

Technical Appendix B: Delta Watershed Demand Dataset

This appendix documents the process used to prepare the Sacramento-San Joaquin Delta (Delta) watershed demand dataset for the Water Unavailability Methodology for the Delta Watershed (methodology). Specifically, this appendix summarizes: (1) the process used to select water right records in the Delta watershed, (2) the quality control process used to review diversion data submitted by water right holders and claimants and address diversion data reporting inaccuracies, and (3) demand dataset updates and formatting. In the future, the State Water Board may also rely upon updated reporting of projected demands for larger users that is provided pursuant to emergency regulations.

Initial Selection of Water Right Records in the Delta Watershed

This section describes the process and computer code logic used to select water right records in the Delta watershed for inclusion in the demand dataset. These water right records were selected from the full list of all of California's water right records using information contained within the State Water Resources Control Board's (State Water Board) Electronic Water Rights Information Management System (eWRIMS) database. The eWRIMS database contains information on water right permits and licenses issued by the State Water Board and other claimed water rights, including reported diversion and use data submitted by water right holders and claimants through the Report Management System (RMS). The eWRIMS database system can be accessed at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/ewrims/

Selection of All Water Right Records in California

Using information from the eWRIMS database, a dataset of all water right records in California was created. The dataset of all water right records included other associated information, such as the water right type, status, and reported diversions for calendar years 2018 and 2019.

To compile this dataset, the full record of California's water rights and claims and annually reported water diversion information was obtained from the eWRIMS database. The eWRIMS database is continuously updated by modifications to water right records, such as the addition of new water right records or changes in water right

status. Water diversion and use information contained within the eWRIMS database is also updated when annual reports of water diversion and use (annual reports) are submitted or modified by diverters. The initial selection of water right records in the Delta watershed and quality control review described below required a static copy of the eWRIMS datasets, which were downloaded on January 15, 2021.

Several plain text comma-separated values (.csv) files, known as eWRIMS flat files, contain the data fields used to create the dataset. Data was compiled from the eWRIMS flat files by the water right Application ID Number. The eWRIMS flat files that contain the data fields used to create the dataset are titled:

- **Water Rights Master Flat File:** This file contains general information associated with each water right record on file with the State Water Board. Several fields within this flat file were selected, such as: primary owner name, water source name, water right face value, water right status (e.g., active, etc.), and water right type (e.g., Appropriative, Statement of Diversion and Use, etc.).
- **Water Rights Annual Water Use Report:** This file contains the monthly water diversion and use data submitted by water right holders and claimants in annual reports. Reported total diversions, which included the amounts directly diverted and the amounts diverted or collected to storage, were selected for each month during calendar years 2018 and 2019. For Statements of Diversion and Use, this file contains information about the water right type (e.g., pre-1914, riparian, etc.) submitted by water right claimants as well as information about the year diversion first commenced, as discussed under *Disaggregation of Statements of Diversion and Use*.
- **Water Rights Uses and Seasons:** This file contains additional information regarding authorized diversion and storage seasons and beneficial uses¹ for each water right record. Beneficial use information was selected and compiled for each water right record. Some water right records have multiple beneficial uses, and each of the beneficial uses for each of the water right records was aggregated by Application ID Number.
- **Water Rights Point of Diversion Flat File:** This file contains general information associated with each water right record on file with the State Water Board, including several fields that are also available in the Water Rights Master Flat File. This file contains additional fields that were incorporated into the demand dataset, including: point of diversion location (latitude/longitude), application received date, and application acceptance date. The application acceptance date and application

¹ The beneficial uses of water pertaining to water rights are defined in the California Code of Regulations, title 23, §§ 659-672 to include: domestic, irrigation, power, municipal, mining, industrial, fish and wildlife preservation and enhancement, aquaculture, recreational, stockwatering, water quality, frost protection, and heat control.

received date fields were used to identify a water right priority date for the post-1914 appropriative water right records, as discussed under *Update and Format Demand Dataset*.

Information from the eWRIMS flat files was used to create one dataset of water rights and claims for all of California on record with the State Water Board.

Selection of Active Water Right Records in California

The dataset of all water right records was limited to those with an active-type water right status, which includes the following water right statuses:

- Claimed
- Licensed
- Permitted
- Registered
- Certified

By only including active-type statuses, water rights with inactive-type statuses, such as inactive, rejected, and cancelled, were excluded from the demand dataset.

