

**State Water Project and Central Valley Project
Drought Contingency Plan
March 1, 2021 – September 30, 2021**

Table of Contents

| | |
|---|----|
| I. Current Hydrologic Conditions | 1 |
| A. Water Quality | 3 |
| B. SWP and CVP Upstream Reservoir Storage | 4 |
| C. Biology | 4 |
| i. Salmonids | 4 |
| ii. Delta Smelt..... | 5 |
| iii. Longfin Smelt | 6 |
| II. SWP and CVP Operational Considerations..... | 6 |
| A. Health and Safety Requirements | 7 |
| B. Preservation of Upstream Storage for Fish and Wildlife and Future Drought Year Protection | 7 |
| C. Regulatory and Senior Water Right Requirements | 8 |
| III. Operations Forecasts - Projected Hydrology and Runoff, Releases and Storage..... | 8 |
| A. January 1, 2021 – Projected Hydrology and Runoff | 8 |
| B. SWP and CVP Operations Forecasts | 9 |
| C. Contractual Obligations..... | 9 |
| IV. SWP and CVP Areas of Potential Concern | 10 |
| A. March 1, 2021 50% Exceedance | 10 |
| B. March 1, 2021 90% Exceedance | 11 |
| i. SWRCB D-1641 Bay Delta Standards..... | 11 |
| ii. Trinity River | 11 |
| iii. Sacramento River..... | 11 |
| iv. Clear Creek | 13 |
| v. Feather River | 13 |
| vi. American River..... | 13 |
| vii. Stanislaus River | 14 |
| V. Monitoring Efforts to Inform Operations | 15 |
| A. Delta Smelt Surveys..... | 15 |
| B. Salmonids Near-Term Drought Monitoring | 15 |
| C. Ecosystem Drought Monitoring | 16 |
| VI. Next Steps | 17 |
| Attachment 1-50% and 90% Operations Forecasts..... | 18 |

**State Water Project and Central Valley Project
Drought Contingency Plan
March 1, 2021 – September 30, 2021**

This Drought Contingency Plan (Drought Plan) is prepared by the California of Water Resources (DWR) and the U.S. Bureau of Reclamation (Reclamation) in an effort to provide updated information about areas of potential concern given the current dry hydrology of 2021. DWR and Reclamation operate the State Water Project (SWP) and the Central Valley Project (CVP), respectively, to the 2019 U.S. Fish and Wildlife Service (USFWS) Biological Opinion and 2019 National Marine Fisheries Service (NMFS) Biological Opinion (Collectively the 2019 Biological Opinions), and DWR also operates to the Incidental Take Permit (CDFW 2020) (ITP). This updated Drought Plan will be submitted by DWR to the California Department of Fish and Wildlife (CDFW) in response to Condition 8.21 of CDFW's ITP. Concurrently, this plan will be shared with the Water Operations Management Team (WOMT) which includes representatives from DWR, Reclamation, USFWS, NMFS, CDFW, and the State Water Resources Control Board (SWRCB) (collectively referred to as Agencies).

Over the past several months, as part of implementing the action included in the 2019 Biological Opinions and ITP, DWR and Reclamation have worked with the Agencies to identify actions that could potentially be implemented during a drought (not specifically for water year 2021) to manage the State's limited water supplies and protect species. These actions (known as the Drought Toolkit) describes the anticipated coordination, process, planning and potential drought response actions in the event of a drought. DWR and Reclamation are committed to continued development of the Drought Toolkit and will continue to coordinate with the Agencies as any actions from that Toolkit are being considered for implementation in WY 2021.

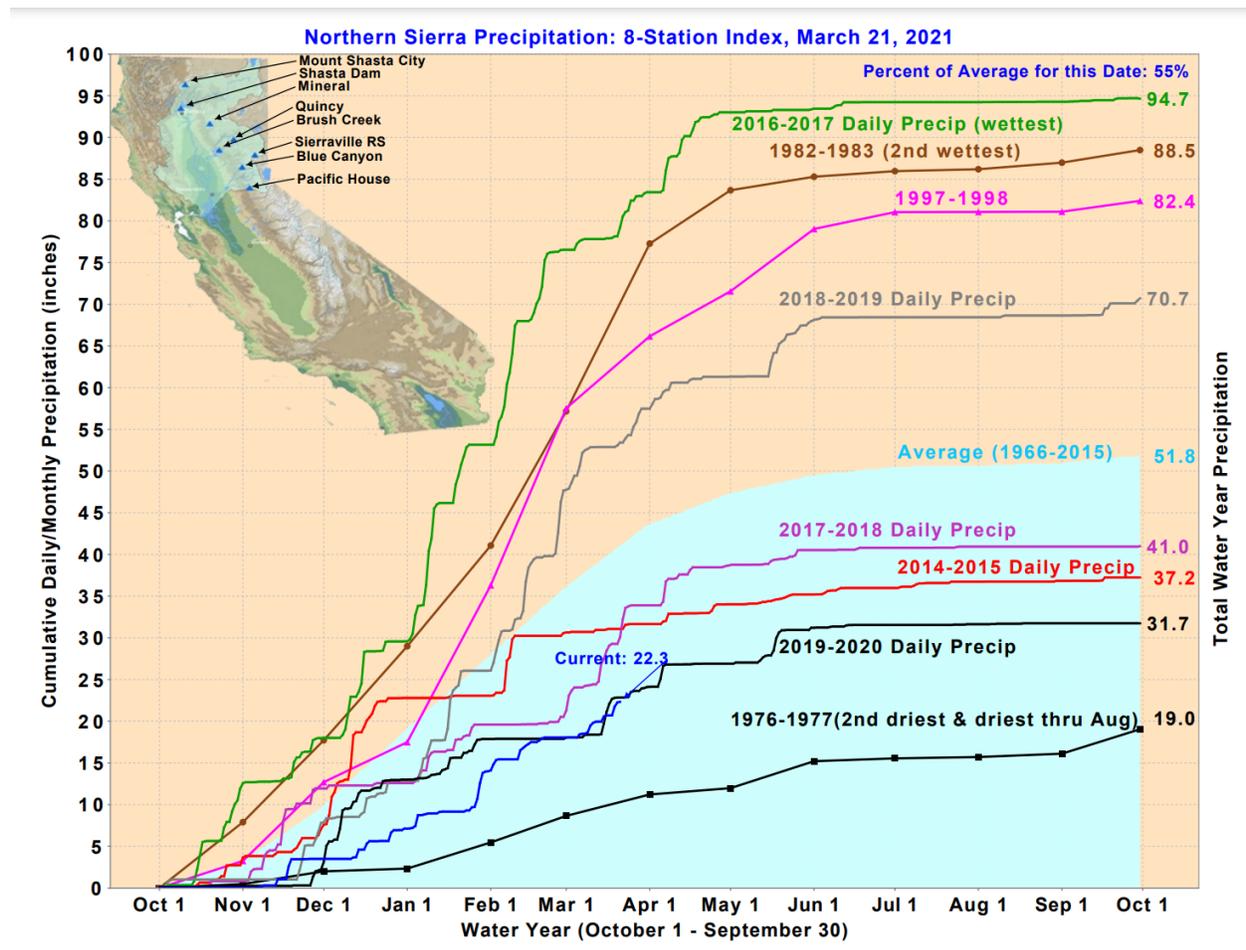
This updated Drought Plan includes the latest hydrological condition assessment, a species status update, the latest forecasts of hydrology, SWP and CVP (collectively referred to as "Projects") operations, areas of potential concern and proposed monitoring efforts to be implemented this summer. This Drought Plan will continue to be updated as necessary based on changing conditions. Most importantly, the forecasts included in this Drought Plan are based upon hydrologic conditions published in the March 1 Bulletin 120 and incorporated adjustments to account for drier conditions in March. DWR and Reclamation are committed to working with the Agencies through further development of Drought Toolkit actions, Long Term Operations (LTO) Implementation Coordination, weekly WOMT coordination, and other forums as necessary.

