

Testimony by City of Antioch

For SWRCB Delta Flow Criteria
Informational Proceeding

Submitted February 16, 2010

For hearings beginning March 22, 2010

Overview

- Antioch has taken fresh drinking water from the Delta since the 1860s
- Infrastructure and flow diversions have changed distribution and timing of freshwater flows
- Historic conditions were far fresher than current conditions
- Quality of water at Antioch has declined markedly

Why Is This Important ?

- Characterizations of the Delta as “historically saline” are false
- Native species are adapted to historical conditions, so historic salinity and flow patterns must be considered in establishing appropriate flow and salinity standards

What Should Happen ?

- SWRCB should review and incorporate historic salinity data into its analyses
- SWRCB should use historic data to establish an historic baseline of water quality and flows for both fisheries and drinking water quality standards

What Should Happen ?

- SWRCB should ensure that flows are not reduced, nor salinity increased, beyond levels assured by D-1641 and current X2 requirements
- In fact, the City of Antioch asks the SWRCB to establish flow and salinity standards in line with the Delta's historic fresh condition
- SWRCB should state that characterizations of the Delta as "historically saline" are false
- SWRCB should consider using Antioch's gauging station as a 'point of interest' to gauge flow and salinity conditions

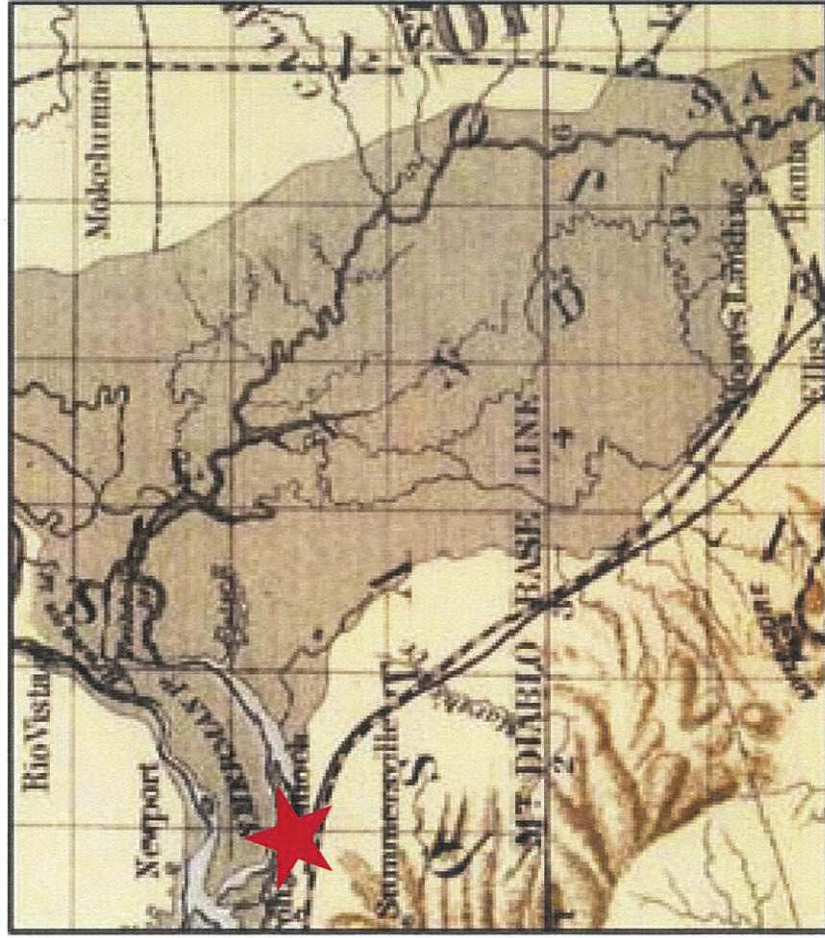
Systemic Changes Have Influenced Flows and Salinity

Factors Influencing Salinity

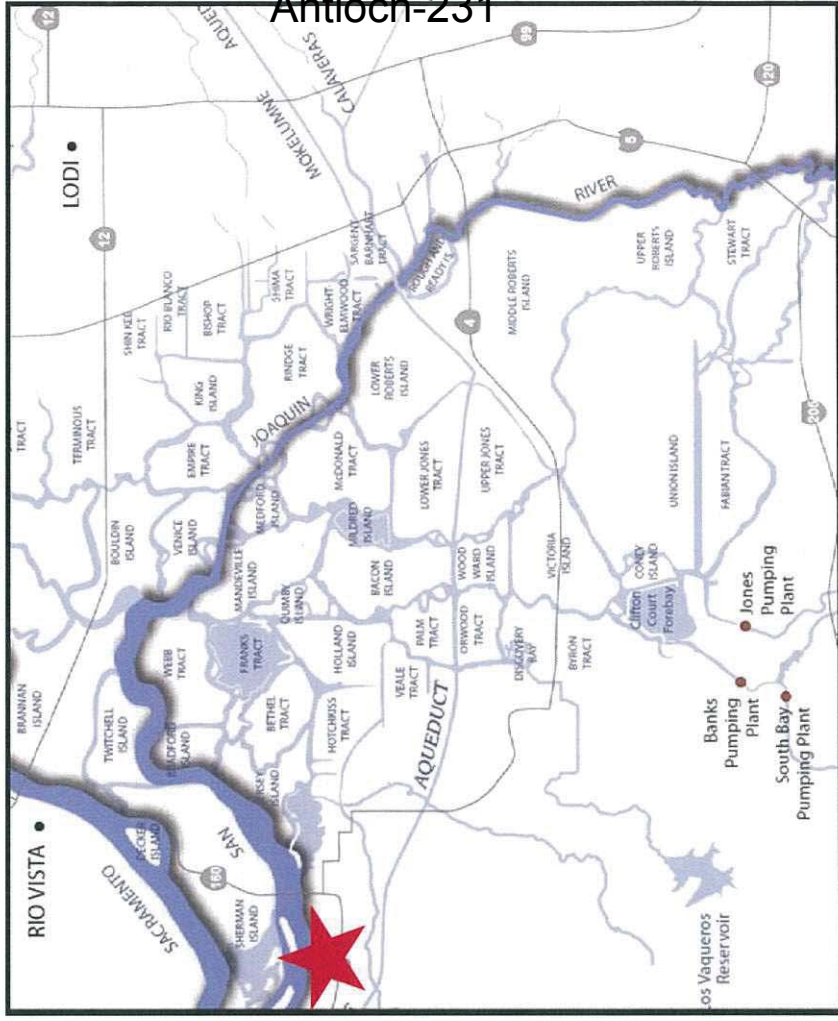
- Hydrology
- Changes to the Delta landscape
- Water Management
 - Exports
 - Diversions
 - Reservoir Storage