Selection of Active Water Right Records in the Delta Watershed

The dataset of active water right records in California was then limited to diversions located in the Delta watershed. Using geographic information system (GIS) software, water right records located in the Delta watershed were selected based on the spatial location of each water right Point of Diversion (POD).

The Division of Water Rights has created an eWRIMS Web Mapping Application that provides the spatial location of all of the water right PODs in California. A public version of the eWRIMS GIS System is available at:

https://waterrightsmaps.waterboards.ca.gov/viewer/index.html?viewer=eWRIMS.eWRIMS_gvh#

The Delta watershed boundaries used for the spatial selection include the following Hydrologic Unit Code level 4 (HUC4) watersheds, as defined by the U.S. Geological Survey (USGS) Watershed Boundary Dataset (WBD):

HUC4 Subregion Number	HUC4 Subregion Name
1802	Sacramento
1804	San Joaquin

The GIS attributes of water right PODs within the Delta watershed were then exported as a plain text .csv file.

Selection of Consumptive Water Right Records in the Delta Watershed

The Delta watershed demand dataset was then further subdivided to include only water right records with consumptive beneficial uses. Water right records that contain only non-consumptive beneficial uses were excluded from the Delta watershed demand dataset. These beneficial use types and combinations include:

- Power
- Power and Recreational
- Power and Industrial
- Power and Domestic
- Power and Fish and Wildlife Preservation and Enhancement
- Fish and Wildlife Preservation and Enhancement

The above beneficial use types and combinations were assumed to be associated primarily with non-consumptive uses of water, including hydropower generation and instream flows. Water right records with the Power and Industrial and Power and Domestic beneficial use combinations were assumed to be primarily associated with hydropower generation, with a negligible amount of incidental industrial or domestic uses of water as a conservative assumption for purposes of avoiding overestimation of demands. Accounting for instream flows is described in the main report.

A small number of water right records did not contain beneficial use information in the eWRIMS flat files. These water right records were initially included in the demand dataset. However, many of these were eventually found to be non-consumptive during the review process described below.

Selection of Appropriative Water Rights and Statements of Diversion and Use in the Delta Watershed

The Delta watershed demand dataset was again subdivided to include only the following water right types:

- Appropriative
- Statement of Diversion and Use

Appropriative water rights include post-1914 appropriative water rights (e.g., water right permits and licenses). Statements of Diversion and Use include pre-1914 appropriative and riparian claims.

By limiting the demand dataset to Appropriative water rights and Statements of Diversion and Use, minor water right types such as Stockponds and Registrations were excluded from the dataset. Similarly, other types of water right records such as Temporary Permits were also excluded. These other water right types were assumed to constitute a negligible amount of the water diversion and use within the Delta watershed. Excluding these uses represents a conservative assumption for the purposes of avoiding overestimation of demands.

Quality Control Review

Diversion data contained within annual reports is self-reported and is not systematically verified for accuracy upon submittal to the State Water Board. As a result, an internal review and quality control effort was conducted. The quality control review process was focused on the review of the total diversion amounts for 2018 and 2019 reported by water right holders or their agents in annual reports. The total diversion amount includes the amount directly diverted and the amount diverted or collected to storage.

The water right records in the Delta watershed demand dataset after initial selection were too numerous to feasibly review in their entirety at this time. Therefore, the scope of the review was narrowed to a subset of water right records, with a focus on the largest diversions in the Delta watershed.

Selection of Largest Diversions in Delta Watershed for Quality Control Review

The approximately 12,000 total water right records in the demand dataset after initial selection were subdivided to approximately 580 water right records that include the largest diversions in the Delta watershed. Criteria used to identify this selection of water right records includes:

- Statements of Diversion and Use with total reported diversion of 5,000 acre-feet (AF) or greater for either 2018 or 2019
- Appropriative water rights with a face value of 5,000 AF or greater, or a total reported diversion of 5,000 AF or greater for either 2018 or 2019

These water right records were the focus of the quality control review process described below, and together represent over 90% of demands in the Delta watershed.