I. Current Hydrologic Conditions

Conditions to date have been extraordinarily dry, and with every month falling below average, results in both the Sacramento Valley and San Joaquin River indices classified as a critical

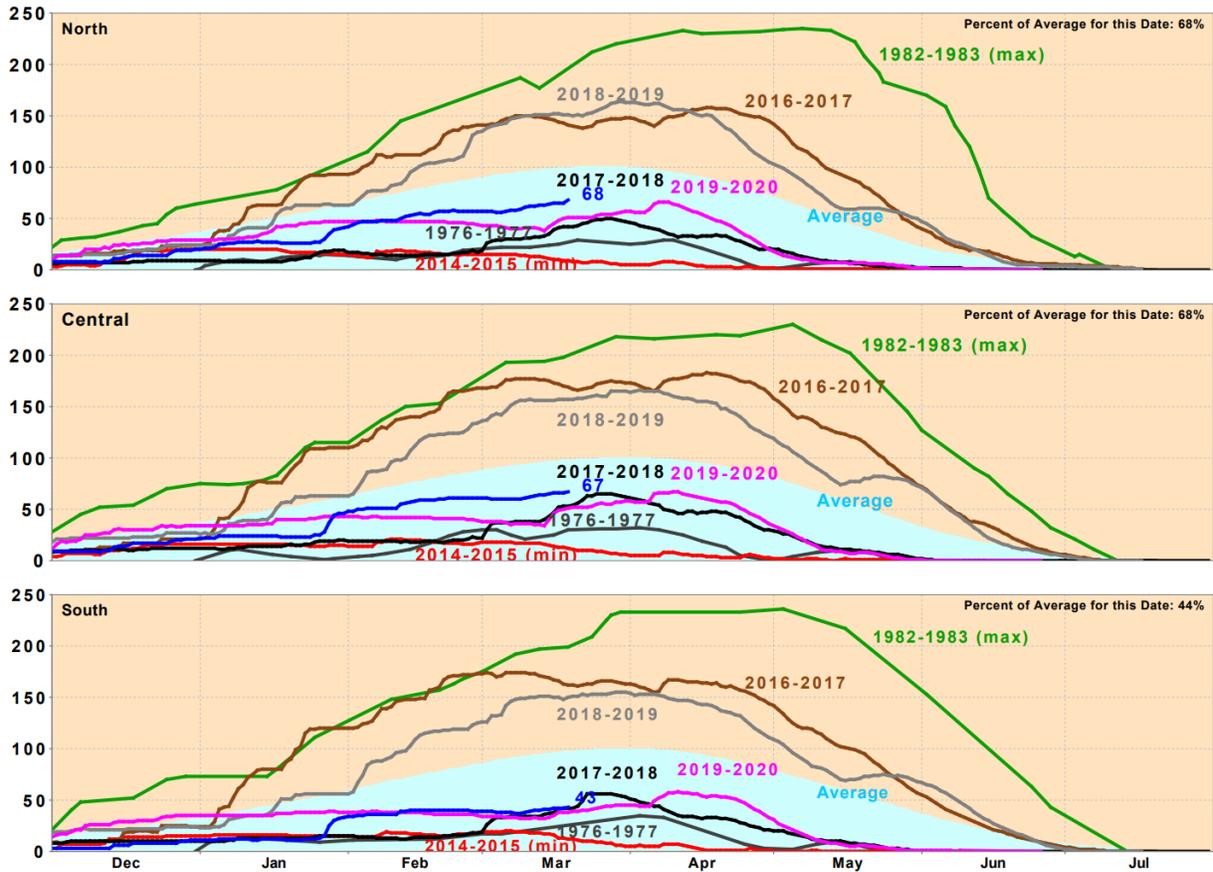
water year type. Following an exceptionally dry Water Year (WY) 2020, the State's March 1, 2021, snow survey found a Sierra Nevada snowpack that is well below average in terms of the amount and water content for this time of year. Furthermore, the Northern Sierra 8-Station Index for WY 2020 was the ninth driest on record, and the cumulative WY 2021 October through February precipitation ranked as the tenth driest on record.

As shown in blue on the following chart, the Northern Sierra Precipitation total as of March 21, is 22.3 inches and 55% of average to date.



As of March 19, 2021, Sierra snowpack, which makes up about 30% of California's water supply, is tracking below average, as shown on the following graphic. The northern and central basins are 68% of historical average and continues to be well below average throughout the entire spine of the Sierras. The southern Sierra snowpack is even worse at 44% of historical average, tracking with the driest years on record. Statewide snowpack is 63% of historical average.

California Snow Water Content, March 19, 2021, Percent of April 1 Average



Statewide Percent of April 1: 62%

Statewide Percent of Average for Date: 63%

The extraordinarily dry conditions to date have resulted in low forecasted Project storages in WY 2021. Adequate storage is needed throughout the year, and especially in dry times of the year, in order for the CVP and SWP to supply health and safety needs, continue repelling saltwater intrusion in the Delta, provide for cold water and flow needs of Chinook salmon and meet each Project's senior water rights demands.

