Interior Delta Salinity Monitoring During Installation of the 2021 West False River Emergency Drought Barrier

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Introduction

- Installation of the West False River Emergency Drought Salinity Barrier (EDB) by the Department of Water Resources (DWR) was initiated on June 3, 2021 in accordance with the Governor's emergency drought proclamations issued on April 21 and May 10, 2021
- The 2021 EDB is a temporary rock fill barrier that has the primary goal of preventing salinity intrusion by seawater into the interior central and south Delta waterways, to maintain freshwater supplies for urban, agricultural, and beneficial environmental uses and allowing for the State Water Project and Central Valley Project to meet water quality objectives outlined in State Water Resources Control Board water quality control plans and Water Right Decision D-1641
- To meet EDB permit compliance, DWR, along with agency partners, are responsible for monitoring and reporting on water quality conditions in the Delta in response to the installation of the EDB

Study Area

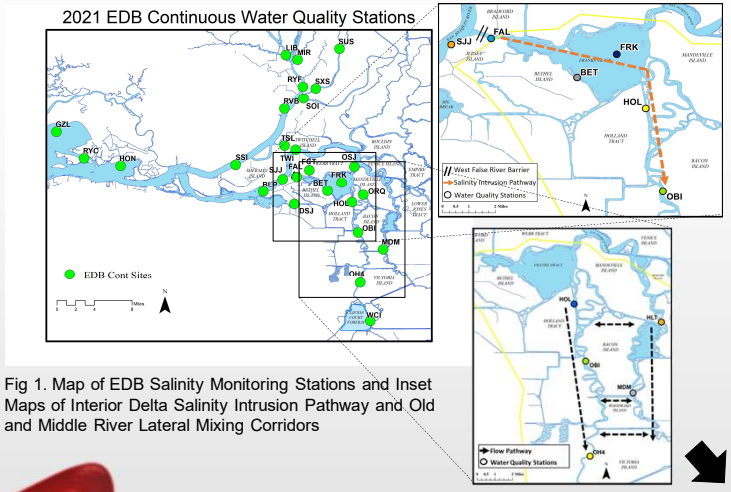

Fig 1. Map of EDB Salinity Monitoring Stations and Inset Maps of Interior Delta Salinity Intrusion Pathway and Old and Middle River Lateral Mixing Corridors

Methods

- DWR and U.S Geological Survey water quality monitoring stations deployed throughout the Delta (Fig 1.) collected continuous specific conductance data (a salinity surrogate measured in microSiemens per centimeter, abbreviated as µS/cm) in 15-minute intervals by deploying Xylem/YSI EXO2 sondes at a one-meter depth and transmitted the data via cellular telemetry
- Daily average specific conductance was calculated and plotted for each monitoring station along the Salinity Intrusion Pathway from April 2020 to December 2021 to compare salinity patterns between 2020, a Dry water year when no barrier was installed, and 2021, a Critical Dry water year when the EDB was installed for the first time since 2015
- Daily average specific conductance was also calculated and plotted for each monitoring station along the Old and Middle River Lateral Mixing Corridor from April 2020 to December 2021 to compare salinity patterns south of Frank's Tract during a barrier versus non-barrier period

Results

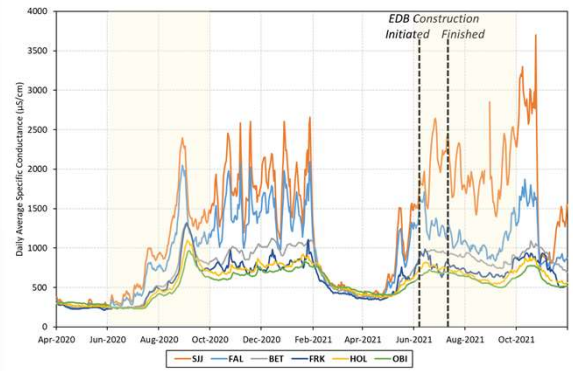

Fig 2. Daily Average Specific Conductance for Stations in the Interior Delta Region Along the Salinity Intrusion Pathway 2020 - 2021

