlife resources."

Title	**THE CALIFORNIA WATER RESOURCES DEVELOPMENT BOND ACT**
Year/Election	**1960** general
Proposition type	bond (leg)
Popular vote	Yes: 3,008,328 (51.5%); No: 2,834,384 (48.5%)
Pass/Fail	Pass
Summary	This act provides for a bond issue of one billion, seven hundred fifty million dollars ($1,750,000,000) to be used by the Department of **Water** Resources for the development of the **water** resources of the State.

For

Argument in Favor of California Water Resources Development Bond Act

Your vote on this measure will decide whether California will continue to prosper.

This Act, if approved, will launch the statewide **water** development program which will meet present and future demands of all areas of California. The program will not be a burden on the taxpayer; no new state taxes are involved; the bonds are repaid from project revenues, through the sale of **water** and power. In other words, it will pay for itself. The bonds will be used over a period of many years and will involve an approximate annual expenditure averaging only $75 million, as compared, for example with $600 million a year we spend on highways.

Existing facilities for furnishing **water** for California's needs will soon be exhausted because of our rapid population growth and industrial and agricultural expansion. We now face a further critical loss in the Colorado River supply. Without the projects made possible by this Act, we face a major **water** crisis. We can stand no more delay.

If we fail to act now to provide new sources of **water**, land development in the great San Joaquin Valley will slow to a halt by 1965 and the return of cultivated areas to wasteland will begin. In southern California, the existing sources of **water** which have nourished its tremendous expansion will reach capacity by 1970 and further development must wholly cease. In northern California desperately needed flood control and **water** supplies for many local areas will be denied.

This Act will assure construction funds for new **water** development facilities to meet California's requirements now and in the future. No area will be deprived of **water** to meet the needs of another. Nor will any area be asked to pay for **water** delivered to another.

To meet questions which concerned, southern California, the bonds will finance completion of all facilities needed, as described in the Act. Contracts for delivery of **water** may not be altered by the Legislature. The tap will be open, and no amount of political maneuvering can shut it off.

Under this Act the **water** rights of northern California will remain securely protected. In addition, sufficient money is provided for construction of local projects to meet the pressing needs for flood control, recreation and **water** deliveries in the north.

A much needed drainage system and **water** supply will be provided in the San Joaquin Valley.

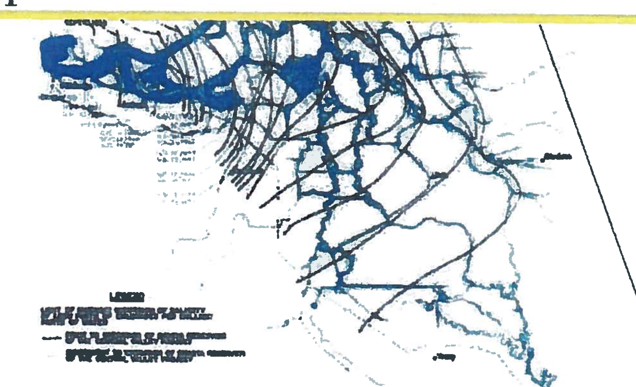
Construction here authorized will provide thousands of jobs. And the program will nourish tremendous industrial and farm and urban expansion which will develop an ever-growing source of employment and economic prosperity for Californians.

Our Legislature has appropriated millions of dollars for work in preparation, and construction is now underway. It would be tragic if this impressive start toward solution of our **water** problems were now abandoned.

If we fail to act now to insure completion of this constructive program, serious existing **water** shortages will only get worse. The success of our State is at stake. Vote "Yes" for **water** for people, for progress, for prosperity!

Delta Problems — salinity incursion and water supplies

In 1959 the State Legislature directed that water shall not be diverted from the Delta for use elsewhere unless adequate supplies for the Delta are first provided.



HISTORICAL SALINITY INCURSION
1920-1960

Salinity incursion into the Delta results from the flooding and ebbing of ocean tides through the San Francisco Bay and Delta system during periods when the fresh water outflow from the Delta is insufficient to repel the saline water. The natural fresh water outflow from the Central Valley was historically inadequate to repel salinity during summer months of some years. The first known record of salinity encroachment into the Delta was reported by Cmdr. Ringgold, U. S. Navy, in August 1841, whose party found the water at the site of the present city of Antioch very brackish and unfit for drinking. Since that time, and particularly after the turn of the century, with expanding upstream water use salinity incursion has become an increasingly greater problem in Delta water supplies. The maximum recorded extent of salinity incursion happened in 1931, when ocean salts reached Stockton. Since 1944 extensive incursion has been repulsed much of the time by fresh water releases from Central Valley Project storage in Shasta and Folsom Reservoirs. Without such releases, saline water would have spread through about 90 percent of the Delta channels in 1955 and 1959. Although upstream uses might not have reached present levels in the absence of the Central Valley Project, salinity problems would still have been very serious during most years.

Further increase in water use in areas tributary to the Delta will worsen the salinity incursion problem and complicate the already complex water rights situation. To maintain and expand the economy of the Delta, it will be necessary to provide an adequate supply of good quality water and protect the lands from the effects of salinity incursion. In 1959 the State Legislature directed that water shall not be diverted from the Delta for use elsewhere unless adequate supplies for the Delta are first provided.

In 1959, when the SWP was authorized, the Legislature enacted the Delta Protection Act. (§§ 12200-12220.) The Legislature recognized the unique water problems in the Delta, particularly "salinity intrusion," which mandates the need for such special legislation "for the protection, conservation, development, control and use of the waters in the Delta for the public good." (§ 12200.) The act prohibits project exports from the Delta of water necessary to provide water to which the Delta users are "entitled" and water which is needed for salinity control and an adequate supply for Delta users.[37] (§§ 12202, 12203, 12204.)

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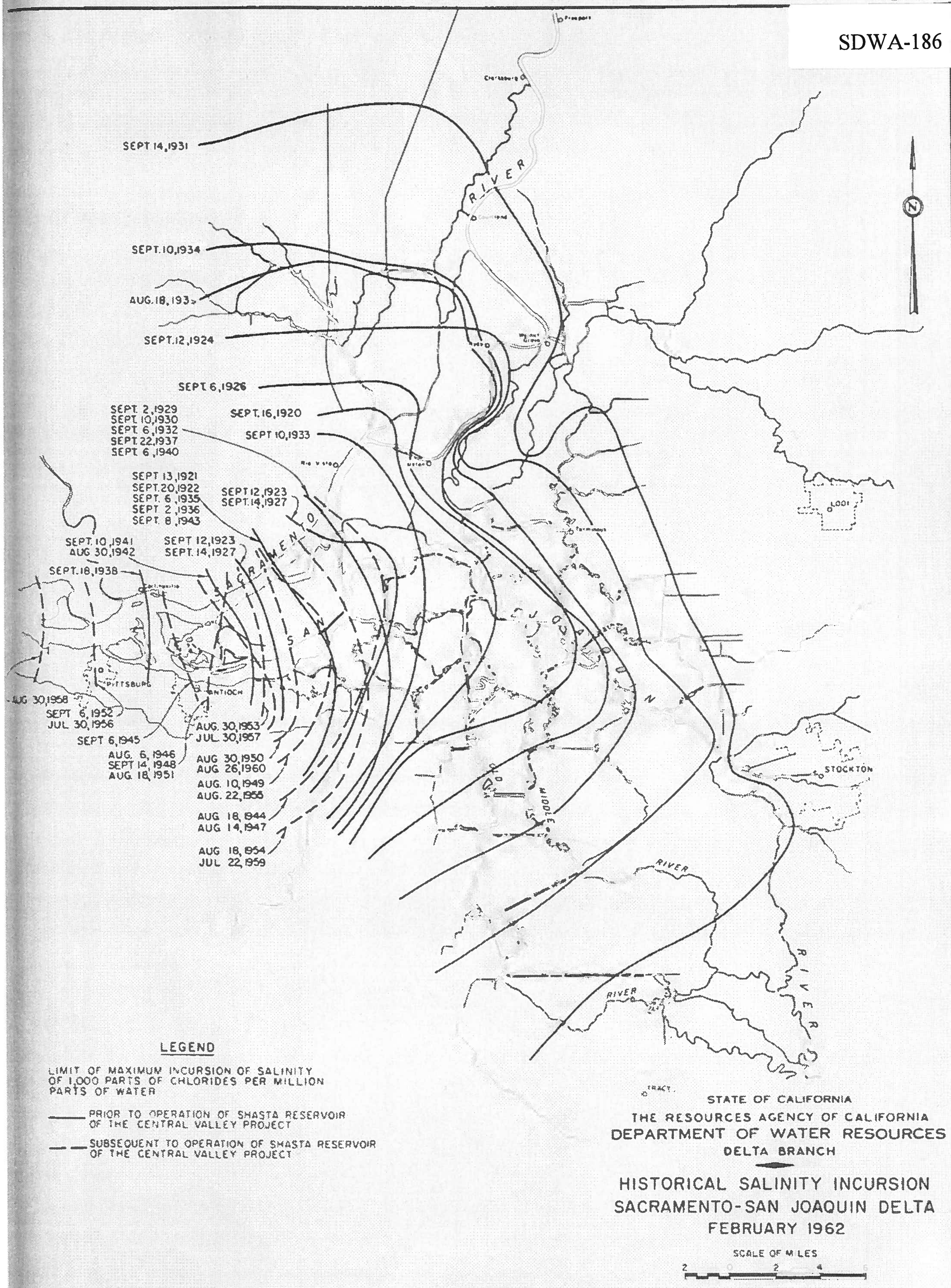
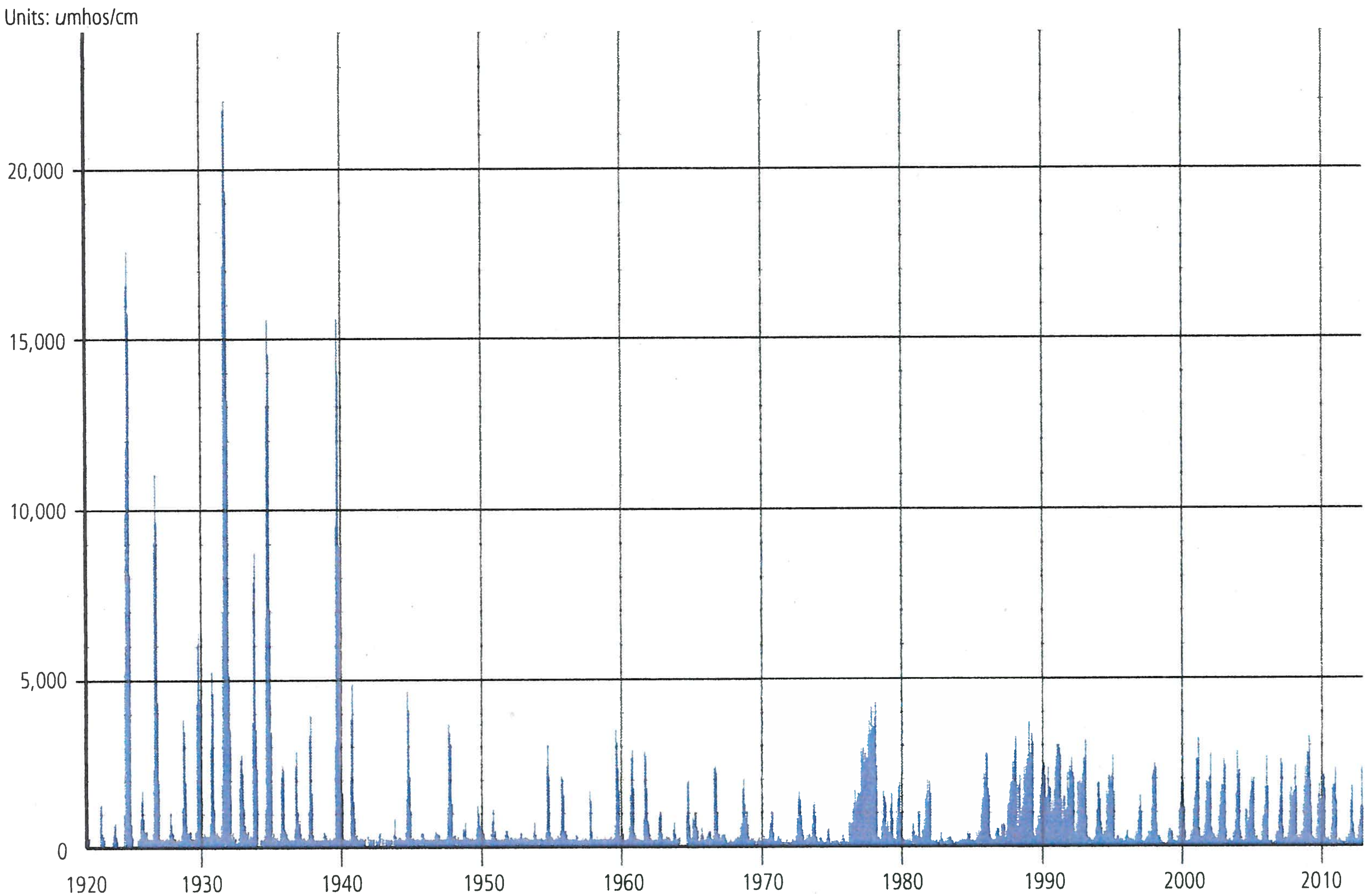

SEPT 14,1931
SEPT.10,1934
AUG.18,1939
SEPT.12,1924
SEPT 6,1926
SEPT. 2,1929
SEPT. 10,1930
SEPT. 6,1932
SEPT. 22,1937
SEPT. 6,1940
SEPT.16,1920
SEPT 10,1933
SEPT 13,1921
SEPT.20,1922
SEPT. 6,1935
SEPT. 2,1936
SEPT. 8,1943
SEPT 12,1923
SEPT.14,1927
SEPT. 10,1941
AUG 30,1942
SEPT 12,1923
SEPT. 14,1927
SEPT.18,1938
AUG 30,1958
SEPT 6,1952
JUL 30,1956
SEPT 6,1945
AUG. 6,1946
SEPT 14,1948
AUG 18,1951
AUG. 30,1953
JUL 30,1957
AUG 30,1950
AUG 26,1960
AUG. 10,1949
AUG. 22,1955
AUG 18,1944
AUG 14,1947
AUG 18,1954
JUL 22,1959
RIVER
SACRAMENTO
SAN JOAQUIN
PITTSBURG
ANTIOCH
LODI
STOCKTON
MIDDLE
RIVER
RIVER
RIVER
LEGEND
LIMIT OF MAXIMUM INCURSION OF SALINITY OF 1,000 PARTS OF CHLORIDES PER MILLION PARTS OF WATER
PRIOR TO OPERATION OF SHASTA RESERVOIR OF THE CENTRAL VALLEY PROJECT
SUBSEQUENT TO OPERATION OF SHASTA RESERVOIR OF THE CENTRAL VALLEY PROJECT
STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DELTA BRANCH
HISTORICAL SALINITY INCURSION
SACRAMENTO-SAN JOAQUIN DELTA
FEBRUARY 1962
SCALE OF MILES
2 0 2 4 6

Figure 3.6: Historical Salinity (Modeled and Observed) at Jersey Point



SDWA-185

Table EC-8A. Period Average Change in EC Levels for Alternative 4A-H3 ELT Relative to Existing Conditions and the No Action Alternative ELT.

