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EMERGENCY DROUGHT BARRIER

Effectiveness Report

Prepared by
California Department of Water Resources

February 2022

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Acronyms and Other Abbreviations

Acronym or Abbreviation	Definition
2021–2022 EDB	2021–2022 West False River Emergency Drought Salinity Barrier
°C	degrees Celsius
µg/L	micrograms per liter
µS/cm	microSiemens per centimeter
AIC	Akaike Information Criterion
barrier	2021–2022 West False River Emergency Drought Salinity Barrier
Bay-Delta	San Francisco Bay/Sacramento–San Joaquin Delta
BET	Bethel Island
BLP	San Joaquin River at Blind Point
CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
cfs	cubic feet per second
CVP	Central Valley Project
D-1641	State Water Resources Control Board Water Right Decision 1641
DCC	Delta Cross Channel
Delta	Sacramento–San Joaquin Delta
DJFMP	Delta Juvenile Fish Monitoring Program
DO	dissolved oxygen
DSJ	Dutch Slough at Jersey Island
DWR	California Department of Water Resources
EDB	emergency drought barrier
EDBPS	Emergency Drought Barrier Predation Study
EMP	Environmental Monitoring Program
EPA	U.S. Environmental Protection Agency
FAL	False River near Oakley
FCT	Fisherman's Cut
FNU	Formazin nephelometric units
FRK	Franks Tract Mid Tract
ft/s	feet per second
GPS	Global Positioning System
HLT	Middle River near Holt
HOL	Holland Cut near Bethel Island
IEP	Interagency Ecological Program
IMU	Inertial Measurement Unit
LE ratio	Lagrangian/Eulerian ratio
m^3	cubic meters
MDM	Middle River at Middle River
mg/L	milligrams per liter
NAVD88	North American Vertical Datum of 1988
NTU	nephelometric turbidity units

Acronym or Abbreviation	Definition
OBI	Old River at Bacon Island
ORQ	Old River at Quimby Island
OSJ	Old River at Franks Tract near Terminous
PER	Predation Event Recorder
PERMANOVA	permutational multivariate analysis of variance
PPK	Post Processed Kinematic
Reclamation	U.S. Bureau of Reclamation
RTMC	Real-Time Monitoring and Control
RVB	Sacramento River at Rio Vista Bridge
SAL	Mokelumne River at San Andreas
SJJ	San Joaquin River at Jersey Point
SSI	Sacramento River near Sherman Island
State Water Board	State Water Resources Control Board
STN	Summer Townet Survey
SWP	State Water Project
TAF	thousand acre-feet
TSL	Threemile Slough at San Joaquin River
TSS	total suspended solids
TUCP	Temporary Urgency Change Petition
TWI	San Joaquin River at Twitchell Island
USGS	U.S. Geological Survey
YSI	Yellow Spring Instrument

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SECTION 1
Construction and Compliance

1.1 Introduction

In the spring of 2021, the California Department of Water Resources (DWR) requested emergency authorization for installation of the 2021–2022 West False River Emergency Drought Salinity Barrier (2021–2022 EDB or barrier) in accordance with the Governor's emergency proclamations issued on April 21 and May 10, 2021 (Newsom 2021). To manage the critically low 2021 water supply for beneficial uses, DWR installed the temporary emergency drought barrier (EDB) on West False River in the Sacramento–San Joaquin Delta (Delta), approximately 5 miles south of Rio Vista, California, in Contra Costa County. Installation began and was completed in June 2021 (**Table 1**), in the same location where DWR had installed a drought salinity barrier in 2015 (DWR 2019). The EDB was installed in compliance with all regulatory permits and authorizations as expeditiously as possible following the May 10, 2021, Governor's drought proclamation.

TABLE 1
TIMELINE OF BARRIER CONSTRUCTION

Date	Drought Barrier Actions
June 3, 2021	In-water construction starts.
June 18, 2021	Barrier hydraulically closed in West False River.
June 23, 2021	In-water construction ends.
October 24, 2021	Record-breaking rainfall event; outflow at 60,000 cubic feet per second on October 26, 2021.
January 4, 2022	Notch construction initiated.
January 7, 2022	Hydraulic breach at 1:30 p.m.
January 18, 2022	Notch completed.

The decision to install the EDB was a joint effort by DWR, the U.S. Bureau of Reclamation, the California Department of Fish and Wildlife (CDFW), the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service. The factors used to evaluate the need for the EDB

included forecasted drought conditions in multiple consecutive years, low levels of reservoir water storage, the high risk of exceeding water quality objectives, and the results of drought modeling and monitoring. The West False River location was selected based on the results of hydrodynamic modeling of salinity patterns in the Delta. The barrier's location optimizes salinity management through the installation of a single barrier, and in 2015 it was proven to be effective in the complex Delta channel system (DWR 2019; Kimmerer et al. 2019).

The EDB is one of two related drought actions necessary to preserve interior Delta water quality with the release of less fresh water from upstream reservoirs. DWR also filed a Temporary Urgency Change Petition (TUCP) with the State Water Resources Control Board (State Water Board) to relax specific water rights conditions associated with Delta outflow and salinity intrusion in the Sacramento River. On June 1, 2021, the State Water Board issued a Temporary Urgency Change Order allowing the requested relaxations through August 15, 2021 (State Water Board 2021).

Construction of a temporary drought salinity barrier in West False River was needed in response to California's current drought condition. The 2021–2022 EDB is a temporary physical rock fill barrier that reduces the intrusion of high-salinity water into the Central and South Delta. The 2021–2022 EDB is very similar in terms of location, size, and design to the drought salinity barrier that was permitted and installed during the 2015 drought, although it will be kept in place through November 2022 instead of being removed in fall 2021, the same year in which it was installed. This report summarizes the construction, monitoring, effectiveness, and impacts of the EDB as measured during 2021. Additional data will be collected in 2022 for an updated report in winter 2022–2023.

1.2 Hydrologic Background

1.2.1 Hydrologic Conditions

Water Year 2020 (October 1, 2019, through September 30, 2020) was mostly dry in Northern California, while parts of Southern California experienced above-average precipitation. Overall, the water year ended with a Sacramento Valley Water Year Hydrologic Classification Index of "Dry" (CDEC 2021), with the state as a whole below average.

Water Year 2020 was characterized by a lack of precipitation that resulted in a snowpack of just 50 percent of average on April 1, 2020. California's major reservoirs received about one-third as much water runoff from precipitation and snowmelt as they did during the same

period in the previous year. DWR's eight-station precipitation index, which tracks conditions in the Sacramento River Basin, ended the year at 62 percent of average. The five-station San Joaquin precipitation index and the six-station Tulare Basin index wrapped up the year at 62 percent and 65 percent of average, respectively (DWR 2020).

California experienced a second consecutive drought year in 2021. Reduced runoff from rain and snowpack led to further reduced reservoir storage. On April 21, 2021, Governor Gavin Newsom proclaimed a state of emergency in select counties because of drought conditions and directed State agencies to take immediate action to bolster drought resilience. On May 10, 2021, Governor Newsom extended the state of emergency to include 41 counties in the Klamath River, Delta, and Tulare Lake watersheds because of warm temperatures and extremely dry soils that resulted in a historic depletion of runoff from the Sierra Nevada snowpack (Newsom 2021).

Drought conditions continued to worsen after the May 10 drought proclamation. For example, Lake Oroville and Lake Shasta, the respective principal reservoirs for the State Water Project (SWP) and Central Valley Project (CVP), were at 41 percent and 48 percent of storage capacity at the time. By September 30, 2021, the end of the water year, storage capacity had decreased to 22 percent and 24 percent, respectively, with Lake Oroville reaching its lowest storage ever since its initial filling. Storage levels at the major reservoirs across the state continued to be well below average at the end of Water Year 2021 (**Figure 1**).

Sufficient reservoir storage levels and subsequent downstream water releases are critical to maintaining beneficial uses in the Delta, which in turn allow the SWP and CVP to operate under normal conditions and capacity. The reduced reservoir storage levels made it unlikely that water released from the reservoirs could be replenished by runoff from upstream resources through snowmelt and precipitation, thereby exacerbating regional drought conditions in the Delta, and further affecting SWP and CVP operations.

With reduced runoff, very little snow remaining, and historically low reservoir levels under existing hydrologic conditions, it was unlikely that current SWP and CVP storage and anticipated inflows to the Delta would be sufficient to repel the intrusion of ocean salinity into the Delta during summer 2021. As result, under the coverage of the Governor's drought emergency proclamation, DWR installed the 2021–2022 EDB at West False River in Contra Costa County in June 2021 in compliance with all regulatory permits and approvals.

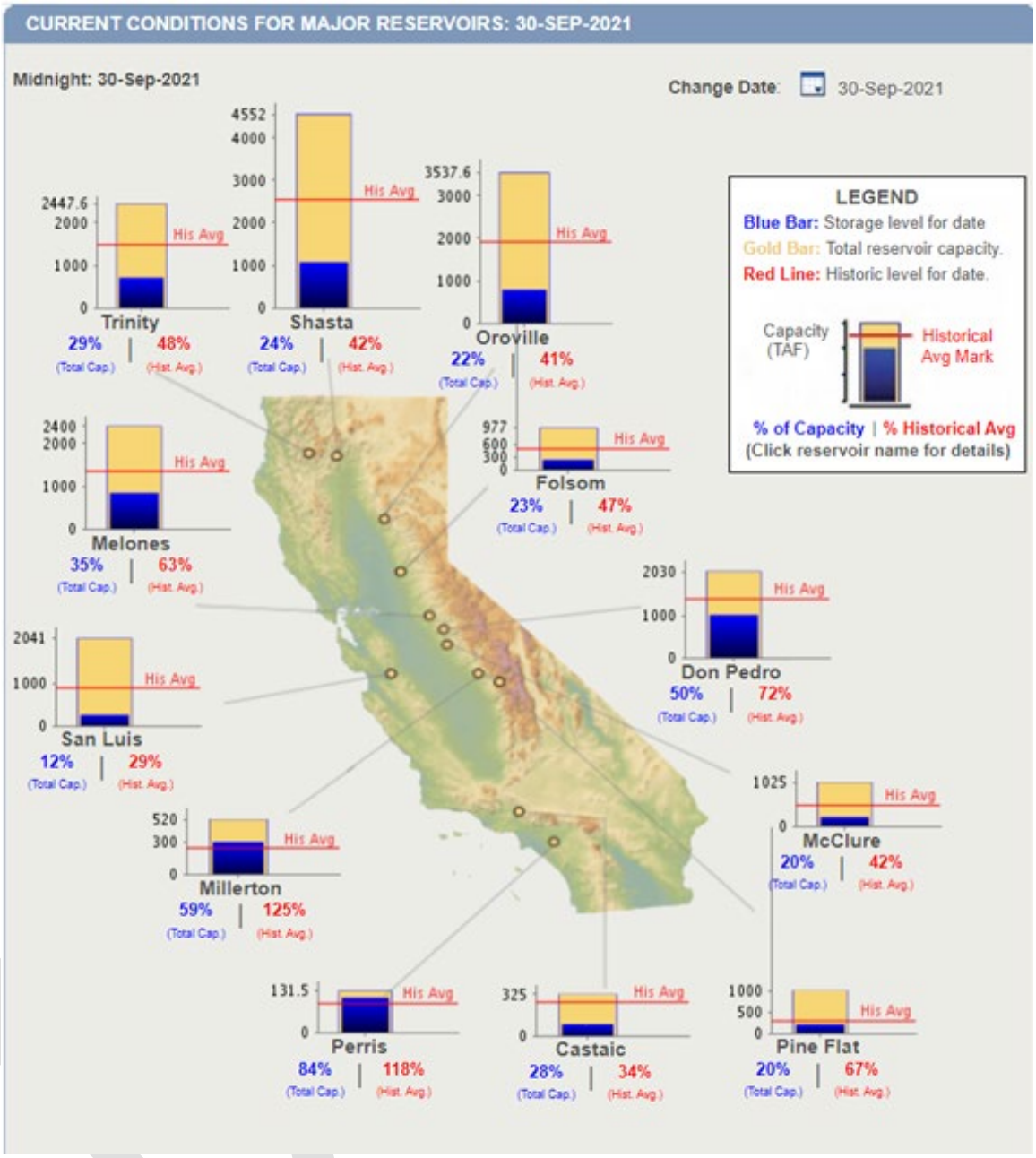


Figure 1 Major State reservoirs—conditions on September 20, 2021.

1.2.2 Operational and Regulatory Context within the Delta

Water operations in calendar year 2021 were controlled by the critically low water supply and regulatory modifications under the TUCP. Operators utilized releases from New Melones Reservoir for Delta obligations downstream of Vernalis, an action not used during other Critical Dry years such as 2015. Through-Delta water transfers were backed into upstream storage and released later in the season

than typical to supplement the coldwater pool in project reservoirs and to help provide Rio Vista minimum flow. Delta Cross Channel (DCC) gate operations were toggled frequently to balance competing needs for Rio Vista flow and water quality. Except during the post-storm periods described below, SWP and CVP exports were at minimum levels to meet health and safety requirements.

Figure 2 shows a timeline of the limiting regulations for summer and fall 2021. This is not a complete discussion of the regulatory structure of the Delta, but instead focuses on items pertaining to the need for and efficacy of the drought barrier.

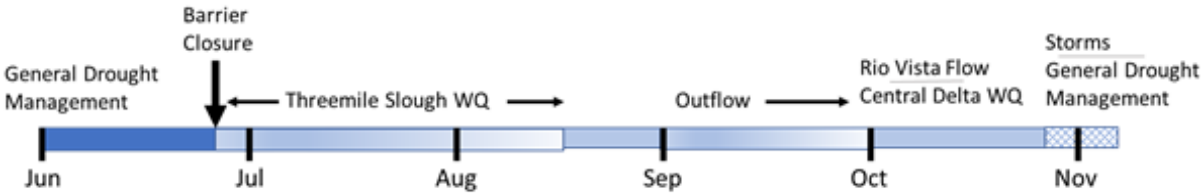


Figure 2 Regulatory and other objectives key to water management in summer and fall 2021.

The following is a summary of period-specific operational considerations during the second half of the 2021 calendar year:

June 14–August 15, 2021: Operators began operating to maintain water quality standards in June. On June 24, an upswing in salinity was observed in the Delta as a result of a subtidal ("filling") event that coincided with a spring tide just as the EDB was completed.

After this event, Delta operations were limited by the western Delta agricultural objective at Sacramento River at Threemile Slough (relocated by the TUCP) and at San Joaquin River at Jersey Point. Salinity at the Threemile Slough compliance location typically averaged 2,400 microSiemens per centimeter (µS/cm), slightly below the 2,780 µS/cm required under the TUCP. DCC gate operations were toggled between open (benefiting Central Delta water quality) and closed (increasing Rio Vista flow) to balance the water quality benefit between the Sacramento and San Joaquin corridors, then the gates were left open for most of July. (See Figure 13 under "Modeled Conditions with and without the Barrier" in Section 2.2.2, "Salinity," of this report.) Beginning in June, supplemental releases were made from New Melones Reservoir to meet Delta obligations, including providing outflow.

During the period of July–August 15, specific conductance at Jersey Point fluctuated around 1,800 µS/cm, with some subtidal water level increases leading to higher values. Jersey Point salinity is not significantly reduced by the EDB, but the barrier plays a big role in determining whether salinity progressing to Jersey Point intrudes farther into the Central Delta. Without the EDB, 1,800 µS/cm at Jersey Point is on the cusp of the salinity level that will threaten beneficial uses in the Central Delta; in non-barrier years, this level of salinity is used as a guidance indicator for operators seeking to protect the freshwater corridor. With the barrier, Central Delta salinity was amply compliant, and this period represents the freshest period of the summer.

Operators focused some attention on Mokelumne River at San Andreas (California Data Exchange Center [CDEC] station SAL) instead of Jersey Point during the summer; 800 µS/cm was used as a rough indicator for when operations might be reconsidered. This salinity level is just below the Critical-year standard of 890 µS/cm in State Water Board Water Right Decision 1641 (D-1641). Salinity approached this level in late June and early July, but more so in October. During both periods, the incursions seemed to coincide with restricted DCC operations.

August 15–September 30, 2021: After August 15, western Delta agricultural salinity objectives were no longer in effect, but high-salinity conditions persisted through the end of August. As a result, outflow remained elevated through the end of August. In late August, the supplemental San Joaquin flows were tapered to a level more typical of recent drought years, and outflow was reduced to the standard level in early September. The month of September was considered outflow constrained. Operations were also altered for the Rio Vista minimum-flow standard. The DCC gates were toggled between open and closed through November. Overall, net Delta outflow remained low, and salinity in the Central Delta increased during this period but did not reach its seasonal peak.

October 2021: During October, salinity in much of the western and Central Delta reached its seasonal peak. The main operational constraints were Rio Vista flow and Central Delta water quality. These were balanced by toggling DCC operations as described above. (See Figure 14 under "Modeled Conditions with and without the Barrier" in Section 2.2.2, "Salinity," of this report.) Although stations near the Central and South Delta export facilities met objectives for local exports, models suggest that this might not have been the case without the barrier. This, then, is the period with the clearest water

savings attributable to the barrier alone; that benefit would have been greatly amplified in the next month, had it not been for the relief provided by the storms that occurred at the end of October. (See Section 2.2.1, "Water Cost Savings," and Section 2.2.2, "Salinity," in Section 2, "Effectiveness and Impacts.")

November–December 2021: Significant storms occurred during late October and again in mid-December, with more precipitation and natural channel accretion occurring during this period. Salinity conditions degraded during the time between storms, driving increased upstream releases and decreased exports. Conditions improved in the latter half of December, and salinity was not a limiting operational consideration in the Delta for the remainder of calendar year 2021.

However, drought conditions remain a concern, and reservoir releases have been reduced to conserve water in an effort to protect next year's water supply (and preserve cold water). The DCC gates continued to be opened and closed in November for Rio Vista considerations after being closed for high flows and fish catch. Beginning December 1, the DCC gates were closed for the remainder of the season.

1.2.3 Goals and Objectives of the Barrier

The overall goals and objectives of the EDB involve protecting the beneficial uses of water in the Delta during the current drought. As observed in 2015, the installation of a drought salinity barrier at West False River proved to be an effective tool for reducing the intrusion of salt water into the Central and South Delta. During drought conditions, water stored in upstream reservoirs is insufficient to repel salinity moving upstream from San Francisco Bay. Without the protection of the drought salinity barrier at West False River, saltwater intrusions could render Delta water unusable for agricultural needs, reduce habitat value for aquatic species, and affect roughly 25 million Californians who rely on the export of this water for personal use.

1.2.4 Barrier Planning and Design

The design of the 2021–2022 EDB is identical to that of the 2015 EDB except for the structural components (i.e., piping preventer sheet piles on the levee crown and steel abutments in the channel) that were left in place from 2015 (**Figure 3**). The barrier is approximately 800 feet long and trapezoid-shaped, with an approximately 150-foot-wide base (in water) tapering to an approximately 12-foot-wide top (above water), set perpendicular to the channel. The top of the barrier is at an elevation of 7 feet North American Vertical Datum of 1988 (NAVD88)

across the entire crest. From the crest, the barrier slopes down to the riverbed at a rate of two horizontal units to one vertical unit (2H:1V).

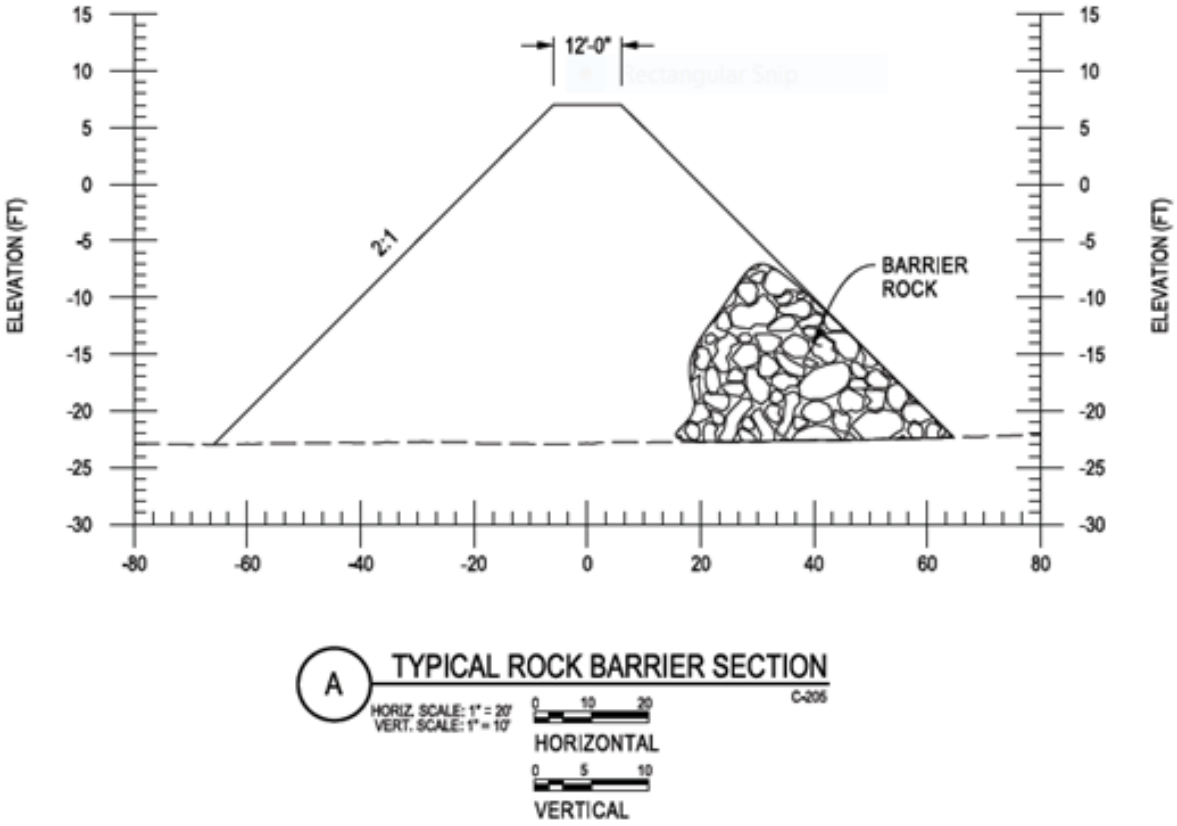


Figure 3 Cross section of the 2021–2022 Emergency Drought Barrier.

The barrier modification design includes construction of a notch (i.e., opening) in the barrier at the center of the channel in January 2022 to reflect that the barrier will be left in place until November 2022 to adapt to ongoing drought conditions. The opening will be 400 feet wide and have a notch invert at -12 feet NAVD88, with a 3:1 slope at both ends. The opening is designed to allow for fish passage and boat navigation through West False River between January and April.

DWR examined several notch configurations to screen for likely velocities anticipated through the notch, using the San Francisco Bay/Sacramento–San Joaquin Delta (Bay-Delta) SCHISM model with enhanced resolution in the region at the barrier itself. Designs with notch inverts at -8, -10, and -12 feet NAVD88 were vetted, as were some alternate widths and depths, but such designs were excluded because they generated high velocities and were considered less stable. The selected design, with a notch invert at -12 feet NAVD88,

had velocities generally in the range of 6–8 feet per second (ft/s) through the center of the notch, with slightly higher velocities in the sloped regions.

1.3 Construction Summary

The EDB was built mostly by excavators on a barge starting on the Jersey Island embankment, then transitioning to the Bradford Island embankment to hydraulically close the barrier at the middle. Approximately 110,000 tons of 24-inch-minus riprap rock were placed in a trapezoidal configuration perpendicular to the West False River channel. EDB construction started on June 3, 2021; contractors worked 24 hours per day, and the barrier was completed on June 24, with hydraulic closure achieved on June 18 (Table 1). **Figure 4** shows the progression of rock placement as the installation of the barrier progressed for the temporary EDB in West False River.

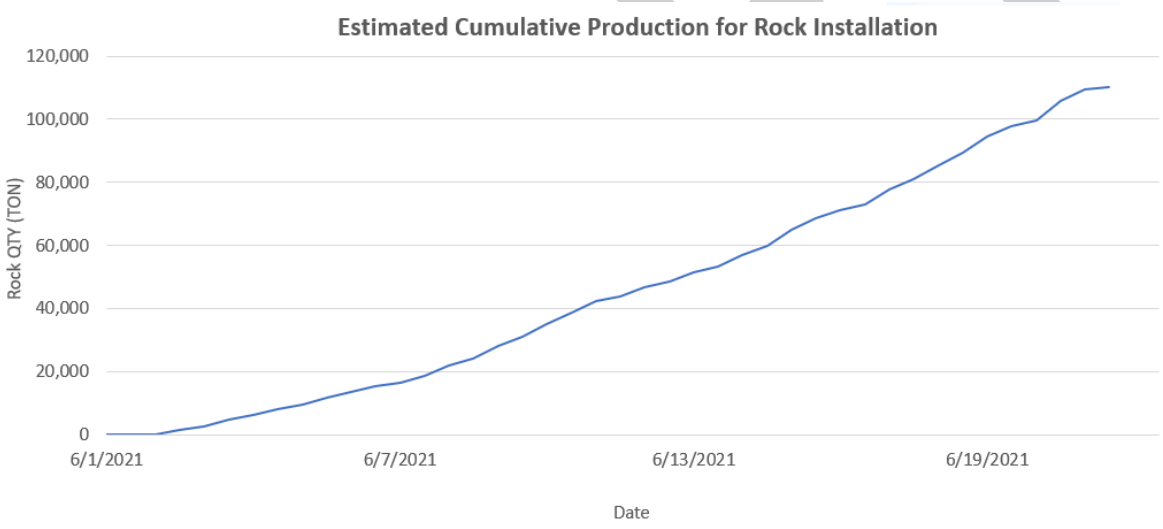


Figure 4 Emergency drought barrier—estimated cumulative production for rock installation.

The existing barrier design remained in place until January 5, 2022, at which point the contractor began removing embankment rock from the center of the barrier, creating a notch to allow for fish and boat passage. This partial removal of the barrier was completed on January 18, with the hydraulic breach achieved on January 7 (**Figure 5**). Assuming that drought conditions persist through spring 2022, DWR intends to re-close the barrier during the first week of April, reversing the barrier modification back to the original design for complete closure of the barrier in place until the fall, with complete removal of all embankment rock scheduled for November 2022.

Figure 5 Construction crew beginning to notch the temporary emergency drought barrier in West False River.

1.3.1 Biological Monitoring during Construction

Biological monitoring was conducted daily at the West False River EDB site by approved biologists for all construction activities with the potential to adversely affect special-status species.

Biological monitoring began at the West False River site on May 29, 2021, to cover all preconstruction activities and equipment staging. Barrier construction began on June 2, 2021, and monitors were initially scheduled for 24 hours per day, split into two 12-hour shifts. On June 19, 2021, following the completion of all rock placement on the levees at both Bradford and Jersey islands, monitoring shifts were adjusted to cover the hours from sunrise to sunset, with the day shift present from 6 a.m. until 2 p.m. and the evening shift from 2 p.m. until 9 p.m. Monitors generally walked the entire site, inspecting the giant garter snake (*Thamnophis gigas*) exclusion fence for damage, and ensured that all vehicles and equipment were located within designated staging areas and workers were complying with all measures, and then monitored all activities throughout the rest of the shift.

Surveys for Swainson's hawk (*Buteo swainsoni*) were conducted weekly by an approved biologist on June 10, 13, and 22, 2021, using binoculars and a spotting scope to scan trees and the surrounding areas from both the Jersey Island and Bradford Island levees. During the surveys, Swainson's hawks and other species of raptors were observed foraging, as well as landing in several trees; however, no nests were identified, and the birds observed did not show any signs of disturbance during the surveys or during other sightings throughout the barrier installation period.

Though not required by permit conditions, biological monitoring was also conducted at the Weber Rock Yard to ensure that no take of protected species occurred. Biological monitoring began at the Weber Rock Yard on May 28, 2021. Monitors remained on site during all work conducted, which included staging of equipment and installation of an exclusion fence along the waterside. On June 1, 2021, rock loading onto barges began, and monitors were scheduled for 24 hours per day, split into two 12-hour shifts.

On June 4, 2021, after three days of continuous monitoring during active rock loading, it was determined that based on the nature of the work and the lack of sensitive-species encounters in the exclusion area, overnight monitoring was no longer warranted at the Weber Rock Yard. As a result, monitoring was reduced to 8 a.m. to 5 p.m. daily. Monitors walked the giant garter snake exclusion fence and inspected it for damage at the beginning of each shift, and then remained on site, actively monitoring during the remainder of the shift. Daily monitoring continued until all work at the Weber Rock Yard concluded on June 23, 2021.

During the 2021 construction period, no sensitive species were encountered or found to be adversely affected within the action area.

1.3.2 Environmental Compliance

Construction of the 2021–2022 EDB was initiated on June 3, 2021, following the receipt of all required permit authorizations from the U.S. Army Corps of Engineers (Regional General Permit 8 SPK-2014-00187), the State Water Board (Individual Water Quality Certification for Federal Permit or License), and CDFW (Final Lake and Streambed Alteration Agreement EPIMS-CCA-19852-R3 and Incidental Take Permit 2081-2021-041-03). The barrier was hydraulically closed on June 18, 2021.

Before the planned removal of the barrier on November 30, 2021, DWR requested and received authorization to leave the barrier in place

until November 30, 2022, with notching and notch re-closure to take place in January and April 2022, respectively. These approvals included a reauthorization under U.S. Army Corps of Engineers Regional General Permit 8; a consistency clarification from the State Water Board stating that the previously issued water quality certification was valid to cover the requested activities and barrier duration; and amendments to the Lake and Streambed Alteration Agreement and incidental take permit from CDFW.

All activities related to the barrier construction and subsequent monitoring requirements were conducted in accordance with these authorizations.

1.3.3 Turbidity Monitoring during Construction

Turbidity and settleable solids samples were taken three times a day during in-water construction activities, at approximately 9 a.m., 12 noon, and 3 p.m. Samples were taken either from the shore or by boat at a nominal distance of 300 feet upstream and downstream of construction activities. Samples were taken for 20 consecutive days during EDB installation from Thursday, June 3, 2021, to Tuesday, June 22, 2021. All settleable solids values were less than 0.1 milliliters per liter, the allowable limit. Turbidity values ranged from 4.3 nephelometric turbidity units (NTU) to 18.3 NTU, well below the allowable limit of 150 NTU. These results are included in Appendix A.

1.3.4 Subsidence Monitoring

Subsidence monitoring was conducted by a contractor during installation of the temporary EDB in West False River. The Geomatics Branch of the DWR Division of Engineering received a survey monitoring report for this construction project from the contractor. The contractor collected survey monitor measurement data throughout the construction of the barrier. Nothing was noted in this report. A copy of this contractor monitoring report is included in Appendix B.

SECTION 2
Effectiveness and Impacts

2.1 Goals and Objectives of Effectiveness Monitoring

2.1.1 Goal 1: Reduce Salinity Entering the Central Delta

The major goal of the 2021–2022 EDB is to protect water quality in the interior Delta while allowing reduced Delta outflow. Therefore, the primary effectiveness monitoring will be for salinity, to assess the end goal of preserving water quality, and for flow, to assess the means goal of rerouting saline water away from the South Delta.

2.1.2 Goal 2: Prevent Negative Impacts on the Ecosystem and Other Beneficial Uses

While DWR will use the barrier to preserve water quality for human use, DWR is committed to reducing negative impacts on other beneficial uses. In particular, the impact of the barrier on the following parameters was assessed:

- Bathymetry and channel bed elevation
- Salinity, nutrients, and turbidity
- Phytoplankton and zooplankton
- Harmful algal blooms
- Aquatic weeds
- Fish community
- Fish predation
- Salvage of at-risk fishes

Each of these metrics is described in detail below.

2.2 Effectiveness

2.2.1 Water Cost Savings

Although it was constructed mainly to defend the freshwater corridor, the 2021–2022 EDB contributes to water savings in two ways: indirectly

by facilitating safe implementation of the TUCP and directly by reducing the amount of water used to manage Central Delta water quality.

The TUCP mechanism tends to prevail in the summer when factors other than the Central Delta's water quality control operations. The EDB provides a margin of operational comfort to take advantage of TUCP regulatory relaxations such as the D-1641 Western Ag and Delta Outflow standards, without threatening an unexpected compliance issue in the Central Delta or triggering a catastrophic scenario of "losing the Delta" as a freshwater conveyance route. This is an auxiliary role in which the barrier serves mostly as an insurance policy; the TUCP determines the savings, and the factors that are limiting the water cost of operations tend to be outflow or Threemile Slough water quality, neither of which is directly improved by the barrier. Of course, the implication of the "insurance policy" analogy is that without the barrier, compliance issues could quickly shift to the Central Delta. Estimates of water savings from the TUCP, as made by the SWP Operations Control Office, Delta Compliance and Modeling Section, were 144 thousand acre-feet (TAF), 110 TAF, and 26 TAF, respectively, in the months of June, July, and August.

It is not clear whether the full TUCP water savings could have been enjoyed without the drought barrier. SCHISM modeling suggests that between July and late September 2021, Central Delta salinity was sufficiently low relative to standards that this region would not have represented an outright exceedance threat without the barrier. To be sure, salinity would have been higher without the EDB, but the key question is whether it would have been high enough to require a flow response. This result stands in some contrast to the same period in 2015, when salinities in the Central Delta were 15–20 percent higher and the EDB was critical to operations throughout the summer and fall (DWR 2019).

The second, more direct mechanism of savings begins in late summer and early fall, when Central Delta salinity becomes the main factor limiting the water cost of operations. This is the area that the EDB protects efficiently. Modeling suggests that starting in early October 2021, Old River at Bacon Island specific conductance would have reached a level close to 1,000 µS/cm in October without the EDB, a compliance issue that certainly would have elicited an operational response and required additional releases.

In the fall, a water savings analysis was performed by the SWP Operations Control Office, Delta Compliance and Modeling Section. This analysis was an upper-bookend estimate of water savings

performed by using the DSM2 model to estimate the additional water that would have been required to achieve the same salinity at various sites (including Old River at Bacon Island) without the EDB as was achieved historically with the EDB. For Bacon Island, the maximum savings was estimated as 157 TAF for the period June 18 to October 31, 2021. The estimate is described here as an upper bookend because maintenance of equal salinity is probably a stricter water quality criterion than would have been necessary from a regulatory or Delta protection imperative, except in late June, October, and parts of December.

2.2.2 Salinity

Salinity Intrusion Pathway

Staff examined the effectiveness of the 2021–2022 EDB at preventing salt intrusion into the interior Delta. For the purposes of this report, the "interior Delta" is defined as the region east of the temporary barrier at False River, south of Webb Tract, west of Jones Tract, and north of the Grant Line Canal.

Salinity patterns were examined along the pathway of salinity propagation via the waterways running from False River, southeast via Franks Tract and into Old River via Holland Cut, the route of salinity intrusion observed in previous years (**Figure 6**). Preventing salinity intrusion into the interior Delta channels that lead to the CVP and SWP pumping intakes is critical to maintaining the freshwater supply for urban, agricultural, and beneficial environmental uses.

Continuous specific conductance data that were collected at stations along the salinity intrusion pathway from April to December were compared between 2020, a Dry year when no barrier was installed, and 2021, a Critical Dry year when the barrier in False River was installed for the first time since 2015.

Daily-average specific conductance, used here as a surrogate for salinity, tracked closely at False River near Oakley (FAL) and San Joaquin River at Jersey Point (SJJ) in 2020, with measurements at FAL registering a few hundred microSiemens per centimeter lower than those at SJJ (**Figure 7**). Looking systematically upstream (or as arrayed from top to bottom in Figure 7), the same pattern in specific conductance can be seen diminishing at each more-interior station. As daily-average specific conductance reached 2,400 µS/cm at SJJ at the end of August 2020, specific conductance at Holland Cut near Bethel Island (HOL) peaked at 1,100 µS/cm several days later, or about 45 percent of SJJ salinity measurements.

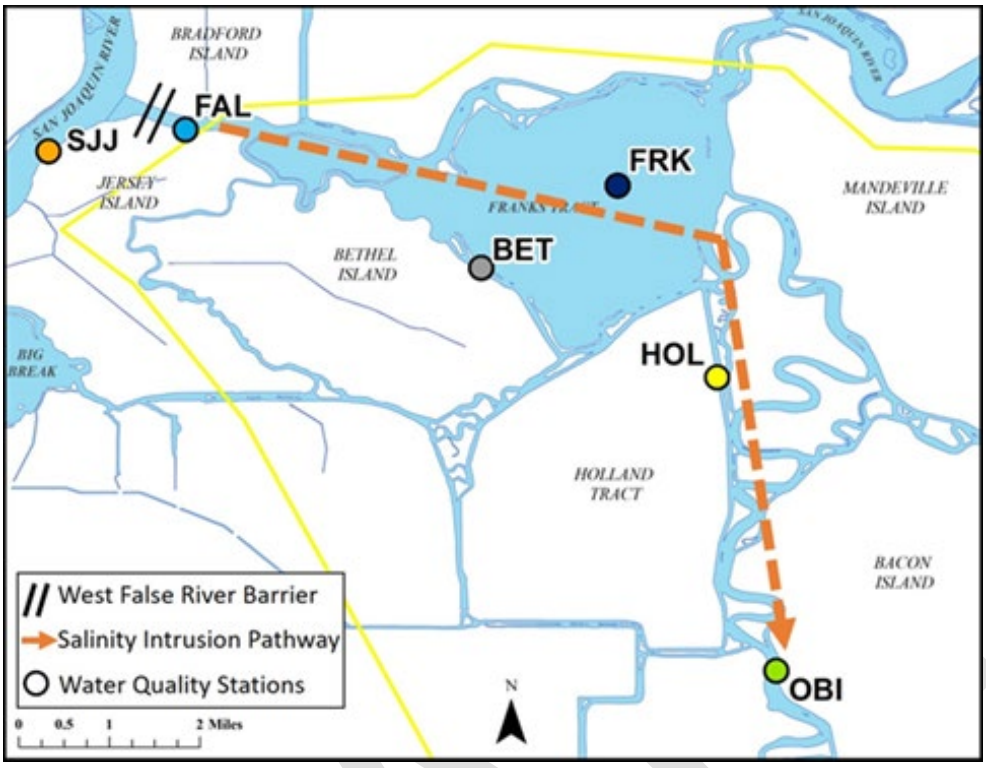


Figure 6 Map of water quality monitoring stations in the Interior Delta Region along the salinity intrusion pathway.

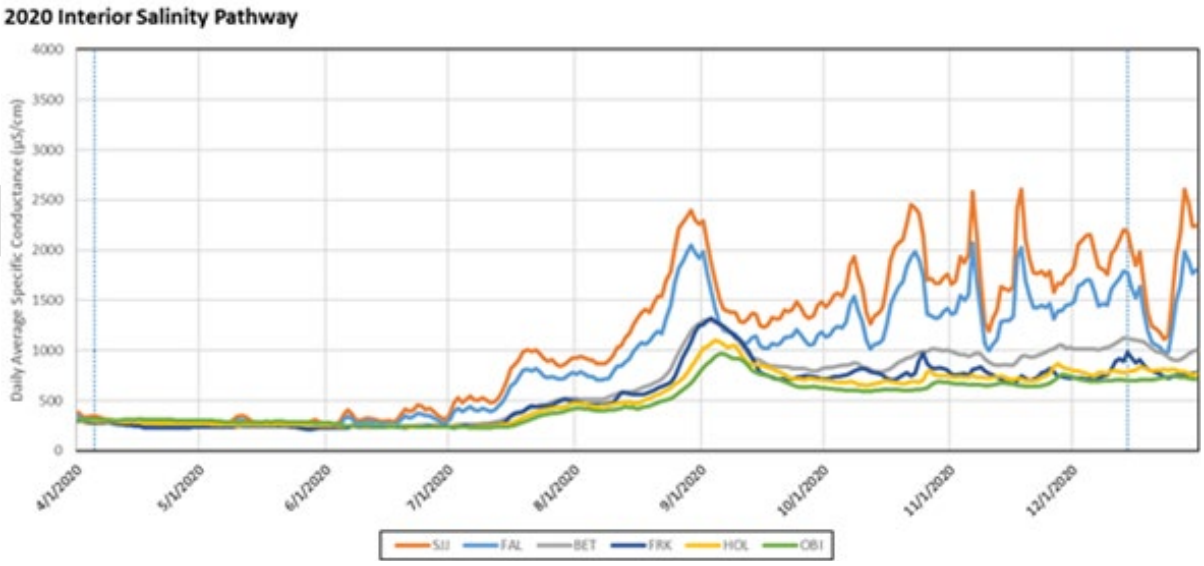


Figure 7 2020 daily-average specific conductance in the Interior Delta Region along the salinity intrusion pathway.

In 2021, even drier conditions led salinity to rise more precipitously and even earlier in the year than in 2020. In response, construction

was initiated on an EDB in West False River on June 3, 2021, with hydraulic closure of False River achieved on June 18 and construction of the barrier finished on June 23. Before completion of the barrier, specific conductance patterns at stations along the interior pathway tracked in step with SJJ, with FAL still only a few hundred microSiemens lower, and with the specific conductance signal diminishing at each more-interior station (**Figure 8**).

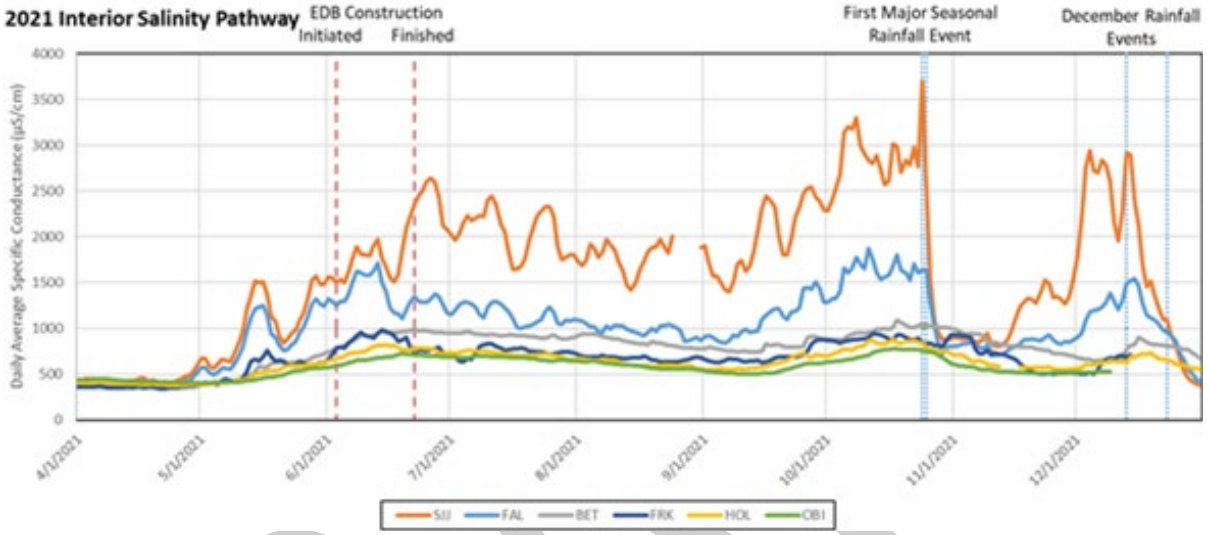


Figure 8 2021 daily-average specific conductance in the Interior Delta Region along the salinity intrusion pathway.

Upon completion of the barrier, sympathetic patterns in specific conductance were greatly reduced at upstream stations. As daily-average specific conductance at SJJ reached 2,650 µS/cm in late June, FAL was more than 1,000 µS/cm lower, at 1,380 µS/cm. Specific conductance at interior stations such as HOL and Old River at Bacon Island (OBI) remained below 1,000 µS/cm through the end of the calendar year, peaking at about 880 µS/cm and 780 µS/cm, respectively, even as SJJ specific conductance reached 3,300 µS/cm in early October, placing HOL salinity levels at about 25 percent of SJJ measurements.

In late October an extreme rainfall event occurred, adding more than 5 inches of rain locally (and a good deal more in the foothills and high country) in a 24-hour period. Rainfall of more than 0.5 inches in a day at the Stockton Fire Station are denoted in Figure 7 and Figure 8 as dotted blue lines. These events led to a precipitous drop in daily-average specific conductance in both 2020 and 2021 and helped to keep late-fall/early-winter salinity levels lower in the Delta.

Salinity Patterns near Franks Tract

An additional factor in limiting the rate of fresher water reaching the interior Delta with the EDB installed in 2021 is the reduced lateral mixing of channel water from the east into the flooded island of Franks Tract. Stations in or near Franks Tract that show the lack of mixing are shown on the map in **Figure 9** and plotted in **Figure 10**. The salinity levels better equilibrate in 2021 between Old River at Quimby Island (ORQ) and Old River at Franks Tract near Terminous (OSJ) than in non-EDB years, primarily as a result of increased tidal excursion through OSJ from the San Joaquin River (Figure 10). HOL becomes more strongly associated to Franks Tract Mid Tract (FRK) and does not equilibrate with the lower salinity water in OSJ and ORQ. It is important to highlight this phenomenon, as it was observed in 2015 and has implications for the water quality that is eventually observed farther south into the interior Delta. This lack of east-to-west water source mixing in Franks Tract has been linked to the higher levels of submerged aquatic vegetation in this region that can block water movement and exchange.

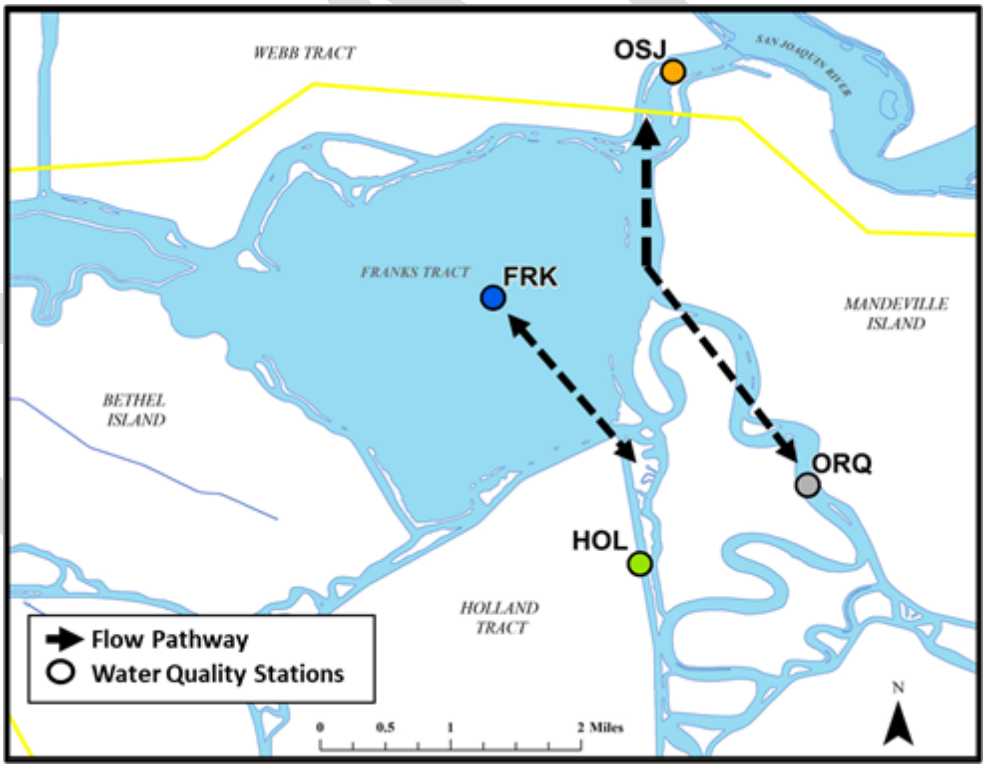
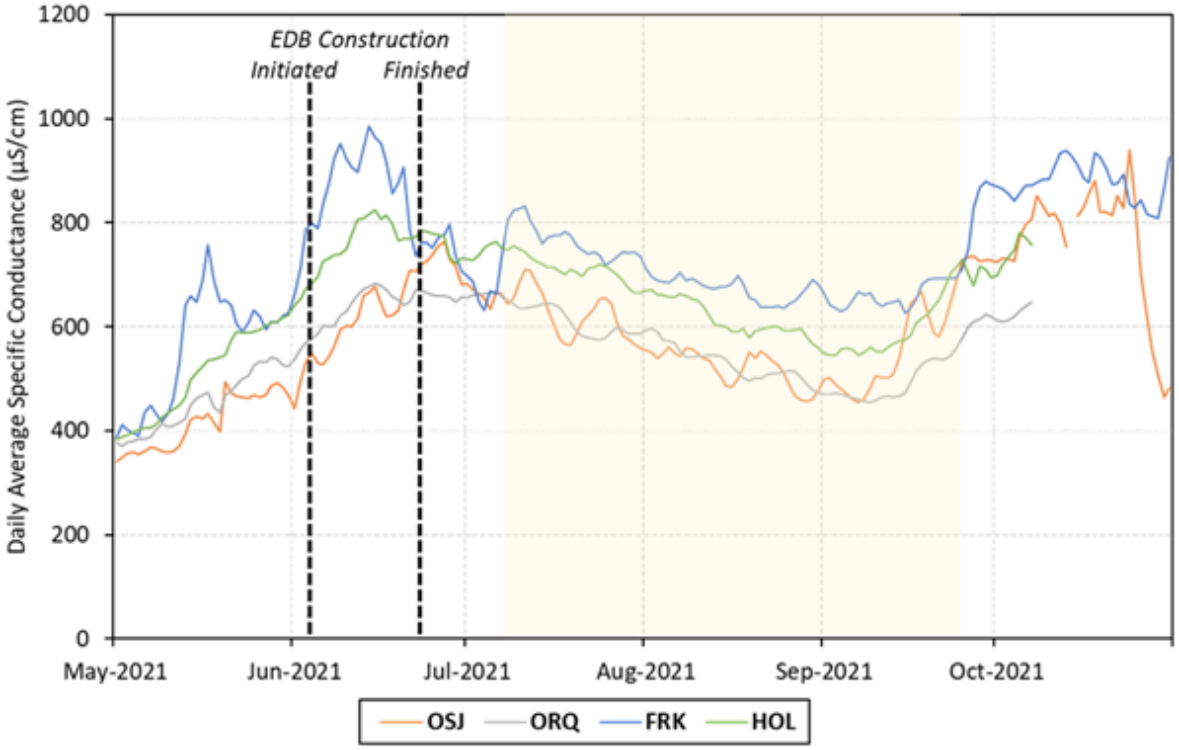


Figure 9 Pairs of stations around Franks Tract that equilibrate in salinity.



NOTE: Yellow-shaded area represents period of equilibrated salinity levels between sites.

Figure 10 Daily-average specific conductivity data for stations on the eastern side of Franks Tract.

Old and Middle River Lateral Mixing

One other factor also affecting the rate of fresher water reaching the interior Delta during the EDB installation in 2021 is the water exchange of the fresher Middle River laterally with Old River. Stations in and along Old and Middle rivers are mapped in **Figure 11** and specific conductance is plotted in **Figure 12**. The salinity levels between Old and Middle rivers become more similar in 2021 from June through October during the EDB installation period than in 2020 (Figure 12). This phenomenon was also observed in 2015 and suggests less influence of Middle River freshening of Old River, possibly a result of reduced cross-channel tidal mixing and/or lower water export flows in Old and Middle rivers as a result of the drought.

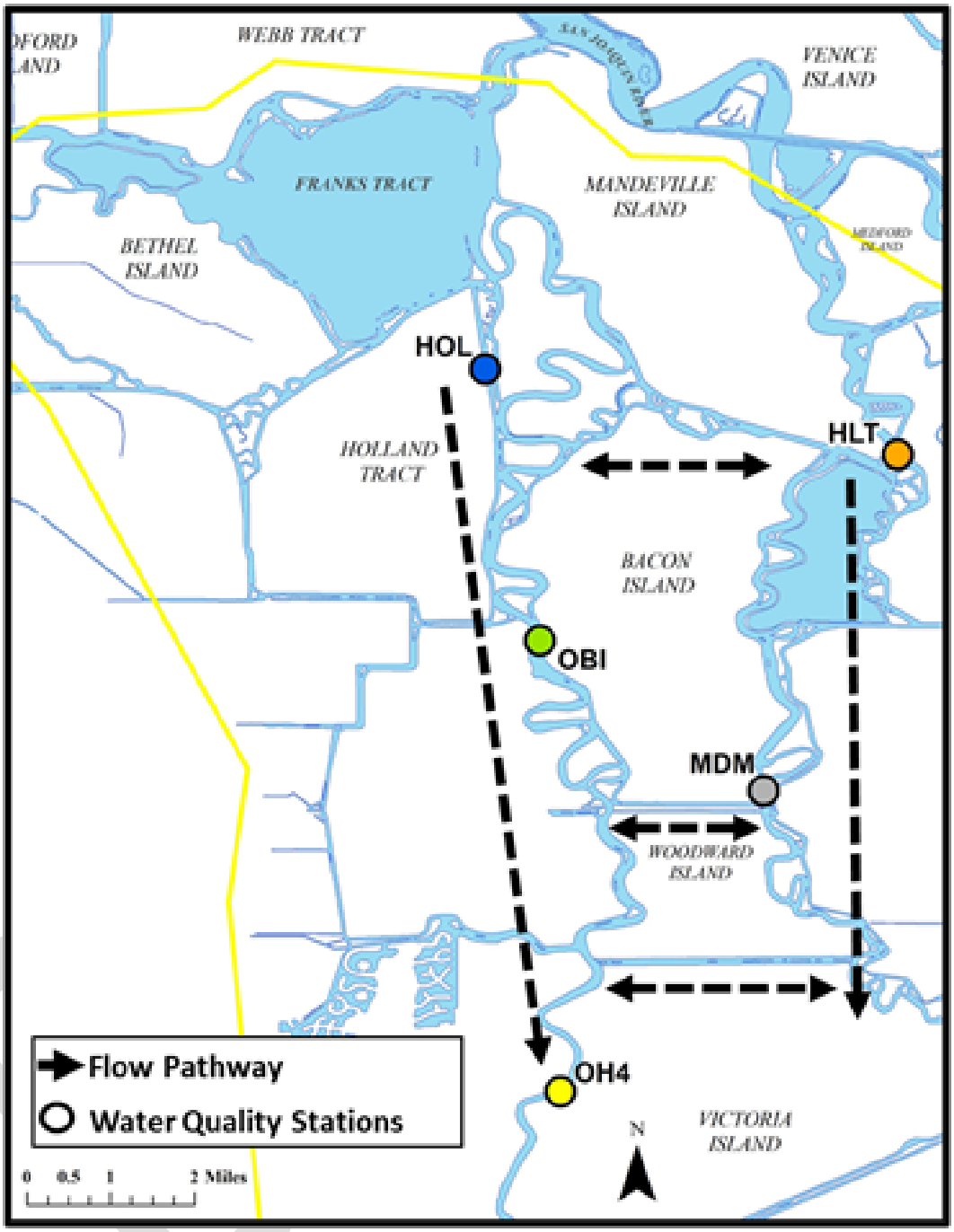
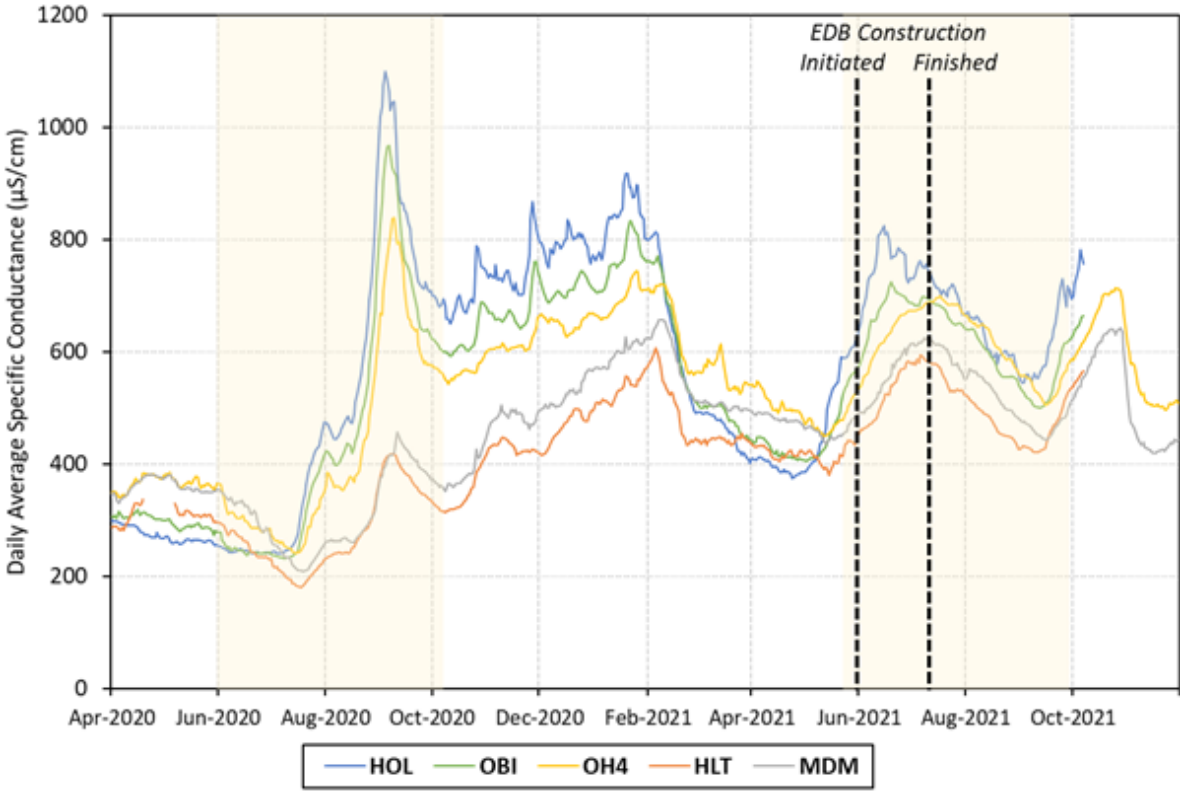


Figure 11 Stations used to examine Old River and Middle River mixing.



NOTE: Yellow-shaded area represents June–October period with differing salinity patterns in Old and Middle rivers.

Figure 12 Daily-average specific conductance data for stations along Old and Middle rivers.

