DISSOLVED OXYGEN TMDL

San Joaquin River Group Authority

What is the Pollutant?

Dissolved Oxygen is not a Pollutant. It may be a byproduct of pollutants, but it is not in itself a pollutant.

(40 CFR Part 130, section 130.2)

What is the Pollutant then?

There are many theories, but no answers in the Staff Report. The Staff Report also misses one main contributor – animal waste.

(Staff Report, p30; USGS 2004.)

What is the baseline loading capacity?

"Baseline loading capacity" is the greatest amount of matter that is introduced into a receiving water without violating water quality standards. Nowhere does the loading capacity appear in the report.

(Staff Report, p9, 40.)

What loads are allocated?

NONE!

Further analysis and study are required.

(Staff Report, p41.)

Then turn to the limiting factor as the assimilative capacity of the DWSC. The problem is the Channel design.

(Staff Report, p10.)

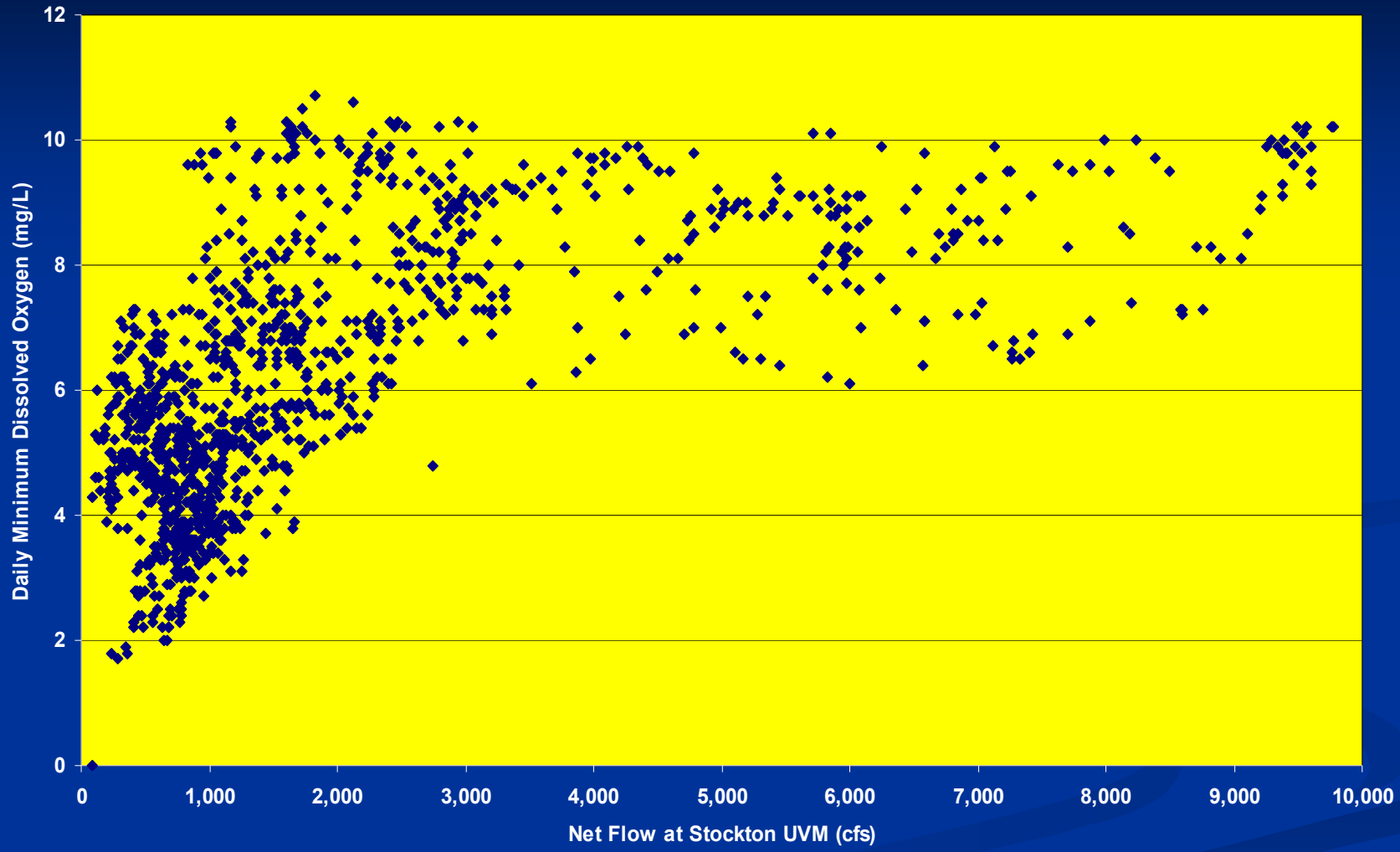
"These conditions occur most often during the months of June through October, although severe conditions have occurred in the winter months as well.

The frequency and severity of violations are generally worse during dryer water years."

(DO TMDL, p18-19.)