A. Water Quality

In order to avoid increasing releases in February to meet the starting gate salinity requirement pursuant to SWRCB Water Rights Decision (D-1641), on February 5, 2021, DWR and Reclamation requested a waiver from meeting this standard. This standard is described in D-1641, Table 3, Footnote 10, and specifies that a daily or 14-day running average electrical conductivity (EC) of 2.64 millimhos per centimeter (mmhos/cm) at the confluence of the Sacramento and the San Joaquin Rivers (Collinsville) shall be met for at least one day between February 1 and February 14. The requirement applies if the Eight River Index (8RI) for January is more than 900 thousand acre-feet (TAF). However, if the 8RI for January is between 650 and 900 TAF, the Executive Director of the State Water Resources Control Board (State Water Board) is delegated authority to decide whether the requirement applies. The 8RI was about

720 TAF, and as such, on February 10, 2021, the Executive Director issued a waiver to this standard acknowledging the low combined exports and agreeing that it was not prudent to modify reservoir operations to meet the February 2021 starting gate requirement at Collinsville. Despite this granted flexibility, this standard was subsequently met with additional flows from early February precipitation events.

Bay-Delta water quality and outflow conditions are likely to remain manageable during the spring and summer months. At this time, storage conservation is a top priority for both Projects. Although increasing releases from reservoirs is one mechanism to improve salinity conditions, doing so could have devastating impacts later in the water year and will only be used if April standards cannot be met through reasonable export reductions.

The Projects do not anticipate that the Delta Cross Chanel (DCC) gates would need to be opened in April to manage salinity. However, if conditions do warrant a change in DCC gate operations, the Projects will coordinate with the State and Federal fishery Agencies through the relevant technical teams and WOMT.

B. SWP and CVP Upstream Reservoir Storage

In the Sacramento River watershed, storage in upstream reservoirs remains well below average for this time of year. Lake Oroville's end-of-February storage was about 1.34 million acre-feet (MAF) (38% of capacity and 55% of historical average) and about 910 TAF lower than in 2020. Lake Shasta's end-of-February storage was about 2.27 MAF (50% of capacity and 68% of historical average), and Folsom Lake's end-of-February storage was approximately 346 TAF (35% of capacity and 64% of historical average), both of which were 1.27 MAF and 101 TAF lower than in 2020, respectively. Trinity Reservoir, which also supports flows on the Sacramento River, was about 1.27 MAF at the end of February (52% of capacity and 82% of historical average).

In the San Joaquin watershed, storage in New Melones Reservoir was 1.55 MAF, which is 65% of capacity and 106% of historical average, but about 375 TAF lower than this time last year.

C. Biology

i. Salmonids

DWR and Reclamation are implementing the 2019 NMFS and USFWS Biological Opinions, and DWR also operates to the ITP. As of March 11, 2021, the preliminary estimate of natural juvenile winter-run Chinook salmon emigration past the Red Bluff Diversion Dam is 2,094,148, based on USFWS rotary screw trap monitoring. This is the second highest number of juvenile salmon estimated to have emigrated past RBDD since 2010. As of March 16, 2021, the Salmonid Monitoring Team (SaMT) determined the weekly risk forecast of exceeding yearly and daily entrainment thresholds remains low due to persistent low-flow, low turbidity conditions and

an OMR index more positive than $-4,500$ cfs. Risk level for the daily entrainment threshold could change quickly with a precipitation-driven high flow event; however no such events are in the short-term (14 day) forecast.

Livingston-Stone hatchery winter-run were released January 30; the number released into the Sacramento River was approximately 302,166. Although most surveys are up and running for salmon monitoring, there have been very few detections of winter-run in lower Sacramento River monitoring, most likely due to a combination of an extended rearing period in the River (i.e. slow migration rates) and poor catch efficiency under this year's low-flow, low-turbidity conditions (which allows fish to detect and avoid rotary screw traps). The dearth of detections is continuing to force the SaMT to base distribution estimates mainly on historical patterns. The SaMT estimates of natural-production salmon and Steelhead estimated to be in the Delta has gone up a bit each week since November, and at the March 16 meeting, the ranges identified were: winter-run at 65-75% (down from 75-85%), spring-run at 70-75% (up from 60-65%), and Steelhead at 35-50% (unchanged). However, as noted above, these estimates are expectations based almost entirely on historical patterns. For this reason, the SaMT agreed that going forward this year, estimates will be made in multiples of 5% to express low accuracy and precision.

| Location | Yet to Enter Delta (Upstream of Knights Landing) | In the Delta | Exited the Delta (Past Chipps Island) |
|--|--|-------------------------------|--|
| <i>Young-of-year (YOY) winter-run Chinook salmon</i> | 5-10% (last week: 5-10%) | 65-75% (last week: 75-85) | 20-25% (last week: 10-15%) |
| <i>YOY spring-run Chinook salmon</i> | 25-30% (last week: 35-40%) | 70-75% (last week: 60-65%) | 0% (last week: same) |
| <i>Steelhead</i> | 30-40% (last week: 35-45%) | 35-50% (last week: 35-50%) | 20-25% (last week: 15-20%) |

ii. Delta Smelt

DWR and Reclamation operate to the 2019 USFWS Delta Smelt Biological Opinion, and DWR also operates to the ITP. The Smelt Monitoring Team (SMT) began meeting to discuss current-year conditions at the end of November 2020. The 2020 Fall Midwater Trawl was completed in December, and the 2020 index was zero ("0") for the third year in a row. Additionally, the Spring Kodiak Trawl (SKT) did not detect any Delta Smelt in January or February. The only survey that has caught Delta Smelt recently is the Enhanced Delta Smelt Monitoring Program (EDSM). EDSM caught Delta Smelt in the Sacramento Deep Water Ship Channel (DWSC) on January 6 and January 26, 2021, a single fish in Suisun Marsh in November of 2020, and a single fish in Suisun Marsh in September of 2020. Additionally, two Delta Smelt were collected in hatchery broodstock sampling in the DWSC in January 2021. This lack of catch reflects the overall decline in the population to levels where we can no longer reliably detect them. Based on sampling and hydrology to date, it is likely that Delta Smelt are at a low risk of entrainment into the South Delta and the export facilities, and the situation continues to be closely monitored by

the SMT in their weekly assessments. Protections continue to rely upon environmental surrogates.