Modeled Conditions with and without the Barrier

To assess the effectiveness of the EDB in reducing salinity intrusion, three-dimensional simulations were carried out using the Bay-Delta SCHISM three-dimensional circulation model (Ateljevich et al. 2014). Bay-Delta SCHISM is an application of the Semi-implicit Cross-scale Hydroscience Integrated System Model (Zhang and Baptista 2008; Zhang et al. 2016). Results shown here focus on historical period of June 1–December 31, 2021, with the full structure in place. Simulations that include the recent notching will be incorporated into a coming report draft.

To obtain the effect of the barrier, salinity difference maps were generated comparing salinity from historical operations and geometry (EDB) to a hypothetical case with no drought barrier (No EDB). Field data were used for flow boundary conditions and exports through the end of the calendar year. The summer and early-fall hydrology are shown in **Figure 13** and the late-fall/early-winter 2021 (Water Year 2022) hydrology is shown in **Figure 14**; note that the scales of the two plots are very different. The No EDB case does not consider

operational response required to freshen the Central Delta, although results indicate that more inflow would have been required.

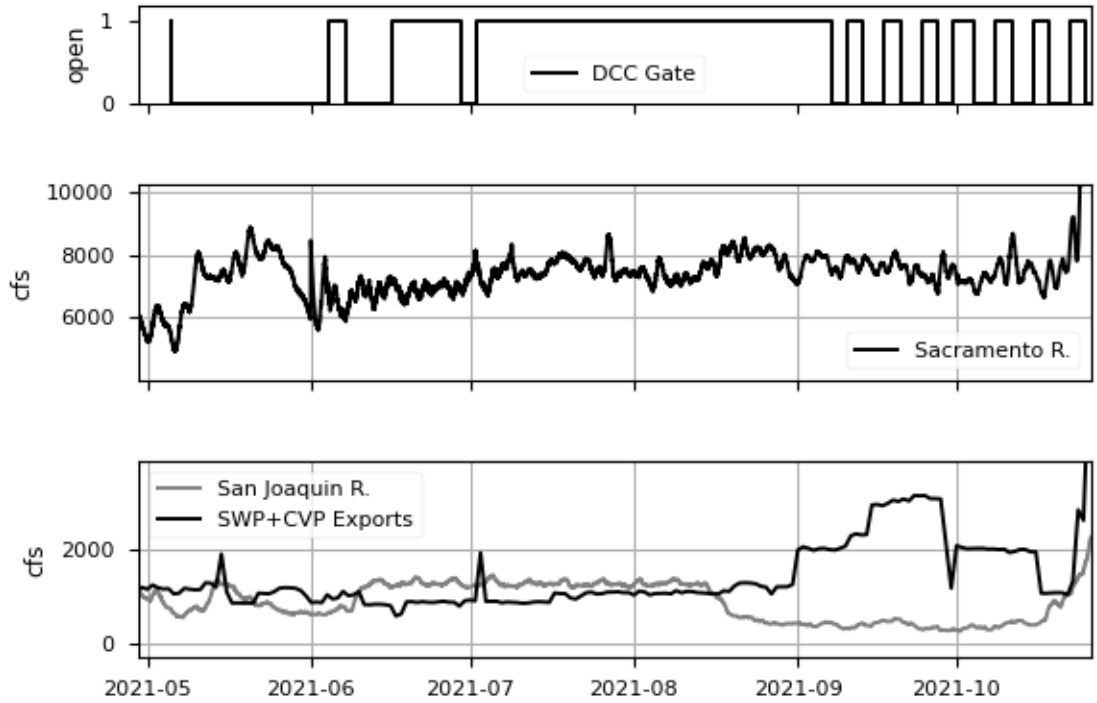


Figure 13 Hydrologic and Delta Cross Channel conditions for summer 2021.

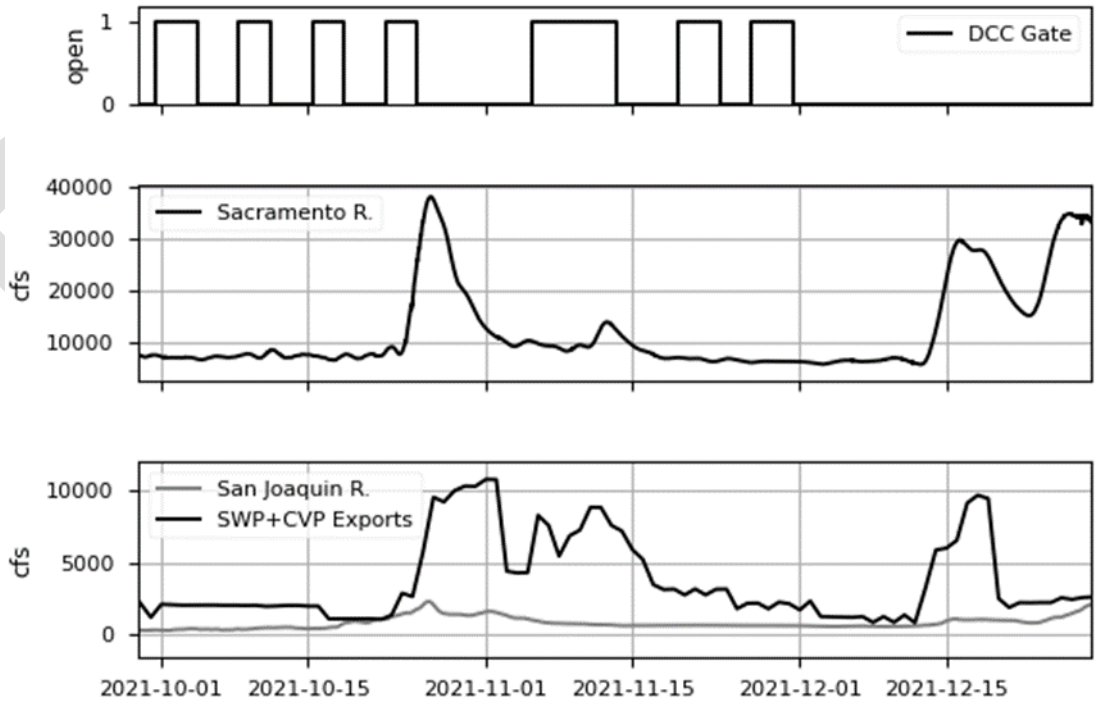


Figure 14 Hydrologic and Delta Cross Channel conditions for October–December of calendar year 2021.

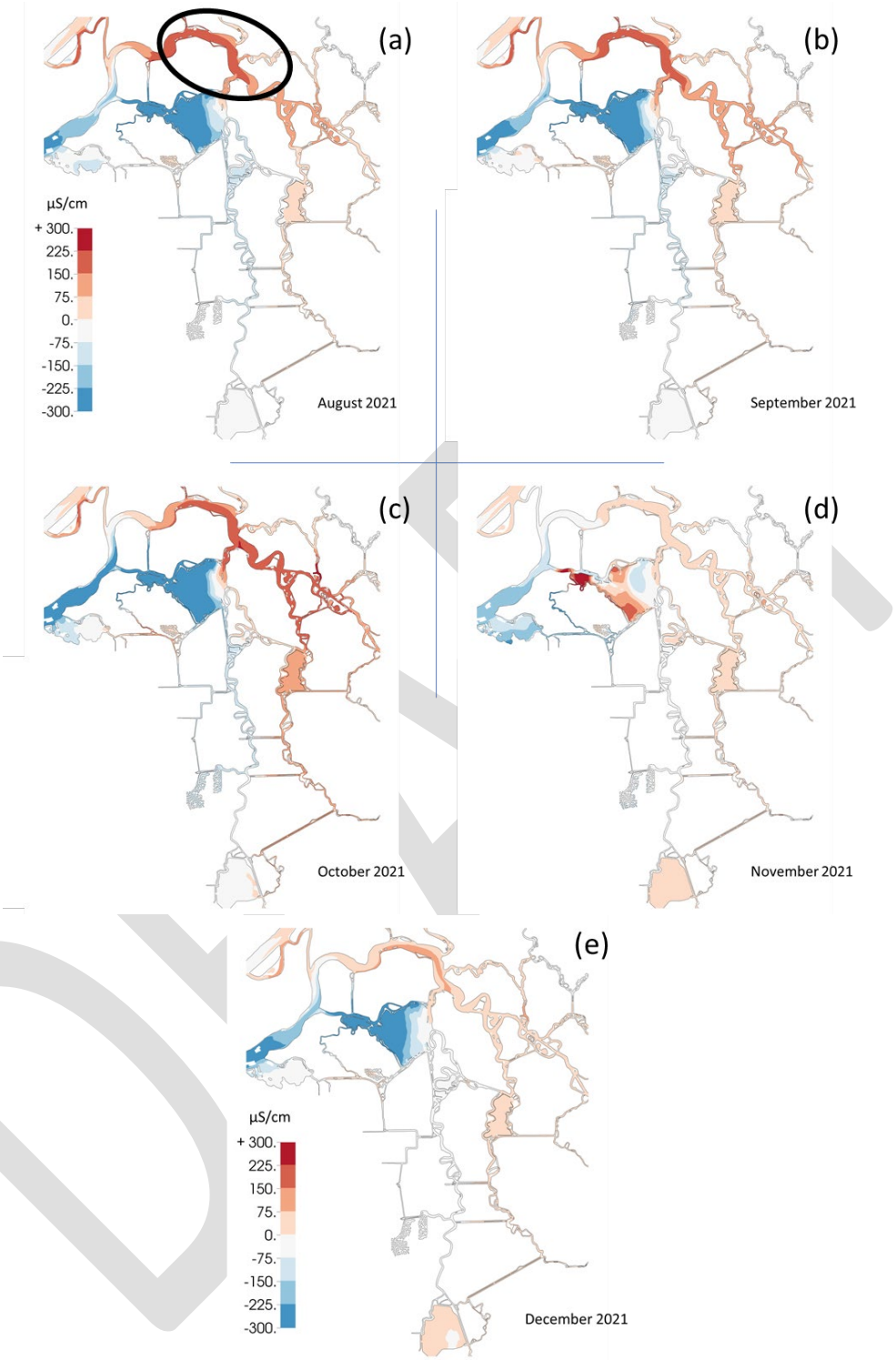
Maps (a) through (e) in **Figure 15** are the salinity change maps, EDB case minus No EDB for the first 14 days of August, September, October, November, and December, given units of specific conductance. Each month represents a different operational context, hydrology, or salinity management challenge. Some of the salient details are described in **Table 2**.

TABLE 2
SUMMARY OF OPERATIONAL CONDITIONS BY MONTH

Period	Notes
August 1–14	D-1641 Threemile Slough standard limits operations.
September	Outflow controlled, lower salinity than August.
October 1–14	Salinity/flow controlled, seasonal peak salinity. Delta Cross Canal toggled.
November 1–14	Large storm, Jersey Point fresh, barrier limits freshening.
December 1–14	Between storms, salinity field revives.

With the exception of the November map, the change maps from the model indicate a water quality improvement due to the EDB in Franks Tract and at locations on Old River immediately south of Franks Tract. The degree of improvement decreases upstream along Old River, caused in part by exchanges with Middle River and in part by additional salinity influences in the South Delta such as Old River and the Grant Line Canal. According to the model, salinity above San Andreas Landing on the San Joaquin River and in Middle River was increased during all periods with the barrier. Under its current calibration, the model tends to overestimate salt in this region of the San Joaquin River (due to underestimation of Georgiana Slough flow), so the magnitude of degradation indicated in the maps may be exaggerated; this point will receive some attention in the next draft.

Because of the greater relative influence of Old River at the export locations during health and safety levels of pumping, the beneficial effect generally prevails in this area. Based on the salinity change maps, it appears that the barrier significantly simplified the compliance onus in the Central Delta and protected part of the freshwater corridor, but only modestly improved salinity at the SWP and CVP export locations.



NOTE: (a) August 1–14, (b) September 1–14, (c) October 1–14, (d) November 1–15, (e) December 1–14. Blue indicates regions where the drought barrier reduced salinity. The circled region in map (a) is mentioned in the text and includes the mouth of the Mokelumne River where most DCC water enters the Central Delta.

Figure 15 Salinity difference map, representing the difference between a scenario with the drought barrier and one without the drought barrier.

November Freshet

As noted above, the November change map is an exception in the series of maps because patches of degradation rather than freshening are seen within western Franks Tract. This map is timed in the aftermath of late October storms that produced outflow as high as 61,600 cubic feet per second (cfs) and reduced salinity at Jersey Point to levels fresher than the water in adjoining Bethel Island. Under these circumstances, the tidal pumping at False River and Franks Tract—the mechanism that produces salinity intrusion in summer and that the barrier is designed to shut down—would have been beneficial. The monitoring team had speculated that because this mechanism was blocked, there might be circumstances under which the barrier could even delay widespread freshening (which would have been offset by the January notch), but it appears that 2021 is not such a case. In December 2021 and January 2022, freshening of Franks Tract and the Central Delta from Old River in the east was nearly complete by the time Jersey Point salinity became low enough to be a source of freshening.

2.2.3 Time Series Plots

Time series plots help put the magnitudes in the salinity difference maps into perspective. **Figure 16** shows the difference in (tidally filtered) specific conductance between the scenarios with and without barriers at several stations that often influence flow management: Piper Slough at Bethel Island, Old River at Bacon Island, and Clifton Court. As the series at Bethel Island shows, the EDB is very effective in preventing the migration of salinity from Jersey Point into Franks Tract. At Bacon Island, reductions are smaller, but are meaningful because of the significance of this station as an indicator. Note that this station has more model bias than the others. The effect of the EDB at Clifton Court seems to be considerably smaller: Clifton Court is affected by other sources of salinity such as Middle River and the South Delta.

Delta Cross Channel

The salinity difference maps for August through October show an area of water quality degradation around San Andreas Landing, the Mokelumne, and the mouth of Old River that develops due to the barrier. In Figure 15, map (a), the area under discussion is circled in black, and the tendency recurs in other months such as September and October in nearly the same location. This area northeast of Franks Tract is a critical region when the EDB is installed, as it represents not only the influx of tributary water from the DCC, but also the location of enhanced exchange between the San Joaquin and Franks Tract through Old River when the barrier is in place.

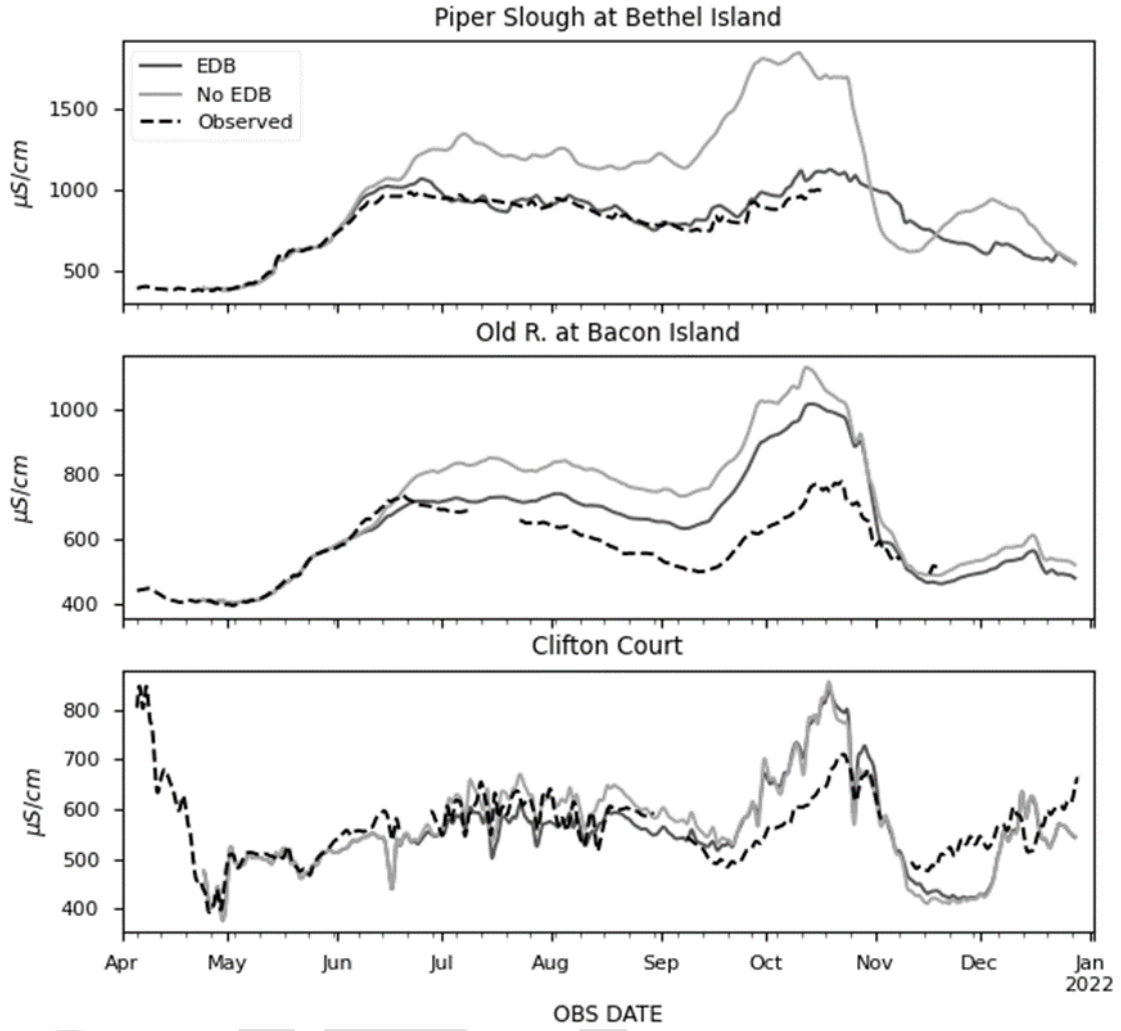


Figure 16 Salinity time series over calendar year 2021 at three stations on the salinity intrusion pathway.

In fall 2021, operation of the DCC (Figures 13 and 14) was toggled open and closed in an effort to balance water quality concerns in the Delta with Rio Vista flow requirements. In October, for instance, a pattern of three days open and four days closed was followed for most of the month. While there was not necessarily any latitude to increase the use of the cross channel, it is natural to inquire whether there is a synergy between DCC operations and the barrier. To investigate this, additional hypothetical/sensitivity simulations were performed that modeled water quality under enhanced operation of the DCC. The enhancement was to add two tidal days (50 hours) at the beginning of each weekly open-close cycle in September and October. Note that this is purely a sensitivity experiment; additional use of the DCC probably would not have been feasible, given the closures needed to meet Rio Vista flow standards.

Figure 17 shows the results of this sensitivity experiment. The dotted lines show salinity under these enhanced DCC operations at the same locations as in Figure 16. At Bethel Island, the added DCC operations made only a little difference; the EDB effect was far larger than that of the cross channel. At Clifton Court, the opposite was true: Differences were small overall and the DCC was more influential. At Bacon Island, the enhanced DCC operations and EDB were approximately equal in the magnitude of change they induced. Only a very weak synergy was found; in the first approximation, the combined DCC and EDB actions provided benefits that were equal to the sum of the benefits of the individual actions. In reaches where the EDB was estimated to increase salinity, the DCC enhancement was still beneficial. This occurred mostly on the Middle River corridor.

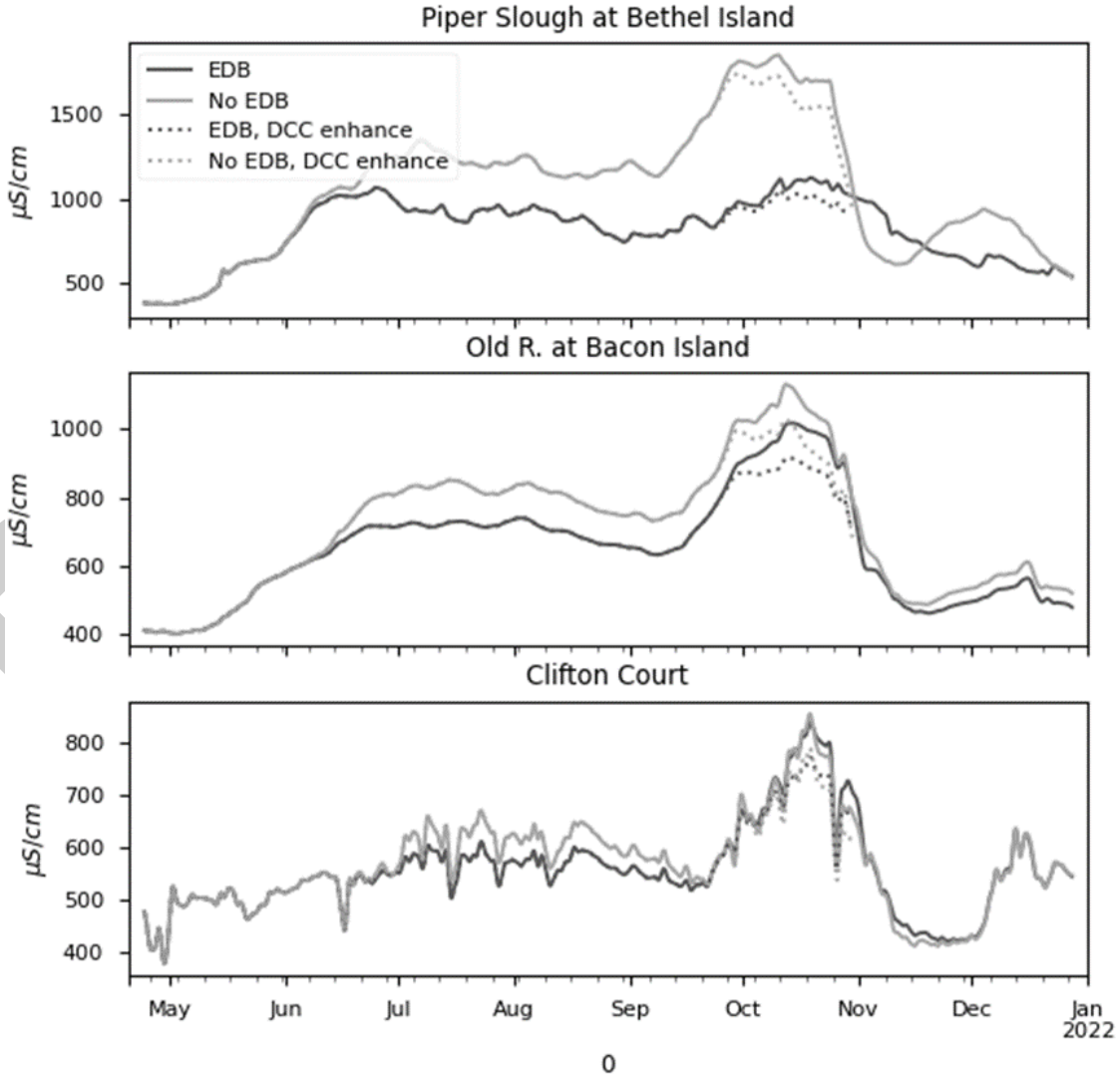


Figure 17 Effect of two additional tidal days of Delta Cross Channel operation on EDB and No EDB scenarios.

2021 Salinity Compared to Previous Water Years

Salinity at HOL was compared across the previous eight water years as the representative station for interior Delta specific conductance. This station was chosen because it is the first station along the salinity intrusion pathway at the entrance to the freshwater corridors of Old and Middle rivers, through which water is moved to the State and federal pumping facilities. HOL was also chosen because of its legacy status as a key station used to examine the efficacy of the 2015 West False River barrier in previous DWR reports produced in 2017 and 2019 (DWR 2019).

Figure 18 depicts daily-average specific conductance at HOL during the eight most recent water years. The figure depicts 2015 and 2021 as dashed lines to denote that the EDB was installed that year, and color-matched vertical dashed lines show the date on which the barrier was installed during the associated water year.

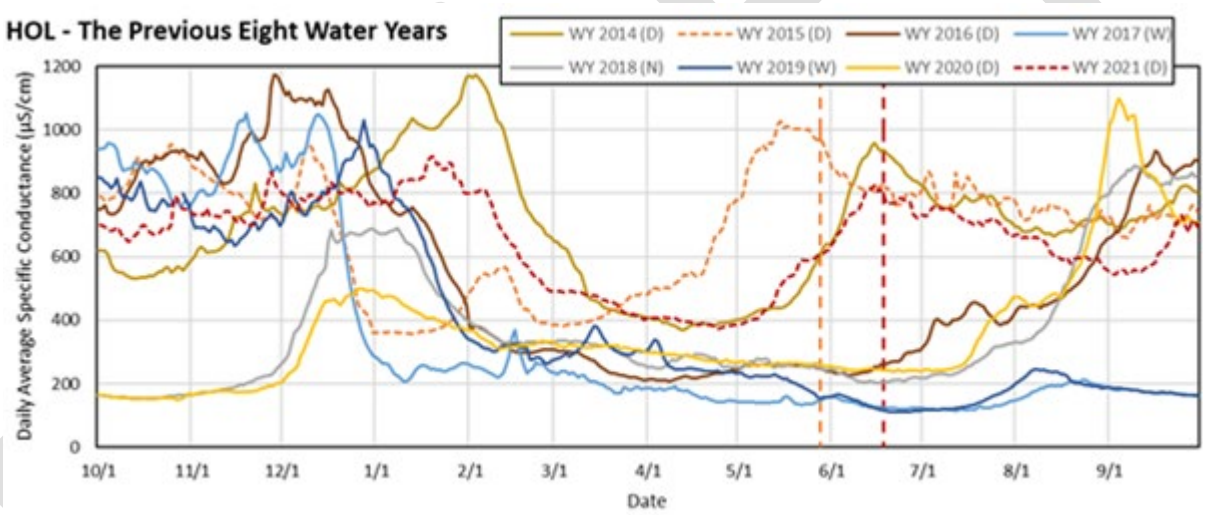


Figure 18 Daily-average specific conductance at Holland Cut near Bethel Island during the last eight water years.

A water year begins on October 1 of the previous year and runs through September 30 of the named water year; for example, Water Year 2021 began October 1, 2020, and ran through September 30, 2021. Each water year has been classified by water year type based on the unimpaired runoff that occurs in the Sacramento and San Joaquin Valley watersheds going back to 1906 and 1901, respectively. For the purposes of this section, Dry water years are graphed with warmer colors and include Critical Dry, Dry, and any combination of Dry and Below Normal designations between the two indices. Normal water years are graphed in gray and include all combinations of Above

Normal and Below Normal across the two watershed indices. Wet years are graphed with colder colors and include all Wet years and combinations of Wet and Above Normal designations between the two indices.

At the beginning of Water Year 2021, daily-average specific conductance at HOL was already elevated, similar to five of the eight other most recent water years and including two Wet years (2017 and 2019). Daily-average specific conductance dropped between 400 and 600 µS/cm during the winter months (before February 1) for each previous water year except 2021 and 2014. In 2014, salinity climbed even higher than in any of the seven other most recent water years, reaching nearly 1,200 µS/cm in early February before gradually decreasing over the next few months. Most of the previous water years achieved a seasonal low salinity around June or July, with only the Wet years (2017 and 2019) staying at or below about 250 µS/cm through the end of the water year. Water Years 2016, 2018, and 2020 experienced a late-summer to early-fall increase in salinity levels due to the absence of adequate rainfall, snowmelt, or released supply to help keep levels lower.

Water Year 2015 saw an early-winter decrease in salinity at HOL, similar to Water Year 2017 (Figure 18) and reminiscent of a typical Wet year (**Figure 19**). However, unlike most other water years, including most other Dry designated water years, salinity began to rise much earlier in 2015, climbing almost 600 µS/cm over a month and a half and reaching a yearly high in May of just over 1,000 µS/cm (Figure 18). In 2015, the West False River EDB was installed, achieving hydraulic closure of False River on May 28, 2015, with salinity levels gradually declining about 300 µS/cm over the next four months to drop below 700 µS/cm in early September before climbing slowly to reach about 750 µS/cm by the end of Water Year 2015 (Figure 18).

Water Year 2021 saw salinity at HOL stay above 800 µS/cm until early February, when it finally began to gradually decrease (Figure 18), more similar in appearance to a typical Normal or Dry year at HOL (Figure 19). Unlike Water Year 2015, salinity in 2021 reached its lowest levels later in the year, around the beginning of May, before climbing sharply over the next month and a half. Salinity then reached a seasonal high of just over 800 µS/cm in June, somewhat lower than the salinity peaks around the same time seen in Water Years 2014 and 2015 (Figure 18).

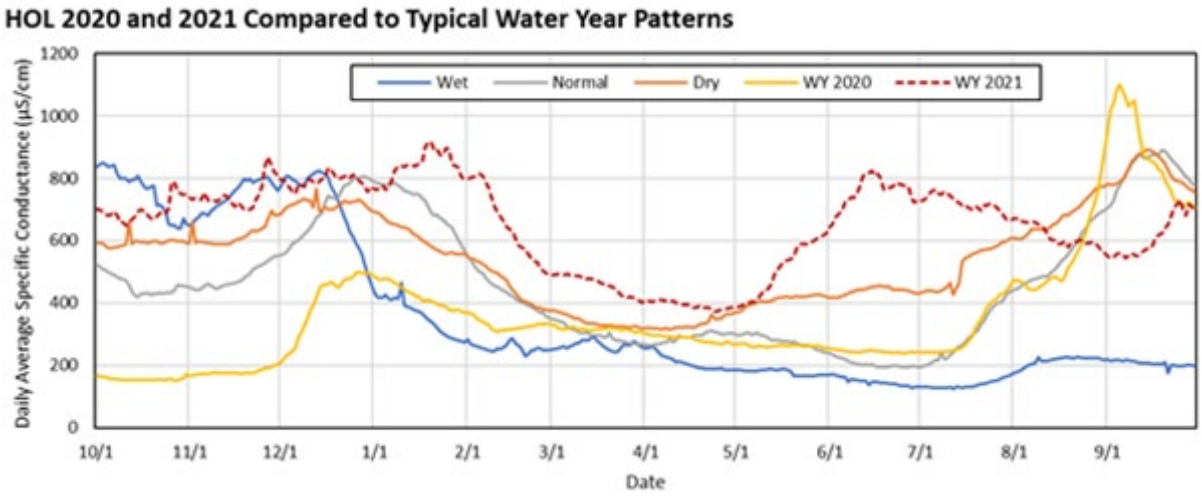


Figure 19 Daily-average specific conductance at Holland Cut near Bethel Island in Water Years 2020 and 2021, compared to averages for a given day combined within water year type since the station's installation in 2005.

In 2021, the West False River EDB was installed once again, achieving hydraulic closure of False River on June 18, 2021. As in Water Year 2015, upon installation of the barrier in False River, salinity levels began to decrease gradually, dropping to about 550 µS/cm by early September and then climbing once more to reach about 700 µS/cm by the end of Water Year 2021 (Figure 18).

2.2.4 Hydrodynamics

Installation of the 2021–2022 EDB within West False River had a notable impact on hydrodynamics, particularly in the channels nearest to the EDB. This discussion focuses on changes attributable to installation of the EDB on water levels, velocities, and flows, measured by five of the six flow monitoring stations in channels immediately adjacent to Franks Tract. Less of this discussion will pertain to the FAL monitoring station because the data feed for velocity and flow was stopped on June 14 during barrier construction, because no flow rating exists for FAL during barrier-in conditions. **Figure 20** shows the general area of discussion.

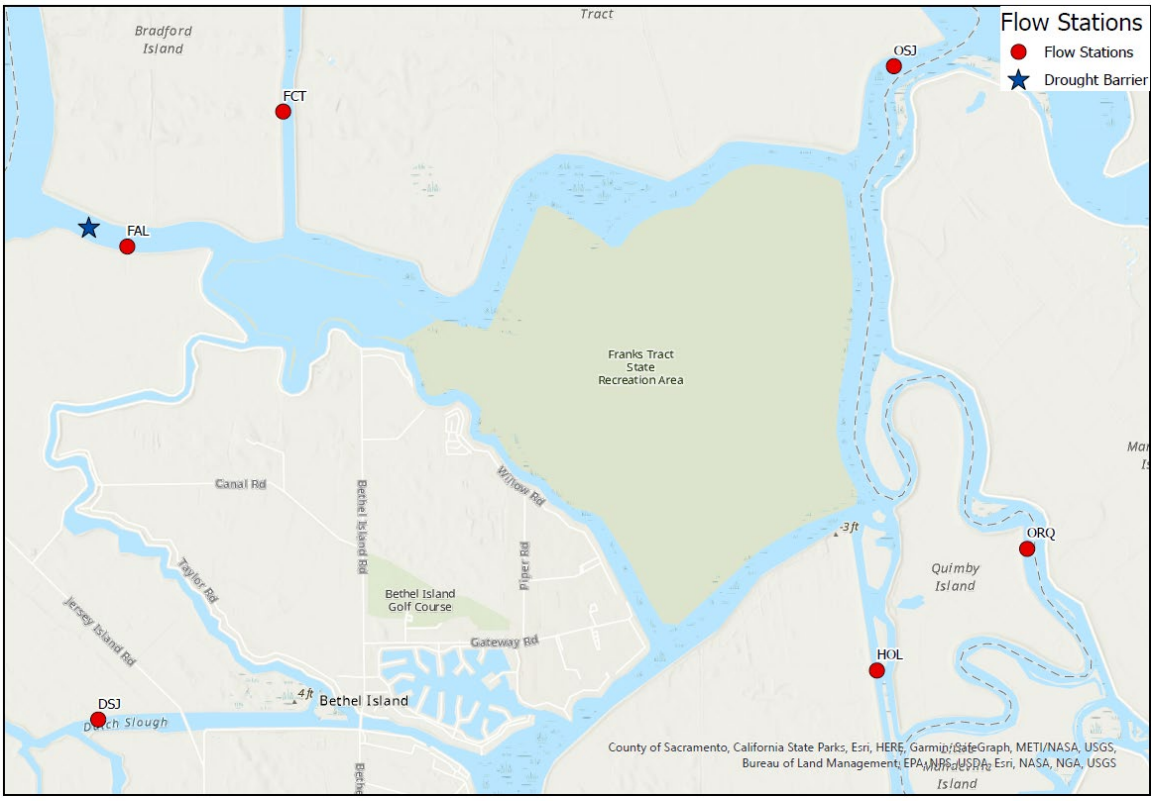


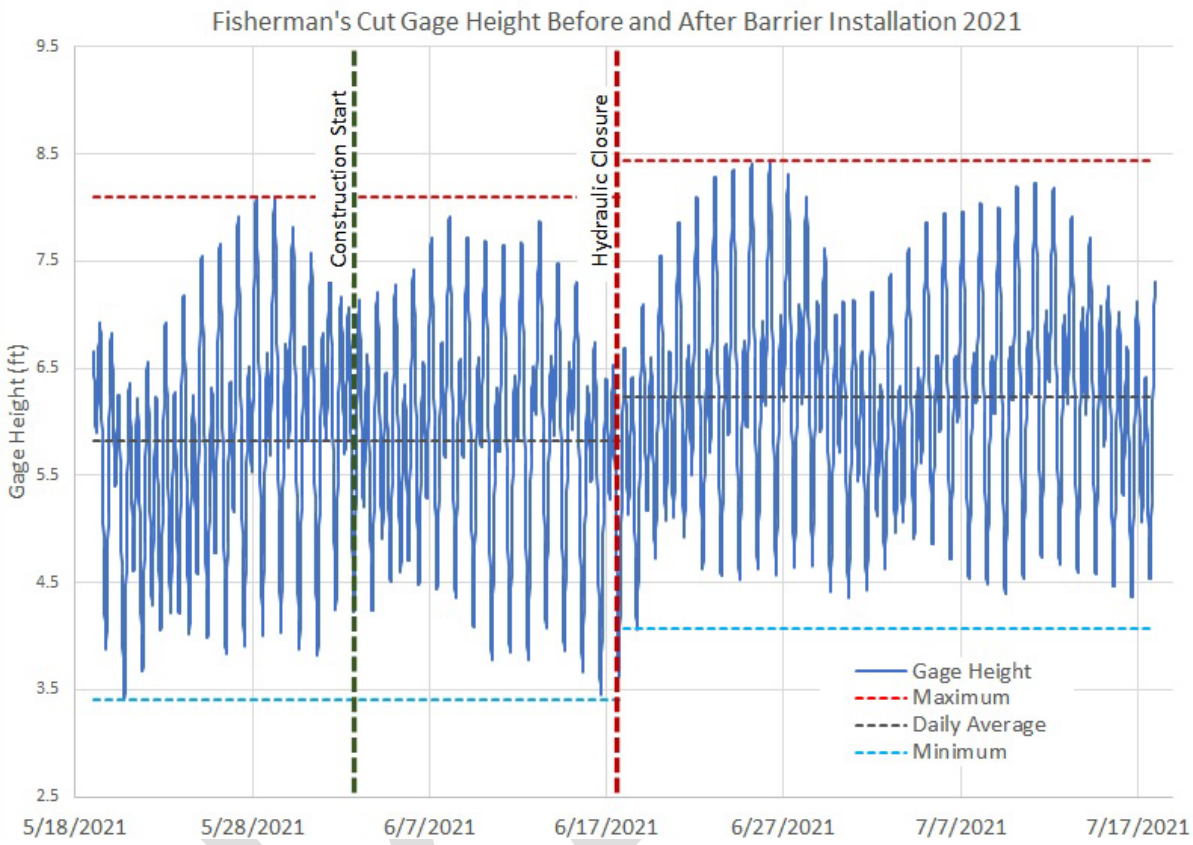
Figure 20 Six flow monitoring stations in channels adjacent to Franks Tract.

Water Level

Delta water levels are affected by tidal forces, inflows and exports, atmospheric pressure, and nearby hydrographic conditions. To examine the barrier's effect on water levels, the analysis evaluated a 60-day period around which the hydraulic closure occurred. This evaluation of the effect of water levels does not eliminate effects from the other sources, but it does reduce them to provide a representation of the effect and overall scale of effect compared to other stations. In 2021, the barrier was hydraulically closed on June 18, and the analysis evaluated the period between May 19 and July 18, 2021. In 2015, the barrier was hydraulically closed on May 28, and the analysis evaluated the period between April 28 and June 27, 2015.

Water levels measured at the six stations near Franks Tract appear to have slightly increased after the hydraulic closure of the 2021–2022 EDB. **Figure 21** shows the 15-minute gage height for Fisherman's Cut, where water levels appear to increase as a result of the installation of

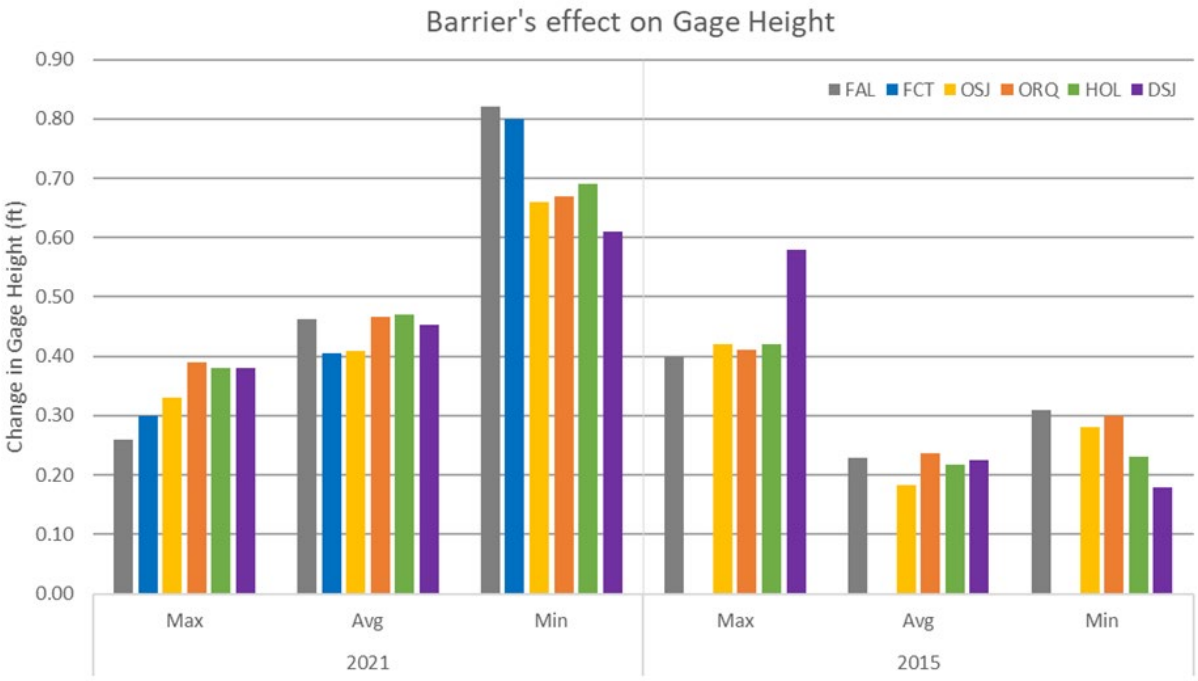
the barrier. The tidal lows appear to be more affected than the averages and tidal highs.



NOTE: Chart includes lines showing the maximum, minimum, and daily average for both the period before and after hydraulic closure.

Figure 21 Fisherman's Cut 15-minute gage heights 30 days before and after hydraulic closure.

This can be seen across the six stations immediately surrounding Franks Tract, but the magnitude of change is different as shown in **Figure 22**. Figure 22 also compares the data from 2021 to those from 2015. Data from 2015 show a similar increase in water levels, but tidal highs and lows seem to have increased more similarly when compared to 2021.



NOTE: The maximum, minimum, and daily-average change in gage heights for 2021 and 2015 are shown here.

Figure 22 Effect of the barrier on water level at six stations immediately surrounding Franks Tract.

Velocity

Mean channel velocities measured at the six stations immediately surrounding Franks Tract all experienced some degree of change as a result of the installation of the EDB. Fisherman's Cut (FCT) was the most affected by the barrier. Baseline tidal velocities at FCT during the month before barrier construction ranged from +0.68 foot per second to –0.27 foot per second. Since the barrier was hydraulically closed on June 18, 2021, velocities have ranged by about ±3.3 ft/s, which is a five- to 12-fold increase depending upon the tidal phase. **Figure 23** shows how installation of the EDB affected velocities within Fisherman's Cut.

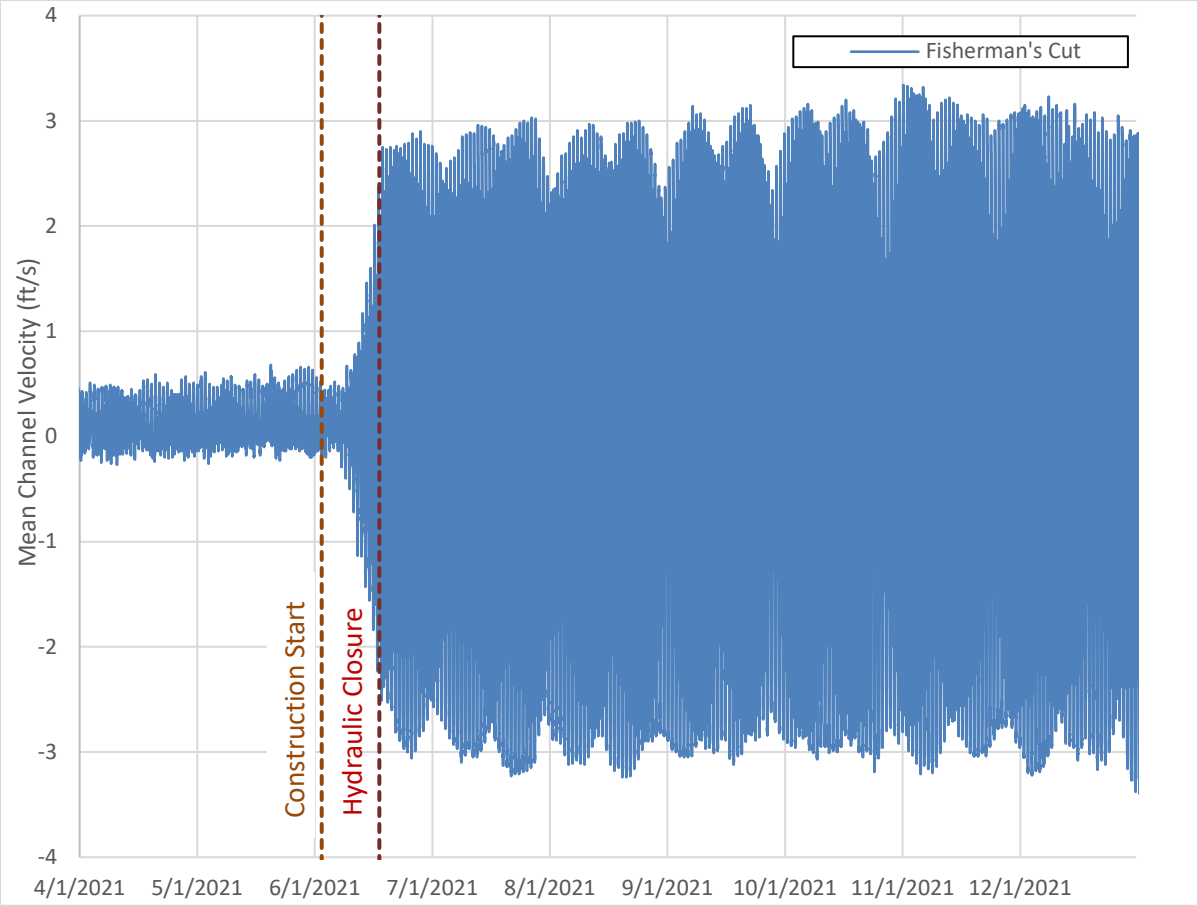


Figure 23 15-minute mean channel velocity data within Fisherman's Cut (April 1–December 31, 2021).

Additionally, the barrier effectively reverses the tide within Fisherman's Cut. As shown in **Figure 24**, without the barrier, water in Fisherman's Cut during an ebb tide (positive velocities) travels from the San Joaquin River south into False River, then westward in False River back into the San Joaquin River. Non-barrier flood tides (negative velocities) travel north in Fisherman's Cut from False River into the San Joaquin River. The barrier changes that dynamic completely (Figure 24) by crimping off flood flows from the San Joaquin River, which normally travel eastward through False River into Franks Tract. Flood tides instead travel farther upstream in the San Joaquin until they meet Fisherman's Cut and then travel south toward Franks Tract. Fisherman's Cut is such a narrow channel, relative to the size of the San Joaquin River, that a lot more flood-tide water flows into Franks Tract farther upstream along the San Joaquin River, past the OSJ monitoring station.

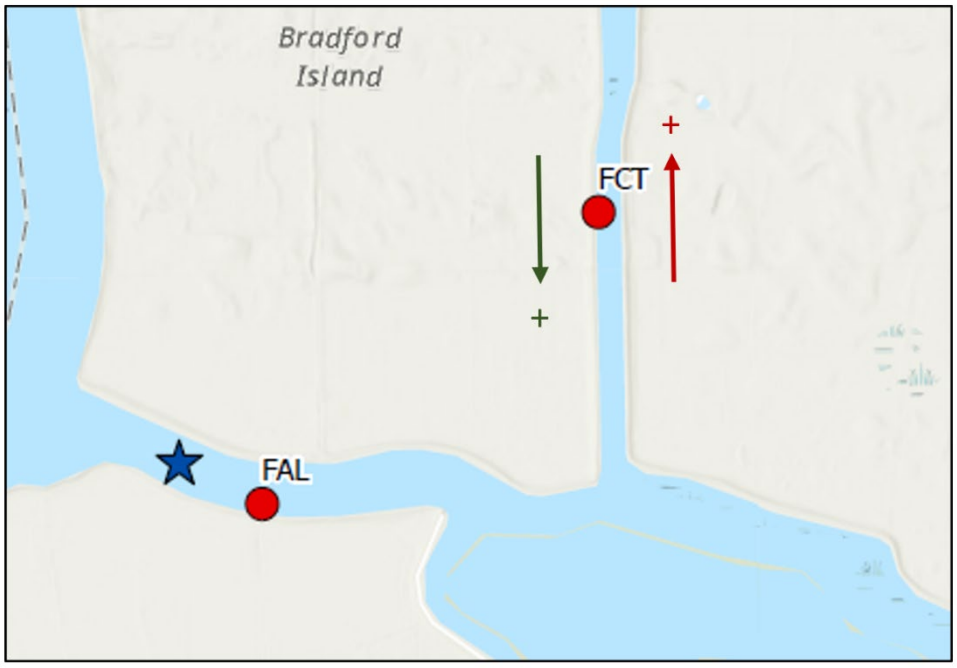


Figure 24 Pre-barrier positive (ebb) flow in green and post-barrier positive flow in red.

Velocities within the five unimpeded channels with flow monitoring stations adjacent to Franks Tract generally changed in the following ways after barrier installation:

- Increased velocities:
  - Fisherman's Cut (FCT): Approximate 8–23x increase in average velocities
  - Old River at Franks Tract near Terminous (OSJ): Approximate 1x to 2.5x increase in average velocities
  - Dutch Slough at Jersey Island (DSJ): Approximate 0.20x increase in average velocities
- Decreased velocities:
  - Holland Cut near Bethel Island (HOL): Approximate 0.25x decrease in average velocities
  - Old River at Quimby Island (ORQ): Approximate 0.30x decrease in average velocities

Thus, the closer a station is to the barrier, the greater the impact from the barrier.

2021 versus 2015 Barrier Conditions

A comparison of velocity data from 2021 versus 2015 barrier-in conditions showed no appreciable difference for the five stations that reported data (**Figure 25**). While subtle differences can be seen in the charts, these likely occur because in contrast with the 2015 barrier, the 2021–2022 EDB was not removed in the fall.

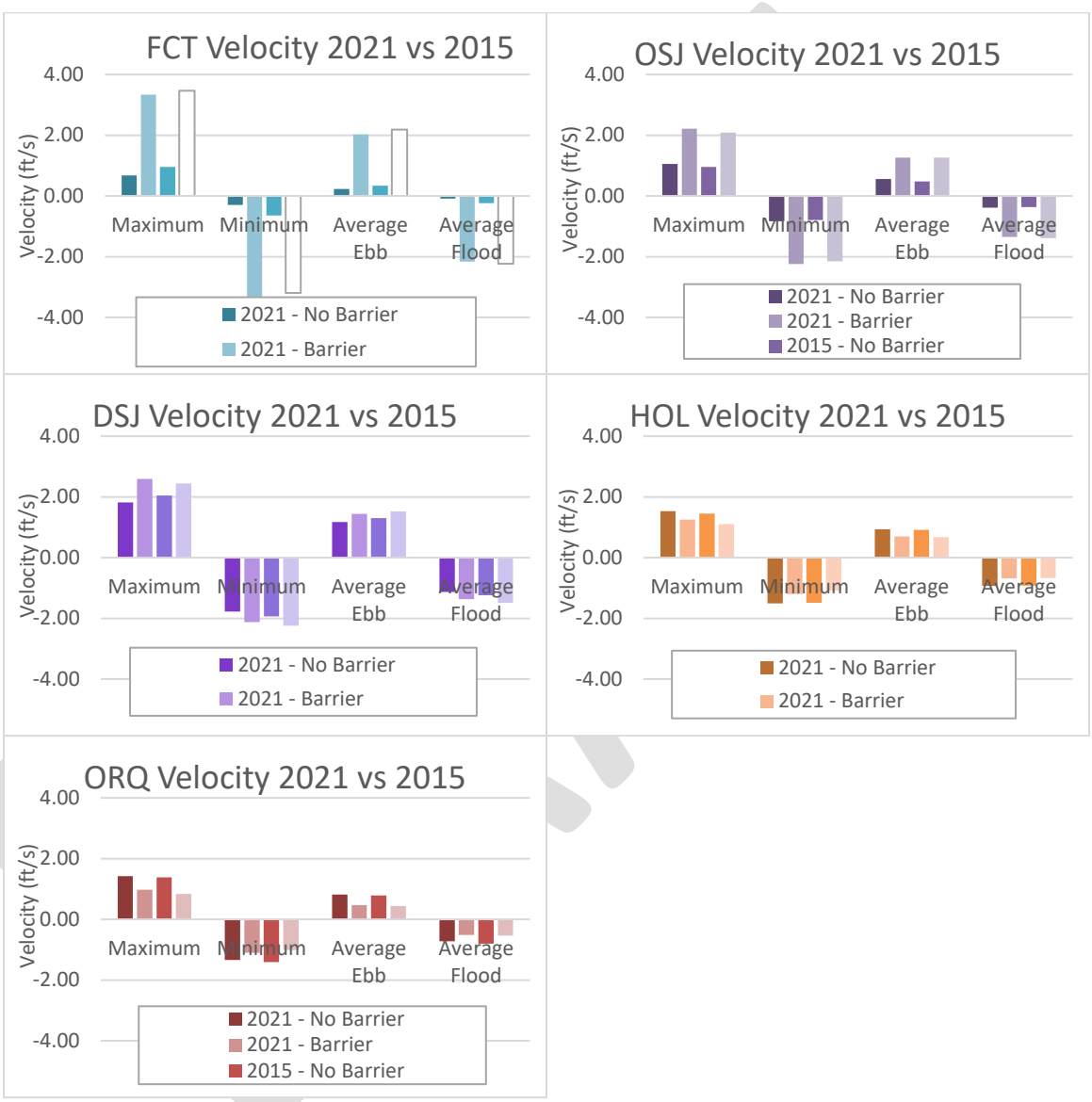


Figure 25 Comparison of maximum, minimum, and average velocity differences between 2021 and 2015 for five monitoring stations adjacent to Franks Tract.

Flow

Unimpeded flows past the FAL flow station, just upstream of the EDB, tidally range by about ±60,000 cfs. Once the EDB was hydraulically closed, flows leaking through the rock barrier in False River were about ±2,100 cfs. This was confirmed by flow measurements made just upstream of the barrier on July 7, 2021, during a peak flood spring tide. The remainder of that flow redistributed into other channels approaching Franks Tract. The charts in **Figure 26** provide perspective indicating how the barrier affected flows in the five unimpeded channels connected to Franks Tract.

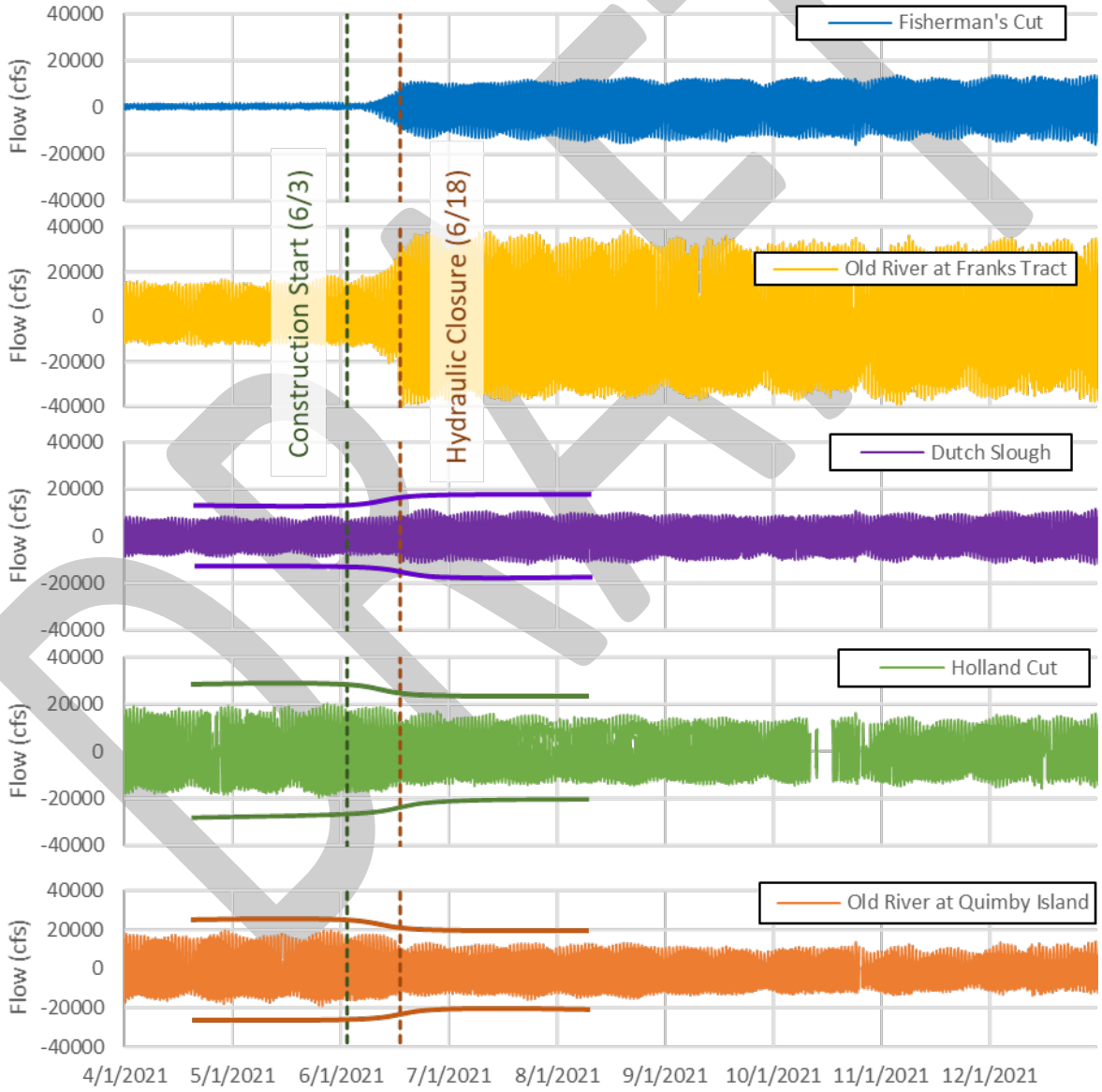


Figure 26 15-minute flow data for five stations affected by the emergency drought barrier (April 1–December 31, 2021).

The proportional changes in flows are very similar to the changes seen in velocities at each of these stations as a result of the barrier installation. Fisherman's Cut and Old River at Franks Tract saw significantly increased flows as a result of the barrier. Dutch Slough saw a slight increase in flows, while Holland Cut and Old River at Quimby Island saw slight decreases in flows. The following general changes occurred:

- Increased flows:
  - Fisherman's Cut (FCT): Approximate 10–25x increase in average flows
  - Old River at Franks Tract near Terminous (OSJ): Approximate 1x to 2.5x increase in average flows
  - Dutch Slough at Jersey Island (DSJ): Approximate 0.25x increase in average flows
- Decreased flows:
  - Holland Cut near Bethel Island (HOL): Approximate 0.25x decrease in average flows
  - Old River at Quimby Island (ORQ): Approximate 0.30x decrease in average flows

2021 versus 2015 Barrier Conditions

As with the velocity data, a comparison of 2021 flow data to 2015 barrier-in conditions revealed no appreciable differences for the five stations' reporting data.