Electrical Conductivity			OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		Annual Avg. Change	
Alt 4 ELT Scn H3	Location	Period [a]	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT
Western Delta	Sac. R. at Emmaton	ALL	-661	-613	-691	-554	-135	-143	-110	-121	-60	-76	15	-16	29	8	58	53	58	10	206	119	364	179	44	115	-74	-87
			(-30%)	(-29%)	(-33%)	(-28%)	(-11%)	(-11%)	(-18%)	(-19%)	(-15%)	(-18%)	(5%)	(-5%)	(10%)	(3%)	(12%)	(11%)	(7%)	(1%)	(21%)	(11%)	(27%)	(12%)	(2%)	(6%)	(-7%)	(-8%)
		DROUGHT	-765	-821	-805	-815	-34	-175	-107	-239	-39	-145	45	-17	52	24	210	107	234	84	651	474	720	299	594	134	63	-91
			(-26%)	(-28%)	(-28%)	(-28%)	(-2%)	(-9%)	(-13%)	(-24%)	(-7%)	(-22%)	(14%)	(-4%)	(18%)	(7%)	(36%)	(16%)	(23%)	(7%)	(49%)	(31%)	(42%)	(14%)	(20%)	(4%)	(4%)	(-6%)
	SJR at Jersey Point	ALL	-888	-579	-1152	-813	-503	-348	-273	-250	-92	-100	5	-13	17	9	8	7	7	-18	-284	-169	-128	-84	-303	-87	-299	-204
			(-46%)	(-35%)	(-52%)	(-44%)	(-30%)	(-23%)	(-32%)	(-30%)	(-20%)	(-22%)	(2%)	(-4%)	(6%)	(3%)	(2%)	(2%)	(1%)	(-3%)	(-20%)	(-13%)	(-8%)	(-6%)	(-15%)	(-5%)	(-26%)	(-20%)
		DROUGHT	-762	-825	-953	-831	-376	-313	-239	-332	-94	-185	19	-26	27	16	64	14	75	-26	-526	-338	-40	127	327	194	-207	-210
			(-33%)	(-35%)	(-37%)	(-34%)	(-17%)	(-15%)	(-22%)	(-28%)	(-17%)	(-29%)	(6%)	(-7%)	(10%)	(6%)	(16%)	(3%)	(11%)	(-3%)	(-24%)	(-17%)	(-2%)	(7%)	(14%)	(8%)	(-15%)	(-15%)
Interior Delta	S. Fork Moke. R. Term.	ALL	9	8	10	9	5	6	14	15	14	16	18	18	14	14	9	10	11	11	8	8	9	7	7	6	11	11
			(5%)	(4%)	(5%)	(5%)	(2%)	(3%)	(6%)	(6%)	(6%)	(7%)	(8%)	(8%)	(7%)	(7%)	(5%)	(5%)	(6%)	(6%)	(4%)	(4%)	(5%)	(4%)	(4%)	(3%)	(5%)	(5%)
		DROUGHT	8	8	8	8	3	5	7	9	6	10	16	20	9	11	10	11	14	15	12	11	9	7	7	7	9	10
			(4%)	(4%)	(4%)	(4%)	(2%)	(2%)	(3%)	(4%)	(2%)	(4%)	(7%)	(8%)	(4%)	(5%)	(5%)	(5%)	(7%)	(8%)	(6%)	(6%)	(5%)	(4%)	(4%)	(3%)	(4%)	(5%)
	SJR at San And. Landing	ALL	-34	-27	-202	-170	-116	-85	-60	-56	-12	-9	7	7	16	18	12	15	29	26	1	25	33	36	48	53	-23	-14
			(-7%)	(-5%)	(-32%)	(-29%)	(-20%)	(-15%)	(-14%)	(-13%)	(-4%)	(-3%)	(3%)	(3%)	(7%)	(8%)	(5%)	(6%)	(12%)	(10%)	(0%)	(7%)	(8%)	(9%)	(9%)	(10%)	(-6%)	(-4%)
		DROUGHT	31	-34	-130	-196	-33	-46	-28	-54	-1	-25	14	11	16	19	27	21	52	32	-45	0	46	63	199	142	12	-6
			(5%)	(-5%)	(-18%)	(-25%)	(-4%)	(-6%)	(-5%)	(-10%)	(-0%)	(-7%)	(6%)	(4%)	(7%)	(8%)	(11%)	(9%)	(20%)	(12%)	(-9%)	(-0%)	(8%)	(12%)	(31%)	(21%)	(3%)	(-1%)
Southern Delta	SJR at Vernalis	ALL	-12	0	-39	0	-44	0	-62	3	-26	0	-29	0	-19	0	-19	0	16	0	12	0	-10	0	-20	0	-21	0
			(-2%)	(0%)	(-7%)	(-0%)	(-6%)	(-0%)	(-8%)	(0%)	(-4%)	(0%)	(-4%)	(0%)	(-4%)	(-0%)	(-4%)	(0%)	(3%)	(0%)	(2%)	(0%)	(-2%)	(0%)	(-4%)	(0%)	(-4%)	(0%)
		DROUGHT	-35	0	-46	0	-55	0	-78	0	-9	0	-20	0	-18	0	-16	0	-7	0	-6	0	-8	0	-22	0	-27	0
			(-6%)	(0%)	(-7%)	(-0%)	(-6%)	(-0%)	(-9%)	(-0%)	(-1%)	(-0%)	(-2%)	(0%)	(-3%)	(0%)	(-3%)	(0%)	(-1%)	(0%)	(-1%)	(0%)	(-1%)	(0%)	(-4%)	(0%)	(-4%)	(0%)
	SJR at Brandt Bridge	ALL	-13	0	-37	0	-44	1	-63	-1	-28	1	-28	-1	-21	-3	-19	-1	16	0	9	1	-8	1	-19	0	-21	0
			(-3%)	(-0%)	(-6%)	(0%)	(-6%)	(0%)	(-8%)	(-0%)	(-4%)	(0%)	(-4%)	(-0%)	(-5%)	(-1%)	(-4%)	(-0%)	(3%)	(0%)	(1%)	(0%)	(-1%)	(0%)	(-3%)	(0%)	(-4%)	(-0%)
		DROUGHT	-34	0	-46	0	-55	1	-78	-2	-14	2	-20	-2	-21	-7	-16	-1	-6	0	-18	4	-9	4	-20	0	-28	0
			(-6%)	(-0%)	(-7%)	(0%)	(-7%)	(0%)	(-9%)	(-0%)	(-1%)	(0%)	(-2%)	(-0%)	(-3%)	(-1%)	(-3%)	(-0%)	(-1%)	(0%)	(-3%)	(1%)	(-1%)	(1%)	(-3%)	(0%)	(-4%)	(-0%)
	Old River at Middle River	ALL	-10	4	-36	0	-44	0	-57	7	-26	2	-26	2	-15	4	-17	1	16	0	13	0	-8	0	-19	0	-19	2
			(-2%)	(1%)	(-6%)	(0%)	(-6%)	(0%)	(-8%)	(1%)	(-4%)	(0%)	(-4%)	(0%)	(-3%)	(1%)	(-4%)	(0%)	(3%)	(-0%)	(2%)	(0%)	(-1%)	(0%)	(-4%)	(-0%)	(-3%)	(0%)
		DROUGHT	-31	3	-45	0	-55	0	-72	4	-12	1	-17	2	-9	6	-13	2	-7	0	-4	1	-7	0	-21	0	-24	2
			(-5%)	(1%)	(-7%)	(0%)	(-6%)	(0%)	(-8%)	(0%)	(-1%)	(0%)	(-2%)	(0%)	(-2%)	(1%)	(-2%)	(0%)	(-1%)	(0%)	(-1%)	(0%)	(-1%)	(0%)	(-3%)	(-0%)	(-3%)	(0%)
	Old River at Tracy Bridge	ALL	3	22	-20	12	-43	0	-39	22	-19	13	-19	8	2	22	-12	6	-4	-4	-14	-16	-17	-1	-15	3	-16	7
			(1%)	(4%)	(-4%)	(2%)	(-6%)	(-0%)	(-5%)	(3%)	(-3%)	(2%)	(-3%)	(1%)	(1%)	(5%)	(-3%)	(1%)	(-1%)	(-1%)	(-2%)	(-3%)	(-3%)	(-0%)	(-3%)	(0%)	(-3%)	(1%)
		DROUGHT	4	35	-28	21	-53	0	-59	13	-16	2	-6	12	20	35	-7	7	-55	-8	-83	-47	-71	-26	-27	-4	-32	3
			(1%)	(6%)	(-4%)	(3%)	(-6%)	(0%)	(-6%)	(2%)	(-2%)	(0%)	(-1%)	(1%)	(3%)	(6%)	(-1%)	(1%)	(-9%)	(-1%)	(-13%)	(-8%)	(-10%)	(-4%)	(-4%)	(-1%)	(-4%)	(0%)
SJR	SJR at Prisoners Point	ALL	-28	-4	-173	-140	-161	-110	-57	-44	24	42	35	53	35	54	14	29	35	44	-36	0	-26	2	1	16	-28	-5
			(-6%)	(-1%)	(-29%)	(-25%)	(-26%)	(-19%)	(-11%)	(-9%)	(6%)	(12%)	(10%)	(17%)	(11%)	(17%)	(4%)	(10%)	(12%)	(16%)	(-9%)	(0%)	(-6%)	(0%)	(0%)	(3%)	(-6%)	(-1%)
		DROUGHT	8	-30	-122	-185	-102	-85	-40	-60	26	28	76	106	62	86	44	50	46	36	-122	-63	-68	0	82	72	-9	-4
			(1%)	(-5%)	(-19%)	(-26%)	(-14%)	(-12%)	(-7%)	(-9%)	(6%)	(7%)	(20%)	(30%)	(17%)	(26%)	(14%)	(17%)	(17%)	(13%)	(-22%)	(-13%)	(-11%)	(0%)	(14%)	(12%)	(-2%)	(-1%)
Export Area	Banks PP	ALL	-112	-76	-209	-169	-242	-184	-234	-212	-130	-115	-138	-117	-114	-94	-42	-21	-35	-28	-88	-63	-119	-70	-132	-115	-133	-105
			(-20%)	(-14%)	(-33%)	(-28%)	(-36%)	(-30%)	(-35%)	(-33%)	(-24%)	(-22%)	(-28%)	(-25%)	(-25%)	(-21%)	(-10%)	(-5%)	(-9%)	(-7%)	(-20%)	(-16%)	(-23%)	(-15%)	(-24%)	(-21%)	(-25%)	(-21%)
		DROUGHT	-24	-14	-177	-219	-229	-194	-134	-163	-59	-64	-228	-190	-188	-153	-83	-61	14	21	-229	-187	-205	-97	-68	-45	-134	-114
			(-4%)	(-2%)	(-25%)	(-29%)	(-28%)	(-25%)	(-17%)	(-20%)	(-9%)	(-10%)	(-35%)	(-31%)	(-30%)	(-26%)	(-15%)	(-12%)	(3%)	(5%)	(-43%)	(-38%)	(-28%)	(-16%)	(-10%)	(-7%)	(-21%)	(-18%)
	Jones PP	ALL	-101	-78	-204	-174	-143	-88	-226	-182	-209	-169	-230	-206	-115	-98	-120	-101	-101	-114	-52	-37	-69	-34	-119	-105	-141	-115
			(-18%)	(-15%)	(-33%)	(-29%)	(-20%)	(-14%)	(-32%)	(-27%)	(-34%)	(-29%)	(-39%)	(-36%)	(-24%)	(-21%)	(-27%)	(-24%)	(-25%)	(-28%)	(-11%)	(-8%)	(-13%)	(-7%)	(-22%)	(-20%)	(-25%)	(-22%)
		DROUGHT	-84	-96	-162	-207	-110	-72	-293	-252	-240	-174	-353	-318	-104	-88	-178	-164	-69	-72	-124	-85	-166	-87	-16	-4	-158	-135
			(-13%)	(-15%)	(-23%)	(-28%)	(-13%)	(-9%)	(-35%)	(-31%)	(-29%)	(-22%)	(-41%)	(-39%)	(-16%)	(-14%)	(-31%)	(-29%)	(-17%)	(-18%)	(-22%)	(-17%)	(-24%)	(-14%)	(-3%)	(-1%)	(-23%)	(-20%)

[a] ALL: Water years 1976-1991 represent the 16-year period modeled using DSM2. DROUGHT: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

