

Technical Guidance

Delta Watershed Water Availability Analysis Tool

This document provides technical guidance on the Delta Watershed Water Availability Analysis Tool (Delta WAA Tool), developed for conducting water availability analysis (WAA) for applications within the Sacramento-San Joaquin Delta (Delta) watershed to support findings required by Water Code Section 1260, subdivision (k); Section 1375, subdivision (d); Section 1243, subdivision (a); and Section 1243.5. The intent of the State Water Board Division of Water Rights (Division) is for Division staff to use the Delta WAA Tool to evaluate if there is water available for appropriation for a proposed water right permit, primarily for applications seeking a permanent allocation of water. WAA methods vary on a case-by-case basis depending on project specifics. Division staff use of the Delta WAA Tool to evaluate water availability for a specific application does not preclude an applicant from conducting an independent analysis, including use of another methodology. Applicants are strongly encouraged to consult with Division staff before preparing a WAA.

Water Availability Analysis in the Delta Watershed

WAAs provide information to support California Water Code findings demonstrating the availability of water for a new appropriation, including consideration of the amount of water required to remain instream for public trust resources (e.g. fisheries, recreation) and compliance with water quality objectives. WAAs are generally comprised of two major steps: estimating unimpaired flow, and accounting for demand from senior diverters and instream flow / water quality objectives. General resources for performing WAAs for water rights permitting are available on the Division's website.¹ This document addresses how the Delta WAA Tool is used to assess water availability for applications in the Delta watershed. Specific considerations related to supply and demand data are addressed in additional technical guidance, linked below.

The Delta WAA Tool is based on the framework of the State Water Board's Water Unavailability Methodology for the Delta Watershed (January 2023)¹, and provides a general estimate of the amount of water that may be available to supply a new appropriation by balancing modeled patterns of unimpaired runoff against average patterns of observed diverter demand. In addition to senior diverter demand, the Delta WAA Tool accounts for adopted and reasonably foreseeable updates to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan).

Supply Representation

The Delta WAA Tool uses unimpaired streamflow data developed for use in CalSim 3 to represent Delta Watershed hydrology over a 100-year period based on observed data

¹https://www.waterboards.ca.gov/drought/drought_tools_methods/delta_method.html



from WY 1922 through WY 2021. CalSim 3 is a model used to simulate hydrology and Central Valley Project (CVP) and State Water Project (SWP) operations within the Delta watershed. As part of the 2023 Delivery Capability Report², the California Department of Water Resources (DWR) developed CalSim 3 hydrology under five different climate scenarios, including historical hydrology, an ‘adjusted historical’ hydrology dataset which captures observed interannual variability while representing current hydrologic conditions, and three “risk-informed” future climate scenarios that simulate 2043 conditions under 50th, 75th, and 95th percentile level-of-concern scenarios from a water supply perspective.³ The Delta WAA Tool is typically used to simulate supply scenarios using the adjusted historical hydrology dataset to represent current conditions and the 50th percentile level-of-concern scenario for 2043 to represent future climate conditions.

Demand Representation

The Delta WAA Tool includes Bay-Delta Plan instream flow requirements as well as senior diverter demand for the entire Delta Watershed.

Bay-Delta Plan Instream Flow Requirements

The Bay-Delta Plan identifies beneficial uses of water in the Bay-Delta, water quality objectives for the reasonable protection of those beneficial uses, and a program of implementation for achieving the water quality objectives. The Delta WAA Tool includes instream flow requirements associated with Decision 1641 (D-1641) and the adopted and reasonably foreseeable updates to the Bay-Delta Plan.

Decision 1641 Flow Requirements

The State Water Board adopted revised D-1641 in 2001 conditioning the water rights of the State Water Project and Central Valley Project (Project) to meet specified flow and water quality objectives included in the Bay-Delta Plan, including inflow, Delta outflow, salinity (measured as electrical conductivity (EC) and chloride), and Project operational requirements. These objectives vary by water year type and month⁴ and whichever requirement is driving Project operations is said to be the ‘controlling’ standard. In any given month a different standard might be ‘controlling’.