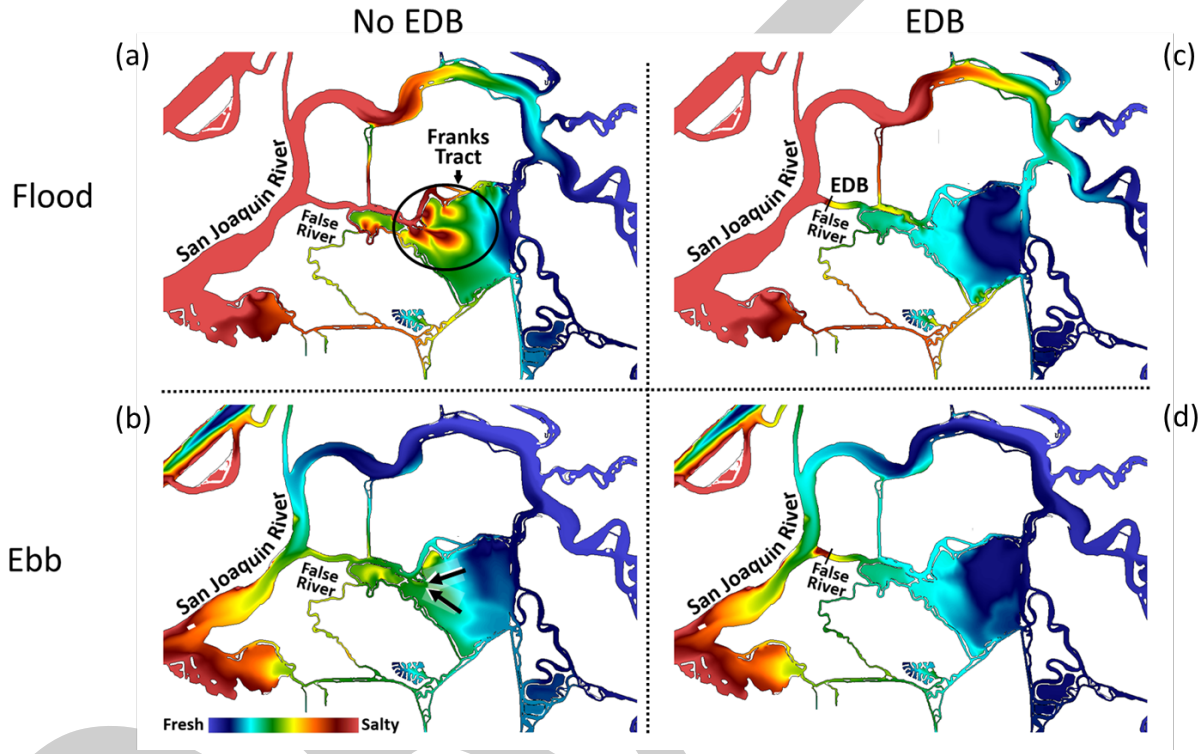
2.2.5 Flux and Dispersion

Tidal Pumping Concept

Figure 27 is a conceptual illustration of why False River and Franks Tract are so critical to salinity intrusion into the Central Delta; it also illustrates how the EDB disrupts the salinity intrusion process.

The mechanism driving most salinity dispersion at Franks Tract is called "tidal pumping." In Panel (a) of Figure 27, a current of higher salinity (red) water can be seen entering Franks Tract from False River on flood tide in what hydrodynamics modelers refer to as a *jet*; the feature is circled. Salinity that enters during flood tide originates from farther west in the estuary, so in summer, it is saltier than the ambient water in Franks Tract itself. By contrast, in Panel (b) of Figure 27, the return flow from Franks Tract on ebb tide is fresher

(blue and green) because the incoming tide will have mixed and become diluted in Franks Tract, and also because the ebb tide is drawn radially from a broader area. Taken together, the saltier flood and fresher ebb combine to act like a pump for salt: Even if the volume of flow is the same in both directions, the asymmetry between flood and ebb accumulates and causes a net transport of salt into the Central Delta.



NOTE: Panels (a) and (b) show flood (incoming) and ebb (outgoing) tide without the EDB. Panels (c) and (d) show the same tide cycle with the barrier.

Figure 27 Illustration of tidal pumping at Franks Tract using simulation results from 2021.

The EDB shuts down this tidal action. Panels (c) and (d) of Figure 27 demonstrate the same tidal cycle in Franks Tract with the EDB. The importance of False River's jet flow is greatly reduced. With the EDB, the main pathway for tidal mixing into Franks Tract is on Old River through its connection to the San Joaquin River just northeast of Franks Tract. Because this location is upstream of False River, farther from the ocean and more influenced by the Mokelumne River and DCC, it tends to be lower in salinity than either False River or Franks Tract. Any tidal pumping at this location tends to exert a freshening effect.

One important characteristic about tidal pumping is that it is entirely tide- and landscape-driven rather than net flow–driven. This

distinguishes the EDB from the DCC and other barriers proposed for the North Delta, which depend in large part on redirecting net flow, a limited resource.

Changes in Tidal Hydrodynamics and Dispersive Mixing Potential Caused by the Emergency Drought Barrier

Introduction

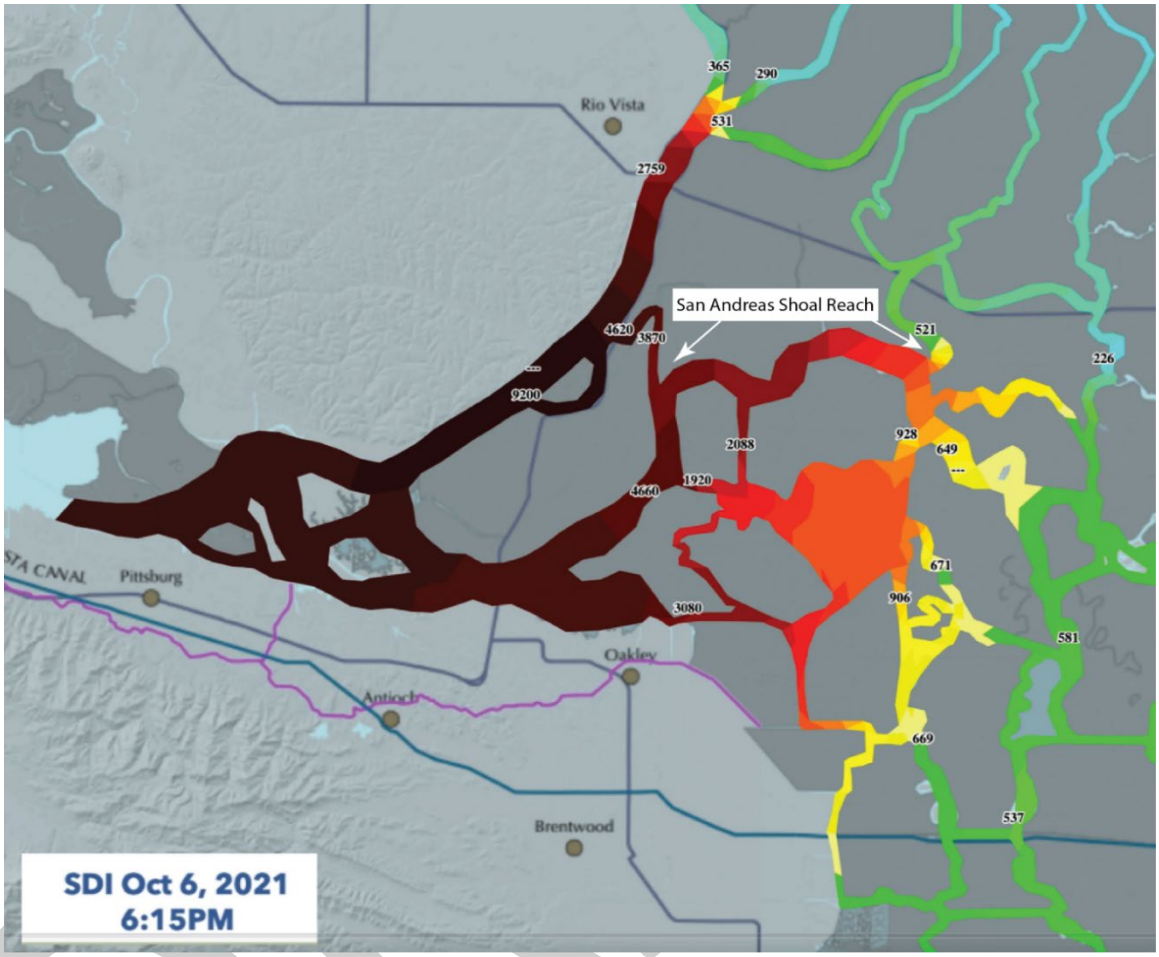
This section begins with a series of heat maps (stills) from an animation of the salt field (courtesy of 34North) that shows the evolution of the salt field over the period the barrier was installed. These plots show the salt field at a constant point in tide, slack after the maximum flood tide, when salt is as far into the Delta on any given tidal day.

The first heat map shown (**Figure 28**, October 6, 2021) begins with salt starting to disperse and mix into Franks Tract through Fisherman's Cut and Old River at OSJ after a period, starting on September 9, 2021, when the DCC gates were intermittently closed. This followed a prolonged period with the DCC gates open that started on approximately June 16, 2021 (**Figure 29**), roughly coincident with the official closure of the EDB on June 18, 2021.

Then, an atmospheric river moved through the Sacramento and San Joaquin River watersheds, increasing flows and pushing salt seaward (**Figure 30**, November 1, 2021). This was followed by another intrusion event, precipitated in part by intermittent periods of DCC closures (**Figure 31**, November 23, 2021). Figure 31 shows the conditions where the barrier demonstrably works effectively to keep salinity out of Franks Tract, even though salt is dispersively mixing salt into Franks Tract through Fisherman's Cut because there is a spatial gradient in salinity from the San Joaquin River to Franks Tract (discussed in detail below). Salt roars back again and begins to dispersively mix into Franks Tract from both Fisherman's Cut and Old River at OSJ (**Figure 32**), in part because of significant periods when the DCC gates were closed (Figure 29). Finally, another atmospheric river arrives and salt is again pushed seaward (**Figure 33**, January 1, 2022).

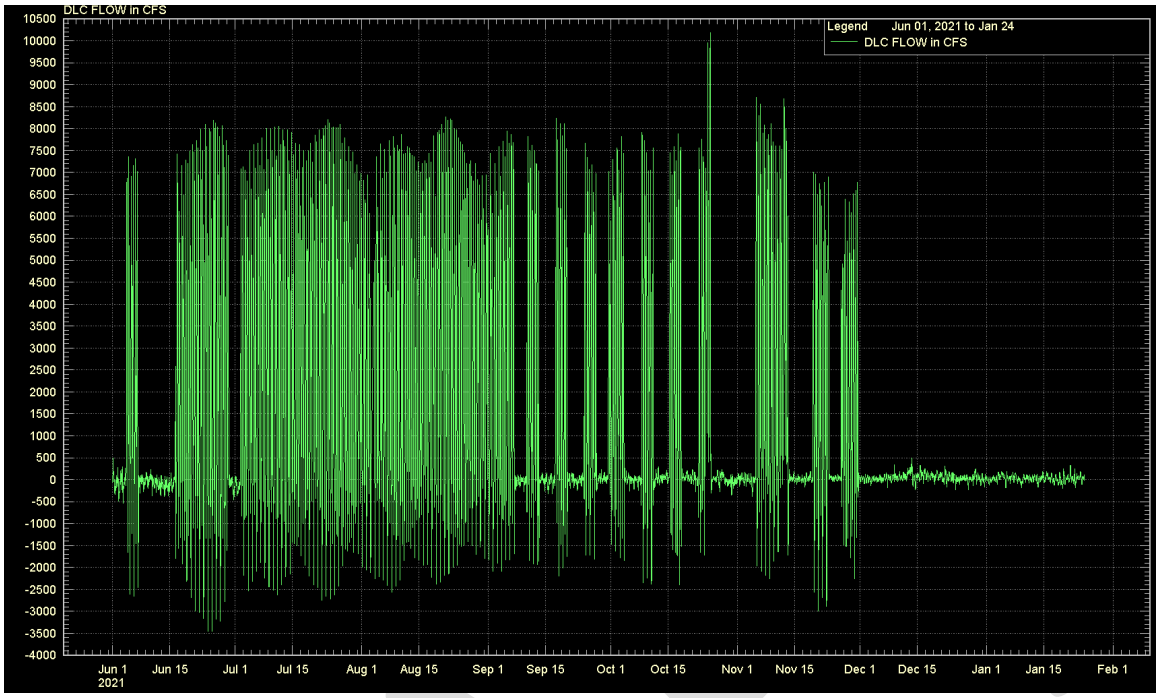
While these heat maps provide a sense of the big-picture movements of the salt field, one of the most important possible hydrodynamic and ecological consequences of the EDB is a change in the dispersive transport of constituents (e.g., salinity, turbidity) and organisms (e.g., phytoplankton and zooplankton, juvenile salmon, Delta Smelt) in the channels adjacent to Franks Tract. Even though these changes

cannot be quantified because they are not measured in sufficient detail to do so, gradients in constituents and organisms in the Franks Tract region will be transported by these changes.



NOTE: In this example, salt is starting to dispersively mix into Franks Tract through Fisherman's Cut and Old River at OSJ after a period when the DCC was intermittently closed starting on September 9, 2021, after a prolonged period with the gate open starting on approximately June 16, 2021, roughly coincident with the official closure of the EDB on June 18, 2021.

Figure 28 Heat map of the salt field (warmer/darker colors = high salinity, blues = lower salinities).



NOTE: Periods of roughly zero represent periods when the gate was closed; all other periods represent open periods.

Figure 29 Discharge (flow) time series measured in the Delta Cross Channel.

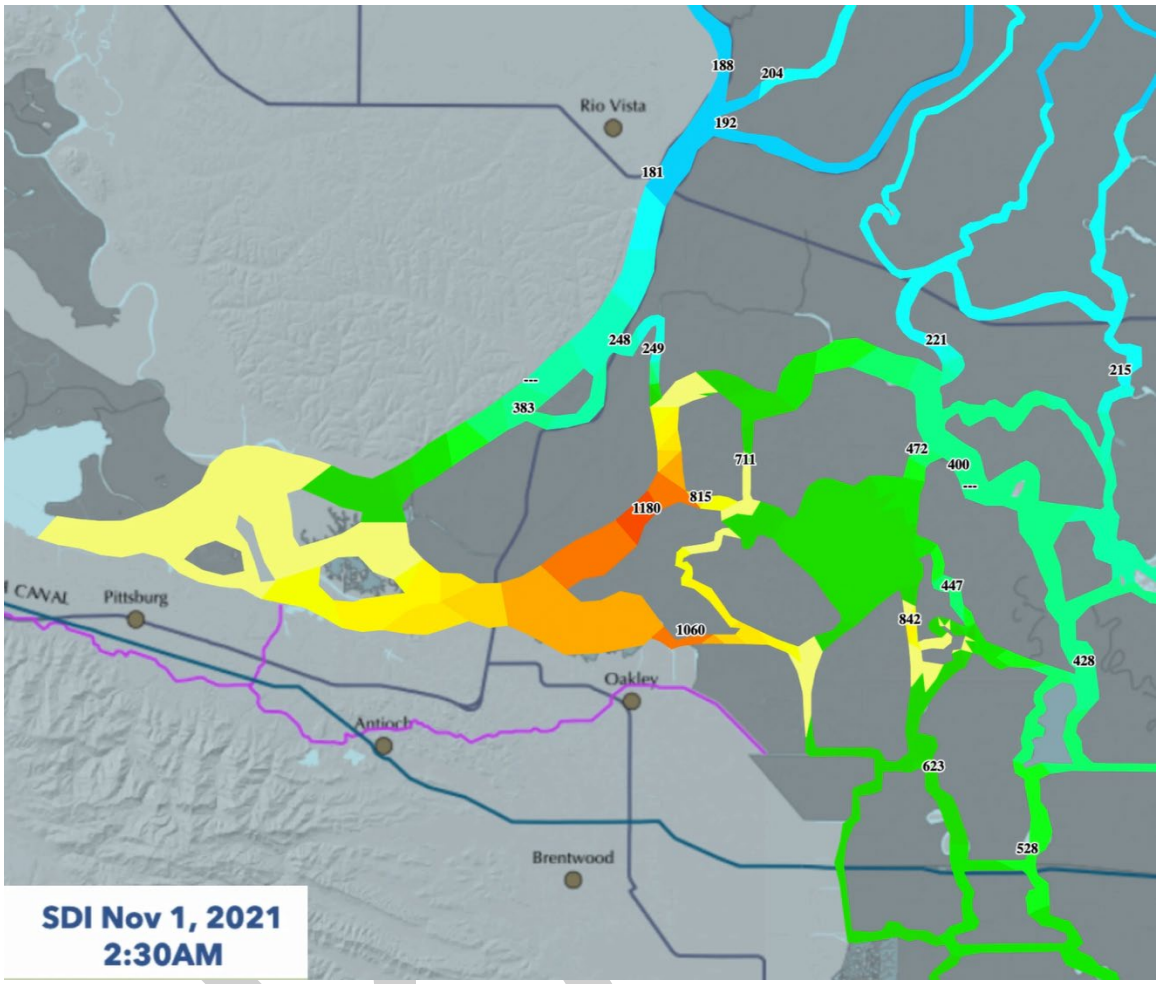
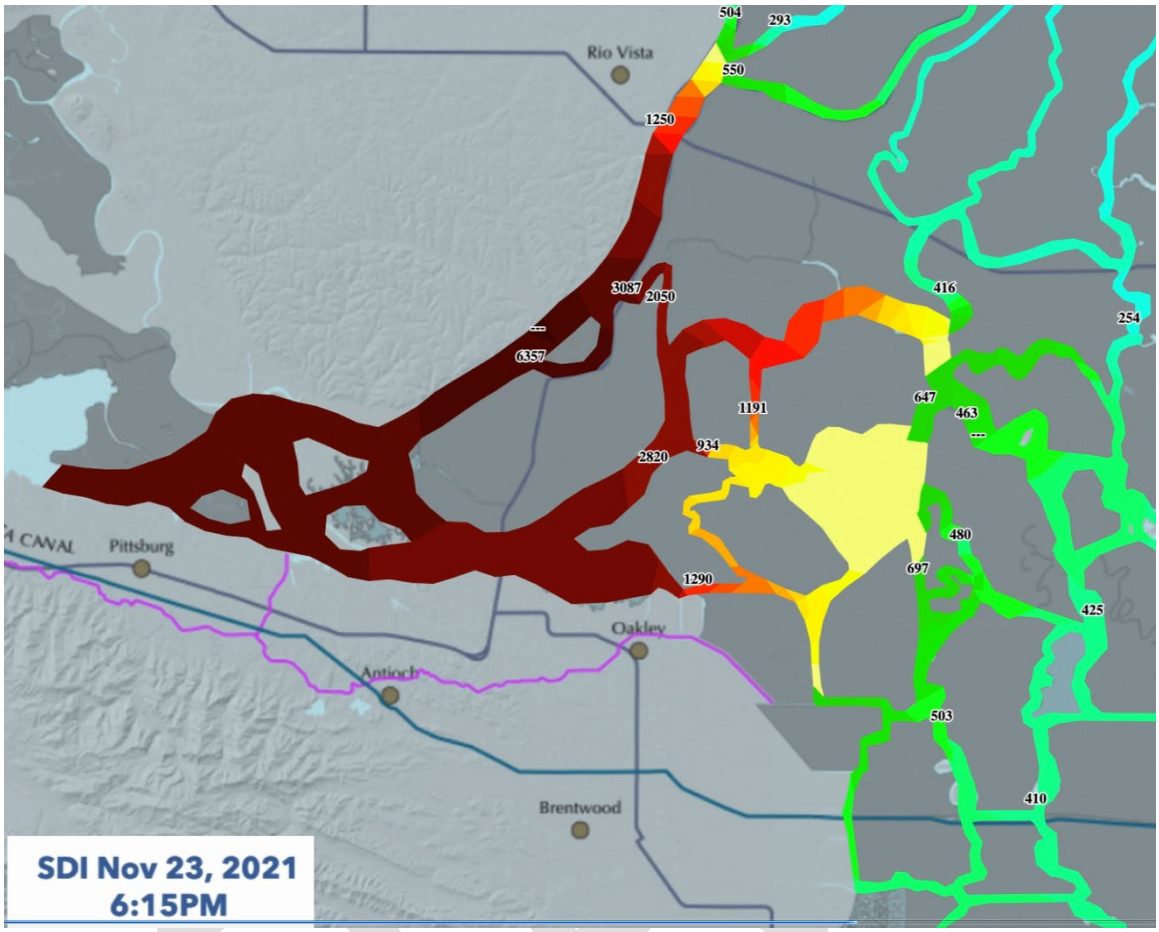


Figure 30 Heat map of the salt field, with salinity pushed out of the system following an atmospheric river.



NOTE: The EDB is effectively keeping salt out of Franks Tract; nevertheless, a relatively small amount of salt is dispersively mixing into Franks Tract through Fisherman's Cut.

Figure 31 Heat map of the salt field after the salt field has intruded into the Delta after being pushed out of the system by the atmospheric river.

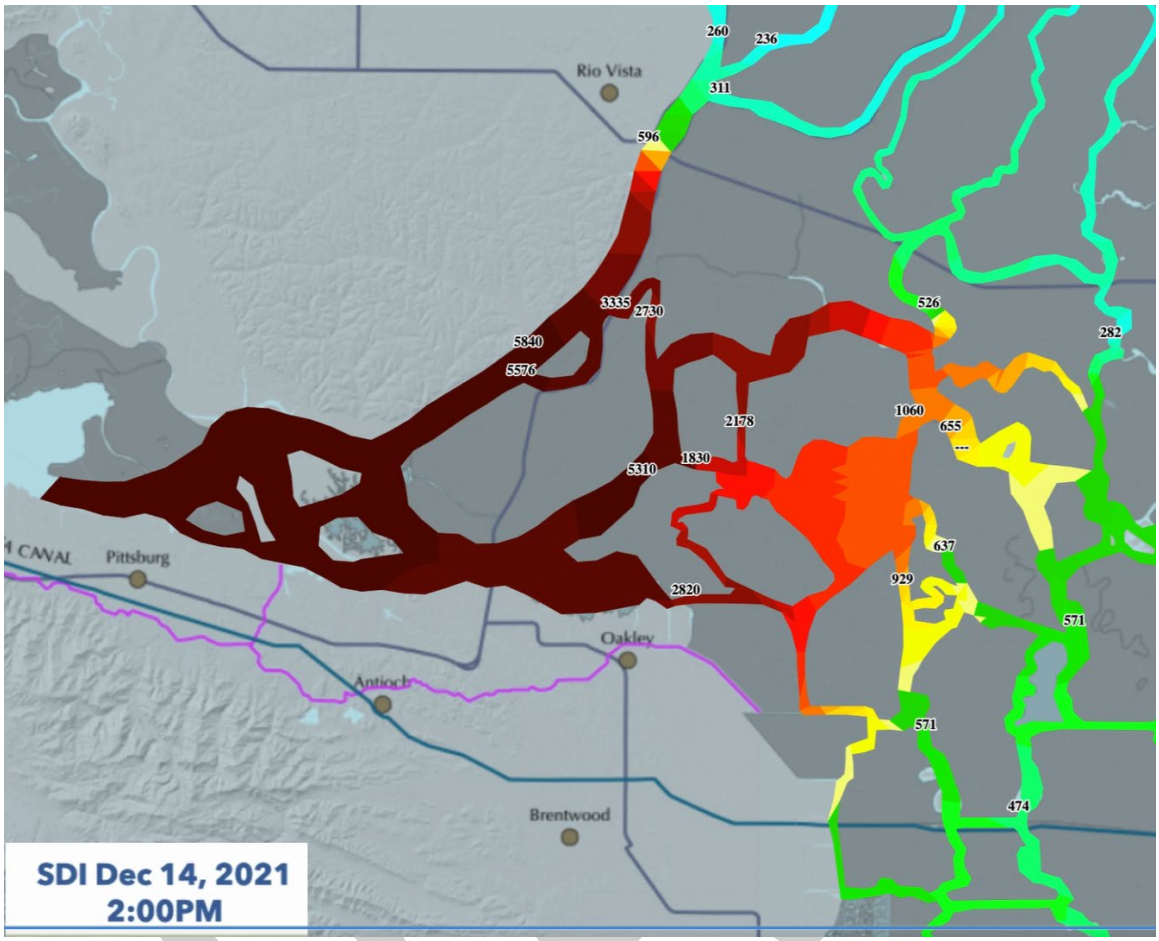


Figure 32 Heat map of the salt field, with salt again dispersing and mixing into Franks Tract through Fisherman's Cut and Old River at OSJ after another period of significant DCC closures.

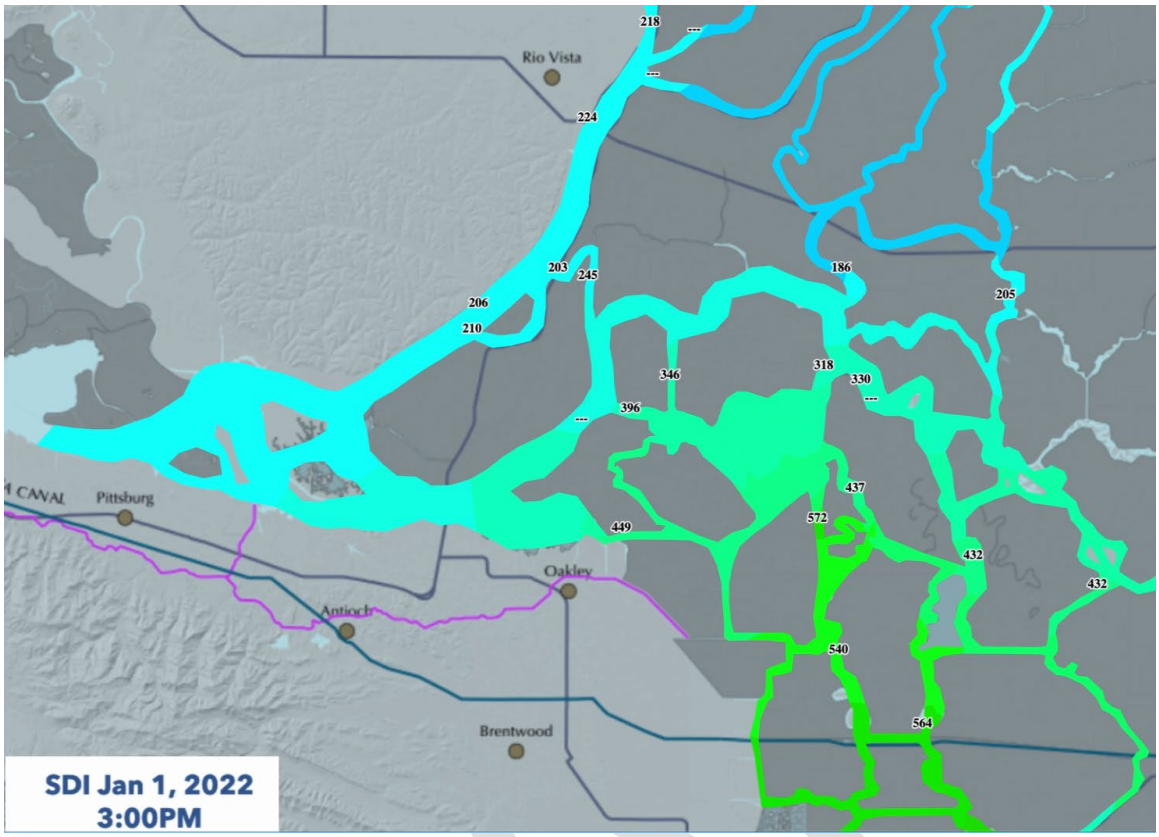


Figure 33 Heat map of the salt field, where salinity is pushed out of the system following another atmospheric river.

The following sections specifically discuss possible changes in transport in the San Joaquin River reach between False River (FAL) and Old River (OSJ), the so-called San Andreas Reach (Figure 28), and in the channels that exchange with Franks Tract; Fisherman's Cut (FCT), Old River at stations OSJ and ORQ and Holland Cut (HOL) (**Figure 34**), and the effect that operation of the DCC gates can have on transport of the salt in the San Andreas Shoal Reach. Transport in this reach is important because transport through it can lead to complete cessation of exports when salt begins to significantly dispersively mix into Franks Tract through Old River at OSJ. If this happens, Old River at OSJ will begin to act like False River, making it an alternative candidate for a barrier instead of, or in addition to barriers at Sutter and Steamboat sloughs.

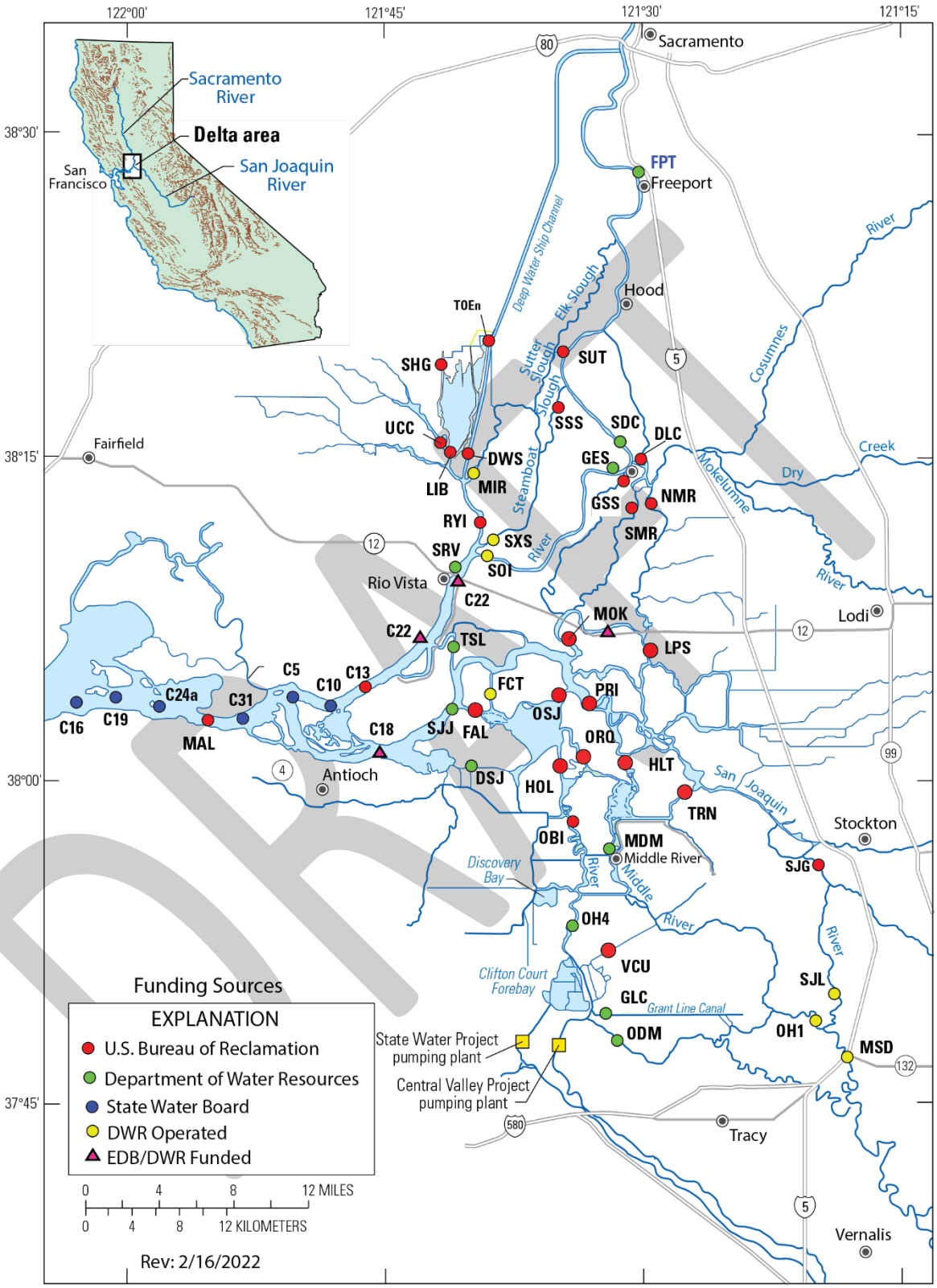


Figure 34 Delta map, with flow and water quality monitoring shown by dots colored by funding sources for the U.S. Geological Survey and by those stations operated by DWR.

Background

The time series for the transport of constituents past specific locations in the Delta can be computed as a flux at most of the monitoring stations in the Delta (Figure 34) simply as the product of the discharge, Q(t), and constituent concentration, C(t):

$$\text{Flux} = Q(t)*C(t) \quad (1)$$

There are two ways in which constituents are transported within the Delta's narrow, prismatic (lacking bathymetric variability) channels: either (1) through advection by the net (tidally averaged discharge) flow or (2) by dispersive mixing that occurs within a tidal excursion of the measurement location. The "tidal excursion" is the distance a parcel of water moves with the tidal currents on a single ebb or flood tide, usually taken as the maximum of each tide during a tidal day. "Dispersive mixing" in the Delta is either (1) channel network dispersion that occurs when the tidal excursion is longer than the channel length; or (2) in rare circumstances in wide Delta channels with bathymetric variability (such as the San Andreas Shoal Reach), a scenario in which the bathymetric variability creates lateral velocity shear, which mixes water with different concentrations within the channel.

The flux in Equation 1 can be decomposed into advective and dispersive components (Equation 3) by decomposing the discharge and concentration time series into tidally averaged (net) using a tidal filter and tidally fluctuating components:

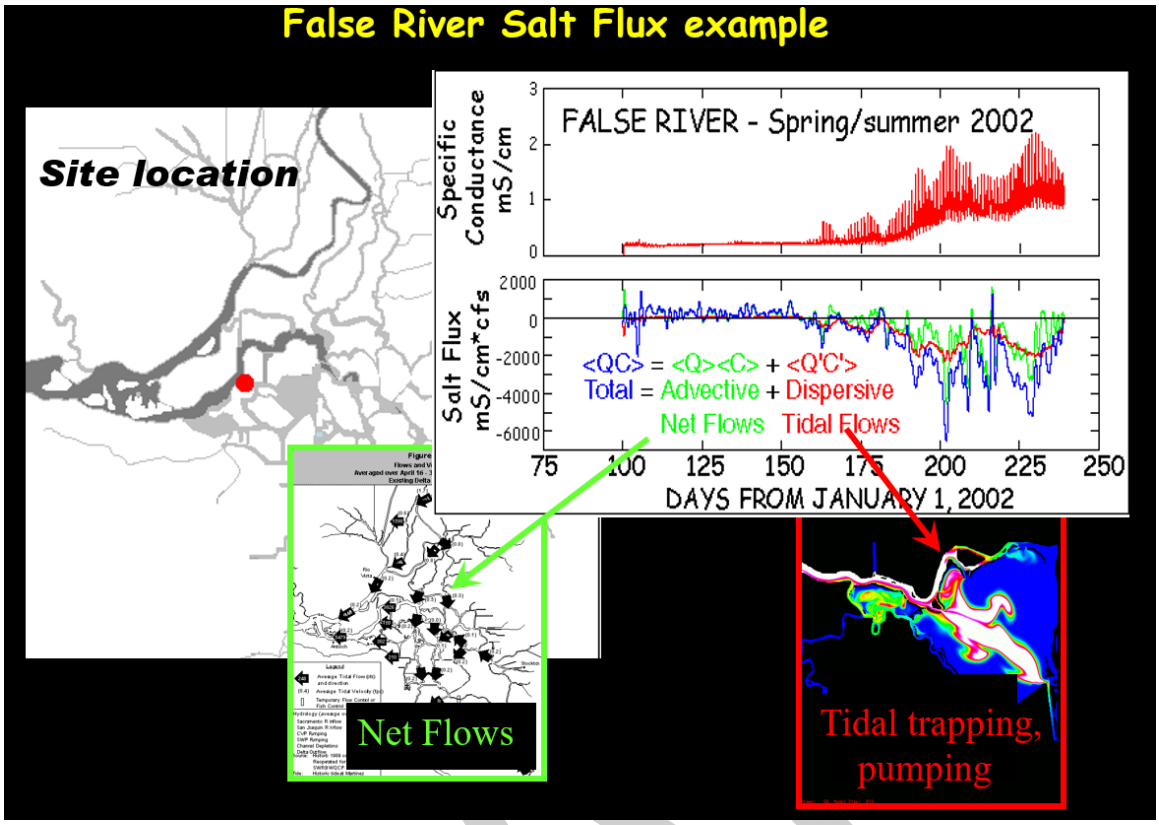
$$Q(t) = \langle Q(t)\rangle + Q'(t) \quad \text{and} \quad C(t) = \langle C(t)\rangle + C'(t) \quad (2)$$

$$\text{Flux} = Q(t)*C(t) = [\langle Q(t)\rangle + Q'(t)][\, C(t) = \langle C(t)\rangle + Q'(t)]$$

Multiplying terms and simplifying (and ignoring the cross terms, which are generally small):

$$\text{Flux} = \langle Q(t)\rangle\langle C(t)\rangle + \langle Q'(t)C'(t)\rangle \quad (3)$$

Where $\langle Q(t)\rangle\langle C(t)\rangle$ is the advective flux due to the net flow and $\langle Q'(t)C'(t)\rangle$ is due to the dispersive flux due to the tidal currents. See **Figure 35** for an example.



NOTE: This example shows the total flux in blue, with partitioning of the salt flux between advective (green) and dispersive flux (red).

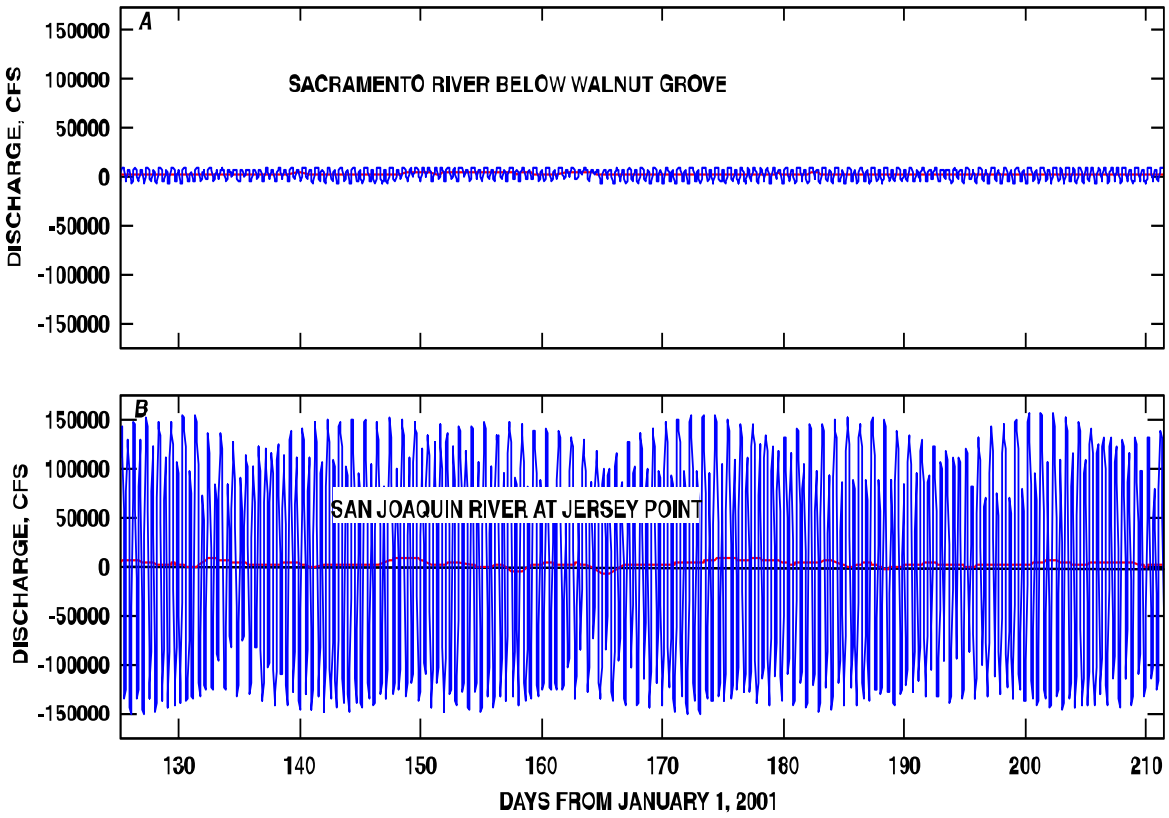
Figure 35 Example of flux decomposition in False River without the barrier.

Approach

Flux decompositions are likely to be computed (Equation 3) in a future, more comprehensive report. This section examines the potential for a large increase in the dispersive transport of constituents in the above-listed channels as a direct result of installation of the EDB, in both the intact and notched states. The reason that "potential" applies in this context is that unlike transport via the net flow, which depends on the direction of flow, dispersive transport past a given location depends on a constituent spatial gradient within a tidal excursion of that location: No constituent or organism spatial gradient within a tidal excursion, no dispersive flux.

This discussion is being limited to dispersive mixing because net flows in the Central Delta are always small compared to tidal flows (**Figure 36**), but they are especially small during droughts when river and export flows, which drive the net flows and advective flux, are at a bare minimum. Most importantly, if the Delta is "lost" to salt (e.g., exports from the Delta must cease), this condition will be caused

by the dispersive transport mechanisms discussed here when salt begins to move into the OSJ region (Figures 28 and 32), which will create the necessary spatial gradient that will drive tidal dispersive transports into Franks Tract.



NOTE: The blue line represents the tidal discharges and the red line represents the tidally averaged or net flow.

Figure 36 Comparison of discharge time series (A) in the Sacramento River below Walnut Grove, and (B) on the San Joaquin River at Jersey Point.

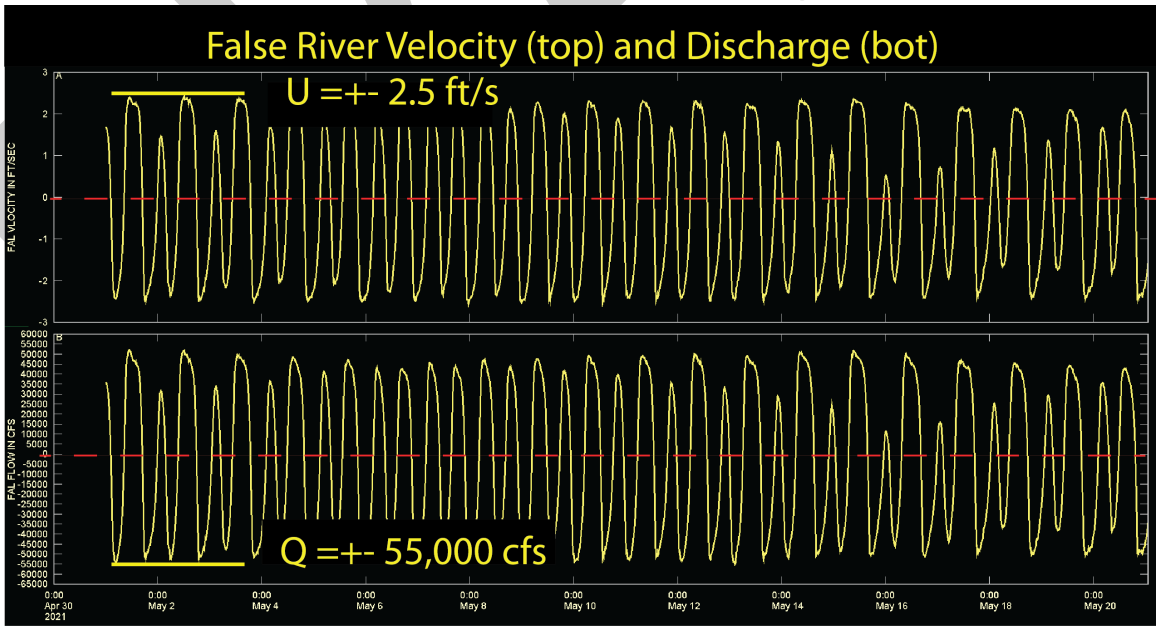
Tidal Currents/Excursion and Dispersive Mixing

The speeds of tidal currents in the Franks Tract region, coupled with the paths taken by water (e.g., the tidal excursion) relative to the local bathymetry, determine the extent to which dispersive transports are important for a given constituent gradient. Therefore, this analysis begins by looking at the effect the barrier had on the tidal currents. Remarkably, given the size and tidal discharges in False River, there was very little effect on channels in most of the Delta, except for the channels in the vicinity of Franks Tract.

Channels that Exchange with Franks Tract

First, the most dramatic effect of the EDB on hydrodynamics in the Franks Tract region was the virtually complete elimination of tidal discharges and tidal currents (±55,000 cfs and ±2.5 ft/s, respectively) that typically occur in False River (**Figure 37**). For all intents and purposes, constituent (salt) transport into Franks Tract was zero in False River when the barrier was in place (minor seepage). However, the EDB changed the tidal flows and velocities at four of the stations currently monitored that exchange with Franks Tract (**Figure 38**, **Figure 39**), which can increase dispersive mixing when tidal flows increase and can decrease when tidal velocities decrease. The tidal velocities and discharges in the northern channels *dramatically increased* with the installation of the barrier, where the tidal currents and discharges at FCT *increased* from U'(t)=±0.5 ft/s to U'(t)=±2.3 ft/s and Q'(t)=±1,400 cfs to Q'(t)=±12,000 cfs, and at OSJ from U'(t)=±1.0 ft/s to U'(t)=±2.4 ft/s and Q'(t)=±16,000 cfs to Q'(t)=±36,000 cfs.

At the same time, the southern channels' velocities and discharges *decreased* slightly, and the tidal currents and discharges *decreased* at HOL from U=±1.3 ft/s to U=±1.2 ft/s and Q'=±18,500 cfs to Q'=±14,500, and at ORQ from U=±1.2 ft/s to U=±0.8 ft/s and Q'=±16,700 cfs to Q'=±11,000 cfs. These decreases imply that there is less tidal exchange through Franks Tract with the barrier installed.



NOTE: Peak tidal current velocities ±2.5 ft/s and discharges of ±55,000 cfs.

Figure 37 Time series plots of (top) velocity and (bottom) discharge in False River when the barrier is not in place.

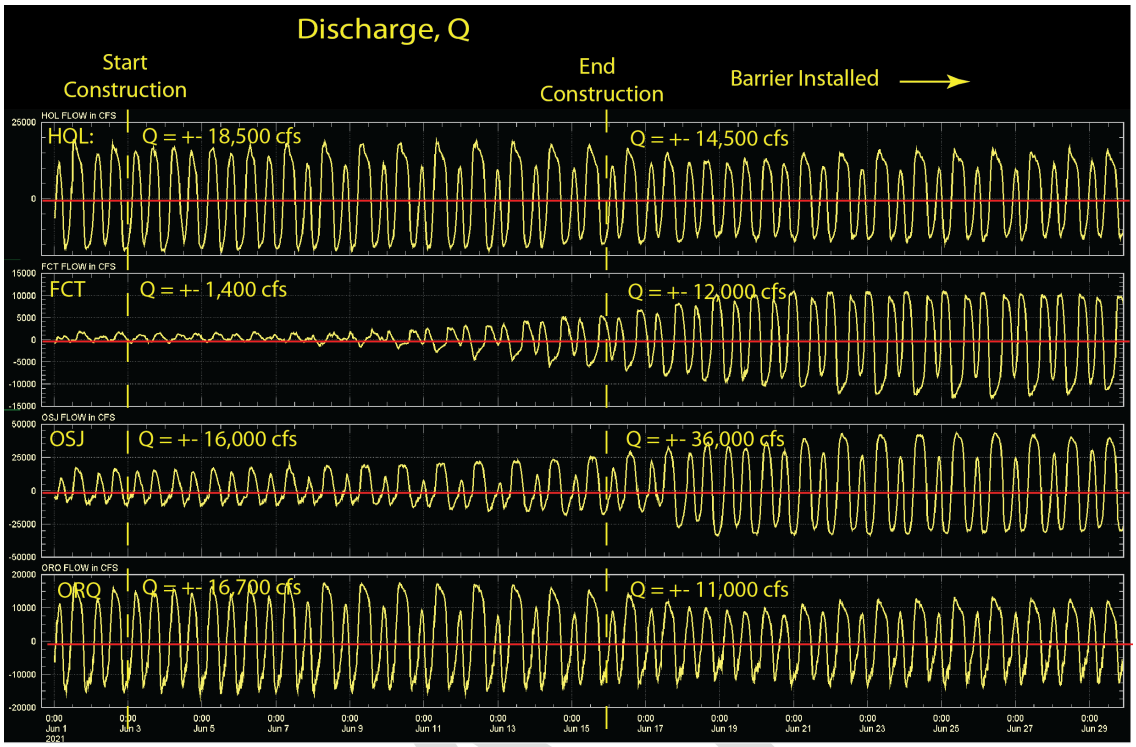


Figure 38 Time series plots of discharge at stations HOL (top), FCT (top middle), OSJ (bottom middle), and ORQ during the transition between no barrier in False River and barrier installed.

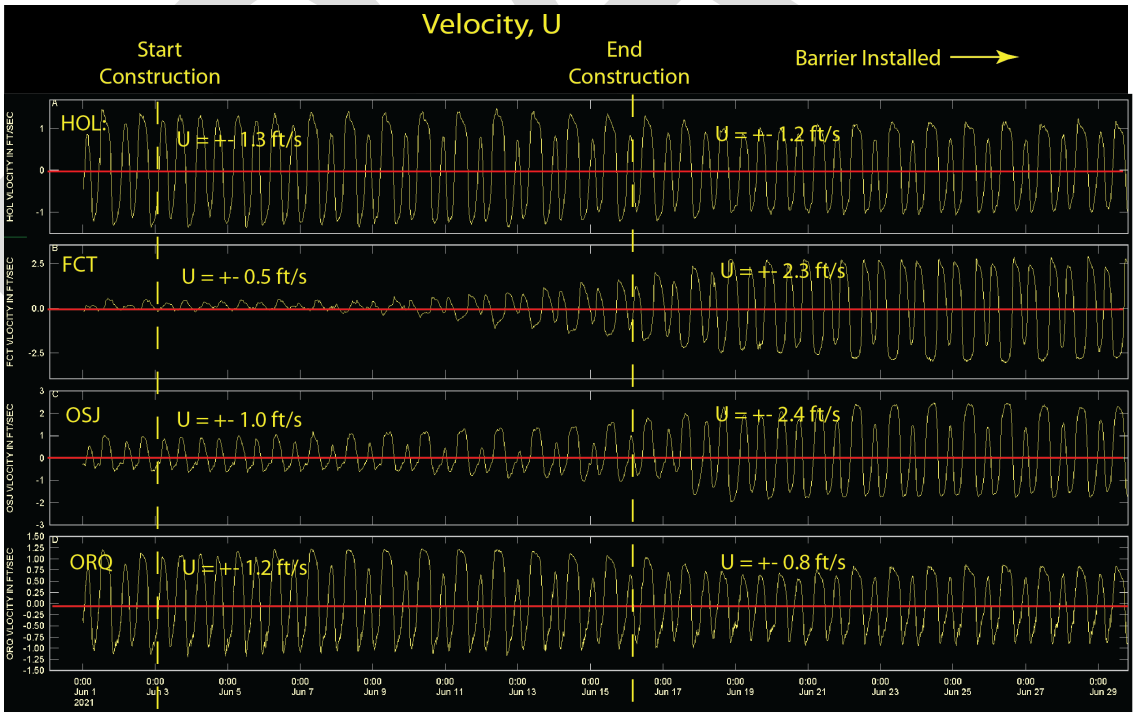


Figure 39 Time series plots of velocity at stations HOL (top), FCT (top middle), OSJ (bottom middle), and ORQ during the transition between no barrier in False River and barrier installed.

In summary, dispersive mixing in FCT and OSJ increased dramatically, while tidal exchange from Franks Tract into the corridor of Old and Middle rivers decreased slightly. Dispersive mixing can be especially important in channels that are shorter than their tidal excursion, the so-called "network dispersion," described in the next section. The bigger Q'(t) is in Equation 3, the greater the potential for dispersive flux; all that is needed is for C'(t) to be large. This occurs when there is a large spatial gradient in C(t) at the station. When the channel is short relative to the tidal excursion under these conditions, there is a perfect storm for exceptionally large dispersive flux, which is the case both in False River and at OSJ when salt is present.

LE Ratio: A Measure of Potential for Dispersive Transport

To examine the effect of network dispersion, this section introduces the Lagrangian/Eulerian ratio (LE ratio), the ratio of the tidal excursion to the channel length:

$$LE\ ratio = \frac{L_{ex}}{L_{ch}} = \frac{Tidal\ excursion}{Channel\ length} \quad (4)$$

Figure 40 shows a schematic of three different channel configurations in which the LE ratio is useful. Configuration (1) is a channel network in which (a) LE ratio is less than 1 (green arrow), which creates very little dispersive transport, and (b) LE ratio is greater than 1 (red arrow), where dispersive mixing can be large, especially if the channel empties into a large channel, or open water body, like Franks Tract. Configurations (2) and (3) in Figure 40 are outside the scope of this analysis. The shorter the green arrow relative to the channel length, the less dispersive transport occurs. In contrast, the greater the length of the tidal excursion beyond the length of the channel (the red arrow in the connecting channel), the greater the possibility of increased dispersive transport.

Thus, for example, the tidal excursion in Franks Tract is approximately 5.2 miles (all the way through False River and a spring tide all the way across Franks Tract, based on drifter data) (**Figure 41**). Its channel length is 3.0 miles, an LE ratio of 1.7 (i.e., the tidal excursion is 1.7 times greater than the channel length), which is indicative of a channel that is likely to have significant dispersive transport. This is the reason the barrier is necessary in Franks Tract during extreme droughts. Threemile Slough, another example shown in Figure 41, can also be highly dispersive when there is a spatial constituent gradient between the Sacramento and San Joaquin rivers.

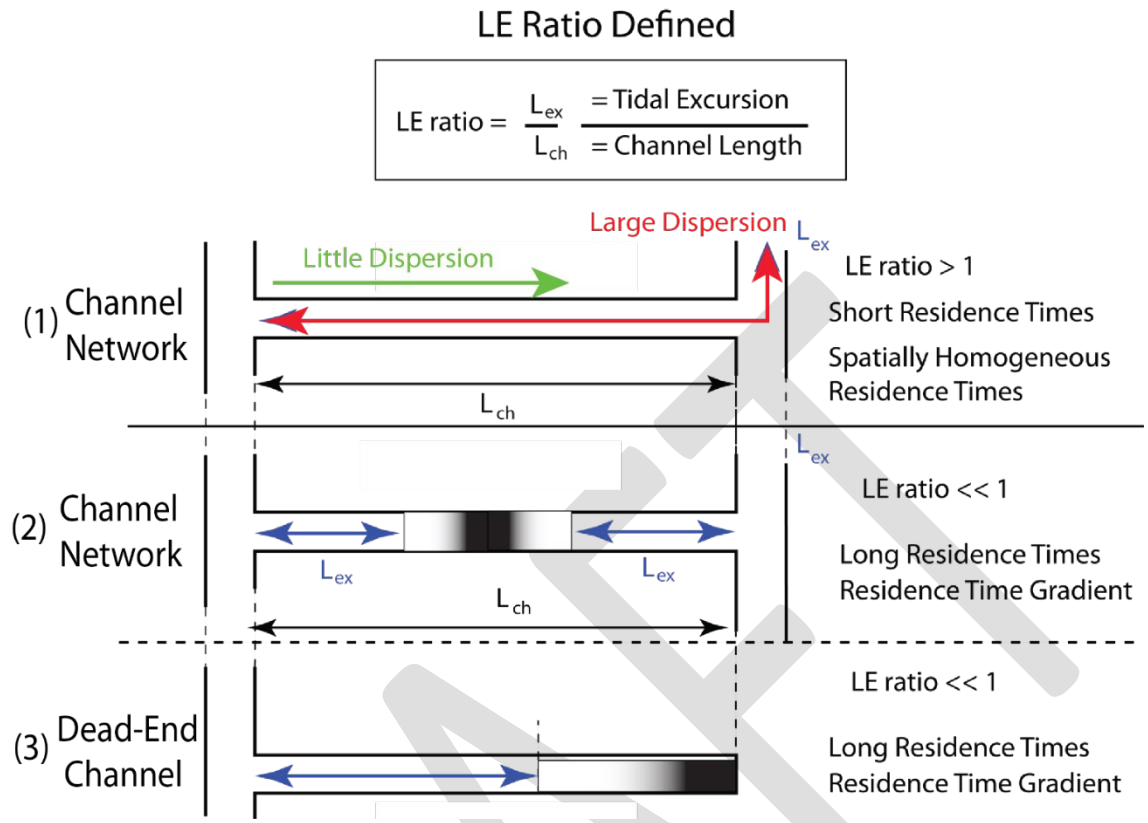


Figure 40 LE ratio defined, with three examples of channel systems where it can be relevant in characterizing network dispersion and residence times.

