Technical Appendix A: Methodology Spreadsheet Description

This appendix outlines the process used to assess water supply and demand in the Sacramento-San Joaquin Delta (Delta) watershed and describes each input used for the analysis and output produced by the analysis. Each section of this document describes a separate tab in the Delta Water Unavailability Methodology Excel workbook ("spreadsheet"), the significance of each column, and data sources. While the spreadsheet posted on the Delta Drought webpage represents a single "snapshot" analysis conducted to determine water unavailability on a given day, it contains multiple interactive elements which allow the user to run a similar analysis with different input data. Each tab that contains static data (e.g., multipliers, streamflows, or water right records) indicates in the top-left cell the date that data was last updated. Archived spreadsheets containing the analyses supporting curtailments are available for each specific day that a weekly update was issued. These spreadsheets are available on the Water Board's File Transfer Protocol (FTP) site; see the Delta Drought webpage for instructions to request credentials to access the FTP site.

NOTE: The spreadsheet is a large file with links to external online files and many complex formulas. It performs best with automatic formula calculation turned off so that recalculations can be done manually rather than each time a single value is changed.

Subwatersheds

This tab shows how Hydrologic Unit Code Level 8 (HUC8) watersheds from the U.S. Geological Survey (USGS) Watershed Boundary Database (WBD) are categorized into "subwatersheds" for the purpose of this analysis. It also indicates the primary watershed that each subwatershed is tributary to, as well as the subwatershed "type" (headwater or lower) assigned to each. These relationships underpin much of the analysis. A map of Delta subwatersheds can be found in Figure 5 of the main report.

Field Name(s)	Definition & Methodology	Data Source(s)
Watershed	The two primary river systems in the Delta watershed: Sacramento and San Joaquin.	USGS WBD

Field Name(s)	Definition & Methodology	Data Source(s)
Subwatershed	An area encompassing one or more HUC8 watersheds, determined based on geospatial mapping of stream and diversion locations and the unavailability of full natural flow (FNF) supply locations ("gages"). Subwatershed is the smallest area over which water unavailability is determined.	Staff-determined
Subwatershed Type	Subwatersheds are categorized as either 'headwater' or 'lower' for the purpose of this analysis: - A headwater subwatershed contains water demands that can only be met by water supplies in the subwatershed (i.e., there are no tributaries flowing into the subwatershed from another subwatershed). - A lower subwatershed can receive water supplies from outside its boundaries (i.e., it is located downstream of the headwaters).	Staff-determined
HUC8[1]	The boundaries of watersheds which contain land that all drains to the outlet, as delineated and classified by the USGS. This delineation provides a consistent boundary for classifying water supplies and demands for the analysis.	USGS WBD

To the right of the data table is a key for the various colors used for each tab of the spreadsheet. **Yellow tabs** contain data fields that can be updated or revised to change the analysis; cells with modifiable data are highlighted yellow in those tabs. **Blue tabs** contain data related to water supply, **green tabs** contain data related to water demand, and **orange tabs** contain analyses of water unavailability at various scales that are used to determine water right curtailments.

[1] As described in Section 2.3.1 of the main report, any records assigned to the Upper Mokelumne, Middle San Joaquin-Lower Chowchilla, Fresno River, or Upper Calaveras California HUC8s (headwater subwatersheds) in the spreadsheet were based on a closer analysis of Hydrologic Unit Code Level 10 (HUC10) boundaries and other criteria. Points of Diversion (PODs) located in these HUC8s that did not meet these criteria are assigned to the Lower San Joaquin River or San Joaquin Delta HUC8s (lower subwatersheds) in this spreadsheet.

Supply Past

This tab contains past supply data for the current water year, which is only used in the water unavailability analyses if the user-specified date range (see Supply Forecast section) contains dates in the past. Water supply observations are obtained from the California Nevada River Forecast Center (CNRFC) and consist of full natural flow (FNF, also known as "unimpaired flow") estimates in thousand acre-feet (TAF). Values must be manually entered into this tab; direct links to individual datasets for each site are provided in the spreadsheet.

Supply Forecast

This tab contains forecasted supply data for a user-specified date range. Water supply forecasts are obtained either from the Department of Water Resources (DWR) Bulletin 120 Water Supply Forecast (B-120) or from CNRFC and consist of FNF estimates. Direct links to individual forecast datasets are provided in the spreadsheet. Supply volumes are provided in units of TAF.

This tab is grouped vertically into three tables separated by gray rows. The top table contains user-specified start and end dates (inclusive) over which water supply and demand are calculated. The dates entered in these cells may range from the start date of the current water year (see Supply Past section) to one year from the current date (e.g., if the spreadsheet is modified on February 1, 2022, any date between October 1, 2021 and February 1, 2023 could be entered). To compute supply for the specified period using CRNFC data, daily past and/or forecasted supply values are added for dates within the period. To compute supply using B-120 data, monthly forecasts are converted to an average daily demand for each month, which is multiplied by the number of days in each month that fall within the specified period to calculate a total volume of water.

The top table also allows the user to select a supply forecast data source; selecting "CNRFC" will use those forecasts for all subwatersheds, while selecting "B120" will use forecasts for the ten major subwatersheds and CNRFC for the smaller ones. Finally, in the top table the user can select the calendar year of quality-controlled demand data from 2018 or 2019 (see Appendix B) to use in the analysis. Finally, the top table allows the user to select a demand scenario (i.e., which diversions will contribute to demand evaluated): only direct diversions, only storage diversions, or the sum of direct and storage diversions, which was the basis for all previous analyses (see Final Demand section for more information on disaggregated direct and storage diversions).

The second table allows the user to select one of seven supply exceedance probabilities for each subwatershed: 99% (equivalent to the minimum forecast), 90%, 75%, 50% (equivalent to the median forecast), 25% 10%, and 1% (equivalent to the

maximum forecast). Alternatively, a “Custom” forecast can be selected to use user-specified volumes entered in the second row.

The third table contains forecasted FNF values for the user-specified time period for each CNRFC gage in each subwatershed. The row of gage names includes direct links to each forecast comma-separated value (CSV) file on the CNRFC website, which are updated daily; to update the forecasts in the spreadsheet, the user must click these links (or open all of them using Excel’s Edit Links window in the Data toolbar) to open all forecast CSVs, then recalculate these formulas. Forecasts are presented as volumes for each of the seven forecast exceedance probabilities. Each forecast exceedance is calculated from the 41 different “traces” for the respective gage in the fourth table; the 75% through 10% exceedances are calculated using Excel’s exclusive percentile function, which is equivalent to computing plotting positions with the Weibull formula.

The fourth table contains forecasted FNF values for each CNRFC gage. Forecasts are presented in the form of 41 different “traces” for each gage each day; this table contains the total forecasted supply over the user-specified time period in the top table, referencing the online forecast CSV file for each gage. CNRFC forecasts are presented as daily average FNF in thousand cubic feet per second (TCFS), which are converted to volumes of TAF in the spreadsheet.

The fifth table contains B-120 forecasted FNF values for the ten major subwatersheds, as published in monthly Water Supply Index (WSI) or weekly Distribution (DIST) products released January through June. These values must be entered manually, and the far-left column contains links to forecast data sources for each subwatershed. While monthly WSI products provide monthly forecasts for all six exceedance probabilities, weekly DIST products provide only 50% monthly forecasts. DIST products also include forecasts for the Mokelumne and Cosumnes subwatersheds, which are not provided in WSI products. The third column in this table contains the calculated B-120 forecast for the user-specified period based on daily averages, including both forecasted and past values; B-120 values for past months are calculated FNF, which are equal for all forecast exceedances. While CNRFC forecasts are available up to one year from the current date, B-120 forecasts are only available until the end of September of the current water year.