The Delta Landscape is Dramatically Different

1873



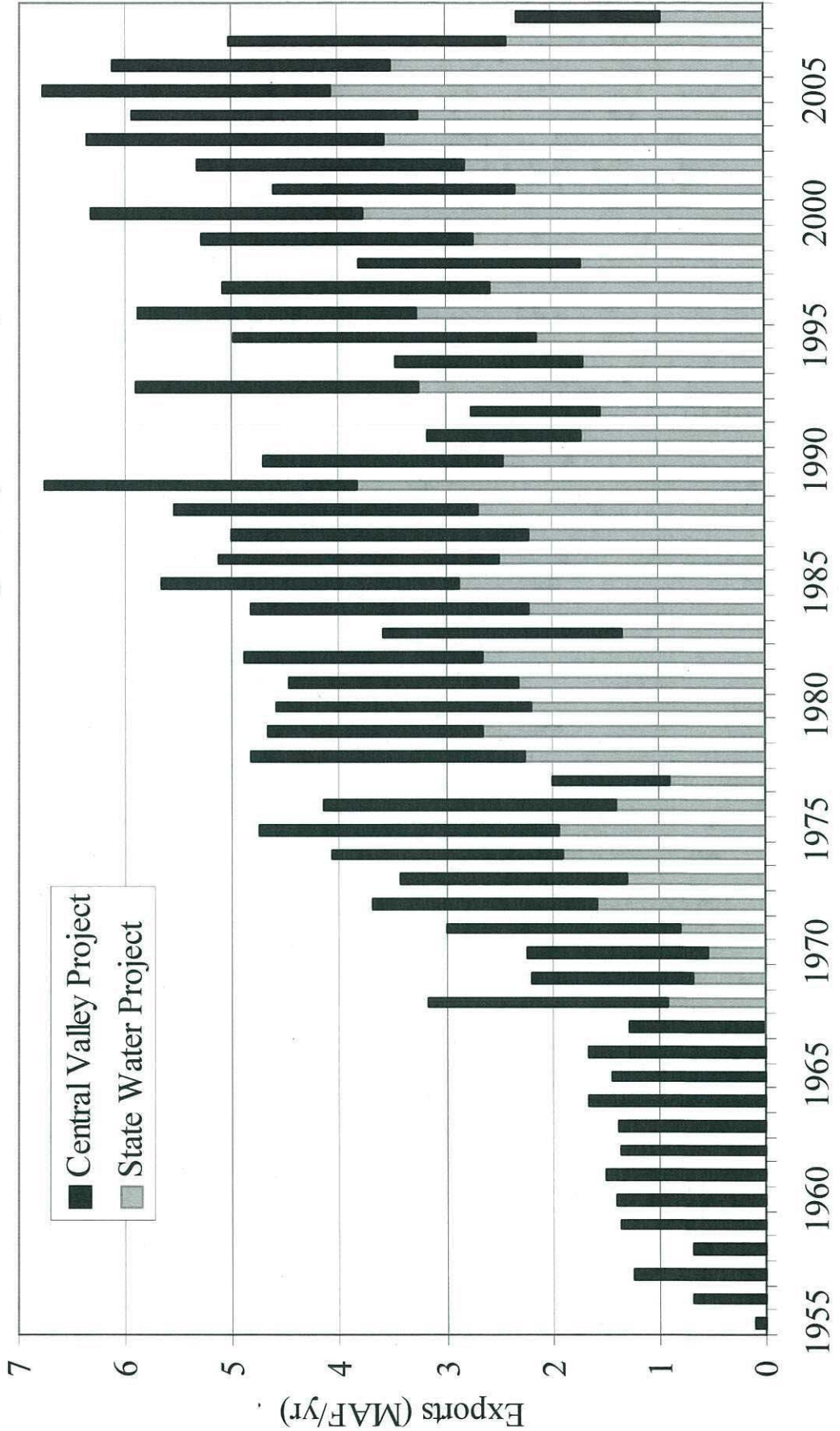
2010



★ Approximate location of City of Antioch's water intake

Water Exports Have Increased and Remove Fresh Water from Delta

State and Federal Annual Delta Exports (1955-2008)