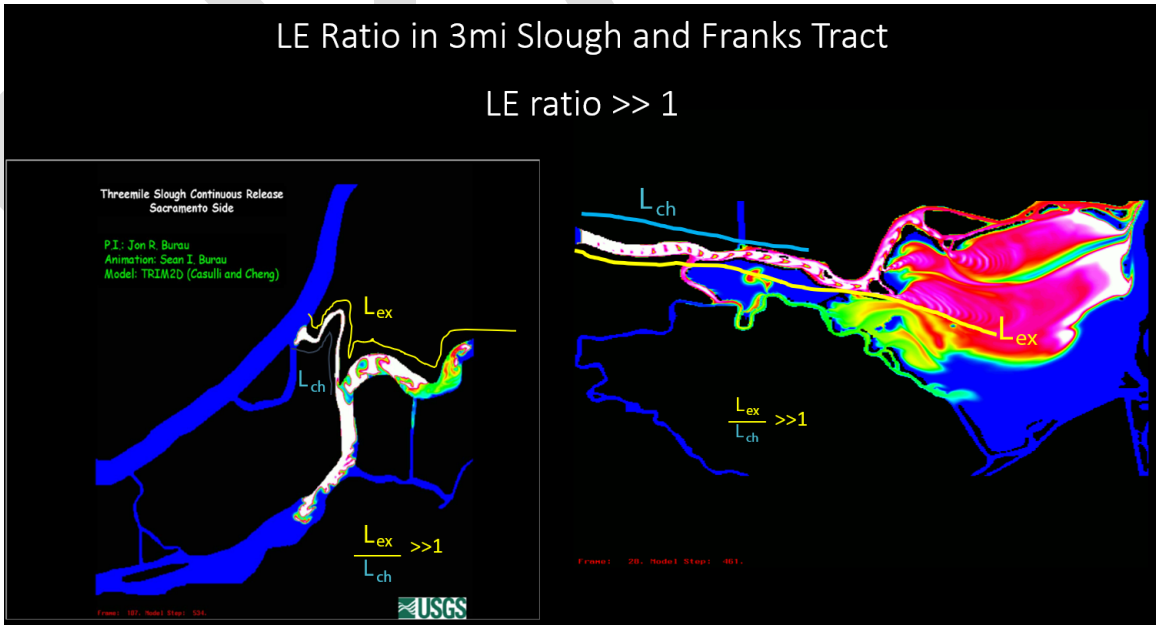


Figure 41 Heat maps of dye releases in numerical model simulations in Threemile Slough (left) and Franks Tract where the tidal excursion (yellow line) and channel length (cyan line) are shown.

Both Fisherman's Cut (FCT on Figure 34) and Old River at OSJ also have short channel lengths relative to their tidal excursions, which can be estimated using the peak in the tidal velocities measured at the gages in these channels using the following relationship:

$$L_{ex} = \int_{t_0}^{t_1} u(t)\, dt \quad (5)$$

where t_0 is the time of slack water and t_1 is the next slack water. Tidal excursion estimates based on Eulerian measures are easy to calculate and are reasonably good first-order estimates.

If $t_0 = 0$, P = 2/ and $t_1 = \frac{P}{2} = \frac{\pi}{\omega}$, and the tidal currents can be reasonably approximated by a single partial tide, $u(t) = U \sin \omega t$, then Equation 1 becomes

$$L_{ex} = -\frac{2U}{\omega} \quad (6)$$

If one assumes that the tidal currents in the San Francisco Estuary are well-represented by the M2 tide, P = 12.42 hours, $t_1 =$ 6.21 hours, or $\omega = 1.404x10^{-4} rad/s$, and the peak currents are in ft/s, the tidal excursion is

L_{ex}(mi) = 2.6969*U(ft/s) (7)

If one plugs the average maximum tidal current speeds (Figure 39) in Fisherman's Cut and Old River at OSJ of U_{FCT}=0.5 ft/s, U_{OSJ}= 1.0 ft/s before the barrier was installed, the tidal excursion estimates are 1.4 miles and 2.69 miles, respectively, which under non-barrier conditions are greater than the channel lengths of 1.8 miles and 1.1 miles, respectively, creating LE ratios of 1.3 and 2.4. Fisherman's Cut is weakly dispersive, whereas OSJ is strongly so. Now, if one takes the average peak tidal currents in these channels when the barrier is installed (U_{FCT}=2.3 ft/s, U_{OSJ}= 2.4 ft/s), the LE ratios increase to 3.4 and 5.9, a large increase in the dispersive transport potential in both channels. This means that if there is a salinity gradient between the San Joaquin River and Franks Tract, salt will be dispersively transported into Franks Tract in a fashion similar to conditions in False River without the barrier.

Dispersive Transport in the San Andreas Reach

Finally, the tidal excursion in the San Joaquin River landward from Jersey Point based on Equation 7 is 7.2 miles, using a Jersey Point maximum velocity of 2.7 ft/s—roughly 80 percent of the distance on

the San Joaquin River from False River to the Mokelumne River (8.7 miles), the source of fresh Sacramento River water that is keeping salt at bay. However, this tidal excursion will significantly increase, given that the tidal discharge that went down False River (not shown) is, with the barrier installed, exchanging with Fisherman's Cut and Old River at OSJ through the San Andreas Shoal Reach. No measurements are available for either the increase in tidal discharge or the velocity in this reach; nonetheless, this increase is significant, which leads to increased dispersive transport in the San Andreas Reach due to lateral mixing when the barrier is installed.

This reach is one of the few in the Delta that has somewhat natural river geomorphology: A couple of significant bends create dispersive mixing due to secondary circulation, and shoals create lateral shear, which strains and mixes constituent distributions, also increasing dispersive mixing. The greater the velocity, the greater the secondary circulation and shear adjacent to shoals, which, in combination, increases dispersive transport in this reach during periods when the barrier is in place.

The bottom line: The barrier definitively keeps salt out of Franks Tract, but it hastens salt intrusion into Franks Tract through Old River at OSJ (Figures 28 and 32), and DCC gate closures that bring salt into the San Andreas Shoal Reach (Figures 28 and 32), with its increased dispersive potential with the barrier in place, should be avoided.

Discussion

Because all exports from the Delta (which supply approximately 30–40 million people and agricultural users with water south of the Delta) will likely have to cease until it rains if salt enters Franks Tract in a significant way, zero transport of salt into Franks Tract through False River is a big deal.

However, this reprieve is temporary, considering that dispersive transports likely increase significantly in the San Andreas Reach and in Old River at OSJ because the tidal currents in these locations increase significantly when the barrier is in place, thus increasing the potential for dispersive mixing. Still, as the ability to maintain Sacramento River flow becomes more precarious, with available storage diminishing as droughts persist, keeping the DCC gates open—in violation of the Rio Vista flow standard—will keep salt at bay for a time; installing barriers in Sutter and Steamboat sloughs will do so for longer yet. Both actions should take place, in this sequence, before a significant spatial salinity gradient begins to occur at Old River at OSJ, to keep dispersive transport of salt into Franks Tract from becoming excessive. This can

be monitored at OSJ; however, a new water quality station is recommended at CM43 on the San Joaquin River to provide an early warning, even though station SAL exists across the channel (**Figure 42**). Station SAL is likely fresher than the bulk of the water passing this station, considering that fresh water flowing out of the Mokelumne River hugs the right bank as indicated by the turbidity plume in **Figure 43**.

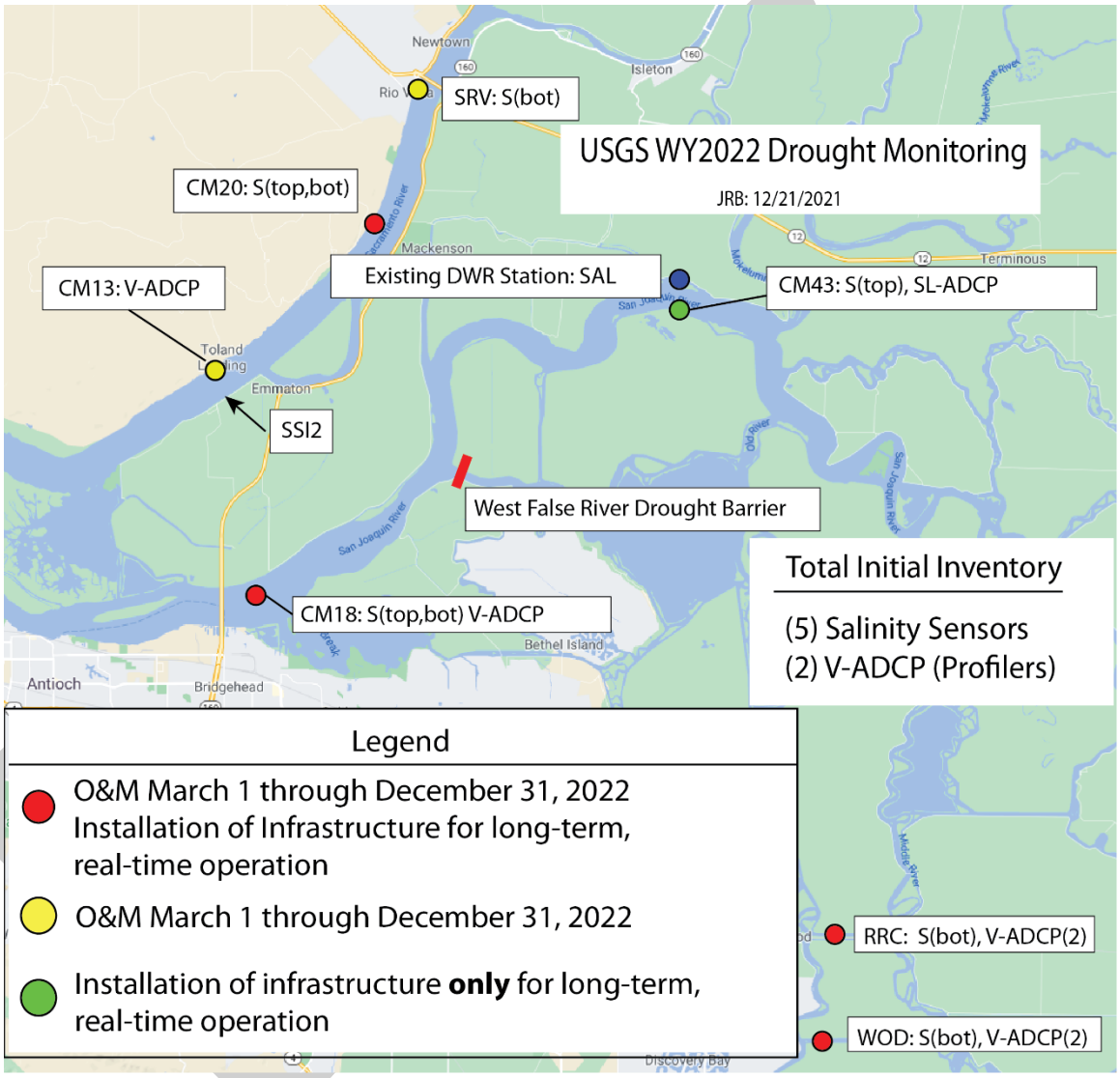


Figure 42 U.S. Geological Survey Water Year 2022 drought monitoring stations, including an existing station in the San Andreas Shoal reach, SAL.

NOTE: This aerial photograph shows that (fresh) water exiting the Mokelumne River initially hugs the right bank, but usually mixes out at the first downstream bend in the San Joaquin.

Figure 43 Aerial photograph of the discharge of high-turbidity water from the Mokelumne River into the San Joaquin River.

The discussion in this section focuses on salt transport because this factor determines whether exports can occur at all during droughts (e.g., health and human safety trumps all). However, should there be an increase in spatial gradients for any other constituent, or for organism abundances, dispersive transports of these constituents and organisms would occur at a greater rate in Fisherman's Cut, in the San Andreas Shoal Reach, and at OSJ because the tidal flows are stronger and tidal excursions longer than with the barrier in place.

2.3 Impacts

2.3.1 Bathymetry—Channel Bed Elevation

Field surveys by the Geomatics Branch of the DWR Division of Engineering mobilized to the proposed barrier site on May 17, 2021. Over the course of the next few weeks, multi-beam bathymetric data were collected at the proposed barrier site, Bradford Island, and a few of the waterways close to the site. These data were collected using two separate multi-beam–equipped vessels: a 23-foot North River Cathedral hull operating an R2Sonic system with a Post Processed Kinematic

(PPK) POS MV Inertial Measurement Unit (IMU) sensor, and a 16-foot remote HydroCat operating dual-head T-50s with a submerged POS MV IMU sensor. The open-channel areas were collected using the North River setup; the nearshore areas were collected using the remote HydroCat setup, with upper collection limits set to near the surface to maximize shoreline areas as much as possible.

Data were collected from the full perimeter of Bradford Island (False River, Fisherman's Cut, and the San Joaquin River) and the sloughs adjacent to Bethel Island to the east and west (Piper Slough and Taylor Slough). All data collected from this survey were processed and adjusted to the same survey control scheme that was used during the 2015 EDB project to allow direct comparisons between the two projects.

2.3.2 Water Quality

Methods

DWR and U.S. Geological Survey (USGS) water quality monitoring stations collected continuous real-time data at 15-minute intervals by deploying Yellow Spring Instrument (YSI) EXO2 sondes (at a depth of 1 meter) for the following constituents:

- Water temperature (degrees Celsius [°C])
- Dissolved oxygen (DO) (milligrams per liter [mg/L])
- Specific conductance (µS/cm)
- Turbidity (Formazin nephelometric units [FNU])
- Chlorophyll (micrograms per liter [µg/L])

YSI EXO2 sondes are approximately 2 feet long and 3½ inches in diameter. They are completely submersible and self-contained, operating on a minimum of 6 volts of battery power from four D-cell alkaline batteries. Deployment data are logged in each sonde's internal memory. For detailed information on YSI instrumentation, visit http://www.ysi.com/index.php.

Staff members regularly performed the following three procedures to check that sondes were operating properly and measuring accurately, and to validate the data:

- Daily data checks via CDEC and/or the Campbell Scientific LoggerNet and Real-Time Monitoring and Control (RTMC) software applications.
- A comparison between the field data measured by the YSI EXO2 sondes during each monthly site visit and the data collected by the station sondes at the closest 15-minute time interval.

- A post-deployment accuracy check, which involved performing an in-field pre-clean and post-clean sensor check (a check for bio-fouling sensor errors) and sensor laboratory standard check (a check for sensor drift errors) to establish a total sensor error.

The accuracy of sonde probes deployed in the field can be negatively affected by probe malfunction, drift away from initial calibration, and/or fouling caused by biological growth on the probe's reading surface (Wagner et al. 2006). DWR and USGS staff performed the post-deployment accuracy check by using the following procedures before cleaning the sonde probes during each monthly station visit:

- Pre-cleaned, recently deployed YSI EXO2 sonde probes were placed in a bucket with a secondary verified, lab-calibrated YSI EXO2 sonde of ambient station water, and values for all sensors were recorded.
- Deployed YSI EXO2 sonde probes were then cleaned and again placed in a bucket with a secondary verified, lab-calibrated YSI EXO2 sonde of ambient station water, and values for all sensors were recorded. Note: Some stations also collect chlorophyll, pH, and fluorescent dissolved organic matter; see Table 2 of the 2021 Emergency Drought Salinity Barrier Project Monitoring Plan, May 2021.
- The deployed YSI EXO2 sondes and sensors were then brought back to the laboratory and placed in fresh calibration standards with known values, and those values were recorded.
- The sensor values were given a final accuracy rating, using the total error from combined biofouling and sensor drift for each constituent. Sensor values were rated as either excellent, good, fair, or poor according to the USGS technical report *Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting* (Wagner et al. 2006).

The applied ratings obtained during the accuracy check indicate the quality, accuracy, and reliability of the data that collected by the sondes while in the field. In addition to conducting the post-deployment accuracy check, DWR and USGS staff compared the water temperature, specific conductance, DO, and turbidity data measured in the field by the verified, lab-calibrated YSI EXO2 to the deployed sonde data that were closest in time. While taking field measurements, DWR and USGS staff made every attempt to collect the field readings at the same depth at which the sonde probes were measuring (1 meter) and as close to the sonde pipe as possible. Because the field instruments are calibrated regularly, a large difference between the

sonde and field readings could indicate inaccuracy of sonde data during the deployment period. DWR and USGS staff considered comparisons between the field and sonde readings and the ratings applied from the post-deployment accuracy check when assessing data quality and entering the continuous data into the database.

In addition to the continuous water quality monitoring, discrete water quality samples were collected at several co-located sites (FAL, Bethel Island [BET], HOL, FCT, OSJ, Threemile Slough at San Joaquin River [TSL], and Sacramento River near Sherman Island [SSI]) as outlined in the 2021 EDB Monitoring Plan. Data were also acquired from the long-term and routine DWR Environmental Monitoring Program (EMP) sites (D19, D26, D22, D4, and NZ068). Several water quality constituents were analyzed in those discrete samples collected in 2021 and prior years, but this discussion focuses on constituents: chlorophyll-*a,* dissolved nitrate + nitrite, dissolved ammonia, dissolved ortho-phosphate, total suspended solids (TSS), dissolved chloride, and dissolved bromide.

Measuring chlorophyll-*a* is a common means of determining the amount of algal growth and biomass in a water body. Concentrations vary based on available nutrients, light, hydrodynamic conditions, and other associated environmental conditions. Nitrate + nitrite, ammonia, and ortho-phosphate were investigated because these forms of nutrients are the most available biological sources of algal growth and assimilation. TSS is a measure of the organic and inorganic particulates in the water body, contributing to the determination of water clarity as an important factor for algal production. Chloride and bromide were investigated further, as they are important anions that can provide a measure of the increase in salts in a water body resulting from seawater intrusion, surface water runoff, and/or groundwater contributions. Chloride concentrations are also outlined in D-1641 and standards must be met in the Delta for maintaining water quality objectives for municipal and industrial beneficial uses (State Water Board 2000).

DWR staff collected samples for all constituents at a depth of 1 meter using a Van Dorn water sampler. Water samples from each site were filtered in the laboratory in preparation for the quantification of nutrients and chlorophyll-*a*. Nutrient samples were filtered through 0.45-micrometer filters (Millipore HATF04700), which were then immediately frozen at -20°C. Ambient nutrient concentrations were analyzed using various established U.S. Environmental Protection Agency (EPA) and American Public Health Association analysis methods: NO_2+NO_3 (Standard Method 4500-NO3-F Modified), NH_4

(EPA 350.1), and PO_4 (EPA 365.1). Concentrations of chlorophyll-*a* were acquired from the extraction of pigments on glass-fiber filters (47-micrometer Millipore) with 90 percent aqueous acetone and using spectrophotometry (Standard Method 10200H) (APHA et al. 2017). TSS concentrations were acquired using EPA Method 160.2. The analyte determination for the months of April–November as outlined in the report (n = 7–13 per site) was conducted at the DWR Bryte Laboratory, West Sacramento, California.

Data from 2015 (the prior EDB installation year) and 2021 were further grouped into regions based on geography and proximity to the major tributary for trend analysis. The three regions and associated stations consist of Sacramento River (D4, SSI/D11A, D22, and NZ068), San Joaquin River (FCT, D26, and OSJ), and Interior Delta (FAL, FRK, BET, and HOL). Data from 2021 and 2015 were further compared to data from previous Dry years (2014, 2018, and 2020) and Wet years (2017 and 2019) to investigate water quality differences both by water year and by EDB installation year.

Figure 44 shows a regional map of all continuous and discrete water quality sites. The sites were grouped into three regions:

- Sacramento River Region, covering the northwest portion of the Central Delta from the confluence of the Sacramento and San Joaquin rivers, up the Sacramento River to the Rio Vista Bridge.
- San Joaquin River Region, covering the middle third of the Central Delta from the southern edge of Sherman Island upstream along the San Joaquin River to the northern end of Mandeville Island.
- Interior Delta Region, covering the southeast portion of the Central Delta from False River east of the barrier upstream to Clifton Court Forebay.

Salinity

Real-time specific conductance data were collected at the SSI, TSL, and Sacramento River at Rio Vista Bridge (RVB) stations to examine regional salinity trends along the Sacramento River (**Figure 45**).

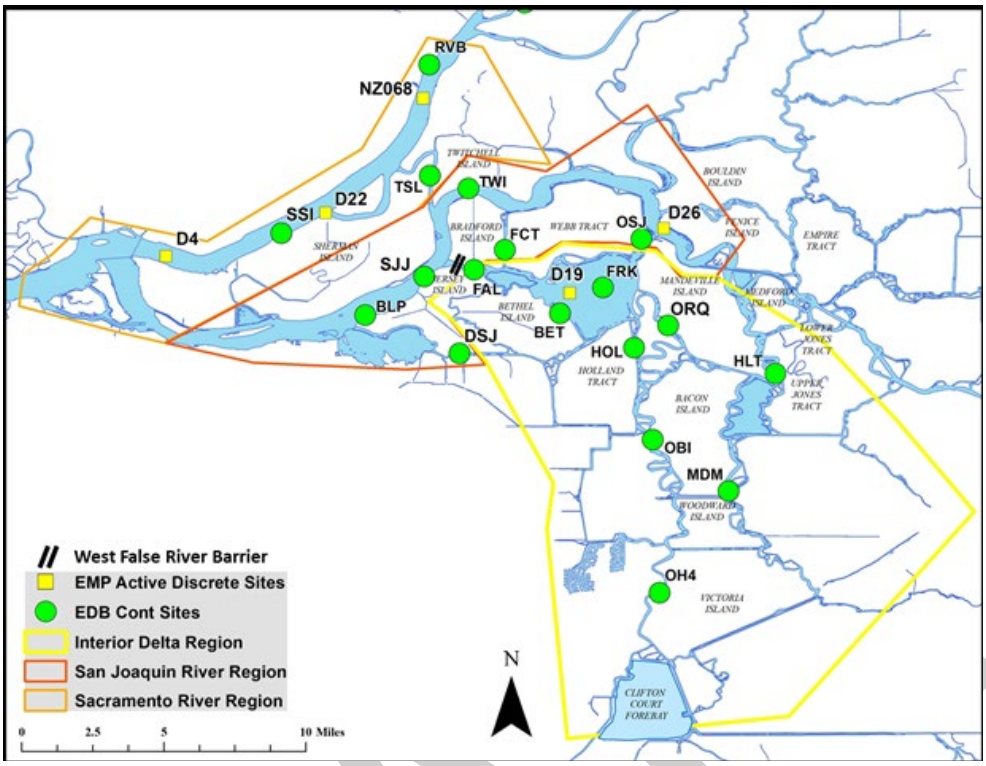


Figure 44 Regional map of all reported continuous and discrete water quality stations.

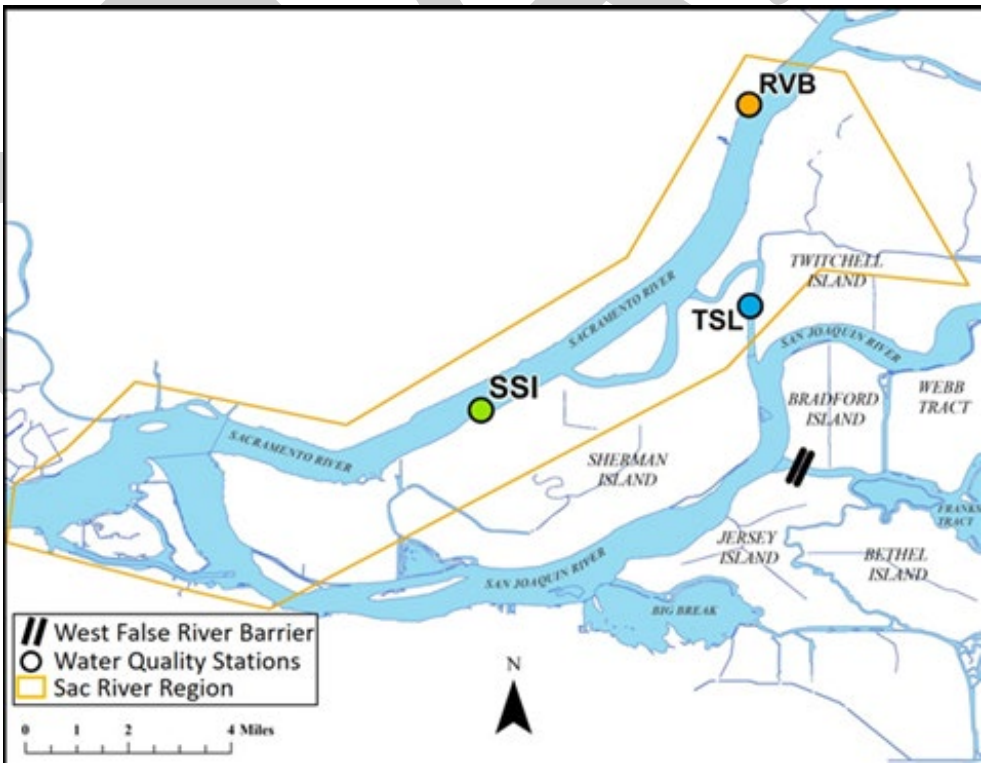


Figure 45 Map of water quality monitoring stations along the Sacramento River.

The three stations along the Sacramento River followed a similar pattern to one another; the more upstream stations TSL and RVB showed a slight lag and were heavily diminished, with the TSL salinity signal reaching about 25–35 percent of the salinity seen downstream at SSI, and salinity at RVB reaching about 50 percent of TSL salinity (**Figure 46**). Salinity along the Sacramento River climbed steadily beginning in late April, reaching a high at SSI of nearly 8,000 µS/cm in late June before gradually decreasing and then vacillating between about 4,000 and 6,000 µS/cm in August and September. Salinity then began to climb again, once more reaching nearly 8,000 µS/cm in late October, when the exceptional rain event caused specific conductance along the Sacramento River to fall to just a few hundred microSiemens per centimeter. Salinity quickly increased again at SSI but was much more gradual at the upstream stations TSL and RVB.

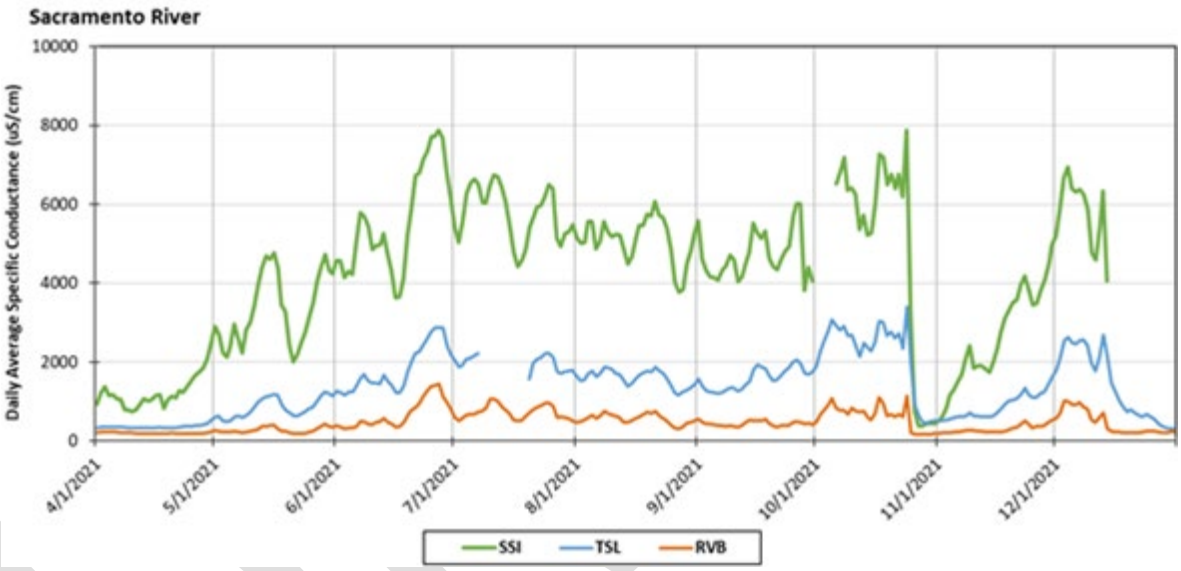


Figure 46 Daily-average specific conductance along the Sacramento River.

Six stations along the San Joaquin River were used to examine regional salinity trends in 2021. From downstream to upstream, these stations are San Joaquin River at Blind Point (BLP), San Joaquin River at Jersey Point (SJJ), Dutch Slough at Jersey Island (DSJ), San Joaquin River at Twitchell Island (TWI), Fisherman's Cut (FCT), and Old River at Franks Tract near Terminous (OSJ) (**Figure 47**).

Daily-average specific conductance along the San Joaquin River showed a pattern largely similar to those seen along the Sacramento River. If overlaid along the Sacramento River salinity graph (Figure 46), BLP and SJJ would fit nicely in between the graphs of SSI and TSL, with TWI falling in step just below TSL. DSJ is the odd one out in

this region, not quite as closely following the pattern observed at the other San Joaquin Region stations; and rightly so, with its entirely separate hydraulic connection to the interior Delta running east along Jersey Island and then Bethel Island.

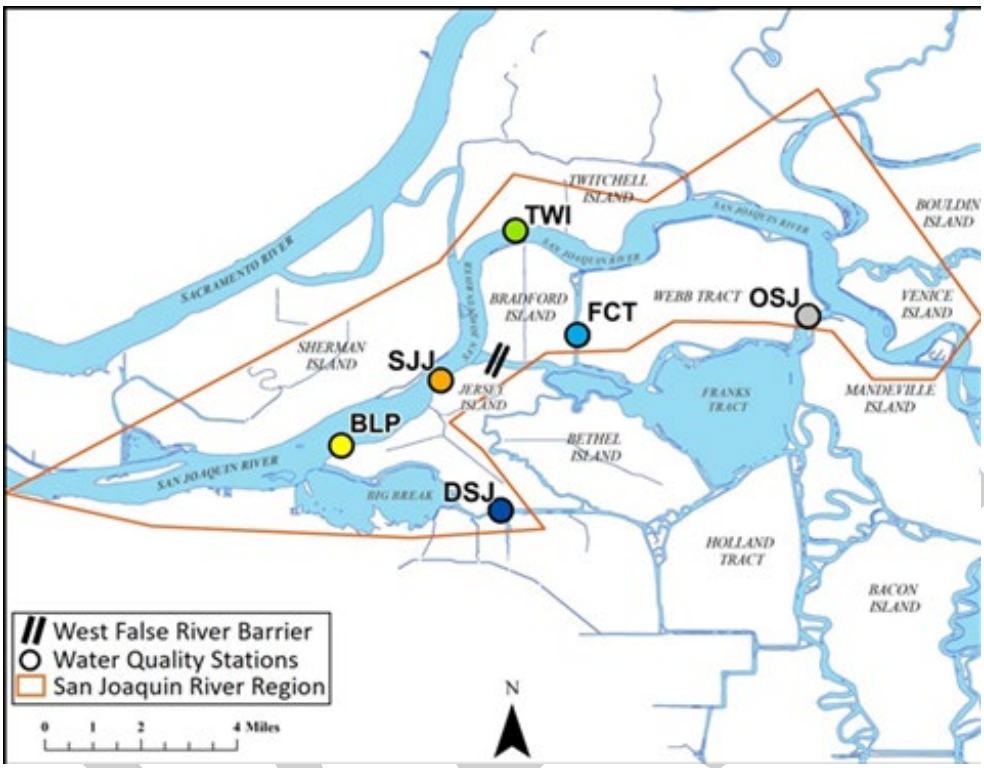


Figure 47 Map of water quality stations along the San Joaquin River.

As with the Sacramento River Region stations, salinity along the San Joaquin River rose in late April, climbed to reach a seasonal high in late June, and then began to gradually decrease again before reaching a seasonal low in late August (or early September at DSJ) (**Figure 48**). Salinity gradually increased again, and likely would have continued to increase without the exceptional rainfall that occurred at the end of October, which caused salinity to drop precipitously. Salinity then began to rise again in late November and early December and dropped again after several lesser rainfall events in December (Figure 15).

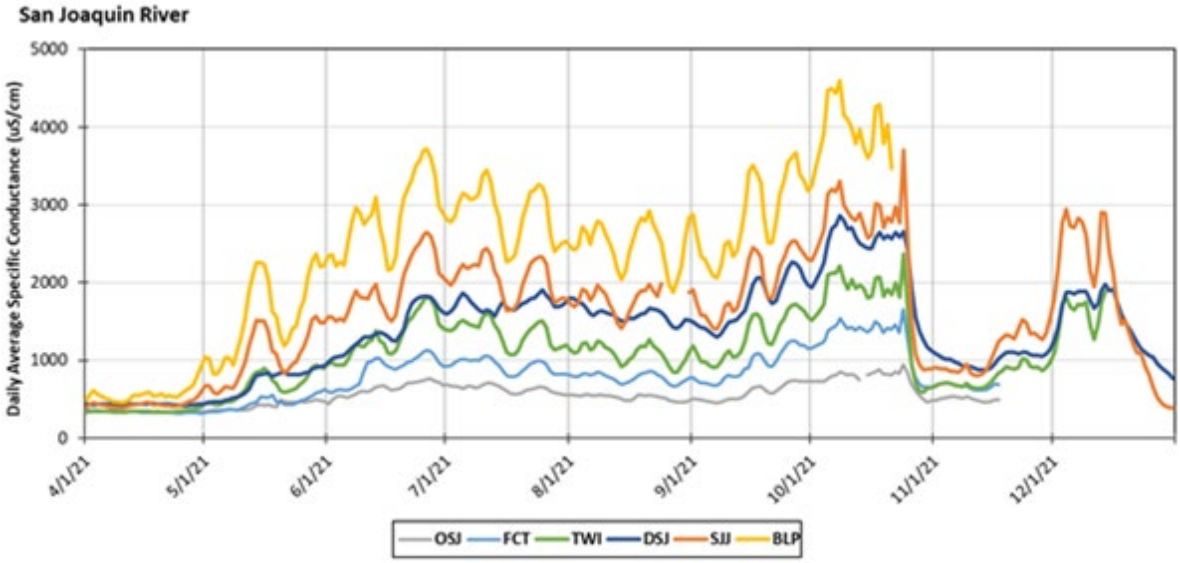


Figure 48 Daily-average specific conductance along the San Joaquin River.

Water Temperature

Daily-average water temperatures followed a similar pattern across each region: Temperatures rose gradually from April to June, peaked in July, and then gradually dropped in August and September, followed by a sudden precipitous decrease in water temperature in early October (**Figure 49**). Water temperature appeared to reach slightly higher values in the interior Delta, with each station meeting or exceeding 24°C in July, and with the most interior stations—HOL and OBI—reaching the highest temperatures. The San Joaquin River Region stations also recorded water temperatures that exceeded 24°C in June and July, although they did not reach levels quite as high as the interior Delta stations.

The Sacramento River had slightly lower water temperatures than those observed at most stations in the interior Delta and San Joaquin River. These regional differences are likely caused by a combination of differences in channel morphology near the stations, temperature of source water inputs, and access to cooling air currents determined by channel orientation, levee height, and/or amount of open water adjacent to the stations.

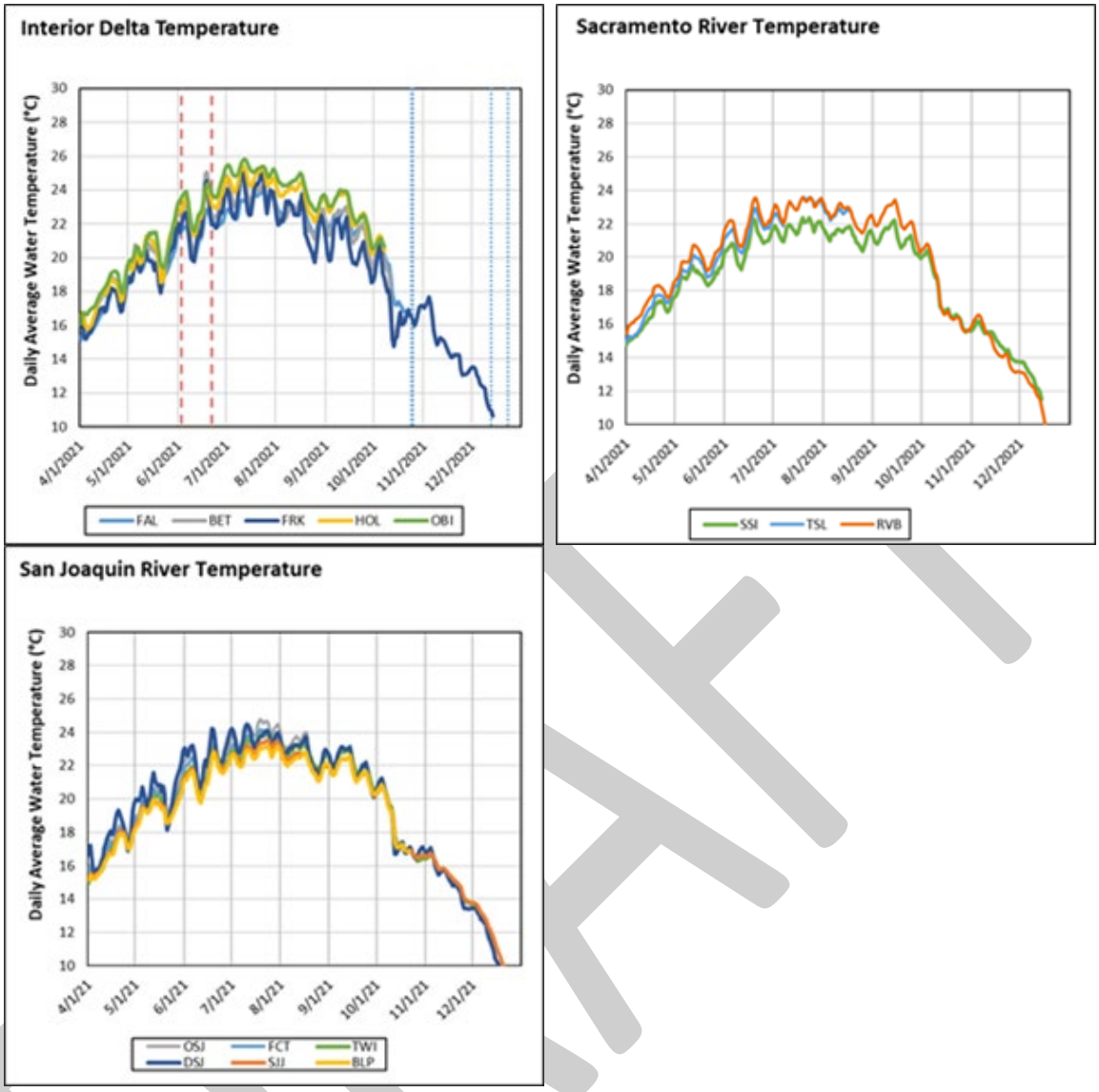


Figure 49 Daily-average water temperature across Delta regions from April 1, 2021, to December 31, 2021.

Turbidity

The increase in turbidity at Franks Tract Mid Tract (FRK) coincided with a large increase in flow at OSJ beginning in early June, which may have helped stir sediment; however, high-wind-speed events occurred exactly as turbidity spikes were recorded at FRK on June 21, 2021, and December 13, 2021, which may also have been a factor (**Figure 50**). There was also a noticeable increase in turbidity around the rain events in late October and mid-December, most visible at the Sacramento River at Rio Vista Bridge (RVB) station.

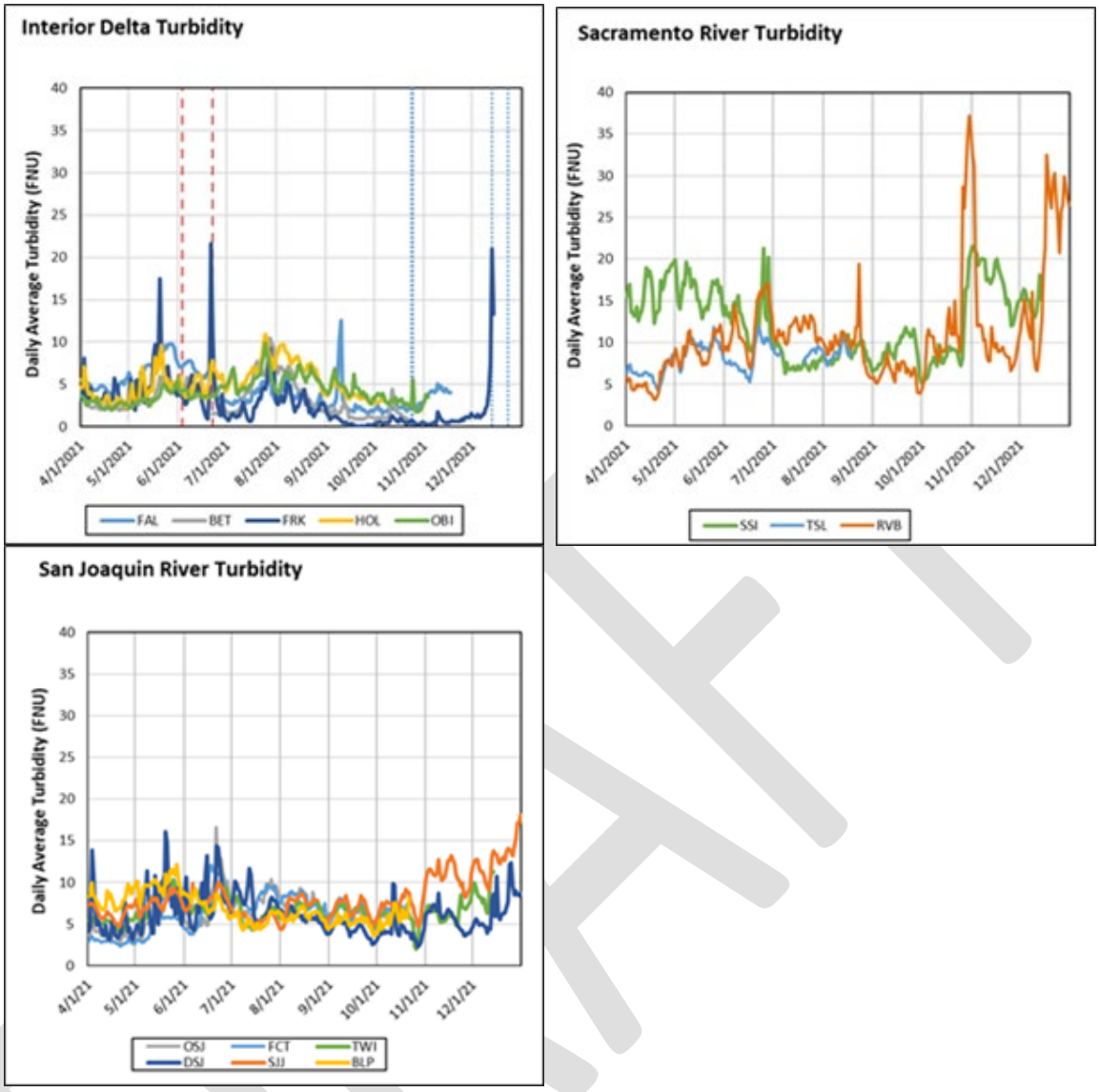


Figure 50 Daily-average turbidity across Delta regions from April 1, 2021, to December 31, 2021.

Dissolved Oxygen

Daily-average DO levels showed a U-shaped pattern over the year in all regions because of the inverse relationship between water temperature and DO saturation in water (**Figure 51**). There was a large increase in DO in Franks Tract beginning in July, with spikes reaching up past 14 mg/L, indicative of the substantial growth of aquatic plants or algae. A noticeable drop in DO levels occurred at the end of October, most visible in the Sacramento River regional graph (Figure 51). This coincides with the major rain event during the last week of October.

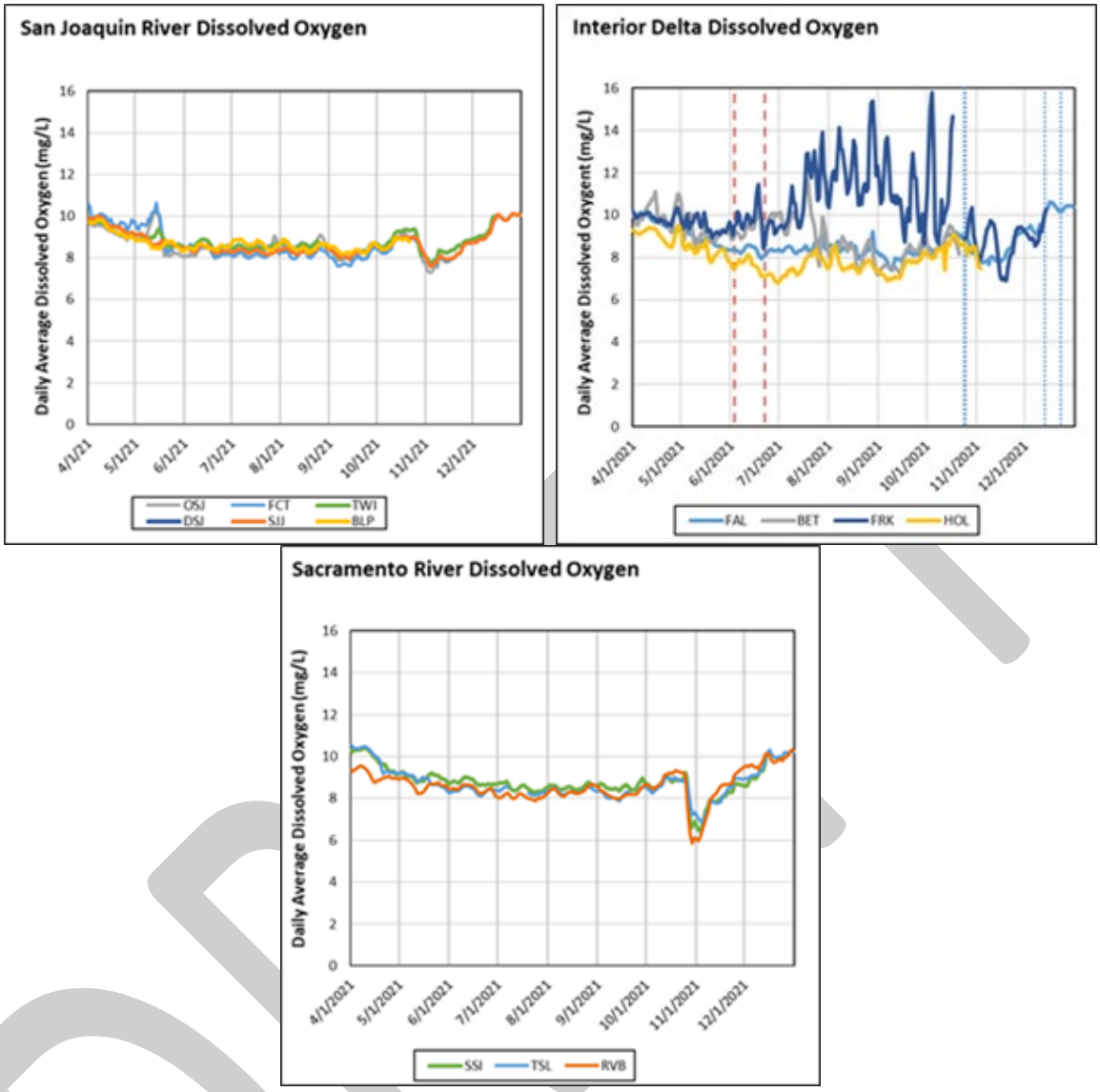
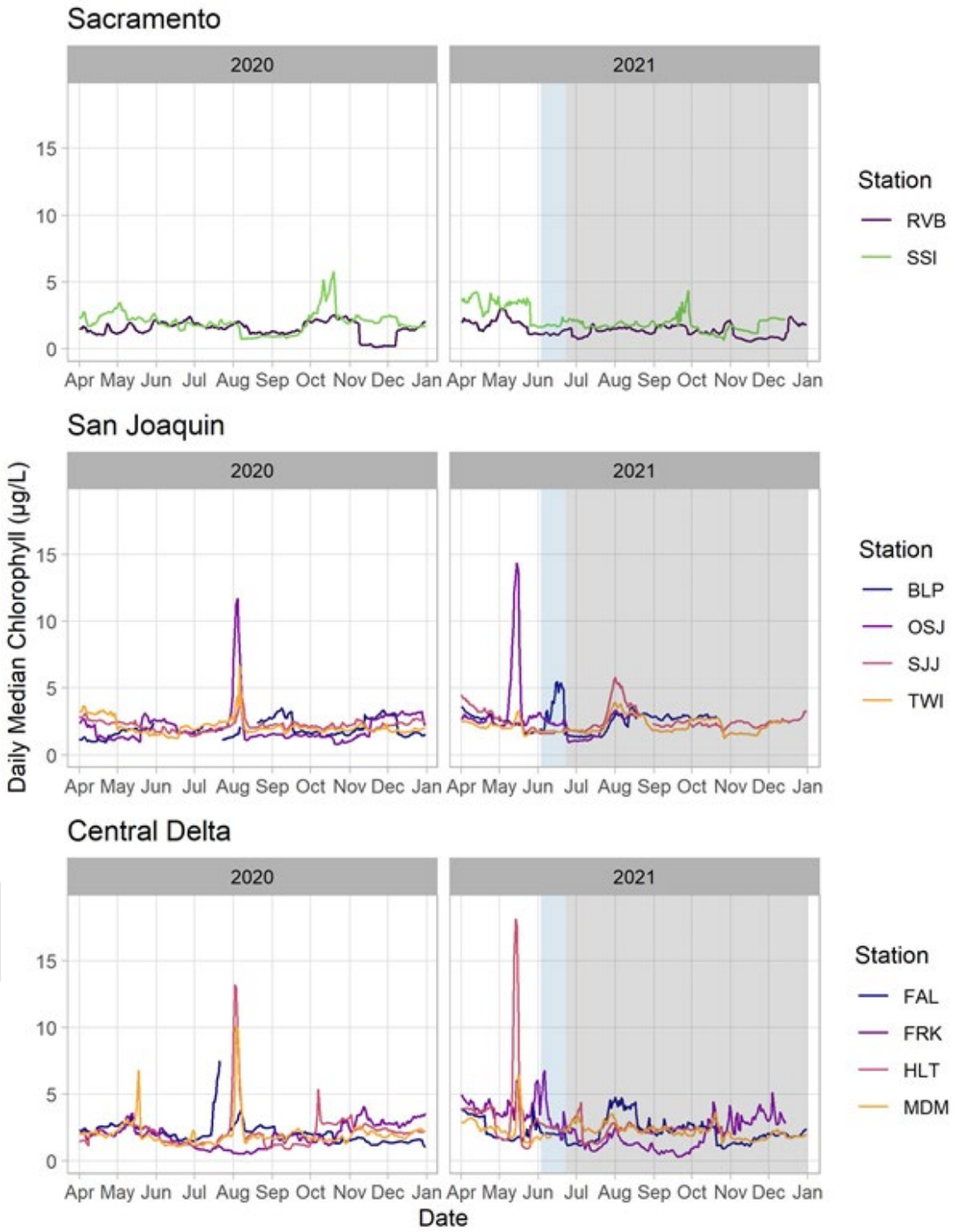


Figure 51 Daily-average dissolved oxygen across Delta regions from April 1, 2021, to December 31, 2021.

Chlorophyll

Overall, daily median values for chlorophyll fluorescence were low at all sites across the Delta from April through December in 2020 and 2021, except for a few periods of elevated values at some stations (**Figure 52**). Most of the time, values were below 5 µg/L; however, in a few instances, daily medians increased to values above 10 µg/L for about one week, most notably at OSJ in 2020 and 2021, Middle River near Holt (HLT) and Middle River at Middle River (MDM) in 2020, and HLT in 2021. The increases in chlorophyll fluorescence in 2021 at both OSJ and HLT occurred in mid-May, which was before work on the



NOTE: The light blue shading represents when the EDB was under construction, and the grey shading represents when the barrier was complete and in place.

Figure 52 Daily medians of continuous chlorophyll fluorescence measurements for April–December 2020 and 2021 for the Sacramento River, San Joaquin River, and Central Delta regions.

barrier began. There appeared to be a much smaller increase in daily medians once barrier installation was complete in August 2021 at a few stations including SJJ, TWI, and FAL. A much larger increase in chlorophyll fluorescence values occurred at some of the stations within the San Joaquin and Central Delta regions during a similar time of year, August 2020.

Comparing daily median values of chlorophyll fluorescence between years, it appeared that values were slightly higher overall in 2021 than in 2020 in the San Joaquin and Central Delta regions; however, this increase was very modest, at about a 1 µg/L increase in the overall median (**Figure 53**). Chlorophyll fluorescence values in the Sacramento River Region were almost identical in 2020 and 2021.

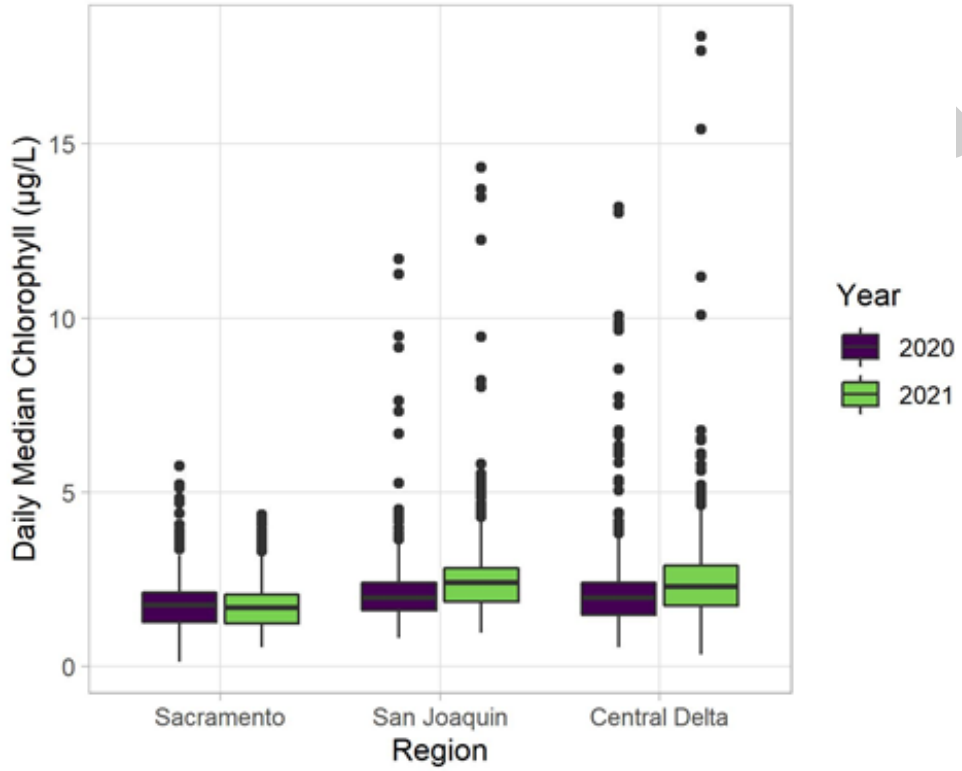


Figure 53 Boxplots of daily median values of continuous chlorophyll fluorescence for each region and comparing by year (April–December).

Nutrients (Nitrogen, Ammonium, Ortho-phosphate)

Table 3 shows water quality sampling sites in the Interior Delta, San Joaquin River, and Sacramento River regions and their respective locations.

TABLE 3
DISCRETE WATER QUALITY SAMPLING SITES, REGIONS, AND GEOGRAPHIC COORDINATES IN WGS84

Station Name	Station Code	Region	Latitude	Longitude
False River near Oakley	FAL	Interior Delta	38.05546	-121.66712
Bethel Island near Piper Slough	BET	Interior Delta	38.03335	-121.61984
Holland Cut near Bethel Island	HOL	Interior Delta	38.01584	-121.58214
Franks Tract near Russo's Landing	D19	Interior Delta	38.04376	-121.61480
Fisherman's Cut	FCT	San Joaquin River	38.06560	-121.64792
Old River near Franks Tract	OSJ	San Joaquin River	38.07125	-121.57837
San Joaquin River at Potato Point	D26	San Joaquin River	38.07664	-121.56690
Three Mile Slough at San Joaquin River	TSL	Sacramento River	38.10330	-121.68610
Sacramento River near Rio Vista	NZ068	Sacramento River	38.14272	-121.68950
Sacramento River at Emmaton	D22	Sacramento River	38.08453	-121.73910
Sacramento River near Sherman Island	SSI/D11A	Sacramento River	38.07410	-121.76174
Sacramento River above point Sacramento	D4	Sacramento River	38.06248	-121.82050

Interior Delta Region

To characterize the concentrations of chlorophyll-*a*, nutrients, TSS, chloride, and bromide in the Interior Delta Region, four active sampling locations were investigated from April to November (**Figure 54**). This included three co-located continuous monitoring locations—FAL, BET, and HOL (2015: n=11–12 per site; 2021: n=7 per site)—which were sampled a minimum of once per month. The EMP monthly discrete monitoring station D19 (2015 and 2021: n=8) was also included to provide data on ambient conditions within Franks Tract.

Chlorophyll-*a* concentrations were low at all sites in the Interior Delta Region in 2021, ranging from 0.71 to 2.94 $\mu g/L^{-1}$ in April–May before installation of the EDB and in June just after EDB closure at West False River (**Figure 55**, graph F). This differed from the prior EDB installation year of 2015, when chlorophyll-*a* concentrations were high ($\geq$10 $\mu g/L^{-1}$) just before EDB closure, with notably elevated concentrations measuring more than 40 $\mu g/L^{-1}$ at sites FAL and HOL. Chlorophyll-*a* concentrations did, however, increase considerably at all sites in July and August 2021 after EDB closure; concentrations peaked at all sites in August, ranging from 15 to 20 $\mu g/L^{-1}$, and the highest concentration was measured at HOL at 23 $\mu g/L^{-1}$.