Under many conditions, the D-1641 requirements are incidentally met. When they are not, the Projects must take action to meet the requirements by either reducing exports, bypassing inflows to their reservoirs or, at times, releasing water from storage. When the Projects are releasing previously stored water to meet flow or water quality

²<https://data.cnra.ca.gov/dataset/finaldcr2023>

³<https://data.cnra.ca.gov/dataset/finaldcr2023/resource/e41f531d-dace-4d37-b52e-35a6ddd2224e>

⁴See D-1641, Tables 1-3 for an explanation of the various water quality objectives: https://www.waterboards.ca.gov/waterrights/water_issues/programs/compliance_monitoring/sacramento_sanjoaquin/docs/d1641_table3.pdf



requirements, curtailments under Standard Water Right Term 91⁵ are triggered for water right holders with a priority date more junior than approximately 1965. New water right permits in the Delta watershed, with limited exceptions, are expected to be subject to Term 91 diversion restrictions. This dynamic has been represented in a simplified manner in the Delta WAA Tool to account for months when water availability would be limited by Term 91 diversion restrictions.

Table 1 - D-1641 flow, EC, and chloride requirements used in the Delta WAA Tool

D-1641 Requirement	Parameter	Compliance Location	Timing	D-1641 Reference	
Delta Inflow and Delta Outflow	Table 3 Delta Outflow	Net Delta Outflow Index (NDOI)	-	Jul – Jan	Table 3
	Table 4 Delta Outflow	NDOI or EC ¹	NDOI or salinity at a specified location	Feb – Jun	Table 4
	Sac @ Rio Vista	Flow rate	Rio Vista	Sep – Dec	Table 3
	SJR @ Vernalis	Flow rate	Vernalis	Oct; Feb - Jun	Table 3
Electrical Conductivity	Sac @ Emmaton	Conductivity	Emmaton	Apr - Aug	Table 2
	SJR @ Jersey Point	Conductivity	Jersey Point	Apr - Aug	Table 2
Chloride	Contra Costa Canal	Chloride	Rock Slough	Oct - Sep	Table 1

¹The Table 4 Delta outflow requirements require a certain number of days of compliance with either a daily or 14-day running average EC or 3-day running average NDOI at specified locations depending on hydrology.

Update to the Bay-Delta Plan

The Delta WAA Tool accounts for the 2018 updates to the Bay-Delta Plan, which require 40 percent of unimpaired flow to be maintained in the Stanislaus, Tuolumne, and Merced Rivers from February through June, as well as the reasonably foreseeable updates to the Bay-Delta Plan for the Sacramento River and its tributaries, Delta eastside tributaries including the Calaveras, Cosumnes, and Mokelumne rivers, and the Delta which could require flows of 55 percent of unimpaired flow within a range between 45 to 65 percent unimpaired flow to be maintained year-round. These flows are represented in the Delta WAA Tool by reducing February-June unimpaired flows (i.e. supply) by 40 percent for the Stanislaus, Tuolumne, and Merced subwatersheds, and reducing year-round unimpaired flows by 55 percent for the Putah, Cache, Stony, Sacramento Bend, Feather, Yuba, Bear, American, Upper Sacramento Valley, Sacramento Valley Floor, Calaveras, Cosumnes, and Mokelumne subwatersheds.

⁵https://www.waterboards.ca.gov/waterrights/water_issues/programs/permits/terms/permitterm091.pdf



Diverter Demand Dataset

WAAs to inform permitting decisions consider demand from senior diversions, such as riparian, pre-1914 appropriative and post-1914 appropriative water rights. Senior demand also includes pending applications with a priority date senior to the application filing. Pending applications include those filed by parties seeking to acquire water right permits and State-Filed Applications (SFAs), a special type of application held in trust by the State Water Board. As SFAs can involve large volumes of water, the Delta WAA Tool has been designed to evaluate water availability under scenarios with and without inclusion of SFA demand.