Pre-1918, Fresh Water was Available in Western Delta Nearly Year-round

| Location | Quotation |
|----------------------------------|--|
| Antioch, CA | <p><i>“From early days, Antioch has obtained all or most of its domestic and municipal water supply from the San Joaquin River immediately offshore from the city... However, conditions were fairly satisfactory in this respect until 1917, when the increased degree and duration of saline invasion began to result in the water becoming too brackish for domestic use during considerable periods in the summer and fall.” (DPW, 1931, pg. 60)</i></p> |
| Western Delta | <p><i>“The dry years of 1917 to 1919, combined with increased upstream irrigation diversions, especially for rice culture in the Sacramento Valley, had already given rise to invasions of salinity into the upper bay and lower delta channels of greater extent and magnitude than had ever been known before.” (DPW, 1931, pg. 22)</i></p> <p><i>“It is particularly important to note that the period 1917-1929 has been one of unusual dryness and subnormal stream flow and that this condition has been a most important contributing factor to the abnormal extent of saline invasion which has occurred during this same time.” (DPW, 1931, pg. 66)</i></p> |
| Carquinez Strait (Western Delta) | <p><i>“Under natural conditions, Carquinez Straits marked, approximately, the boundary between salt and fresh water in the upper San Francisco Bay and delta region...” (Means, 1928, pg. 9)</i></p> <p><i>“For short intervals in late summer of years of minimum flow, salt water penetrated at lower river and delta region, and in wet seasons the upper bay was fresh, part of the time, to the Golden Gate.” (Means, 1928, pg. 9 & pg. 57)</i></p> |

DPW (1931). Bulletin No. 27. State of California, Department of Public Works. See <http://www.archive.org/details/variationcontrol27calirch>
 Means, T. (1928). Salt Water Problem: San Francisco Bay and Delta of Sacramento and San Joaquin Rivers, San Francisco, California, April 1928. A report prepared for the Association of Industrial Water Users of Contra Costa and Solano Counties.

Pre-1918, Fresh Water was Available in Western Delta Nearly Year-round

| Location | Quotation |
|-----------------------------|---|
| Benicia, CA (Suisun Bay) | <p><i>“In 1889, an artificial lake was constructed. This reservoir, filled with fresh water from Suisun Bay during the spring runoff of the Sierra snow melt water ...”</i> (Dillon, 1980, pg. 131)</p> <p><i>“...in 1889, construction began on an artificial lake for the [Benicia] arsenal which would serve throughout its remaining history as a reservoir, being filled with fresh water pumped from Suisun Bay during spring runoffs of the Sacramento and San Joaquin Rivers which emptied into the bay a short distance north of the installation.”</i> (Cowell, 1963, pg. 31)</p> |
| Pittsburg, CA | <p><i>“From 1880 to 1920, Pittsburg (formerly Black Diamond) obtained all or most of its domestic and municipal water supply from New York Slough [near Pittsburg at the confluence of the Sacramento and San Joaquin Rivers] offshore.”</i> (DPW, 1931, pg. 60)</p> <p><i>“There was an inexhaustible supply of river water available in the New York Slough [near Pittsburg at the confluence of the Sacramento and San Joaquin Rivers], but in the summer of 1924 this river water showed a startling rise in salinity to 1,400 ppm of chlorine, the first time in many years that it had grown very brackish during the dry summer months.”</i> (Tolman and Poland, 1935, pg. 27)</p> |

Cowell, J. W. 1963. History of Benicia Arsenal: Benicia, California: January 1851 – December 1962. Berkeley, Howell-North Books

Dillon, R. 1980. Great Expectations: The Story of Benicia, California, Fresno, California. 241 pp.

Tolman, C. F. and J. F. Poland. 1935. Investigation of the Ground-Water Supply of the Columbia Steel Company Pittsburg, California. Stanford University, California, May 30, 1935

Testimony from Antioch Lawsuit: Pre-1918, Fresh Water was Available at Antioch Year-round

- Antioch lawsuit in 1920: Town of Antioch [Plaintiff] v. Williams Irrigation District et al. [Defendants] (1922, 188 Cal. 451)
- Plaintiff alleged that the upstream diversions were causing increased salinity intrusion at Antioch
- Testimony from defendants in the Antioch lawsuit (from the supporting Supreme Court record on file at the State Archives) (CCWD, 2010)
 - In the late 1800s, water at Antioch was known to be brackish at high tide during certain time periods.
 - Antioch was able to pump fresh water at low tide throughout the year, with the possible exception of the fall season during one or two dry years.
 - Water at Antioch was apparently fresh at low tide at least until around 1915 (when the pumping plants started pumping continuously, regardless of tidal stage).

Testimony from Antioch Lawsuit: Pre-1918, Fresh Water was Available at Antioch in Fall

Testimony from plaintiff in the Antioch lawsuit (from the supporting Supreme Court record on file at the State Archives)

- Antioch’s freshwater supply was obtained directly from the western Delta from about 1866 to 1918 (pg. 47-48).
- Prior to 1918, freshwater was available at Antioch even during dry years and in the fall (pg. 23-24).

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| Date | Location | Salinity (ppm) |
|--|-----------------|-----------------------|
| 1913 (Sept; a dry year) | Antioch | 66 |
| 1916 (Aug. 5 th ; wet year) | Antioch | 22.3 |
| 1916 (Aug. 9 th ; wet year) | Antioch | 12.3 |
| 1916 (Sept. 19 th ; wet year) | Antioch | 101.3 |
| 1917 (Sept. 14 th ; wet year) | Antioch | 141.6 |

Testimony from Antioch Lawsuit: Post-1918, Upstream Diversions Drastically Increased Salinity Intrusion

Testimony from plaintiff in the Antioch lawsuit (continued)

- After 1918, salinity abruptly increased during irrigation (rice cultivation) season, and returned to a potable level after irrigation ceased (pg. 18-20)

| Date | Location | Salinity (ppm) |
|---|---------------|----------------|
| 1918 (Sept. 25 th ; dry year) | Antioch | 1360 |
| 1920 (mid-July; critical year) | Pittsburg, CA | 4500 |
| 1920 (end-July; critical year) | Pittsburg, CA | 6000 |
| 1920 (mid-Aug.; critical year) | Pittsburg, CA | 9500 |
| 1920 (end-Sept.; critical year) | Pittsburg, CA | 2500 |
| 1920 (during rice irrigation; critical year) | Antioch | 12,500 |
| 1920 (end-Oct, after irrigation; critical year) | Pittsburg, CA | fresh |

Measurements at Pittsburg, CA, are from the Great Western Electro Chemical Co.