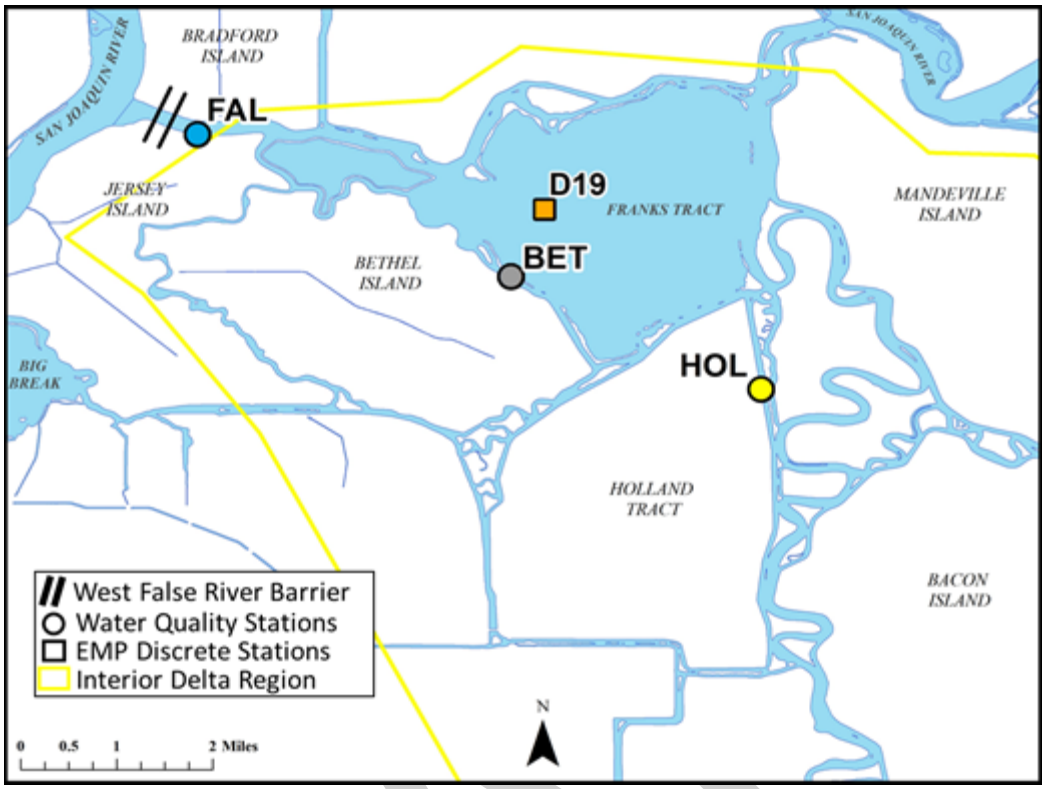
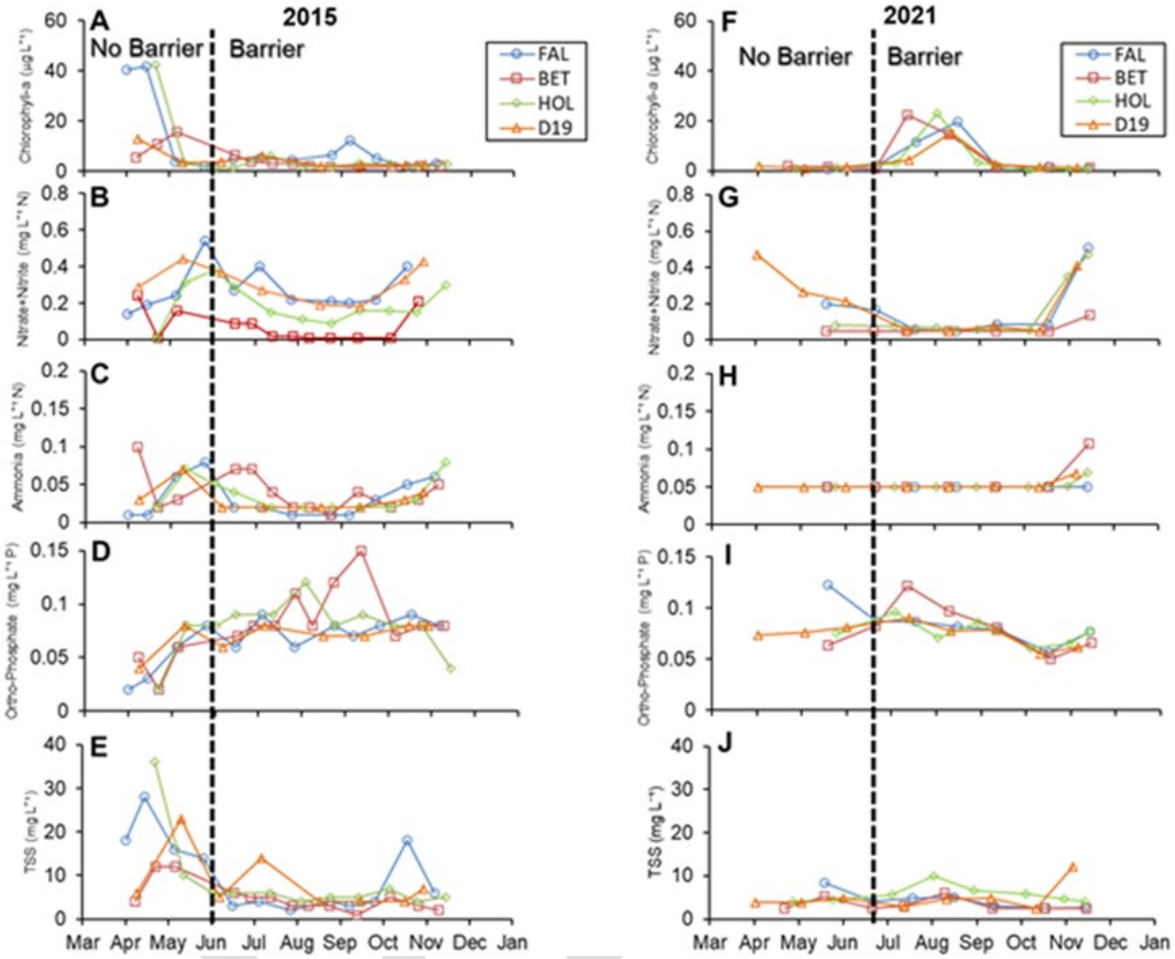


Figure 54 Map of the Interior Delta Region and discrete water quality sampling sites.

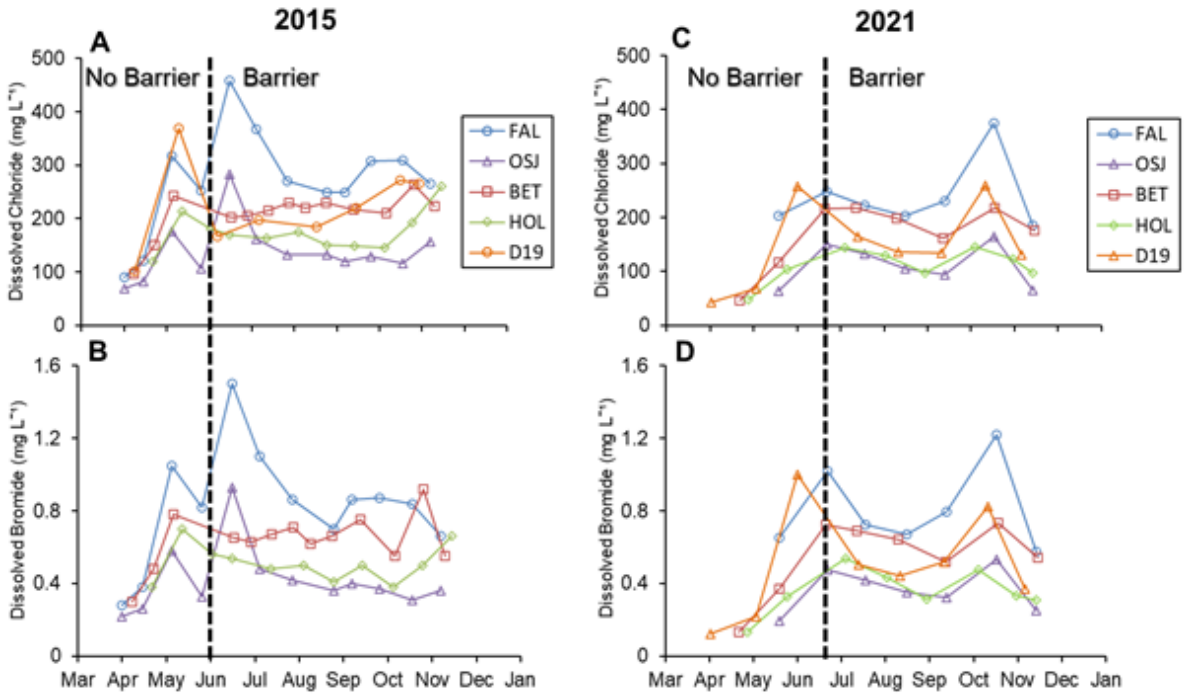
Nutrient concentrations at all sites in the Interior Delta Region were low both pre- and post–EDB closure in 2021 (Figure 55, graphs G, H, I, and J). Nitrate + nitrite concentrations were highest in April–June at sites FAL and D19 (Figure 55, graph G), ranging from 0.164 to 0.473 mg/L^{-1}; however, the concentrations were decreasing leading up to the EDB closure, reaching near or below the DWR Bryte Laboratory's reporting limit of 0.05 mg/L^{-1} at all sites in August. This low in nitrate + nitrite concentrations aligned with peak chlorophyll-*a* concentrations at all Interior Delta Region sites in 2021, which suggested that there was high algal uptake (Figure 55, graphs F and G). To compare 2021 to 2015: The nitrate + nitrite concentrations in the Interior Delta Region were much lower in 2021 (Figure 55, graphs B and G), but the ammonia and ortho-phosphate concentrations were similar post-EDB closure in both years (Figure 55, graphs C and H). The TSS concentrations in 2021 observed minimal change, averaging 5 mg/L^{-1} throughout April–November (Figure 55, graph J). TSS concentrations were similar in 2015 to 2021 during the post–EDB closure period, but there were much higher TSS concentrations pre-EDB in 2015 (Figure 55, graphs D and J).



NOTE: Black dashed line denotes closure period for the EDB. DWR Bryte Laboratory reporting limits for 2015 were 0.01 mg/L^{-1} for nitrate, nitrite, and ammonia analysis and increased to 0.05 mg/L^{-1} in 2021.

Figure 55 2015 and 2021 April–November discrete concentrations of chlorophyll-*a*, dissolved nitrate + nitrite, dissolved ammonia, dissolved ortho-phosphate, and total suspended solids in the Interior Delta Region, by site.

In 2021, chloride concentrations were lowest in April and May before the EDB closure, with concentrations across all sites ranging from 43 to 204 mg/L^{-1}, and increased to 66–375 mg/L^{-1} from June through November post–EDB closure (**Figure 56**, graph C). Bromide concentrations followed trends similar to those of chloride concentrations, ranging from 0.13 to 0.65 mg/L^{-1} in April and May and increasing to a range of 0.25 to 1.22 mg/L^{-1} in June–November after the EDB closure. The highest concentrations of chloride and bromide were measured at the farthest west sites of FAL, D19, and BET, nearest the connecting channels to the San Joaquin River at Fisherman's Cut and Dutch Slough (Table 3 and Figure 56, graphs C and D).



NOTE: Black dashed line denotes closure period for the EDB.

Figure 56 2015 and 2021 April–November discrete concentrations of dissolved chloride and bromide in the Interior Delta Region, by site.

To compare 2015 to 2021: Chloride and bromide concentrations were lower in 2021, but concentrations became elevated again in fall 2021 as outflows remained low and salinity intrusion increased in the San Joaquin River.

San Joaquin River Region

To characterize the concentrations of chlorophyll-*a*, nutrients, TSS, chloride, and bromide in the San Joaquin River Region, three active sampling locations were investigated from April to November (**Figure 57**). This included two co-located continuous monitoring locations—FCT and OSJ (2015: n=11–12 per site; 2021: n=7 per site)—which were sampled a minimum of once per month. The EMP monthly discrete monitoring station D26 (2015 and 2021: n=8; except site D26 dissolved bromide n=3 in 2021) was also included to provide data on ambient conditions within the lower San Joaquin River.

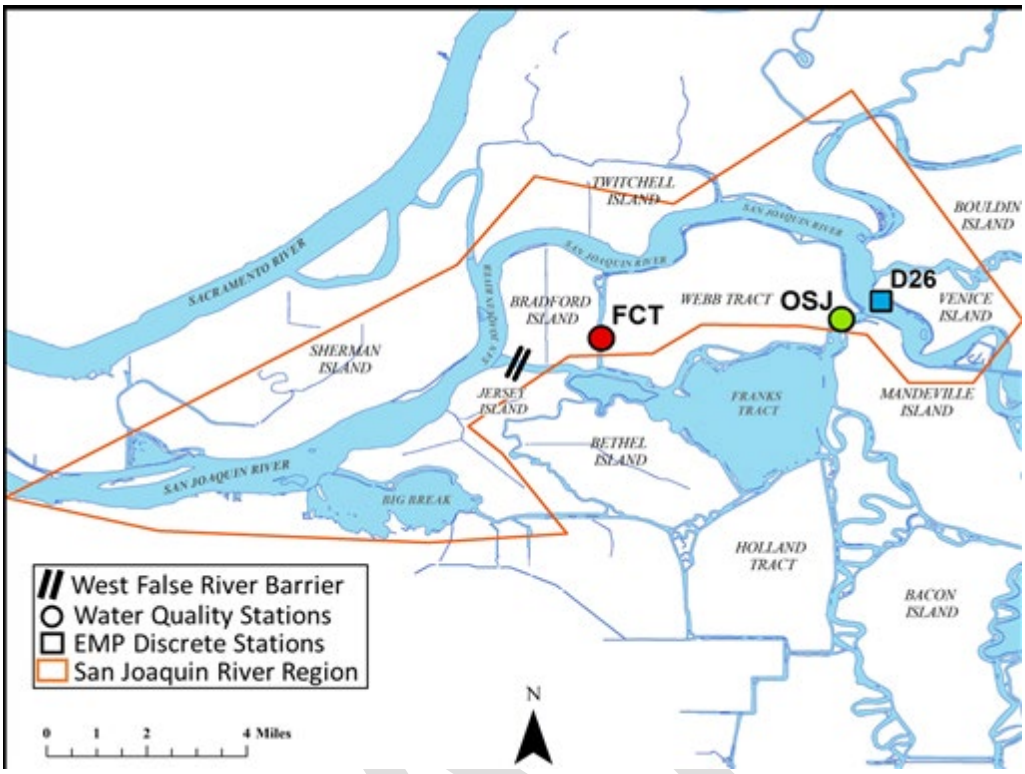
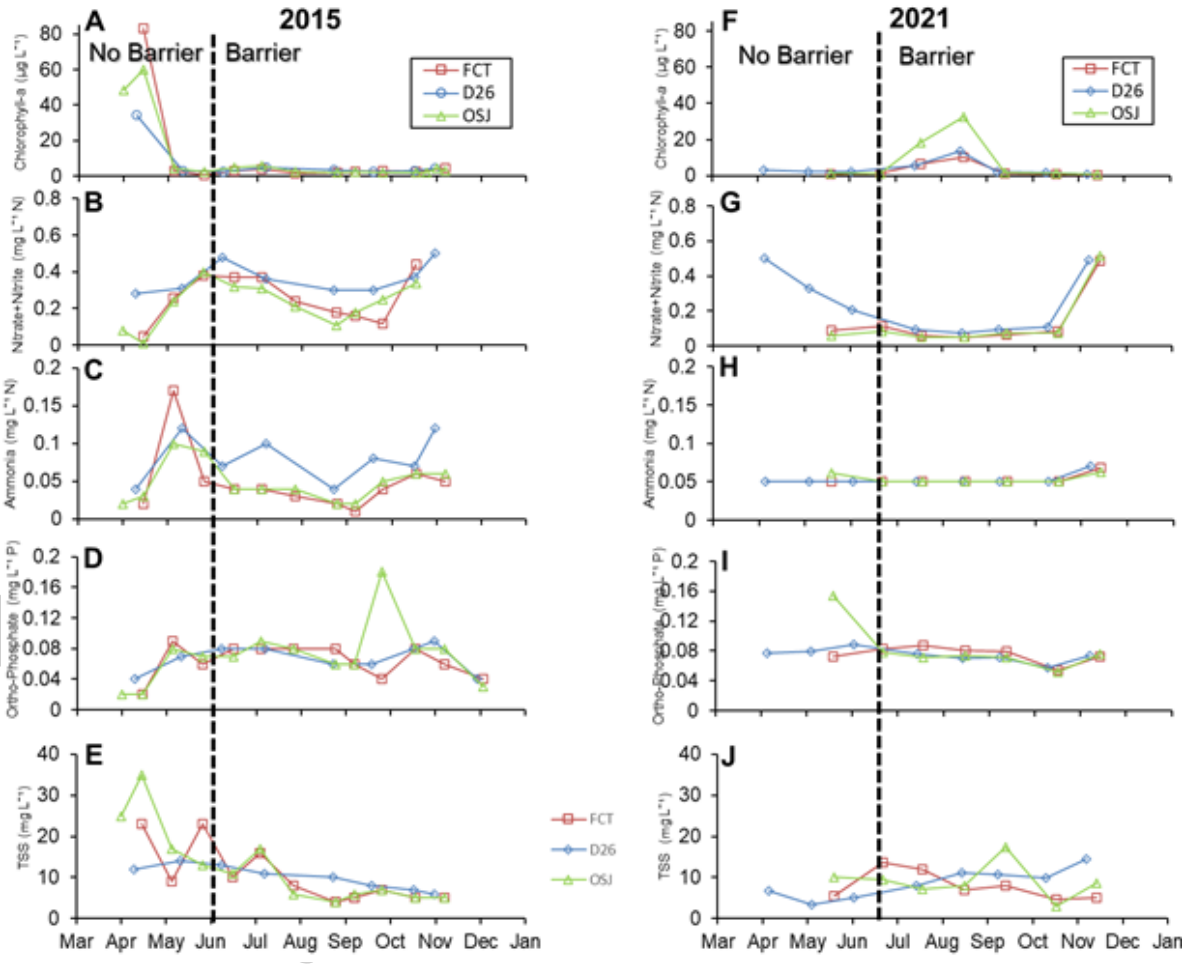


Figure 57 Map of the San Joaquin River Region and discrete water quality sampling sites.

Similar to conditions in the Interior Delta Region, chlorophyll-*a* concentrations were low at all sites in the San Joaquin River Region in 2021, ranging from 0.95 to 3.43 µg/L^{-1} in April–June before installation of the EDB and just after the EDB closure at West False River (**Figure 58**, graph F). This differed from 2015, when chlorophyll-*a* concentrations were high(≥10 µg/L^{-1}) just before EDB closure, with notably elevated concentrations measuring more than 30 µg/L^{-1} across sites (Figure 58, graph 5A), and a peak chlorophyll concentration of 83 µg/L^{-1} at FCT. Chlorophyll-*a* concentrations did, however, increase at all sites in July and August 2021 after EDB closure; concentrations peaked at all sites in August, ranging from 10 to 30 µg/L^{-1}, and the highest concentration was measured at OSJ at 32 µg/L^{-1}.

Nutrient concentrations at all sites in the San Joaquin River Region were low both pre- and post–EDB closure in 2021 (Figure 58, graphs G, H, I, and J). Nitrate + nitrite concentrations were highest in April–June at site D26 (Figure 58, graph G), ranging from 0.21 to 0.50 mg/L^{-1}; however, the concentrations were decreasing leading up to the EDB closure, reaching near or below the DWR Bryte Laboratory's reporting limit of 0.05 mg/L^{-1} across all sites in August. This low in

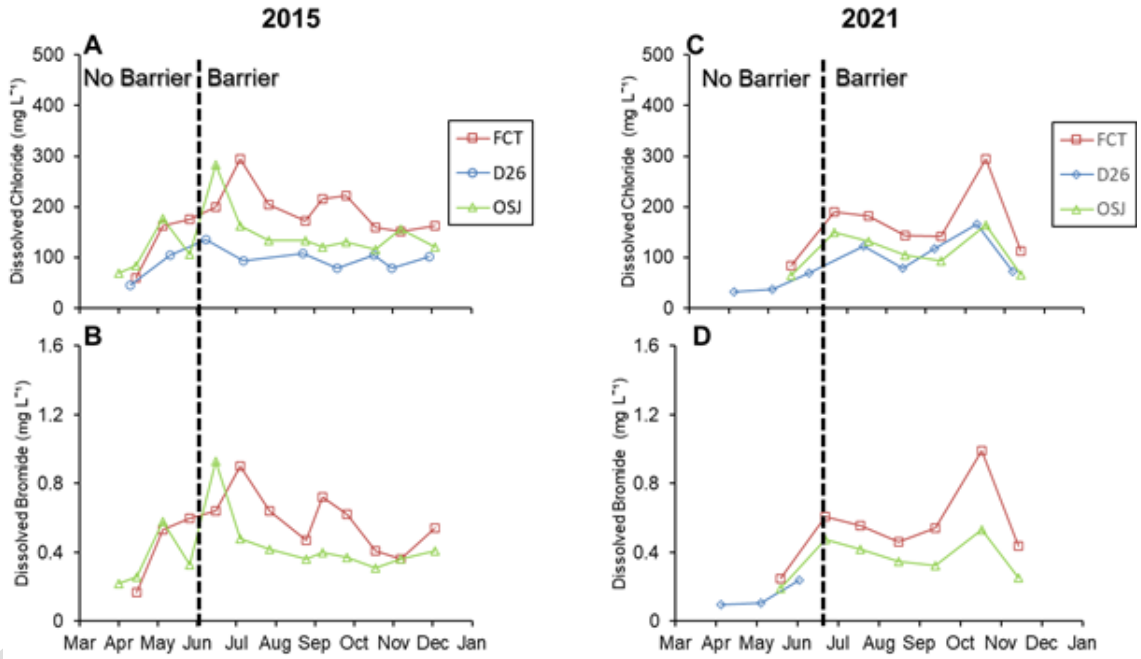
nitrate + nitrite concentrations aligned with peak chlorophyll-*a* concentrations at all sites in the San Joaquin River and Interior Delta regions in 2021, which suggested that there was high algal uptake (Figure 58, graphs F and G). To compare 2021 to 2015: The nitrate + nitrite, ammonia, and ortho-phosphate concentrations in the San Joaquin River Region were much lower in 2021 (Figure 58, graphs B, G, C, H, D, and I). TSS concentrations in 2021 observed minimal change, averaging 9 mg/L^{-1} throughout April–November (Figure 58, graph J). TSS concentrations were similar in 2015 to 2021 during the post–EDB closure period, but similar to conditions in the Interior Delta Region, pre-EDB TSS concentrations were much higher in 2015 (Figure 58, graph J).



NOTE: Black dashed line denotes closure period for the EDB. DWR Bryte Laboratory reporting limits for 2015 were 0.01 mg/L^{-1} for nitrate + nitrite and ammonia analysis and increased to 0.05 mg/L^{-1} in 2021.

Figure 58 2015 and 2021 April–November discrete concentrations of chlorophyll-*a*, dissolved nitrate + nitrite, dissolved ammonia, dissolved ortho-phosphate, and total suspended solids in the San Joaquin River Region, by site.

In 2021, chloride concentrations were lowest in April and May before the EDB closure, with concentrations across all sites ranging from 33 to 84 mg/L^{-1}, and increased to 66–294 mg/L^{-1} from June through November post–EDB closure (**Figure 59**, graph C). Bromide concentrations followed trends similar to those of chloride concentrations, ranging from 0.10 to 0.61 mg/L^{-1} in April and May and increasing to a range of 0.24 to 1.0 mg/L^{-1} in June–November after the EDB closure. The highest concentrations of chloride and bromide were measured at FCT and OSJ, those sites farthest west and closest to the EDB (Figure 57 and Figure 59, graphs C and D).



NOTE: Black dashed line denotes closure period for the EDB.

Figure 59 2015 and 2021 April–November discrete concentrations of dissolved chloride and bromide in the San Joaquin River Region, by site.

To compare 2015 to 2021: The chloride and bromide concentrations were lower in 2021, but similar to the Interior Delta Region, concentrations became elevated again in fall 2021 as outflows remained low and salinity intrusion increased in the San Joaquin River.

Sacramento River Region

To characterize the concentrations of chlorophyll-*a*, nutrients, TSS, chloride, and bromide in the Sacramento River Region, three active sampling locations were investigated from April to November (**Figure 60**). This included two co-located continuous monitoring locations—SSI and TSL (2015: n=11 at site TSL only; 2021: n=6–7

per site)—which were sampled a minimum of once per month. The EMP monthly discrete monitoring stations D4, D22, and NZ068 (2015: n=8 at site D4 only; 2021: n=8) were also included to provide data on ambient conditions within the lower Sacramento River.

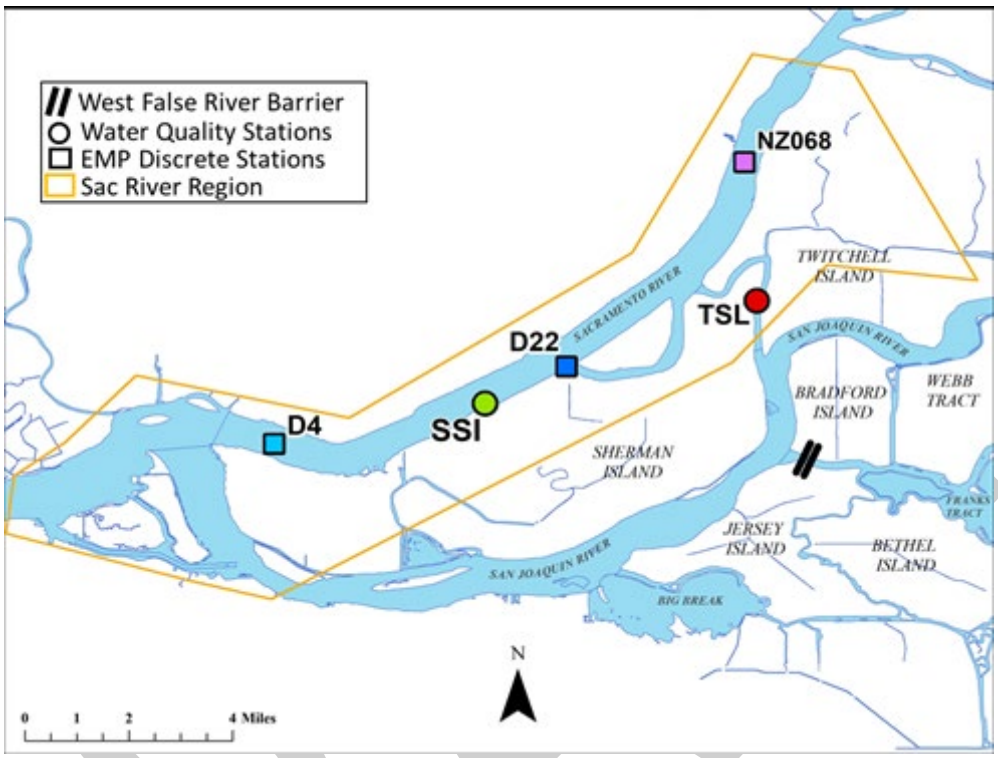
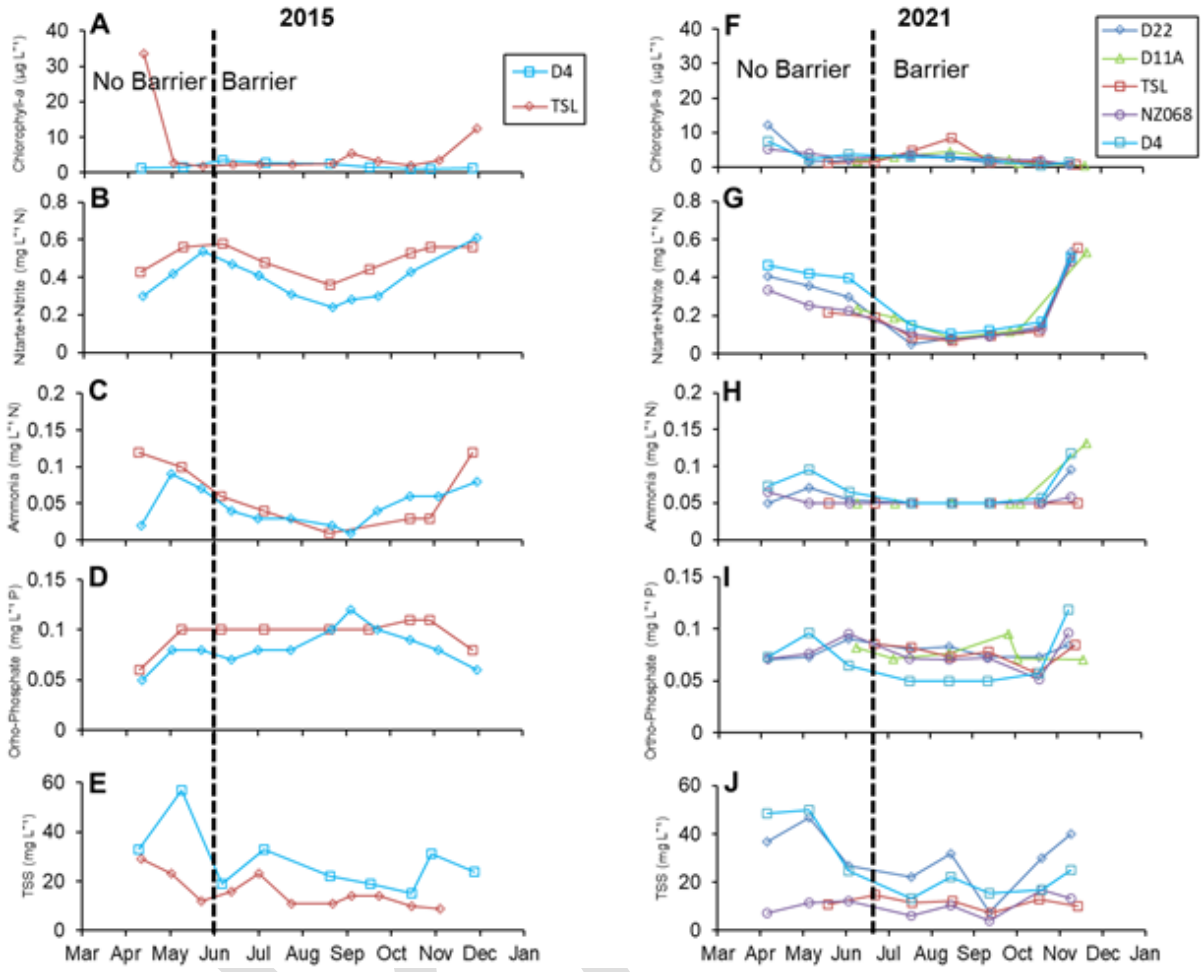


Figure 60 Map of the Sacramento River Region and discrete water quality sampling sites.

Chlorophyll-*a* concentrations were low at all sites in the Sacramento River Region in 2021, with the highest concentrations in April, ranging from 5.12 to 12.07 µg/L^{-1} across all sites (**Figure 61**, graph F). The highest concentration was measured at D4 closest to the confluence with the San Joaquin River (Figure 60). Chlorophyll-*a* concentrations averaged 2.32 µg/L^{-1} from May through November across all sites both pre- and post–EDB closure. There was an increase in chlorophyll concentrations in 2021 at TSL similar to the sites in the Interior Delta and San Joaquin River regions post–EDB closure, with a peak concentration of 8.49 µg/L^{-1} in August (Figure 61, graph F). In comparison to 2015, the Sacramento River Region's chlorophyll-*a* level was similar to 2021 throughout the EDB closure period, remaining less than 3 µg/L^{-1} across sites from May through November pre- and post–EDB closure (Figure 61, graphs A and F).



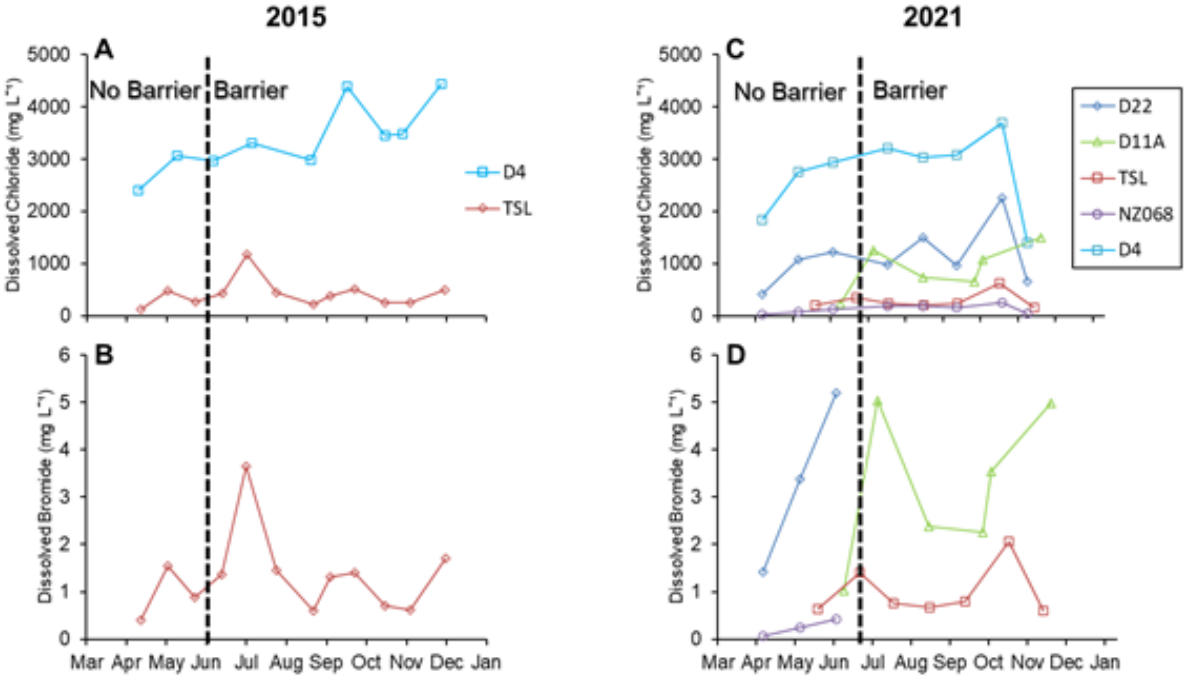
NOTE: Black dashed line denotes closure period for the EDB. DWR Bryte Laboratory reporting limits for 2015 were 0.01 mg/L^{-1} for the nitrate + nitrite and ammonia analysis and increased to 0.05 mg/L^{-1} in 2021. Discrete sampling did not occur at sites D22, D11A/SSI, and NZ068 in 2015.

Figure 61 2015 and 2021 April–November discrete concentrations of chlorophyll-*a*, dissolved nitrate + nitrite, dissolved ammonia, dissolved ortho-phosphate, and total suspended solids in the Sacramento River Region, by site.

Nitrate + nitrite concentrations were highest in April–June across all sites (Figure 61, graph G), ranging from 0.191 to 0.464 mg/L^{-1}; however, the concentrations were decreasing leading up to the EDB closure. Ammonia and ortho-phosphate concentrations were low throughout April–November 2021 and were decreasing leading up to EDB closure (Figure 61, graphs H and I). To compare 2021 to 2015: The nitrate + nitrite concentrations in the Sacramento River Region were higher in 2015, but the ammonia and ortho-phosphate concentrations were equivalent to 2021 concentrations (Figure 61, graphs B, G, C, H, D, and I). TSS concentrations in 2021 were highest in April and May at those sites (D22 and D4) closest to the confluence

with the San Joaquin River before the EDB closure, ranging from 36.9 to 50 mg/L^{-1} (Figure 61, graph J). TSS concentrations were similar at sites D4 and TSL in 2015 to 2021 during both the pre- and post–EDB closure periods (Figure 61, graphs E and J).

In 2021, chloride concentrations were lowest in April and May before the EDB closure, with chloride concentrations ranging from 409 to 2,760 mg/L^{-1} at lower sites D4 and D22, and increased to 650–3,700 mg/L^{-1} from June through November post–EDB closure (**Figure 62**, graph C). Chloride concentrations averaged 50 mg/L^{-1} farther upriver at site NZ068 before the EDB closure (Figure 62, graph C). Bromide concentrations followed trends similar to those of chloride concentrations, increasing from April through November both pre- and post–EDB closure. The highest concentrations of chloride and bromide were measured at D4 and D22, those sites farthest west and near the confluence with the San Joaquin River (Figure 60 and Figure 62, graphs C and D).



NOTE: Black dashed line denotes closure period for the EDB. Sites D22, D11A/SSI, and NZ068 were not sampled in 2015 and D4 water samples were not analyzed for dissolved bromide concentrations.

Figure 62 2015 and 2021 April–November Sacramento River discrete concentrations of dissolved chloride and bromide, by site.

To compare 2015 to 2021: The chloride and bromide concentrations (though limited by sampling) were lower in 2021, but similar to the Interior Delta and San Joaquin River regions, concentrations became

elevated in fall 2021 as outflows remained low and salinity intrusion increased in the lower Sacramento River.

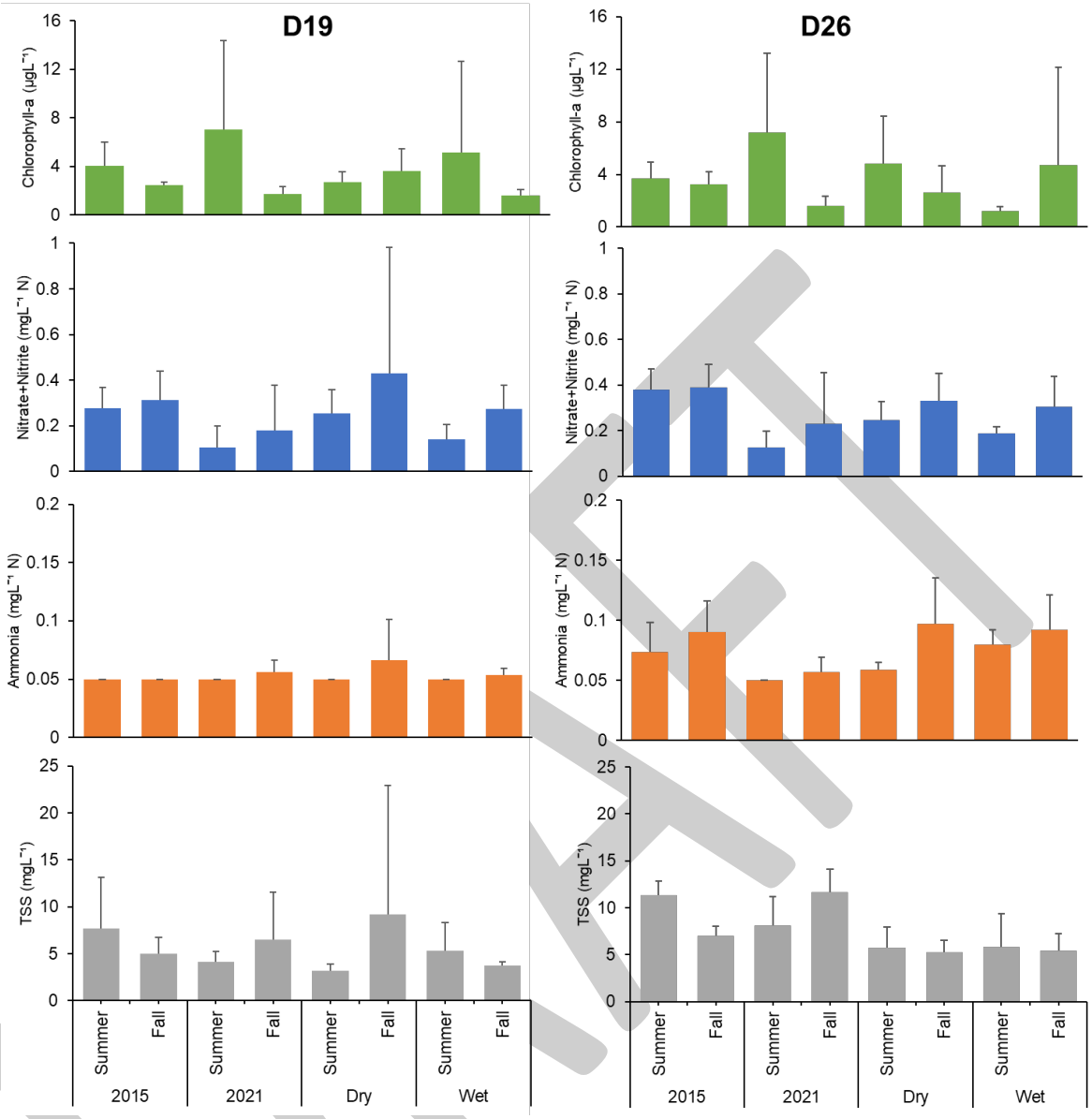
Comparison of 2021, 2015, Dry Years (2014, 2018, and 2020), and Wet Years (2017 and 2019)

As shown in **Figure 63**, summer (June–August) chlorophyll-*a* concentrations at both D19 (Franks Tract) and D26 (San Joaquin River) were higher in 2021 than in 2015, Dry years, and Wet years, but fall (September–November) concentrations were lower than in these other years. Nitrate + nitrite concentrations were lower in summer and fall 2021 than in other years; this was likely because of the presence and uptake of higher algal biomass, as seen in the report on harmful algal blooms in 2021 (Hartman et al. 2021).

Ammonia concentrations at D19 were similar across years and seasons, averaging at or near the DWR Bryte Laboratory's reporting limit of 0.05 mg/L^{-1}. D26 ammonia concentrations were lower in 2021; this was also likely attributed to the higher algal biomass and subsequent uptake during the summer months, although the upgrade to the Sacramento Wastewater Treatment Plant (reducing ammonium inputs) may have also played a role (Regional San 2021). At D19, TSS concentrations in 2021 followed patterns similar to those of other years, but TSS concentrations were higher in the San Joaquin River at D26, possibly related to higher levels of organic material from the summer algal bloom.

Harmful Algal Blooms

High concentrations of cyanobacteria, including *Microcystis*, *Dolichospermum*, and *Aphanizomenon*, were observed within Franks Tract in late July and August. This bloom may have been exacerbated by the reduced flow from the EDB. This bloom and the prevalence of harmful algae in other regions of the Delta is discussed at length in the companion report *Report on the Impact of the Emergency Drought Barrier on Harmful Algal Blooms and Aquatic Weeds in the Delta* (Hartman et al. 2021).



NOTE: Error bars represent standard deviation for each data set.

Figure 63 Bar graph of average chlorophyll-*a*, nitrate + nitrite, ammonia, and TSS at sites D19 and D26 for summer and fall 2015, 2021, Dry years (2014, 2018, and 2020), and Wet years (2017 and 2019).

2.3.3 Fish and Wildlife

Fish Community

The drought of 2020–2021 was predicted to cause an overall decline in pelagic fishes (including Longfin Smelt and Delta Smelt) and an increase in invasive littoral fishes (as seen in Mahardja et al. 2021). The barrier caused an increase in salinity in the Sacramento River and

a slight increase in X2; however, this was not expected to have a significant effect on pelagic fish distribution or abundance beyond the impact of the drought itself. The EBD may cause local increases in predatory fishes (Striped Bass and Black Bass) immediately around the barrier or notched barrier, as well as an increase in centrarchids and other vegetation specialists in the area around Franks Tract (Conrad et al. 2016).

Methods

Overall fish community response to the EDB was assessed by comparing fish catch in the CDFW Summer Townet Survey (STN) and the U.S. Fish and Wildlife Service Delta Juvenile Fish Monitoring Program (DJFMP) surveys in years with and without the EDB present. In addition, the number of fish salvaged at the State and federal fish rescue facilities was compared for years with and without the barrier.

For the analysis of the STN, catch data were obtained from the CDFW FTP site: https://filelib.wildlife.ca.gov/Public/TownetFallMidwaterTrawl/TNS%20MS%20Access%20Data/TNS%20data/

The DJFMP's beach seine data were obtained from its data publication on the Environmental Data Initiative (IEP et al. 2021): https://doi.org/10.6073/pasta/41b9eebed270c0463b41c5795537ca7c

The data sets were subset to include only surveys from 2014 through 2021 and only stations within the regions outlined in **Figure 64**.

With these data, a Bayesian generalized linear model was used with a zero-inflated negative binomial distribution to model of total catch of fish and invertebrates using the formula:

$$\text{Catch} \sim \text{Year} * \text{Region} + (1|\text{Station}) + \text{offset}(\text{Volume})$$

Analyses were performed using the function `brm` from the R package `brms` (Bürkner 2017).

To test for differences in community composition between region and year, the relative percent composition was calculated for each species, and a permutational multivariate analysis of variance was performed using the function `adonis` from the R package `vegan` (Oksanen et al. 2020) using the formula:

$$\text{Catch} \sim \text{Year} * \text{Region} + \text{block}(\text{Station})$$

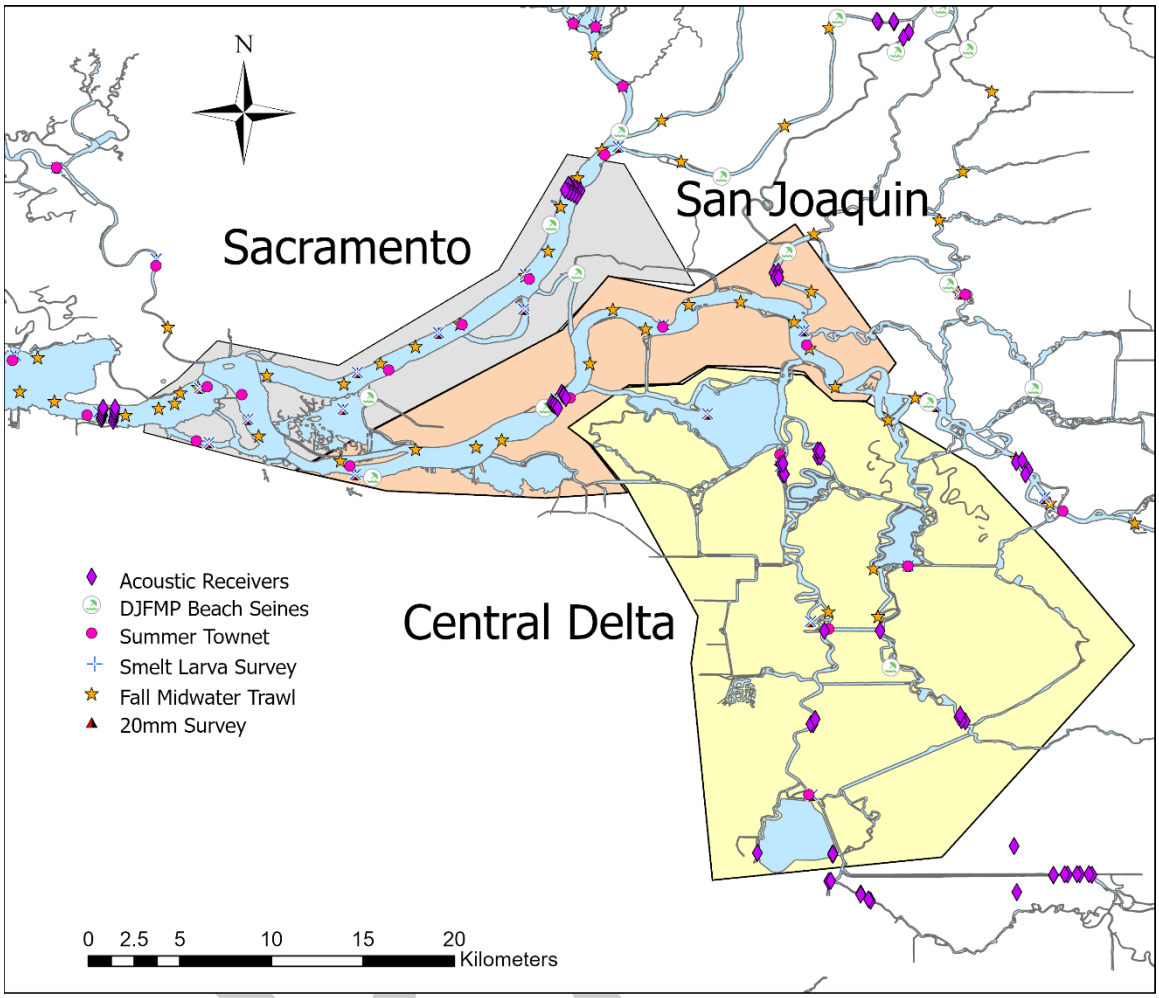


Figure 64 Survey locations.

If there is a significant impact of year, or a significant interaction between region and year, with a similar response in years with a barrier in place (2015 and 2021), it would indicate that the barrier has an impact on fish abundance and/or community composition.

For the analysis of fish salvage data, the salvage database was downloaded from the CDFW website: https://filelib.wildlife.ca.gov/Public/salvage/

The total catch was calculated for all listed fish species (Chinook Salmon [*Oncorhynchus tshawytscha*], Delta Smelt [*Hypomesus transpacificus*], Longfin Smelt [*Spirinchus thaleichthys*], Green Sturgeon [*Acipenser medirostris*], and Steelhead [*Oncorhynchus mykiss*]) for June–November in 2014–2021. This corresponds with months in which the barrier was in place during 2021 where the data set is complete. The resulting data were graphed to visually

inspect trends in salvage; however, catches of listed fishes were too erratic to model statistically.

Analysis of data from the 20mm survey, Fall Midwater Trawl, Smelt Larval survey, and acoustic telemetry will be included with the 2023 update to this report after the EDB has been in for 18 months.

Results

Summer Townet

Summer townet catch was highest in the Sacramento River Region in all years, with some fish also caught in the San Joaquin River Region, but very small catches in the Central Delta Region (**Figure 65**, **Figure 66**, **Table 4**). Catch in the Sacramento River Region was higher during barrier years (2015 and 2021) than during Dry, non-barrier years or Wet years. This response appears to have been driven partially by an increase in the catch of the jellyfish *Maeotius*, which is a brackish-water specialist, although catch of *Tridentiger* spp. also increased in the Sacramento River Region during barrier years. The barrier and associated salinity intrusion farther up the Sacramento River may have facilitated dispersal of these species farther upstream than normal.

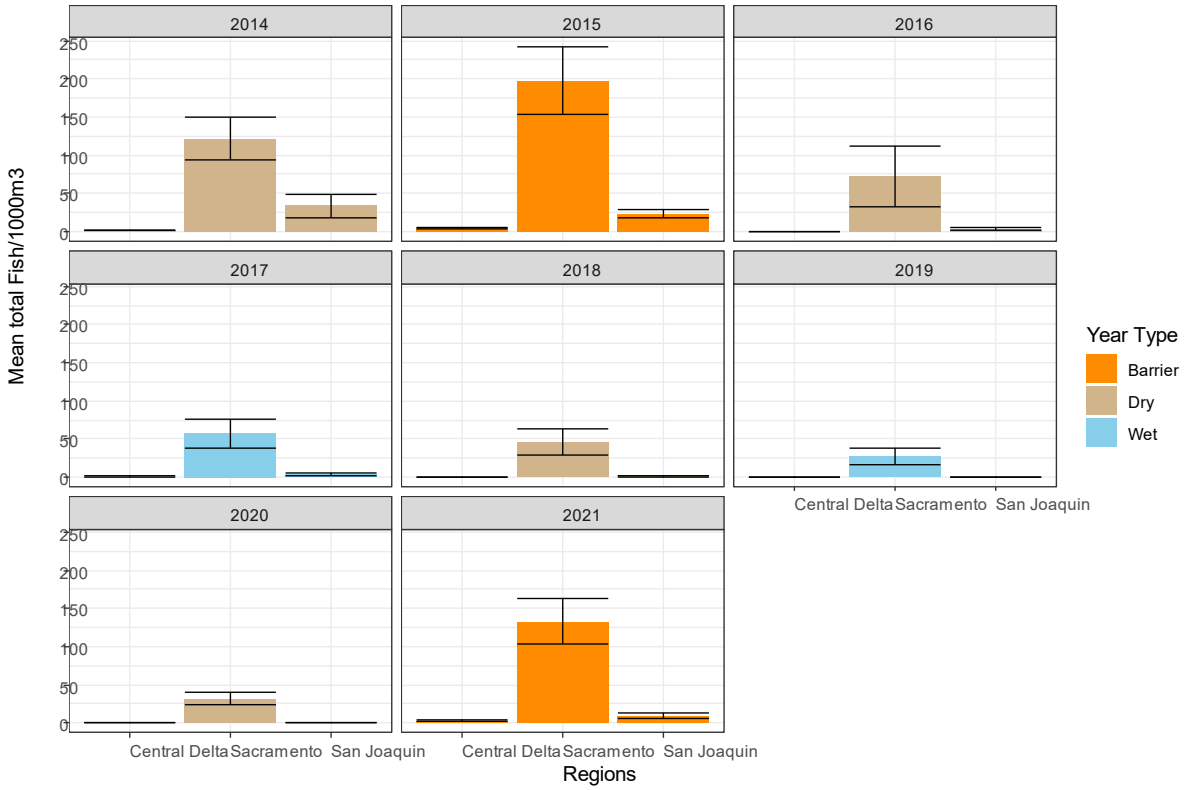


Figure 65 Average fish catch per unit of fishing effort (±1 standard error) collected in the Summer Townet Survey by region and year.

TABLE 4
COEFFICIENTS OF BAYESIAN ZERO-INFLATED NEGATIVE BINOMIAL MODEL OF SUMMER TOWNET CATCH WITH THE UPPER AND LOWER 95% CONFIDENCE INTERVALS

Model term	Estimate	Estimated Error	Lower 95% Confidence Interval	Upper 95% Confidence Interval	Rhat
Intercept—2014, South Central	0.587	0.614	-0.624	1.817	1.001
Region—Sacramento	4.498	0.779	3.025	6.043	1.004
Region—San Joaquin	2.548	0.843	0.877	4.188	1.002
Year—2015	1.031	0.462	0.121	1.938	1.001
Year—2016	-1.573	0.548	-2.648	-0.510	1.000
Year—2017	-1.127	0.539	-2.213	-0.097	1.002
Year—2018	-2.286	0.653	-3.613	-1.045	1.001
Year—2019	-1.678	0.573	-2.820	-0.584	1.001
Year—2020	-1.004	0.517	-2.028	0.034	1.001
Year—2021	0.623	0.462	-0.302	1.511	1.000
Sacramento x 2015	-1.000	0.584	-2.178	0.126	1.001
San Joaquin x 2015	-0.859	0.633	-2.120	0.387	1.000
Sacramento x 2016	-0.232	0.653	-1.524	1.025	1.000
San Joaquin x 2016	-0.540	0.700	-1.902	0.839	1.001
Sacramento x 2017	-0.108	0.651	-1.389	1.199	1.002
San Joaquin x 2017	-1.108	0.698	-2.463	0.303	1.000
Sacramento x 2018	0.561	0.750	-0.924	2.035	1.000
San Joaquin x 2018	-0.434	0.813	-1.976	1.190	1.000
Sacramento x 2019	-0.803	0.700	-2.186	0.527	1.001
San Joaquin x 2019	-1.799	0.773	-3.334	-0.251	1.000
Sacramento x 2020	-1.000	0.642	-2.291	0.247	1.001
San Joaquin x 2020	-2.683	0.711	-4.073	-1.305	1.001
Sacramento x 2021	-1.041	0.588	-2.200	0.118	1.000
San Joaquin x 2021	-1.564	0.628	-2.780	-0.325	1.000

NOTE:
Rhat = potential scale reduction statistic (Gelman-Rubin statistic)

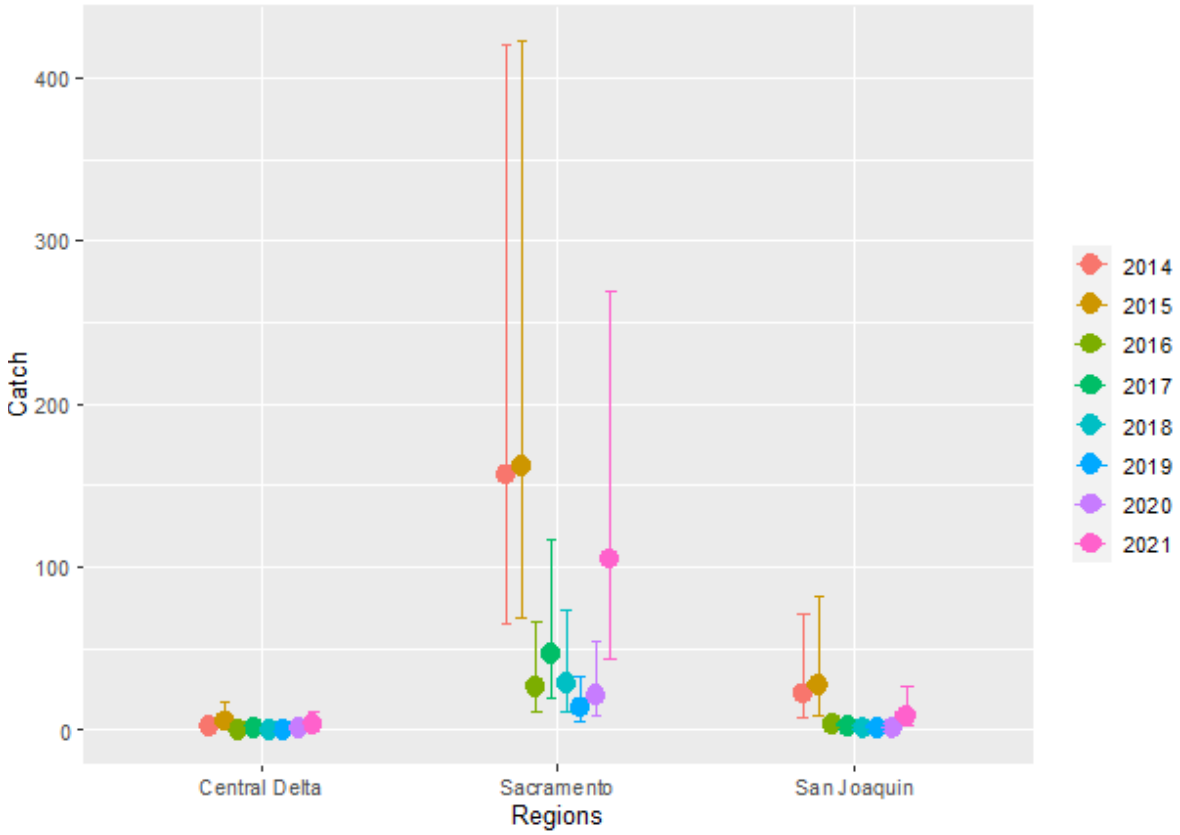


Figure 66 Conditional effects plot from zero-inflated negative binomial Bayesian model of total fish catch per unit of fishing effort by season and region.

The permutational multivariate analysis of variance (PERMANOVA) on relative abundance of species caught by the summer townet between regions and years found significant difference between years, but not between regions (**Table 5**). Catch in the San Joaquin River and Central Delta regions was often very small and highly variable, with many trawls catching no fish at all. Therefore, differences in community composition between regions that may exist will be difficult to show statistically. Differences between years were easier to see, with 2014, 2015, 2017, and 2021 having greater proportions of *Maeotias*; 2016 and 2017 having greater proportions of Siberian prawns; and 2016, 2017, and 2020 having more White Catfish (*Ameiurus catus*) (**Figure 67**).

When looking just at listed fish species, no salmon, sturgeon, or smelt were caught in the Central Delta Region or San Joaquin River Region from 2014 through 2021 (**Figure 68**). A few Delta Smelt were caught in the Sacramento River Region during 2014–2017, and a few Longfin Smelt were caught in 2014, 2020, and 2021. None of these patterns appear associated with the barrier.