Quality Control Review

The quality control process focused on review of diversion data obtained from annual reports submitted by water right holders and their agents for calendar years 2018 and 2019. For each of the approximately 580 water right records included in the quality control review, the 2018 and 2019 annual reports were accessed through the eWRIMS

database system. The contents of the annual reports were reviewed, including but not limited to the following information:

- Purpose of Use
- Amount of Water Diverted and Used, including monthly amounts directly diverted, monthly amounts diverted or collected to storage, and monthly amounts used
- Maximum Rate of Diversion, including maximum monthly diversion rates
- Comments and Additional Remarks

The specific issues that were investigated during the quality control review, and corrected when possible, included:

- Non-consumptive diversions improperly appearing as consumptive
- Duplicate diversion values, such as the same diversions reported under multiple water right records
- Diversion data entry and reporting errors, such as incorrect units of measurement and decimal placement errors
- Reported diversions in excess of the water right's face value (applies to post-1914 appropriative water rights only)

In general, the issues that were investigated relate to the correction of over-reporting of diversion amounts. An overview of the commonly identified issues and corrections that were applied to the demand dataset is provided below.

In some cases, it was not possible to resolve outstanding issues without further information. State Water Board staff has contacted numerous water right holders or their agents to gather this information. However, it was not feasible to contact all water right holders or agents in all cases where a potential reporting related error was identified or a correction applied to a diversion value. Efforts were prioritized to contact water right holders or agents based on several factors, including reported diversion size and relative level of uncertainty regarding potential reporting-related inaccuracies. Some water right holders and agents did not provide timely responses to inquiries regarding potential reporting related errors. In the absence of additional information provided by the water right holder or agent, estimates of the actual diversion amounts were used based on information contained within the annual report and supplemental information available within the eWRIMS database.

Non-Consumptive Diversions and Uses

Annual reports reviewed for some water right records appeared to indicate that water was diverted only for non-consumptive use. Water right records were generally identified as non-consumptive based on the reported purposes of use contained within the 2018 and 2019 annual reports. Some non-consumptive purposes of use identified during the quality control review include instream flow uses (e.g., "maintain a live

stream”), power generation, or non-consumptive aquaculture uses. These records were removed from the demand dataset.

In some cases, annual reports included both consumptive and non-consumptive purposes of use, such as both power generation and irrigation. It was generally assumed that all water diverted under these records was used consumptively. However, for some water right records, comments or additional remarks included in the annual report appeared to indicate that only a portion of the water diverted was used consumptively, but information was not provided within the annual report to quantify the volume of water diverted for consumptive uses. If it was not possible to quantify the volume of water diverted for consumptive uses, the water right record was identified for outreach to the water right holder to resolve the issue.

Duplication of Reported Diversion Amounts

Some 2018 and 2019 annual reports contain comments, additional remarks, or other information that clearly indicated that a particular diversion was fully reported under two or more separate rights (i.e., duplicated). In these cases, reported diversions were retained for only one record and were changed to zero for the other record(s) in the demand dataset.

Some water right holders have multiple water rights or claims. In some cases, identical monthly diversion amounts were reported under multiple records associated with a particular water right holder, but the annual reports did not clearly indicate if the same diversion volumes were reported under multiple water right records. If it was not possible to determine if the water right holder had reported duplicative diversion volumes under multiple records, the water right records were identified for outreach to the water right holder to resolve the issue.

Some 2018 and 2019 annual reports contain information that appeared to identify some duplicate reporting of the same diversion volumes under multiple water right records, including water right records held by different water right holders. If it was not possible to quantify the volume of water reported under multiple water right records, the water right records were identified for outreach to the water right holders to resolve the issue.

Diversion Data Entry and Reporting Issues

Numerous diversion data entry and reporting issues were identified during the quality control review, including data entry, unit reporting, and other related issues. Commonly encountered diversion data entry and reporting issues are summarized below.

Diversion data entry issues encountered during the quality control review include misplaced decimal points, apparent reporting of monthly diversion volumes in the wrong data field within the annual report, and other similar issues. When the data entry issue was identifiable, the diversion data was corrected accordingly.