Final Supply

This tab contains water supply data from the Supply Forecast tab that is reformatted and computed to represent available supply data for each of the Delta watershed’s 20 subwatersheds. This tab also contains intermediate supply calculations which are used in water unavailability analyses at the headwater and subwatershed scales. All supply volumes in this tab are provided in units of acre-feet (AF).

This tab is grouped vertically into four tables separated by gray rows. The top table contains water supply forecasts for seven exceedance probabilities for each subwatershed: 99% (equivalent to the minimum forecast), 90%, 75%, 50% (equivalent to the median forecast), 25% 10%, 1% (equivalent to the maximum forecast), or a user-specified Custom forecast (see Supply Forecast section). The top row is populated with forecasts based on the user-specified exceedance forecast for each subwatershed (see Supply Forecast section). Water supply computations for each subwatershed based on the forecasted values in the Supply Forecast tab are explained in the table below. Some subwatersheds are computed using Gap Filling (GF) factors that are explained in the next section.

Field Name(s)	Definition & Methodology	Data Source(s)
Exceedance	The probability of the water supply over the user-specified period exceeding the given volume.	--
Sacramento Bend	Supply forecasts for the Sacramento River at Bend subwatershed: - CNRFC gage BDBC1. - B-120 SRSWI or DIST (50% only).	CNRFC, B-120
Stony	Supply forecasts for the Stony Creek subwatershed (at East Park Reservoir): - Augmented, CNRFC gage EPRC1 * GF Stony Increase Factor.	CNRFC w/ staff adjustments
Cache	Supply forecasts for the Cache Creek subwatershed (above Rumsey): - Extrapolated, Stony * GF Cache-Stony Ratio.	Staff estimates
Upper Feather	Supply forecasts for the Upper Feather River subwatershed (at Lake Oroville): - CNRFC gage ORDC1. - B-120 SRSWI or DIST (50% only).	CNRFC, B-120
Yuba	Supply forecasts for the Yuba River subwatershed (at Englebright Reservoir or near Smartville plus Deer Creek): - CNRFC gage HLEC1. - B-120 SRSWI or DIST (50% only).	CNRFC, B-120
Bear	Supply forecasts for the Bear River subwatershed (near Wheatland): - Extrapolated, Upper Feather * GF Bear-Yuba Ratio.	Staff estimates

Field Name(s)	Definition & Methodology	Data Source(s)
Upper American	Supply forecasts for the Upper American River subwatershed (at Folsom Lake): - CNRFC gage FOLC1. - B-120 SRSWI or DIST (50% only).	CNRFC, B-120
Putah	Supply forecast for the Putah Creek subwatershed (near Winters): - Extrapolated, Stony * GF Putah-Stony Ratio.	Staff estimates
Upper Sacramento Valley	Supply forecasts for the Upper Sacramento River Valley subwatershed (tributaries between Bend and Butte Slough, including Redbank, Elder, Thomes, Antelope, Mill, Deer, Big Chico, and Butte Creeks): - Augmented, CNRFC gages (EDCC1+TCRC1) * GF Elder-Thomes Increase Factor + (MLMC1+DCVC1+BKCC1) * GF Mill-Deer-Butte Increase Factor.	CNRFC w/ staff adjustments
Sacramento Valley Floor	Supply forecasts for the Sacramento Valley Floor subwatershed (minor east and west side tributaries between Stony Creek and the Delta, including tributaries to the Lower Feather and American Rivers): - Extrapolated, (Sacramento Bend+Upper Feather+Upper American) * GF Sacramento Valley Ratio.	Staff estimates
Sacramento Total	The sum of all subwatershed supplies in the Sacramento River watershed for the given forecast exceedance over the user-specified time period.	Calculated
Chowchilla	Supply forecasts for the Chowchilla River subwatershed (at Buchanan Reservoir): - CNRFC gage BHNC1.	CNRFC
Upper San Joaquin	Supply forecasts for the Upper San Joaquin River subwatershed (at Millerton Reservoir): - CNRFC gage FRAC1. - B-120 SJSWI or DIST (50% only).	CNRFC, B-120

Field Name(s)	Definition & Methodology	Data Source(s)
Fresno	Supply forecasts for the Fresno River subwatershed (at Hensley Lake): - CNRFC gage HIDC1.	CNRFC
Merced	Supply forecasts for the Merced River subwatershed (at Exchequer Reservoir or below Merced Falls): - CNRFC gage EXQC1. - B-120 SJSWI or DIST (50% only).	CNRFC, B-120
Tuolumne	Supply forecasts for the Tuolumne River subwatershed (at New Don Pedro Reservoir or below La Grange Reservoir): - CNRFC gage NDPC1. - B-120 SJSWI or DIST (50% only).	CNRFC, B-120
Stanislaus	Supply forecasts for the Stanislaus River subwatershed (at New Melones Reservoir or below Goodwin Reservoir): - CNRFC gage NMSC1. - B-120 SJSWI or DIST (50% only).	CNRFC, B-120
Calaveras	Supply forecasts for the Calaveras River subwatershed (at New Hogan Reservoir): - CNRFC gage NHGC1.	CNRFC
Mokelumne	Supply forecasts for the Mokelumne River subwatershed (at Pardee Reservoir): - CNRFC gage CMPC1. - B-120 DIST (50% only).	CNRFC
Cosumnes	Supply forecasts for the Cosumnes River subwatershed (at Michigan Bar): - CNRFC gage MHBC1. - B-120 DIST (50% only).	CNRFC
San Joaquin Valley Floor	Supply forecasts for the San Joaquin River Valley Floor subwatershed (including minor east and west side tributaries between the Chowchilla and American Rivers): - Extrapolation, CNRFC gages MPAC1+OWCC1+MEEC1 + (Upper San Joaquin+Merced+Tuolumne+Stanislaus)* GF San Joaquin Valley Ratio + (Mokelumne+Cosumnes) * GF San Joaquin-Mokelumne-Cosumnes Ratio.	CNRFC, staff estimates

Field Name(s)	Definition & Methodology	Data Source(s)
San Joaquin Total	The sum of all subwatershed supplies in the San Joaquin River watershed for the given forecast exceedance over the user-specified time period.	Calculated
Delta Watershed Total	The sum of all supplies in the Delta watershed for the given forecast exceedance over the user-specified time period.	Calculated
% Sacramento/ San Joaquin	The percent of total Delta watershed supply for the given forecast exceedance over the user-specified time period which came from the respective watershed.	Calculated

The second table in this tab contains calculations related to the contributions of each subwatershed to watershed-wide supply. The first row indicates if any Riparian-priority claims in each subwatershed faced water unavailability over the user-specified period (see Headwaters section). In other words, these cells identify if each subwatershed's supplies and demands should be excluded from the Watershed unavailability analysis due to lack of connectivity with the Delta watershed; they have conditional formatting to **highlight red** if the subwatershed lacks connectivity. Lower subwatersheds have static values that indicate they are never disconnected from the watershed. The second row indicates if any subwatershed's supply is less than its abandoned instream flow requirement for the user-specified period (see Instream Flows section), with conditional formatting to **highlight red** if the instream flow is greater. The fourth row calculates the volume of instream flow in excess of the FNF supply for each subwatershed; these volumes are not available to Riparian-only claims in the watershed-wide analysis (see Watersheds section). Finally, the fourth row calculates the supply from each subwatershed that contributes to the watershed-wide analysis: if the subwatershed is disconnected its contributing supply is zero, otherwise its Total Supply is equal to its Selected Supply Forecast value plus its Instream Flow in Excess of Supply value. Supply ratios for the Delta watershed are calculated based on total supply volumes for each watershed for the purpose of Legal Delta demand proration (see Watersheds section).