TABLE 5
RESULTS OF PERMUTATIONAL MULTIVARIATE ANALYSIS OF VARIANCE ON SUMMER TOWNET DATA, 2014–2021

	Degrees of Freedom (Df)	Sums of Squares (SumsOfSqs)	Means of Squares (MeanSqs)	F-statistic (F.Model)	Coefficient of Determination (R2)	P-value (Pr(>F))
Year	4.000	2.580	0.645	3.074	0.359	0.003
Region	1.000	0.248	0.248	1.181	0.034	0.293
Year*Region	2.000	0.371	0.186	0.885	0.052	0.591
Residuals	19.000	3.987	0.210		0.555	
Total	**26.000**	**7.185**			**1.000**	

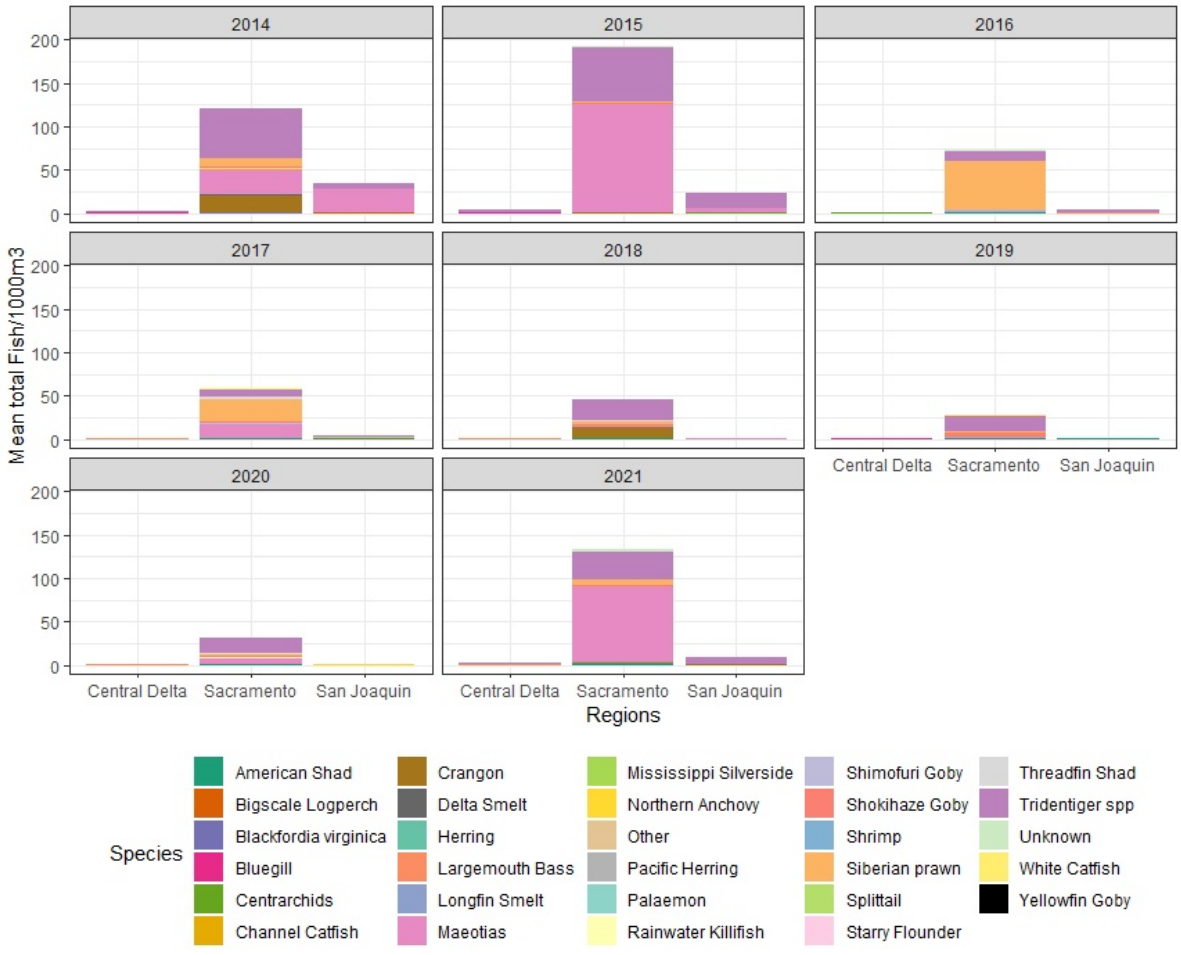


Figure 67 Community composition of townet samples collected in each region and year.

Figure 68 Catch of special-status species in the summer townet by year and region.

Delta Juvenile Fish Monitoring Program

The beach seine data, which target littoral fishes rather than pelagic fishes, had many higher catches than the pelagic surveys. Average catch per unit of fishing effort was highest in the San Joaquin River Region during many years instead of the Sacramento River Region, but the Central Delta Region still had relatively low catch (**Figure 69**, **Figure 70**, **Table 6**). Inland Silversides (*Menidia audens*) were the most frequently caught species in all regions and years, with Western Mosquitofish (*Gambusia affinis)* and Threadfin Shad (*Dorosoma petenense*) being the second and third most abundant.

TABLE 6
COEFFICIENTS OF BAYESIAN ZERO-INFLATED NEGATIVE BINOMIAL MODEL OF DJFMP BEACH SEINE WITH THE UPPER AND LOWER 95% CONFIDENCE INTERVALS

Model Term	Estimate	Estimated Error	Lower 95% Confidence Interval	Upper 95% Confidence Interval	Rhat
Intercept—South Delta, 2014	3.154	0.490	2.165	4.128	1.002
Region—Sacramento	2.007	0.830	0.338	3.639	1.003
Region—San Joaquin	1.161	0.798	-0.408	2.735	1.000
2015	1.177	0.349	0.498	1.855	1.001
2016	1.140	0.375	0.397	1.888	1.001
2017	-0.080	0.351	-0.764	0.606	1.000
2018	-1.083	0.396	-1.852	-0.307	1.001
2019	0.319	0.383	-0.422	1.067	1.000
2021	-0.470	0.926	-1.965	1.560	1.000
2020	-0.029	0.633	-1.178	1.284	1.001
Sacramento x 2015	-1.448	0.462	-2.370	-0.533	1.000
San Joaquin x 2015	-0.799	0.424	-1.613	0.017	1.000
Sacramento x 2016	-1.567	0.492	-2.537	-0.597	1.000
San Joaquin x 2016	0.198	0.463	-0.692	1.110	1.001
Sacramento x 2017	-0.871	0.476	-1.799	0.085	1.001
San Joaquin x 2017	-0.002	0.435	-0.859	0.841	1.000
Sacramento x 2018	0.595	0.515	-0.431	1.586	1.000
San Joaquin x 2018	1.420	0.477	0.469	2.337	1.000
Sacramento x 2019	-0.796	0.515	-1.803	0.201	1.001
San Joaquin x 2019	0.046	0.475	-0.907	0.941	1.000
Sacramento x 2021	-0.326	1.010	-2.540	1.399	1.000
San Joaquin x 2021	2.183	0.997	0.057	3.855	1.000
Sacramento x 2020	0.009	0.864	-1.622	1.700	1.000
San Joaquin x 2020	1.058	0.759	-0.482	2.500	1.000

NOTE:
Rhat = potential scale reduction statistic (Gelman-Rubin statistic)

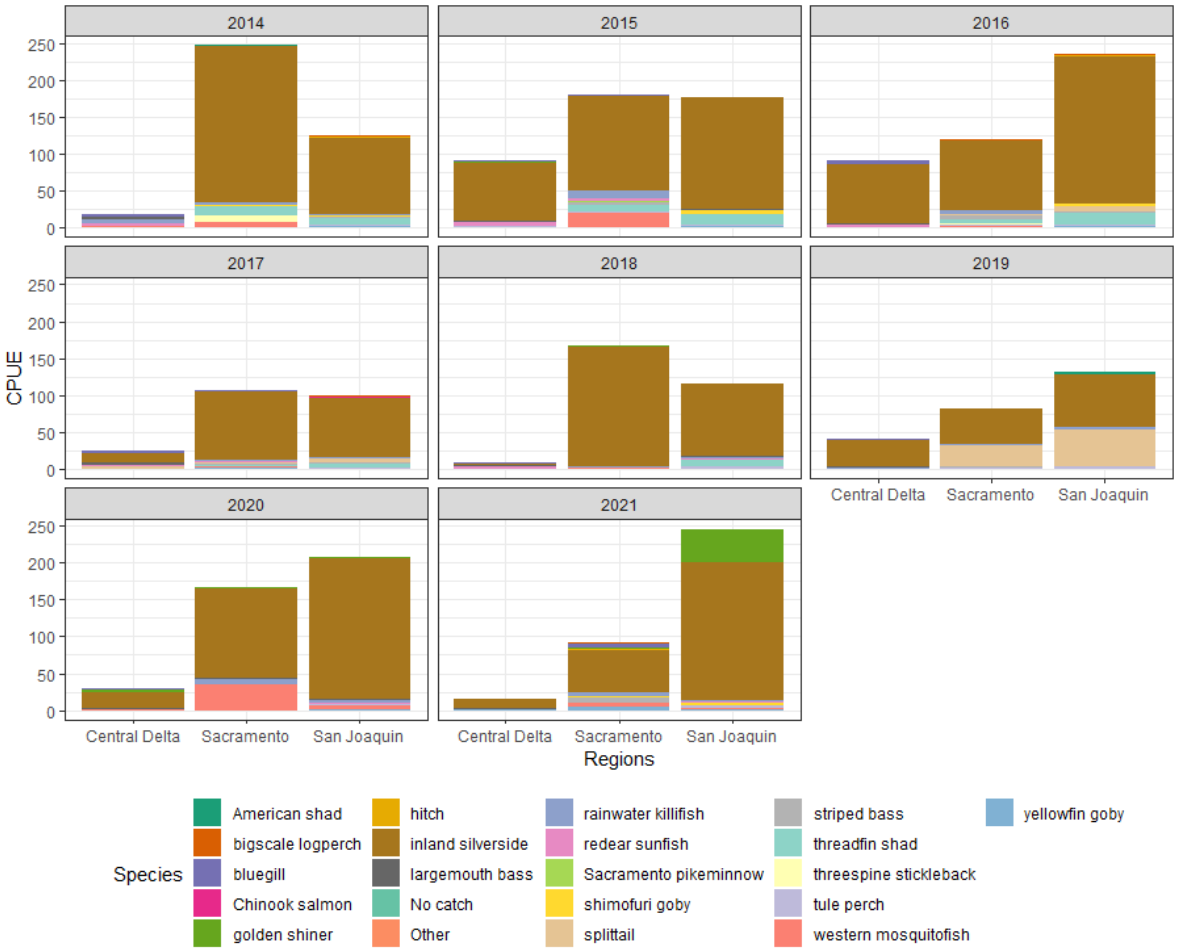


Figure 69 DJFMP community composition by region and year.

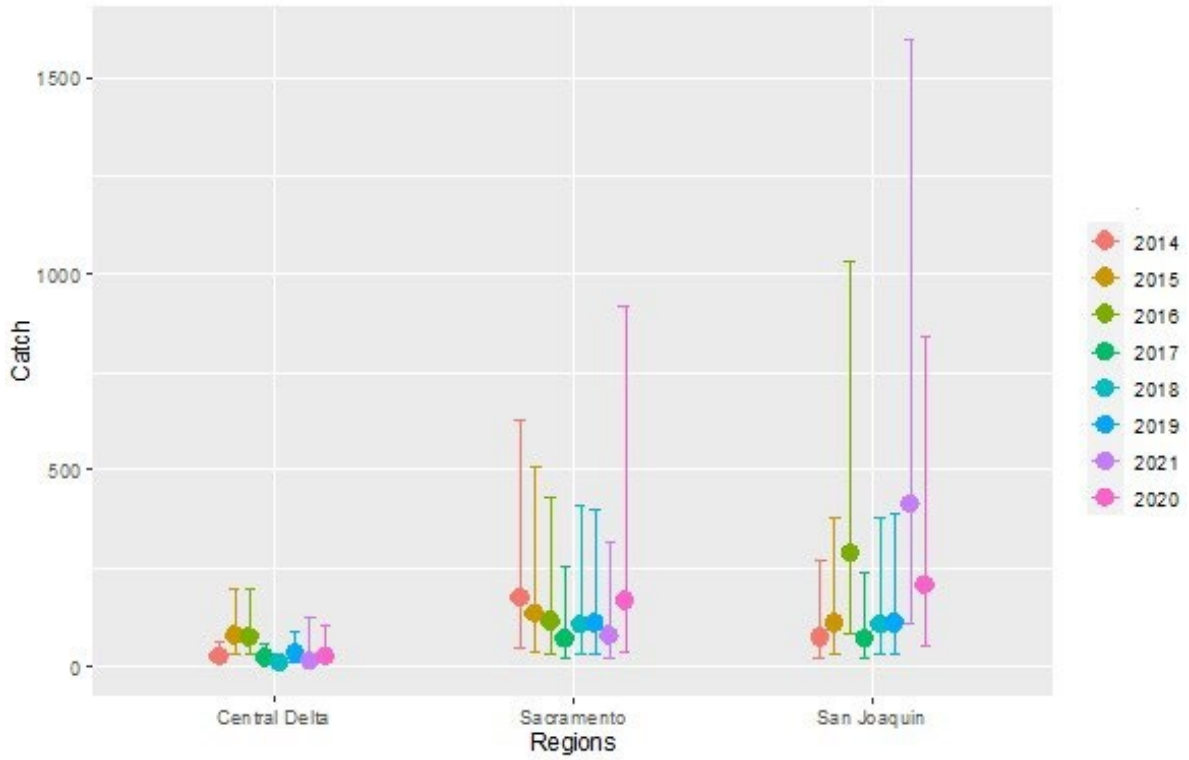


Figure 70 Conditional effects plot of the Bayesian model of total fish catch in the DJFMP's beach seines interaction of year and region.

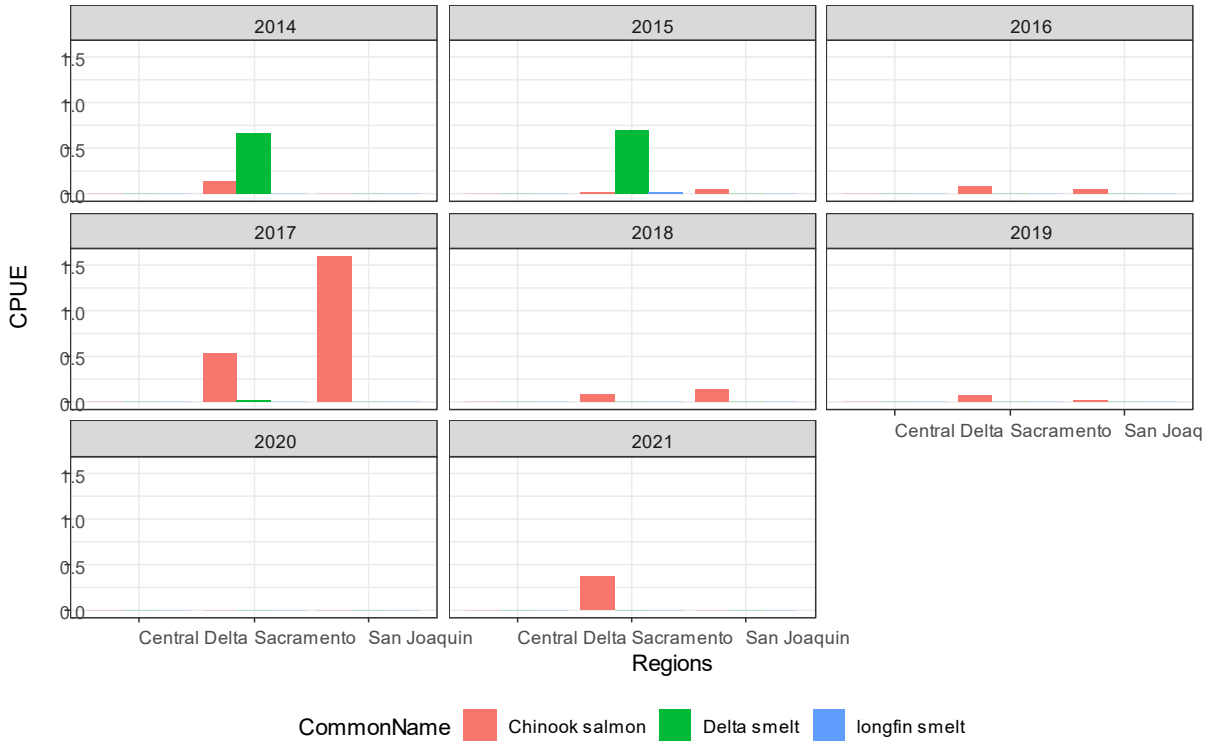
The PERMANOVA on community composition found that there was a significant difference in community composition between regions, years, and the interaction of region and year; however, none of these three terms explained more than 8 percent of the variance (**Table 7**). Some notable differences between regions were the higher relative abundance of Redear Sunfish (*Lepomis microlophus*) and Bluegill (*Lepomis macrochirus*) in the Central Delta Region, the higher relative abundance of Threadfin Shad and Western Mosquitofish in the Sacramento River Region, and the relatively high abundance of Threadfin Shad and Sacramento Splittail (*Pogonichthys macrolepidotus*) in the San Joaquin River Region. Notable differences between years include higher abundances of splittail in 2016, 2017, and 2019, with higher abundances of Western Mosquitofish in 2014, 2015, and 2020 and an unusually high catch of golden shiners in 2021.

TABLE 7
RESULTS OF PERMUTATIONAL MULTIVARIATE ANALYSIS OF VARIANCE OF BEACH SEINE COMMUNITIES

Model Term	Degrees of Freedom (Df)	Sums of Squares (SumsOfSqs)	Means of Squares (MeanSqs)	F-statistic (F.Model)	Coefficient of Determination (R2)	P-value (Pr(>F))	Signifi-cance
Year	7.000	9.164	1.309	4.384	0.034	0.001	***
Regions	2.000	20.451	10.226	34.240	0.076	0.001	***
Year:Regions	14.000	9.515	0.680	2.276	0.035	0.001	***
Residuals	773.000	230.850	0.299		0.855		
Total	**796.000**	**269.980**			**1.000**		

NOTE:
*** Statistically significant at the p<0.01 level

Listed fish species were rarely caught in beach seines, although a few Delta Smelt and Longfin Smelt were caught in 2014 and 2015 (**Figure 71**). Chinook Salmon were caught occasionally in the Sacramento River and San Joaquin River regions, especially during 2017, but were never caught in the Central Delta Region (Figure 71).



NOTE: No sturgeon or steelhead were caught during this time period.

Figure 71 Catch of Chinook Salmon, Delta Smelt, and Longfin Smelt in the DJFMP beach seine by region and year.

One of the hypotheses about the effect of the barrier on fish communities was that there would be an increase in centrarchids in the Central Delta, because fish in this family tend to associate with slower-moving water and vegetation. While the DJFMP beach seine surveys do not include a site within Franks Tract itself, sites in the Central Delta Region had a lower abundance of centrarchids in 2021 than in previous years (**Table 8**, **Figure 72**, **Figure 73**). In contrast, the Sacramento River Region saw the highest catch per unit of fishing effort of centrarchids seen in that region, mostly Bluegill (Figure 72).

Figure 72 Graph of DJFMP beach seine catch in the family Centrarchidae.

TABLE 8
COEFFICIENTS OF BAYESIAN ZERO-INFLATED NEGATIVE BINOMIAL MODEL OF DJFMP BEACH SEINE CENTRARCHID CATCH WITH THE UPPER AND LOWER 95% CONFIDENCE INTERVALS

Model Term	Estimate	Estimated Error	Lower 95% Confidence Interval	Upper 95% Confidence Interval	Rhat
Intercept—South Delta, 2014	2.375	0.668	1.046	3.684	1.003
Region—Sacramento	-3.202	1.147	-5.490	-1.019	1.000
Region—San Joaquin	-2.574	1.134	-4.773	-0.401	1.001
2015	-0.035	0.374	-0.764	0.681	1.001
2016	-0.368	0.403	-1.164	0.422	1.001
2017	-0.592	0.382	-1.348	0.141	1.001
2018	-0.912	0.452	-1.812	-0.037	1.001
2019	-0.617	0.423	-1.458	0.223	1.000
2021	-1.352	0.818	-2.834	0.353	1.000
2020	-2.104	1.449	-4.783	1.055	1.001
Sacramento x 2015	1.050	0.632	-0.202	2.256	1.001
San Joaquin x 2015	0.198	0.501	-0.747	1.189	1.000
Sacramento x 2016	1.071	0.761	-0.403	2.554	1.000
San Joaquin x 2016	0.303	0.531	-0.736	1.352	1.000
Sacramento x 2017	2.564	0.687	1.174	3.907	1.001
San Joaquin x 2017	0.902	0.518	-0.088	1.950	1.000
Sacramento x 2018	-0.131	0.876	-1.826	1.564	1.001
San Joaquin x 2018	1.491	0.555	0.403	2.601	1.001
Sacramento x 2019	3.214	0.820	1.601	4.819	1.000
San Joaquin x 2019	1.161	0.549	0.079	2.234	1.000
Sacramento x 2021	-0.231	1.332	-2.929	2.262	1.000
San Joaquin x 2021	1.947	0.963	-0.006	3.766	1.001
Sacramento x 2020	5.498	1.567	2.288	8.466	1.001
San Joaquin x 2020	2.079	1.527	-1.130	4.884	1.001

NOTE:
Rhat = potential scale reduction statistic (Gelman-Rubin statistic)

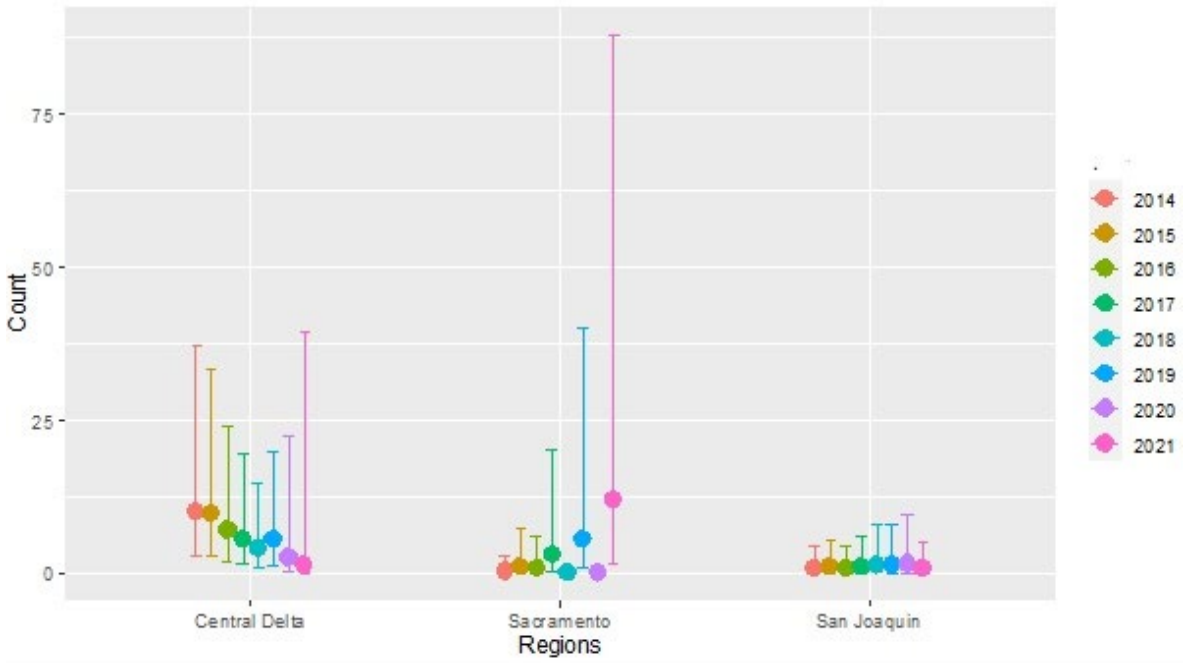


Figure 73 Conditional effects plot of the Bayesian model of total Centrarchid catch in DJFMP's beach seines interaction of year and region.

Salvage

From June through November 2021, five juvenile Chinook Salmon were salvaged and five Delta Smelt were salvaged. No Steelhead, Longfin Smelt, or Green Sturgeon were caught. In 2015, the other "barrier year," four Chinook Salmon and no other listed fishes were caught. Catch of Delta Smelt was too sporadic to statistically test for differences between years. Delta Smelt catch was the same in 2020 and 2021, and no Delta Smelt were caught in 2015, so the barrier is unlikely to have had a measurable impact on Delta Smelt. Other efforts are currently underway to model Chinook Salmon salvage, so they will not be repeated here. However, when looking at the data graphically, catch of Chinook Salmon from June through November was much higher during the two Wet years (2017 and 2019) than during any of the Dry years (**Figure 74**).

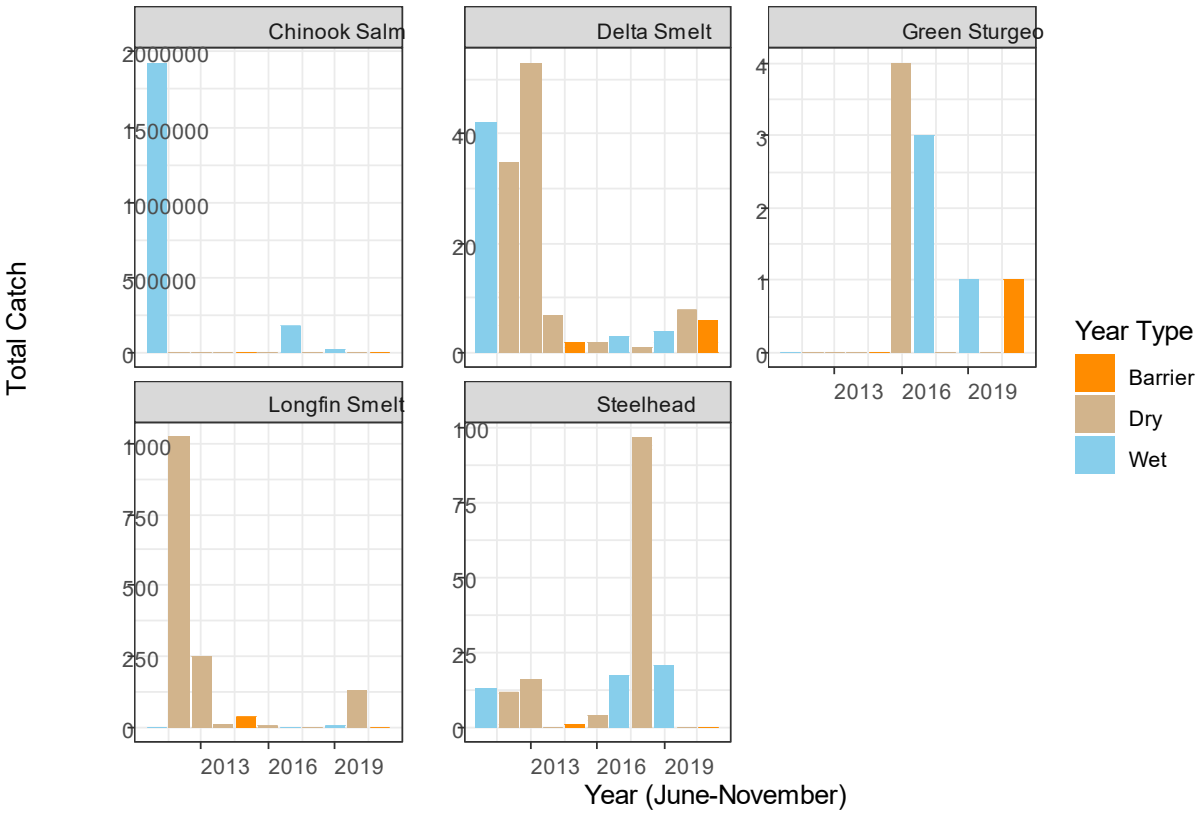


Figure 74 Total catch of listed fish species collected at the State and federal fish salvage facilities by year for June–November.

Discussion

The clearest effect the West False River barrier had on fish communities was higher total catch, higher catch of the jellyfish species *Maeotius*, and higher catch of *Trientiger* gobies in the Sacramento River in the Summer Townet Survey during years when the barrier was in place. Because of the availability of only two years of data when the barrier was present, the increase in catch of gobies and jellyfish cannot be conclusively tied to the barrier. Other similarities between 2021 and 2015, such as the extreme Dry year, could have been driving this relationship; however, there was not as dramatic an increase in other Dry years, such as 2014, 2016, and 2020.

No clear patterns in the littoral fish community were apparent that could be attributed to the barrier (Figure 69), although several patterns can be tied to the drought in general. Total fish catch was higher across all regions during Dry years, possibly driven by the high catch of Mississippi Silversides, which are known to increase with droughts (Mahardja et al. 2016). The DJFMP beach seines did not have any clear similarities between 2015 and 2021, but the Wet years of

2017 and 2019 had particularly high splittail catch. Splittail spawn in floodplains, so young-of-year splittail catch shows a strong relationship with Wet years, particularly with inundation of the Yolo Bypass and Cosumnes River floodplains (Moyle et al. 2004).

Summary of Predation Study

Objectives

The purpose of the EDB Predation Study (EDBPS) is to assess impacts of the EDB on the predation rate of juvenile salmonids. The EDBPS study addresses the following 2021 EDB Biological Assessment conservation measure:

> *To address the uncertainty associated with potential predation effects from the retained barrier rock, DWR will conduct a study using predation event recorders or other appropriate technology to examine the evidence for areas along the barrier with relatively high predation and, should any such areas be identified, the feasibility of structural modifications to address any predation concerns noted will be evaluated. In the event that embankment rock is retained, through a subsequent permit action, DWR will expand this analysis to continue during the period when the embankment rock is retained within the channel.*

The objectives of the 2021 EDBPS were to (1) determine whether there was a change in relative predation rate associated with the construction of the EDB; (2) determine whether there was an increase in relative predation rate once the EDB was fully constructed; and (3) examine the influence of the EDB on predation rate over time.

Predation Study Design

The EDBPS was conducted at the site of the EDB in False River. The study reach extended 500 meters east and 500 meters west of the EDB and included the entire channel width. The study implemented the use of drifting predation loggers to measure where and when predation events occurred. The drifting predation loggers were designed and constructed based on the National Marine Fisheries Service's Predation Event Recorders (PERs) (Demetras et al. 2016). Each PER was equipped with a Global Positioning System (GPS) transponder and magnetic timer. A tethered Golden Shiner was attached to each PER as a surrogate bait species for Chinook Salmon.

Sampling occurred at the study site three hours before sunset to three hours after sunset, to target a total of 600 minutes of cumulative float

time on each sampling day. Sampling was conducted during three periods: pre-construction, during construction, and post-construction of the EDB. Before and during construction, PERs were deployed across the width of False River 500 meters up-current of the barrier and allowed to drift to 500 meters down-current of the barrier, or drift for one hour if the current was insufficient for the PERs to drift the entire 500 meters. During the post-construction period, PERs were deployed simultaneously on the east and west sides of the EDB. Depending on prevailing current and winds, PERs were allowed to drift either from the EDB to 500 meters away, or from 500 meters away toward the EDB, or for one hour within 500 meters of the barrier. If a PER intersected the buoy line associated with the EDB and became stuck, crews manually guided PERs under the buoy line to continue the duration of the drift.

PERs were manually retrieved one by one. Upon retrieval, the status of the predation-triggered time and Golden Shiner was recorded. If triggered, the timer was reset and Golden Shiner replaced before subsequent deployments. A predation event was defined as a triggered timer where the fish was missing.

Light and Vegetation Surveys

During the 2021 sampling season, pilot surveys were conducted to measure light and vegetation within the study area. Results from these efforts are not included in the survival model and thus are not discussed in detail in this report. During May, June, and July, a light meter was deployed to the subsurface from a boat and transects were driven across the PER deployment area. Future light surveys will employ a stationary light meter deployed at the study site.

Two vegetation surveys were completed during the 2021 sampling season. Surveys used side-scan sonar to visualize underwater structures and vegetation. Future vegetation surveys will consist of monthly surveys of the shorelines using sonar and drone technology.

Statistical Approach

To evaluate effects of the barrier on predation risk, a Cox Proportional Hazard Model was used. This model evaluates the effects of spatial and temporal parameters during each construction period. The response variable, "predation," is a Boolean value, which may occur at a single point in time for a trial (the trigger time), and after which the trial ends. The predictor variables are a mix of linear parameters and categorical values. Predation risk models were run with each combination of all 10 parameters. The most parsimonious model was

chosen via Akaike Information Criterion (AIC). Potential covariates are described in **Table 9**.

TABLE 9
POTENTIAL COVARIATES

Covariate	Metric	Reason for Inclusion in Model
Period	Pre-, during, post-construction	The construction phase alters flow, habitat, and environment.
Distance to barrier	Meters	This is the primary habitat alteration of interest.
Distance to shore	Meters	Shoreline structure provides potential predator habitat.
Tidal phase	Low slack, flood, high slack, ebb	May influence predator behavior, salinity, turbidity, and water velocities in False River.
Water speed (flow)	Meters per second (m/s)	Slower water may lead to higher predation risk.
Starting position	East, west	Captures unmeasured environmental differences on each side of barrier.
Water temperature	Degrees Celsius	High temperatures may increase predation.
Salinity	Practical salinity units (PSU)	Higher salinities may increase predation by Striped Bass.
Turbidity	Nephelometric turbidity units (NTU)	Higher turbidity may promote predation by visual predators.
Sunset	Before, during, after	Predation events may be more common during sunset.

Assumptions and Challenges

Assumptions of the predation risk model include that each PER is interchangeable with respect to GPS ping rate, trigger magnet pull strength, and Golden Shiner action. The model also assumes that there was equal coverage of the study area, and that predators would have equal prey selectivity between Golden Shiners and Chinook Salmon.

The 2021 sampling season encountered several challenges. The project was under an accelerated timeline for planning and implementation because of the emergency designation of the work. Predator identification was not possible, given the turbid water and night sampling. During and post-construction, access to the barrier proved challenging. Predator survey crews also had to safely navigate around construction boat traffic, relocation of the construction barges, and the buoy line buffering the barrier.

Preliminary Results

During the pre-construction sampling, there were a total of six days of sampling and 382 PER deployments. During construction, there were

11 days of sampling and 848 PER deployments. During post-construction, there were 10 days of sampling and 1,200 PER deployments. The total soak time during the pre-, during, and post-construction periods was 248, 516, and 999 hours, respectively. The number of predation events during the pre-, during, and post-construction periods was 26, 52, and 79, respectively. Percent predation (percentage of deployments) was 6.8 percent, 6.1 percent, and 6.6 percent during the pre-construction, construction, and post-construction periods, respectively. **Table 10** shows a summary of the descriptive results.

TABLE 10
DESCRIPTIVE RESULTS OF THE EMERGENCY DROUGHT BARRIER PREDATION STUDY

Parameter	Pre-construction	During Construction	Post-construction
Number of sampling days	6	11	10
Number of PER deployments	382	848	1200
Soak time (hours)	248	516	999
Number of predation events	26	52	79
Percent predation	6.8	6.1	6.6

The Cox Proportional Hazard Model identified numerous covariates that were significantly related to predation risk. Preliminary model results indicated the following:

- Lower predation rates during the post-construction period than pre-construction.
- Higher predation rates near the shore and the barrier.
- Predation rate that increased with increased salinity.
- Higher predation rates observed when PERs were moving quickly.
- No effect of tidal stage on predation rate.
- In the post-construction period, higher predation rate associated with proximity to the barrier.

Overall, preliminary modeling results indicated that predation rates did not change significantly between pre-construction and construction periods. The observed decrease in predation rate following construction may indicate that habitat connectedness was the main driver in changes in predation rate. Once the barrier was in place following construction, False River became disconnected, and

eliminated the migratory route between the San Joaquin River and the interior Delta. Therefore, lack of habitat connectedness may have limited the presence of highly migratory species like Striped Bass, thereby reducing predation rates. This reduction in habitat connectedness was also correlated with slower PERs speeds, and lower salinities in the post-construction period, likely leading to the observed relationships with lower predation rate.

Future Sampling

The notching of the EDB is expected to create complex hydrodynamics and alter the connectedness of False River, potentially affecting the movement of predator and prey species and altering the local predation risk of juvenile salmonids. Therefore, additional PERs sampling will be conducted for five days each month from November through May during the pre-notching period (November–December), notched period (January–March), and post-notching period (April–May). In addition to PERs sampling, monitoring of multiple different environmental covariates will occur, including stationary light surveys, vegetation surveys, hydrodynamics sampling conducted by USGS, and bathymetry sampling conducted by DWR. Lastly, USGS will place additional acoustic telemetry receivers adjacent to the EDB to examine the impact of the EDB on the exposure and movement of acoustically tagged juvenile salmonids that will be released throughout the Sacramento–San Joaquin Basin during winter and spring 2021–2022.

Zooplankton

Zooplankton sample processing from summer 2021 is still ongoing at this time. Once sample processes and data quality assurance have been completed, data will be analyzed for barrier impacts on zooplankton biomass and community composition.

Aquatic Weeds

Franks Tract, on the eastern side of the barrier, has been inundated with submerged aquatic vegetation for the past several years. To assess the impact of the barrier, aquatic vegetation was monitored across the Delta using hyperspectral imagery. Imagery has been collected over all or most of the Delta annually since 2014, with additional surveys conducted in 2004 and 2008. Imagery was collected in July 2021, but these data were still being processed at the time of this report. Submerged aquatic vegetation within Franks Tract has also been monitored annually using rake surveys conducted by the California Department of Parks and Recreation, Division of Boating and Waterways, in collaboration with SePRO Corporation, Carmel, Indiana. These data are summarized in the companion report *Report on the*

Impact of the Emergency Drought Barrier on Harmful Algal Blooms and Aquatic Weeds in the Delta (Hartman et al. 2021).

Without final imagery for 2021, no statements can be made regarding the impact of the barrier. However, the increasing prevalence of weeds over the past 15 years may be caused in part by the increased frequency of droughts and increases in temperature.

SECTION 3
Conclusions and Lessons Learned

3.1 Summary of Effectiveness and Impacts

The 2021–2022 EDB effectively reduced the salinity of water entering the Central Delta and Old/Middle River corridor in 2021, although it had less of an influence on salinity at the SWP and CVP pumps. This salinity reduction achieved by altering tidal dispersion patterns so that less saline water was pumped through Franks Tract into the South Delta and more saline water was pushed farther into the Sacramento River; however, operations of the DCC gates interacted with the barrier to change its efficiency. The barrier, combined with the 2021 TUCP, allowed the SWP to meet water quality standards while conserving 280 TAF of water over the course of the summer.

The barrier's impact on flow was strongest within Franks Tract itself, where water age increased significantly on the western side of the tract and decreased slightly on the eastern side. Velocity increased greatly through Fisherman's Cut and Old River at Franks Tract, while decreasing at Holland Cut and Quimby Island, similar to the response to the 2015 barrier.

Changes to flow within Franks Tract most likely contributed to the large cyanobacteria bloom seen in July and August 2021. While toxin levels were relatively low when sampling occurred, sampling was insufficient to fully record the bloom. This also coincided with an increase in chlorophyll, increase in pH, decrease in nitrogen, and highly variable DO, which could have further impacts on the food web.

No special-status species were observed being harmed during the construction period, and all water quality parameters remained within acceptable levels during construction. There was no evidence of increased predation rates on pelagic fishes before and after construction of the barrier. There was some evidence of increased abundance of the jellyfish *Maeotioas* and juvenile Tridentiger gobies in the Sacramento River during years when the barrier was in place.

3.2 Recommendations for the Future

Overall, the barrier achieved its objective of reducing salinity in the South Delta while preserving upstream storage. However, operations of the DCC gates could have been better coordinated to achieve the maximum benefit of the barrier. This is the second time in the past seven years that drought conditions have required an emergency barrier in this location; therefore, planning for installation of a drought barrier on a non-emergency basis would be very beneficial to water management in the region. These plans are already underway.

The largest impact the barrier had on the ecosystem over the summer was the large cyanobacteria bloom in July, which was poorly understood. Monitoring associated with the barrier in 2022 and 2023 will include increased monitoring for cyanotoxins and potentially harmful cyanobacteria.

Impacts of the barrier on fish migration over the winter have not been assessed yet, and because the 2015 barrier was removed in November, no historical precedent is available to consult for predictions. It will be important to evaluate the impact of the barrier on salmon migration, particularly to assess whether the barrier acts as an obstacle to juvenile outmigration and whether the notch in the barrier alleviates this impact.

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Appendix A

Monitoring Results for Turbidity and Settleable Solids

West False River Emergency Drought Barrier — June 3 thru June 22

TEMPORARY BARRIER SITE: West False River Emergency Drought Barrier - Installation

TURB - TURBIDITY CRITERIA: Below 150 NTU is acceptable.

SS - SETTLEABLE SOLIDS CRITERIA: Below 0.1 ml/L is acceptable.

DAY	Thursday
DATE	06/03/21
TECHNICIAN	Chris Weber

SAMPLE	Morning
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	0916	7.0	< 0.1
SOUTH - WEST	0900	6.3	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Mid-Day
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	-	-	-
SOUTH - WEST	-	-	-

OBSERVATION: (1200) No in-water work
Equipment down

SAMPLE	Afternoon
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	1530	8.6	< 0.1
SOUTH - WEST	1500	11.6	< 0.1

OBSERVATION: Placing rock in water
South channel only

DAY	Friday
DATE	06/04/21
TECHNICIAN	Chris Weber

SAMPLE	Morning
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	0910	7.7	< 0.1
SOUTH - WEST	0900	7.0	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Mid-Day
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	1215	9.2	< 0.1
SOUTH - WEST	1200	7.0	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Afternoon
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	-	-	-
SOUTH - WEST	-	-	-

OBSERVATION: (1500) No in-water work
Equipment down

West False River Emergency Drought Barrier — June 3 thru June 22

TEMPORARY BARRIER SITE: West False River Emergency Drought Barrier - Installation

TURB - TURBIDITY CRITERIA: Below 150 NTU is acceptable.

SS - SETTLEABLE SOLIDS CRITERIA: Below 0.1 ml/L is acceptable.

DAY	Saturday
DATE	06/05/21
TECHNICIAN	Chris Weber

SAMPLE	Morning
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	0915	8.1	< 0.1
SOUTH - WEST	0900	6.8	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Mid-Day
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	1215	8.9	< 0.1
SOUTH - WEST	1200	6.9	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Afternoon
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	1515	10.7	< 0.1
SOUTH - WEST	1500	7.2	< 0.1

OBSERVATION: Placing rock in water
South channel only

DAY	Sunday
DATE	06/06/21
TECHNICIAN	Nicholas Barker

SAMPLE	Morning
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	0915	10.3	< 0.1
SOUTH - WEST	0905	8.1	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Mid-Day
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	1220	8.6	< 0.1
SOUTH - WEST	1205	8.5	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Afternoon
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - EAST	-	-	-
NORTH - WEST	-	-	-
SOUTH - EAST	1515	11.2	< 0.1
SOUTH - WEST	1500	7.1	< 0.1

OBSERVATION: Placing rock in water
South channel only

West False River Emergency Drought Barrier — June 3 thru June 22

TEMPORARY BARRIER SITE: West False River Emergency Drought Barrier - Installation

TURB - TURBIDITY CRITERIA: Below 150 NTU is acceptable.

SS - SETTLEABLE SOLIDS CRITERIA: Below 0.1 ml/L is acceptable.

DAY	Monday
DATE	06/07/21
TECHNICIAN	Jordan Bachart

	SAMPLE	TIDE	TIME	TURB	SS
NORTH - EAST	Morning	Flood (W → E)	-	-	-
NORTH - WEST			-	-	-
SOUTH - EAST			0915	12.5	< 0.1
SOUTH - WEST			0900	8.6	< 0.1

OBSERVATION: Placing rock in water
South channel only

	SAMPLE	TIDE	TIME	TURB	SS
NORTH - EAST	Mid-Day	Flood (W → E)	-	-	-
NORTH - WEST			-	-	-
SOUTH - EAST			1210	7.6	< 0.1
SOUTH - WEST			1200	7.4	< 0.1

OBSERVATION: Placing rock in water
South channel only

	SAMPLE	TIDE	TIME	TURB	SS
NORTH - EAST	Afternoon	Ebb (W ← E)	-	-	-
NORTH - WEST			-	-	-
SOUTH - EAST			1515	11.5	< 0.1
SOUTH - WEST			1500	10.3	< 0.1

OBSERVATION: Placing rock in water
South channel only

DAY	Tuesday
DATE	06/08/21
TECHNICIAN	Nicholas Barker

	SAMPLE	TIDE	TIME	TURB	SS
NORTH - EAST	Morning	Ebb (W ← E)	-	-	-
NORTH - WEST			-	-	-
SOUTH - EAST			0900	9.1	< 0.1
SOUTH - WEST			0915	10.4	< 0.1

OBSERVATION: Placing rock in water
South channel only

	SAMPLE	TIDE	TIME	TURB	SS
NORTH - EAST	Mid-Day	Slack (W—E)	-	-	-
NORTH - WEST			-	-	-
SOUTH - EAST			-	-	-
SOUTH - WEST			-	-	-

OBSERVATION: (1200) No in-water work
Changing barges

	SAMPLE	TIDE	TIME	TURB	SS
NORTH - EAST	Afternoon	Flood (W → E)	-	-	-
NORTH - WEST			-	-	-
SOUTH - EAST			1515	13.8	< 0.1
SOUTH - WEST			1500	7.9	< 0.1

OBSERVATION: Placing rock in water
South channel only

West False River Emergency Drought Barrier — June 3 thru June 22

TEMPORARY BARRIER SITE: West False River Emergency Drought Barrier - Installation

TURB - TURBIDITY CRITERIA: Below 150 NTU is acceptable.

SS - SETTLEABLE SOLIDS CRITERIA: Below 0.1 ml/L is acceptable.

DAY: Wednesday
DATE: 06/09/21
TECHNICIAN: Chris Weber

SAMPLE: Morning
TIDE: Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	0915	7.4	< 0.1
SOUTH - BELOW	0900	10.6	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE: Mid-Day
TIDE: Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	1215	12.7	< 0.1
SOUTH - BELOW	1200	8.3	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE: Afternoon
TIDE: Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	1510	9.6	< 0.1
SOUTH - BELOW	1500	9.7	< 0.1

OBSERVATION: Placing rock in water
South channel only

DAY: Thursday
DATE: 06/10/21
TECHNICIAN: Nicholas Barker

SAMPLE: Morning
TIDE: Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	0910	8.5	< 0.1
SOUTH - BELOW	0900	11.0	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE: Mid-Day
TIDE: Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	1210	5.6	< 0.1
SOUTH - BELOW	1200	10.1	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE: Afternoon
TIDE: Slack (W—E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	1510	8.8	< 0.1
SOUTH - BELOW	1500	9.2	< 0.1

OBSERVATION: Placing rock in water
South channel only

West False River Emergency Drought Barrier — June 3 thru June 22

TEMPORARY BARRIER SITE: West False River Emergency Drought Barrier - Installation

TURB - TURBIDITY CRITERIA: Below 150 NTU is acceptable.

SS - SETTLEABLE SOLIDS CRITERIA: Below 0.1 ml/L is acceptable.

DAY	Friday
DATE	06/11/21
TECHNICIAN	Nicholas Barker

SAMPLE	Morning
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	0905	7.7	< 0.1
NORTH - BELOW	0910	9.1	< 0.1
SOUTH - ABOVE	0900	8.3	< 0.1
SOUTH - BELOW	0855	12.8	< 0.1

OBSERVATION: Placing rock in water
South and mid-channel

SAMPLE	Mid-Day
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	1200	8.1	< 0.1
NORTH - BELOW	1155	7.0	< 0.1
SOUTH - ABOVE	1210	6.4	< 0.1
SOUTH - BELOW	1205	9.7	< 0.1

OBSERVATION: Placing rock in water
South and mid-channel

SAMPLE	Afternoon
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	1510	6.5	< 0.1
NORTH - BELOW	1505	7.1	< 0.1
SOUTH - ABOVE	1500	5.5	< 0.1
SOUTH - BELOW	1455	9.1	< 0.1

OBSERVATION: Placing rock in water
North and mid-channel

DAY	Saturday
DATE	06/12/21
TECHNICIAN	Nicholas Barker

SAMPLE	Morning
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	0900	8.4	< 0.1
NORTH - BELOW	0855	8.1	< 0.1
SOUTH - ABOVE	0910	6.3	< 0.1
SOUTH - BELOW	0905	9.1	< 0.1

OBSERVATION: Placing rock in water
North and south channel

SAMPLE	Mid-Day
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	1155	7.0	< 0.1
NORTH - BELOW	1200	6.9	< 0.1
SOUTH - ABOVE	1210	5.5	< 0.1
SOUTH - BELOW	1200	12.1	< 0.1

OBSERVATION: Placing rock in water
North and south channel

SAMPLE	Afternoon
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - ABOVE	1500	5.4	< 0.1
NORTH - BELOW	1455	5.5	< 0.1
SOUTH - ABOVE	1510	4.3	< 0.1
SOUTH - BELOW	1505	8.3	< 0.1

OBSERVATION: Placing rock in water
North and south channel

West False River Emergency Drought Barrier — June 3 thru June 22

TEMPORARY BARRIER SITE: West False River Emergency Drought Barrier - Installation

TURB - TURBIDITY CRITERIA: Below 150 NTU is acceptable.

SS - SETTLEABLE SOLIDS CRITERIA: Below 0.1 ml/L is acceptable.

DAY	Sunday
DATE	06/13/21
TECHNICIAN	Jordan Bachart

SAMPLE	Morning
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - ABOVE	0905	8.6	< 0.1
NORTH - BELOW	0900	10.8	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

SAMPLE	Mid-Day
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: (1200) No in-water work
Changing barges

SAMPLE	Afternoon
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - ABOVE	1505	6.1	< 0.1
NORTH - BELOW	1500	6.1	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

DAY	Monday
DATE	06/14/21
TECHNICIAN	Jordan Bachart

SAMPLE	Morning
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	0915	11.7	< 0.1
NORTH - BELOW	0905	12.5	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

SAMPLE	Mid-Day
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	1215	8.6	< 0.1
NORTH - BELOW	1200	9.3	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

SAMPLE	Afternoon
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	1510	11.7	< 0.1
NORTH - BELOW	1500	7.4	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

West False River Emergency Drought Barrier — June 3 thru June 22

TEMPORARY BARRIER SITE: West False River Emergency Drought Barrier - Installation

TURB - TURBIDITY CRITERIA: Below 150 NTU is acceptable.

SS - SETTLEABLE SOLIDS CRITERIA: Below 0.1 ml/L is acceptable.

DAY	Tuesday
DATE	06/15/21
TECHNICIAN	Nicholas Barker

SAMPLE	Morning
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	0905	8.6	< 0.1
NORTH - BELOW	0900	9.8	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

SAMPLE	Mid-Day
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: (1200) No in-water work
Changing barges

SAMPLE	Afternoon
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	1500	13.0	< 0.1
NORTH - BELOW	1505	12.2	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

DAY	Wenesday
DATE	06/16/21
TECHNICIAN	Nicholas Barker

SAMPLE	Morning
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: (0900) No in-water work

SAMPLE	Mid-Day
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	1200	12.9	< 0.1
NORTH - BELOW	1205	10.7	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

SAMPLE	Afternoon
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: (1500) No in-water work
Waiting for barge arrival

West False River Emergency Drought Barrier — June 3 thru June 22

TEMPORARY BARRIER SITE: West False River Emergency Drought Barrier - Installation

TURB - TURBIDITY CRITERIA: Below 150 NTU is acceptable.

SS - SETTLEABLE SOLIDS CRITERIA: Below 0.1 ml/L is acceptable.

DAY	Thursday
DATE	06/17/21
TECHNICIAN	Nicholas Barker

SAMPLE	Morning
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	0900	11.1	< 0.1
NORTH - BELOW	0905	10.5	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

SAMPLE	Mid-Day
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: (1200) No in-water work
Changing barges

SAMPLE	Afternoon
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - ABOVE	1505	9.2	< 0.1
NORTH - BELOW	1500	12.7	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North/Mid channel only

DAY	Friday
DATE	06/18/21
TECHNICIAN	Nicholas Barker

SAMPLE	Morning
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: (1200) No in-water work
Changing barges

SAMPLE	Mid-Day
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - ABOVE	1215	9.2	< 0.1
NORTH - BELOW	1205	10.3	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
Mid channel

SAMPLE	Afternoon
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	1510	4.3	< 0.1
NORTH - BELOW	1500	15.9	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
Mid channel

West False River Emergency Drought Barrier — June 3 thru June 22

TEMPORARY BARRIER SITE: West False River Emergency Drought Barrier - Installation

TURB - TURBIDITY CRITERIA: Below 150 NTU is acceptable.

SS - SETTLEABLE SOLIDS CRITERIA: Below 0.1 ml/L is acceptable.

DAY	Saturday
DATE	06/19/21
TECHNICIAN	Chris Weber

SAMPLE	Morning
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	0945	8.3	< 0.1
SOUTH - BELOW	0930	8.6	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Mid-Day
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: (1200) No in-water work
Changing barges

SAMPLE	Afternoon
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	1515	6.2	< 0.1
NORTH - BELOW	1500	10.7	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

DAY	Sunday
DATE	06/20/21
TECHNICIAN	Chris Weber

SAMPLE	Morning
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	0910	7.1	< 0.1
SOUTH - BELOW	0900	11.6	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Mid-Day
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	1215	18.3	< 0.1
SOUTH - BELOW	1200	6.8	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Afternoon
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: (1500) No in-water work

West False River Emergency Drought Barrier — June 3 thru June 22

TEMPORARY BARRIER SITE: West False River Emergency Drought Barrier - Installation

TURB - TURBIDITY CRITERIA: Below 150 NTU is acceptable.

SS - SETTLEABLE SOLIDS CRITERIA: Below 0.1 ml/L is acceptable.

DAY	Monday
DATE	06/21/21
TECHNICIAN	Jordan Bachart

SAMPLE	Morning
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	0915	8.9	< 0.1
NORTH - BELOW	0905	12.6	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

SAMPLE	Mid-Day
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	1215	8.6	< 0.1
NORTH - BELOW	1200	9.4	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

SAMPLE	Afternoon
TIDE	Ebb (W ← E)

	TIME	TURB	SS
NORTH - ABOVE	1520	10.0	< 0.1
NORTH - BELOW	1505	10.5	< 0.1
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: Placing rock in water
North channel only

DAY	Tuesday
DATE	06/22/21
TECHNICIAN	Jordan Bachart

SAMPLE	Morning
TIDE	Slack (W—E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	0915	9.9	< 0.1
SOUTH - BELOW	0900	11.4	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Mid-Day
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	1215	12.4	< 0.1
SOUTH - BELOW	1200	10.8	< 0.1

OBSERVATION: Placing rock in water
South channel only

SAMPLE	Afternoon
TIDE	Flood (W → E)

	TIME	TURB	SS
NORTH - ABOVE	-	-	-
NORTH - BELOW	-	-	-
SOUTH - ABOVE	-	-	-
SOUTH - BELOW	-	-	-

OBSERVATION: (1500) No in-water work
Barrier Installation complete

Appendix B
Subsidence Monitoring Results

Reviewed Submittal Package

Specification No. 21-07

Contract No. C51620

Contract Title: Drought Emergency - Temporary Rock Barrier - 2021, West False River

Department File Number: C46 - 122 - 0

Submittal Title: 01720 3.01 A - Surveys - Survey Monuments - Baseline Monitoring Report

Contents

Section 1 - Reviewer Response

- Reviewer Action Page

Section 2 - Original Submittal

Section 1 – Reviewer Response

Reviewer Action Page

Specification No. 21-07

Contract No. C51620

Contract Title: Drought Emergency - Temporary Rock Barrier - 2021, West False River

Department File Number: C46 - 122 - 0

Submittal Title: 01720 3.01 A - Surveys - Survey Monuments - Baseline Monitoring Report

INSPECTED
DWR

BY Bal Sah DATE 6/10/2021

- ☐ NO APPARENT DEFECTS
- ☐ DEFECTS NOTED - RESUBMITTAL WAIVED
- ☐ DEFECTS NOTED - RESUBMITTAL REQUIRED
- ☐ REJECTED
- ☒ NO ACTION TAKEN

SEE LETTER NO. H2106-1164

Submittal C46-122

Action Taken: O

Submittal is used for informational purposes only. No further revisions of this submittal are allowed.

Section 2 – Original Submittal

Kiewit

SUBMITTAL TRANSMITTAL LETTER

DATE: June 3, 2021

FROM:	Kiewit Infrastructure West Co. 4650 Business Center Drive Fairfield, CA 94534	PHONE:	707-439-7300
PROJECT:	Drought Emergency – Temporary Rock Barrier - 2021 False River, Oakley, CA	PROJECT NO:	Specification 21-07 Contract C51620
TO:	Paul Strusinski, Chief, Construction Branch Department of Water Resources Sacramento Project Headquarters 3500 Industrial Blvd West Sacramento, CA 95691 Attn: John Berringer	PHONE:	916-653-5791

DWR FILE NO: C46-122

REVISION:

SHEET: 1 OF: 5

NEW SUBMITTAL ☒ RESUBMITTAL ☐

SUBMITTAL TYPE:

WORKING DRAWINGS ☐ SAMPLE ☐ MANUFACTURER'S DATA ☐ CERTIFICATIONS ☐ TEST REPORTS ☐ OTHERS AS SPECIFIED ☒

THE FOLLOWING SUBMITTAL ITEM:

SUBMITTAL TITLE:	**Survey Monuments - Baseline Monitoring Report**
SUPPLIER/SUB:	Kiewit Infrastructure West Co.
SPEC. SECTION NAME:	Construction Layout (Surveys)
DIVISION NO:	01
SPEC. NO:	01720
PARAGRAPH NO:	3.01.A
DESCRIPTION:	Record of the survey with copies of records furnished to the Engineer as directed.

COMMENTS OR DEVIATIONS FROM CONTRACT DOCUMENTS (attach an extra sheet as needed):

CONTRACTOR'S CERTIFICATION STATEMENT: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers, and similar data and I have checked and coordinated each item with other applicable submittals and other requirements of the Contract Documents.