Even having found the DWSC assimilative capacity to be the limiting factor, they still cannot determine the limiting volume of matter that may be introduced from upstream sources that diminish this assimilative capacity.

Dissolved Oxygen Concentration versus Flow



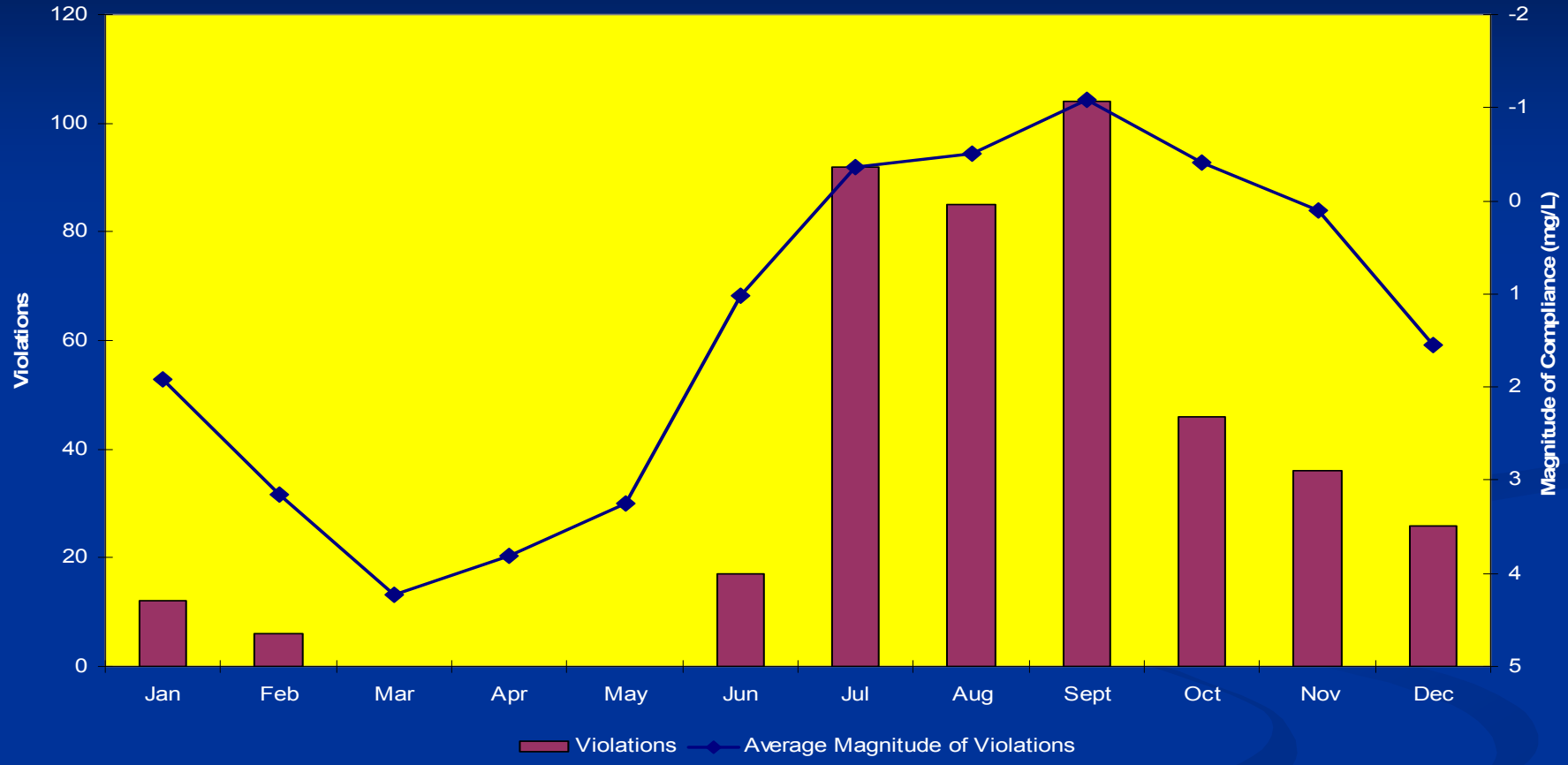
MONTHLY DISSOLVED OXYGEN AND FLOW DATA (1996-2000)

Month	Objective	Average Minimum DO (mg/L)	Compliance	Violations	Percent Compliance	Average Magnitude	Average Net Flow (cfs)
Jan	5.0	6.92	Yes	12	89	1.92	1,451
Feb	5.0	8.16	Yes	6	89	3.16	4,919
Mar	5.0	9.23	Yes	0	100	4.23	4,187
Apr	5.0	8.82	Yes	0	100	3.82	4,405
May	5.0	8.25	Yes	0	100	3.25	4,056
Jun	5.0	6.02	Yes	17	81	1.02	1,566
Jul	5.0	4.63	No	92	27	-0.37	1,771
Aug	5.0	4.49	No	85	42	-0.51	1,136
Sept	6.0	4.92	No	104	29	-1.08	1,264
Oct	6.0	5.59	No	46	41	-0.41	1,660
Nov	6.0	6.10	Yes	36	53	0.10	786
Dec	5.0	6.55	Yes	26	77	1.55	881