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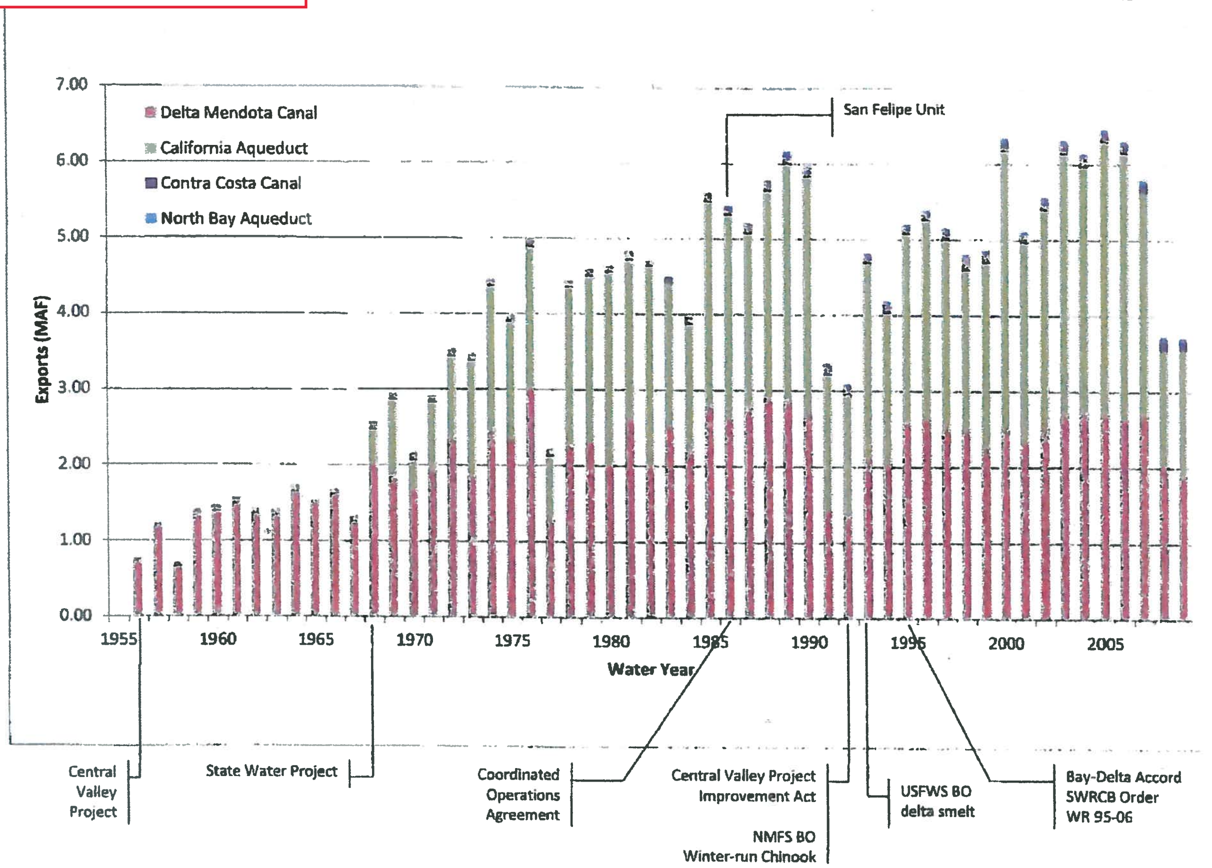
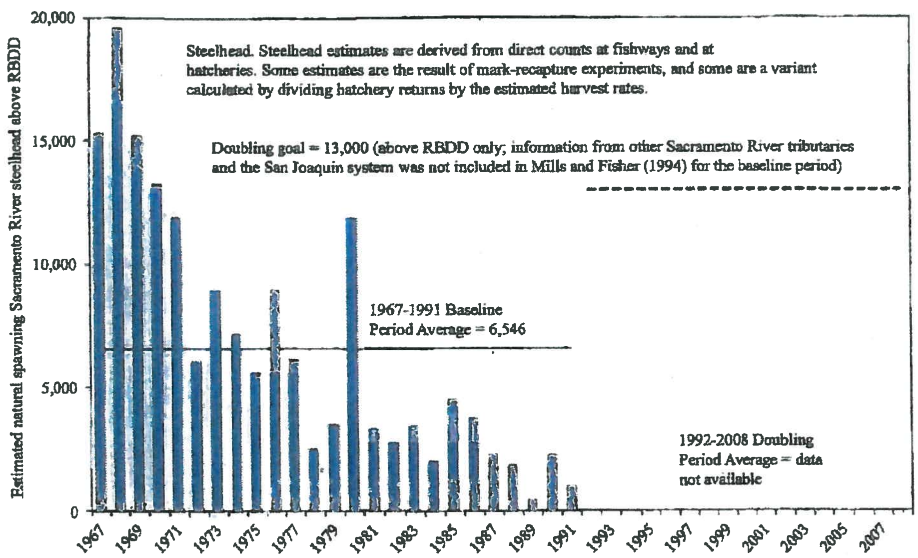
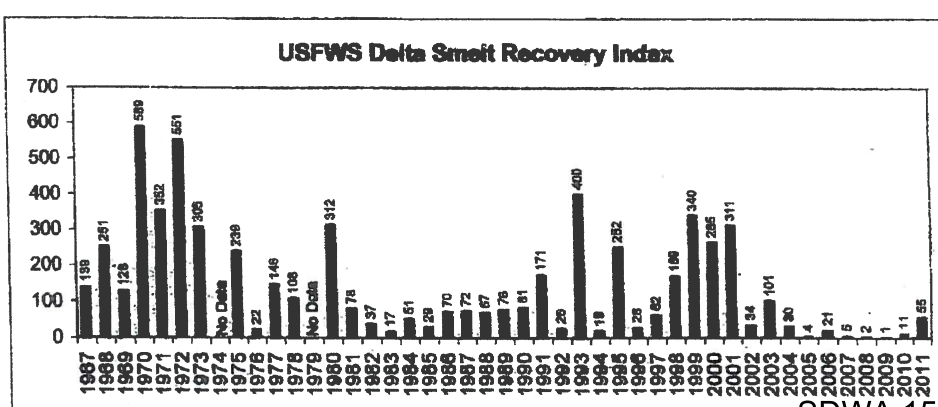
Table EC-8B. Period Average Change in EC Levels for Alternative 4A-H4 ELT Relative to Existing Conditions and the No Action Alternative ELT.

Electrical Conductivity			OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		Annual Avg. Change	
Alt 4 ELT Scn H4	Location	Period[a]	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT	Ex. Cond.	No Act. ELT
Western Delta	Sac. R. at Emmaton	ALL	-632	-584	-669	-532	-103	-111	-120	-131	-65	-81	14	-17	20	0	41	36	73	26	317	230	400	214	51	122	-56	-69
			(-29%)	(-27%)	(-32%)	(-27%)	(-8%)	(-9%)	(-20%)	(-21%)	(-16%)	(-19%)	(5%)	(-6%)	(7%)	(-0%)	(9%)	(7%)	(9%)	(3%)	(33%)	(22%)	(30%)	(14%)	(2%)	(6%)	(-5%)	(-6%)
		DROUGHT	-855	-911	-867	-877	73	-68	-140	-272	-61	-167	48	-14	46	17	192	89	267	117	835	657	810	389	518	58	72	-82
			(-29%)	(-31%)	(-30%)	(-30%)	(4%)	(-3%)	(-16%)	(-28%)	(-11%)	(-25%)	(15%)	(-4%)	(16%)	(5%)	(33%)	(13%)	(26%)	(10%)	(63%)	(44%)	(47%)	(18%)	(18%)	(2%)	(5%)	(-5%)
	SJR at Jersey Point	ALL	-872	-562	-1154	-815	-525	-370	-279	-257	-99	-106	-2	-20	13	4	2	1	-1	-26	-371	-256	-113	-70	-287	-71	-307	-212
			(-45%)	(-34%)	(-52%)	(-44%)	(-31%)	(-24%)	(-32%)	(-31%)	(-22%)	(-23%)	(-1%)	(-6%)	(5%)	(1%)	(1%)	(0%)	(-0%)	(-4%)	(-26%)	(-20%)	(-7%)	(-5%)	(-14%)	(-4%)	(-27%)	(-20%)
		DROUGHT	-821	-883	-1103	-981	-389	-327	-238	-331	-104	-195	15	-30	22	11	55	5	60	-41	-697	-508	1	168	424	291	-231	-235
			(-36%)	(-37%)	(-43%)	(-40%)	(-18%)	(-15%)	(-22%)	(-28%)	(-19%)	(-31%)	(5%)	(-8%)	(8%)	(4%)	(14%)	(1%)	(9%)	(-5%)	(-32%)	(-25%)	(0%)	(10%)	(18%)	(11%)	(-16%)	(-17%)
Interior Delta	S. Fork Moke. R. Term.	ALL	9	9	9	9	5	6	12	13	13	15	17	17	14	14	10	10	13	14	11	11	9	8	7	7	11	11
			(5%)	(5%)	(5%)	(5%)	(2%)	(3%)	(5%)	(6%)	(5%)	(6%)	(8%)	(8%)	(7%)	(7%)	(5%)	(5%)	(7%)	(7%)	(6%)	(6%)	(5%)	(4%)	(4%)	(4%)	(5%)	(5%)
		DROUGHT	8	8	6	6	3	5	6	8	4	7	14	17	10	11	11	12	17	17	15	15	10	8	7	6	9	10
			(4%)	(4%)	(3%)	(3%)	(2%)	(2%)	(3%)	(3%)	(1%)	(3%)	(6%)	(7%)	(4%)	(5%)	(5%)	(6%)	(9%)	(9%)	(8%)	(8%)	(5%)	(4%)	(4%)	(3%)	(4%)	(5%)
	SJR at San And. Landing	ALL	-32	-25	-197	-166	-122	-91	-65	-61	-11	-9	9	8	17	19	15	18	33	31	-27	-3	20	23	59	64	-25	-16
			(-6%)	(-5%)	(-31%)	(-28%)	(-21%)	(-16%)	(-15%)	(-15%)	(-4%)	(-3%)	(4%)	(4%)	(7%)	(8%)	(6%)	(7%)	(13%)	(12%)	(-7%)	(-1%)	(5%)	(5%)	(11%)	(12%)	(-6%)	(-4%)
		DROUGHT	-10	-75	-180	-247	-55	-68	-32	-58	-3	-27	13	11	23	27	35	30	55	35	-69	-24	37	54	216	159	3	-15
			(-2%)	(-11%)	(-25%)	(-31%)	(-7%)	(-9%)	(-6%)	(-10%)	(-1%)	(-8%)	(5%)	(4%)	(10%)	(11%)	(14%)	(12%)	(22%)	(13%)	(-13%)	(-5%)	(7%)	(10%)	(34%)	(23%)	(1%)	(-3%)
Southern Delta	SJR at Vernalis	ALL	-12	0	-38	0	-44	0	-65	0	-26	0	-29	0	-19	0	-19	0	16	0	12	1	-9	1	-20	0	-21	0
			(-2%)	(0%)	(-7%)	(0%)	(-6%)	(-0%)	(-9%)	(0%)	(-4%)	(-0%)	(-4%)	(-0%)	(-5%)	(-0%)	(-4%)	(-0%)	(3%)	(-0%)	(2%)	(0%)	(-2%)	(0%)	(-4%)	(-0%)	(-4%)	(0%)
		DROUGHT	-35	0	-46	0	-55	0	-78	0	-9	0	-21	0	-18	0	-16	0	-7	0	-5	2	-6	2	-22	0	-27	0
			(-6%)	(0%)	(-7%)	(0%)	(-6%)	(0%)	(-9%)	(0%)	(-1%)	(-0%)	(-2%)	(-0%)	(-3%)	(-0%)	(-3%)	(-0%)	(-1%)	(0%)	(-1%)	(0%)	(-1%)	(0%)	(-4%)	(-0%)	(-4%)	(0%)
	SJR at Brandt Bridge	ALL	-13	0	-37	0	-44	1	-66	-4	-29	0	-29	-1	-21	-4	-19	-1	16	0	8	1	-7	2	-19	0	-22	0
			(-3%)	(-0%)	(-6%)	(0%)	(-6%)	(0%)	(-9%)	(-1%)	(-4%)	(0%)	(-4%)	(-0%)	(-5%)	(-1%)	(-4%)	(-0%)	(3%)	(-0%)	(1%)	(0%)	(-1%)	(0%)	(-4%)	(-0%)	(-4%)	(-0%)
		DROUGHT	-34	0	-46	0	-55	1	-78	-2	-14	2	-20	-2	-21	-8	-16	-1	-6	0	-19	3	-7	6	-20	0	-28	0
			(-6%)	(-0%)	(-7%)	(0%)	(-6%)	(0%)	(-9%)	(-0%)	(-1%)	(0%)	(-2%)	(-0%)	(-3%)	(-1%)	(-3%)	(-0%)	(-1%)	(0%)	(-3%)	(0%)	(-1%)	(1%)	(-3%)	(0%)	(-4%)	(-0%)
	Old River at Middle River	ALL	-9	4	-36	0	-44	0	-59	4	-26	2	-26	1	-15	4	-17	1	15	0	13	1	-7	1	-19	0	-19	1
			(-2%)	(1%)	(-6%)	(0%)	(-6%)	(0%)	(-8%)	(1%)	(-4%)	(0%)	(-4%)	(0%)	(-3%)	(1%)	(-4%)	(0%)	(3%)	(-0%)	(2%)	(0%)	(-1%)	(0%)	(-4%)	(-0%)	(-3%)	(0%)
		DROUGHT	-30	4	-45	0	-55	0	-72	4	-12	1	-17	2	-9	6	-13	2	-7	0	-3	2	-5	2	-21	0	-24	2
			(-5%)	(1%)	(-7%)	(0%)	(-6%)	(0%)	(-8%)	(0%)	(-1%)	(0%)	(-2%)	(0%)	(-1%)	(1%)	(-2%)	(0%)	(-1%)	(0%)	(-0%)	(0%)	(-1%)	(0%)	(-3%)	(-0%)	(-3%)	(0%)
	Old River at Tracy Bridge	ALL	6	25	-20	12	-44	-1	-41	19	-20	12	-19	9	4	24	-12	6	-2	-2	-16	-18	-28	-12	-18	-1	-17	6
			(1%)	(5%)	(-3%)	(2%)	(-6%)	(-0%)	(-5%)	(3%)	(-3%)	(2%)	(-3%)	(1%)	(1%)	(5%)	(-3%)	(1%)	(-0%)	(-0%)	(-3%)	(-3%)	(-5%)	(-2%)	(-3%)	(-0%)	(-3%)	(1%)
		DROUGHT	7	38	-27	22	-53	0	-59	13	-16	2	-6	12	25	40	-7	8	-48	0	-86	-50	-96	-51	-35	-12	-33	2
			(1%)	(7%)	(-4%)	(4%)	(-6%)	(0%)	(-6%)	(2%)	(-2%)	(0%)	(-1%)	(1%)	(4%)	(6%)	(-1%)	(1%)	(-8%)	(-0%)	(-13%)	(-8%)	(-14%)	(-8%)	(-5%)	(-2%)	(-5%)	(0%)
SJR	SJR at Prisoners Point	ALL	-22	3	-171	-138	-168	-116	-61	-47	26	45	43	62	48	67	23	38	45	53	-60	-24	-45	-17	11	26	-27	-4
			(-4%)	(1%)	(-29%)	(-24%)	(-27%)	(-20%)	(-12%)	(-9%)	(7%)	(12%)	(13%)	(19%)	(14%)	(21%)	(7%)	(13%)	(15%)	(19%)	(-15%)	(-6%)	(-10%)	(-4%)	(2%)	(5%)	(-6%)	(-1%)
		DROUGHT	2	-37	-162	-225	-137	-120	-38	-58	23	26	78	108	91	115	63	70	55	44	-158	-99	-90	-22	105	95	-14	-9
			(0%)	(-6%)	(-25%)	(-31%)	(-19%)	(-17%)	(-6%)	(-9%)	(6%)	(6%)	(20%)	(30%)	(25%)	(34%)	(21%)	(23%)	(20%)	(16%)	(-29%)	(-20%)	(-15%)	(-4%)	(17%)	(15%)	(-3%)	(-2%)
Export Area	Banks PP	ALL	-116	-81	-237	-196	-239	-182	-275	-253	-148	-134	-143	-122	-90	-70	-99	-77	-60	-53	-103	-78	-156	-107	-143	-125	-151	-123
			(-21%)	(-15%)	(-37%)	(-33%)	(-35%)	(-29%)	(-42%)	(-40%)	(-28%)	(-26%)	(-30%)	(-27%)	(-19%)	(-16%)	(-23%)	(-19%)	(-15%)	(-14%)	(-24%)	(-19%)	(-30%)	(-22%)	(-26%)	(-23%)	(-28%)	(-25%)
		DROUGHT	-56	-46	-197	-238	-259	-224	-239	-267	-86	-91	-267	-229	-229	-195	-158	-136	-42	-36	-278	-236	-275	-166	-15	7	-175	-155
			(-9%)	(-7%)	(-28%)	(-32%)	(-32%)	(-29%)	(-31%)	(-33%)	(-13%)	(-14%)	(-41%)	(-38%)	(-36%)	(-33%)	(-29%)	(-26%)	(-10%)	(-9%)	(-52%)	(-48%)	(-38%)	(-27%)	(-2%)	(1%)	(-27%)	(-25%)
	Jones PP	ALL	-169	-146	-208	-178	-155	-99	-182	-138	-188	-148	-227	-203	-140	-122	-100	-82	-62	-75	-74	-59	-93	-58	-98	-83	-141	-116
			(-30%)	(-27%)	(-33%)	(-30%)	(-22%)	(-15%)	(-26%)	(-21%)	(-30%)	(-25%)	(-38%)	(-36%)	(-29%)	(-26%)	(-23%)	(-20%)	(-16%)	(-18%)	(-16%)	(-13%)	(-18%)	(-12%)	(-18%)	(-16%)	(-25%)	(-22%)
		DROUGHT	-200	-212	-218	-264	-154	-116	-167	-126	-195	-128	-317	-282	-149	-132	-156	-141	-3	-6	-123	-84	-151	-72	21	34	-151	-128
			(-31%)	(-32%)	(-31%)	(-35%)	(-19%)	(-15%)	(-20%)	(-16%)	(-23%)	(-17%)	(-37%)	(-34%)	(-23%)	(-21%)	(-27%)	(-25%)	(-1%)	(-2%)	(-22%)	(-16%)	(-22%)	(-12%)	(3%)	(5%)	(-22%)	(-19%)