- Information on the effect of upstream diversions is also confirmed by records in the plaintiff's testimony from C&H Sugar (see CCWD 2010).

Testimony from Antioch Lawsuit: Water at Antioch is from Sacramento River

• Testimony from plaintiff in the Antioch lawsuit (continued)

• Plaintiff testimony asserted that in 1920 “the amount of water which the San Joaquin carried was dependent entirely upon the amount of water in the Sacramento,” and that “the San Joaquin itself carried practically no water at all. In other words, **it was demonstrated that the amount of fresh water which came into the San Joaquin and down as far as the Town of Antioch was practically all Sacramento River water.**” (pg. 15)

• Water was delivered to the San Joaquin River from the Sacramento River via two main conduits: Georgiana Slough and Three Mile Slough. 1920 flow rates in these sloughs were the basis of the assertion quoted above.

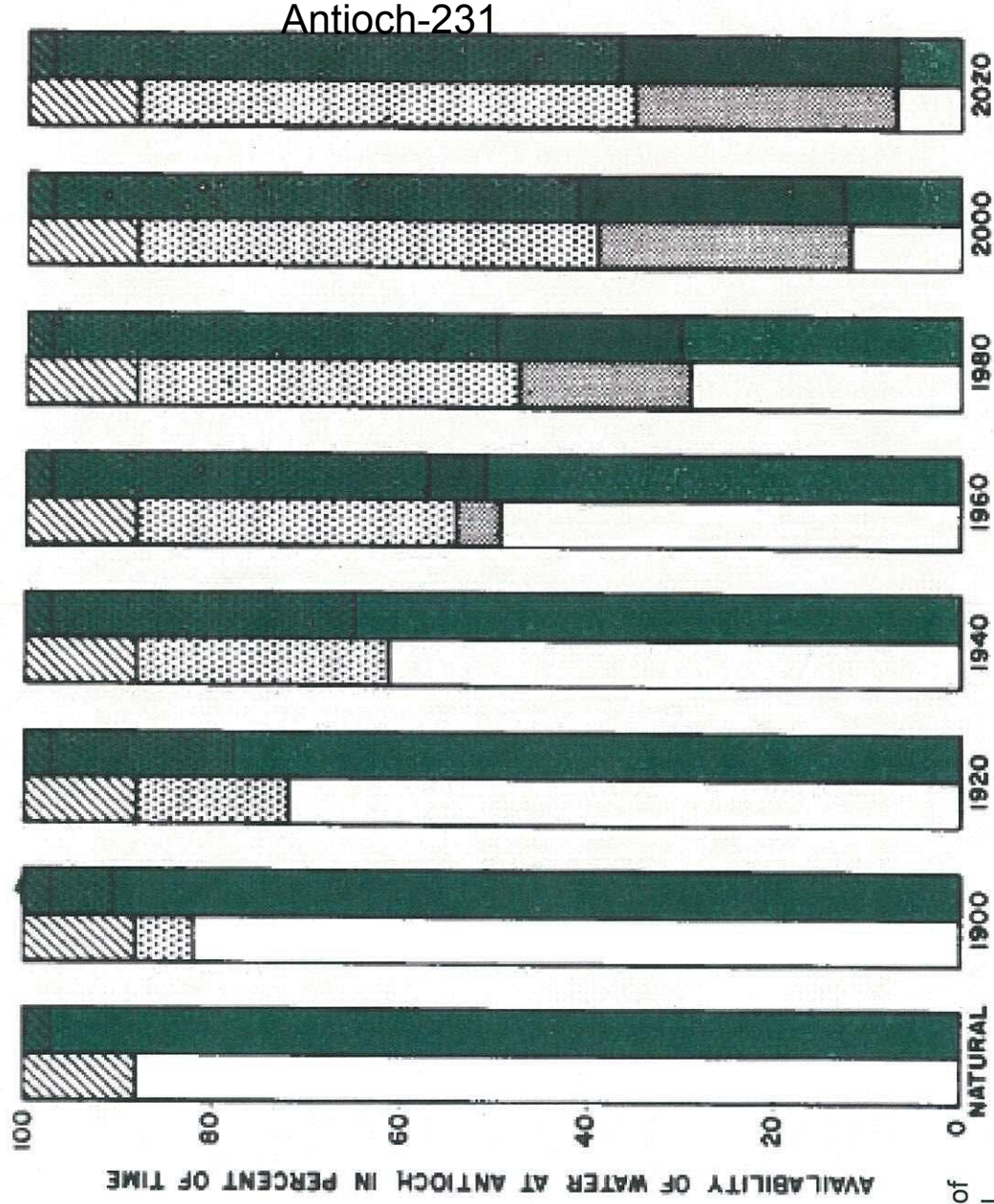
Testimony from Antioch Lawsuit: Water at Antioch is from Sacramento River

- “It is necessary here to state some additional facts to explain how this pollution comes about and why **diversions from the Sacramento River may or do affect the volume and quality of the water flowing down the San Joaquin River** . . . From the Sacramento River at two points, one about eight [Three Mile] and the other about twenty - three miles [Georgiana] above its mouth, sloughs diverge, into which parts of its waters escape and flow through the said sloughs and into the San Joaquin River at points several miles above the place of the diversion by the city of Antioch.” Town of Antioch v. Williams Irrigation District et al. (1922) 188 Cal. 451, 455