The third table in this tab indicates the priority date of the most senior right or claim in each subwatershed, as well as the Sacramento and San Joaquin watersheds and the Legal Delta as a whole, that would be under curtailment for the user-specified time period with the user-specified supply forecasts (see Final Supply section) and the Watershed-wide unavailability analysis (see Watersheds section below). These cells will only display "Riparian" priority if the supply in the given headwater subwatershed is forecasted to be zero; they will display "All Pre-14" if all pre-1914 appropriative water

right claims are under curtailment. Values of "Project" mean that one or more Project water rights (assumed to be the most junior in the Delta watershed) are under curtailment. These cells display "-" if no water rights or claims are under curtailment for the given subwatershed/watershed. In some cases, these cells may display the priority of a right that has no water available in that subwatershed but is not curtailed because it diverts from additional subwatershed(s) or is located in the Legal Delta; these rights are only curtailed if water is unavailable from all sources (see Curtailments section). The third table also contains calculations of the total unmet demand and excess local supply in each subwatershed; unmet demand would be zero if no rights or claims in the subwatershed face water unavailability, while excess supply would be zero if some rights or claims face water unavailability. Excess supplies from individual headwater subwatersheds may meet demands further downstream in the watershed, so the total excess supply for each watershed is less than the sum its subwatersheds. The fourth table in this tab contains a reformatted and simplified version of the third table, with priority dates of first curtailments displayed as years only.

Gap Filling

This tab contains monthly factors which are used to fill gaps in supply data for select subwatersheds, either to estimate missing past/forecasted data (extrapolation) or to adjust existing supply data (augmentation). These monthly average factors are computed outside the Methodology spreadsheet based on past supply data, and detailed methods for each subwatershed are described in the table below. Outlying values (outside the range of the overall mean plus or minus three times the overall standard deviation) are not included in the calculated monthly mean factors shown in this tab. The bottom Supply Forecast Period row contains average calculated factors for the user-specified time period (see Supply Forecast section) based on the number of days in each month that fall within the specified period.

Field Name(s)	Definition & Methodology	Data Source(s)
Month	Month of the calendar year for which the gap-filling factor applies.	--

Field Name(s)	Definition & Methodology	Data Source(s)
Cache-Stony Ratio (CSR)	Factor used to extrapolate the FNF supply for the Cache Creek subwatershed based on data for the Stony Creek subwatershed: - CSR = DWR subbasin UF3 / DWR subbasin UF4 for WY -1922-2014, removed outlying values and averaged by month. - GF Cache = CSR*(EPRC1*SIF) for WY 2015-Present and Forecasts.	Calculated
Stony Increase Factor (SIF)	Factor used to augment recent FNF supply values for the Stony Creek subwatershed to approximate the entire subwatershed's supply based on past DWR data (CNRFC gage EPRC1 is located upstream of several tributaries): - SIF = DWR subbasin UF4 / CNRFC gage EPRC1 for WYs 2013-2014, removed outlying values and averaged by month. - GF Stony = SIF*EPRC1 for WY 2015-Present and Forecasts.	Calculated
Bear-Yuba Ratio (BYR)	Factor used to extrapolate the FNF supply for the Bear River subwatershed based on data for the Yuba River subwatershed: - BYR = DWR subbasin UF10 / CDEC gage YRS for WY -1922-2014, removed outlying values and averaged by month. - GF Bear = BYR*YRS for WY 2015-Present and Forecasts.	Calculated

Field Name(s)	Definition & Methodology	Data Source(s)
Elder-Thomes Increase Factor (ETIF)	Factor used to augment recent FNF supply values for west side tributaries in the Upper Sacramento River Valley subwatershed to approximate the supply of all west side tributaries based on past DWR data (CNRFC gages EDCC1 and TCRC1 do not include all west side tributaries): - ETIF = DWR subbasin UF5 / (CNRFC gages EDCC1+TCRC1) for WYs 2013-2014, removed outlying values and averaged by month. - GF Upper Sacramento Valley West = ETIF*(EDCC1+TCRC1) for WY 2015-Present and Forecasts.	Calculated
Mill-Deer-Butte Increase Factor (MDBIF)	Factor used to augment recent FNF supply values for east side tributaries in the Upper Sacramento River Valley subwatershed to approximate the supply of all east side tributaries based on past DWR data (CNRFC gages MLMC1, DCVC1, and BKCC1 do not include all east side tributaries): - MDBIF = DWR subbasin UF7 / (CNRFC gages MLMC1+DCVC1+BKCC1) for WYs 2013-2014, removed outlying values and averaged by month. - GF Upper Sacramento Valley East = MDBIF*(MLMC1+DCVC1+BKCC1) for WY 2015-Present and Forecasts.	Calculated
Putah-Stony Ratio (PSR)	Factor used to extrapolate the FNF supply for the Putah Creek subwatershed based on data for the Stony Creek subwatershed: - PSR = DWR subbasin UF2 / DWR subbasin UF4 for WY 1922-2014, removed outlying values and averaged by month. - GF Putah = PSR*(EPRC1*SIF) for WY 2015-Present and Forecasts.	Calculated

Field Name(s)	Definition & Methodology	Data Source(s)
Sacramento Valley Ratio (SRVR)	Factor used to extrapolate the FNF supply for the Sacramento River Valley Floor subwatershed based on data for the Sacramento, Feather, and American Rivers (no recent or projected supply data exists for the Valley Floor): - SRVR = DWR subbasin UF1 / CDEC gages SBB+FTO+AMF for WY 1922-2014, removed outlying values and averaged by month. - GF Sacramento Valley Floor = SRVR*(SBB+FTO+AMF) for WY 2015-Present and Forecasted.	Calculated
San Joaquin-Mokelumne-Cosumnes Ratio (SJMCR)	Factor used to extrapolate the FNF supply for east side tributaries in the San Joaquin River Valley Floor subwatershed based on data for the Mokelumne and Cosumnes Rivers (no recent or projected supply data exists for the Valley Floor): - SJMCR = DWR subbasin UF12 / CDEC gages MKM+CSN for WY -1922-2014, removed outlying values and averaged by month. - GF San Joaquin Valley Floor East = SJMCR*(MKM+CSN) for WY 2015-Present and Forecasted.	Calculated
San Joaquin-Merced-Tuolumne-Stanislaus Ratio (SJMTSR)	Factor used to estimate the FNF supply for west side tributaries in the San Joaquin River Valley Floor subwatershed based on data for the San Joaquin, Merced, Tuolumne, and Stanislaus Rivers (no recent or projected supply data exists for the Valley Floor): - SJMTSR = DWR subbasin UF24 / CDEC gages SJF+MRC+TLG+SNS for WY -1922-2014, removed outlying values and averaged by month. - GF San Joaquin Valley Floor West = SJMTSR*(SJF+MRC+TLG+SNS) for WY 2015-Present and Forecasted.	Calculated

Instream Flows

This tab contains instream flow requirements for each subwatershed, which are used to increase available supplies to account for the abandonment of these dedicated flows below their intended reach. Flow requirements are sourced from the Division's Sacramento Valley Water Allocation Model (SacWAM) and Water Supply Effects (WSE) model. Only requirements which crossed subwatershed boundaries or ended near the bottom of a subwatershed (less than 30 river miles from its mouth) are included. If the instream flow reach ends higher up in the subwatershed, such that it may meet demand in that subwatershed itself, the abandoned instream flow is not considered in the analysis. The source of each instream flow requirement is detailed in the Note column.

All flow values in the Instream Flows table are given in average cubic feet per second (CFS) by month, with the exception of the Supply Forecast Period column which converts flows for the user-specified time period (see Supply Forecast section) to a volume in acre-feet (AF) using daily averages and the number of days in each month that fall within the specified period. The supply contribution of each subwatershed to the watershed-wide analysis is represented by the greater of either the forecasted full natural flow (FNF) or the abandoned instream flow in this table for the respective subwatershed (see Final Supply section). In other words, during very dry conditions instream flows are assumed to consist of supplemental reservoir releases which would replace available natural flows when abandoned below their intended reach. During wet conditions instream flows are assumed to consist of bypassed natural flows, which would not contribute abandoned water in excess of FNF below their intended reach.