Data Points = 1168
Total Days of Violations = 424
Total Days of Compliance = 744

Frequency of Compliance = 43%
Average Magnitude of Violation = 0.59

Stockton Deep Water Ship Channel Dissolved Oxygen Objective Violations and Magnitude of Compliance



"Between 1979 and 1992, the measured runoff in the basin as measured at Vernalis was 2.4 maf lower than the mean annual unimpaired discharge of 6.1 maf. The difference is due to consumptive use…"

(DO TMDL, p32.)

UNIMPAIRED VERSUS MEASURED FLOW

	Flow (TAF)	Difference (TAF)
July		
Unimpaired Flow	6,220	
USGS Flow	2,769	-3,451
August		
Unimpaired Flow	1,905	
USGS Flow	1,976	71
September		
Unimpaired Flow	1,064	
USGS Flow	2,367	1,303
October		
Unimpaired Flow	1,315	
USGS Flow	2,974	1,659
Total		-418

418 TAF / 14 Years = 29.86 MAF per Year

29.86 TAF per Year / 122 Days = 245 AF per Day

The difference at Vernalis is 122 cfs.

"Based on the San Joaquin River flow data at Vernalis, the fifteen year moving average of annual discharge in the late 1990's was approximately 800,000 acre feet lower than in the late 1940's."

(DO TMDL, p32.)

FLOW BEFORE THE PROJECTS AND TODAY

	Month	Flow (TAF)	TAFA	Change
1935-1949	July	3,351	223	
1985-1999	July	2,678	179	-45
1935-1949	August	1,158	77	
1985-1999	August	1,864	124	+47
1935-1949	September	1,275	85	
1985-1999	September	1,964	131	+46
1935-1949	October	1,674	112	
1985-1999	October	2,763	184	+73