Freshwater Availability has Declined

DWR (1960, pg. 13) found that freshwater was available at San Joaquin River at Antioch:

- 85% of the time under “natural” conditions
- 80% of the time in 1900
- 60% of the time by 1940
- 50% of the time by 1960

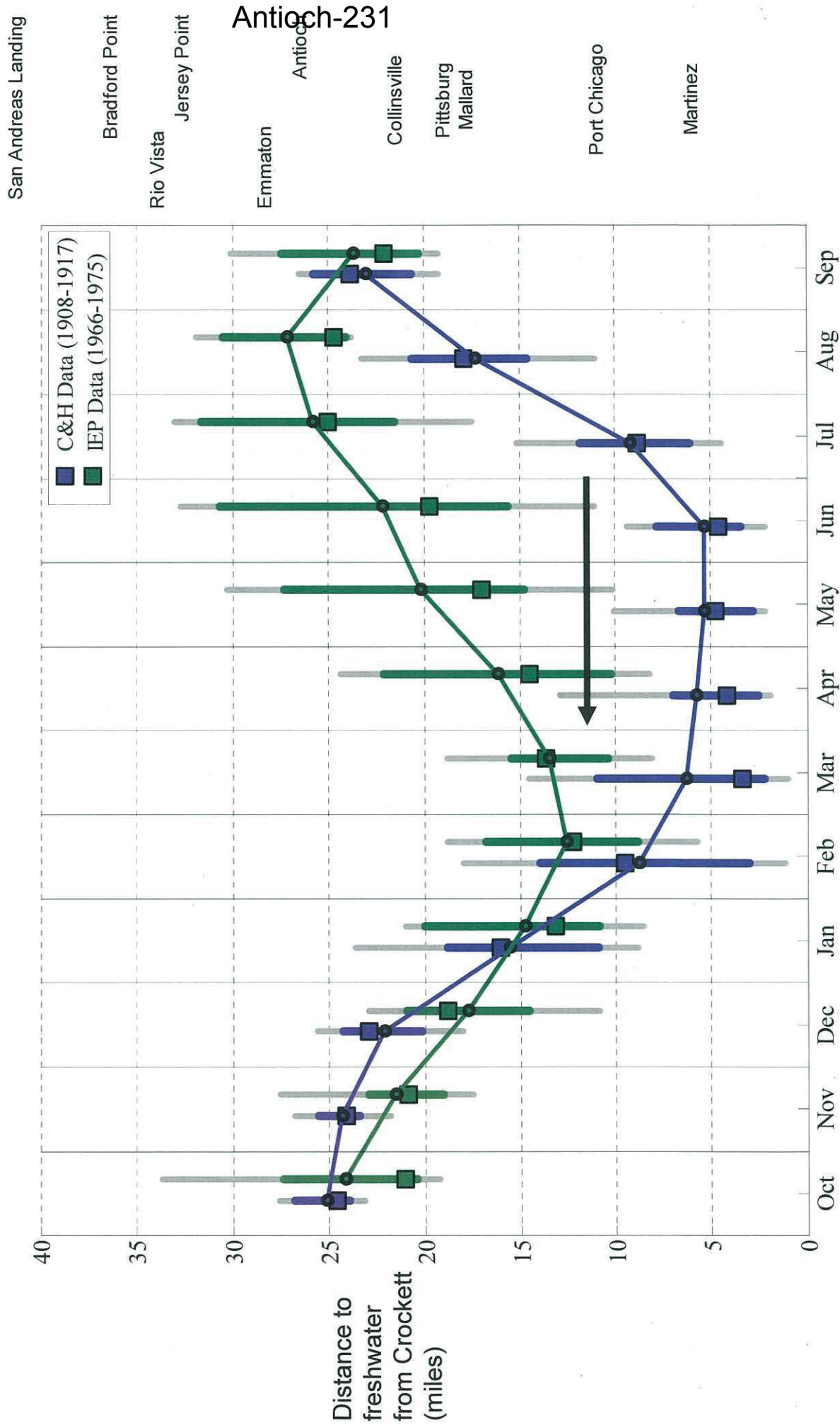


Note:- report did not include effects of reservoir releases for salinity control