Demand

This tab contains monthly water diversion (demand) data for water right records in the Delta watershed. This data originated from the State Water Board's Electronic Water Rights Information Management System (eWRIMS) database. Technical Appendix B describes the process used to select these water right records and quality-control reported data to produce this dataset. In this tab each row quantifies reported water diversions for a single water right or claim in each month of the 2018 and 2019 calendar years, which are used as proxies for 2021 water demand in this analysis. Demand data are further distributed to individual points of diversion (PODs) and account for return flows in the Final Demand tab (see Final Demand section).

Field Name(s)	Definition & Methodology	Data Source(s)
Application ID	Water Right Application ID; each water right record on file with the State Water Board (Board) is assigned a unique Application ID.	eWRIMS database

Field Name(s)	Definition & Methodology	Data Source(s)
Water Right Type	Water right or claim type (see Appendix B for additional information on the different Statement assigned categories): - Appropriative: A post-1914 appropriative water right pursuant to a permit or license from the Board. - Statement of Div[ersion] and Use (Riparian): A riparian water right claim. - Statement of Div[ersion] and Use (Riparian or Pre-1914): A riparian and/or pre-1914 appropriative water right claim. - Statement of Div[ersion] and Use (Pre-1914): A pre-1914 appropriative water right claim. - Statement of Div[ersion] and Use (Reserved): A federal reserved water right claim. - Statement of Div[ersion] and Use (Other): Any other category of water right claim (e.g., court decreed/adjudicated or contract/agreement). - Statement of Div[ersion] and Use (Unclassified): A water right claim with an unspecified category. - Statement of Div[ersion] and Use (Pending): A statement filed to document diversions while an appropriative water right application is pending. - Stockpond or Federal Stockpond: A water right for a small livestock watering impoundment constructed before 1969 (Water Code §1226). - Registration (Domestic, Livestock, or Cannabis): Water rights issued for certain small projects (Water Code §§1228-1229). - Federal Claims: A claim of federal reserved water rights filed before July 1, 1984 (Water Code §1227). - Section 12 File: A specific type of water right, similar to a pre-1914 appropriative water right claim.	eWRIMS database w/ staff adjustments
Water Right Status	Status of the water right or claim:	eWRIMS database

Field Name(s)	Definition & Methodology	Data Source(s)
	- Licensed: A post-1914 appropriative water right for which the Board has issued a license. - Permitted: A post-1914 appropriative water right for which the Board has issued a permit. - Claimed: A water right claimed by the owner (i.e., Statements of Diversion and Use) which the Board has not verified. - Certified: A Stockpond, Federal Stockpond, or Section 12 File water right for which the Board has issued a certificate. - Registered: A Domestic, Livestock, Cannabis, or other small water right Registration which has been approved by the Board.	
Primary Owner	Name of the primary owner of the water right record.	eWRIMS database
Beneficial Use(s)	Concatenated list of the beneficial use(s) of water associated with the water right record, as defined by Water Code §§660-669.	eWRIMS database
Priority Date	The priority date of the water right or claim (YYYY/MM/DD): - Appropriative, Federal Stockponds, Cannabis/Domestic/Livestock Registration: The earlier of the Application Acceptance Date and Application Received Date values. - Statements (Riparian): 'Riparian' are assumed to have a more senior priority date than all appropriative water rights and claims. - Statements (Pre-1914, 'Riparian or Pre-1914', Pending, Unclassified, or Other): Assumed to be January 1st of the earliest claimed Year Diversion Commenced attribute, which is present in both Initial Statements of Diversion and Use and annual Supplemental Statements of Diversion and Use. - Stockpond: The earlier of the Application Acceptance Date or Application Received Date values, if this date is after 1977. Otherwise, assumed to be January 1st of the Year Diversion First Commenced value. - Federal Claims: Assumed to be January 1st of the Year Diversion First Commenced value if	eWRIMS database

Field Name(s)	Definition & Methodology	Data Source(s)
	this date is before 1914. Otherwise, the earlier of the Application Acceptance Date and Application Received Date values. - Section 12 File: The Priority Date value.	
Assumed Priority Date	The date which carries over to all other parts of the spreadsheet. Equal to the Priority Date except for certain rights and claims: - Statements ('Riparian or Pre-1914' or Other): Assumed to be 'Riparian' because the statement does not contain sufficient information to designate a volume of demand to each type of claim. Conservatively assumed to have a more senior priority date than all appropriative water rights and claims. [2] - Statements (Pre-1914 or Unclassified) with a Priority Date after 1914: In 1914 but with the relative order of dates preserved by assigning sequential dates to each starting with 1914/01/02. - Statements (Pending): 'Pending' and assumed to be the most junior of all records, because the statement was only filed to document diversions while an appropriative water right application is pending. - Appropriative Project water rights listed in Board Decision 1641 (excepting 2 New Melones Project rights, per Board Decision 1422): 'Project' and assumed to be junior to other appropriative water rights and claims.	Staff-determined
Face Value (AFA)	The maximum volume of water authorized for diversion annually under an appropriative water right. Statements, including Riparian and Pre-1914 Appropriative claims, do not have an assigned face value; for the purposes	eWRIMS database

[2] For claims in the Legal Delta, this categorization of colorable riparian claims is consistent with recent judicial decisions (see e.g., *Modesto Irrigation District v. Heather Robinson Tanaka*, 48 Cal.App.5th 898 (2020)) and with the legal principles described in a memorandum dated December 15, 2017, regarding Issues Related to Overlap between Pre-1914 and Riparian Water Right Claims in the Delta and available on the website of the Office of the Delta Watermaster (Overlap Memo).

Field Name(s)	Definition & Methodology	Data Source(s)
	of this analysis, their face value is assumed to be zero.	
2018/2019 Total Direct (AFA)	The total reported direct diversion of the water right record in calendar year 2018 or 2019. Values for select water right records were manually reviewed by staff and corrected as necessary (see Direct Review columns).	eWRIMS database w/ staff adjustments
2018/2019 Total Storage (AFA)	The total reported diversion to storage of the water right record in calendar year 2018 or 2019. Values for select water right records were manually reviewed by staff and corrected as necessary (see Storage Review columns).	eWRIMS database w/ staff adjustments
2018/2019 Total Diversion (AFA)	The total reported diversion of the water right record in calendar year 2018 or 2019 (sum of Total Direct and Total Storage columns).	eWRIMS database w/ staff adjustments
2018/2019 Direct/Storage Review	Indicates whether and how the 2018 or 2019 reported diversion was reviewed or corrected by staff: - Estimated Downward: Staff reviewed and corrected the user-reported diversion value to be higher than reported. - Estimated Upward: Staff reviewed and corrected the user-reported diversion value to be lower than reported. - Reviewed Not Changed: Staff reviewed the reported diversion value but did not apply a correction. - Not Reviewed: Staff did not manually review the annual report.	Staff-determined
2018/2019 Jan-Dec Direct (AF)	The total reported direct diversion of the water right record in each month of calendar year 2018 or 2019. Values for select water right records were manually reviewed by staff and corrected as necessary (see Direct Review columns).	eWRIMS database w/ staff adjustments
2018/2019 Jan-Dec Storage (AF)	The total reported diversion to storage of the water right record in each month of calendar year 2018 or 2019. Values for select water right records were manually reviewed by staff	eWRIMS database w/ staff adjustments

Field Name(s)	Definition & Methodology	Data Source(s)
	and corrected as necessary (see Storage Review columns).	

Return Flows

This tab contains factors which are used to adjust demand data to account for return flows in each subwatershed. Return Flow factors are calculated for each month in the Sacramento and San Joaquin River watersheds as the percent of diversion which returned as flow in the same month (Factor = Total Diversions / Total Return Flows). Data used to determine the factors, which include return flows from both agricultural and municipal water uses, were sourced from CalSim 3 results published by DWR.