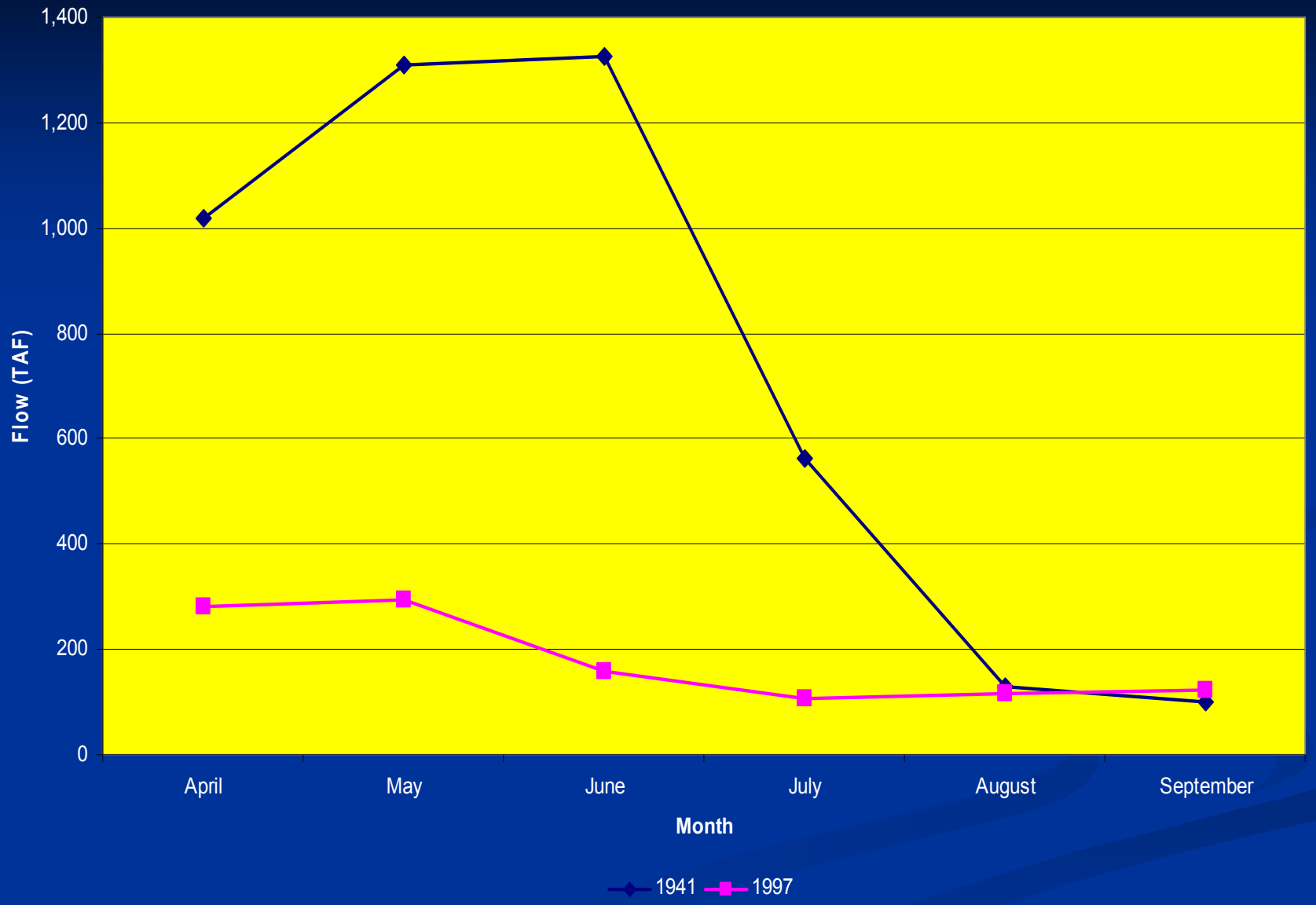
SAN JOAQUIN RIVER INDEX YEAR TYPES

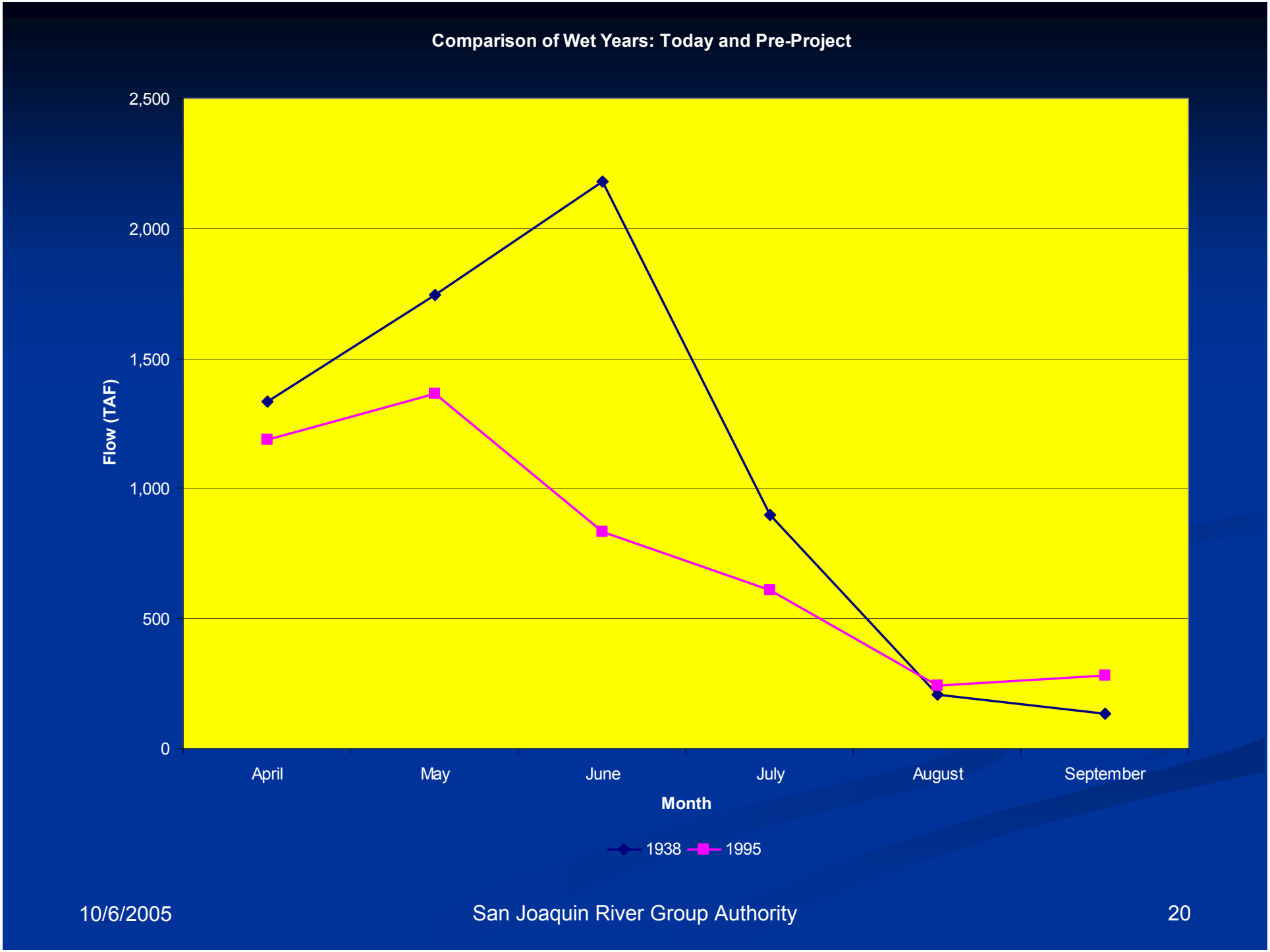
YEAR TYPE	1935-1949	1985-1999
Wet	5	6
Above Normal	5	1
Below Normal	3	0
Dry	2	1
Critical	0	7