iii. Longfin Smelt

DWR operates to the ITP which includes Longfin Smelt operational considerations. Salvage data from WY 1994 through WY 2014 indicates that salvage of adult Longfin Smelt is generally rare and typically occurs between the months of December and February. In WY 2020, young of year (age 0) Longfin Smelt were mostly observed at the salvage facilities between April and May. The majority of Longfin Smelt salvage typically occurs after February when young of year fish rearing in the south and central Delta have grown large enough to be effectively screened by the fish collection facilities. As of March 17, 2021, a total of 19 Longfin Smelt (20-33 mm) have been salvaged this water year, and larvae have also been consistently detected by the Smelt Larva Survey (SLS) in the lower San Joaquin River and in the northern OMR corridor. Catch has generally been low, but detections suggest that spawning in the Delta has occurred in both the San Joaquin River and Sacramento River corridors. The SMT tracks Longfin Smelt distribution and salvage to assess risk and make appropriate operational recommendations consistent with the Longfin Smelt ITP, and the most recent assessment showed a high risk of entrainment and an OMR recommendation of –2500 cubic feet per second (cfs) was made, however, because of continuing dry conditions, the OMR recommendation has not controlled SWP operations. Lastly, Barker Slough Pumping Plant (BSPP) operations can be affected under the ITP when a Longfin Smelt larvae is detected at station 716 in Lindsey Slough. Such detections have occurred in several of the SLS trawls of 2021, limiting BSPP operations to no more than 60 cfs on a seven-day average. As of March 17, these restrictions are in place.

II. SWP and CVP Operational Considerations

DWR and Reclamation have developed preliminary operational forecasts through September 30, 2021, using the 50% and 90% exceedance forecasts from the March 1 forecast from DWR's Hydrology and Flood Operations Office within the Division of Flood Management. The operational forecasts developed for this Drought Plan are designed to make the most efficient use of the limited water resources in 2021 for multiple beneficial uses while meeting regulatory requirements and managing the potential risks of continued drought conditions into next year. There are three main goals of SWP and CVP Project operations within this forecast:

1. Meet health and safety requirements throughout the SWP and CVP service areas, including those that rely on Project exports;
2. Preserve upstream storage to the extent possible for temperature management, instream uses in the water year, peak-summer power production, and carry-over storage for future drought protection; and
3. Meet regulatory and senior/riparian water right obligations throughout the basins.

The operational forecasts provided in this Drought Plan reflect potential outcomes given the hydrologic forecast on March 1 and assumptions on regulatory and policy decisions regarding

prioritization of an extremely limited water supply. However, the real-time operations are expected to vary to adjust to real-time system conditions. The hydrologic scenarios used in this Drought Plan are discussed in the Projected Hydrology and Runoff section later in the document.

The following are the Projects' critical operational considerations and objectives under the potential drought conditions, reflected in the operational forecasts. Drought conditions along with potential concerns and actions are primarily reflected in the 90% exceedance forecast.

A. Health and Safety Requirements

Operations of the SWP and CVP must provide for, at a minimum, essential human health and safety needs throughout the SWP and CVP service areas and retain the capability to provide for such minimum needs throughout WY 2021 and WY 2022 should extremely dry conditions persist. For clarity, DWR and Reclamation's consideration of these essential human health and safety needs includes adequate water supplies and water quality for drinking water, sanitation, and fire suppression, but does not extend to other urban water demands (e.g., outdoor landscape irrigation). While most California communities may have reserve water supplies, some communities will require continued delivery of limited amounts of water through the CVP and SWP facilities to meet these basic needs.

Reclamation currently uses its Municipal and Industrial (M&I) Water Shortage Policy to determine the amount of water to be provided to its M&I contractors in those years where human health and safety needs govern CVP allocations to these contractors. Under these conditions, M&I contractors are required to update population estimates and non-CVP water source information to determine how much water will be needed from the CVP to meet their overall human health and safety demand for that year. The vast majority of CVP contractors throughout the entire service area that receive M&I water from the CVP have other available supplies to help meet their demand.

B. Preservation of Upstream Storage for Fish and Wildlife and Future Drought Year Protection

The SWP and CVP operations outlined in this Drought Plan are consistent with the requirements set forth in the 2019 Biological Opinions to address unavoidable impacts to endangered species due to drought. The Drought Plan also addresses SWP obligations set forth in the ITP. As noted above, this Drought Plan does not set forth specific operations due to the uncertain hydrology. Future revisions by DWR and Reclamation to this Drought Plan, including identifying expected actions, will follow the process set forth in the 2019 Biological Opinions. DWR will also follow the provisions set forth in the ITP.

The operations forecast included in this Drought Plan covers March 1 to September 30. A primary consideration involves the need to conserve enough cold water in the Projects' reservoirs early in the year to maintain cool water temperatures in the Sacramento River and

tributaries to support the various runs of Chinook salmon and steelhead. If conditions remain dry, these same water supplies may be needed to provide for other critical operational considerations throughout 2021. The timing, flow rate, and rate of any flow changes for instream fishery needs will also vary with storage and hydrologic conditions.

C. Regulatory and Senior Water Right Requirements

Both DWR and Reclamation have commitments to deliver water for Delta salinity and outflow, to senior water rights holders, and to wildlife refuges. These commitments are made through D-1641, various contracts, and through the Central Valley Project Improvement Act (CVPIA). D-1641 includes reduced requirements in dry and critically dry conditions to recognize the limited water supply in those years. The various senior water right contracts and wildlife refuge deliveries also include provisions for reduced deliveries in critically dry years. The current 90% forecast indicates all the above dry and critically dry-year provisions will be triggered in 2021.

Reclamation and DWR allocate water to agricultural and M&I contractors based on available water supply after meeting other obligations as described above. Given the critically dry hydrology, this available supply is extremely limited.

III. Operations Forecasts - Projected Hydrology and Runoff, Releases and Storage

A. March 1, 2021 – Projected Hydrology and Runoff

The DWR's Hydrology and Flood Operations Office within the Division of Flood Management produces estimates of water year runoff for the major watersheds of the Sacramento and San Joaquin River basins beginning in December and updates these as part of DWR's Bulletin 120 update process through May of each year. The Water Supply Index (WSI) forecasts that are utilized for this March Drought Plan are unique to this water year and informed by precipitation, runoff, and other antecedent hydrologic conditions as they existed on March 1, 2021. The March 1 Bulletin 120 runoff forecast also incorporates actual snowpack measurements.

These forecasts combine the runoff associated with antecedent conditions with the anticipated runoff resulting from precipitation predicted to occur through September 30 under the 50% and 90% hydrologic exceedance scenarios. For example, the 90% exceedance hydrology assumes inflows from rainfall and snowmelt at levels that are likely to be exceeded with a 90% probability, or in other words, there is a 10% or less chance of actual conditions turning out to be this dry or drier from this point forward. The 50% probability assumes there is an even chance that it will be drier or wetter from this point forward.

