



DEPARTMENT OF WATER RESOURCES
Division of Operations and Maintenance
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Sacramento, California 95821



— BUREAU OF —
RECLAMATION

BUREAU OF RECLAMATION
Central Valley Operations Office
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

Erik Ekdahl
State Water Resources Control Board
1001 I Street
Sacramento, California 95814

Condition 11 of the June 1, 2021 Temporary Urgency Change Order

Dear Mr. Ekdahl:

Consistent with the June 1, 2021 Temporary Urgency Change Order granted by the State Water Resources Control Board (Water Board) issued to the U.S. Bureau of Reclamation (Reclamation) and the California Department of Water Resources (DWR), and in compliance with Condition 11 of that Order, DWR and Reclamation hereby submit this initial Operational Strategy for Water Year (WY) 2022.

Improvements to Hydrologic Forecasting

DWR has been forecasting runoff for the State of California since 1930. Within that time, DWR has built an extensive database of data and sound methods for estimating runoff volumes based on current conditions, statistical trends, and historical distributions. Although adjustments have been made to these methods based on changing hydrologic patterns, California has experienced more and more climate extremes over the past ten years. WY 2021 highlighted the challenge with relying solely on these past approaches with a rapidly changing climate that results in hydrologic patterns that exist outside of historical distributions.

Climate change has impacted precipitation patterns and snow water content, affecting our ability to forecast water supply. Increased seasonal and sub-seasonal variability in how precipitation accumulates in the watersheds is not reliably captured by lumped-sum parameters covering multiple months. Factors such as warmer and drier summer and fall months have decreased the amount of runoff following precipitation events.

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Impacts to precipitation, snow water content, and runoff responses have reduced baseflow in streams. Furthermore, a loss of correlation between lower elevation snowpack and higher elevation snowpack has been observed; it is no longer true that there is more snow as a percent of average the higher the elevation.

There are a number of data enhancements being implemented this year by DWR's Division of Flood Management (DFM) to help improve water supply forecasts.

DFM is using a new period of record, 30 years (1991-2020) for the averages used in its forecasts. This change places an emphasis on more recent and relevant hydrologic patterns, and the new period includes the two most recent droughts, the most recent years with the warmest temperature records, the lowest historic snowpack (2015), and the wettest 8-station year (2017). Also, DFM is updating the averages for precipitation, snow, and full natural flow, all variables in the forecast equations, and this update is foundational for all other forecast improvements.

In addition, DFM is conducting assessments this year with two tasks to help address greater sub-season variability in our climate: 1) breaking the precipitation and Full Natural Flow (FNF) variables into monthly values rather than using seasonal values; and 2) including May 1 snow water content in forecasts to capture depletion rate of snow as compared to runoff. Disaggregating the lumped seasonal precipitation or FNF values into monthly timesteps allows for better analysis of how these two variables accumulate and removes biases from larger storms that may dominate seasonal precipitation.

Finally, DFM is assessing the use of better spatially explicit data in the forecasts through the collection of Airborne Snow Observatory (ASO) data in the Feather, Truckee, Carson, and Yuba River watersheds, in addition to the Tuolumne, Merced, San Joaquin, Kings, and Kaweah basins, where data has traditionally been collected. DFM will also be utilizing the U.S. Geological Survey's Basin Characterization Model (BCM) to provide modeled, gridded statewide climate water deficit and soil moisture data.