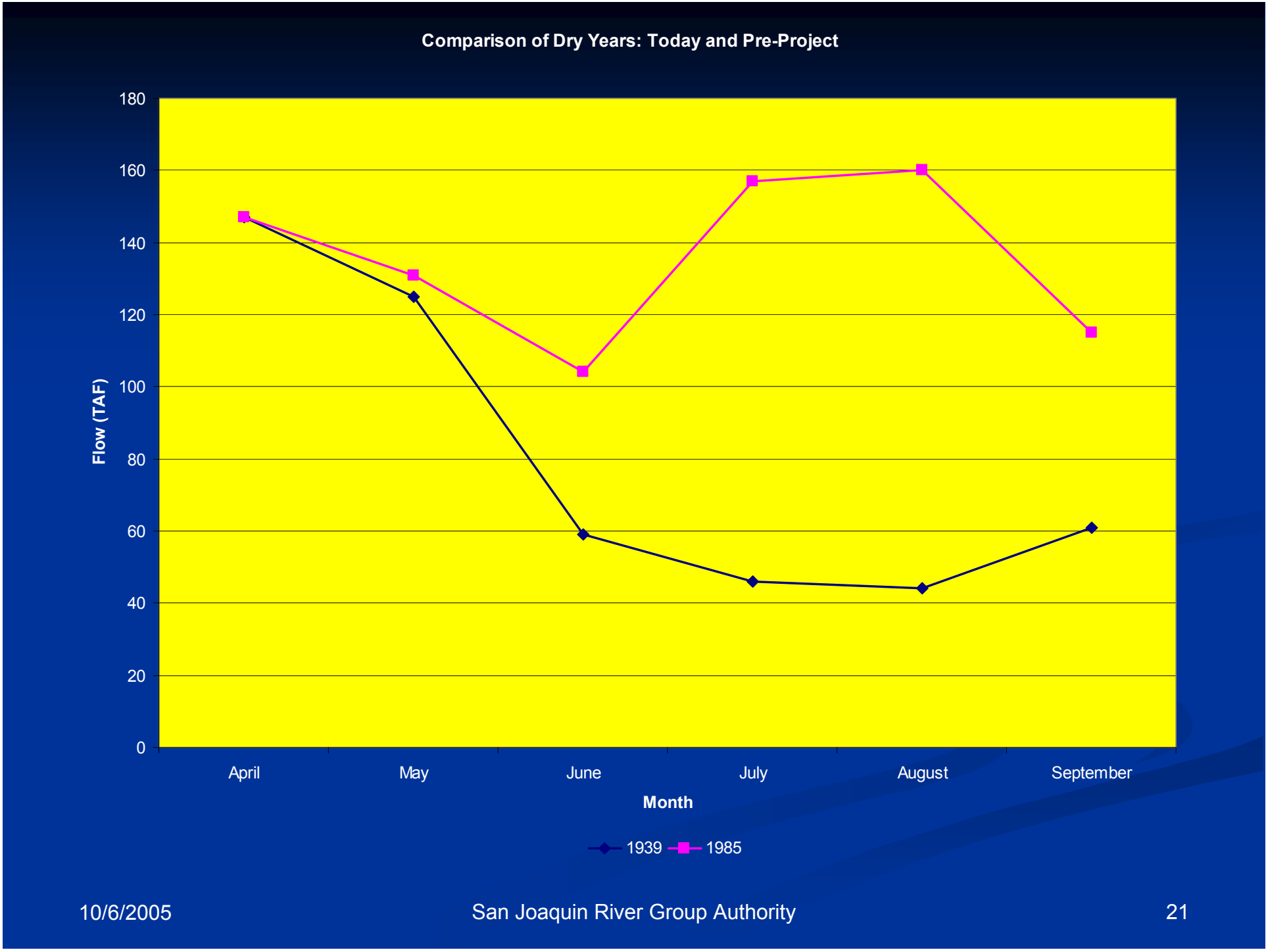
"Almost all of this reduction in annual watershed discharge occurred during the months of April through August."

(DO TMDL, p32.)

Comparison of Wet Years: Today and Pre-Project




Comparison of Wet Years: Today and Pre-Project
2,500
2,000
1,500
1,000
500
0
Flow (TAF)
April
May
June
July
August
September
Month
1938
1995


Comparison of Dry Years: Today and Pre-Project
180
160
140
120
100
80
60
40
20
0
Flow (TAF)
April
May
June
July
August
September
Month
1939
1985

"Another study found the San Joaquin River flows at Vernalis reduced by 44-56 percent from pre-1944 levels between the months of April through September."

(DO TMDL, p32.)