Unit reporting issues encountered during the quality control review include apparent reporting of monthly diversion amounts using incorrect units of measurement, such as reporting of diversion volumes in units of acre-feet instead of gallons. These unit reporting errors generally resulted in unreasonably large diversion amounts, particularly when compared with the reported purpose of use. Other information contained within the annual report, such as the reported purpose of use, crop acreage, maximum rate of diversion, amount beneficially used, and comments and additional remarks, was generally used to identify and correct the reported diversion amounts. In some cases, a comparison of 2018 and 2019 reported diversions with reported diversions in prior annual reports provided information that informed a correction to the diversion amount.

In some cases, a diversion data entry or unit reporting error was detected, but it was unclear how the reported diversion amounts should be corrected. If it was not possible to correct the diversion amount without supplemental information provided by the water right holder, the water right record was identified for outreach to the water right holder to resolve the issue.

Some additional data reporting errors were also identified during the quality control review, such as annual reports that contain reported monthly diversion volumes in excess of the reported maximum monthly rate of diversion. In some cases, it was determined that the water right holder or their agent likely reported the maximum monthly rate of diversion using incorrect units, such as gallons per day (GPD) instead of gallons per minute (GPM). In many cases, this specific issue did not require a correction to the reported monthly diversion amounts. However, some other miscellaneous reporting-related issues were identified during the quality control review that required additional information to resolve. These water right records were generally identified and prioritized for outreach to the water right holder.

Reported Diversions in Excess of Water Right Face Value

Annual reports submitted for some post-1914 appropriative water rights included reported diversions in excess of the water right face value. In most instances, the reported diversion amount was changed to the face value amount or other updated value based on information contained within the annual report or supplemental information available in other documentation accessed through the eWRIMS database, such as the water right permit or license.

In addition to the records review described above, approximately 100 post-1914 appropriative rights were identified that reported diversions less than 5,000 AF but in excess of the face value of the water right. Most of these diversions are very small. Due to time constraints, no investigation of the approximately 100 post-1914 appropriative water right records with 2018 or 2019 reported diversions in excess of the water right face value was conducted. In these cases, the reported diversion amounts within the demand dataset were updated to equal the face value of the water right.

Update and Format Demand Dataset

Following completion of the quality control review process described above, several additional steps were completed to update, format, and export the demand dataset for use in the Water Unavailability Methodology Excel workbook (spreadsheet). The contents of the spreadsheet are described in Appendix A.

Select water right records (Application ID Numbers) were removed from the initial demand dataset as a result of the quality control review discussed above, including water right records that appeared to divert water only for non-consumptive use. As discussed in the main report, several consumptive water right records were also removed from the dataset, including consumptive water rights associated with the Central Valley Project (CVP) Trinity River Division (A005628, A015374, A015375, A016767, and A017374). A small number (less than 10) of additional water right records were determined to be located outside of the Delta watershed based on their Hydrologic Unit Code level 8 (HUC8) watershed and were also removed from the demand dataset. These records all contain PODs located near the boundary of the Delta watershed that were improperly included in the spatial selection of water right records in the Delta watershed.

The quality control process described above focused on the review of the annual total diversion amounts for calendar years 2018 and 2019. If an annual diversion amount was adjusted as a result of a correction applied during the quality control process, the monthly diversion values were adjusted in a proportional manner.

Some water right holders did not submit annual reports in 2018 or 2019. When an annual report is not submitted, there is no diversion data value recorded in the eWRIMS flat files. In instances where a water right holder did not submit an annual report, the diversion amount was recorded as zero in the demand dataset. This provides a conservative assumption for the purposes of avoiding the overestimation of demands.

Upon completion of the quality control review process, diversion values were merged with a March 16, 2021 copy of the eWRIMS datasets to produce a demand dataset that reflects updates to eWRIMS database information that occurred between January 15 and March 16, 2021. For example, a small number of diverters submitted new or revised 2018 or 2019 annual reports between January 15 and March 16, 2021. These new or revised diversion values were incorporated into the demand dataset. In addition, seven water right records were removed from the demand dataset due to changes in water right status from an active-type status to an inactive-type status between January 15 and March 16, 2021.