All values in the Return Flows table are given as multipliers (i.e., a value of 0.6 means that the analysis will reduce demands in the given subwatershed in the given month by 40%). Demand values in the analysis are adjusted by multiplying monthly direct diversion demand for a given water right or claim by the monthly factor for the appropriate subwatershed where it diverts; return flows are not applied to reduce demands for diversions to storage. The Methodology currently only applies return flow factors to reduce demands in lower valley portions of the Delta watershed (the Sacramento Bend, Upper Sacramento Valley, Sacramento Valley Floor, and San Joaquin Valley Floor subwatersheds) because return flows from diversions in headwater subwatersheds are not expected to be available in the same subwatershed (i.e., they return further downstream on the valley floor). Demand adjustments are done in the Final Demand tab of the spreadsheet (see next section).

Final Demand

This tab contains monthly demand data for water rights and claims in the Delta watershed, modified from the Demand tab (see previous section) to account for return flows and the distribution of demand to individual points of diversion (PODs). This demand separation is necessary because annual water right reports, and thus the data in the Demand tab of the spreadsheet, are provided for each water right record rather than each POD. While the data necessary to separate demands to each POD originated from the Division's eWRIMS database, some staff judgement is required to develop the Direct and Storage Weights listed in this tab based on the nature of PODs associated with each right. Demand adjustments to account for return flows are sourced from the Return Flows tab of the spreadsheet. Each row quantifies monthly demands from a single water right or claim's POD. This tab also contains demands calculated for the user-specified period using daily averages multiplied by the number of days in each month that fall within the specified period (see Supply Forecast section).

Field Name(s)	Definition & Methodology	Data Source(s)
Application ID	Application ID of the water right or claim, sourced from the Demand tab. Water rights or claims with multiple PODs are split into multiple rows, one for each POD.	eWRIMS database
Water Right Type	Water right or claim type, sourced from the Demand tab.	eWRIMS database w/ staff adjustments
Primary Owner	Name of the primary owner of the water right record.	eWRIMS database
POD ID	Unique numeric identifier for the POD.	eWRIMS database
Latitude/ Longitude	Latitude and longitude coordinates of the POD location (NAD83).	eWRIMS database
HUC8	The name of the Hydrologic Unit Code Level 8 watershed where demand from the POD. Water right or claim PODs are automatically assigned a HUC8 value in eWRIMS based on their location. HUC8 values for some PODs in the Upper Mokelumne, Middle San Joaquin-Lower Chowchilla, and Fresno River were manually assigned to other HUC8s so that PODs in these subwatersheds represent headwater demands that can only be met by local supply.	eWRIMS database, USGS WBD
Subwatershed	Subwatershed where demand from the POD is row is located. Sourced from the Subwatersheds tab based on the HUC8 value.	Staff-determined
Watershed	The watershed in which the demand occurs: the Sacramento River watershed or the San Joaquin River watershed. Sourced from the Subwatersheds tab based on the HUC8 value.	eWRIMS database, USGS WBD

Field Name(s)	Definition & Methodology	Data Source(s)
Legal Delta?	Indicates if that POD is located in the Legal Delta (TRUE/FALSE). Assigned in the eWRIMS database based on the location of the POD.	eWRIMS database w/ staff adjustments
Priority Date	The priority date of a water right or claim, sourced from the 'Assumed Priority Date' field in the Demand tab (YYYY/MM/DD).	eWRIMS database w/ staff adjustments
Priority Year	The year of the priority date, sourced from the previous column. Riparian, Project, or Pending priorities are shown as such.	eWRIMS database w/ staff adjustments
Direct Weight	The percent of a given water right or claim's direct diversion demand which was assumed to occur from a given POD: - Direct Weight = (1 if an Active point of Direct Diversion, 0 if Inactive or Point of Rediversion) / (total number of Active Points of Diversion in the Delta watershed for the given record). - Equal to one for any records with only one POD. - Equal to zero for PODs associated only with storage (as long as the water right record has additional PODs associated with direct diversions). - The sum of Direct Weights for most water rights or claims is equal to one (see exception in Demand Comment column).	Staff-determined

Field Name(s)	Definition & Methodology	Data Source(s)
Storage Weight	The percent of a given water right or claim's diversion to storage demand which was assumed to occur from a given POD: - Storage Weight = (1 if an Active point of Diversion to Storage, 0 if Inactive or Point of Rediversion) / (total number of Active Points of Diversion to Storage in the Delta watershed for the given record). - Equal to one for any records with only one POD. - Equal to zero for PODs associated only with direct diversions (as long as the water right record has additional PODs associated with storage). - The sum of Storage Weights for most water rights or claims is equal to one (see exception in Demand Comment column), regardless of whether they have reported diversions to storage.	Staff-determined
Demand Comment	Additional detail about the Direct or Storage Weights or other aspects of the demand: - POD(s) outside Delta watershed: The water right or claim has one or more associated PODs which divert from streams outside the Delta watershed (sum of Direct and/or Storage Weights is less than one). - Inactive: The POD is not actively used (Direct and Storage Weights are zero). - Rediversion: The POD does not divert natural flow (Direct and Storage Weights are zero). - Project: The water right is listed in Board Decision 1641 and its Priority Date is set to 'Project.' Indicates the associated project (e.g., Shasta).	Staff-determined

Field Name(s)	Definition & Methodology	Data Source(s)
Storage Comment	The name of a storage reservoir that appears to be associated with a given POD, with terms like “Reservoir”, “Lake”, “Pond”, or “Dam” removed.	eWRIMS database, staff-determined
2018/2019 Jan-Dec Direct/Storage (AF)	Monthly demands of a given water right or claim from a given POD for a given demand year for direct diversion. Calculated as follows: (Application ID Demand for month of demand year, sourced from Demand tab) * (Return Flow Factor for subwatershed and month, sourced from Return Flows tab) * (Direct Weight)	Calculated
2018/2019 Jan-Dec Storage (AF)	Monthly demands of a given water right or claim from a given POD for a given demand year for storage. Calculated as follows: (Application ID Demand for month of demand year, sourced from Demand tab) * (Storage Weight)	Calculated
2018/2019 Period Direct/Storage/ Demand (AF)	Monthly demands (direct, storage, or the sum of both) of a given water right or claim POD for a given demand year for the user-specified period in the Supply Forecast tab, calculated based on a daily average for each month and the number of days in each month that fall within the period.	Calculated
Selected Period Demand (AF)	Monthly demand based on the user-specified Demand Scenario for the user-specified Demand Year for a given water right or claim POD over the user-specified period.	Calculated

Headwaters

This tab contains tabular water unavailability analyses for the 17 headwater subwatersheds in the Delta watershed. In each, forecasted water supplies are used to determine water unavailability for each water right or claim in order of priority date. Rights or claims which are not expected to have water available to meet their demands

due to limited local supplies are flagged for the receipt of a notice of water unavailability or curtailment order, and these unmet demands are excluded from the Watershed-level analysis (see next section). If the Headwaters Analysis indicates that any Riparian claims of right (senior demands) would face water unavailability, all supplies and demands from that subwatershed are excluded from its respective Watershed analysis (see calculations in Final Supply section). In other words, these streams are assumed to not have connectivity to the Delta watershed due to senior demands exceeding all available water supplies.