DELTA WATER QUALITY WITHOUT SALINITY CONTROL

Salinity Intrusion Occurred Earlier by 1975

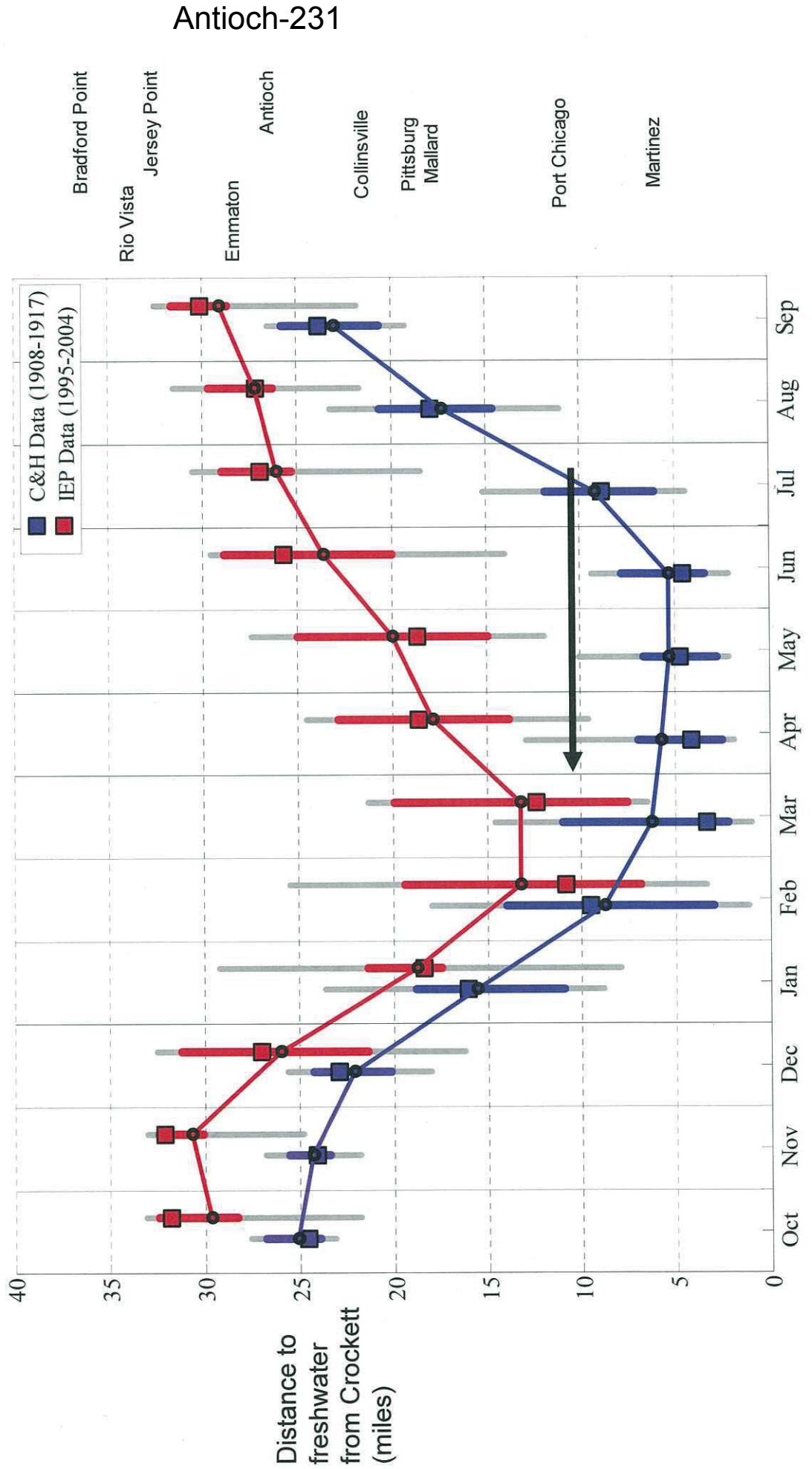
Distance to freshwater from Crockett (~25 miles west of Antioch)
C&H observations (1908-1917) vs. IEP data (1966-1975)



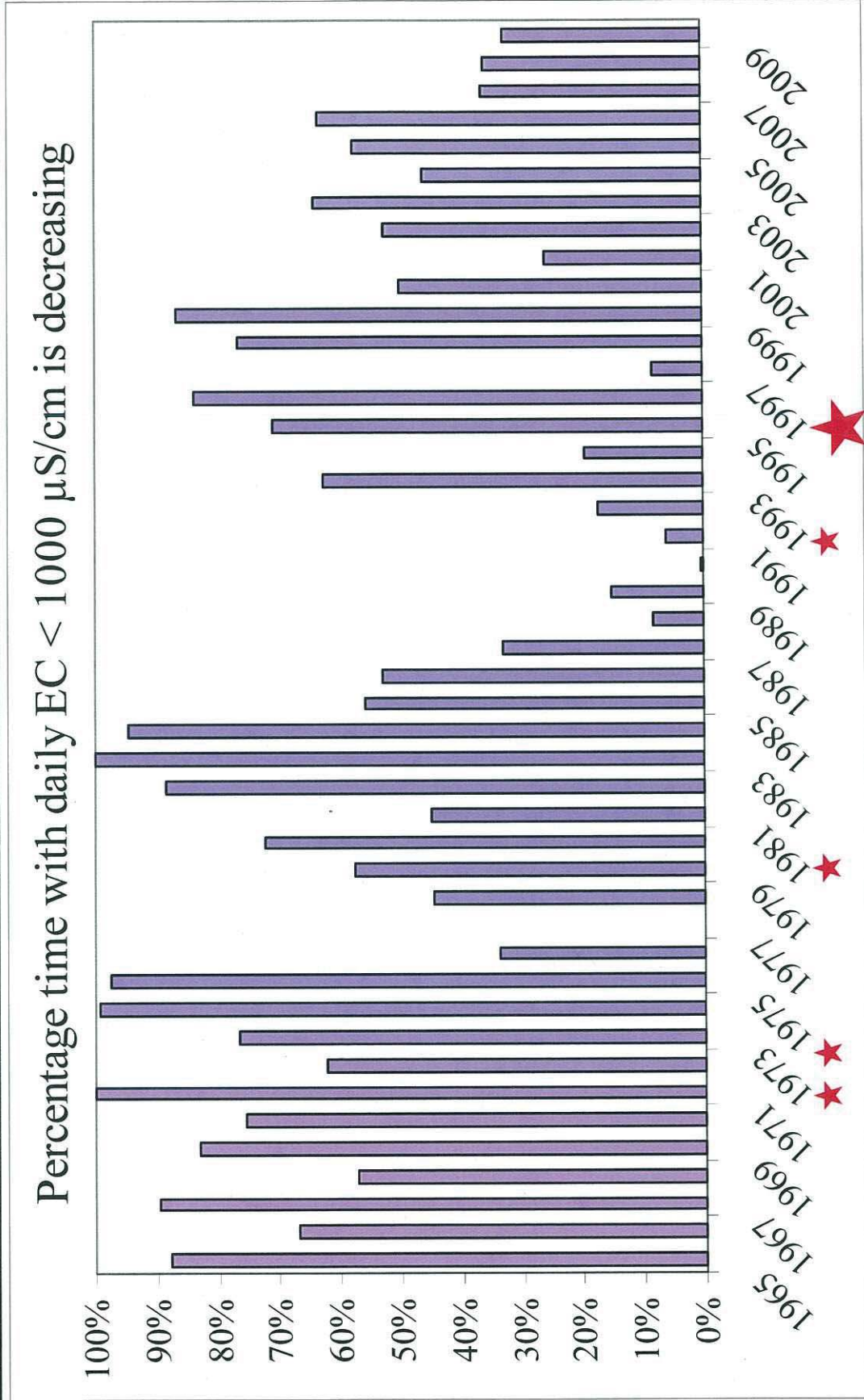
Salinity Intrusion Occurred Even Earlier and Extended Farther by 2004