[a] ALL: Water years 1976-1991 represent the 16-year period modeled using DSM2. DROUGHT: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).


Delta Mendota Canal
California Aqueduct
Contra Costa Canal
North Bay Aqueduct
Exports (MAF)
Water Year
San Felipe Unit
Central Valley Project
State Water Project
Coordinated Operations Agreement
Central Valley Project Improvement Act
NMFS BO Winter-run Chinook
USFWS BO delta smelt
Bay-Delta Accord SWRCB Order WR 95-06


Steelhead. Steelhead estimates are derived from direct counts at fishways and at hatcheries. Some estimates are the result of mark-recapture experiments, and some are a variant calculated by dividing hatchery returns by the estimated harvest rates.
Doubling goal = 13,000 (above RBDD only; information from other Sacramento River tributaries and the San Joaquin system was not included in Mills and Fisher (1994) for the baseline period)
1967-1991 Baseline Period Average = 6,546
1992-2008 Doubling Period Average = data not available
Estimated natural spawning Sacramento River steelhead above RBDD


USFWS Delta Smelt Recovery Index
No Data
No Data

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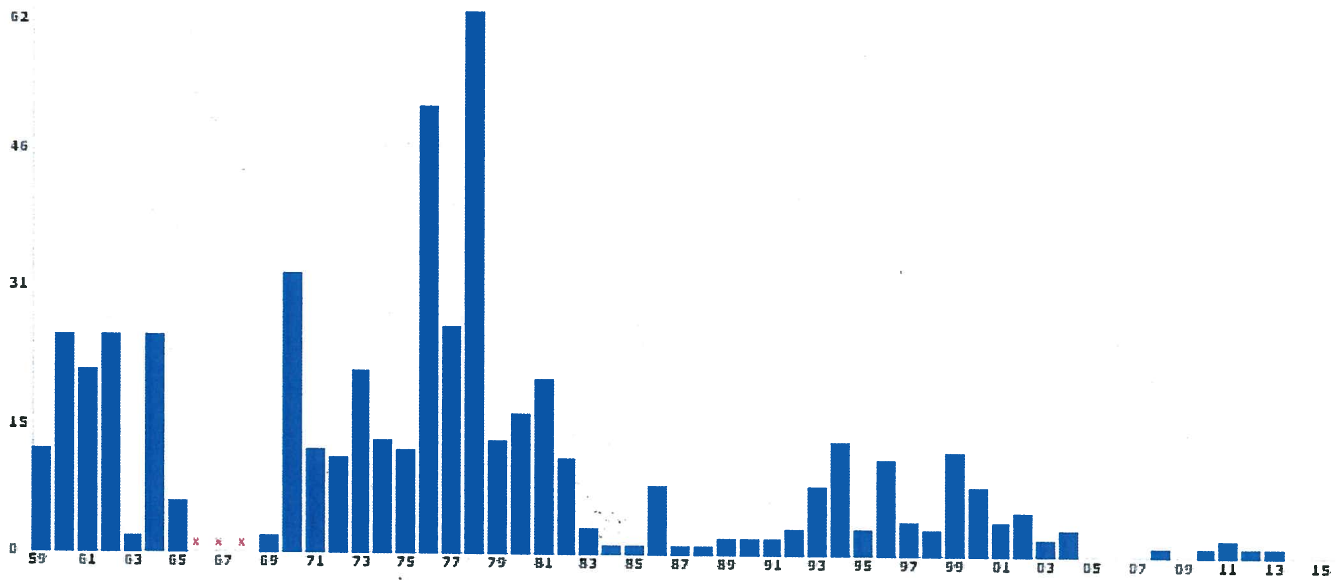
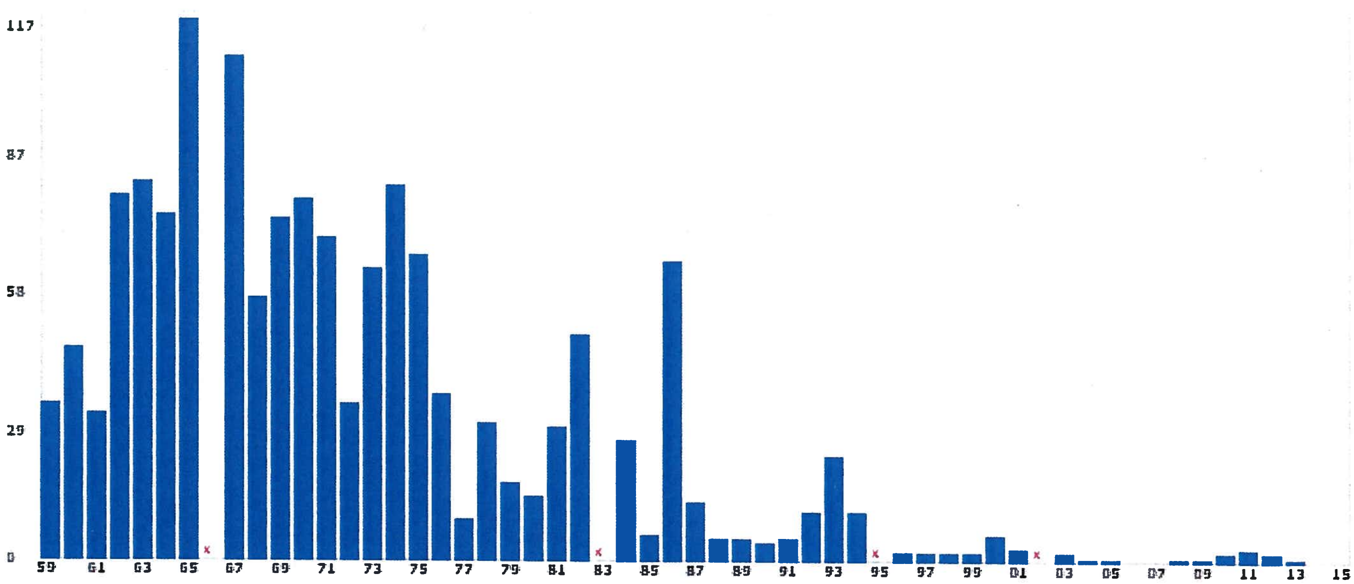
Delta Smelt Indices



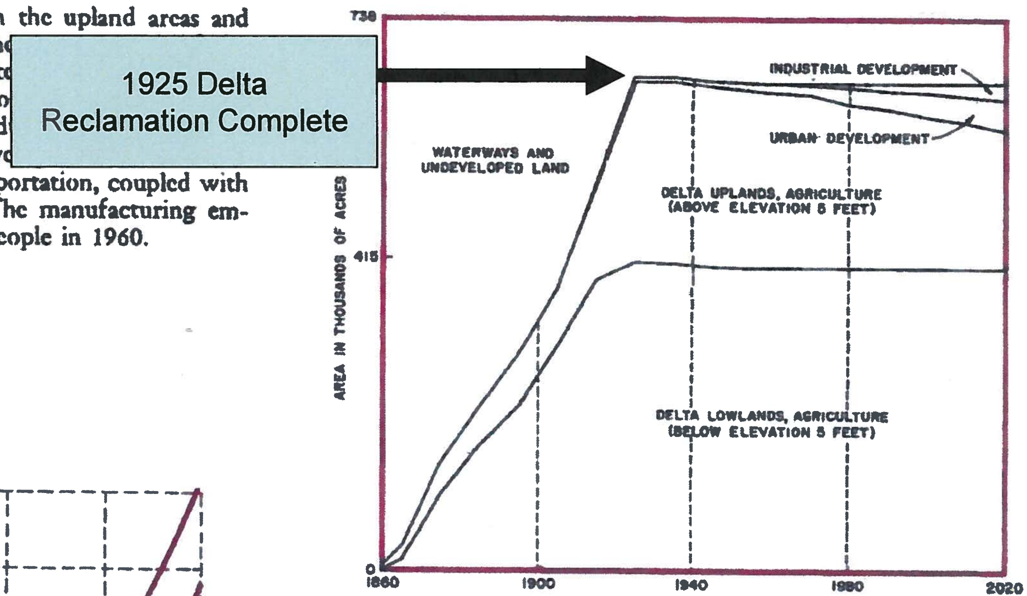
Delta Smelt Indices

Striped Bass Indices

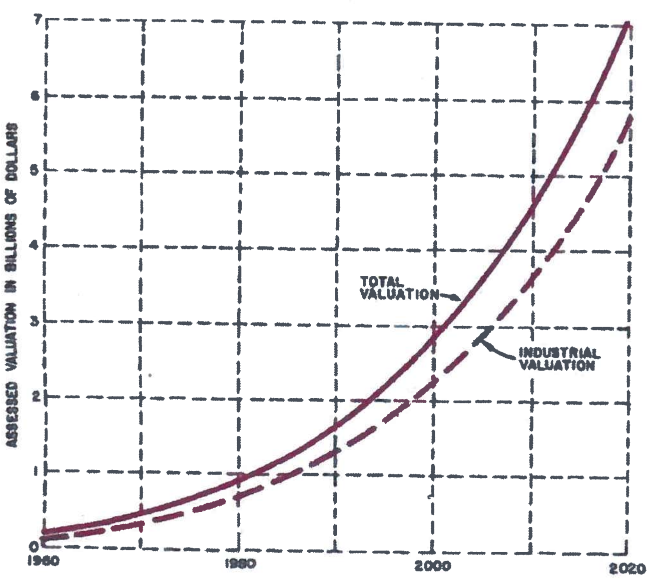


Striped Bass Indices

Several towns and cities are located in the upland areas and an industrial complex is expanding in th[...] Delta. Early industrial development cent[...] kindred products, steel production, fibrebo[...] building activity. Large water-using ind[...] paper products, and chemicals, have dev[...] area where water, rail, and highway transportation, coupled with water supplies, has stimulated growth. The manufacturing employment in this area was about 10,000 people in 1960.



TRENDS IN LAND USE



PROJECTED ASSESSED VALUATIONS WITHIN THE WESTERN DELTA STUDY AREA

A deep-draft ship channel serving commercial and military installations terminates at Stockton, and another is being constructed to Sacramento. Water-borne shipments in the Delta amounted to about 6,000,000 tons annually in recent years.