The WSI forecast is summarized as follows:

| | |
|------------------------------------|--|
| Sacramento River Unimpaired Runoff | 50% Exceedance: 8.7 MAF (49% average) |
| Sacramento Valley Index | 50% Exceedance: 4.6 MAF (Critical) Oct-Feb Sacramento Region Runoff: 34% of historical average |
| San Joaquin Valley Index | 75% Exceedance: 1.6 MAF (Critical) Oct-Feb San Joaquin Region Runoff: 22% of historical average |

B. SWP and CVP Operations Forecasts

The March 1, 2021 SWP and CVP operations forecasts are included in Attachment 1. The forecasts used the 50% and 90% exceedance hydrologic forecasts as model inputs to simulate SWP and CVP Project operations under various regulatory requirements and produce forecasted reservoir storages, releases, flows, and deliveries under the same set of hydrologic exceedances. These operations forecasts give general guidance for annual water delivery, storage management, and power planning purposes for each exceedance assumption. Actual hydrologic events act in time steps shorter than a month and are often unpredictable more than a few days to a week out. Day-to-day operations are driven by operating criteria such as those found in U.S. Army Corps of Engineers flood control manuals, D-1641, the NMFS and USFWS 2019 Biological Opinions, and the ITP for the SWP. Output from forecast models as provided in this Drought Plan represent system responses to the overlay of very specific operating criteria on each of the discrete hydrologic scenarios.

The base forecast assumptions utilize existing storage conditions, actual precipitation through February 2021, forecasted precipitation based on the hydrology, projected water supply deliveries, and meeting existing flow and water quality standards, and fish and wildlife protections. Each forecast includes monthly storage levels, reservoir releases, Delta export rates, and Delta outflow through September 30, 2021. The hydrology will likely converge between the scenarios over the next two months. Therefore, DWR and Reclamation will be planning potential operations based on each of the hydrological scenarios presented.

The storage and flows under the March 1, 2021 50% and 90% hydrologic scenarios are included in Attachment 1. The March 1, 2021 50% and 90% exceedance scenarios were selected to show standard ranges of hydrology for potential future conditions. These operations forecast updates are generally updated monthly and are typically completed by the third week of the month.

C. Contractual Obligations

Under both the 50% and 90% exceedance hydrologic scenarios, the model assumes fulfilling the contractual obligations between DWR and North Delta Water Agency. For the Feather River Settlement Contractors (FRSC), the full 50% delivery shortage provision is assumed to be

triggered and implemented for both March 1 hydrologic exceedance forecast scenarios. A final determination, in accordance with the FRSC Agreements, of the delivery to the FRSC will be made based on the April 1 forecast. Deliveries to Sacramento River Settlement contractors, San Joaquin River Exchange contractors, and wildlife Refuges are determined by the Shasta Index. For 2021, an index below 3.9 MAF indicates a “Shasta Critical” year, which triggers reduced allocations. Due to the critically dry hydrology, both the March 50% and 90% exceedance hydrology indicates the index will be less than 3.9 MAF. As a result, the Sacramento River Settlement contractors, the San Joaquin River Exchange contractors, and the wildlife refuges are represented as reduced to their Shasta Critical volumes. Reclamation made an initial determination on February 12 based on the Shasta index from the February 1 forecast, and this determination has continued through the March forecast. This determination will be reviewed with future forecasts and updated if needed.

IV. SWP and CVP Areas of Potential Concern

Differences in snowpack distribution, variation among basin and sub-basin hydrologic circumstances, disparity among month-to-month hydrologic conditions, and other meteorological uncertainties also affect real-time reservoir and Delta operations and the available water supply at any given time. The 50% and 90% probability exceedance forecasts presented in this document are very general and are not the only drivers of actions that may be needed in the future. The purpose of this document is to identify generally foreseeable areas of concern and potential actions in the 50% and 90% exceedance scenarios. The forecasts provided in Attachment 1 are projections based on hydrology forecasts and conditions known at the time and may change due to real-time conditions.

WY 2021 is classified as critical for both the 50% and 90% hydrological exceedances. However, significant concerns are only presented in the 90% exceedance scenario as summarized below. Many of these concerns may apply under the 50% hydrology as well.

A. March 1, 2021 50% Exceedance

Both Projects are anticipated to be able to meet the Sacramento Valley in-basin requirements (which include senior water rights diverters and D-1641), the contractual obligations of both the Sacramento River and Feather River Settlement Contractors, and minimum health and safety needs.

Although the SWP and CVP Projects are able to meet the Sacramento Valley In-Basin requirements and D-1641, should WY 2022 be classified as a third consecutive dry or critical year, the low carryover storage will likely lead to concerns and challenges in meeting system demands.

Many of the concerns highlighted below, particularly those related to storage levels and temperature management, would also apply, albeit to a lesser degree, in the 50% exceedance forecast.

B. March 1, 2021 90% Exceedance

The 90% exceedance forecast incorporates critically dry conditions for WY 2021. Each Project reservoir exhibits extremely low carryover storage at the end of WY2021. This forecast includes the trade-off between storage management and meeting the Sacramento Valley in-basin uses. Current system-specific operations and 90% exceedance forecast areas of potential concern are further described in detail below.

i. D-1641 SWRCB Bay Delta Standards

Under very dry conditions, SWRCB D-1641 includes flexibilities of Spring X2 water quality and outflow standards in May and June. Spring X2 does not apply in May and June when the best available May estimate of the Sacramento River Index for the water year is less than 8.1 MAF. The Sacramento River Index refers to the sum of the unimpaired runoff in the water year as published in the DWR Bulletin 120 for the following locations: Sacramento River above Bend Bridge, near Red Bluff; Feather River, total unimpaired inflow to Oroville Reservoir; Yuba River at Smartville; and American River, total unimpaired inflow to Folsom Reservoir. The 90% exceedance forecast of the SVI is 6.7 MAF, well below the 8.1 MAF, and therefore, Spring X2 under the 90% exceedance forecast is not an expected requirement in May and June.