This analysis is set-up for each headwater subwatershed as follows:

1. The water rights and claims listed in the Final Demand tab of the spreadsheet are grouped by subwatershed.
2. Any rights or claims located in the Legal Delta (Legal Delta? = TRUE) are excluded; this only occurs in the furthest downstream reaches of the Putah Creek, Stanislaus River, Calaveras River, Mokelumne River, and Cosumnes River headwater subwatersheds. Water unavailability for these rights or claims is only analyzed in the Watershed analyses, as they are assumed to have access to water from both the Sacramento and San Joaquin Rivers and not be limited by local supplies.
3. Any duplicate records (i.e., with the same Application ID, Subwatershed, and Legal Delta? values) are merged; this occurs for any records with multiple PODs in the same subwatershed. All Riparian-priority claims in each subwatershed are also merged since water unavailability is not determined for individual Riparian-priority claims; they are merged into two distinct categories based on their Water Right Type.
4. Any records with total Direct and Storage Weight (see Final Demand section) sums of zero for the given Application ID, Subwatershed, and Legal Delta? values (i.e., with only inactive PODs or points of rediversion in the given area) are removed to ensure that water availability for these rights or claims is analyzed only based on where they divert natural flow. This affects only three rights owned by the U.S. Bureau of Reclamation for Black Butte Reservoir on Stony Creek, New Melones Reservoir on the Stanislaus River, and Hensley Lake on the Fresno River.
5. Rights and claims in each subwatershed are sorted by priority date, with the most senior rights or claims first: Riparian, Pre-1914 Appropriative, Appropriative, Project (see the description of Assumed Priority Dates for certain Statements in the Demand section). All Riparian claims of right are assumed to have senior priority over all pre-1914 appropriative claims, which are in turn assumed to have priority over all post-1914 appropriative rights.
6. For each right or claim in a subwatershed, each of the following parameters is calculated or determined: demand, cumulative supply available, water unavailability (i.e., will this right or claim receive a notice of water unavailability or

curtailment order?), demand met, and demand unmet. Demands are calculated, and thus water unavailability is evaluated, only for the user-specified time period in the Supply Forecast tab.

This tab is grouped into seventeen tables separated by black rows. Each contains the analysis for a headwater subwatershed: Sacramento River above Bend, Stony Creek, Cache Creek, Upper Feather River, Yuba River, Bear River, Upper American River, Putah Creek, Chowchilla River, Upper San Joaquin River, Fresno River, Merced River, Tuolumne River, Stanislaus River, Calaveras River, Mokelumne River, and Cosumnes River.

Field Name(s)	Definition & Methodology	Data Source(s)
Watershed	The watershed in which the demand occurs, Sacramento River or San Joaquin River. Sourced from the Final Demand tab.	USGS WBD
Subwatershed	Smallest area over which water unavailability is determined, based on one or more HUC8s. This tab contains data for only headwater subwatersheds (see Subwatersheds tab), sourced from the Final Demand tab.	Staff-determined
Application ID	Application ID of a given water right or claim, sourced from the Final Demand tab. Any duplicate Application IDs in a single subwatershed are merged.	eWRIMS database
Primary Owner	Name of the primary owner of the water right or claim, sourced from the Demand tab.	eWRIMS database
Water Right Type	Water right or claim type, sourced from the Demand tab.	eWRIMS database w/ staff adjustments

Field Name(s)	Definition & Methodology	Data Source(s)
Priority Date	The priority date of a water right or claim, sourced from the 'Assumed Priority Date' field in the Demand tab (YYYY/MM/DD). Statements with 'Riparian' priority are grouped together as two demands (either Riparian-only or 'Riparian or Pre-1914' and Other) at the top of each subwatershed, both of which are assumed to have equal senior priority. With the exception of 2 New Melones water rights, Project rights listed in Board Decision 1641 are denoted as 'Project' priority and are assumed to be junior to other appropriative demands. Statements with 'Pending' priority are assumed to be junior to all other water rights and claims and are listed at the bottom of each subwatershed.	eWRIMS database w/ staff adjustments
Demand (AF)	Demands by a given water right or claim in the respective subwatershed for the user-specified Demand Year over the user-specified time period in the Supply Forecast tab, summed from the Selected Period Demand column of the Final Demand tab. Excludes any demands in the Legal Delta.	eWRIMS database w/ staff adjustments

Field Name(s)	Definition & Methodology	Data Source(s)
Supply Cumulative (AF)	Available supply to meet a given water right or claim's Demand over the user-specified time period based on the user-specified Forecast Source. Calculated as follows: - For the first group of Riparian-only claims in each subwatershed, equal to the subwatershed's Selected Supply Forecast value from the first table in the Final Supply tab. - For the next water right or claim, the Supply Cumulative available to the previous right or claim minus the previous right or claim's Demand Potentially Met in Subwatershed (see below). - Continued for each next junior water right or claim, until all Demands are accounted for or there is no remaining water supply available.	CNRFC, B-120, staff estimates
Water Unavailable in Headwater Subwatershed?	If water is anticipated to be unavailable to a given water right or claim for the user-specified time period (TRUE/FALSE). Water is only considered unavailable if Supply Cumulative is zero (i.e., water is available even if only a portion of demand can be met by available supply). These cells have conditional formatting to **highlight red** if water is unavailable for a given right or claim.	Staff-determined

Field Name(s)	Definition & Methodology	Data Source(s)
Demand Potentially Met in Subwatershed (AF)	Amount of a given right or claim's Demand which can be met by available supply over the user-specified time period, calculated as follows: - If Supply Cumulative > Demand, equal to Demand. - If 0 < Supply Cumulative < Demand, equal to Supply Cumulative (i.e., only a portion of Demand can be met). - If Supply Cumulative = 0, equal to zero (i.e., Water Unavailable in Subwatershed).	Calculated
Demand Unmet in Subwatershed (AF)	Amount of a given right or claim's Demand which cannot be met by available water supply over the user-specified time period, calculated as follows: - If Demand Potentially Met = Demand, equal to zero. - If Demand Potentially Met < Demand, equal to Demand - Demand Potentially Met in Subwatershed. - If Demand Potentially Met in Subwatershed = 0, equal to Demand.	Calculated

Watersheds

This tab contains tabular water unavailability analyses for the Sacramento and San Joaquin River watersheds. In each watershed, total forecasted supplies are used to determine water unavailability for each right or claim in order of priority date. Demands compared in this analysis include those in headwater subwatersheds which may be met by local supplies (see previous section), as well as all demands located in lower subwatersheds and in the Legal Delta. Rights or claims which are not expected to have water available to meet their demands are flagged for the receipt of a notice of water unavailability or curtailment order. This is in addition to those flagged for receipt of a notice of water unavailability or curtailment order in the Headwaters analysis; while there may be enough water present locally to meet a given demand, those supplies may not actually be available if they are needed to supply more senior rights or claims further downstream in the watershed. Headwater subwatersheds where not all senior demands (Riparian priority) can be met by available supplies have their supplies and

demands removed from the Watershed Analysis (see Final Supply and Headwaters sections).

This analysis is set-up for each watershed as follows:

1. The water rights and claims listed in the Final Demand tab of the spreadsheet are grouped by watershed. Rights or claims in the Legal Delta (Legal Delta? = TRUE), with the exception of Riparian-only claims (Water Right Type = Statement of Div and Use (Riparian)), are present in both watersheds so that they can be prorated to each based on available supplies.
2. Any duplicate records (i.e., with the same Application ID, Subwatershed, Watershed, and Legal Delta? values) are merged; this occurs for any records with multiple PODs in the same subwatershed. All Riparian-priority claims in each watershed are also merged since water unavailability is not determined for individual Riparian-priority claims; they are merged into four distinct categories based on their Water Right Type and location outside or within the Legal Delta.
3. Any records with total Direct and Storage Weight (see Final Demand section) sums of zero for the given Application ID, Subwatershed, and Legal Delta? value (i.e., with only inactive PODs or points of rediversion in the given area) are removed to ensure that water availability for these rights or claims is analyzed only based on where they divert natural flow. This affects only four rights owned by the U.S. Bureau of Reclamation for Black Butte Reservoir on Stony Creek, New Melones Reservoir on the Stanislaus River, and Hensley Lake on the Fresno River.
4. Rights and claims in each watershed are sorted by priority date, with the most senior rights or claims first: Riparian, Pre-1914 Appropriative, Appropriative, Project (see the description of Assumed Priority Dates for certain Statements in the Demand section). All Riparian claims of right are assumed to have senior priority over all pre-1914 appropriative claims, which are in turn assumed to have priority over all post-1914 appropriative rights.
5. For each right or claim in a watershed, each of the following parameters is calculated or determined: demand (both total and headwater subwatershed demand which can potentially be met by local supplies), cumulative supply available, water unavailability (i.e., will this right or claim receive a notice of water unavailability or curtailment order?), demand met, and demand unmet. Demands are calculated, and thus water unavailability is evaluated, only for the user-specified time period in the Supply Forecast tab.