The Delta encompasses one of California's most important high quality natural gas fields. Since 1941 the field has produced about 300,000,000 cubic feet of methane gas for use in the San Francisco Bay area.

With the growing significance of recreation, the Delta has blossomed into a major recreation area at the doorsteps of metropolitan development in the San Francisco Bay area, Sacramento, and Stockton. In 1960, nearly 2,800,000 recreation-days were enjoyed in this boating wonderland.

TABLE A-5
1976-77 Estimated Crop Et Values
Delta Service Area
(in inches)

Land Use Category	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Total Oct.76-Sep.77	Oct.77	Total Nov.77-Oct.77
Sacramento-San Joaquin Delta															
Irrigated Pasture	3.2	1.5	1.0	0.7	1.5	3.6	5.4	4.8	6.9	7.7	6.4	4.7	47.4	3.4	47.6
Alfalfa	3.2	1.5	1.0	0.7	1.5	3.2	4.9	4.4	6.5	7.5	6.5	4.9	45.8	3.4	46.0
Deciduous Orchard (Fruits & Nuts)	2.6	1.5	1.0	0.7	1.5	2.7	3.8	4.0	6.1	7.4	6.1	4.3	41.7	2.6	41.7
Tomatoes	2.4	1.5	1.0	0.7	1.5	1.9	2.2	2.6	4.0	8.2	6.0	2.3	34.3	1.9	33.8
Sugar Beets	2.4	1.5	1.0	0.7	1.5	1.9	2.2	3.7	7.6	8.3	6.4	4.4	41.6	2.4	41.6
Grain Sorghum (Milo)	2.4	1.5	1.0	0.7	1.5	1.9	2.2	2.0	5.9	7.3	4.3	2.5	33.2	1.9	32.7
Field Corn	2.4	1.5	1.0	0.7	1.5	1.9	2.2	2.3	5.7	6.9	5.1	2.6	33.8	1.9	33.3
Dry Beans	2.4	1.5	1.0	0.7	1.5	1.9	2.2	1.7	5.7	6.2	2.7	2.5	30.0	1.9	29.5
Safflower	2.4	1.5	1.0	0.7	1.5	1.9	2.5	4.8	8.7	7.7	4.4	2.5	39.6	1.9	39.1
Asparagus	2.4	1.5	1.0	0.7	1.5	1.9	2.2	1.0	3.5	7.7	6.4	4.7	34.5	2.4	34.5
Potatoes	2.4	1.5	1.0	0.7	1.5	1.9	2.2	1.7	4.3	7.4	5.5	2.8	32.9	1.9	32.4
Irrigated Grain	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	1.8	1.0	1.0	1.6	26.1	1.6	24.7
Vineyard	2.4	1.5	1.0	0.7	1.5	1.9	2.2	2.8	5.3	6.5	5.3	3.4	34.5	2.4	34.5
Rice	3.2	1.5	1.0	0.7	1.5	1.9	2.8	5.6	8.8	9.8	8.1	5.5	50.4	3.4	50.6
Sudan	2.4	1.5	1.0	0.7	2.0	4.3	5.7	4.8	6.9	7.7	4.9	4.7	46.6	2.4	46.6
Misc. Truck	2.4	1.5	1.0	0.7	1.5	1.9	3.2	4.6	6.7	7.4	5.2	3.7	39.8	1.9	39.3
Misc. Field	2.4	1.5	1.0	0.7	1.5	1.9	2.2	2.4	6.1	7.4	5.0	1.9	34.0	1.9	33.5
Double Cropped with Grain															
Sugar Beets	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	1.8	4.2	5.2	5.8	37.7	3.4	38.7
Field Corn	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	1.8	4.3	6.3	6.1	39.2	2.7	39.5
Grain Sorghum (Milo)	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	1.8	2.7	6.1	5.2	36.5	1.9	36.0
Sudan	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	3.6	7.7	4.9	4.7	41.6	1.9	41.1
Dry Beans	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	3.1	7.6	3.5	1.5	36.4	1.9	35.9
Tomatoes	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	2.3	6.6	6.0	5.2	40.8	1.9	40.3
Lettuce	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	4.1	7.4	5.3	4.9	42.4	2.4	42.4
Misc. Truck	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	2.3	6.6	6.0	5.2	40.8	2.4	40.8
Misc. Field	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	4.1	7.4	5.3	4.9	42.4	3.4	43.4
Fallow Lands 1/	2.4	1.5	1.0	0.7	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	14.0	1.0	12.6
Native Vegetation 2/	2.4	1.5	1.0	0.7	1.4	3.7	3.8	2.1	2.3	2.6	2.3	2.0	25.8	1.6	25.0
Riparian Veg. & Water Surface	4.6	2.4	1.4	0.8	1.9	4.5	7.4	6.6	9.7	11.8	9.7	7.0	67.8	4.3	67.5
Urban	1.6	0.8	0.6	0.7	1.0	1.0	1.9	2.4	2.4	2.5	2.4	1.9	19.2	1.6	19.2

1/ Applies also to nonirrigated grain.
2/ Applies also to nonirrigated orchards and vineyards

Metric conversion: inches times 25.4 equals millimetres.

TABLE 69

UNIT CONSUMPTIVE USE OF WATER IN SACRAMENTO-SAN JOAQUIN DELTA**
Acre-feet per Acre

Crop or Classification	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total Seasonal Use	Total Annual Use
Alfalfa	(.06)	(.08)	.10	.30	.40	.50	.65	.55	.50	.20	(.10)	(.07)	3.20	3.51
Asparagus	.05	.05	.05	.05	.08	.14	.40	.68	.55	.42	.12	.10	2.69	2.69
Beans	(.06)	(.08)	(.08)	(.16)	(.20)	.14	.24	.58	.37	(.09)	(.07)	(.05)	1.33	2.12
Beets	(.06)	(.08)	(.08)	.13	.32	.51	.61*	.53*	.20*	(.13)	(.10)	(.07)	2.30	2.82
Celery	(.04)	(.04)	(.04)	(.08)	(.10)	.10	.10	.20	.25	.30	.20	.05	1.20	1.50
Corn	(.04)	(.04)	(.04)	(.08)	(.10)	.24	.35	.84*	.40*	.10	(.10)	(.07)	2.43	2.90
Fruit	(.04)	(.04)	(.04)	.18	.32	.50	.57	.40	.23	.07	(.07)	(.05)	2.27	2.51
Grain and Hay	(.04)	(.04)	.07	.60	.83	.20	(.14)	(.23)	(.21)	(.14)	(.07)	(.05)	1.70	2.62
Onions	(.04)	(.04)	.08	.13	.27	.49	.43	.20	(.16)	(.13)	(.10)	(.07)	1.60	2.14
Pasture	.08	.10	.20	.25	.25	.25	.25	.25	.20	.15	.10	.08	2.16	2.16
Potatoes	(.06)	(.08)	(.08)	(.16)	.15	.38	.52	.30	.15	(.09)	(.07)	(.05)	1.50	2.09
Seed	(.06)	(.08)	(.08)	.10	.25	.50	.50	.50	.35	.10	(.10)	(.07)	2.30	2.69
Truck	(.06)	(.08)	.10	.10	.25	.50	.45	.45	.30	.15	.10	(.07)	2.40	2.61
Tules	.16	.09	.30	.74	1.10	1.28	1.53	1.32	1.18	.98	.59	.36	9.63	9.63
Willows	.05	.03	.09	.22	.33	.38	.46	.40	.35	.29	.18	.10	2.88	2.88
Bare Land	.04	.04	.04	.08	.10	.13	.14	.13	.11	.09	.07	.05	1.02	1.02
Idle Land with Weeds***	.06	.08	.08	.16	.20	.26	.28	.24	.16	.13	.10	.07	1.82	1.82
Open Water Surfaces	.08	.13	.23	.34	.60	.76	.84	.78	.60	.33	.14	.08	4.91	4.91

NOTE: Figures shown in brackets ( ) represent estimated consumptive use on cropped areas before planting and after harvest. (Evaporation from bare land, use by weeds, etc.).

* Includes estimated additional use by weeds during these months.

** These are the data as determined for and published in Bulletin No.27 - "Variation and Control of Salinity in Sacramento-San Joaquin Delta and Upper San Francisco Bay" - Table 1.

*** Average for land below elevation 5.0 U.S.G.S. datum. Use on unirrigated lands above elevation 5.0 is considered zero.

TABLE 70

CONSUMPTIVE USE OF WATER IN THE SACRAMENTO-SAN JOAQUIN DELTA, 1931
ACRE-FEET

CROP OR CLASSIFICATION	ACREAGE 1/	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL SEA-SONAL USE	TOTAL ANNUAL USE
ALFALFA	26882	(1610)	(2150)	2690	8060	10750	13440	17470	14790	13440	5380	(2690)	(1880)	86020	94350
ASPARAGUS 2/	70580	3530	3530	3530	3530	5650	9920	28940	49540	39780	29660	8480	7060	193150	193150
BEANS 3/	26992 5/	(1460)	(1950)	(1960)	(4110)	(5170)	3460	5890	14210	9070	(2210)	(1720)	(1220)	32630	52430
BEETS	30915 5/	(1850)	(2470)	(2480)	4070	9940	15750	18850*	16390*	6210*	(4030)	(3090)	(2170)	71210	87300
CELERY	6303	(250)	(250)	(250)	(500)	(630)	630	630	1260	1580	1890	1260	320	7570	9450
CORN 3/	55798 5/	(2230)	(2230)	(2240)	(4710)	(5920)	13360	47320	46760*	22270*	5570	(5570)	(3890)	135280	162070
FRUIT	10775	(430)	(430)	(430)	1940	3450	5390	6140	4310	2480	750	(750)	(540)	24460	27040
GRAIN AND HAY 4/	65086	(2560)	(2560)	4480	38370	53070	12790	(8950)	(14710)	(13430)	(8950)	(4480)	(3200)	108710	167550
ONIONS	3769 5/	(150)	(150)	310	530	1060	1830	1630	770	(610)	(490)	(380)	(270)	6130	8180
PASTURE	12748	1020	1270	2550	3190	3190	3190	3190	3190	2550	1910	1270	1020	27540	27540
POTATOES	18042	(1080)	(1440)	(1440)	(2890)	2710	6860	9380	5410	2710	(1620)	(1260)	(900)	27070	37700
SEED	8967	(540)	(720)	(720)	900	2240	4480	4480	4480	3140	900	(900)	(630)	20620	24130
TRUCK	6498 5/	(390)	(520)	640	670	1650	3230	2920	2920	1950	990	650	(450)	15620	16980
TOTAL IRRIGATED CROPS	343355 6/	17100	19670	23720	73470	105430	94330	155790	178740	119220	64350	32500	23550	756010	907870
TULES	8300 7/	1330	750	2490	6140	9130	10620	12700	10960	9790	8130	4900	2990	79930	79930
WILLOWS	5600 8/	280	170	500	1230	1850	2130	2580	2240	1960	1620	1010	560	16130	16130
BARE LANDS 10/	8480 9/	340	340	340	680	850	1100	1190	1100	930	760	590	420	8640	8640
IDLE LANDS WITH WEEDS 10/	35230 11/	2110	2820	2820	5640	7050	9160	9860	8460	5640	4580	3520	2470	64130	64130
OPEN WATER SURFACES	49400 12/	3950	6420	11360	16800	29640	37540	41500	38530	29640	16300	6920	3950	242550	242550
TOTAL CONSUMPTIVE AREA	446310 13/	25110	30170	41230	103960	153950	154880	223620	240030	167180	95740	49440	33940	1167390	1319250
UNIT CONSUMPTION-AC.FT.PER AC.															
TOTAL CONSUMPTIVE AREA	446310	.06	.07	.09	.23	.35	.35	.50	.54	.37	.21	.11	.08	2.61	2.96
IRRIGATED CROP AREA	339300 13/	.05	.06	.07	.21	.31	.28	.46	.53	.35	.19	.10	.07	2.23	2.68

NOTE: FIGURES IN BRACKETS ( ) REPRESENT CONSUMPTIVE USE ON CROPPED AREAS BEFORE PLANTING AND AFTER HARVEST. (EVAPORATION FROM BARE LAND, USE BY WEEDS, ETC.)

* INCLUDES ESTIMATED ADDITIONAL USE BY WEEDS DURING THESE MONTHS.

1/ DATA FROM TABLE 68.

2/ FIGURES FOR ASPARAGUS INCLUDE ALLOWANCE FOR GREATER USER BY AREAS INTERCROPPED WITH BEANS AND CORN.

3/ FIGURES INCLUDE USE BY AREAS DOUBLE CROPPED AFTER GRAIN BUT DO NOT INCLUDE USE BY INTERCROPPED ASPARAGUS ACREAGE. (SEE 2/).

4/ FIGURES DO NOT INCLUDE USE BY DOUBLE CROPPED AREAS (SEE 3/).

5/ INCLUDES SECOND CROP AND INTERPLANTINGS.

6/ INCLUDES 4053 ACRES OF SECOND CROP AND INTERPLANTINGS.

7/ INTERIOR, 3000 ACRES AND EXTERIOR CHANNELS, 5300 ACRES.

8/ INTERIOR, AS A PORTION OF LEVEE ACREAGE, 4400 ACRES; EXTERIOR CHANNELS, 1200 ACRES.