Considering the expected Spring X2 flexibilities in May and June described above and the information known to date, DWR and Reclamation do not plan to submit a Temporary Urgency Change Petition to the SWRCB for modifications to the spring and summer water quality and outflow standards set forth in D-1641.

ii. Trinity River

Spring flows on the Trinity River will be consistent with the annual allocation as prescribed by the Trinity River Main-stem Fishery Restoration Record of Decision. Consistent with fish health criteria, releases to augment flows in the Lower Klamath River will also be considered. The storage forecasted for the end of September is extremely low at just over 600 TAF and does not leave a storage buffer in the event WY 2022 is also dry. In addition, low storages of this level also typically bring temperature management concerns both in this water year and in WY 2022.

iii. Sacramento River

Flow releases at Keswick are currently at 3,500 cfs to support Delta outflow needs. This is slightly above the minimum of 3,250 cfs for instream flows. Reclamation's goal is to minimize releases throughout spring as much as practicable to help conserve storage in Shasta Lake;

however, releases for Delta requirements and senior water right demands may require increases as early as April.

Absent significant precipitation in early April, Keswick flows are expected to begin increasing in the mid-April timeframe for meeting in-river temperatures, senior water right deliveries and Delta requirements. Procedures and commitments consistent with the 2020 Record of Decision implementing the PA, consulted upon and permitted in the NMFS 2019 Biological Opinion will be applied through this period.

The key areas of concern for the upper Sacramento River include temperature management, meeting in-basin demands (including senior water right deliveries and Delta requirements) and carryover storage. Temperature management is of significant concern given the projected storage peaks in March and indicates that the full use of the temperature control device will not be possible. In particular, there will be little to no ability to release warmer water through the temperature control device in the spring prior to the hot summer temperatures and instead will require colder water to be released earlier in the season, and therefore not be available later in the late summer/early fall. This could present significant concerns for fishery protection in the late summer/early fall season. Preliminary estimates, based primarily on the forecasted storage on April 30, indicate that 56°F will not be achievable at the Clear Creek gauge throughout the water year. The ability to manage temperatures will be heavily influenced by required releases for in-basin demands including Delta requirements under D-1641 and senior water right holder deliveries for the Sacramento River Settlement Contractors. The 90% exceedance forecast shows a carryover storage under 1,300 TAF. This is similar to storages seen in the previous drought and would likely cause challenges in WY 2022 should that year also be dry or critically dry. Drought actions currently being considered and evaluated for improving temperature management and carryover storage include the following:

- Deploying a temperature curtain later in the summer to limit leakage of warmer water through the temperature control device and preserve the colder water for longer.
- Limited use of the higher-elevation river outlet/power bypass gates to release warmer water in the spring to conserve cooler water for releasing later in the year.
- Requesting that a portion of transfer water made available by the Sacramento River Settlement contractors be delivered in the fall months rather than the summer to maintain higher volumes of cold water through the summer months.
- Coordination on the timing of initial diversions to the Sacramento River Settlement Contractors to limit the impact on system performance and potentially reduce required spring releases.
- Continuation of the winter-run reintroduction program on Battle Creek
- Increased intake of winter-run at Livingston-Stone National Fish Hatchery with contingencies to maintain suitable hatchery water temperatures.

Reclamation will continue to coordinate through the Sacramento River Temperature Task Group, which includes CDFW, DWR, FWS, NMFS, SWRCB and Sacramento River Settlement Contractors.

iv. Clear Creek

Flows on Clear Creek will be consistent with the 2020 Record of Decision implementing the Proposed Action (PA) and the NMFS 2019 Biological Opinion. The timing of any prescribed pulse flows will be closely evaluated through technical teams to minimize effects on temperature management and/or ability to help meet other system flow needs. Concerns with Clear Creek temperature management are similar to those of the Trinity system.

v. Feather River

Total flows on the Feather River through the High Flow channel of the Feather River are currently at the minimum (1,000 cfs) as required by the 1983 agreement between DWR and CDFW and the current Federal Energy Regulatory Commission license which included consultation with NMFS and USFWS. The flow through the Low Flow Channel is 800 cfs. The 90% forecast, included in Attachment 1, projects historically record low storages in Lake Oroville late summer through fall. DWR's objective is to maintain minimum releases for as long as practicable; storage releases are needed later in the spring and early summer to meet in-basin requirements. A key objective for DWR is to maintain at least 900 TAF in Lake Oroville through August. This is the storage level at which operational challenges may be encountered with power generation and temperature management.

Lake Oroville's Hyatt Power Plant (Hyatt) plays a significant role in supporting the power grid reliability; therefore maintaining storage above at or above the 900 TAF for as long as possible through the summer is critical to help maintain grid integrity during peak summer power demand for the State of California. In addition, during dry years when storage is low, it is common for DWR to blend warmer water being conveyed through Hyatt with colder water conveyed through the low-level river valve outlet system (RVOS). Maintaining storage above 900 TAF through August will allow for this more efficient temperature blending operation and avoid depleting large volumes of cold water when not needed for downstream temperatures. Beginning September 1 of each year, the Feather River Hatchery temperature requirements drop six degrees from 58 degrees to 52 degrees (+/- 4 degrees), and beginning October 1, the temperature requirement drops one more degree to 51 degrees (+/- 4 degrees). By maintaining Lake Oroville at or around 900 TAF by the end of August, DWR is able to conserve much of the cold water for the time period when very cold water is needed to meet the colder temperature requirements in the fall.

vi. American River

Flows on the American River will be consistent with the provisions of the 2020 Record of Decision implementing the proposed action and the NMFS 2019 Biological Opinion. Flows in the winter and spring will generally follow the minimum flows from the 2017 revised American River Flow Management plan although they may need to be increased above minimums due to meeting Delta requirements. The current forecast shows elevated releases in April for delta outflow requirements. Flows in the summer and into the fall may also be adjusted for meeting the temperature management plan for Folsom Lake and the American River. Typically starting in June, flow releases may increase at Nimbus to facilitate temperature management along the

American River, and these increased flows will then be used to meet other Project purposes in the system. The key areas of concerns for the American River include temperature management, meeting minimum health and safety deliveries within the American River basin and carryover storage. Temperature management is of significant concern given the projected storage for April and May, which indicate the highest shutter gates will not be able to be operated, requiring colder water to be released earlier in the season and therefore not be available later in the late summer/early fall. Drought actions currently being considered and evaluated for improving temperature management and carryover storage include the following:

- Power Bypass at Folsom Dam in early or late fall to lower American River temperatures for supporting Endangered Species Act listed fish.
- Coordination with the Sacramento Water Forum on potential water shortage provisions.

These potential provisions and actions being considered will help to ensure that urban water users in the greater Sacramento area will continue to have access to surface water and groundwater, and that flows on the lower American River will meet the minimum flow standards for fish.