Distance to freshwater from Crockett (~25 miles west of Antioch)
C&H observations (1908-1917) vs. IEP data (1995-2004)

San Andreas Landing



Freshwater Availability at Antioch Continues to Decline



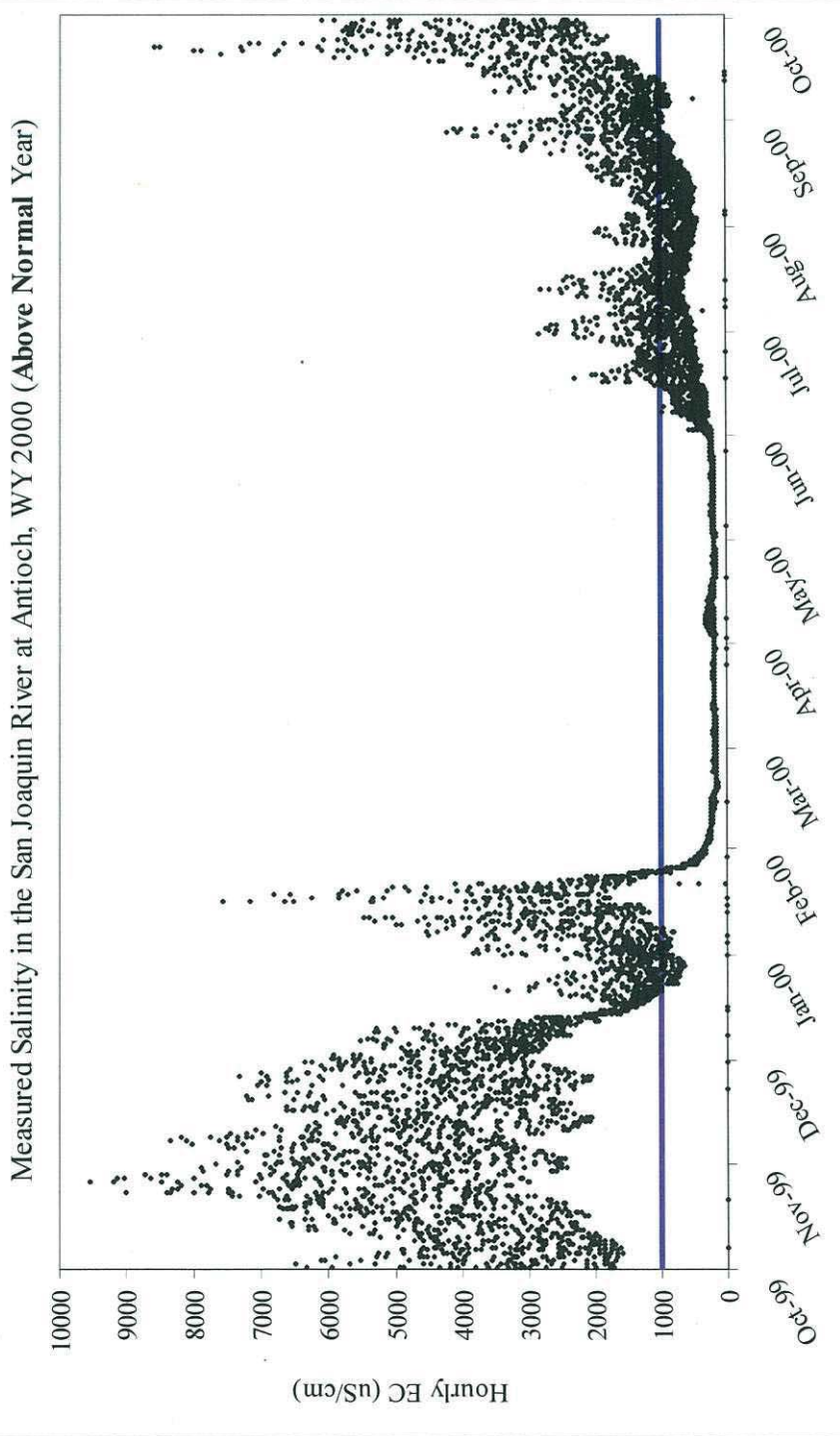
Data from IEP & CDEC

★ 10%-20% data missing

★ 80% data missing

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Even in Above Normal Years, Freshwater is Now Unavailable in Summer/Fall