EFFECTS OF THE CVP UPON THE SOUTHERN DELTA WATER SUPPLY SACRAMENTO-SAN JOAQUIN RIVER DELTA, CALIFORNIA (USBR, JUNE, 1980)

Table V-21

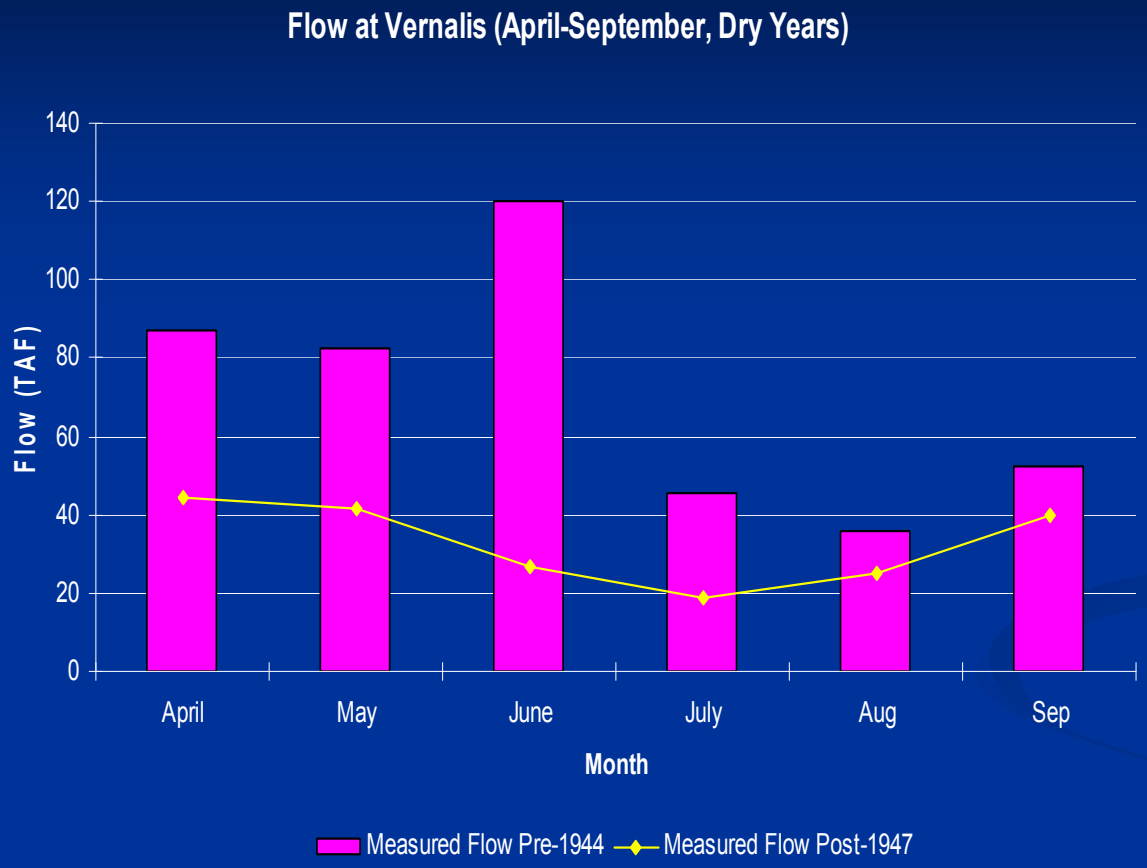
SUMMARY OF RUNOFF REDUCTIONS OF SAN JOAQUIN RIVER AT VERNALIS FROM PRE-CVP TO POST-CVP

Year Type and Period	Effect of All Post Post-CVP Upstream Development on Runoff at Vernalis		Effect of CVP on Runoff at Vernalis		
	Reduction in Runoff (TAF)[1]	Post-1947 Reduction as Percent of Pre-1944 Actual Runoff	Reduction in Runoff (TAF)	Reduction at Vernalis as Percent of Pre-1944 Flow	Reduction at Vernalis as Percent of Post-1947 Flow
DRY					
April-Sept	206-417	49-67[2]	6-7	1.4-1.6	3.0-3.6
Full Year	294-519	24-44	93-138	8-12	10-14
BELOW NORMAL					
April-Sept	1064-1177	60-68[2]	306-428	22-24[2]	55-61
Full Year	1219	44[2]	543	-20[2]	35
ABOVE NORMAL					
April-Sept	1406-1732	47-57	440-704	14-23	40-64
Full Year	1400-1721	28-34	768-1076	15-21	25-36
WET					
April-Sept	1002-1760	19-32	554-965	10-18	15-26
Full Year	1168-2916	13-32	771-2014	9-22	12-31
AVERAGE OF ALL YEARS[3]					
April-Sept	920-1272	44-56	347-526	12-17	28-39
Full Year	1020-1594	28-39	544-943	13-19	21-29

[1] Range of estimates by all methods of analysis. See Tables V-2 through V-17.
[2] Pre-CVP "actual" is assumed to be post-1947 actual plus pre-1944 to post-1947 loss.
[3] Assumes that each year class occupies one-quarter of period.