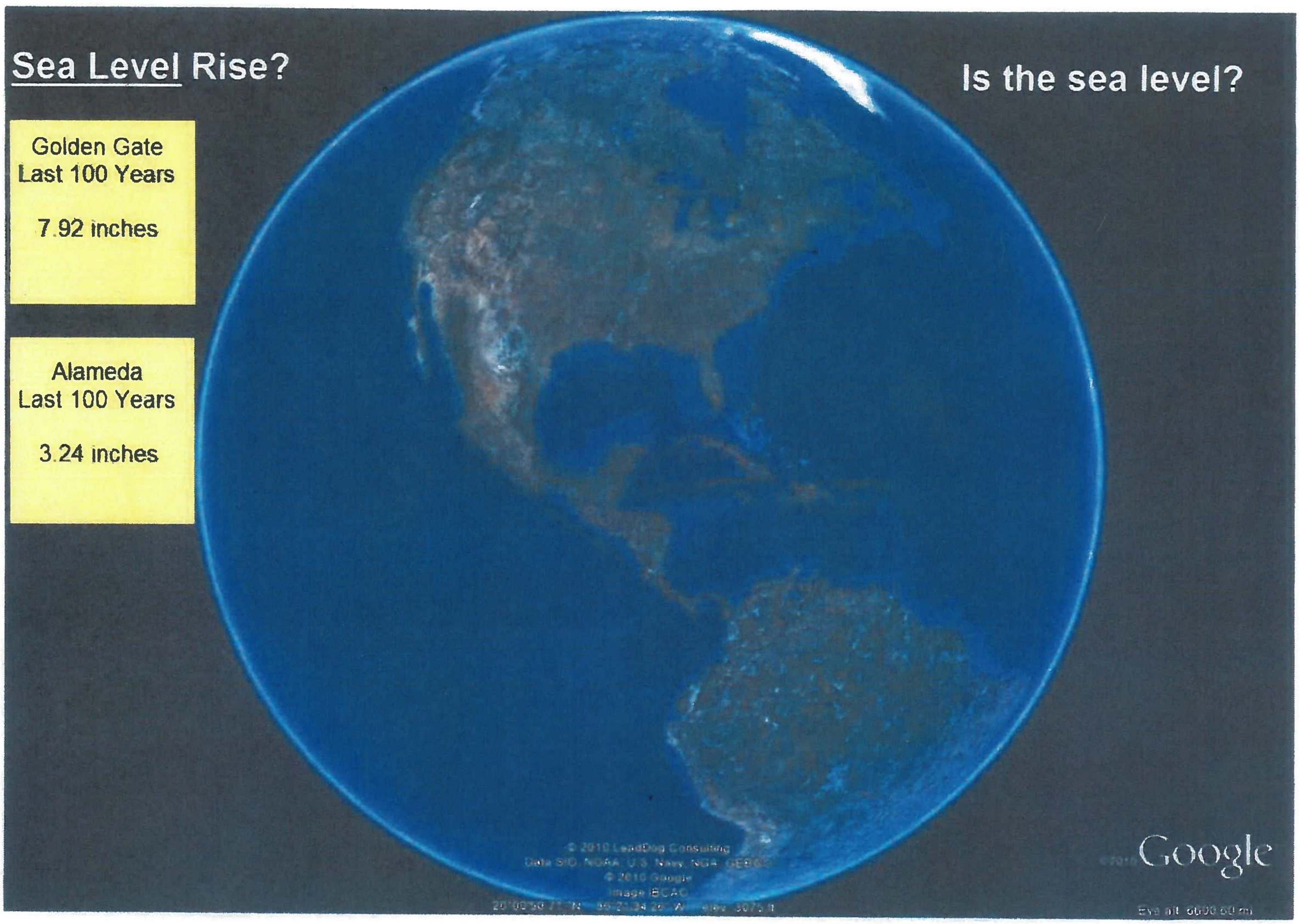
9/ INCLUDES ROADS, CAMP AREAS, INTERIOR LEVEES, ETC.

10/ BELOW ELEVATION 5.0 U.S.G.S. DATUM. NON-IRRIGATED AND IDLE LANDS ABOVE THIS ELEVATION ARE NOT CONSIDERED AS CONSUMING WATER.

11/ INCLUDES 28527 ACRES INTERIOR; 4583 ACRES AS A PORTION OF LEVEE AREA; 1800 ACRES OAKS AND BRUSH IN EXTERIOR CHANNELS; 320 ACRES TOTAL FOR A GROUP OF SMALL ISLANDS NOT INCLUDED IN TABLE 68.

12/ INCLUDES INTERIOR WATER SURFACES, 7500 ACRES; FLOODED RECLAMATIONS, 4300; OPEN EXTERIOR CHANNELS WITHIN THE DELTA, 36500 ACRES; AND OPEN CHANNELS BETWEEN DELTA BOUNDARY AND STREAM GAGING STATIONS (RECORDING FLOW TO THE DELTA), 1100 ACRES.

13/ IN THIS TOTAL, THE ACREAGE OF IRRIGATED CROPS HAS BEEN CORRECTED FOR SECOND CROP AND INTERPLANTINGS (SEE 6/).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Last 100 Years
7.92 inches
Alameda
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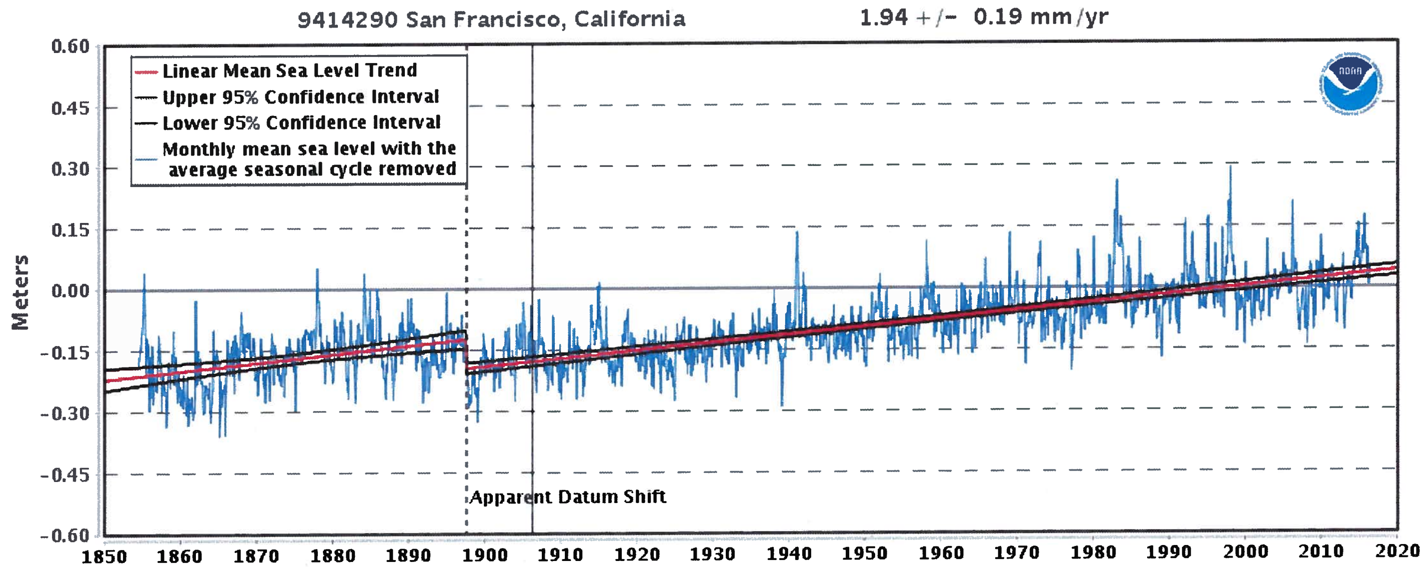

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The mean sea level trend is 1.94 millimeters/year with a 95% confidence interval of +/- 0.19 mm/yr based on monthly mean sea level data from 1897 to 2015 which is equivalent to a change of 0.64 feet in 100 years. [Metadata: Apparent datum shift]

The plot shows the monthly mean sea level without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents. The long-term linear trend is also shown, including its 95% confidence interval. The plotted values are relative to the most recent Mean Sea Level datum established by CO-OPS (http://tidesandcurrents.noaa.gov/datum_options.html). The calculated trends for all stations are available as a table in millimeters/year and in feet/century (mslUSTrendsTable.htm) (0.3 meters = 1 foot).

If present, solid vertical lines indicate times of any major earthquakes in the vicinity of the station and dashed vertical lines bracket any periods of questionable data or datum shift.

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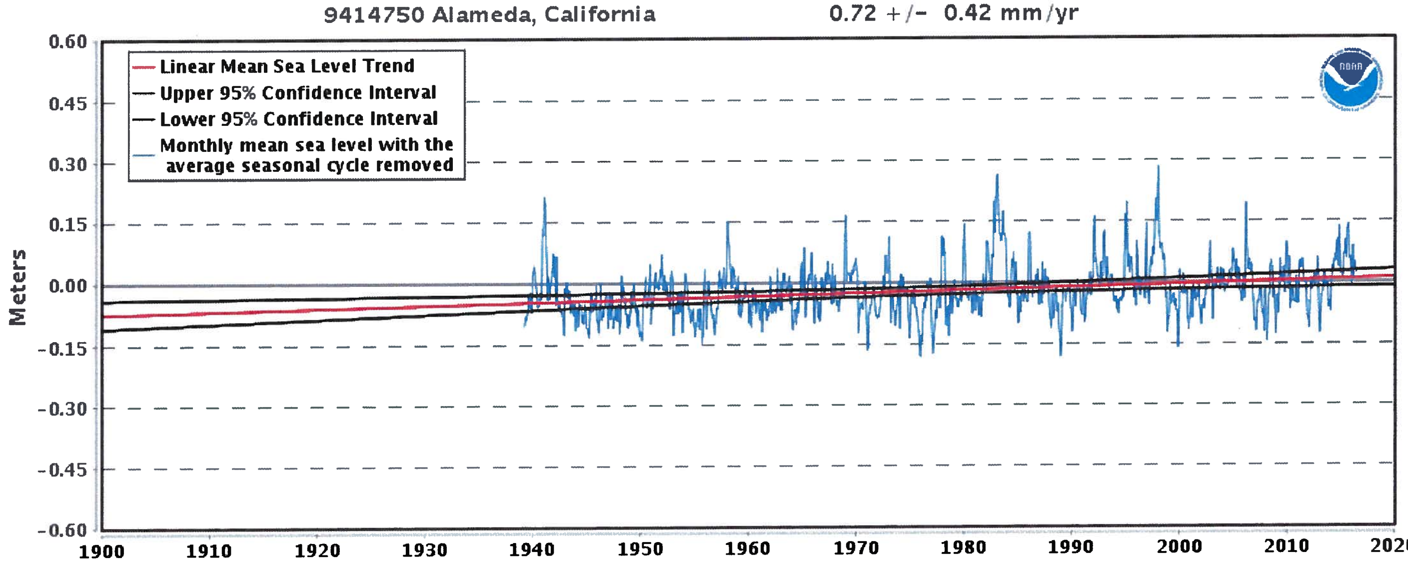

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The mean sea level trend is 0.72 millimeters/year with a 95% confidence interval of +/- 0.42 mm/yr based on monthly mean sea level data from 1939 to 2015 which is equivalent to a change of 0.24 feet in 100 years.

The plot shows the monthly mean sea level without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents. The long-term linear trend is also shown, including its 95% confidence interval. The plotted values are relative to the most recent Mean Sea Level datum established by CO-OPS (http://tidesandcurrents.noaa.gov/datum_options.html). The calculated trends for all stations are available as a table in millimeters/year and in feet/century (mslUSTrendsTable.htm) (0.3 meters = 1 foot).

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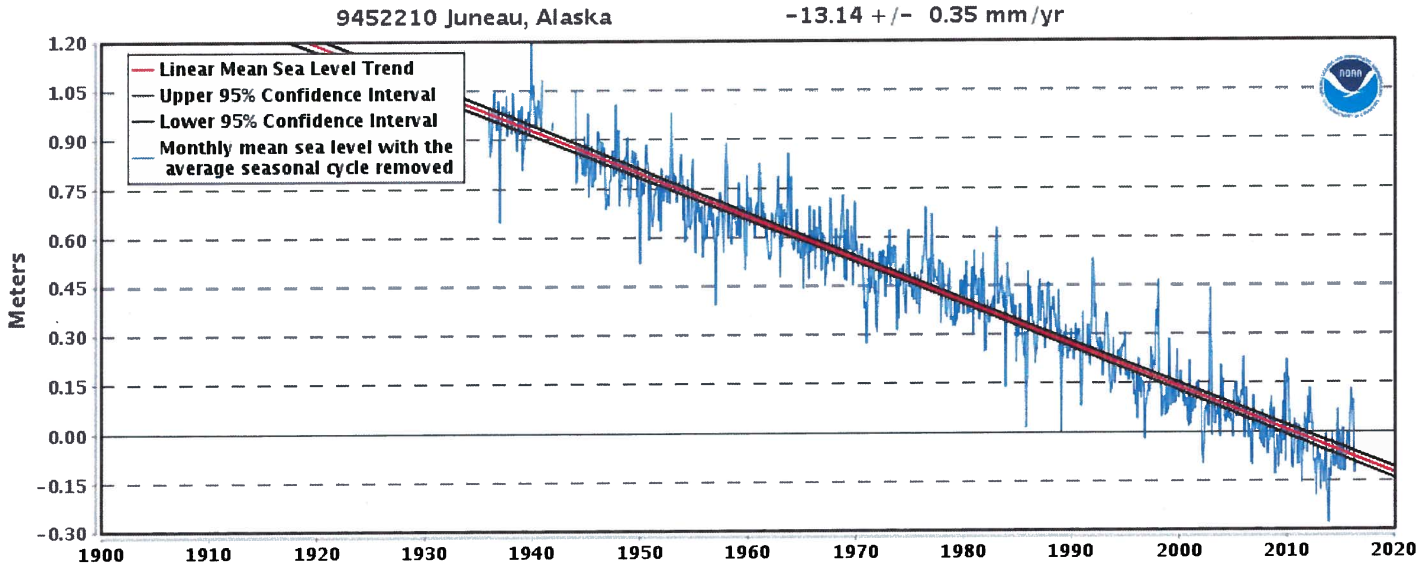

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The mean sea level trend is -13.14 millimeters/year with a 95% confidence interval of +/- 0.35 mm/yr based on monthly mean sea level data from 1936 to 2015 which is equivalent to a change of -4.31 feet in 100 years.