Folsom is a key (and sometimes the sole) water source for many M&I communities within the American River basin, some with senior water rights. For many in the area, this supply is contingent on a minimum storage within Folsom Reservoir. Although the exact storage varies with the demand expected, Reclamation generally assumes a storage less than 110 TAF is not adequate to operate the facilities to meet expected demands. A storage below this level would require Reclamation to install emergency pumps to continue minimal deliveries. The current storage in the 90% exceedance forecast shows a Folsom storage of approximately 200 TAF for the end of September. This projected extremely low storage would likely cause challenges in WY 2022 should that year also be dry or critically dry.

vii. Stanislaus River

Flows on the Stanislaus River will be consistent with the provisions of the 2020 Record of Decision implementing the PA and the NMFS 2019 Biological Opinion. Generally, flows in the winter and spring will follow the Stepped Release Plan schedules (from the PA) as modified through the interagency Stanislaus Watershed Team. The key areas of concern for the Stanislaus River basin include primarily carryover storage. New Melones has a very low refill rate, meaning it only typically fills in very wet years (such as 2017) and can go many years between filling even with non-drought hydrology. For this reason, storage within New Melones can be relied upon for meeting basin requirements for several years after the last filling. The 90% exceedance forecast shows a carryover storage of approximately 1,100 TAF at the end of September. While this storage is relatively high compared to the other reservoir within the system, it may still present challenges with regard to meeting future requirements should WY 2022 or even WY 2023 also be dry.

V. Monitoring Efforts to Inform Operations

A. Delta Smelt Surveys

The current dry conditions have highlighted the need to improve the array of information that is collected to support management decisions pertaining to the effect of winter/spring exports on the Delta Smelt population. Since the previous major drought, a new management-relevant survey has been developed--EDSM, which conducts high intensity sampling year-round and provides regional population estimates for Delta Smelt across their range. This information has helped to inform export operational decisions and allowed for flexibility in maximizing export opportunities earlier this year.

The EDSM surveys are conducted in addition to several other key surveys, including the Smelt Larva Survey and 20-mm Survey, which focus on early life stages. As part of the new ITP, DFW, DWR, and partners will be testing improved methods to measure larval smelt entrainment at the SWP.

Despite these advancements in survey methods, the Delta Smelt population is at extremely low abundances in WY 2021, so catch is expected to be limited. As a consequence, as outlined in the Biological Opinions and DWR's ITP, management activities may focus more on habitat conditions including turbidity, temperature, and OMR flows when assessing the risk of entrainment. Particle tracking and life cycle models will also be considered, as appropriate, to guide management actions.

B. Salmonids Near-Term Drought Monitoring

In WY 2021, salmonid monitoring efforts include rotary screw traps, acoustic tagging, trawls and beach seining. Environmental DNA sampling to complement the Sacramento, Mossdale, and Chipps Island trawls is being investigated to improve salmon detection at Delta entry and exit sites. An increase in sampling duration at the salvage facilities may be considered as part of the monitoring plan to minimize inaccuracies in expanded salvage counts and loss calculations. However, in 2018, DOSS advised NMFS against increased sampling duration because the disadvantages would outweigh the potential benefits, and the SaMT may provide similar advice this year.

Other studies on migration paths and mortality will continue in WY 2021 for winter-run and spring-run salmon, and steelhead, to improve scientific knowledge about the population dynamics of these species. Several new or updated models, such as the STARS model and the enhanced Particle Tracking Model, are available to simulate fish migration rate, routing, and survival in the Delta in response to flow and other variables. These models will be used to inform real-time management decisions to minimize the impact of drought actions on the survival of salmon migrating through the Delta.

As a potential additional tool, DWR's ITP requires the development of a predictive tool to improve management of winter-run Chinook Salmon salvage. One of the potential models is

already in an advanced state of development, and another will be initiated. These models will be piloted by SaMT to provide additional information regarding real-time operations, potentially improving our ability to reduce entrainment throughout the winter and spring.

This monitoring in WY 2021 and beyond was developed, partly in response to previous droughts, to improve our understanding of timing and distribution of species in the Delta, as well as inform targeted research and fill data gaps that further detail risks resulting from water operations.

C. Ecosystem Drought Monitoring

Monitoring during the previous major drought (2014-2015) demonstrated that there can be major ecological changes in the estuary. For example, the previous drought showed increases in harmful algal blooms, aquatic weeds, and invasive fishes (e.g. centrarchids). These changes are likely to occur again under drought conditions, and monitoring could focus on measuring these effects to understand the impacts of this potential drought and efficacy of different management actions taken to address these ecological stressors. As a specific example, these data can help evaluate the effects of controllable factors (e.g. diversions) versus factors that can't be managed (e.g. Delta temperature).

DWR is currently developing a drought monitoring and synthesis plan built on existing monitoring and synthesis efforts to examine the effects of flow management and extreme flow events (e.g. drought, flood) on critical ecological conditions, such as work currently underway by the IEP Flow Alteration Team (FLoAT) that coordinates a broad suite of monitoring, studies, and synthesis activities. DWR may also update the previous synthesis effort that occurred during the 2012-2016 drought that assessed overall ecosystem change by combining data from existing monitoring surveys of water quality, phytoplankton, zooplankton, vegetation, and fishes (Mahardja et al. 2021, Conrad et al. Draft manuscript).

Ecosystem monitoring relies primarily on existing status and trend monitoring, with the addition of a few focused special studies. Examples of new monitoring not available in 2014 and 2015 includes Reclamation's Directed Outflow Project (DOP), which is designed to provide key supplemental information on environmental and Delta Smelt responses to changes in outflow, Reclamation's San Joaquin steelhead telemetry studies, and the U.S. Fish and Wildlife Service's Enhanced Delta Smelt Monitoring Program, a more comprehensive CDWF, DSP, and Reclamation acoustic telemetry network, and the State's surveys of aquatic vegetation. Similarly, if major management changes occur in response to the drought (such as a drought barrier), a focused monitoring effort will be used to assess the effects of this management action (e.g. Kimmerer et al. 2019).

VI. Next Steps

DWR and Reclamation will continue to collaborate with Agencies on the development of the Drought Toolkit and provide weekly hydrology and operations updates at the WOMT meetings. In addition, this Drought Plan will be updated in May with the final B120 water supply forecast unless there will need to be significant changes to this Drought Plan based upon the April 1 B120 forecast.

REFERENCES

[CDFW] California Department of Fish and Wildlife. 2020. California Endangered Species Act Incidental Take Permit No. 2081-2019-066-00. Long-term operation of the State Water Project in the Sacramento–San Joaquin Delta. March 30, 2020. 142 p. [accessed 2020 Sep 02].