	April	May	June	July	August	September
1944 Actual	137	235	201	77	67	71
1944 Unimpaired	509	144	820	314	61	20
Total	-372	91	-619	-237	+6	+51

	April	May	June	July	August	September
1933 Actual	68	85	316	68	41	68
1933 Unimpaired	538	788	1227	247	54	27
Total	-470	-703	-911	-179	-13	+41



1980 Report Methodology

Annual Dry-Year Reduction

162 TAF

April-September Dry-year Reduction

35 TAF/Mo 213 TAF

July-October Dry-year Reduction

9 TAF/Mo 56 TAF

Pre-44 Years: 1930, 31, 33, 34, 39

Post-47 Years: 1959, 60, 61, 64, 68

"A final scenario was examined in which conditions at Vernalis were restored to natural flow, i.e., flow that would have occurred without any diversion, storage, or water transfers upstream of Vernalis. As illustrated by the seasonal distributions for the simulation period, October 1983 through April 2003, flow management typically causes a decrease in flow during March-July and an increase during September-October. With the barrier at the head of Old River in place, i.e., net discharge into the Ship Channel set equal to discharge at Vernalis, the restoration of full natural flow offers little additional benefit for dissolved oxygen conditions. Although the frequency of intermediate-sized deficits decreases, the frequency of small deficits actually increases. The proportion of months completely free of deficits changes a negligible amount."

("Low Dissolved Oxygen in an Estuarine Channel (SJR: California) Mechanisms and Model Based on Long-Term Time Series", p24.)

"Ironically, change in upstream storage-and-release pattern from years before construction of the Central Valley Project appear to be approximately neutral with respect to hypoxic conditions. Discharge at Vernalis is generally lower than unimpaired runoff, or full natural flow, in the San Joaquin River during spring and early summer, and higher during late summer and autumn."

(Id.)

"It may seem that management of river discharge offers an effective tool, immediately at hand, for addressing the hypoxia problem, one that could produce effects with only weak management conditions."

(Id.)

"It dilutes non-point pollution, i.e., loading."

(Id., p30.)

"Move water through the channel, i.e., causing less residence time." (Id.)

UNIMPAIRED RUNOFF AT VERNALIS (cfs, sorted by Year Type) - DWR

YEAR	JUL	AUG	SEP	OCT	Year Type
1983	34,976	11,886	4,387	6,927	W
1969	19,187	4,146	1,210	618	W
1995	33,897	8,339	2,084	1,208	W
1938	16,764	4,000	1,479	455	W
1998	31,557	5,462	2,796	686	W
1982	15,496	4,748	5,815	1,041	W
1967	26,276	5,106	1,950	455	W
1952	15,057	3,561	1,143	569	W
1958	11,854	3,577	1,261	732	W
1980	17,398	3,724	1,412	1,203	W
1978	16,992	4,488	5,092	146	W
1922	10,602	2,098	739	390	W
1956	12,455	2,780	1,092	260	W
1942	12,455	2,179	588	764	W
1941	12,569	2,537	723	504	W
1986	7,772	2,260	1,361	1,106	W
1993	11,707	3,106	1,395	504	W
1997	3,874	1,909	899	560	W
1996	6,659	1,641	620	936	W
1943	7,187	1,724	487	472	W
1937	5,496	1,138	353	423	W
1974	6,374	2,016	706	911	W
1975	7,398	1,642	992	748	W
1965	11,252	4,927	1,328	455	W

YEAR	JUL	AUG	SEP	OCT	Year Type
1936	6,114	1,333	370	602	AN
1984	5,610	1,756	739	4,276	AN
1979	4,098	1,382	639	1,268	AN
1945	8,797	1,951	622	488	AN
1999	4,855	1,553	1,065	1,419	AN
1963	9,431	2,114	941	878	AN
1927	7,480	1,577	639	293	AN
1935	5,707	1,480	487	537	AN
1923	8,049	1,659	1,160	585	AN
1973	4,000	1,350	504	797	AN
1932	9,203	1,854	605	195	AN
2000	3,436	1,491	844	603	AN
1940	3,366	748	218	1,870	AN
1946	3,951	992	454	2,634	AN
1970	4,309	1,285	538	1,837	AN
1951	3,837	894	286	911	AN
1962	6,976	1,350	471	309	BN
1953	7,854	1,106	420	618	BN
1957	4,081	927	420	1,073	BN
1925	5,837	1,659	487	585	BN
1971	5,821	1,398	622	455	BN
1950	3,512	650	319	325	BN
2003	3,235	1,458	625	191	BN
1944	5,106	992	336	569	BN
1954	2,618	472	235	423	BN
1948	4,667	748	336	1,415	BN
1928	1,626	455	202	894	BN
1949	2,130	650	353	407	BN
1966	1,545	683	420	634	BN