This tab is grouped into two tables separated by black rows, one for each watershed (Sacramento and San Joaquin).

NOTE: Though this tab evaluates water unavailability for any user-specified time period entered in the Supply Forecast tab, water unavailability analyses for the purpose of

issuing curtailments in the Legal Delta will not be performed on a timestep any shorter than one month.

Field Name(s)	Definition & Methodology	Data Source(s)
Watershed	The watershed in which the demand occurs, Sacramento River or San Joaquin River. Sourced from the Final Demand tab. Legal Delta demands (Legal Delta? = TRUE, with the exception of Water Right Type = Statement of Div and Use (Riparian)) are present in both watersheds, with their demands prorated between them.	USGS WBD
Subwatershed	Smallest area over which water unavailability is determined, based on one or more HUC8s. Sourced from the Final Demand tab.	Staff-determined
Application ID	Application ID of a given water right or claim, sourced from the Final Demand tab. Any duplicate Application IDs in a single subwatershed with the same Legal Delta? value are merged.	eWRIMS database
Primary Owner	Name of the primary owner of the water right or claim, sourced from the Demand tab.	eWRIMS database
Water Right Type	Water right or claim type, sourced from the Demand tab.	eWRIMS database w/ staff adjustments

Field Name(s)	Definition & Methodology	Data Source(s)
Priority Date	The priority date of a water right or claim, sourced from the 'Assumed Priority Date' field in the Demand tab (YYYY/MM/DD). Statements with 'Riparian' priority are grouped together as four demands (Riparian-only or 'Riparian or Pre-1914' and Other, either within or outside of the Legal Delta) at the top of each watershed, all of which are assumed to have equal senior priority. With the exception of two New Melones water rights, Project rights listed in Board Decision 1641 are denoted as 'Project' priority and are assumed to be junior to other appropriative demands. Statements with 'Pending' priority are assumed to be junior to all other water rights and claims and are listed at the bottom of each watershed.	eWRIMS database w/ staff adjustments
Legal Delta?	If demand for that row occurs in the Legal Delta (TRUE/FALSE), sourced from the Final Demand tab. Each water right or claim located in the Legal Delta (with the exception of Water Right Type = Statement of Div and Use (Riparian)) is present in both the Sacramento and San Joaquin Watershed Analyses.	eWRIMS database
Headwater Subwatershed?	If demand for that row occurs in a headwater subwatershed (TRUE/FALSE), sourced from the Subwatersheds tab based on the Subwatershed value.	Staff-determined

Field Name(s)	Definition & Methodology	Data Source(s)
Demand (AF)	Demands by a given water right or claim in the respective subwatershed for the user-specified Demand Year over the user-specified time period in the Supply Forecast tab, summed from the Final Demand tab. If the right or claim is located in the Legal Delta (Legal Delta? = TRUE, with the exception of Water Right Type = Statement of Div and Use (Riparian)), the demand is multiplied by the respective watershed's supply ratio (see Total Supply values in the second table in the Final Supply tab) in order to prorate these demands between both watersheds.	eWRIMS database w/ staff adjustments
Water Unavailable in Headwater Subwatershed?	If water is anticipated to be unavailable in a headwater subwatershed (TRUE/FALSE): - If located in a headwater subwatershed and outside the Legal Delta, equal to the Water Unavailable in Subwatershed? value in the Headwaters tab for the respective right or claim. - FALSE if located in a lower subwatershed and/or in the Legal Delta. These cells have conditional formatting to **highlight red** if water is unavailable for a given right or claim.	Staff-determined

Field Name(s)	Definition & Methodology	Data Source(s)
Demand Potentially Met in Subwatershed (AF)	Demand by a given water right or claim which could be met by available supply in the respective subwatershed: - If supply is less than the total demand of Riparian-priority Statements in the given headwater subwatershed (see Disconnected? value in the second table in the Final Supply tab), equal to zero. - If located in a headwater subwatershed and outside the Legal Delta, equal to the Demand Potentially Met in Subwatershed value in the Headwaters tab for the respective right or claim. - If located in a lower subwatershed and/or in the Legal Delta, equal to Demand.	Calculated

Field Name(s)	Definition & Methodology	Data Source(s)
Supply Cumulative (AF)	Available supply to meet a given water right or claim's Demand Potentially Met in Subwatershed over the user-specified time period based on the user-specified Forecast Source. Calculated as follows: - For the first group of Riparian-only claims outside the Legal Delta in each watershed, equal to the watershed's Total Supply value minus its Instream Flow in Excess of Supply value from the second table in the Final Supply tab. - For the second group of claims, the previous group's Supply Cumulative minus the previous group's Demand Met in Watershed (see below). - For the third group of 'Riparian or Pre-1914' or Other claims outside the Legal Delta, the previous Supply Cumulative minus the previous Demand Met in Watershed plus the watershed's Instream Flow in Excess of Supply value from the second table in the Final Supply tab. - For the fourth group of claims, the previous Supply Cumulative minus the previous Demand Met in Watershed. - Continued for each next junior water right or claim until all Demands are accounted for or Supply Cumulative is zero.	CNRFC, B-120, staff estimates
Water Unavailable in Watershed?	If water is anticipated to be unavailable to a given water right or claim for the user-specified time period (TRUE/FALSE). Water is only considered unavailable if Supply Cumulative is zero (i.e., water is available even if only a portion of demand can be met by available supply). These cells have conditional formatting to **highlight red** if water is unavailable for a given right or claim.	Staff-determined

Field Name(s)	Definition & Methodology	Data Source(s)
Demand Met in Watershed (AF)	Amount of a given right or claim's Demand Potentially Met in Subwatershed which can be met by available supply in the watershed, calculated as follows: - If Supply Cumulative > Demand Potentially Met in Subwatershed, equal to Demand Potentially Met in Subwatershed. - If 0 < Supply Cumulative < Demand Potentially Met in Subwatershed, equal to Supply Cumulative (i.e., only a portion of Demand can be met). - If Supply Cumulative = 0, equal to zero (i.e., Water Unavailable in Watershed).	Calculated
Demand Unmet in Watershed (AF)	Amount of a given right or claim's Demand which can be physically met by local supply but is unavailable, calculated as follows: - If Demand Met = Demand Potentially Met in Subwatershed, equal to zero. - If Demand Met < Demand Potentially Met in Subwatershed, equal to Demand Potentially Met in Subwatershed - Demand Met. - If Demand Met = 0, equal to Demand Potentially Met in Subwatershed.	Calculated
Water Unavailable?	If water is anticipated to be unavailable to the given water right or claim over the user-specified time period (i.e., will this right or claim receive a notice of water unavailability or curtailment order?), either from the Headwaters Analysis (Water Unavailable in Subwatershed?) or Watershed Analysis (Water Unavailable in Watershed?). These cells have conditional formatting to **highlight red** if water is unavailable for a given right or claim.	Staff-determined

Legal Delta

This tab contains information on water rights and claims located in the Legal Delta. Because these rights and claims are assumed to have access to supplies from both the Sacramento and San Joaquin Rivers to meet their demands (see Demand column in Watersheds section), this tab quantifies total demands and demands met from each watershed to identify which rights or claims may receive notices of water unavailability or curtailment orders. Riparian-priority claims in the Legal Delta are merged into two rows (one for Riparian-only claims, one for 'Pre-1914 and Riparian' and Other claims) since water unavailability is not determined for individual Riparian-priority claims. Per State Water Board Order WR 89-8, this analysis assumes that demands by Statements of Diversion and Use claiming only Riparian water rights can only be met by supply from the watershed in which they are located; therefore, they are excluded from demand proration between watersheds.