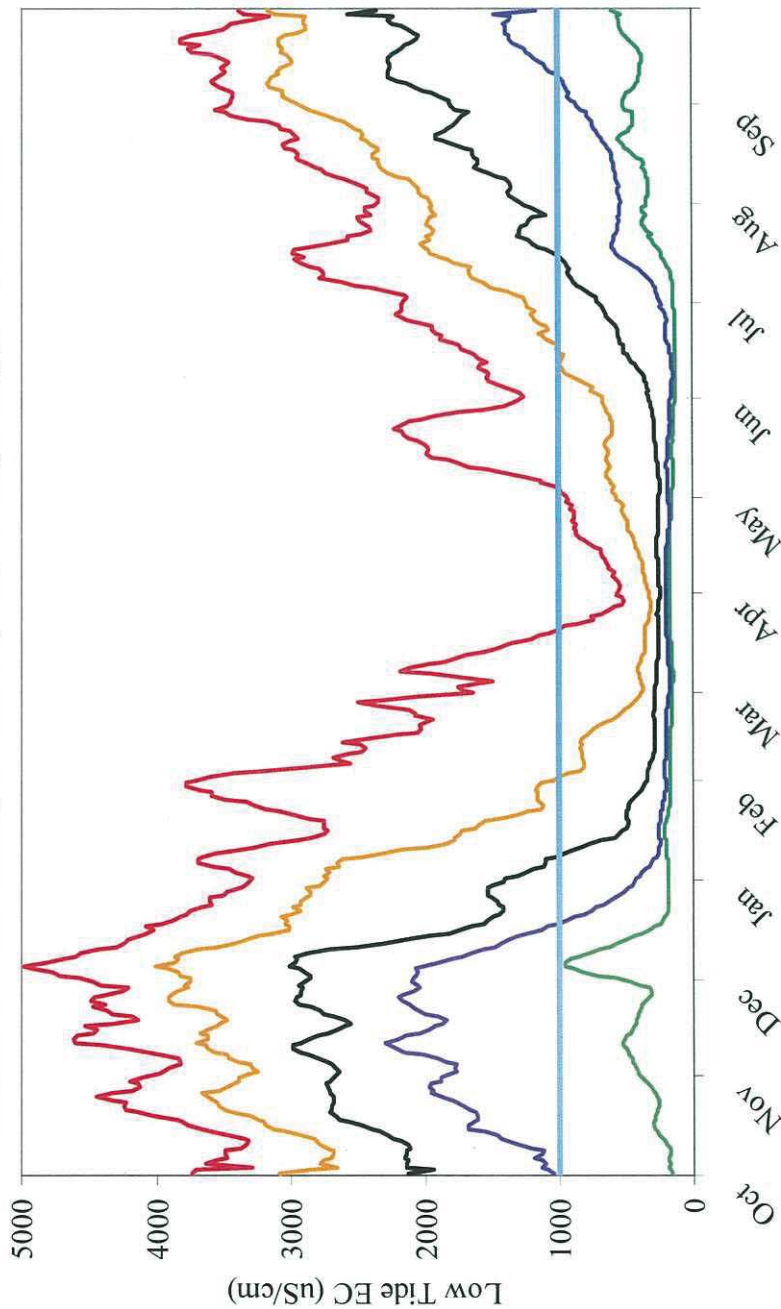


- < 1000 EC all day
- < 1000 EC low tide only
- > 1000 EC all day

Pre-1918, freshwater was available year-round

Freshwater is Now Available at Antioch Far Less Often

Measured Low Tide Salinity at Antioch (7-day running average), WY 1985-2009



Driest 10%

Driest 25%

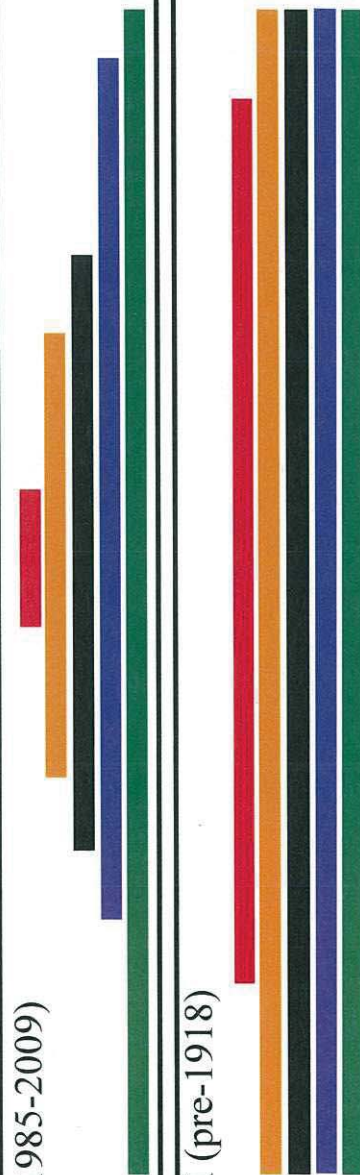
Median

Wettest 25%

Wettest 10%

Present (1985-2009)

Historical (pre-1918)



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Pre-1918, freshwater was available year-round at low tide in all but driest years

Summary: The Western Delta was Historically Fresher

- Pre-1918, freshwater was almost always available at least at low tide.
- Between 1918 and the late 1930s, drought conditions, upstream water diversions, and channelization increased the salinity of water at Antioch.
- By 1940 the drought receded, but salinity at Antioch remained elevated.
- Salinity continues to increase in recent years at Antioch.
- The fraction of time that water at Antioch is suitable for use (when salinity is < 250 mg/L chlorides or 1000 $\mu\text{S/cm EC}$) has declined significantly.
- “Historic” Delta was significantly fresher than the current Delta.

Conclusions

Consider historic fresh conditions to:

Establish Delta outflows and inflows to protect species adapted to these conditions.

Establish the criteria (volume, timing, quality) required by SB 7X 1.

Establish drinking water quality standards for the Delta.