Available from: <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=178057&inline>

Kimmerer W, Wilkerson F, Downing B, Dugdale R, Gross ES, Kayfetz K, Khanna S, Parker AE, Thompson J. 2019. Effects of drought and the emergency drought barrier on the ecosystem of the California Delta. *San Franc Estuary Watershed Sci.* [accessed 2020 Jul 15];17(3).

<https://doi.org/10.15447/sfews.2019v17iss3art2>

Mahardja, B., V. Tobias, S. Khanna, L. Mitchell, P. Lehman, T. Sommer, L. Brown, S. Culberson, and J. L. Conrad. 2021. Resistance and resilience of pelagic and littoral fishes to drought in the San Francisco Estuary. *Ecological Applications* 31(2).

<https://esajournals.onlinelibrary.wiley.com/doi/pdf/10.1002/eap.2243>

[NMFS] National Marine Fisheries Service, Southwest Region. 2019. Biological opinion for the reinitiation of consultation on the long-term operations of the Central Valley Project and State Water Project. Long Beach (CA): Endangered Species Act Section 7 Consultation. October 21, 2019. [accessed 2020 Sep 02]. Available from:

<https://www.fisheries.noaa.gov/resource/document/biological-opinion-reinitiation-consultation-long-term-operation-central-valley>

[USFWS] US Fish and Wildlife Service. 2019. Biological opinion of consultation on the coordinated operations of the Central Valley Project and State Water Project. Sacramento (CA): USFWS. Available from: https://www.fws.gov/sfbaydelta/cvp-swp/documents/10182019_ROC_BO_final.pdf

OPERATIONS FORECAST RESULTS

For the March 2021 Drought Contingency Plan

March 1st WSI - 50% HYDROLOGY

END OF MONTH STORAGES (TAF)

| RESERVOIRS | 2021 | | | | | | |
|-------------|-------|-------|------|------|------|--------|-----------|
| | MARCH | APRIL | MAY | JUNE | JULY | AUGUST | SEPTEMBER |
| Trinity | 1264 | 1354 | 1281 | 1172 | 1051 | 899 | 749 |
| Shasta | 2580 | 2780 | 2847 | 2625 | 2277 | 2013 | 1948 |
| Folsom | 498 | 621 | 629 | 567 | 480 | 416 | 367 |
| Oroville | 1483 | 1755 | 1804 | 1613 | 1389 | 1239 | 1231 |
| New Melones | 1539 | 1507 | 1465 | 1384 | 1300 | 1231 | 1191 |

MONTHLY AVERAGE RELEASES (CFS)

| RESERVOIRS | 2021 | | | | | | |
|------------|-------|-------|-------|-------|--------|--------|-----------|
| | MARCH | APRIL | MAY | JUNE | JULY | AUGUST | SEPTEMBER |
| Trinity | 300 | 600 | 1498 | 783 | 450 | 857 | 870 |
| Sacramento | 3,500 | 4,500 | 5,700 | 9,000 | 10,000 | 8,500 | 5,500 |
| American | 1,200 | 1,750 | 3,050 | 2,600 | 2,500 | 2,200 | 1,850 |
| Feather | 1,050 | 800 | 800 | 2,750 | 3,650 | 3,000 | 1,150 |
| Stanislaus | 200 | 460 | 150 | 150 | 150 | 150 | 150 |

DELTA SUMMARY (CFS)

| | 2021 | | | | | | |
|--------------------------|-------|-------|------|-------|-------|--------|-----------|
| | MARCH | APRIL | MAY | JUNE | JULY | AUGUST | SEPTEMBER |
| Rio Vista Flows | 5250 | 7350 | 5600 | 5450 | 4700 | 4500 | 3650 |
| Sac River at Freeport | 6700 | 9650 | 8400 | 10700 | 11450 | 11100 | 9300 |
| SJ River at Vernalis | 1750 | 1950 | 1800 | 950 | 800 | 750 | 850 |
| Computed Outflow | 8350 | 10100 | 7400 | 7100 | 4150 | 4250 | 4200 |
| Combined Project Pumping | 1200 | 1200 | 1200 | 1250 | 4050 | 4100 | 3950 |

OPERATIONS FORECAST RESULTS

For the March 2021 Drought Contingency Plan

March 1st WSI - 90% HYDROLOGY

END OF MONTH STORAGES (TAF)

| RESERVOIRS | 2021 | | | | | | |
|-------------|-------|-------|------|------|------|--------|-----------|
| | MARCH | APRIL | MAY | JUNE | JULY | AUGUST | SEPTEMBER |
| Trinity | 1275 | 1333 | 1249 | 1112 | 984 | 829 | 676 |
| Shasta | 2368 | 2379 | 2173 | 1916 | 1593 | 1350 | 1285 |
| Folsom | 341 | 398 | 443 | 370 | 258 | 210 | 203 |
| Oroville | 1383 | 1522 | 1498 | 1303 | 1071 | 900 | 802 |
| New Melones | 1524 | 1471 | 1386 | 1298 | 1220 | 1155 | 1119 |

MONTHLY AVERAGE RELEASES (CFS)

| RESERVOIRS | 2021 | | | | | | |
|------------|-------|-------|------|-------|------|--------|-----------|
| | MARCH | APRIL | MAY | JUNE | JULY | AUGUST | SEPTEMBER |
| Trinity | 300 | 600 | 1498 | 783.1 | 450 | 857 | 870 |
| Sacramento | 3500 | 6000 | 7750 | 8850 | 9050 | 7700 | 5000 |
| American | 1550 | 1550 | 900 | 2200 | 2550 | 1600 | 800 |
| Feather | 1050 | 800 | 900 | 2050 | 2600 | 2050 | 2300 |
| Stanislaus | 300 | 460 | 150 | 200 | 150 | 150 | 150 |

DELTA SUMMARY (CFS)

| | 2021 | | | | | | |
|--------------------------|-------|-------|------|------|------|--------|-----------|
| | MARCH | APRIL | MAY | JUNE | JULY | AUGUST | SEPTEMBER |
| Rio Vista Flows | 5600 | 5700 | 3350 | 3350 | 2750 | 2050 | 3050 |
| Sac River at Freeport | 7150 | 7700 | 5700 | 7900 | 8650 | 7550 | 8450 |
| SJ River at Vernalis | 1400 | 1400 | 1350 | 700 | 700 | 600 | 700 |
| Computed Outflow | 7750 | 7100 | 4000 | 4000 | 4100 | 3000 | 3000 |
| Combined Project Pumping | 1300 | 1200 | 1250 | 1200 | 1150 | 1650 | 3950 |