PREPARED BY	RECEIVED
Company Name: Kiewit Infrastructure West Co.	Company Name: California Department of Water Resources
By: Julia Owaidat	By:
Engineer Title: Engineer 1	Title:

TABLE OF CONTENTS

SECTION NO.	DESCRIPTION	PAGE NO.
01720	Construction Layout (Surveys) Specifications	2 - 3
01720 – 3.01.A	Survey Monuments - Baseline Monitoring Report	4 - 6

SECTION 01720

CONSTRUCTION LAYOUT (SURVEYS)

PART 1 GENERAL

To comply 1.01 RELATED SECTIONS

A. Supplementary General Conditions, General Conditions, other Division 1 sections, and Drawings apply to this section.

To comply 1.02 SURVEYS

A. The Engineer will perform surveys required for measurement of quantities for payment.

B. The Engineer will provide horizontal and vertical control monuments suitable for the project sites.

C. Surveys required for properly laying out and performance of the work shall be performed by the Contractor. The Contractor's survey marks shall be preserved by the Contractor unless authorized to remove them.

D. Contractor shall monitor the horizontal and vertical movement of survey monuments installed along the levees at West False River on a daily basis when placing and removing rock for the temporary drought barrier within 100 feet of the waterside levee crown .

To comply 1.03 MONUMENTS

A. Contractor shall place 20 survey monuments (40 in total) along each levee at West False River. Contractor shall monitor the horizontal and vertical movement of the monuments on a daily basis when placing rock within 100 feet of the waterside levee crown.

B. The monuments shall be placed in three rows along both levees. Row 1 shall have 10 monuments located at the waterside levee crown spaced 25 feet on center. Row 2 shall have 5 monuments located at the landside levee crown spaced 50 feet on center. Row 3 shall have 5 monuments located at the landside levee toe spaced 50 feet on center. All rows shall be centered over the rock barrier centerline.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 RECORDS

A. The Contractor shall record the surveys, and copies of such records shall be furnished to the Engineer as directed.

To comply 3.02 EQUIPMENT AND PERSONNEL

A. The Contractor's instruments and other survey equipment shall be accurate, suitable for the surveys required, and in proper condition and adjustment at all times. Surveys shall be performed under the direct supervision of either California State licensed Professional Land Surveyor or registered Professional Engineer authorized to perform survey work. The Contractor shall furnish verification of registration to the Engineer 5 days prior to beginning survey work.

To comply 3.03 USE OF SURVEYS BY ENGINEER

A. The Engineer may at any time use line and grade points and markers established by the Contractor.

To comply 3.04 CHECKING BY ENGINEER

A. The Contractor's surveys are a part of the work and may be checked by the Engineer.

B. The Contractor shall correct lines, grades, or measurements which do not comply with specified or proper tolerances, or which are otherwise defective, and any resultant defects in the work.

To comply 3.05 ENGINEER'S SURVEY MARKS

A. The Engineer's survey marks shall be preserved by the Contractor. Engineer's survey marks disturbed by the Contractor shall be replaced at no additional expense to the Department.

PART 4 PAYMENT

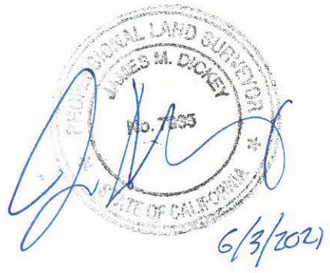
4.01 PAYMENT

A. The contract prices shall include full compensation for all costs incurred under this section.

END OF SECTION

CINQUINI & PASSARINO, INC.
LAND SURVEYING

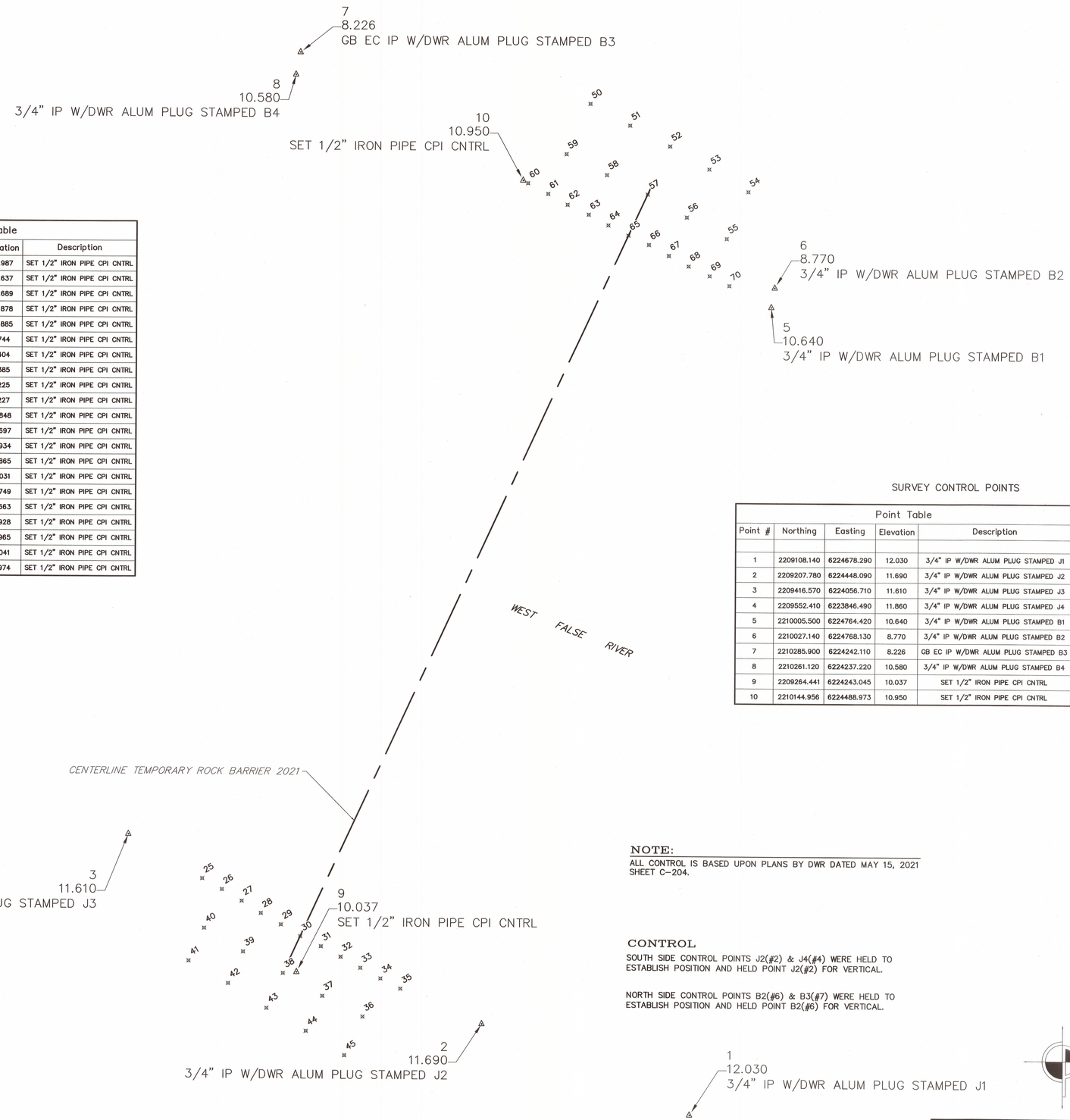
▲ BOUNDARY ▲ TOPOGRAPHIC
▲ INFRASTRUCTURE ▲ DEVELOPMENT
▲ LASER SCANNING ▲ RAILROAD



Job Name: Drought Emergency
Temp. Rock Barrier
Job Number: 9397-21
Client: Kiewit

			Survey Date 6/1/2021			Survey Date XX/XX/2021							
			Baseline Measurements			1st Re-Observation Measurements			Movement Since XX/XX/2021				
Monitoring Point	Description	Location	Northing	Easting	Elevation	Northing	Easting	Elevation	ΔNorthing	ΔEasting	ΔElevation	Δ2d	Δ3d
25	Iron Pipe	Waterside South Levee Crown	2209367.68	6224138.30	11.93								
26	Iron Pipe	Waterside South Levee Crown	2209355.63	6224160.17	12.05								
27	Iron Pipe	Waterside South Levee Crown	2209342.96	6224182.12	11.72								
28	Iron Pipe	Waterside South Levee Crown	2209329.55	6224203.29	11.86								
29	Iron Pipe	Waterside South Levee Crown	2209317.00	6224225.56	11.87								
30	Iron Pipe	Waterside South Levee Crown	2209304.05	6224247.04	11.99								
31	Iron Pipe	Waterside South Levee Crown	2209293.12	6224269.90	12.02								
32	Iron Pipe	Waterside South Levee Crown	2209281.69	6224291.77	11.70								
33	Iron Pipe	Waterside South Levee Crown	2209269.49	6224313.68	11.72								
34	Iron Pipe	Waterside South Levee Crown	2209257.81	6224335.92	11.71								
35	Iron Pipe	Waterside South Levee Crown	2209246.60	6224357.93	11.82								
36	Iron Pipe	Landside South Levee Crown	2209215.24	6224316.33	9.88								
37	Iron Pipe	Landside South Levee Crown	2209237.92	6224271.68	9.40								
38	Iron Pipe	Landside South Levee Crown	2209263.14	6224228.02	9.74								
39	Iron Pipe	Landside South Levee Crown	2209286.78	6224183.95	9.37								
40	Iron Pipe	Landside South Levee Crown	2209312.74	6224140.69	9.58								
41	Iron Pipe	LandsideSouth Levee Toe	2209276.38	6224123.84	-1.76								
42	Iron Pipe	LandsideSouth Levee Toe	2209251.56	6224167.54	-2.20								
43	Iron Pipe	LandsideSouth Levee Toe	2209224.09	6224210.06	-2.63								
44	Iron Pipe	LandsideSouth Levee Toe	2209198.80	6224253.64	-2.66								
45	Iron Pipe	LandsideSouth Levee Toe	2209172.08	6224296.30	-3.28								
50	Iron Pipe	Landside North Levee Toe	2210230.44	6224562.77	-3.99								
51	Iron Pipe	Landside North Levee Toe	2210206.74	6224606.90	-3.64								
52	Iron Pipe	Landside North Levee Toe	2210183.93	6224651.34	-3.69								
53	Iron Pipe	Landside North Levee Toe	2210158.52	6224694.84	-3.88								
54	Iron Pipe	Landside North Levee Toe	2210133.71	6224738.37	-3.89								
55	Iron Pipe	Landside North Levee Crown	2210081.51	6224714.61	6.74								
56	Iron Pipe	Landside North Levee Crown	2210105.01	6224670.30	6.40								
57	Iron Pipe	Landside North Levee Crown	2210130.28	6224626.86	6.39								
58	Iron Pipe	Landside North Levee Crown	2210151.63	6224581.53	7.23								
59	Iron Pipe	Landside North Levee Crown	2210174.30	6224536.90	7.23								
60	Iron Pipe	Waterside North Levee Crown	2210141.78	6224494.41	10.85								
61	Iron Pipe	Waterside North Levee Crown	2210130.01	6224516.78	10.70								
62	Iron Pipe	Waterside North Levee Crown	2210118.06	6224538.29	10.93								
63	Iron Pipe	Waterside North Levee Crown	2210107.42	6224561.59	10.87								
64	Iron Pipe	Waterside North Levee Crown	2210095.74	6224583.39	11.03								
65	Iron Pipe	Waterside North Levee Crown	2210084.55	6224605.58	10.75								
66	Iron Pipe	Waterside North Levee Crown	2210074.29	6224628.48	10.66								
67	Iron Pipe	Waterside North Levee Crown	2210062.38	6224650.59	10.93								
68	Iron Pipe	Waterside North Levee Crown	2210050.65	6224672.59	10.97								
69	Iron Pipe	Waterside North Levee Crown	2210039.95	6224695.80	11.04								
70	Iron Pipe	Waterside North Levee Crown	2210029.16	6224717.80	10.97								

Movement is measured by subtracting the baseline measurement from the current measurement value
N.O.= Not Observed



SET MONITORING POINTS

Point Table				
Point #	Northing	Easting	Elevation	Description
25	2209367.684	6224138.295	11.931	SET 1/2" IRON PIPE CPI CNTRL
26	2209355.631	6224160.171	12.053	SET 1/2" IRON PIPE CPI CNTRL
27	2209342.956	6224182.115	11.720	SET 1/2" IRON PIPE CPI CNTRL
28	2209329.545	6224203.293	11.858	SET 1/2" IRON PIPE CPI CNTRL
29	2209316.998	6224225.559	11.866	SET 1/2" IRON PIPE CPI CNTRL
30	2209304.050	6224247.036	11.989	SET 1/2" IRON PIPE CPI CNTRL
31	2209293.124	6224269.896	12.020	SET 1/2" IRON PIPE CPI CNTRL
32	2209281.686	6224291.771	11.698	SET 1/2" IRON PIPE CPI CNTRL
33	2209269.491	6224313.675	11.717	SET 1/2" IRON PIPE CPI CNTRL
34	2209257.807	6224335.921	11.710	SET 1/2" IRON PIPE CPI CNTRL
35	2209246.600	6224357.932	11.816	SET 1/2" IRON PIPE CPI CNTRL
36	2209215.237	6224316.333	9.880	SET 1/2" IRON PIPE CPI CNTRL
37	2209237.916	6224271.683	9.399	SET 1/2" IRON PIPE CPI CNTRL
38	2209263.139	6224228.016	9.741	SET 1/2" IRON PIPE CPI CNTRL
39	2209286.783	6224183.945	9.368	SET 1/2" IRON PIPE CPI CNTRL
40	2209312.736	6224140.686	9.580	SET 1/2" IRON PIPE CPI CNTRL
41	2209276.377	6224123.843	-1.761	SET 1/2" IRON PIPE CPI CNTRL
42	2209251.556	6224167.542	-2.199	SET 1/2" IRON PIPE CPI CNTRL
43	2209224.093	6224210.060	-2.626	SET 1/2" IRON PIPE CPI CNTRL
44	2209198.800	6224253.637	-2.658	SET 1/2" IRON PIPE CPI CNTRL
45	2209172.075	6224296.298	-3.275	SET 1/2" IRON PIPE CPI CNTRL

Point Table				
Point #	Northing	Easting	Elevation	Description
50	2210230.439	6224562.768	-3.987	SET 1/2" IRON PIPE CPI CNTRL
51	2210206.736	6224606.897	-3.637	SET 1/2" IRON PIPE CPI CNTRL
52	2210183.927	6224651.342	-3.689	SET 1/2" IRON PIPE CPI CNTRL
53	2210158.515	6224694.840	-3.878	SET 1/2" IRON PIPE CPI CNTRL
54	2210133.713	6224738.373	-3.885	SET 1/2" IRON PIPE CPI CNTRL
55	2210081.508	6224714.610	6.744	SET 1/2" IRON PIPE CPI CNTRL
56	2210105.008	6224670.304	6.404	SET 1/2" IRON PIPE CPI CNTRL
57	2210130.284	6224626.858	6.385	SET 1/2" IRON PIPE CPI CNTRL
58	2210151.628	6224581.527	7.225	SET 1/2" IRON PIPE CPI CNTRL
59	2210174.300	6224536.903	7.227	SET 1/2" IRON PIPE CPI CNTRL
60	2210141.784	6224494.408	10.848	SET 1/2" IRON PIPE CPI CNTRL
61	2210130.012	6224516.782	10.697	SET 1/2" IRON PIPE CPI CNTRL
62	2210118.062	6224538.286	10.934	SET 1/2" IRON PIPE CPI CNTRL
63	2210107.418	6224561.594	10.865	SET 1/2" IRON PIPE CPI CNTRL
64	2210095.738	6224583.386	11.031	SET 1/2" IRON PIPE CPI CNTRL
65	2210084.546	6224605.581	10.749	SET 1/2" IRON PIPE CPI CNTRL
66	2210074.290	6224628.479	10.663	SET 1/2" IRON PIPE CPI CNTRL
67	2210062.377	6224650.585	10.928	SET 1/2" IRON PIPE CPI CNTRL
68	2210050.651	6224672.591	10.965	SET 1/2" IRON PIPE CPI CNTRL
69	2210039.954	6224695.796	11.041	SET 1/2" IRON PIPE CPI CNTRL
70	2210029.163	6224717.801	10.974	SET 1/2" IRON PIPE CPI CNTRL

SURVEY CONTROL POINTS

Point Table				
Point #	Northing	Easting	Elevation	Description
1	2209108.140	6224678.290	12.030	3/4" IP W/DWR ALUM PLUG STAMPED J1
2	2209207.780	6224448.090	11.690	3/4" IP W/DWR ALUM PLUG STAMPED J2
3	2209416.570	6224056.710	11.610	3/4" IP W/DWR ALUM PLUG STAMPED J3
4	2209552.410	6223846.490	11.860	3/4" IP W/DWR ALUM PLUG STAMPED J4
5	2210005.500	6224764.420	10.640	3/4" IP W/DWR ALUM PLUG STAMPED B1
6	2210027.140	6224768.130	8.770	3/4" IP W/DWR ALUM PLUG STAMPED B2
7	2210285.900	6224242.110	8.226	GB EC IP W/DWR ALUM PLUG STAMPED B3
8	2210261.120	6224237.220	10.580	3/4" IP W/DWR ALUM PLUG STAMPED B4
9	2209264.441	6224243.045	10.037	SET 1/2" IRON PIPE CPI CNTRL
10	2210144.956	6224488.973	10.950	SET 1/2" IRON PIPE CPI CNTRL

SURVEYOR'S STATEMENT

THIS MAP REPRESENTS A FIELD SURVEY MADE BY ME OR UNDER MY DIRECTION ON JUNE 1, 2021 AND REPRESENTS THE VISUAL SURFACE CONDITIONS AS OF AFORESAID DATE.

LICENSED LAND SURVEYOR JAMES M. DICKEY No. 7935 STATE OF CALIFORNIA

James M. Dickey, P.L.S. 7935 — DATE 6/3/2021

NOTE:

ALL CONTROL IS BASED UPON PLANS BY DWR DATED MAY 15, 2021 SHEET C-204.

CONTROL

SOUTH SIDE CONTROL POINTS J2(#2) & J4(#4) WERE HELD TO ESTABLISH POSITION AND HELD POINT J2(#2) FOR VERTICAL.

NORTH SIDE CONTROL POINTS B2(#6) & B3(#7) WERE HELD TO ESTABLISH POSITION AND HELD POINT B2(#6) FOR VERTICAL.

CINQUINI & PASSARINO, INC.
LAND SURVEYING
BOUNDARY
TOPOGRAPHIC
CONSTRUCTION
SUBDIVISIONS
1360 No. Dutton Ave.
Santa Rosa, Ca. 95401
Phone: (707) 542-6268
Fax: (707) 542-2106
WWW.CINQUINIPASSARINO.COM

JOB NAME: DROUGHT EMERGENCY BARR.	DRAWN BY: BMT	SHEET: 1 OF 1
DESCRIPTION: MONITORING LAYOUT	SCALE: 1"=60'	JOB #: 9397-21
	Y:\9397\Cad\9397_CONST-V20.dwg Jun 03, 2021 - 8:43am	

1	2209108.14	6224678.29	12.03	3/4" IP W/DWR ALUM PLUG STAMPED J1
2	2209207.78	6224448.09	11.69	3/4" IP W/DWR ALUM PLUG STAMPED J2
3	2209416.57	6224056.71	11.61	3/4" IP W/DWR ALUM PLUG STAMPED J3
4	2209552.41	6223846.49	11.86	3/4" IP W/DWR ALUM PLUG STAMPED J4
5	2210005.5	6224764.42	10.64	3/4" IP W/DWR ALUM PLUG STAMPED B1
6	2210027.14	6224768.13	8.77	3/4" IP W/DWR ALUM PLUG STAMPED B2
7	2210285.9	6224242.11	8.226	GB EC IP W/DWR ALUM PLUG STAMPED B3
8	2210261.12	6224237.22	10.58	3/4" IP W/DWR ALUM PLUG STAMPED B4
9	2209264.441	6224243.045	10.037	SET 1/2" IRON PIPE CPI CNTRL
10	2210144.956	6224488.973	10.95	SET 1/2" IRON PIPE CPI CNTRL
25	2209367.684	6224138.295	11.931	SET 1/2" IRON PIPE CPI CNTRL
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35	2209246.6	6224357.932	11.816	SET 1/2" IRON PIPE CPI CNTRL
36	2209215.237	6224316.333	9.88	SET 1/2" IRON PIPE CPI CNTRL
37	2209237.916	6224271.683	9.399	SET 1/2" IRON PIPE CPI CNTRL
38	2209263.139	6224228.016	9.741	SET 1/2" IRON PIPE CPI CNTRL
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51	2210206.736	6224606.897	-3.637	SET 1/2" IRON PIPE CPI CNTRL
52	2210183.927	6224651.342	-3.689	SET 1/2" IRON PIPE CPI CNTRL
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54	2210133.713	6224738.373	-3.885	SET 1/2" IRON PIPE CPI CNTRL
55	2210081.508	6224714.61	6.744	SET 1/2" IRON PIPE CPI CNTRL
56	2210105.008	6224670.304	6.404	SET 1/2" IRON PIPE CPI CNTRL
57	2210130.284	6224626.858	6.385	SET 1/2" IRON PIPE CPI CNTRL
58	2210151.628	6224581.527	7.225	SET 1/2" IRON PIPE CPI CNTRL
59	2210174.3	6224536.903	7.227	SET 1/2" IRON PIPE CPI CNTRL
60	2210141.784	6224494.408	10.848	SET 1/2" IRON PIPE CPI CNTRL
61	2210130.012	6224516.782	10.697	SET 1/2" IRON PIPE CPI CNTRL
62	2210118.062	6224538.286	10.934	SET 1/2" IRON PIPE CPI CNTRL
63	2210107.418	6224561.594	10.865	SET 1/2" IRON PIPE CPI CNTRL
64	2210095.738	6224583.386	11.031	SET 1/2" IRON PIPE CPI CNTRL
65	2210084.546	6224605.581	10.749	SET 1/2" IRON PIPE CPI CNTRL
66	2210074.29	6224628.479	10.663	SET 1/2" IRON PIPE CPI CNTRL
67	2210062.377	6224650.585	10.928	SET 1/2" IRON PIPE CPI CNTRL
68	2210050.651	6224672.591	10.965	SET 1/2" IRON PIPE CPI CNTRL
69	2210039.954	6224695.796	11.041	SET 1/2" IRON PIPE CPI CNTRL
70	2210029.163	6224717.801	10.974	SET 1/2" IRON PIPE CPI CNTRL
9001	2209273.41	6224232.83	0	CL BGN TEMP ROCK BARRIER
9002	2210136.58	6224629.58	0	CL END TEMP ROCK BARRIER

Reviewed Submittal Package

Specification No. 21-07

Contract No. C51620

Contract Title: Drought Emergency - Temporary Rock Barrier - 2021, West False River

Department File Number: C46 - 148 - 0

Submittal Title: 01720 3.01 A - Surveys - Daily Monitoring Monument Survey Records

Contents

Section 1 - Reviewer Response

- Reviewer Action Page
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Section 1 – Reviewer Response

Reviewer Action Page

Specification No. 21-07

Contract No. C51620

Contract Title: Drought Emergency - Temporary Rock Barrier - 2021, West False River

Department File Number: C46 - 148 - 0

Submittal Title: 01720 3.01 A - Surveys - Daily Monitoring Monument Survey Records

INSPECTED
DWR

BY Bal Sah DATE 8/10/2021

- ☐ NO APPARENT DEFECTS
- ☐ DEFECTS NOTED - RESUBMITTAL WAIVED
- ☐ DEFECTS NOTED - RESUBMITTAL REQUIRED
- ☐ REJECTED
- ☒ NO ACTION TAKEN

SEE LETTER NO. H2108-1519

21-07 Submittal No. 148 Response

Action Taken: "O" – No Action Taken, W Comment

The Department has reviewed the submittal and has the following comments:

1. PDF pages 6 – 42 (survey measurements collected 6/6/2021 – 6/17/2021 data). The cover page for each individual report shown within pages 6 – 42 require the stamp, signature and date from a person authorized to practice Land Surveying in California.

   Future survey records (every individual pages of the report) shall be stamped, signed and dated from a person authorized to practice Land Surveying in California prior to submitting it to the Department.

Section 2 – Original Submittal

Kiewit

SUBMITTAL TRANSMITTAL LETTER

DATE: August 3, 2021

FROM:	Kiewit Infrastructure West Co. 4650 Business Center Drive Fairfield, CA 94534	PHONE:	707-439-7300
PROJECT:	Drought Emergency – Temporary Rock Barrier - 2021 False River, Oakley, CA	PROJECT NO:	Specification 21-07 Contract C51620
TO:	Paul Strusinski, Chief, Construction Branch Department of Water Resources Sacramento Project Headquarters 3500 Industrial Blvd West Sacramento, CA 95691 Attn: John Berringer	PHONE:	916-653-5791

DWR FILE NO: C46-148

REVISION:

SHEET: 1 OF: 42

NEW SUBMITTAL ☒ RESUBMITTAL ☐

SUBMITTAL TYPE:

WORKING DRAWINGS ☐ SAMPLE ☐ MANUFACTURER'S DATA ☐ CERTIFICATIONS ☐ TEST REPORTS ☐ OTHERS AS SPECIFIED ☒

THE FOLLOWING SUBMITTAL ITEM:

SUBMITTAL TITLE:	**Daily Monitoring Monument Survey Records**
SUPPLIER/SUB:	Kiewit Infrastructure West Co.
SPEC. SECTION NAME:	Construction Layout (Surveys)
DIVISION NO:	01
SPEC. NO:	10720
PARAGRAPH NO:	3.01.A
DESCRIPTION:	All records collected from the daily monitoring of Survey Monuments.

COMMENTS OR DEVIATIONS FROM CONTRACT DOCUMENTS (attach an extra sheet as needed):

CONTRACTOR'S CERTIFICATION STATEMENT: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers, and similar data and I have checked and coordinated each item with other applicable submittals and other requirements of the Contract Documents.

PREPARED BY	RECEIVED
Company Name: Kiewit Infrastructure West Co.	Company Name: California Department of Water Resources
By: Julia Owaidat	By:
Engineer Title: Engineer 1	Title:

TABLE OF CONTENTS

SECTION NO.	DESCRIPTION	PAGE NO.
01720	Construction Layout (Surveys) Specifications	2 – 3
01720 – 3.01.A	Records for Survey Monuments	4 – 42

Submitting the Records for Daily Monitoring of Survey Monuments ONLY

SECTION 01720

CONSTRUCTION LAYOUT (SURVEYS)

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Supplementary General Conditions, General Conditions, other Division 1 sections, and Drawings apply to this section.

1.02 SURVEYS

A. The Engineer will perform surveys required for measurement of quantities for payment.

B. The Engineer will provide horizontal and vertical control monuments suitable for the project sites.

C. Surveys required for properly laying out and performance of the work shall be performed by the Contractor. The Contractor's survey marks shall be preserved by the Contractor unless authorized to remove them.

D. Contractor shall monitor the horizontal and vertical movement of survey monuments installed along the levees at West False River on a daily basis when placing and removing rock for the temporary drought barrier within 100 feet of the waterside levee crown .

1.03 MONUMENTS

A. Contractor shall place 20 survey monuments (40 in total) along each levee at West False River. Contractor shall monitor the horizontal and vertical movement of the monuments on a daily basis when placing rock within 100 feet of the waterside levee crown.

B. The monuments shall be placed in three rows along both levees. Row 1 shall have 10 monuments located at the waterside levee crown spaced 25 feet on center. Row 2 shall have 5 monuments located at the landside levee crown spaced 50 feet on center. Row 3 shall have 5 monuments located at the landside levee toe spaced 50 feet on center. All rows shall be centered over the rock barrier centerline.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 RECORDS

A. The Contractor shall record the surveys, and copies of such records shall be furnished to the Engineer as directed.

3.02 EQUIPMENT AND PERSONNEL

A. The Contractor's instruments and other survey equipment shall be accurate, suitable for the surveys required, and in proper condition and adjustment at all times. Surveys shall be performed under the direct supervision of either California State licensed Professional Land Surveyor or registered Professional Engineer authorized to perform survey work. The Contractor shall furnish verification of registration to the Engineer 5 days prior to beginning survey work.

3.03 USE OF SURVEYS BY ENGINEER

A. The Engineer may at any time use line and grade points and markers established by the Contractor.

3.04 CHECKING BY ENGINEER

A. The Contractor's surveys are a part of the work and may be checked by the Engineer.

B. The Contractor shall correct lines, grades, or measurements which do not comply with specified or proper tolerances, or which are otherwise defective, and any resultant defects in the work.

3.05 ENGINEER'S SURVEY MARKS

A. The Engineer's survey marks shall be preserved by the Contractor. Engineer's survey marks disturbed by the Contractor shall be replaced at no additional expense to the Department.

PART 4 PAYMENT

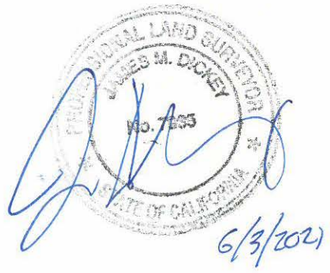
4.01 PAYMENT

A. The contract prices shall include full compensation for all costs incurred under this section.

END OF SECTION

CINQUINI & PASSARINO, INC.
LAND SURVEYING

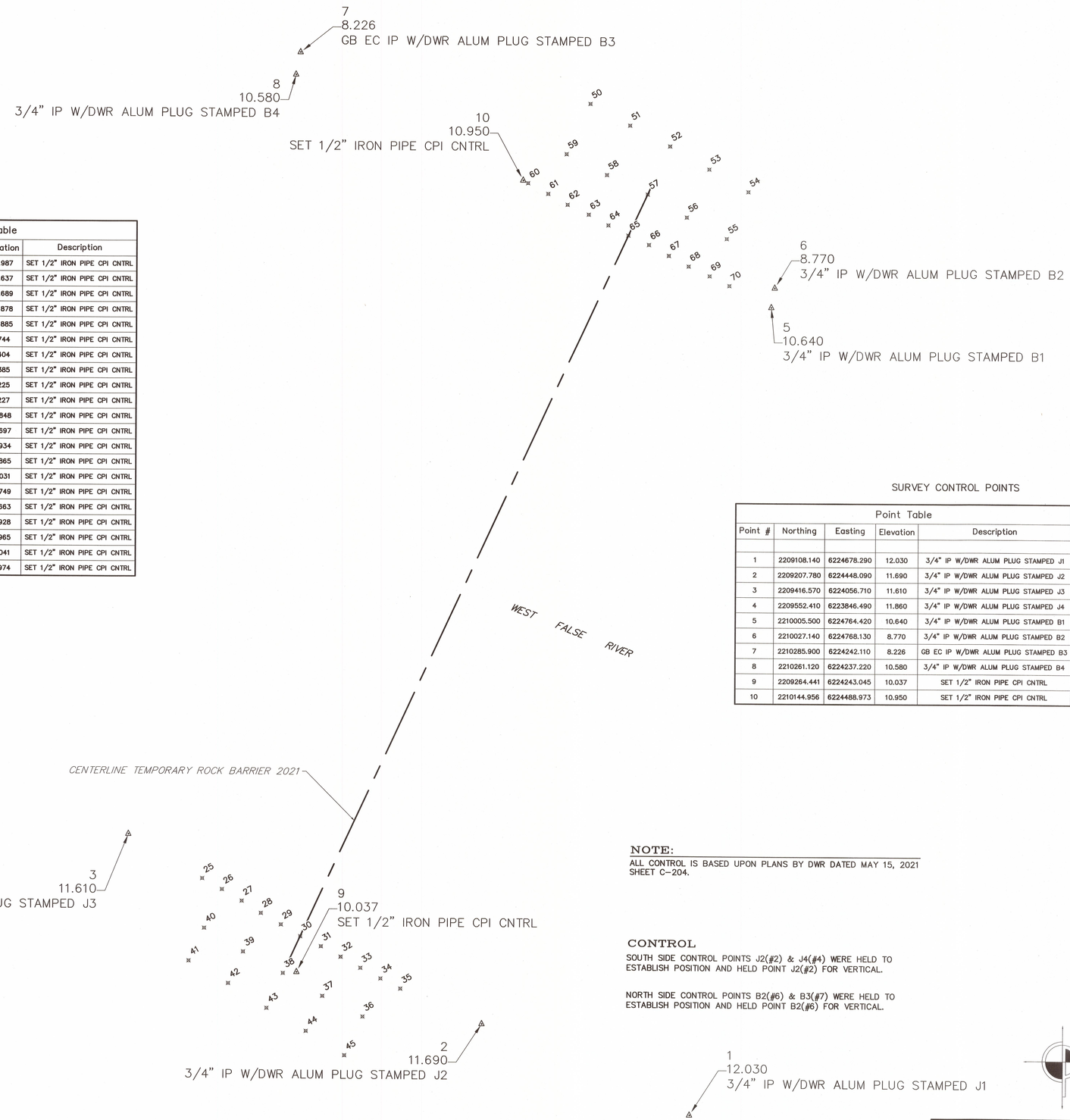
▲ BOUNDARY ▲ TOPOGRAPHIC
▲ INFRASTRUCTURE ▲ DEVELOPMENT
▲ LASER SCANNING ▲ RAILROAD



Job Name: Drought Emergency
Temp. Rock Barrier
Job Number: 9397-21
Client: Kiewit

			Survey Date 6/1/2021			Survey Date XX/XX/2021							
			Baseline Measurements			1st Re-Observation Measurements			Movement Since XX/XX/2021				
Monitoring Point	Description	Location	Northing	Easting	Elevation	Northing	Easting	Elevation	ΔNorthing	ΔEasting	ΔElevation	Δ2d	Δ3d
25	Iron Pipe	Waterside South Levee Crown	2209367.68	6224138.30	11.93								
26	Iron Pipe	Waterside South Levee Crown	2209355.63	6224160.17	12.05								
27	Iron Pipe	Waterside South Levee Crown	2209342.96	6224182.12	11.72								
28	Iron Pipe	Waterside South Levee Crown	2209329.55	6224203.29	11.86								
29	Iron Pipe	Waterside South Levee Crown	2209317.00	6224225.56	11.87								
30	Iron Pipe	Waterside South Levee Crown	2209304.05	6224247.04	11.99								
31	Iron Pipe	Waterside South Levee Crown	2209293.12	6224269.90	12.02								
32	Iron Pipe	Waterside South Levee Crown	2209281.69	6224291.77	11.70								
33	Iron Pipe	Waterside South Levee Crown	2209269.49	6224313.68	11.72								
34	Iron Pipe	Waterside South Levee Crown	2209257.81	6224335.92	11.71								
35	Iron Pipe	Waterside South Levee Crown	2209246.60	6224357.93	11.82								
36	Iron Pipe	Landside South Levee Crown	2209215.24	6224316.33	9.88								
37	Iron Pipe	Landside South Levee Crown	2209237.92	6224271.68	9.40								
38	Iron Pipe	Landside South Levee Crown	2209263.14	6224228.02	9.74								
39	Iron Pipe	Landside South Levee Crown	2209286.78	6224183.95	9.37								
40	Iron Pipe	Landside South Levee Crown	2209312.74	6224140.69	9.58								
41	Iron Pipe	LandsideSouth Levee Toe	2209276.38	6224123.84	-1.76								
42	Iron Pipe	LandsideSouth Levee Toe	2209251.56	6224167.54	-2.20								
43	Iron Pipe	LandsideSouth Levee Toe	2209224.09	6224210.06	-2.63								
44	Iron Pipe	LandsideSouth Levee Toe	2209198.80	6224253.64	-2.66								
45	Iron Pipe	LandsideSouth Levee Toe	2209172.08	6224296.30	-3.28								
50	Iron Pipe	Landside North Levee Toe	2210230.44	6224562.77	-3.99								
51	Iron Pipe	Landside North Levee Toe	2210206.74	6224606.90	-3.64								
52	Iron Pipe	Landside North Levee Toe	2210183.93	6224651.34	-3.69								
53	Iron Pipe	Landside North Levee Toe	2210158.52	6224694.84	-3.88								
54	Iron Pipe	Landside North Levee Toe	2210133.71	6224738.37	-3.89								
55	Iron Pipe	Landside North Levee Crown	2210081.51	6224714.61	6.74								
56	Iron Pipe	Landside North Levee Crown	2210105.01	6224670.30	6.40								
57	Iron Pipe	Landside North Levee Crown	2210130.28	6224626.86	6.39								
58	Iron Pipe	Landside North Levee Crown	2210151.63	6224581.53	7.23								
59	Iron Pipe	Landside North Levee Crown	2210174.30	6224536.90	7.23								
60	Iron Pipe	Waterside North Levee Crown	2210141.78	6224494.41	10.85								
61	Iron Pipe	Waterside North Levee Crown	2210130.01	6224516.78	10.70								
62	Iron Pipe	Waterside North Levee Crown	2210118.06	6224538.29	10.93								
63	Iron Pipe	Waterside North Levee Crown	2210107.42	6224561.59	10.87								
64	Iron Pipe	Waterside North Levee Crown	2210095.74	6224583.39	11.03								
65	Iron Pipe	Waterside North Levee Crown	2210084.55	6224605.58	10.75								
66	Iron Pipe	Waterside North Levee Crown	2210074.29	6224628.48	10.66								
67	Iron Pipe	Waterside North Levee Crown	2210062.38	6224650.59	10.93								
68	Iron Pipe	Waterside North Levee Crown	2210050.65	6224672.59	10.97								
69	Iron Pipe	Waterside North Levee Crown	2210039.95	6224695.80	11.04								
70	Iron Pipe	Waterside North Levee Crown	2210029.16	6224717.80	10.97								

Movement is measured by subtracting the baseline measurement from the current measurement value
N.O.= Not Observed



SET MONITORING POINTS

Point Table				
Point #	Northing	Easting	Elevation	Description
25	2209367.684	6224138.295	11.931	SET 1/2" IRON PIPE CPI CNTRL
26	2209355.631	6224160.171	12.053	SET 1/2" IRON PIPE CPI CNTRL
27	2209342.956	6224182.115	11.720	SET 1/2" IRON PIPE CPI CNTRL
28	2209329.545	6224203.293	11.858	SET 1/2" IRON PIPE CPI CNTRL
29	2209316.998	6224225.559	11.866	SET 1/2" IRON PIPE CPI CNTRL
30	2209304.050	6224247.036	11.989	SET 1/2" IRON PIPE CPI CNTRL
31	2209293.124	6224269.896	12.020	SET 1/2" IRON PIPE CPI CNTRL
32	2209281.686	6224291.771	11.698	SET 1/2" IRON PIPE CPI CNTRL
33	2209269.491	6224313.675	11.717	SET 1/2" IRON PIPE CPI CNTRL
34	2209257.807	6224335.921	11.710	SET 1/2" IRON PIPE CPI CNTRL
35	2209246.600	6224357.932	11.816	SET 1/2" IRON PIPE CPI CNTRL
36	2209215.237	6224316.333	9.880	SET 1/2" IRON PIPE CPI CNTRL
37	2209237.916	6224271.683	9.399	SET 1/2" IRON PIPE CPI CNTRL
38	2209263.139	6224228.016	9.741	SET 1/2" IRON PIPE CPI CNTRL
39	2209286.783	6224183.945	9.368	SET 1/2" IRON PIPE CPI CNTRL
40	2209312.736	6224140.686	9.580	SET 1/2" IRON PIPE CPI CNTRL
41	2209276.377	6224123.843	-1.761	SET 1/2" IRON PIPE CPI CNTRL
42	2209251.556	6224167.542	-2.199	SET 1/2" IRON PIPE CPI CNTRL
43	2209224.093	6224210.060	-2.626	SET 1/2" IRON PIPE CPI CNTRL
44	2209198.800	6224253.637	-2.658	SET 1/2" IRON PIPE CPI CNTRL
45	2209172.075	6224296.298	-3.275	SET 1/2" IRON PIPE CPI CNTRL

Point Table				
Point #	Northing	Easting	Elevation	Description
50	2210230.439	6224562.768	-3.987	SET 1/2" IRON PIPE CPI CNTRL
51	2210206.736	6224606.897	-3.637	SET 1/2" IRON PIPE CPI CNTRL
52	2210183.927	6224651.342	-3.689	SET 1/2" IRON PIPE CPI CNTRL
53	2210158.515	6224694.840	-3.878	SET 1/2" IRON PIPE CPI CNTRL
54	2210133.713	6224738.373	-3.885	SET 1/2" IRON PIPE CPI CNTRL
55	2210081.508	6224714.610	6.744	SET 1/2" IRON PIPE CPI CNTRL
56	2210105.008	6224670.304	6.404	SET 1/2" IRON PIPE CPI CNTRL
57	2210130.284	6224626.858	6.385	SET 1/2" IRON PIPE CPI CNTRL
58	2210151.628	6224581.527	7.225	SET 1/2" IRON PIPE CPI CNTRL
59	2210174.300	6224536.903	7.227	SET 1/2" IRON PIPE CPI CNTRL
60	2210141.784	6224494.408	10.848	SET 1/2" IRON PIPE CPI CNTRL
61	2210130.012	6224516.782	10.697	SET 1/2" IRON PIPE CPI CNTRL
62	2210118.062	6224538.286	10.934	SET 1/2" IRON PIPE CPI CNTRL
63	2210107.418	6224561.594	10.865	SET 1/2" IRON PIPE CPI CNTRL
64	2210095.738	6224583.386	11.031	SET 1/2" IRON PIPE CPI CNTRL
65	2210084.546	6224605.581	10.749	SET 1/2" IRON PIPE CPI CNTRL
66	2210074.290	6224628.479	10.663	SET 1/2" IRON PIPE CPI CNTRL
67	2210062.377	6224650.585	10.928	SET 1/2" IRON PIPE CPI CNTRL
68	2210050.651	6224672.591	10.965	SET 1/2" IRON PIPE CPI CNTRL
69	2210039.954	6224695.796	11.041	SET 1/2" IRON PIPE CPI CNTRL
70	2210029.163	6224717.801	10.974	SET 1/2" IRON PIPE CPI CNTRL

SURVEY CONTROL POINTS

Point Table				
Point #	Northing	Easting	Elevation	Description
1	2209108.140	6224678.290	12.030	3/4" IP W/DWR ALUM PLUG STAMPED J1
2	2209207.780	6224448.090	11.690	3/4" IP W/DWR ALUM PLUG STAMPED J2
3	2209416.570	6224056.710	11.610	3/4" IP W/DWR ALUM PLUG STAMPED J3
4	2209552.410	6223846.490	11.860	3/4" IP W/DWR ALUM PLUG STAMPED J4
5	2210005.500	6224764.420	10.640	3/4" IP W/DWR ALUM PLUG STAMPED B1
6	2210027.140	6224768.130	8.770	3/4" IP W/DWR ALUM PLUG STAMPED B2
7	2210285.900	6224242.110	8.226	GB EC IP W/DWR ALUM PLUG STAMPED B3
8	2210261.120	6224237.220	10.580	3/4" IP W/DWR ALUM PLUG STAMPED B4
9	2209264.441	6224243.045	10.037	SET 1/2" IRON PIPE CPI CNTRL
10	2210144.956	6224488.973	10.950	SET 1/2" IRON PIPE CPI CNTRL

SURVEYOR'S STATEMENT

THIS MAP REPRESENTS A FIELD SURVEY MADE BY ME OR UNDER MY DIRECTION ON JUNE 1, 2021 AND REPRESENTS THE VISUAL SURFACE CONDITIONS AS OF AFORESAID DATE.

LICENSED LAND SURVEYOR JAMES M. DICKEY No. 7935 STATE OF CALIFORNIA

James M. Dickey, P.L.S. 7935 — DATE 6/3/2021

NOTE:

ALL CONTROL IS BASED UPON PLANS BY DWR DATED MAY 15, 2021 SHEET C-204.

CONTROL

SOUTH SIDE CONTROL POINTS J2(#2) & J4(#4) WERE HELD TO ESTABLISH POSITION AND HELD POINT J2(#2) FOR VERTICAL.

NORTH SIDE CONTROL POINTS B2(#6) & B3(#7) WERE HELD TO ESTABLISH POSITION AND HELD POINT B2(#6) FOR VERTICAL.

CINQUINI & PASSARINO, INC.
LAND SURVEYING
BOUNDARY
TOPOGRAPHIC
CONSTRUCTION
SUBDIVISIONS
1360 No. Dutton Ave.
Santa Rosa, Ca. 95401
Phone: (707) 542-6268
Fax: (707) 542-2106
WWW.CINQUINIPASSARINO.COM

JOB NAME: DROUGHT EMERGENCY BARR.	DRAWN BY: BMT	SHEET: 1 OF 1
DESCRIPTION: MONITORING LAYOUT	SCALE: 1"=60'	JOB #: 9397-21
	Y:\9397\Cad\9397_CONST-V20.dwg Jun 03, 2021 - 8:43am	

DROUGHT EMERGENCY TEMPORARY ROCK BARRIER 2021

DAILY ONSITE SURVEY MONITORING

June 6th, 2021

Surveyor: Justin Stange

Open WO	Date	6/6/21
Open WO	Time	3:55:16 PM
Open WO	Work Order	Daily Inspect 06.06.21
Open WO	Site	06.06.21 False River
Open WO	Design	
Open WO	Program Version	3.72.18100.77

Feature Entered	Date	6/6/21
Feature Entered	Time	3:55:20 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	3:56:25 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	3:59:38 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**4_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J4	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**4**
Stake Point Report	Design elev	11.860 usft
Stake Point Report	Ground elev	12.023 usft
Stake Point Report	Staked out N	2209552.450 usft
Stake Point Report	Staked out E	6223846.484 usft
Stake Point Report	Slope to design	-407.52%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.040 usft
Stake Point Report	Cut	0.163 usft
Stake Point Report	Stake marking	Up 3.118 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	3:59:39 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	3:59:48 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:01:54 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**3_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J3	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**3**
Stake Point Report	Design elev	11.610 usft
Stake Point Report	Ground elev	11.718 usft
Stake Point Report	Staked out N	2209416.538 usft
Stake Point Report	Staked out E	6224056.706 usft
Stake Point Report	Slope to design	-331.45%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.033 usft
Stake Point Report	Cut	0.108 usft
Stake Point Report	Stake marking	Up 3.173 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:01:55 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	4:03:10 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:04:07 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**25_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**25**
Stake Point Report	Design elev	11.931 usft
Stake Point Report	Ground elev	12.049 usft
Stake Point Report	Staked out N	2209367.611 usft
Stake Point Report	Staked out E	6224138.280 usft
Stake Point Report	Slope to design	-157.70%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.075 usft
Stake Point Report	Cut	0.118 usft
Stake Point Report	Stake marking	Up 3.163 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:04:08 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	4:04:38 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:06:11 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**26_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**26**
Stake Point Report	Design elev	12.053 usft
Stake Point Report	Ground elev	12.126 usft
Stake Point Report	Staked out N	2209355.583 usft
Stake Point Report	Staked out E	6224160.164 usft
Stake Point Report	Slope to design	-148.73%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.049 usft
Stake Point Report	Cut	0.073 usft
Stake Point Report	Stake marking	Up 3.208 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:06:12 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	4:06:47 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:08:13 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**27_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**27**
Stake Point Report	Design elev	11.720 usft
Stake Point Report	Ground elev	11.806 usft
Stake Point Report	Staked out N	2209342.916 usft
Stake Point Report	Staked out E	6224182.105 usft
Stake Point Report	Slope to design	-206.82%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.041 usft
Stake Point Report	Cut	0.086 usft
Stake Point Report	Stake marking	Up 3.195 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:08:14 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	4:08:24 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:09:49 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**28_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**28**
Stake Point Report	Design elev	11.858 usft
Stake Point Report	Ground elev	11.909 usft
Stake Point Report	Staked out N	2209329.479 usft
Stake Point Report	Staked out E	6224203.302 usft
Stake Point Report	Slope to design	-76.51%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.067 usft
Stake Point Report	Cut	0.051 usft
Stake Point Report	Stake marking	Up 3.230 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:09:50 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	4:09:58 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:11:02 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**29_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**29**
Stake Point Report	Design elev	11.866 usft
Stake Point Report	Ground elev	11.991 usft
Stake Point Report	Staked out N	2209316.947 usft
Stake Point Report	Staked out E	6224225.538 usft
Stake Point Report	Slope to design	-227.14%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.055 usft
Stake Point Report	Cut	0.125 usft
Stake Point Report	Stake marking	Up 3.156 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:11:03 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	4:11:18 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:12:28 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**30_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**30**
Stake Point Report	Design elev	11.989 usft
Stake Point Report	Ground elev	12.027 usft
Stake Point Report	Staked out N	2209303.994 usft
Stake Point Report	Staked out E	6224247.013 usft
Stake Point Report	Slope to design	-63.51%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.060 usft
Stake Point Report	Cut	0.038 usft
Stake Point Report	Stake marking	Up 3.243 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:12:28 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	4:12:41 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:13:21 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**31_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**31**
Stake Point Report	Design elev	12.020 usft
Stake Point Report	Ground elev	12.064 usft
Stake Point Report	Staked out N	2209293.095 usft
Stake Point Report	Staked out E	6224269.888 usft
Stake Point Report	Slope to design	-148.94%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.030 usft
Stake Point Report	Cut	0.044 usft
Stake Point Report	Stake marking	Up 3.237 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:13:34 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/6/21
Feature Entered	Time	4:13:38 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:14:32 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**32_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**32**
Stake Point Report	Design elev	11.698 usft
Stake Point Report	Ground elev	11.784 usft
Stake Point Report	Staked out N	2209281.670 usft
Stake Point Report	Staked out E	6224291.759 usft
Stake Point Report	Slope to design	-432.77%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.020 usft
Stake Point Report	Cut	0.086 usft
Stake Point Report	Stake marking	Up 3.195 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:14:33 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/6/21
Feature Entered	Time	4:14:38 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:15:18 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**33_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**33**
Stake Point Report	Design elev	11.717 usft
Stake Point Report	Ground elev	11.807 usft
Stake Point Report	Staked out N	2209269.444 usft
Stake Point Report	Staked out E	6224313.649 usft
Stake Point Report	Slope to design	-167.84%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.054 usft
Stake Point Report	Cut	0.090 usft
Stake Point Report	Stake marking	Up 3.191 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:15:19 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/6/21
Feature Entered	Time	4:15:26 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:16:07 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**34_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**34**
Stake Point Report	Design elev	11.710 usft
Stake Point Report	Ground elev	11.778 usft
Stake Point Report	Staked out N	2209257.762 usft
Stake Point Report	Staked out E	6224335.877 usft
Stake Point Report	Slope to design	-108.54%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.063 usft
Stake Point Report	Cut	0.068 usft
Stake Point Report	Stake marking	Up 3.213 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:16:08 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/6/21
Feature Entered	Time	4:16:15 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:17:11 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**35_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**35**
Stake Point Report	Design elev	11.816 usft
Stake Point Report	Ground elev	11.920 usft
Stake Point Report	Staked out N	2209246.531 usft
Stake Point Report	Staked out E	6224357.905 usft
Stake Point Report	Slope to design	-140.08%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.074 usft
Stake Point Report	Cut	0.104 usft
Stake Point Report	Stake marking	Up 3.177 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:17:12 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/6/21
Feature Entered	Time	4:17:36 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:20:28 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**36_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**36**
Stake Point Report	Design elev	9.880 usft
Stake Point Report	Ground elev	9.987 usft

Stake Point Report	Staked out N	2209215.181 usft
Stake Point Report	Staked out E	6224316.296 usft
Stake Point Report	Slope to design	-158.37%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.067 usft
Stake Point Report	Cut	0.107 usft
Stake Point Report	Stake marking	Up 3.174 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:20:28 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	4:20:48 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:22:15 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**37_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**37**
Stake Point Report	Design elev	9.399 usft
Stake Point Report	Ground elev	9.462 usft
Stake Point Report	Staked out N	2209237.901 usft
Stake Point Report	Staked out E	6224271.645 usft
Stake Point Report	Slope to design	-154.29%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.041 usft
Stake Point Report	Cut	0.063 usft
Stake Point Report	Stake marking	Up 3.218 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:22:15 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	4:22:23 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:23:28 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**9_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**9**
Stake Point Report	Design elev	10.037 usft
Stake Point Report	Ground elev	10.060 usft
Stake Point Report	Staked out N	2209264.393 usft
Stake Point Report	Staked out E	6224243.011 usft
Stake Point Report	Slope to design	-38.61%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.058 usft
Stake Point Report	Cut	0.023 usft
Stake Point Report	Stake marking	Up 3.258 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:24:58 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	4:25:09 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:25:57 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**38_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**38**
Stake Point Report	Design elev	9.741 usft
Stake Point Report	Ground elev	9.838 usft
Stake Point Report	Staked out N	2209263.093 usft
Stake Point Report	Staked out E	6224227.994 usft
Stake Point Report	Slope to design	-191.06%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.051 usft
Stake Point Report	Cut	0.097 usft
Stake Point Report	Stake marking	Up 3.184 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:28:11 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/6/21
Feature Entered	Time	4:28:34 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:29:29 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**39_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**39**
Stake Point Report	Design elev	9.368 usft
Stake Point Report	Ground elev	9.428 usft
Stake Point Report	Staked out N	2209286.710 usft
Stake Point Report	Staked out E	6224183.935 usft
Stake Point Report	Slope to design	-81.42%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.074 usft
Stake Point Report	Cut	0.060 usft
Stake Point Report	Stake marking	Up 3.221 usft C 3.281 usft

Feature Entered	Date	6/6/21
Feature Entered	Time	4:30:13 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/6/21
Feature Entered	Time	4:30:19 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:30:27 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**40_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**40**
Stake Point Report	Design elev	9.580 usft
Stake Point Report	Ground elev	9.628 usft
Stake Point Report	Staked out N	2209312.680 usft
Stake Point Report	Staked out E	6224140.678 usft
Stake Point Report	Slope to design	-83.99%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.057 usft
Stake Point Report	Cut	0.048 usft
Stake Point Report	Stake marking	Up 3.233 usft C 3.281 usft
Feature Entered	Date	6/6/21
Feature Entered	Time	4:30:28 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/6/21
Feature Entered	Time	4:30:35 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:31:18 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**41_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**41**
Stake Point Report	Design elev	-1.761 usft
Stake Point Report	Ground elev	-1.751 usft
Stake Point Report	Staked out N	2209276.334 usft
Stake Point Report	Staked out E	6224123.836 usft
Stake Point Report	Slope to design	-23.12%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.043 usft
Stake Point Report	Cut	0.010 usft
Stake Point Report	Stake marking	Up 3.271 usft C 3.281 usft
Feature Entered	Date	6/6/21
Feature Entered	Time	4:31:19 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/6/21
Feature Entered	Time	4:31:25 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:32:07 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**42_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**42**
Stake Point Report	Design elev	-2.199 usft
Stake Point Report	Ground elev	-2.188 usft
Stake Point Report	Staked out N	2209251.539 usft
Stake Point Report	Staked out E	6224167.528 usft
Stake Point Report	Slope to design	-49.83%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.022 usft
Stake Point Report	Cut	0.011 usft
Stake Point Report	Stake marking	Up 3.270 usft C 3.281 usft
Feature Entered	Date	6/6/21
Feature Entered	Time	4:32:08 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/6/21
Feature Entered	Time	4:32:13 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/6/21
Stake Point Report	Time	4:32:51 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**43_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**43**
Stake Point Report	Design elev	-2.626 usft
Stake Point Report	Ground elev	-2.494 usft
Stake Point Report	Staked out N	2209224.050 usft
Stake Point Report	Staked out E	6224210.055 usft
Stake Point Report	Slope to design	-304.90%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.043 usft
Stake Point Report	Cut	0.132 usft
Stake Point Report	Stake marking	Up 3.149 usft C 3.281 usft

Feature Entered	Date	6/6/21	
Feature Entered	Time	4:32:52 PM	
Feature Entered	Feature Name	Measure Point	
Feature Entered	Date	6/6/21	
Feature Entered	Time	4:32:57 PM	
Feature Entered	Feature Name	Stakeout Point	
Stake Point Report	Date	6/6/21	
Stake Point Report	Time	4:33:33 PM	
Stake Point Report	**Stake location is in tolerance.**		
Stake Point Report	**Point name**	**44_stk**	
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL		
Stake Point Report	Stake Data		
Stake Point Report	**Origin point**	**44**	
Stake Point Report	Design elev	-2.658 usft	
Stake Point Report	Ground elev	-2.536 usft	
Stake Point Report	Staked out N	2209198.756 usft	
Stake Point Report	Staked out E	6224253.586 usft	
Stake Point Report	Slope to design	-180.92%	
Stake Point Report	Deviation from design		
Stake Point Report	Horiz	0.067 usft	
Stake Point Report	Cut	0.122 usft	
Stake Point Report	Stake marking	Up 3.159 usft C 3.281 usft	
Feature Entered	Date	6/6/21	
Feature Entered	Time	4:33:34 PM	
Feature Entered	Feature Name	Measure Point	
Feature Entered	Date	6/6/21	
Feature Entered	Time	4:33:38 PM	
Feature Entered	Feature Name	Stakeout Point	
Stake Point Report	Date	6/6/21	
Stake Point Report	Time	4:34:44 PM	
Stake Point Report	**Stake location is in tolerance.**		
Stake Point Report	**Point name**	**45_stk**	
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL		
Stake Point Report	Stake Data		
Stake Point Report	**Origin point**	**45**	
Stake Point Report	Design elev	-3.275 usft	
Stake Point Report	Ground elev	-3.177 usft	
Stake Point Report	Staked out N	2209172.047 usft	
Stake Point Report	Staked out E	6224296.243 usft	
Stake Point Report	Slope to design	-160.27%	
Stake Point Report	Deviation from design		
Stake Point Report	Horiz	0.061 usft	
Stake Point Report	Cut	0.098 usft	
Stake Point Report	Stake marking	Up 3.183 usft C 3.281 usft	

DROUGHT EMERGENCY TEMPORARY ROCK BARRIER 2021

DAILY ONSITE SURVEY MONITORING

June 7th, 2021

Surveyor: Justin Stange

Open WO	Date	6/7/21	
Open WO	Time	9:29:28 AM	
Open WO	Work Order	Daily Inspect 06.07.21	
Open WO	Site	06.06.21 False River	
Open WO	Design		
Open WO	Program Version	3.72.18100.77	

Feature Entered	Date	6/7/21	
Feature Entered	Time	9:35:56 AM	
Feature Entered	Feature Name	Measure Point	

Feature Entered	Date	6/7/21	
Feature Entered	Time	9:36:02 AM	
Feature Entered	Feature Name	Stakeout Point	