Water rights or claims in the Legal Delta will only receive a notice of water unavailability or curtailment order if water is anticipated to be unavailable from both watersheds. This tab does not contain any new analysis, it only compiles values from the Watersheds tab for rights or claims located in the Legal Delta (Legal Delta? = TRUE in the Final Demand tab). Duplicate rights were merged in this tab, so each row represents a single water right's total demand. Water rights that have PODs both within and outside the Legal Delta are not included in this tab because they will only receive a notice of water unavailability or curtailment order if water is determined to be unavailable from all potential sources; these rights can be found in the Curtailments tab (see next section).

NOTE: Though this tab evaluates water unavailability for any user-specified time period entered in the Supply Forecast tab, water unavailability analyses for the purpose of issuing curtailments in the Legal Delta will not be performed on a timestep any shorter than one month.

Field Name(s)	Definition & Methodology	Data Source(s)
Application ID	Application ID of a given water right or claim, sourced from the Final Demand tab.	eWRIMS database
Primary Owner	Name of the primary owner of the water right or claim, sourced from the Demand tab.	eWRIMS database
Water Right Type	Water right or claim type, sourced from the Demand tab.	eWRIMS database w/ staff adjustments

Field Name(s)	Definition & Methodology	Data Source(s)
Priority Date	The priority date of a water right or claim, sourced from the 'Assumed Priority Date' field in the Demand tab (YYYY/MM/DD).	eWRIMS database w/ staff adjustments
Sacramento/ San Joaquin Demand (AF)	Demands by a given water right or claim in the respective watershed for the user-specified Demand Year over the user-specified time period, sourced from the Demand column of the Watersheds tab.	eWRIMS database w/ staff adjustments
Water Unavailable in Sacramento/ San Joaquin?	If the water right or claim is anticipated to face water unavailability from the respective watershed, sourced from the Water Unavailable in Watershed? column of the Watersheds tab. These cells have conditional formatting to **highlight red** if water is unavailable for a given right or claim.	Staff-determined
Sacramento/ San Joaquin Demand Met (AF)	Amount of a given right or claim's Demand in the respective watershed which can be met by available supplies, sourced from the Watersheds tab.	Staff-determined
Water Unavailable?	If the water right or claim is anticipated to face water unavailability in both the Sacramento and San Joaquin River watersheds over the user-specified time period (i.e., will this right or claim receive a notice of water unavailability or curtailment order?). These cells have conditional formatting to **highlight red** if water is unavailable for a given right or claim.	Staff-determined

Curtailments

This tab contains information on the curtailment status of all water rights and claims in the Delta watershed. It does not contain any new analysis, it only compiles values from the Watersheds tab to determine which rights or claims face water unavailability over the user-specified time period in the Supply Forecast tab. Information presented for each right or claim includes ownership, location, total demands, and curtailment status based on either headwater subwatershed or watershed-wide water unavailability. Rights and claims are only curtailed if there is zero supply available to meet their demands (either based on local supply or watershed-wide availability). Any rights with

multiple PODs are merged into single rows in this tab, including rights and claims in the Legal Delta that are assumed to have access to supplies from both the Sacramento and San Joaquin River watersheds or any other rights or claims with PODs in multiple subwatersheds that are assumed to have access to water from all of them (with the exception of subwatersheds with zero demand, as described in the Headwaters and Watersheds sections). These rights and claims will only receive a notice of water unavailability or curtailment order if water is unavailable from all potential water sources (i.e., all subwatersheds where demands occur or both the Sacramento and San Joaquin River watersheds).

NOTE: Though this tab contains water unavailability determinations for any user-specified time period entered in the Supply Forecast tab, water unavailability analyses for the purpose of issuing curtailments in the Legal Delta will not be performed on a timestep any shorter than one month.

Field Name(s)	Definition & Methodology	Data Source(s)
Application ID	Application ID of a given water right or claim, sourced from the Final Demand tab.	eWRIMS database
Primary Owner	Name of the primary owner of the water right or claim, sourced from the Demand tab.	eWRIMS database
Water Right Type	Water right or claim type, sourced from the Demand tab.	eWRIMS database w/ staff adjustments
Priority Date	The priority date of a water right or claim, sourced from the 'Assumed Priority Date' field in the Demand tab (YYYY/MM/DD.	eWRIMS database w/ staff adjustments
Watershed	The watershed in which the demand occurs, Sacramento River or San Joaquin River. Sourced from the Final Demand tab; water rights with multiple PODs that fall in both watersheds are denoted as 'Both.'	USGS WBD
Subwatershed	Smallest area over which water unavailability is determined, based on one or more HUC8s. Sourced from the Final Demand tab; water rights with PODs in multiple subwatersheds are denoted as 'Multiple.'	Staff-determined

Field Name(s)	Definition & Methodology	Data Source(s)
Legal Delta?	If demand for that row occurs in the Legal Delta (TRUE/FALSE), sourced from the Final Demand tab; water rights with multiple PODs both within and outside the Legal Delta are denoted as 'Partial.'	eWRIMS database w/ staff adjustments
Demand (AF)	Total demands by a given water right or claim for the user-specified Demand Year over the user-specified time period, sourced from the Watersheds tab.	eWRIMS database w/ staff adjustments
Demand Met (AF)	Amount of each right or claim's Demand which can be met by available supply, sourced from the Demand Met in Watershed column in the Watersheds tab. NOTE: This column does not compute partially met demands for Riparian-priority claims; these claims will either appear as having all of their demand met (if some supply is available) or having zero demand met (if there is zero supply available in their respective subwatershed or watershed).	
Water Unavailable in Subwatershed?	If the water right or claim is anticipated to face water unavailability due to limited local supplies in a headwater subwatershed. Sourced from the Water Unavailable in Subwatershed? column of the Watersheds tab; will only equal TRUE if there is zero supply available at a given record's priority of right. Riparian claims will only equal TRUE if zero supply is available in their respective subwatershed. Rights or claims in the Legal Delta or rights with PODs in multiple subwatersheds will only equal TRUE if water is unavailable from all potential sources. These cells have conditional formatting to **highlight red** if water is unavailable for a given right or claim.	Staff-determined

Field Name(s)	Definition & Methodology	Data Source(s)
Water Unavailable in Watershed?	If the water right or claim is anticipated to face water unavailability due to limited supplies in its respective watershed. Sourced from the Water Unavailable in Watershed? column of the Watersheds tab; will only equal TRUE if there is zero supply available at a given record's priority of right. Riparian claims will only equal TRUE if zero supply is available in their respective watershed. Rights or claims in the Legal Delta or rights with PODs in multiple subwatersheds will only equal TRUE if water is unavailable from all potential sources. These cells have conditional formatting to **highlight red** if water is unavailable for a given right or claim.	Staff-determined
Water Unavailable?	If the water right or claim is anticipated to face water unavailability from all potential sources due to insufficient supplies in a headwater subwatershed and/or the watershed (i.e., will this right or claim receive a notice of water unavailability or curtailment order?). These cells have conditional formatting to **highlight red** if water is unavailable for a given right or claim.	Staff-determined
Curtailment Status	If the water right or claim is curtailed for the user-specified time period. Based on the Water Unavailable? value (TRUE = Curtailed, FALSE = Not Curtailed), with some exceptions: - Pending Statements are marked as "Not Authorized to Divert" at all times. - Cannabis Registration rights are marked as "Not Authorized to Divert" if the user-specified time period (based on the Start Date in the Supply Forecast tab) is during the dry season forbearance period of April 1-October 31.	Staff-determined