Permitting WAAs should assume that existing right holders fully utilize their rights in order to determine the volume of unappropriated water remaining for a new appropriation. The Delta WAA Tool includes a representation of all relevant senior demand in the Delta watershed contained in the Division's Electronic Water Rights Information Management System (eWRIMS).

The Delta WAA Tool aggregates senior diverter demand at the subwatershed level, meaning that diversions are not spatially explicit within a given subwatershed. The Delta WAA Tool excludes demand for non-consumptive uses of water, such as direct diversion for hydropower production, when these supplies are returned to the source stream. The Delta WAA Tool also includes a return flow factor for direct diversions. Demand for riparian and pre-1914 appropriative claims is based on a quality-controlled demand dataset which includes reported diversions for the years 2018-2019. For each water right, the monthly diversion pattern from 2018 or 2019, whichever annual total was larger, was applied. For post-1914 appropriative water rights, reported diversions from the years 2000-2021 were used to develop average patterns of monthly diversions for each water right. These patterns were applied to the annual face value of each water right to estimate average monthly diversions. The Delta WAA Tool senior diverter demand dataset may be updated over time following State Water Board staff review of reported diversions for individual riparian and pre-1914 appropriative claims and post-1914 appropriative water rights.

Interpreting Results

Water availability in the Delta Watershed can be limited by constraints at different scales. The Delta WAA Tool separates the Delta watershed into 20 subwatersheds, including 17 "headwater" subwatersheds and three "valley floor" subwatersheds, and demonstrates how much water could be appropriated in each subwatershed. This subwatershed-scale analysis demonstrates how much water could be appropriated within a given subwatershed but does not demonstrate water availability at points of diversion (PODs) located upstream of a subwatershed outlet or along smaller tributary streams. In order to provide a comprehensive understanding of likely water availability for a specific application, State Water Board Staff often use a paired, supplementary analysis to assess water availability at the proposed POD. Future enhancements may expand the functionality of the Delta WAA Tool to evaluate water availability at intermediate scales.



When considering results from the Delta WAA Tool, it is important to keep in mind that water availability findings don't correspond to specific calendar years because the Delta WAA Tool applies long term average patterns of demand to modeled patterns of unimpaired flow developed to represent stationary climatic conditions. Rather, the results can be viewed as a reasonable assumption for the probability of water availability under a given hydrologic regime (e.g. current conditions hydrology, or future climate hydrology).

Simplifying Assumptions

The Delta WAA Tool is a simplified representation of a complex system and the results from any analysis making use of the Delta WAA Tool should be viewed in the context of the assumptions and limitations involved in its development. Relevant assumptions and limitations are described in detail in documentation developed for project-specific analyses (available upon request) and these include:

- Calculations are performed using a monthly timestep;
- Supply and demand are aggregated at the subwatershed scale;
- Reservoir operations are not accounted for;
- Project-specific operations are not accounted for;
- D1641 flow requirements are translated into monthly flow volumes;
- Statement demand is based on reported diversions for a limited number of years;
- Post-1914 appropriative demand is represented as a fixed pattern based on face values and averages of reported diversions;
- Pending application demand is evenly distributed across the proposed diversion season;
- Demand from water rights in adjudicated basins is not accounted for.

Additional Resources

[Delta Watershed Water Availability Analysis Tool Climate Scenario Analysis Staff Report](#)

[Technical Guidance on Delta Watershed Water Availability Analysis Climate Scenario Analysis](#)

[Technical Guidance on Delta Watershed Water Availability Analysis Demand Considerations](#)

[Technical Guidance on Delta Watershed Water Availability Analysis Analytical Framework](#)

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