The plot shows the monthly mean sea level without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents. The long-term linear trend is also shown, including its 95% confidence interval. The plotted values are relative to the most recent Mean Sea Level datum established by CO-OPS (http://tidesandcurrents.noaa.gov/datum_options.html). The calculated trends for all stations are available as a table in millimeters/year and in feet/century (mslUSTrendsTable.htm) (0.3 meters = 1 foot).
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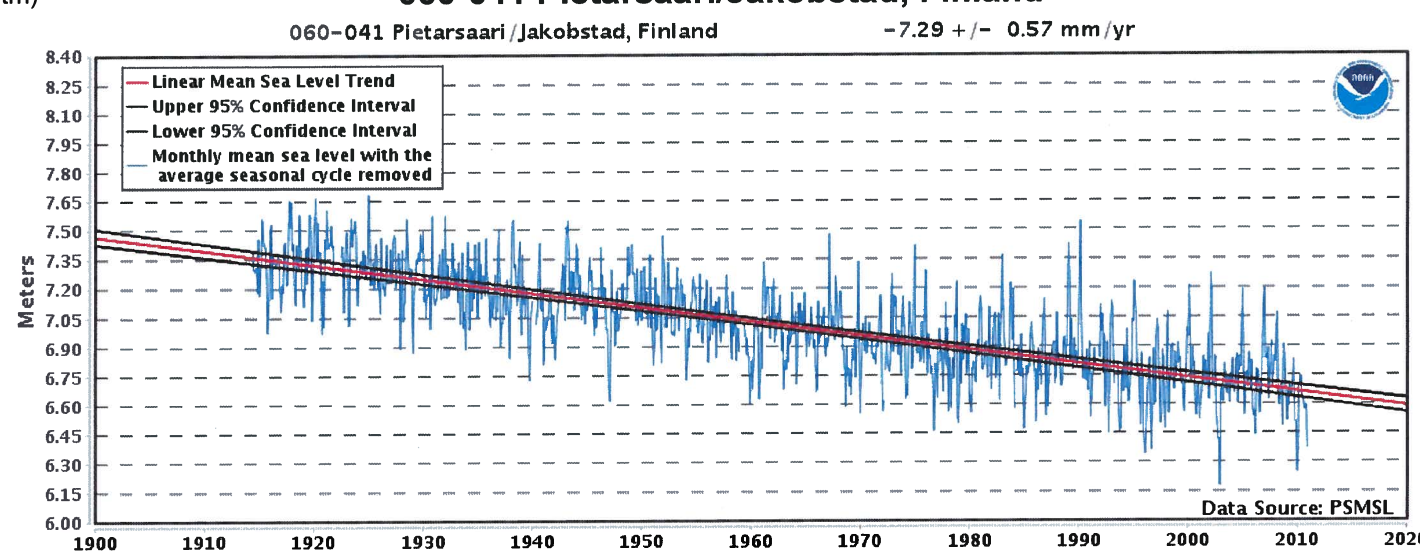
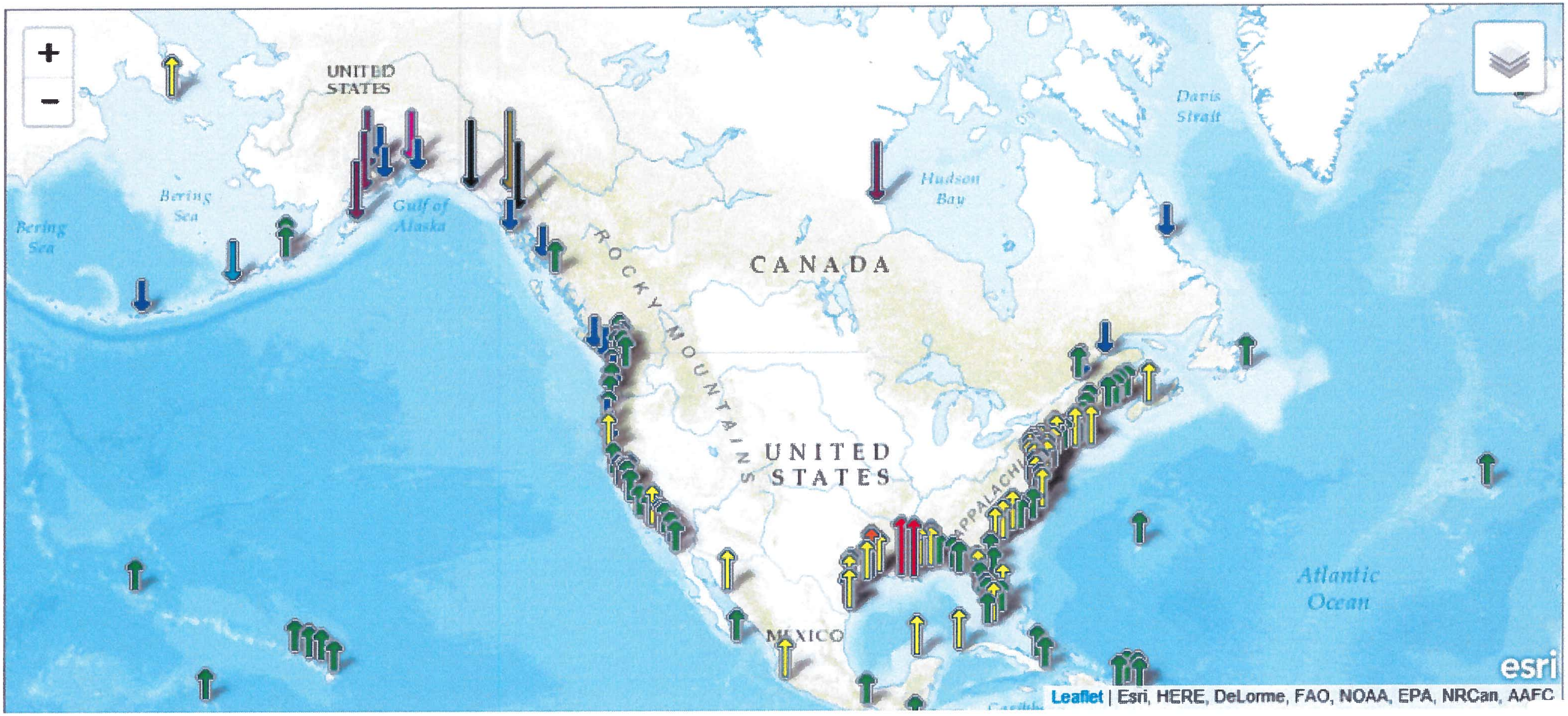
060-041 Pietarsaari/Jakobstad, Finland





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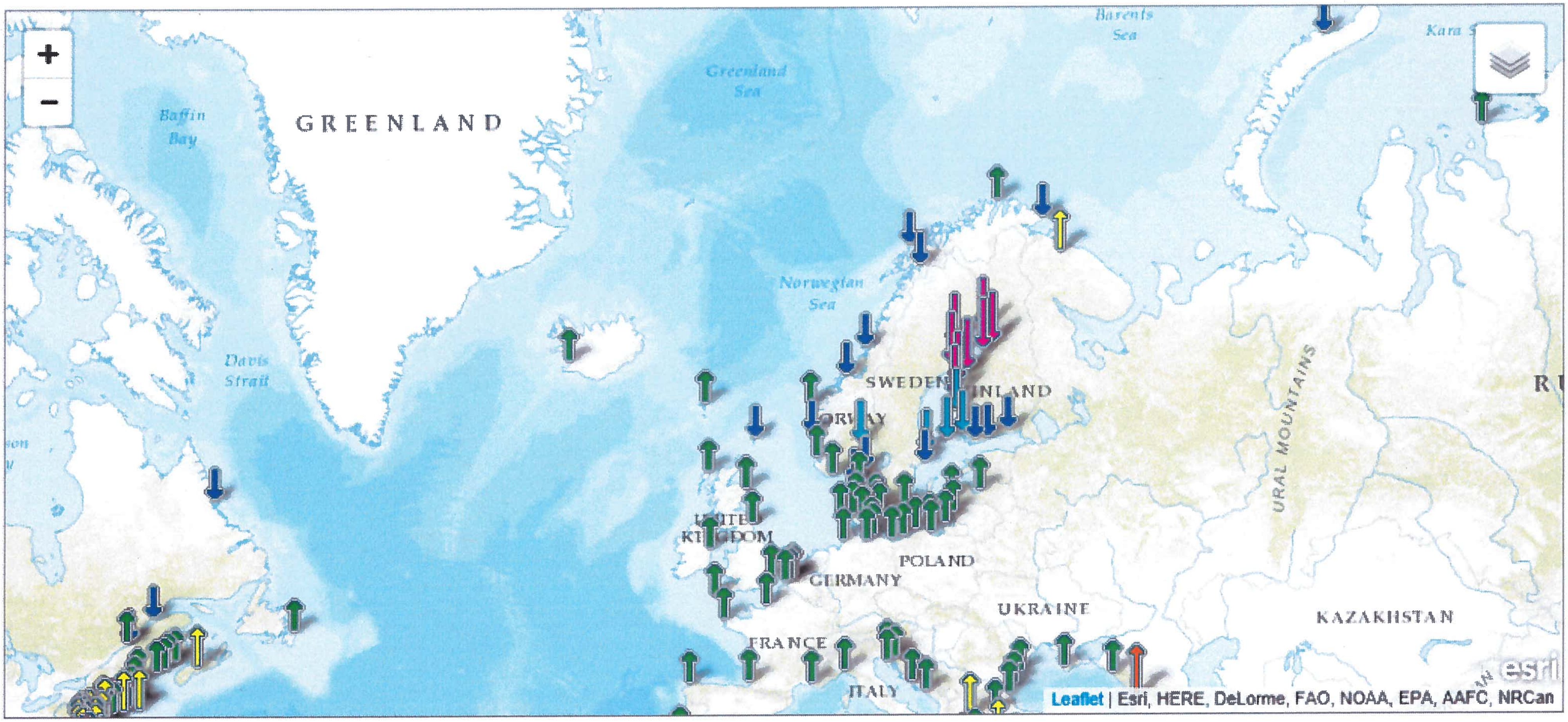
Leaflet | Esri, HERE, DeLorme, FAO, NOAA, EPA, NRCan, AAFC

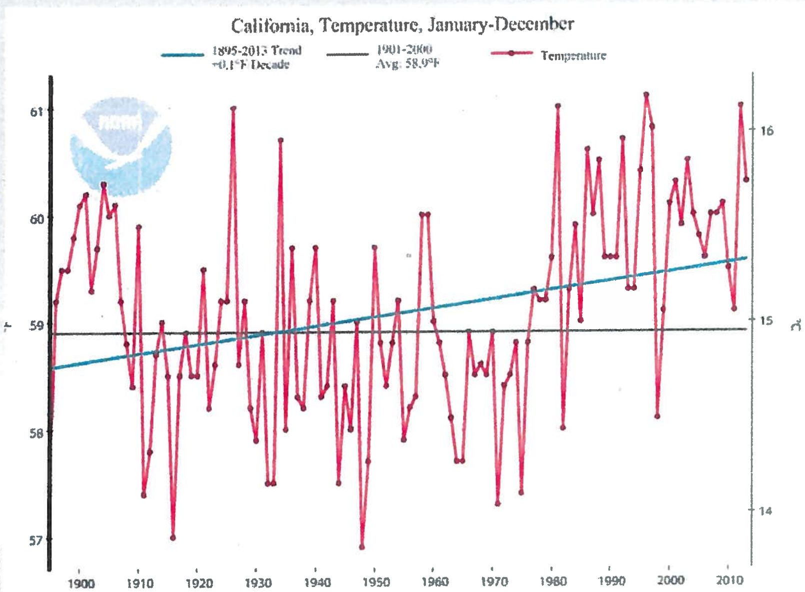
SDWA-195



Baffin Bay
GREENLAND
Greenland Sea
Barents Sea
Kara
Norwegian Sea
Davis Strait
SWEDEN
FINLAND
UNITED KINGDOM
POLAND
GERMANY
UKRAINE
KAZAKHSTAN
FRANCE
ITALY
URAL MOUNTAINS
Leaflet | Esri, HERE, DeLorme, FAO, NOAA, EPA, AAFC, NRCan

Why Climate Change in CVFPP

- Future climate different from historical climate
  - Warmer temperatures
  - Increasing precipitation extremes
  - Sea level rise
- Flood planning, long-term planning for resiliency
- Policy and technical guidance on climate change