Stake Point Report	Date	6/7/21	
Stake Point Report	Time	9:37:49 AM	
Stake Point Report	**Stake location is in tolerance.**		
Stake Point Report	**Point name**	**3_stk**	
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J3		
Stake Point Report	Stake Data		
Stake Point Report	**Origin point**	**3**	
Stake Point Report	Design elev	11.610 usft	
Stake Point Report	Ground elev	11.535 usft	
Stake Point Report	Staked out N	2209416.598 usft	
Stake Point Report	Staked out E	6224056.726 usft	
Stake Point Report	Slope to design	228.73%	
Stake Point Report	Deviation from design		
Stake Point Report	Horiz	0.033 usft	
Stake Point Report	Fill	0.075 usft	
Stake Point Report	Stake marking	Up 3.356 usft C 3.281 usft	

Feature Entered	Date	6/7/21	
Feature Entered	Time	9:37:50 AM	
Feature Entered	Feature Name	Measure Point	

Feature Entered	Date	6/7/21	
Feature Entered	Time	9:38:02 AM	
Feature Entered	Feature Name	Stakeout Point	

Stake Point Report	Date	6/7/21	
Stake Point Report	Time	9:39:55 AM	
Stake Point Report	**Stake location is in tolerance.**		
Stake Point Report	**Point name**	**25_stk**	
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL		
Stake Point Report	Stake Data		
Stake Point Report	**Origin point**	**25**	
Stake Point Report	Design elev	11.931 usft	
Stake Point Report	Ground elev	11.879 usft	
Stake Point Report	Staked out N	2209367.650 usft	
Stake Point Report	Staked out E	6224138.298 usft	
Stake Point Report	Slope to design	149.57%	
Stake Point Report	Deviation from design		
Stake Point Report	Horiz	0.035 usft	
Stake Point Report	Fill	0.052 usft	
Stake Point Report	Stake marking	Up 3.333 usft C 3.281 usft	

Feature Entered	Date	6/7/21	
Feature Entered	Time	9:39:56 AM	
Feature Entered	Feature Name	Measure Point	

Feature Entered	Date	6/7/21	
Feature Entered	Time	9:40:21 AM	
Feature Entered	Feature Name	Stakeout Point	

Stake Point Report	Date	6/7/21	
Stake Point Report	Time	9:41:13 AM	
Stake Point Report	**Stake location is in tolerance.**		
Stake Point Report	**Point name**	**26_stk**	
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL		
Stake Point Report	Stake Data		
Stake Point Report	**Origin point**	**26**	
Stake Point Report	Design elev	12.053 usft	
Stake Point Report	Ground elev	12.040 usft	
Stake Point Report	Staked out N	2209355.605 usft	
Stake Point Report	Staked out E	6224160.181 usft	
Stake Point Report	Slope to design	45.97%	
Stake Point Report	Deviation from design		
Stake Point Report	Horiz	0.028 usft	
Stake Point Report	Fill	0.013 usft	
Stake Point Report	Stake marking	Up 3.294 usft C 3.281 usft	

Feature Entered	Date	6/7/21	
Feature Entered	Time	9:41:13 AM	
Feature Entered	Feature Name	Measure Point	

Feature Entered	Date	6/7/21	
Feature Entered	Time	9:41:19 AM	
Feature Entered	Feature Name	Stakeout Point	

Stake Point Report	Date	6/7/21	
Stake Point Report	Time	9:42:09 AM	
Stake Point Report	**Stake location is in tolerance.**		
Stake Point Report	**Point name**	**27_stk**	
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL		
Stake Point Report	Stake Data		
Stake Point Report	**Origin point**	**27**	
Stake Point Report	Design elev	11.720 usft	
Stake Point Report	Ground elev	11.710 usft	
Stake Point Report	Staked out N	2209342.923 usft	
Stake Point Report	Staked out E	6224182.119 usft	
Stake Point Report	Slope to design	29.95%	
Stake Point Report	Deviation from design		
Stake Point Report	Horiz	0.033 usft	
Stake Point Report	Fill	0.010 usft	
Stake Point Report	Stake marking	Up 3.291 usft C 3.281 usft	

Feature Entered	Date	6/7/21	
Feature Entered	Time	9:42:10 AM	
Feature Entered	Feature Name	Measure Point	

Feature Entered	Date	6/7/21	
Feature Entered	Time	9:42:18 AM	
Feature Entered	Feature Name	Stakeout Point	

Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:43:33 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**28_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**28**
Stake Point Report	Design elev	11.858 usft
Stake Point Report	Ground elev	11.861 usft
Stake Point Report	Staked out N	2209329.503 usft
Stake Point Report	Staked out E	6224203.273 usft
Stake Point Report	Slope to design	-6.79%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.046 usft
Stake Point Report	Cut	0.003 usft
Stake Point Report	Stake marking	Up 3.278 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	9:43:33 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	9:43:44 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:44:53 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**29_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**29**
Stake Point Report	Design elev	11.866 usft
Stake Point Report	Ground elev	11.834 usft
Stake Point Report	Staked out N	2209316.962 usft
Stake Point Report	Staked out E	6224225.567 usft
Stake Point Report	Slope to design	85.76%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.037 usft
Stake Point Report	Fill	0.032 usft
Stake Point Report	Stake marking	Up 3.313 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	9:44:54 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	9:45:08 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:45:58 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**30_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**30**
Stake Point Report	Design elev	11.989 usft
Stake Point Report	Ground elev	11.999 usft
Stake Point Report	Staked out N	2209303.980 usft
Stake Point Report	Staked out E	6224247.015 usft
Stake Point Report	Slope to design	-13.08%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.073 usft
Stake Point Report	Cut	0.010 usft
Stake Point Report	Stake marking	Up 3.271 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	9:45:59 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	9:46:04 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:46:48 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**31_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**31**
Stake Point Report	Design elev	12.020 usft
Stake Point Report	Ground elev	11.994 usft
Stake Point Report	Staked out N	2209293.057 usft
Stake Point Report	Staked out E	6224269.863 usft
Stake Point Report	Slope to design	35.04%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.074 usft
Stake Point Report	Fill	0.026 usft
Stake Point Report	Stake marking	Up 3.307 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	9:46:48 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	9:46:54 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:47:45 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**32_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**32**
Stake Point Report	Design elev	11.698 usft
Stake Point Report	Ground elev	11.660 usft
Stake Point Report	Staked out N	2209281.668 usft
Stake Point Report	Staked out E	6224291.751 usft
Stake Point Report	Slope to design	138.31%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.027 usft
Stake Point Report	Fill	0.038 usft
Stake Point Report	Stake marking	Up 3.319 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	9:47:45 AM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/7/21
Feature Entered	Time	9:47:50 AM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:48:31 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**33_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**33**
Stake Point Report	Design elev	11.717 usft
Stake Point Report	Ground elev	11.728 usft
Stake Point Report	Staked out N	2209269.457 usft
Stake Point Report	Staked out E	6224313.638 usft
Stake Point Report	Slope to design	-22.06%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.050 usft
Stake Point Report	Cut	0.011 usft
Stake Point Report	Stake marking	Up 3.270 usft C 3.281 usft
Feature Entered	Date	6/7/21
Feature Entered	Time	9:48:32 AM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/7/21
Feature Entered	Time	9:48:36 AM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:49:15 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**34_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**34**
Stake Point Report	Design elev	11.710 usft
Stake Point Report	Ground elev	11.770 usft
Stake Point Report	Staked out N	2209257.787 usft
Stake Point Report	Staked out E	6224335.907 usft
Stake Point Report	Slope to design	-243.97%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.024 usft
Stake Point Report	Cut	0.060 usft
Stake Point Report	Stake marking	Up 3.221 usft C 3.281 usft
Feature Entered	Date	6/7/21
Feature Entered	Time	9:49:16 AM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/7/21
Feature Entered	Time	9:49:20 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:50:13 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**35_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**35**
Stake Point Report	Design elev	11.816 usft
Stake Point Report	Ground elev	11.879 usft
Stake Point Report	Staked out N	2209246.543 usft
Stake Point Report	Staked out E	6224357.879 usft
Stake Point Report	Slope to design	-80.87%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.078 usft
Stake Point Report	Cut	0.063 usft
Stake Point Report	Stake marking	Up 3.218 usft C 3.281 usft
Feature Entered	Date	6/7/21
Feature Entered	Time	9:50:13 AM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/7/21
Feature Entered	Time	9:50:20 AM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:51:38 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**36_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**36**
Stake Point Report	Design elev	9.880 usft
Stake Point Report	Ground elev	9.935 usft
Stake Point Report	Staked out N	2209215.197 usft
Stake Point Report	Staked out E	6224316.288 usft
Stake Point Report	Slope to design	-91.26%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.061 usft
Stake Point Report	Cut	0.055 usft
Stake Point Report	Stake marking	Up 3.226 usft C 3.281 usft
Feature Entered	Date	6/7/21
Feature Entered	Time	9:55:41 AM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/7/21
Feature Entered	Time	9:55:46 AM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:56:37 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**45_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**45**
Stake Point Report	Design elev	-3.275 usft
Stake Point Report	Ground elev	-3.229 usft

Stake Point Report	Staked out N	2209172.014 usft
Stake Point Report	Staked out E	6224296.244 usft
Stake Point Report	Slope to design	-56.79%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz 0.081 usft	
Stake Point Report	Cut 0.046 usft	
Stake Point Report	Stake marking	Up 3.235 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	9:57:35 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	9:57:39 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:57:48 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**44_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**44**
Stake Point Report	Design elev	-2.658 usft
Stake Point Report	Ground elev	-2.620 usft
Stake Point Report	Staked out N	2209198.777 usft
Stake Point Report	Staked out E	6224253.611 usft
Stake Point Report	Slope to design	-111.09%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz 0.034 usft	
Stake Point Report	Cut 0.038 usft	
Stake Point Report	Stake marking	Up 3.243 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	9:57:48 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	9:57:53 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	9:58:38 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**43_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**43**
Stake Point Report	Design elev	-2.626 usft
Stake Point Report	Ground elev	-2.588 usft
Stake Point Report	Staked out N	2209224.072 usft
Stake Point Report	Staked out E	6224210.032 usft
Stake Point Report	Slope to design	-109.57%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz 0.035 usft	
Stake Point Report	Cut 0.038 usft	
Stake Point Report	Stake marking	Up 3.243 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	9:58:39 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	9:58:47 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	10:00:06 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**42_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**42**
Stake Point Report	Design elev	-2.199 usft
Stake Point Report	Ground elev	-2.132 usft
Stake Point Report	Staked out N	2209251.532 usft
Stake Point Report	Staked out E	6224167.537 usft
Stake Point Report	Slope to design	-277.07%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz 0.024 usft	
Stake Point Report	Cut 0.067 usft	
Stake Point Report	Stake marking	Up 3.214 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	10:00:07 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	10:00:18 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	10:02:08 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**41_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**41**
Stake Point Report	Design elev	-1.761 usft
Stake Point Report	Ground elev	-1.715 usft
Stake Point Report	Staked out N	2209276.326 usft
Stake Point Report	Staked out E	6224123.796 usft
Stake Point Report	Slope to design	-66.24%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz 0.069 usft	
Stake Point Report	Cut 0.046 usft	
Stake Point Report	Stake marking	Up 3.235 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	10:02:09 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	10:02:19 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	10:04:00 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**40_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**40**
Stake Point Report	Design elev	9.580 usft
Stake Point Report	Ground elev	9.576 usft
Stake Point Report	Staked out N	2209312.692 usft
Stake Point Report	Staked out E	6224140.657 usft
Stake Point Report	Slope to design	7.92%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.053 usft
Stake Point Report	Fill	0.004 usft
Stake Point Report	Stake marking	Up 3.285 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	10:04:00 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	10:04:10 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	10:05:17 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**39_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**39**
Stake Point Report	Design elev	9.368 usft
Stake Point Report	Ground elev	9.414 usft
Stake Point Report	Staked out N	2209286.716 usft
Stake Point Report	Staked out E	6224183.934 usft
Stake Point Report	Slope to design	-67.69%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.068 usft
Stake Point Report	Cut	0.046 usft
Stake Point Report	Stake marking	Up 3.235 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	10:05:18 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	10:05:28 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	10:06:29 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**38_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**38**
Stake Point Report	Design elev	9.741 usft
Stake Point Report	Ground elev	9.852 usft
Stake Point Report	Staked out N	2209263.109 usft
Stake Point Report	Staked out E	6224227.960 usft
Stake Point Report	Slope to design	-174.64%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.063 usft
Stake Point Report	Cut	0.111 usft
Stake Point Report	Stake marking	Up 3.170 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	10:06:30 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	10:06:38 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	10:07:36 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**37_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**37**
Stake Point Report	Design elev	9.399 usft
Stake Point Report	Ground elev	9.492 usft
Stake Point Report	Staked out N	2209237.874 usft
Stake Point Report	Staked out E	6224271.657 usft
Stake Point Report	Slope to design	-189.35%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.049 usft
Stake Point Report	Cut	0.093 usft
Stake Point Report	Stake marking	Up 3.188 usft C 3.281 usft

Feature Entered	Date	6/7/21
Feature Entered	Time	10:07:36 AM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/7/21
Feature Entered	Time	10:07:46 AM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/7/21
Stake Point Report	Time	10:08:38 AM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**9_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**9**
Stake Point Report	Design elev	10.037 usft
Stake Point Report	Ground elev	10.121 usft
Stake Point Report	Staked out N	2209264.405 usft
Stake Point Report	Staked out E	6224243.007 usft
Stake Point Report	Slope to design	-160.26%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.053 usft
Stake Point Report	Cut	0.084 usft
Stake Point Report	Stake marking	Up 3.197 usft C 3.281 usft

Feature Entered	Date	6/7/21	
Feature Entered	Time	10:08:39 AM	
Feature Entered	Feature Name	Measure Point	
Feature Entered	Date	6/7/21	
Feature Entered	Time	10:09:38 AM	
Feature Entered	Feature Name	Stakeout Point	
Stake Point Report	Date	6/7/21	
Stake Point Report	Time	10:11:43 AM	
Stake Point Report	**Stake location is in tolerance.**		
Stake Point Report	**Point name**	**2_stk**	
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J2		
Stake Point Report	Stake Data		
Stake Point Report	**Origin point**	**2**	
Stake Point Report	Design elev	11.690 usft	
Stake Point Report	Ground elev	11.873 usft	
Stake Point Report	Staked out N	2209207.736 usft	
Stake Point Report	Staked out E	6224448.078 usft	
Stake Point Report	Slope to design	-404.71%	
Stake Point Report	Deviation from design		
Stake Point Report	Horiz	0.045 usft	
Stake Point Report	Cut	0.183 usft	
Stake Point Report	Stake marking	Up 3.098 usft C 3.281 usft	
Feature Entered	Date	6/7/21	
Feature Entered	Time	10:15:29 AM	
Feature Entered	Feature Name	Measure Point	
Feature Entered	Date	6/7/21	
Feature Entered	Time	10:15:34 AM	
Feature Entered	Feature Name	Stakeout Point	
Stake Point Report	Date	6/7/21	
Stake Point Report	Time	10:18:07 AM	
Stake Point Report	**Stake location is in tolerance.**		
Stake Point Report	**Point name**	**1_stk**	
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J1		
Stake Point Report	Stake Data		
Stake Point Report	**Origin point**	**1**	
Stake Point Report	Design elev	12.030 usft	
Stake Point Report	Ground elev	12.202 usft	
Stake Point Report	Staked out N	2209108.075 usft	
Stake Point Report	Staked out E	6224678.252 usft	
Stake Point Report	Slope to design	-227.35%	
Stake Point Report	Deviation from design		
Stake Point Report	Horiz	0.076 usft	
Stake Point Report	Cut	0.172 usft	
Stake Point Report	Stake marking	Up 3.109 usft C 3.281 usft	

DROUGHT EMERGENCY TEMPORARY ROCK BARRIER 2021

DAILY ONSITE SURVEY MONITORING

June 8th, 2021

Surveyor: Justin Stange

Open WO	Date	6/8/21
Open WO	Time	2:08:42 PM
Open WO	Work Order	06.08.21 Daily Inspect
Open WO	Site	06.08.21 Site Cali
Open WO	Design	
Open WO	Program Version	3.72.18100.77

Feature Entered	Date	6/8/21
Feature Entered	Time	2:27:14 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:27:21 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**41_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**41**
Stake Point Report	Design elev	-1.761 usft
Stake Point Report	Ground elev	-1.774 usft
Stake Point Report	Staked out N	2209276.373 usft
Stake Point Report	Staked out E	6224123.835 usft
Stake Point Report	Slope to design	142.77%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.009 usft
Stake Point Report	Fill	0.013 usft
Stake Point Report	Stake marking	Up 3.294 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:27:22 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:28:21 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:28:27 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**42_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**42**
Stake Point Report	Design elev	-2.199 usft
Stake Point Report	Ground elev	-2.188 usft
Stake Point Report	Staked out N	2209251.543 usft
Stake Point Report	Staked out E	6224167.571 usft
Stake Point Report	Slope to design	-34.60%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.032 usft
Stake Point Report	Cut	0.011 usft
Stake Point Report	Stake marking	Up 3.270 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:28:27 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:28:33 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:29:19 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**43_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**43**
Stake Point Report	Design elev	-2.626 usft
Stake Point Report	Ground elev	-2.611 usft
Stake Point Report	Staked out N	2209224.086 usft
Stake Point Report	Staked out E	6224210.072 usft
Stake Point Report	Slope to design	-107.86%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.014 usft
Stake Point Report	Cut	0.015 usft
Stake Point Report	Stake marking	Up 3.266 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:29:19 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:29:24 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:30:10 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**44_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**44**
Stake Point Report	Design elev	-2.658 usft
Stake Point Report	Ground elev	-2.735 usft
Stake Point Report	Staked out N	2209198.822 usft
Stake Point Report	Staked out E	6224253.659 usft
Stake Point Report	Slope to design	248.77%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.031 usft
Stake Point Report	Fill	0.077 usft
Stake Point Report	Stake marking	Up 3.358 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:30:10 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:30:53 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:30:59 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**45_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**45**
Stake Point Report	Design elev	-3.275 usft
Stake Point Report	Ground elev	-3.347 usft
Stake Point Report	Staked out N	2209172.054 usft
Stake Point Report	Staked out E	6224296.313 usft
Stake Point Report	Slope to design	278.16%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.026 usft
Stake Point Report	Fill	0.072 usft
Stake Point Report	Stake marking	Up 3.353 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:30:59 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:31:05 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:31:58 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**36_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**36**
Stake Point Report	Design elev	9.880 usft
Stake Point Report	Ground elev	9.849 usft
Stake Point Report	Staked out N	2209215.221 usft
Stake Point Report	Staked out E	6224316.336 usft
Stake Point Report	Slope to design	196.78%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.016 usft
Stake Point Report	Fill	0.031 usft
Stake Point Report	Stake marking	Up 3.312 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:31:59 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:32:06 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:32:45 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**37_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**37**
Stake Point Report	Design elev	9.399 usft
Stake Point Report	Ground elev	9.412 usft
Stake Point Report	Staked out N	2209237.891 usft
Stake Point Report	Staked out E	6224271.687 usft
Stake Point Report	Slope to design	-51.78%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.025 usft
Stake Point Report	Cut	0.013 usft
Stake Point Report	Stake marking	Up 3.268 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:32:46 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:33:04 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:34:12 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**9_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**9**
Stake Point Report	Design elev	10.037 usft
Stake Point Report	Ground elev	10.050 usft
Stake Point Report	Staked out N	2209264.404 usft
Stake Point Report	Staked out E	6224243.058 usft
Stake Point Report	Slope to design	-32.33%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.039 usft
Stake Point Report	Cut	0.013 usft
Stake Point Report	Stake marking	Up 3.268 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:34:13 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:34:39 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:35:13 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**38_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**38**
Stake Point Report	Design elev	9.741 usft
Stake Point Report	Ground elev	9.712 usft
Stake Point Report	Staked out N	2209263.109 usft
Stake Point Report	Staked out E	6224228.038 usft
Stake Point Report	Slope to design	76.16%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.038 usft
Stake Point Report	Fill	0.029 usft
Stake Point Report	Stake marking	Up 3.310 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:35:14 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:37:43 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:38:25 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**39_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**39**
Stake Point Report	Design elev	9.368 usft
Stake Point Report	Ground elev	9.390 usft
Stake Point Report	Staked out N	2209286.742 usft
Stake Point Report	Staked out E	6224183.930 usft
Stake Point Report	Slope to design	-51.35%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.043 usft
Stake Point Report	Cut	0.022 usft
Stake Point Report	Stake marking	Up 3.259 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:38:26 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:38:31 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:39:15 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**40_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**40**
Stake Point Report	Design elev	9.580 usft
Stake Point Report	Ground elev	9.564 usft
Stake Point Report	Staked out N	2209312.712 usft
Stake Point Report	Staked out E	6224140.693 usft
Stake Point Report	Slope to design	61.27%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.025 usft
Stake Point Report	Fill	0.016 usft
Stake Point Report	Stake marking	Up 3.297 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:39:16 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:39:31 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:41:21 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**35_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**35**
Stake Point Report	Design elev	11.816 usft
Stake Point Report	Ground elev	11.800 usft
Stake Point Report	Staked out N	2209246.606 usft
Stake Point Report	Staked out E	6224357.917 usft
Stake Point Report	Slope to design	94.51%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.016 usft
Stake Point Report	Fill	0.016 usft
Stake Point Report	Stake marking	Up 3.297 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:41:21 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:41:37 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:43:19 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**1_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J1	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**1**
Stake Point Report	Design elev	12.030 usft
Stake Point Report	Ground elev	11.985 usft
Stake Point Report	Staked out N	2209108.139 usft
Stake Point Report	Staked out E	6224678.309 usft
Stake Point Report	Slope to design	236.70%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.019 usft
Stake Point Report	Fill	0.045 usft
Stake Point Report	Stake marking	Up 3.326 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:43:19 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:43:24 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:44:52 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**2_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J2	
Stake Point Report	Stake Data	
Stake Point Report	Origin point	2

Stake Point Report	Design elev	11.690 usft
Stake Point Report	Ground elev	11.651 usft
Stake Point Report	Staked out N	2209207.791 usft
Stake Point Report	Staked out E	6224448.103 usft
Stake Point Report	Slope to design	221.94%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.018 usft
Stake Point Report	Fill	0.039 usft
Stake Point Report	Stake marking	Up 3.320 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:44:52 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:45:02 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	2:46:32 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**34_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**34**
Stake Point Report	Design elev	11.710 usft
Stake Point Report	Ground elev	11.675 usft
Stake Point Report	Staked out N	2209257.828 usft
Stake Point Report	Staked out E	6224335.892 usft
Stake Point Report	Slope to design	97.34%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.036 usft
Stake Point Report	Fill	0.035 usft
Stake Point Report	Stake marking	Up 3.316 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	2:46:32 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	2:51:41 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	3:01:37 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**33_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**33**
Stake Point Report	Design elev	11.717 usft
Stake Point Report	Ground elev	11.673 usft
Stake Point Report	Staked out N	2209269.495 usft
Stake Point Report	Staked out E	6224313.681 usft
Stake Point Report	Slope to design	588.98%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.007 usft
Stake Point Report	Fill	0.044 usft
Stake Point Report	Stake marking	Up 3.325 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	3:01:37 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	3:01:41 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	3:02:16 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**32_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**32**
Stake Point Report	Design elev	11.698 usft
Stake Point Report	Ground elev	11.674 usft
Stake Point Report	Staked out N	2209281.699 usft
Stake Point Report	Staked out E	6224291.756 usft
Stake Point Report	Slope to design	122.06%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.020 usft
Stake Point Report	Fill	0.024 usft
Stake Point Report	Stake marking	Up 3.305 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	3:02:16 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	3:02:20 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	3:02:56 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**31_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**31**
Stake Point Report	Design elev	12.020 usft
Stake Point Report	Ground elev	11.984 usft
Stake Point Report	Staked out N	2209293.147 usft
Stake Point Report	Staked out E	6224269.900 usft
Stake Point Report	Slope to design	150.16%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.024 usft
Stake Point Report	Fill	0.036 usft
Stake Point Report	Stake marking	Up 3.317 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	3:02:56 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	3:03:01 PM

Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/8/21
Stake Point Report	Time	3:03:43 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**30_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**30**
Stake Point Report	Design elev	11.989 usft
Stake Point Report	Ground elev	11.956 usft
Stake Point Report	Staked out N	2209304.031 usft
Stake Point Report	Staked out E	6224247.034 usft
Stake Point Report	Slope to design	177.03%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.019 usft
Stake Point Report	Fill	0.033 usft
Stake Point Report	Stake marking	Up 3.314 usft C 3.281 usft
Feature Entered	Date	6/8/21
Feature Entered	Time	3:03:43 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/8/21
Feature Entered	Time	3:03:48 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/8/21
Stake Point Report	Time	3:04:16 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**29_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**29**
Stake Point Report	Design elev	11.866 usft
Stake Point Report	Ground elev	11.829 usft
Stake Point Report	Staked out N	2209317.002 usft
Stake Point Report	Staked out E	6224225.569 usft
Stake Point Report	Slope to design	333.26%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.011 usft
Stake Point Report	Fill	0.037 usft
Stake Point Report	Stake marking	Up 3.318 usft C 3.281 usft
Feature Entered	Date	6/8/21
Feature Entered	Time	3:04:16 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/8/21
Feature Entered	Time	3:04:21 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/8/21
Stake Point Report	Time	3:04:59 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**28_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**28**
Stake Point Report	Design elev	11.858 usft
Stake Point Report	Ground elev	11.809 usft
Stake Point Report	Staked out N	2209329.554 usft
Stake Point Report	Staked out E	6224203.321 usft
Stake Point Report	Slope to design	165.85%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.030 usft
Stake Point Report	Fill	0.049 usft
Stake Point Report	Stake marking	Up 3.330 usft C 3.281 usft
Feature Entered	Date	6/8/21
Feature Entered	Time	3:04:59 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/8/21
Feature Entered	Time	3:05:04 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/8/21
Stake Point Report	Time	3:05:39 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**27_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**27**
Stake Point Report	Design elev	11.720 usft
Stake Point Report	Ground elev	11.704 usft
Stake Point Report	Staked out N	2209342.980 usft
Stake Point Report	Staked out E	6224182.136 usft
Stake Point Report	Slope to design	49.81%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.032 usft
Stake Point Report	Fill	0.016 usft
Stake Point Report	Stake marking	Up 3.297 usft C 3.281 usft
Feature Entered	Date	6/8/21
Feature Entered	Time	3:05:40 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/8/21
Feature Entered	Time	3:05:44 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/8/21
Stake Point Report	Time	3:06:13 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**26_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**26**
Stake Point Report	Design elev	12.053 usft
Stake Point Report	Ground elev	11.980 usft
Stake Point Report	Staked out N	2209355.660 usft
Stake Point Report	Staked out E	6224160.193 usft
Stake Point Report	Slope to design	200.87%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.036 usft
Stake Point Report	Fill	0.073 usft

Stake Point Report	Stake marking	Up 3.354 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	3:06:14 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	3:06:25 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	3:07:27 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**3_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J3	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**3**
Stake Point Report	Design elev	11.610 usft
Stake Point Report	Ground elev	11.557 usft
Stake Point Report	Staked out N	2209416.598 usft
Stake Point Report	Staked out E	6224056.717 usft
Stake Point Report	Slope to design	183.47%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.029 usft
Stake Point Report	Fill	0.053 usft
Stake Point Report	Stake marking	Up 3.334 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	3:07:28 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	3:07:37 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	3:09:02 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**4_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J4	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**4**
Stake Point Report	Design elev	11.860 usft
Stake Point Report	Ground elev	11.967 usft
Stake Point Report	Staked out N	2209552.459 usft
Stake Point Report	Staked out E	6223846.472 usft
Stake Point Report	Slope to design	-205.82%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.052 usft
Stake Point Report	Cut	0.107 usft
Stake Point Report	Stake marking	Up 3.174 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	3:09:03 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/8/21
Feature Entered	Time	3:09:07 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/8/21
Stake Point Report	Time	3:10:55 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**25_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**25**
Stake Point Report	Design elev	11.931 usft
Stake Point Report	Ground elev	11.923 usft
Stake Point Report	Staked out N	2209367.711 usft
Stake Point Report	Staked out E	6224138.314 usft
Stake Point Report	Slope to design	25.85%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.033 usft
Stake Point Report	Fill	0.008 usft
Stake Point Report	Stake marking	Up 3.289 usft C 3.281 usft

Feature Entered	Date	6/8/21
Feature Entered	Time	3:10:55 PM
Feature Entered	Feature Name	Measure Point

DROUGHT EMERGENCY TEMPORARY ROCK BARRIER 2021

DAILY ONSITE SURVEY MONITORING

June 9th, 2021

Surveyor: Justin Stange

Open WO	Date	6/9/21
Open WO	Time	2:59:46 PM
Open WO	Work Order	06.09.21 Daily Inspect
Open WO	Site	06.08.21 Site Cali
Open WO	Design	
Open WO	Program Version	3.72.18100.77

Feature Entered	Date	6/9/21
Feature Entered	Time	3:03:59 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:04:29 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:05:31 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**26_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**26**
Stake Point Report	Design elev	12.053 usft
Stake Point Report	Ground elev	12.012 usft
Stake Point Report	Staked out N	2209355.652 usft
Stake Point Report	Staked out E	6224160.179 usft
Stake Point Report	Slope to design	178.62%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.023 usft
Stake Point Report	Fill	0.041 usft
Stake Point Report	Stake marking	Up 3.322 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:05:31 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:05:37 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:06:58 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**25_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**25**
Stake Point Report	Design elev	11.931 usft
Stake Point Report	Ground elev	11.863 usft
Stake Point Report	Staked out N	2209367.714 usft
Stake Point Report	Staked out E	6224138.331 usft
Stake Point Report	Slope to design	146.13%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.046 usft
Stake Point Report	Fill	0.068 usft
Stake Point Report	Stake marking	Up 3.349 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:06:59 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:07:37 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:08:56 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**3_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J3	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**3**
Stake Point Report	Design elev	11.610 usft
Stake Point Report	Ground elev	11.564 usft
Stake Point Report	Staked out N	2209416.624 usft
Stake Point Report	Staked out E	6224056.734 usft
Stake Point Report	Slope to design	77.70%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.059 usft
Stake Point Report	Fill	0.046 usft
Stake Point Report	Stake marking	Up 3.327 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:10:32 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:10:38 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:10:57 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**4_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J4	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**4**
Stake Point Report	Design elev	11.860 usft
Stake Point Report	Ground elev	11.964 usft
Stake Point Report	Staked out N	2209552.483 usft
Stake Point Report	Staked out E	6223846.515 usft
Stake Point Report	Slope to design	-134.55%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.077 usft
Stake Point Report	Cut	0.104 usft
Stake Point Report	Stake marking	Up 3.177 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:10:58 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:11:04 PM

Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:13:31 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**28_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**28**
Stake Point Report	Design elev	11.858 usft
Stake Point Report	Ground elev	11.776 usft
Stake Point Report	Staked out N	2209329.579 usft
Stake Point Report	Staked out E	6224203.333 usft
Stake Point Report	Slope to design	157.27%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.052 usft
Stake Point Report	Fill	0.082 usft
Stake Point Report	Stake marking	Up 3.363 usft C 3.281 usft
Feature Entered	Date	6/9/21
Feature Entered	Time	3:13:32 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/9/21
Feature Entered	Time	3:13:39 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:14:27 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**29_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**29**
Stake Point Report	Design elev	11.866 usft
Stake Point Report	Ground elev	11.799 usft
Stake Point Report	Staked out N	2209317.018 usft
Stake Point Report	Staked out E	6224225.583 usft
Stake Point Report	Slope to design	213.77%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.031 usft
Stake Point Report	Fill	0.067 usft
Stake Point Report	Stake marking	Up 3.348 usft C 3.281 usft
Feature Entered	Date	6/9/21
Feature Entered	Time	3:14:27 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/9/21
Feature Entered	Time	3:27:17 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:28:16 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**30_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**30**
Stake Point Report	Design elev	11.989 usft
Stake Point Report	Ground elev	11.930 usft
Stake Point Report	Staked out N	2209304.101 usft
Stake Point Report	Staked out E	6224247.019 usft
Stake Point Report	Slope to design	109.61%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.054 usft
Stake Point Report	Fill	0.059 usft
Stake Point Report	Stake marking	Up 3.340 usft C 3.281 usft
Feature Entered	Date	6/9/21
Feature Entered	Time	3:28:16 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/9/21
Feature Entered	Time	3:28:22 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:29:13 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**31_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**31**
Stake Point Report	Design elev	12.020 usft
Stake Point Report	Ground elev	11.963 usft
Stake Point Report	Staked out N	2209293.185 usft
Stake Point Report	Staked out E	6224269.892 usft
Stake Point Report	Slope to design	92.83%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.061 usft
Stake Point Report	Fill	0.057 usft
Stake Point Report	Stake marking	Up 3.338 usft C 3.281 usft
Feature Entered	Date	6/9/21
Feature Entered	Time	3:29:14 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/9/21
Feature Entered	Time	3:29:18 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:30:12 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**32_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**32**
Stake Point Report	Design elev	11.698 usft
Stake Point Report	Ground elev	11.631 usft
Stake Point Report	Staked out N	2209281.738 usft
Stake Point Report	Staked out E	6224291.758 usft
Stake Point Report	Slope to design	126.73%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.053 usft
Stake Point Report	Fill	0.067 usft

Stake Point Report	Stake marking	Up 3.348 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:30:13 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:30:18 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:30:57 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**33_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**33**
Stake Point Report	Design elev	11.717 usft
Stake Point Report	Ground elev	11.663 usft
Stake Point Report	Staked out N	2209269.534 usft
Stake Point Report	Staked out E	6224313.679 usft
Stake Point Report	Slope to design	125.34%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.043 usft
Stake Point Report	Fill	0.054 usft
Stake Point Report	Stake marking	Up 3.335 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:30:58 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:31:02 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:31:48 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**34_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**34**
Stake Point Report	Design elev	11.710 usft
Stake Point Report	Ground elev	11.642 usft
Stake Point Report	Staked out N	2209257.845 usft
Stake Point Report	Staked out E	6224335.924 usft
Stake Point Report	Slope to design	177.52%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.038 usft
Stake Point Report	Fill	0.068 usft
Stake Point Report	Stake marking	Up 3.349 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:31:49 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:31:53 PM

Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:32:37 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**35_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**35**
Stake Point Report	Design elev	11.816 usft
Stake Point Report	Ground elev	11.778 usft
Stake Point Report	Staked out N	2209246.664 usft
Stake Point Report	Staked out E	6224357.931 usft
Stake Point Report	Slope to design	58.80%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.064 usft
Stake Point Report	Fill	0.038 usft
Stake Point Report	Stake marking	Up 3.319 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:32:37 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:32:45 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:33:49 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**2_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J2	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**2**
Stake Point Report	Design elev	11.690 usft
Stake Point Report	Ground elev	11.640 usft
Stake Point Report	Staked out N	2209207.776 usft
Stake Point Report	Staked out E	6224448.105 usft
Stake Point Report	Slope to design	311.83%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.016 usft
Stake Point Report	Fill	0.050 usft
Stake Point Report	Stake marking	Up 3.331 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:33:49 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:33:55 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:35:35 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**1_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED J1	

Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**1**
Stake Point Report	Design elev	12.030 usft
Stake Point Report	Ground elev	11.888 usft
Stake Point Report	Staked out N	2209108.182 usft
Stake Point Report	Staked out E	6224678.336 usft
Stake Point Report	Slope to design	228.12%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.062 usft
Stake Point Report	Fill	0.142 usft
Stake Point Report	Stake marking	Up 3.423 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:35:35 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:35:46 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:37:55 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**45_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**45**
Stake Point Report	Design elev	-3.275 usft
Stake Point Report	Ground elev	-3.404 usft
Stake Point Report	Staked out N	2209172.144 usft
Stake Point Report	Staked out E	6224296.325 usft
Stake Point Report	Slope to design	175.11%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.074 usft
Stake Point Report	Fill	0.129 usft
Stake Point Report	Stake marking	Up 3.410 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:37:55 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:38:01 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:38:51 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**44_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**44**
Stake Point Report	Design elev	-2.658 usft
Stake Point Report	Ground elev	-2.758 usft
Stake Point Report	Staked out N	2209198.850 usft
Stake Point Report	Staked out E	6224253.660 usft
Stake Point Report	Slope to design	180.73%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.055 usft
Stake Point Report	Fill	0.100 usft
Stake Point Report	Stake marking	Up 3.381 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:38:52 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:38:56 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:39:46 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**43_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**43**
Stake Point Report	Design elev	-2.626 usft
Stake Point Report	Ground elev	-2.694 usft
Stake Point Report	Staked out N	2209224.109 usft
Stake Point Report	Staked out E	6224210.075 usft
Stake Point Report	Slope to design	310.12%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.022 usft
Stake Point Report	Fill	0.068 usft
Stake Point Report	Stake marking	Up 3.349 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:39:46 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:39:50 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:40:35 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**42_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**42**
Stake Point Report	Design elev	-2.199 usft
Stake Point Report	Ground elev	-2.268 usft
Stake Point Report	Staked out N	2209251.558 usft
Stake Point Report	Staked out E	6224167.554 usft
Stake Point Report	Slope to design	563.20%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.012 usft
Stake Point Report	Fill	0.069 usft
Stake Point Report	Stake marking	Up 3.350 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:40:36 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21

Feature Entered	Time	3:40:40 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:41:24 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**41_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**41**
Stake Point Report	Design elev	-1.761 usft
Stake Point Report	Ground elev	-1.807 usft
Stake Point Report	Staked out N	2209276.403 usft
Stake Point Report	Staked out E	6224123.819 usft
Stake Point Report	Slope to design	129.94%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.035 usft
Stake Point Report	Fill	0.046 usft
Stake Point Report	Stake marking	Up 3.327 usft C 3.281 usft
Feature Entered	Date	6/9/21
Feature Entered	Time	3:41:25 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/9/21
Feature Entered	Time	3:41:31 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:42:34 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**40_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**40**
Stake Point Report	Design elev	9.580 usft
Stake Point Report	Ground elev	9.560 usft
Stake Point Report	Staked out N	2209312.760 usft
Stake Point Report	Staked out E	6224140.667 usft
Stake Point Report	Slope to design	66.41%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.030 usft
Stake Point Report	Fill	0.020 usft
Stake Point Report	Stake marking	Up 3.301 usft C 3.281 usft
Feature Entered	Date	6/9/21
Feature Entered	Time	3:42:34 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/9/21
Feature Entered	Time	3:42:39 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:43:42 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**39_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**39**
Stake Point Report	Design elev	9.368 usft
Stake Point Report	Ground elev	9.370 usft
Stake Point Report	Staked out N	2209286.768 usft
Stake Point Report	Staked out E	6224183.950 usft
Stake Point Report	Slope to design	-9.83%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.016 usft
Stake Point Report	Cut	0.002 usft
Stake Point Report	Stake marking	Up 3.279 usft C 3.281 usft
Feature Entered	Date	6/9/21
Feature Entered	Time	3:43:43 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/9/21
Feature Entered	Time	3:43:49 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:46:30 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**38_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**38**
Stake Point Report	Design elev	9.741 usft
Stake Point Report	Ground elev	9.745 usft
Stake Point Report	Staked out N	2209263.110 usft
Stake Point Report	Staked out E	6224228.021 usft
Stake Point Report	Slope to design	-12.99%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.030 usft
Stake Point Report	Cut	0.004 usft
Stake Point Report	Stake marking	Up 3.277 usft C 3.281 usft
Feature Entered	Date	6/9/21
Feature Entered	Time	3:46:30 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/9/21
Feature Entered	Time	3:46:39 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:47:17 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**9_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**9**
Stake Point Report	Design elev	10.037 usft
Stake Point Report	Ground elev	10.035 usft
Stake Point Report	Staked out N	2209264.403 usft
Stake Point Report	Staked out E	6224243.046 usft
Stake Point Report	Slope to design	5.83%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.038 usft
Stake Point Report	Fill	0.002 usft

Stake Point Report	Stake marking	Up 3.283 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:47:17 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:47:22 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:48:05 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**37_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**37**
Stake Point Report	Design elev	9.399 usft
Stake Point Report	Ground elev	9.395 usft
Stake Point Report	Staked out N	2209237.907 usft
Stake Point Report	Staked out E	6224271.673 usft
Stake Point Report	Slope to design	31.68%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.013 usft
Stake Point Report	Fill	0.004 usft
Stake Point Report	Stake marking	Up 3.285 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:48:06 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/9/21
Feature Entered	Time	3:48:10 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/9/21
Stake Point Report	Time	3:48:54 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**36_stk**
Stake Point Report	Point code	SET 1/2" IRON PIPE CPI CNTRL
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**36**
Stake Point Report	Design elev	9.880 usft
Stake Point Report	Ground elev	9.869 usft
Stake Point Report	Staked out N	2209215.224 usft
Stake Point Report	Staked out E	6224316.315 usft
Stake Point Report	Slope to design	51.72%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.022 usft
Stake Point Report	Fill	0.011 usft
Stake Point Report	Stake marking	Up 3.292 usft C 3.281 usft

Feature Entered	Date	6/9/21
Feature Entered	Time	3:48:54 PM
Feature Entered	Feature Name	Measure Point

DROUGHT EMERGENCY TEMPORARY ROCK BARRIER 2021

DAILY ONSITE SURVEY MONITORING

June 14th, 2021

Surveyor: Justin Stange

Open WO	Date	6/14/21
Open WO	Time	3:25:19 PM
Open WO	Work Order	Daily Inspect 06.14.21
Open WO	Site	06.14.21 Site Cali
Open WO	Design	
Open WO	Program Version	3.72.18100.77

Feature Entered	Date	6/14/21
Feature Entered	Time	3:57:45 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	3:58:13 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**8_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED B4	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**8**
Stake Point Report	Design elev	10.580 usft
Stake Point Report	Ground elev	10.661 usft
Stake Point Report	Staked out N	2210261.105 usft
Stake Point Report	Staked out E	6224237.242 usft
Stake Point Report	Slope to design	-305.59%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.026 usft
Stake Point Report	Cut	0.081 usft
Stake Point Report	Stake marking	Up 3.200 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	3:58:14 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	3:58:45 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:00:50 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**10_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**10**
Stake Point Report	Design elev	10.950 usft
Stake Point Report	Ground elev	10.885 usft
Stake Point Report	Staked out N	2210145.000 usft
Stake Point Report	Staked out E	6224489.038 usft
Stake Point Report	Slope to design	82.02%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.079 usft
Stake Point Report	Fill	0.065 usft
Stake Point Report	Stake marking	Up 3.346 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:00:50 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:01:12 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:01:45 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**60_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**60**
Stake Point Report	Design elev	10.848 usft
Stake Point Report	Ground elev	10.787 usft
Stake Point Report	Staked out N	2210141.832 usft
Stake Point Report	Staked out E	6224494.461 usft
Stake Point Report	Slope to design	85.57%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.072 usft
Stake Point Report	Fill	0.061 usft
Stake Point Report	Stake marking	Up 3.342 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:01:46 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:01:50 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:02:41 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**61_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**61**
Stake Point Report	Design elev	10.697 usft
Stake Point Report	Ground elev	10.651 usft
Stake Point Report	Staked out N	2210130.062 usft
Stake Point Report	Staked out E	6224516.813 usft
Stake Point Report	Slope to design	77.45%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.059 usft
Stake Point Report	Fill	0.046 usft
Stake Point Report	Stake marking	Up 3.327 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:02:42 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:02:46 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:03:25 PM
Stake Point Report	**Stake location is in tolerance.**	

Stake Point Report	**Point name**	**62_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**62**
Stake Point Report	Design elev	10.934 usft
Stake Point Report	Ground elev	10.928 usft
Stake Point Report	Staked out N	2210118.132 usft
Stake Point Report	Staked out E	6224538.307 usft
Stake Point Report	Slope to design	7.73%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.073 usft
Stake Point Report	Fill	0.006 usft
Stake Point Report	Stake marking	Up 3.287 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:03:26 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:03:31 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:04:09 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**63_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**63**
Stake Point Report	Design elev	10.865 usft
Stake Point Report	Ground elev	10.846 usft
Stake Point Report	Staked out N	2210107.478 usft
Stake Point Report	Staked out E	6224561.626 usft
Stake Point Report	Slope to design	27.33%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.068 usft
Stake Point Report	Fill	0.019 usft
Stake Point Report	Stake marking	Up 3.300 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:04:10 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:04:14 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:05:06 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**64_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**64**
Stake Point Report	Design elev	11.031 usft
Stake Point Report	Ground elev	11.026 usft
Stake Point Report	Staked out N	2210095.812 usft
Stake Point Report	Staked out E	6224583.404 usft
Stake Point Report	Slope to design	6.72%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.076 usft
Stake Point Report	Fill	0.005 usft
Stake Point Report	Stake marking	Up 3.286 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:05:06 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:05:11 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:05:51 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**65_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**65**
Stake Point Report	Design elev	10.749 usft
Stake Point Report	Ground elev	10.751 usft
Stake Point Report	Staked out N	2210084.607 usft
Stake Point Report	Staked out E	6224605.583 usft
Stake Point Report	Slope to design	-4.02%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.061 usft
Stake Point Report	Cut	0.002 usft
Stake Point Report	Stake marking	Up 3.279 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:05:51 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:05:56 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:06:33 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**66_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**66**
Stake Point Report	Design elev	10.663 usft
Stake Point Report	Ground elev	10.670 usft
Stake Point Report	Staked out N	2210074.337 usft
Stake Point Report	Staked out E	6224628.498 usft
Stake Point Report	Slope to design	-14.51%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.051 usft
Stake Point Report	Cut	0.007 usft
Stake Point Report	Stake marking	Up 3.274 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:06:34 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:06:39 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:07:18 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**67_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**67**
Stake Point Report	Design elev	10.928 usft
Stake Point Report	Ground elev	10.969 usft
Stake Point Report	Staked out N	2210062.436 usft
Stake Point Report	Staked out E	6224650.582 usft
Stake Point Report	Slope to design	-69.10%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.059 usft
Stake Point Report	Cut	0.041 usft
Stake Point Report	Stake marking	Up 3.240 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:07:18 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:07:26 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:08:15 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**68_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	Origin point	68
Stake Point Report	Design elev	10.965 usft
Stake Point Report	Ground elev	11.002 usft
Stake Point Report	Staked out N	2210050.684 usft
Stake Point Report	Staked out E	6224672.589 usft
Stake Point Report	Slope to design	-110.96%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.034 usft
Stake Point Report	Cut	0.037 usft
Stake Point Report	Stake marking	Up 3.244 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:08:16 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:08:20 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:09:01 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**69_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**69**
Stake Point Report	Design elev	11.041 usft
Stake Point Report	Ground elev	11.096 usft
Stake Point Report	Staked out N	2210040.010 usft
Stake Point Report	Staked out E	6224695.759 usft
Stake Point Report	Slope to design	-82.52%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.067 usft
Stake Point Report	Cut	0.055 usft
Stake Point Report	Stake marking	Up 3.226 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:09:01 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:09:08 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:10:08 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**70_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**70**
Stake Point Report	Design elev	10.974 usft
Stake Point Report	Ground elev	11.025 usft
Stake Point Report	Staked out N	2210029.225 usft
Stake Point Report	Staked out E	6224717.769 usft
Stake Point Report	Slope to design	-72.95%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.070 usft
Stake Point Report	Cut	0.051 usft
Stake Point Report	Stake marking	Up 3.230 usft C 3.281 usft

Feature Entered	Date	6/14/21
Feature Entered	Time	4:11:22 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/14/21
Feature Entered	Time	4:11:28 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/14/21
Stake Point Report	Time	4:11:48 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**5_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED B1	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**5**
Stake Point Report	Design elev	10.640 usft
Stake Point Report	Ground elev	11.082 usft
Stake Point Report	Staked out N	2210005.524 usft
Stake Point Report	Staked out E	6224764.454 usft
Stake Point Report	Slope to design	-1064.14%

Stake Point Report	Deviation from design		
Stake Point Report	Horiz	0.042 usft	
Stake Point Report	Cut	0.442 usft	
Stake Point Report	Stake marking		Up 2.839 usft C 3.281 usft

Feature Entered	Date	6/14/21	
Feature Entered	Time	4:11:49 PM	
Feature Entered	Feature Name		Measure Point

Feature Entered	Date	6/14/21	
Feature Entered	Time	4:11:54 PM	
Feature Entered	Feature Name		Stakeout Point

Stake Point Report	Date	6/14/21	
Stake Point Report	Time	4:12:48 PM	
Stake Point Report	**Stake location is in tolerance.**		
Stake Point Report	**Point name**		**6_stk**
Stake Point Report	Point code		3/4" IP W/DWR ALUM PLUG STAMPED B2
Stake Point Report	Stake Data		
Stake Point Report	**Origin point**		**6**
Stake Point Report	Design elev		8.770 usft
Stake Point Report	Ground elev		8.872 usft
Stake Point Report	Staked out N		2210027.201 usft
Stake Point Report	Staked out E		6224768.124 usft
Stake Point Report	Slope to design		-165.79%
Stake Point Report	Deviation from design		
Stake Point Report	Horiz	0.062 usft	
Stake Point Report	Cut	0.102 usft	
Stake Point Report	Stake marking		Up 3.179 usft C 3.281 usft

DROUGHT EMERGENCY TEMPORARY ROCK BARRIER 2021

DAILY ONSITE SURVEY MONITORING

June 17th, 2021

Surveyor: Justin Stange

Open WO	Date	6/17/21
Open WO	Time	3:44:22 PM
Open WO	Work Order	2 Daily Inspect 06.17.21
Open WO	Site	06.14.21 Site Cali
Open WO	Design	
Open WO	Program Version	3.72.18100.77

Feature Entered	Date	6/17/21
Feature Entered	Time	3:44:26 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/17/21
Feature Entered	Time	3:50:39 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/17/21
Stake Point Report	Time	3:52:18 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**8_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED B4	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**8**
Stake Point Report	Design elev	10.580 usft
Stake Point Report	Ground elev	10.683 usft
Stake Point Report	Staked out N	2210261.073 usft
Stake Point Report	Staked out E	6224237.155 usft
Stake Point Report	Slope to design	-129.71%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.080 usft
Stake Point Report	Cut	0.103 usft
Stake Point Report	Stake marking	Up 3.178 usft C 3.281 usft

Feature Entered	Date	6/17/21
Feature Entered	Time	3:52:18 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/17/21
Feature Entered	Time	3:52:31 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/17/21
Stake Point Report	Time	3:54:06 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**60_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**60**
Stake Point Report	Design elev	10.848 usft
Stake Point Report	Ground elev	10.851 usft
Stake Point Report	Staked out N	2210141.783 usft
Stake Point Report	Staked out E	6224494.464 usft
Stake Point Report	Slope to design	-5.79%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.057 usft
Stake Point Report	Cut	0.003 usft
Stake Point Report	Stake marking	Up 3.278 usft C 3.281 usft

Feature Entered	Date	6/17/21
Feature Entered	Time	3:54:06 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/17/21
Feature Entered	Time	3:54:10 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/17/21
Stake Point Report	Time	3:55:39 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**61_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**61**
Stake Point Report	Design elev	10.697 usft
Stake Point Report	Ground elev	10.650 usft
Stake Point Report	Staked out N	2210130.034 usft
Stake Point Report	Staked out E	6224516.822 usft
Stake Point Report	Slope to design	101.80%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.046 usft
Stake Point Report	Fill	0.047 usft
Stake Point Report	Stake marking	Up 3.328 usft C 3.281 usft

Feature Entered	Date	6/17/21
Feature Entered	Time	3:55:40 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/17/21
Feature Entered	Time	3:55:44 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/17/21
Stake Point Report	Time	3:56:17 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**62_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	Origin point	62
Stake Point Report	Design elev	10.934 usft
Stake Point Report	Ground elev	10.914 usft
Stake Point Report	Staked out N	2210118.092 usft
Stake Point Report	Staked out E	6224538.326 usft
Stake Point Report	Slope to design	39.86%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.050 usft
Stake Point Report	Fill	0.020 usft
Stake Point Report	Stake marking	Up 3.301 usft C 3.281 usft

Feature Entered	Date	6/17/21
Feature Entered	Time	3:56:18 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/17/21
Feature Entered	Time	3:56:22 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/17/21
Stake Point Report	Time	3:57:00 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**63_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**63**
Stake Point Report	Design elev	10.865 usft
Stake Point Report	Ground elev	10.836 usft
Stake Point Report	Staked out N	2210107.444 usft
Stake Point Report	Staked out E	6224561.619 usft
Stake Point Report	Slope to design	78.87%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.036 usft
Stake Point Report	Fill	0.029 usft
Stake Point Report	Stake marking	Up 3.310 usft C 3.281 usft

Feature Entered	Date	6/17/21
Feature Entered	Time	3:57:00 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/17/21
Feature Entered	Time	3:57:09 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/17/21
Stake Point Report	Time	3:57:52 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**64_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**64**
Stake Point Report	Design elev	11.031 usft
Stake Point Report	Ground elev	11.020 usft
Stake Point Report	Staked out N	2210095.780 usft
Stake Point Report	Staked out E	6224583.397 usft
Stake Point Report	Slope to design	24.29%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.044 usft
Stake Point Report	Fill	0.011 usft
Stake Point Report	Stake marking	Up 3.292 usft C 3.281 usft

Feature Entered	Date	6/17/21
Feature Entered	Time	3:57:53 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/17/21
Feature Entered	Time	3:57:58 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/17/21
Stake Point Report	Time	3:58:31 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**65_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**65**
Stake Point Report	Design elev	10.749 usft
Stake Point Report	Ground elev	10.773 usft
Stake Point Report	Staked out N	2210084.598 usft
Stake Point Report	Staked out E	6224605.598 usft
Stake Point Report	Slope to design	-44.38%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.054 usft
Stake Point Report	Cut	0.024 usft
Stake Point Report	Stake marking	Up 3.257 usft C 3.281 usft

Feature Entered	Date	6/17/21
Feature Entered	Time	3:58:32 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/17/21
Feature Entered	Time	3:58:39 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/17/21
Stake Point Report	Time	4:00:13 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**66_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**66**
Stake Point Report	Design elev	10.663 usft
Stake Point Report	Ground elev	10.672 usft
Stake Point Report	Staked out N	2210074.333 usft
Stake Point Report	Staked out E	6224628.492 usft
Stake Point Report	Slope to design	-20.42%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.045 usft
Stake Point Report	Cut	0.009 usft
Stake Point Report	Stake marking	Up 3.272 usft C 3.281 usft

Feature Entered	Date	6/17/21
Feature Entered	Time	4:00:14 PM
Feature Entered	Feature Name	Measure Point

Feature Entered	Date	6/17/21
Feature Entered	Time	4:00:18 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/17/21
Stake Point Report	Time	4:00:55 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**67_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**67**
Stake Point Report	Design elev	10.928 usft
Stake Point Report	Ground elev	10.962 usft
Stake Point Report	Staked out N	2210062.419 usft
Stake Point Report	Staked out E	6224650.581 usft
Stake Point Report	Slope to design	-80.10%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.042 usft
Stake Point Report	Cut	0.034 usft
Stake Point Report	Stake marking	Up 3.247 usft C 3.281 usft

Feature Entered	Date	6/17/21
Feature Entered	Time	4:00:56 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/17/21
Feature Entered	Time	4:01:00 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/17/21
Stake Point Report	Time	4:01:34 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**68_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**68**
Stake Point Report	Design elev	10.965 usft
Stake Point Report	Ground elev	11.003 usft
Stake Point Report	Staked out N	2210050.699 usft
Stake Point Report	Staked out E	6224672.584 usft
Stake Point Report	Slope to design	-78.99%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.048 usft
Stake Point Report	Cut	0.038 usft
Stake Point Report	Stake marking	Up 3.243 usft C 3.281 usft
Feature Entered	Date	6/17/21
Feature Entered	Time	4:01:35 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/17/21
Feature Entered	Time	4:01:39 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/17/21
Stake Point Report	Time	4:02:23 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**69_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	Origin point	69
Stake Point Report	Design elev	11.041 usft
Stake Point Report	Ground elev	11.092 usft
Stake Point Report	Staked out N	2210039.985 usft
Stake Point Report	Staked out E	6224695.790 usft
Stake Point Report	Slope to design	-162.73%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.031 usft
Stake Point Report	Cut	0.051 usft
Stake Point Report	Stake marking	Up 3.230 usft C 3.281 usft
Feature Entered	Date	6/17/21
Feature Entered	Time	4:02:23 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/17/21
Feature Entered	Time	4:02:29 PM
Feature Entered	Feature Name	Stakeout Point

Stake Point Report	Date	6/17/21
Stake Point Report	Time	4:03:04 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**70_stk**
Stake Point Report	Point code SET 1/2" IRON PIPE CPI CNTRL	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**70**
Stake Point Report	Design elev	10.974 usft
Stake Point Report	Ground elev	11.060 usft
Stake Point Report	Staked out N	2210029.226 usft
Stake Point Report	Staked out E	6224717.796 usft
Stake Point Report	Slope to design	-136.41%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.063 usft
Stake Point Report	Cut	0.086 usft
Stake Point Report	Stake marking	Up 3.195 usft C 3.281 usft
Feature Entered	Date	6/17/21
Feature Entered	Time	4:03:05 PM
Feature Entered	Feature Name	Measure Point
Feature Entered	Date	6/17/21
Feature Entered	Time	4:03:10 PM
Feature Entered	Feature Name	Stakeout Point
Stake Point Report	Date	6/17/21
Stake Point Report	Time	4:04:40 PM
Stake Point Report	**Stake location is in tolerance.**	
Stake Point Report	**Point name**	**5_stk**
Stake Point Report	Point code 3/4" IP W/DWR ALUM PLUG STAMPED B1	
Stake Point Report	Stake Data	
Stake Point Report	**Origin point**	**5**
Stake Point Report	Design elev	10.640 usft
Stake Point Report	Ground elev	11.075 usft
Stake Point Report	Staked out N	2210005.545 usft
Stake Point Report	Staked out E	6224764.364 usft
Stake Point Report	Slope to design	-611.30%
Stake Point Report	Deviation from design	
Stake Point Report	Horiz	0.071 usft
Stake Point Report	Cut	0.435 usft
Stake Point Report	Stake marking	Up 2.846 usft C 3.281 usft
Feature Entered	Date	6/17/21
Feature Entered	Time	4:04:41 PM
Feature Entered	Feature Name	Measure Point