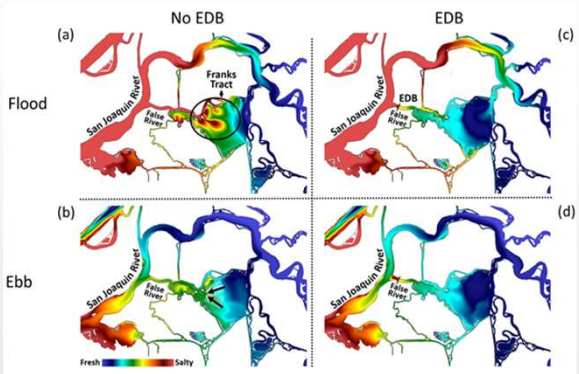

Fig 3. Illustration of Tidal Pumping at Frank's Tract Using Simulation Results from 2021

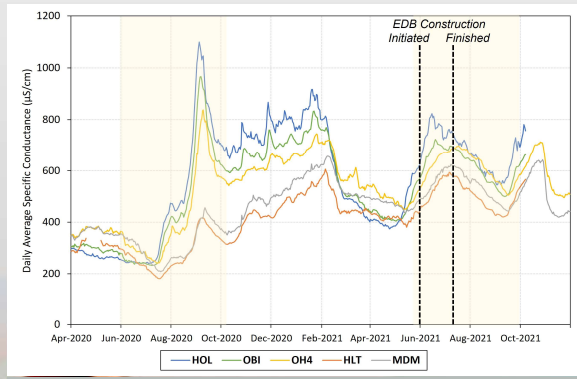

Fig 4. Daily Average Specific Conductance for Stations Along Old and Middle Rivers

Discussion

Salinity Intrusion Pathway

- In 2020, prior to the installation of the EDB, salinity patterns at the False River near Oakley (FAL) and San Joaquin River at Jersey Point (SJJ) monitoring stations tracked closely with one another with the salinity signal diminishing at each more-interior station (Fig 2.)
- As salinity reached 2,400 µS/cm at SJJ at the end of August 2020, FAL read 2,050 µS/cm (85% of the SJJ signal), and the more interior Holland Cut near Bethel Island (HOL) peaked at 1,100 µS/cm (45% of SJJ) several days later (Fig 2.)
- After completion of the EDB on June 22, 2021, salinity levels at interior Delta stations were greatly reduced relative to conditions to the west of the EDB; when SJJ reached 3,300 µS/cm in early October, FAL reached 1,800 µS/cm (55% of SJJ salinity) and HOL reached 870 µS/cm (25% of SJJ) (Fig 2.)
- In late October 2021, an extreme rainfall event occurred, adding over 5 inches of rain locally in a 24-hour period and leading to a precipitous drop in daily average specific conductance which helped to keep late-fall/early-winter salinity levels lower in the Delta (Fig 2.)

Tidal Pumping at Frank's Tract

- The mechanism driving most salinity dispersion into the interior Delta via False River and Frank's Tract is "tidal pumping"
- Higher salinity water moves east through False River during flood tide and mixes with lower salinity ambient water in Frank's Tract, while during ebb tide this mixed water moves west past False River and into the San Joaquin River (Fig 3.)
- However, asymmetry between the flood and ebb accumulates and causes an overall net transport of salt into the interior Delta[1], creating a tidal salinity pump
- The EDB (Fig 5.) blocks this tidal mechanism from moving through False River, redirecting the main tidal mixing pathway into the interior Delta to Old River via the San Joaquin River northeast of Frank's Tract where increased distance from the ocean and the greater influence of the Mokelumne River and Delta Cross Channel operations create a net freshening effect on the interior Delta via tidal action[1]

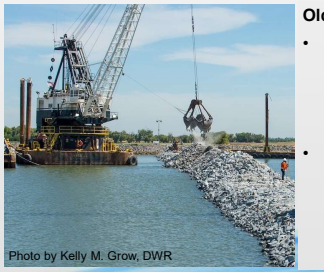

Fig 5. Emergency Drought Barrier

Old and Middle River Lateral Salinity Mixing

- Salinity levels between Old and Middle Rivers became more similar during the dry season in 2021 (while the EDB was present) than the same period in 2020 (Fig 4.)
- This effect was seen in 2015 as well[2] and suggests less influence of the fresher Middle River on Old River likely due to reduced cross-channel tidal mixing and/or lower water export flows in Old and Middle rivers as a result of the drought

Acknowledgements

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References

1. California Department of Water Resources (DWR). 2022. *Emergency Drought Barrer – Effectiveness Report*

2. California Department of Water Resources (DWR). 2019. *Efficacy Report – 2015 Emergency Drought Barrier Project*