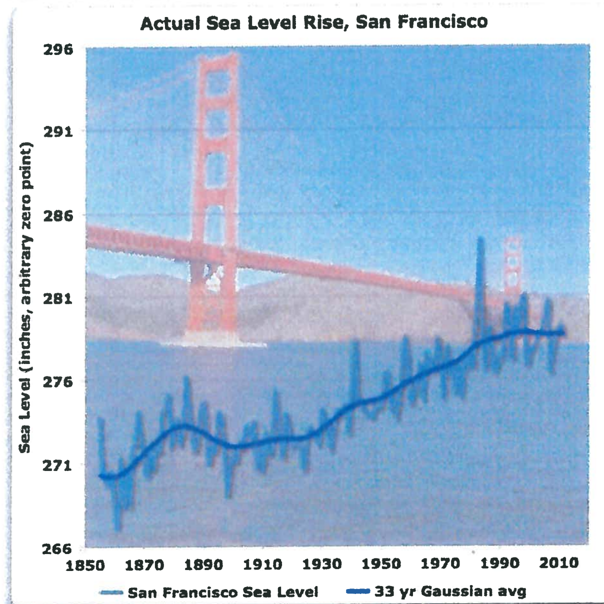
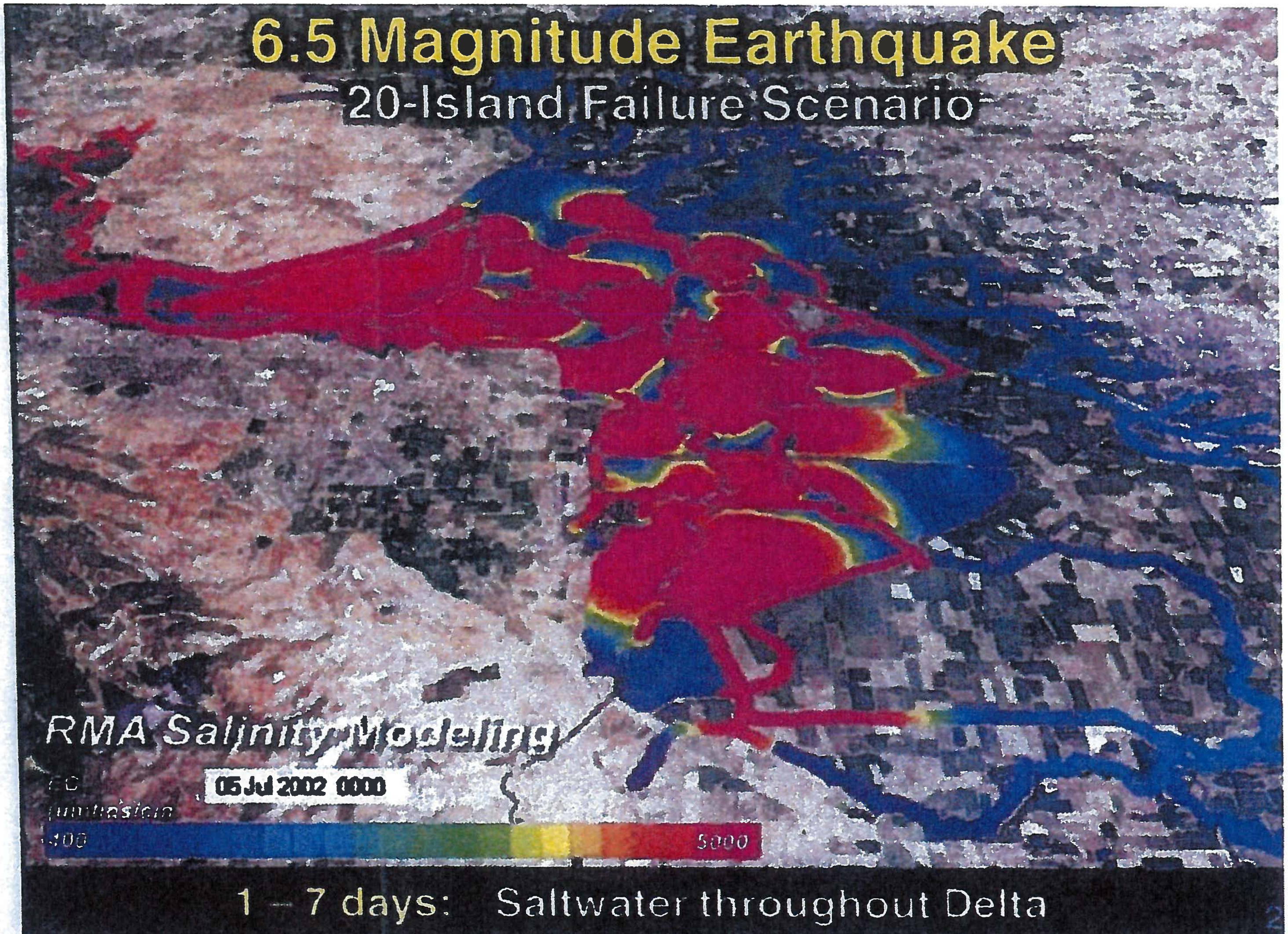


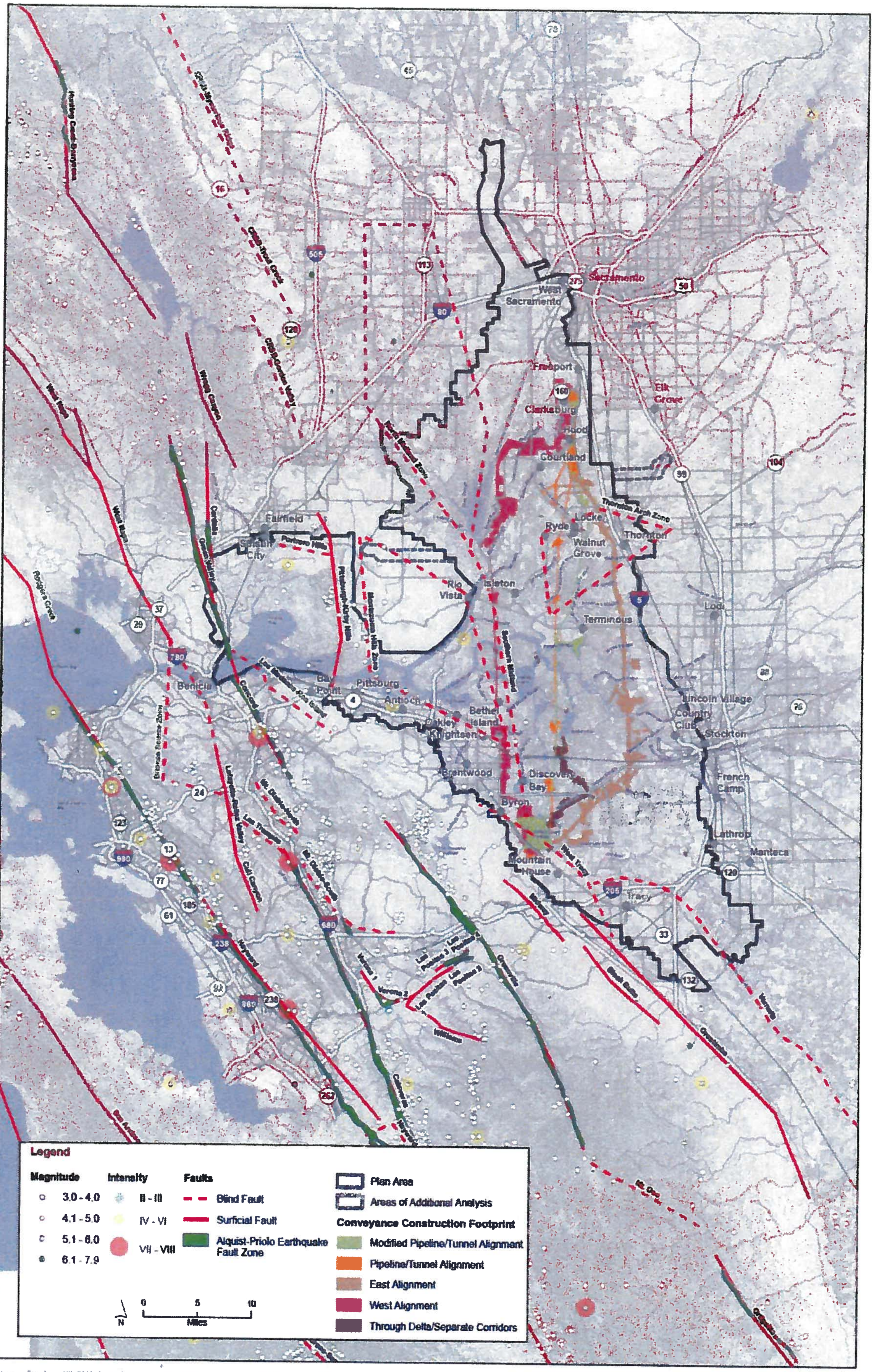
Figure 1. 160 years of sea level observations in San Francisco, California. Source: PSMSL

2017 ROADMAP DRAFT DOCUMENT- SUBJECT

[TRACKING NUMBER]

SDWA-196


6.5 Magnitude Earthquake
20-Island Failure Scenario
RMA Salinity Modeling
05 Jul 2002 0000
5000
1 – 7 days: Saltwater throughout Delta



Sources: Plan Area, ICF 2012; Alquist-Priolo Earthquake Fault Zones (FTZ), California Geological Survey 2001; Faults, DRMS 2008; Seismicity/Magnitude, URS 2010; Constructability (Rev 5a), DHCCP DWR 2015; Constructability (Rev 10b), DHCCP DWR 2012; Constructability (Rev 3a), DHCCP DWR 2012

Figure 9-5
Active Faults and Historical Seismicity of the Bay and Delta Region, 1800–2010

EXTRACTS OF USACE MAY 23, 2007 COMMENTS

The assumption that the 23 large watershed's 100-year flows can be added together to produce the 100-year Delta flow is invalid.

The assumption that failures in a levee system will not significantly reduce stage elevations along channel is questionable.

Annual mean number for seismic levee failures is 3.41 . . . . 341 failures per 100 years which is 341 more than observed in the past 100+ years . . . . Surely, these numbers cannot be credible results.

The average of 7.35 flood failures per year is three times the (undocumented) 2.60 number and nearly 6 times the observed flood failure rate from 1950 to 2006. Thus, as with the seismic failure number above, this flood number simply appears way outside the bounds of credibility.

Return periods of 2.7 or 5 years for many levees just seem incorrect and incompatible with decades of recent data.

Overall, the seismic fragilities simply appear unrealistic - with far too many breaks to be credible.

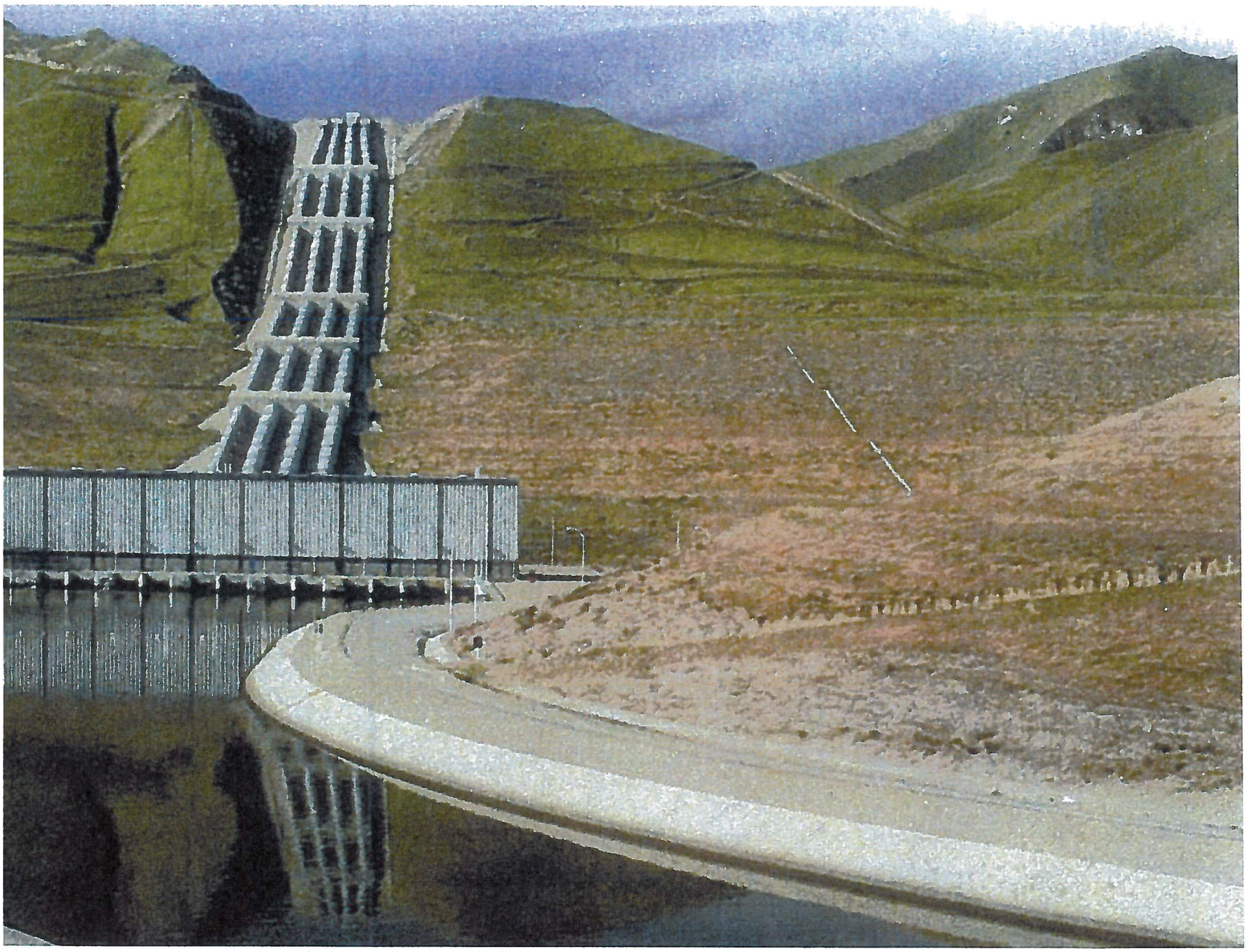
Figure 6-40 implies that for a M 7.5 event this type of levee has a 10% chance of displacing 10 ft. at all PGAs > 0.10. This seems Really Extreme.

Conclusion that 40% of historical failures (2.6) are from through seepage results in over 1.0 per year is different than historical rate and needs to be explained.

At first glance, the calculated annual number of failures is, to be polite, "extraordinary" albeit not as extreme as the seismic results above.

The estimated 30 or more island breaches in the next 25 years due to flood events seem too high/pessimistic.

The BAU assumption that levee crest elevations will not be raised in response to increased tidal and flood elevations is not realistic.
1 ft easy, 3 ft maybe doable for 100 years of effort.




SURGE TANK
MOUNTAINS
TUNNEL NO. 1
TUNNEL NO. 2
PASTORIA SIPHON
TUNNEL NO. 3
CARLEY V. PORTER TUNNEL
CONTROL
STRUCTURE
GARLOCK FAULT
DISCHARGE LINES - APPROXIMATELY 2000' LIFT

Table 7-8 Comparison of Total Replacement Costs of Delta Infrastructure - Current and 2050[a]

Inundation Level	Current (2005)[c]	2050	Cost Ratio: 2050/Current
Within Mean Higher High Water (MHHW) Limits [b]	$6.7 billion	$8.5 billion [e]	1.3
Within 100-year Flood Limits [b,c]	$56.3 billion	$67.1 billion [e]	1.2

[a] Costs in this table are for infrastructure assets and their contents that could be damaged as a result of levee breaching and island flooding.
[b] See Section 4.1.2 and Figure 4-1 for limits of inundation.
[c] Flood plain limits were developed from FEMA Flood Insurance Rate Maps.
[d] Costs are in 2005 dollars.
[e] Costs are in 2005 dollars; not escalated to 2050.