System drought indicator for the Southern California hydrologic region

# Water portfolio of the Southern California hydrologic region

Water Data Portfolios is used to obtain the supply portfolio for the 2002-19 period.

The main sources which compromise around 83% of the supply in southern California are:

* State Water Project (SWP) - 24% of the supply
* Colorado - 22% of the supply
* Groundwater - 33% of the supply
* Los Angeles Aqueduct (Imports)- 4% of the supply

# Estimating supplies using drought indicators

## State Water Project

Given SWP supply comes from Northern California, we try correlating swp supply with delta surface water drought indicator (SWDI).

Different datasets are used to better understand the relationship between indicators and state water project.

### Water Data Portfolios

We correlate SWP data with water year SWDI delta indicator. Some correlation is observed (r2=0.435) as seen in figure 1. Generally during dry years when SWDI delta is low, less water is delivered. However, in normal years (SWDI between 0.4 and 0.6), deliveries can vary by as much as 1,000 MAF. This variability may be due to water being stored outside of SoCal to ensure adequate supply during future drought years.

Figure 1 Monthly average SWDI over the water year vs SWP deliveries over the water year.

2006 regulation changes (2006 Bay-Delta Plan) negatively impacted deliveries to SoCal from 2008 and on. By dividing the SWP deliveries to pre 2008 and post 2008 deliveries, a noticeable decrease in SWP deliveries is observed. Pre-2008 deliveries always exceeded 1400maf, whereas post-2008 deliveries have not exceeded 1300maf. Furthermore, no improvement in correlation is observed (Figure 2).

Figure 2 Monthly average SWDI over the water year vs SWP deliveries over the water year.

### SWP Allocations

Write more about SWP allocations. About how it was divided into ag and ub before.

DWR publishes a percent allocation for SWP contractors at the beginning of each water year based on availability of supply in the delta. Initial allocations are conservative and generally allocations increase throughout the year.

The figure below shows the allocation percentages by the final of each water year. 1995-2000 was a very wet period as the allocations were around 100%.

SWDI delta is used to determine SWP allocations. The correlation between the average calendar year SWDI and the annual allocation (final allocation at the end of each year) is r2=0.7594. This score is higher than the average water year SWDI (r2=0.6939) and the correlation with the SWDI at the time the allocation is published (r2=0.7025) as shown in figure below.

A graph with blue dots and a line

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### B132-19 report

(just recently b132-20 was released)

A map of a train

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This report provides a detailed explanation of California State Water Project Management for each calendar year. Full reports of the State Water Project for each calendar year are released after a few years. For example, the full report for:

* B132-2019 was released in 2022
* B132-2018 was released in 2021
* B132-2017 was released in 2019
* B132- 2016 was released in 2017

Up until the release of the full report, appendices are provided annually.

Our focus is on the deliveries. Relevant tables related to our project include:

* Table B-4: Maximum Contractual Table A Amounts
* Table B-5A: Annual Water Quantities Delivered from Each Aqueduct Reach to Each Contractor

This shows amounts of actual allocated water quantities delivered from each aqueduct reach to each SWP contractor

It also includes non-project water delivered to SWP water contractors, surplus water deliveries prior to May 1, 1973, and actual Article 21 water deliveries in 1994 and thereafter.

* Table B-5B: Annual Water Quantities Delivered to Each Contractor

This presents a summary of actual and projected annual allocated water quantities for each SWP water contractor. The quantities also include amounts of non-project water and surplus water delivered prior to May 1, 1973, and actual deliveries of Article 21 water in 1994 and thereafter.

* Table B-6: Annual Water Quantities Conveyed through Each Pumping and Power Recovery Plant of Project Transportation Facilities.

This summarizes the annual allocated water quantities conveyed or to be conveyed through each aqueduct pumping plant or power plant.

The following is for 2018 only:

* Table 8-1: Storage of Water Outside SWP Contractor Service Areas in 2018
* Table 8-5 2018 Allocated Table A Amounts
* Table 8-6 Water Delivered to SWP Contractors in 2018, by Service Area
* Table 8-7 Total Amounts of Water Delivered in 2018, by Month

Extra:

* Table 8-8 Total Amounts of Annual Table A Water and Water Conveyed, by Type, 1962–2018
* Table 8-9 SWP Water Delivered by Category, 1962–2018

This is for each category in table A delivered (Municipal, Ag), Article 21 and other SWP water deliveries (feather river diversions, fish wildlife and other)

* Table B-5A-Adj:

This presents a summary of accounting adjustments that result from water deliveries not originating from the Sacramento-San Joaquin Delta (Delta).

The methodologies used to calculate various components are based on cumulative charges from the Delta through facilities conveying water to a specific repayment reach. When water is introduced to the SWP downstream of the Delta, SWP water

**SWP Water.** as defined in the SWP Water Supply Contracts, includes Article 21 water, carryover Table A water, current year Table A amounts, transfer and exchange of Table A water, and Turn Back Pools A and B. Detailed information concerning those conveyances for 2018 is found under the “Miscellaneous Agreements with SWP Contractors” section in this chapter’s preceding pages or is listed below.

**Non-SWP Water.** In 2018, DWR used SWP facilities to convey non-SWP water to various non‑SWP agencies according to the terms of water rights and water transfer and exchange agreements. Detailed information concerning those deliveries is in this chapter.

We know total deliveries to all SWP contractors from 1990s to 2022.

Correlating it SWDI delta we get a relatively high r2 of 0.7922.

## Groundwater

Groundwater delivery data is only available through water data portfolios. We’ve tried to identify a relationship between the groundwater indicators and the deliveries.

Moderate correlation is observed between the pumping intensity indicator (annual changes in groundwater elevations) and groundwater deliveries (r2=0.5765). No correlation exists between surface deliveries (SWP+Colorado+imports) and groundwater deliveries (r2=0.0024). Figures for both are below.

## Los Angeles Aqueduct

Los Angeles Aqueduct comes from Mono Lake in the Owens valley, located in the Sierra Nevada mountains. Environmental regulations implemented in the 1980s for Mono Lake have led to significant reductions in water diversions which has decreased the supply of the LA Aqueduct.

We will be utilizing SWDI South Lahontan indicator to predict the LA aqueduct supply because it’s located in the South Lahontan hydrologic region.



### Water Data Portfolio

DWR’s import data is in water year and shows high correlation with SWDI SL WY (r2=0.8624) as shown in figure below. A similar high correlation is observed with SWDI delta (r2=0.8621); This could be because both the Los Angeles Aqueduct and the State Water Project rely on hydrological conditions in the Sierra Nevada mountains for their water supply. Whereas, SWDI SC has lower correlation (r2=0.5976), which makes sense as the water surface condition in SoCal is not reflective of LA aqueduct supply.

### MWD

MWD historic supply dataset spans from 1976 to 2015 as shown in the figure below.

MWD’s Aqueduct with DWR’s Imports data reveals a remarkably high correlation of r2=0.9316. This strong correlation reassures us that the datasets are similar.

SWDI SL indicator (both for water year and calendar year) shows high correlation with MWD Aqueduct (respectively, r2=0.7979 and r2=0.7973)

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## Colorado River

# Estimating demands using drought indicators

Appendix

A close-up of a document

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