YEAR	JUL	AUG	SEP	OCT	Year Type
1933	4,016	878	454	488	D
1981	1,561	748	555	894	D
1985	1,545	699	756	1,268	D
2002	1,779	484	289	340	D
1926	1,285	358	218	829	D
1955	2,878	618	218	276	D
1959	1,333	358	2,017	650	D
1968	1,398	699	387	878	D
2004	1,950	637	319	304	D
1939	1,350	569	689	2,016	D
2001	1,233	339	300	914	D
1964	2,228	748	403	1,008	D
1947	1,447	358	286	1,203	D
1972	1,724	488	1,176	407	D
1994	1,377	795	484	934	C
1930	2,520	569	269	179	C
1929	2,488	488	134	211	C
1989	1,756	553	605	341	C
1991	3,756	862	471	228	C
1987	976	553	286	1,024	C
1960	1,252	390	235	569	C
1976	1,008	959	1,042	2,862	C
1992	2,667	715	353	732	C
1990	1,821	407	185	1,772	C
1988	1,707	683	319	569	C
1934	911	358	303	195	C
1924	618	179	118	1,350	C
1961	927	732	319	244	C
1931	585	244	151	504	C
1977	650	260	168	634	C

MEASURED FLOW AT VERNALIS – USGS (TAF, sorted by Year Type)

YEAR	JUL	AUG	SEP	OCT	Type
1983	19,224	9,033	11,311	8,178	W
1969	5,802	2,324	3,255	1,384	W
1995	9,879	3,924	4,735	1,369	W
1938	14,607	3,359	2,225	1,898	W
1998	13,190	5,441	5,758	2,705	W
1982	6,162	4,016	6,130	1,386	W
1967	10,448	2,020	2,029	1,101	W
1952	3,497	1,355	1,620	1,784	W
1958	4,091	1,535	2,243	2,055	W
1980	3,383	1,969	3,802	2,790	W
1978	1,907	1,418	2,731	246	W
1956	3,482	1,902	1,885	799	W
1942	7,775	1,684	1,916	2,198	W
1941	9,141	2,094	1,686	1,603	W
1986	2,893	3,183	4,181	2,072	W
1993	1,509	1,998	2,771	849	W
1997	1,756	1,875	2,069	2,690	W
1996	2,209	2,033	2,164	5,691	W
1943	2,208	1,542	1,689	2,236	W
1937	3,260	1,129	1,396	1,889	W
1974	1,636	1,615	2,846	2,546	W
1975	1,718	1,680	2,653	3,496	W
1965	1,973	1,220	1,678	1,411	W

YEAR	JUL	AUG	SEP	OCT	Type
1936	3,047	1,121	1,281	2,033	AN
1984	1,904	2,179	2,918	13,314	AN
1979	1,333	1,451	1,841	3,327	AN
1945	3,880	1,779	2,031	1,648	AN
1999	2,094	1,969	2,037	6,152	AN
1963	1,821	1,095	1,515	1,453	AN
1935	2,698	994	1,350	849	AN
1973	1,082	1,067	1,471	1,991	AN
1932	5,792	1,164	1,067	477	AN
2000	1,898	2,171	2,330	2,531	AN
1940	1,994	1,186	1,688	1,484	AN
1946	1,465	1,224	1,483	2,758	AN
1970	1,330	1,044	1,319	4,461	AN
1951	870	759	1,035	1,324	AN
1962	856	694	993	410	BN
1953	1,604	747	1,093	1,865	BN
1957	875	753	1,149	1,998	BN
1971	1,066	892	1,097	1,466	BN
1950	687	621	946	1,267	BN
2003	1,481	1,431	1,383	1,563	BN
1944	1,245	1,091	1,199	2,108	BN
1954	542	546	754	1,629	BN
1948	1,328	725	1,088	1,314	BN
1949	562	602	715	1,548	BN
1966	440	500	725	2,944	BN

YEAR	JUL	AUG	SEP	OCT	Type
1933	1,113	666	1,150	1,671	D
1981	1,265	1,269	1,181	4,071	D
1985	2,557	2,600	1,925	3,813	D
2002	1,273	1,150	1,161	1,886	D
1955	416	431	610	1,042	D
1959	312	402	786	2,835	D
1968	503	768	938	2,725	D
2004	1,146	1,136	1,125	1,927	D
1939	756	715	1,034	2,665	D
2001	1,401	1,338	1,374	2,806	D
1964	383	440	900	2,677	D
1947	527	569	1,074	1,814	D
1972	481	543	1,563	2,252	D
1994	1,135	867	869	3,040	C
1930	1,237	919	1,433	1,407	C
1989	1,284	1,169	1,353	1,126	C
1991	594	537	574	993	C
1987	1,632	1,626	1,597	3,741	C
1960	222	267	385	876	C
1976	671	1,055	1,067	4,542	C
1992	447	483	635	788	C
1990	1,010	1,033	876	1,402	C
1988	1,357	1,557	1,452	1,369	C
1934	395	383	501	1,533	C
1924	420	420	417	2,591	C
1961	104	151	321	712	C
1931	233	228	320	1,668	C
1977	93	124	179	1,273	C