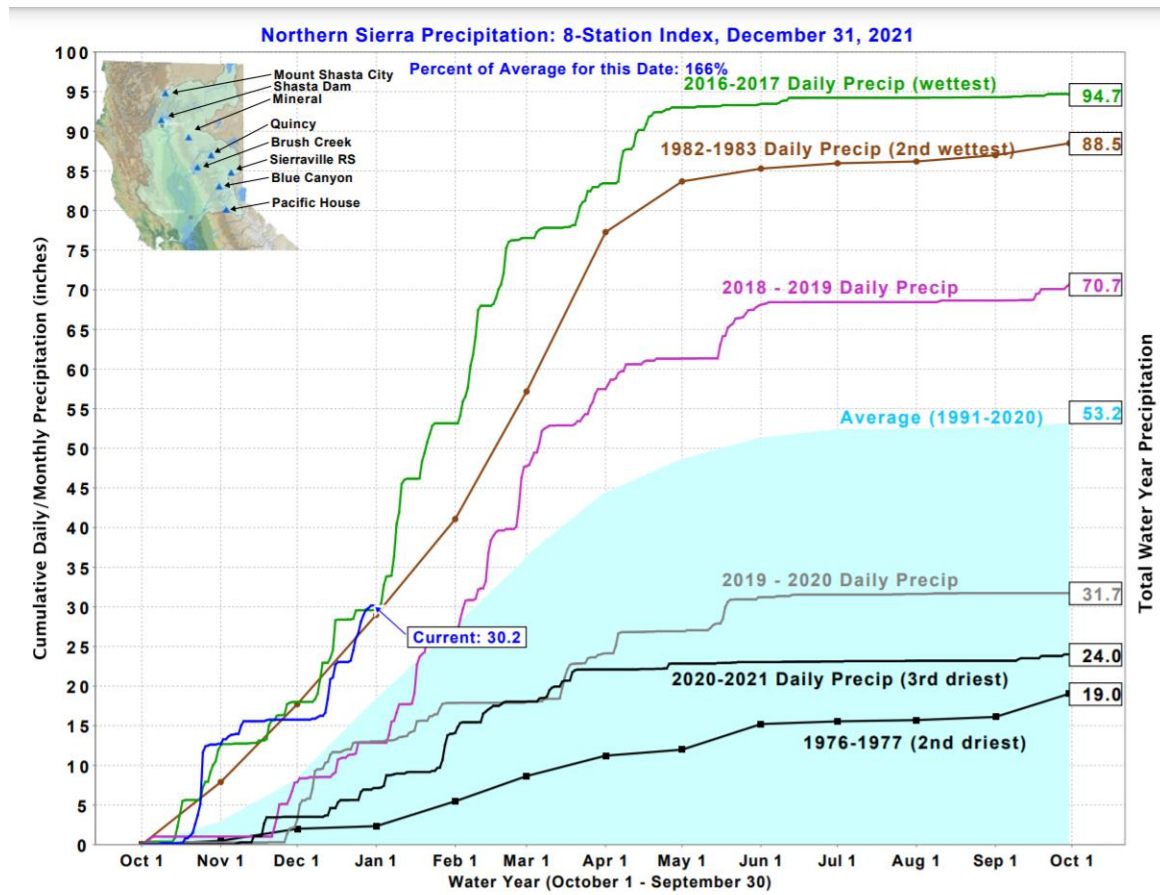
There are also some runoff forecast improvements being assessed this year. For example, staff have expanded the use of machine learning tools, enabling greater flexibility in utilizing existing or newer hydroclimate variables in runoff forecasting. These staff are working with Scripps/CW3E to make use of their experience and expertise in using machine learning and applying it to hydroclimate analyses such as runoff forecasts. DFM is also testing a pilot forecast models in the Feather and San Joaquin watersheds. Using ASO data, coupled with the WRF-Hydro physically based and climate informed model used by (National Oceanic and Atmospheric Administration (NOAA) in its National Water Model. Additionally, staff have developed an entire suite of the USDA's iSnoBal model where ASO data is collected. This enables a better understanding of what is physically happening in the snowpack, which in turn provides better guidance.

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DWR is also coordinating with the Bureau of Reclamation in the longer-term work they are doing to improve forecasting across the western United States. New approaches and/or data arising from these processes will also be incorporated into DWR's forecast process as appropriate.

Current Hydrologic Conditions

California continues to see very low reservoir storage at many of the larger reservoirs; however, a series of storms in late October, including a Category 5 atmospheric river, and the recent December storms have boosted precipitation totals, and WY 2022 precipitation to date has surpassed the total precipitation received in WY 2021. As shown in blue on the following chart, the Northern Sierra Precipitation total as of December 31, 2021 is 30.2 inches and 166% of average to date.