Appendix A contains more information about the field names and content included in the demand dataset used in the spreadsheet. Many of the demand dataset fields were obtained directly from the eWRIMS flat files. Several other fields, including the Watershed and Legal Delta (True/False) fields, were determined based on a GIS

analysis. One field, Priority Date, was determined for post-1914 appropriative rights and select Statements of Diversion and Use using multiple data fields contained within the eWRIMS flat files. The Priority Date for post-1914 appropriative water right types was based on the 'Application Acceptance Date' and 'Application Received Date' fields in the eWRIMS database and was determined to be the earlier date among the two fields. The Priority Date for Statements of Diversion and Use was based on the year diversion first commenced or was assigned a Priority date of "Riparian," depending on the Statement of Diversion and Use assigned category. These Statement of Diversion and Use assigned categories and priority dates are described in greater detail in the next section.

The demand data diversion values are structured in a wide format, such that each water right record (Application ID Number) exists on a single row with total annual and monthly diversion amounts for both 2018 and 2019. Some water right records divert from multiple subwatersheds or divert within the Legal Delta, with access to water from both the Sacramento and the San Joaquin River watersheds. The demands of these water right records are modified and expanded upon in the Demand Separated tab of the methodology spreadsheet. Appendix A provides additional details on these modifications.

Disaggregation of Statements of Diversion and Use

Water right holders and claimants that divert water under Statements of Diversion and Use provide information about the water right claim type to the State Water Board in Initial Statements of Water Diversion and Use and in annual reports (Supplement Statements of Diversion and Use). This user-submitted information was obtained from the Initial Statements of Diversion and Use and the 2018 and 2019 annual reports, and was used to disaggregate Statements of Diversion and Use into several categories.

Statement of Diversion and Use water right claim type information provided in the Initial Statement of Diversion and Use is stored in the 'Sub-Type' field in the Water Rights Point of Diversion Flat File. Statement of Diversion and Use water right claim type information provided in the 2018 and 2019 annual reports is stored in the 'Diverted and Used Under' field in the Water Rights Annual Water Use Report Flat File. Water right claim type information were concatenated, capitalized for uniformity, and reduced to a minimum set of unique and ordered values for each Statement of Diversion and Use.

The Statement of Diversion and Use water right claim type information was then searched for keywords and a category (Riparian, Riparian or Pre-1914, Pre-1914, Reserved, Other, or Unclassified) was assigned based on matches as summarized below. The search was conducted in sequence and stopped when the first match was found, following the sequence below with the assigned category in bold:

1. **Riparian or Pre-1914** – Keywords: RIPARIAN or RIPERIAN and PRE-1914, PRE-14, PRE1914, or PRE14
2. **Riparian** – Keywords: RIPARIAN or RIPERIAN
3. **Pre-1914** – Keywords: PRE-1914, PRE-14, PRE1914, or PRE14
4. **Reserved** – Keywords: RESERVE or RESERVATION
5. **Other** – Keywords: COURTADJ, COURTDECREE, COURT DECREE, HOLDING CONTRACT, COWELL AGREEMENT, or CONTRACT WITH YOLO COUNTY
6. Removal from demand dataset – Keywords: STOCKPOND, STOCK POND, PENDING, or PENDINGAPPROPRIATE
7. **Unclassified** – did not contain any of the above keywords.

Statements of Diversion and Use assigned to the Riparian category contain the keyword RIPARIAN or RIPERIAN, but do not contain the keywords PRE-1914, PRE-14, PRE1914, or PRE14. Statements of Diversion and Use assigned to the Pre-1914 category contain the keyword PRE-1914, PRE-14, PRE1914, or PRE14, but do not contain the keywords RIPARIAN or RIPERIAN. Statements of Diversion and Use assigned to the ‘Riparian or Pre-1914’ category contain keywords for both the Riparian and Pre-1914 categories.

Priority dates were assigned to each record in the ‘Riparian or Pre-1914,’ Pre-1914, Reserved, and Unclassified categories based upon the earliest ‘Year Diversion Commenced’ value reported in the Initial Statements of Diversion and Use, the 2018 annual report, or the 2019 annual report. These values can be found in the ‘Year Diversion Commenced’ column of both the Water Rights Point of Diversion Flat File and the Water Rights Annual Water Use Report Flat File. Though priority dates were assigned to Statements of Diversion and Use in the ‘Riparian or Pre-1914’ category, for the purposes of evaluating water unavailability these claims are assigned a non-priority date value of “Riparian” and are assumed to have senior priority over all appropriative water rights.² Statements in the Riparian and Other categories are similarly assigned a “Riparian” priority and assumed to all have equal senior priority.

² For claims within 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).