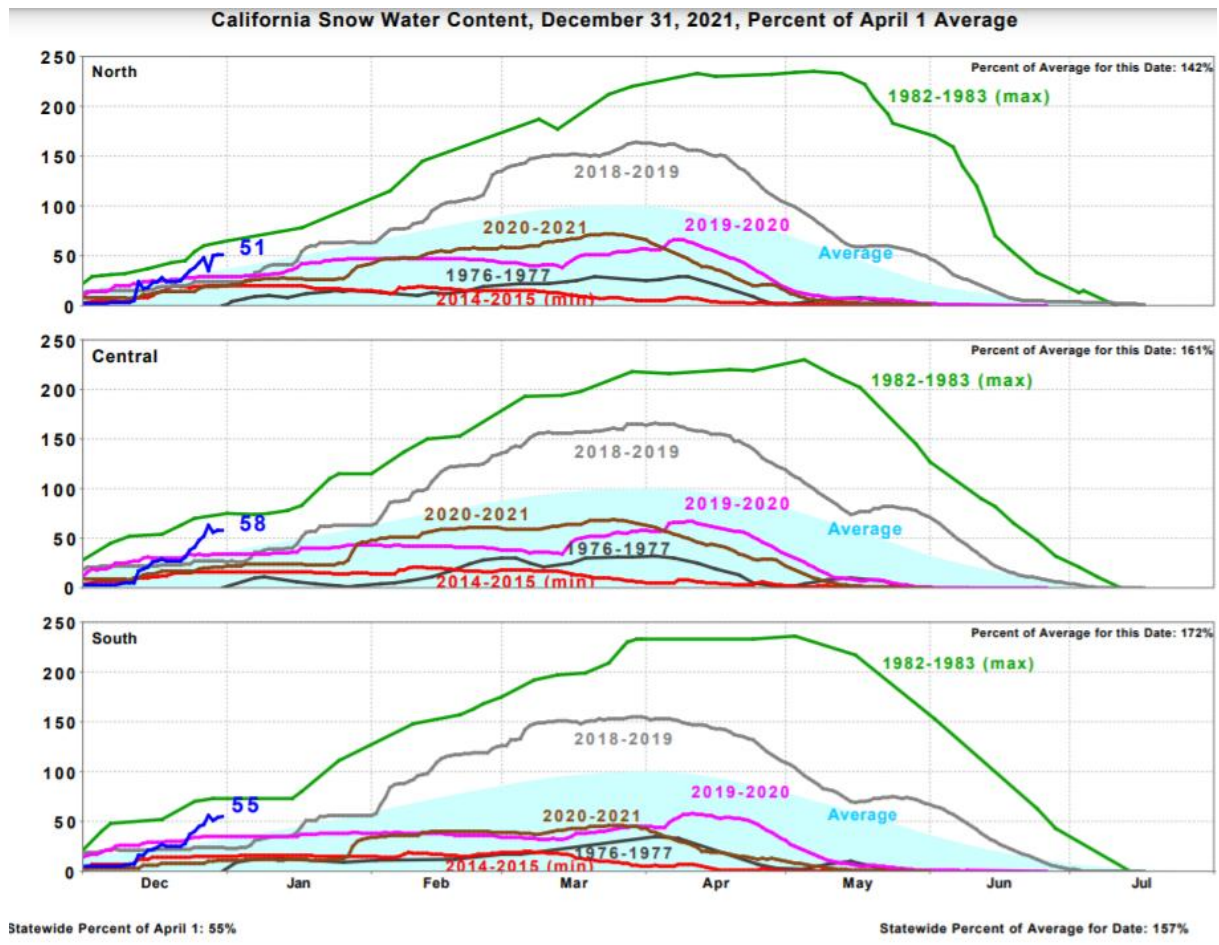


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Additional precipitation has occurred in late December and is anticipated in early January, but as of December 31, upstream reservoir storage conditions were as follows:

Reservoir	Percent of Capacity	Percent of Average
Shasta	29	50
Oroville	38	73
Folsom	60	147
New Melones	39	71

In addition to the above average precipitation, the storms experienced in December have been colder, and snowpack statewide across the Sierra Nevada as of December 31, 2021 is currently 157% of historical average, as shown in the following chart:



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Operational Strategy

DWR and Reclamation are planning for a third dry year should the current weather patterns shift back to dry hydrology this winter. The Projects' leading concerns with a dry 2022 are as follows:

- At Shasta, storage is very low, creating a high risk for limited cold water for temperature management going into 2022 and limited supply for meeting minimum demands (including summer delta outflow/salinity) and storage for carryover into 2023;
- Low carryover storage going into 2022 and potential for low carryover storage into 2023 are leading concerns for Lake Oroville. However, storage levels in Oroville have improved from the historic low point experienced in September. Because of the October and December storm systems, Oroville storage has gained about 550 TAF.

Should the winter change to a drier pattern, significant storage releases may be needed to manage salinity intrusion for health and safety needs (even in winter if it remains dry), and the Projects would anticipate a lack of operational flexibility with low exports and minimal releases.

Currently, the Projects are maintaining minimum releases from Shasta and Oroville for storage conservation, and this week, Folsom releases were increased for flood control purposes to make room for incoming flows. The Projects are also modifying exports to meet Delta requirements and fishery protections, but will export available water to build San Luis storage, which is currently at 30% of capacity and 48% of average for this time of year.

The SWP initial 2022 Water Supply allocation issued on December 1 is to meet Health and Safety needs of SWP contractors. The SWP allocation will continue to be assessed as hydrological conditions develop. Reclamation's initial allocation will not be issued until February 2022.

Drought Action Implementation

DWR and the U.S. Bureau of Reclamation submitted a Temporary Urgency Change Petition on December 1, 2021, requesting modifications to specific Decision 1641 objectives between February 1 and April 30, 2022. The purpose of these requested modifications is to conserve upstream storage through operational flexibility. This modification was requested under the assumption that WY 2022 may continue with dry conditions from 2021. Because of the changing hydrology and recent flood control releases from Folsom Lake, a TUCP for the month of February may not be necessary, and the Projects will provide updates at the January 5 and 18, 2022, scheduled Water Board meetings.

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DWR has been granted approval to keep the drought barrier in place through the winter. The barrier would be notched in January to allow boat and fish passage, and the barrier profile would be restored in April. While notched, the barrier will not provide changes in flow, but leaving the barrier's foundation in place will aid the reconstruction of the barrier in 2022, should it be needed.

If appropriate, DWR and Reclamation will be developing a joint Drought Contingency Plan, to be submitted to the fisheries agencies and Water Board by February 1, 2022, per the Incidental Take Permit Condition of Approval 8.21.

DWR and Reclamation continue to provide weekly condition and Project operations updates through WOMT. In addition, DWR and Reclamation will continue to coordinate with the existing Long-term Operation Agency working groups and Drought Relief Year Team to develop a robust drought monitoring program with updates to WOMT and other forums as necessary.

If you have any questions about this submittal, please contact Molly White of DWR at (916) 574-2722 or Kristin White of Reclamation at (916) 979-2199.

Sincerely,

Molly White

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