

Demand QA/QC Guidelines

Overall suggestion: Activating data filters in Excel is very helpful to quickly analyze data results from each Module. Excel does not filter cells containing formulas reliably though, as it is trying to sort on the formulas themselves rather than the results, therefore the QA/QC process contains steps to copy and paste results as values only before analysis. All suggested review actions below assume review of the value only versions of Module results, which should be compiled into the QAQC_Working_File spreadsheet. The only spreadsheet that still relies on formulas is the “EXPECTED_DEMAND_EXCEEDSFV”, which needs to recalculate demand when you make edits to the monthly diversions/ storage.

Additionally, Electronic Water Rights Information Management System (eWRIMS) is only as accurate as the data inputted into it, and unfortunately the data entry process has passed through different versions of operating procedures, including entries that were bulk uploaded from the previous version called the Water Rights Information Management System (WRIMS) in 2006/2007. There are record inconsistencies that you will see when looking at records entered in the 1990s vs the 2000s or even the 2010s that reflect changing use of various fields in the database. This can make it difficult to rely on certain fields as they may only have actual values for a certain date range of entries, so it is important to be aware of these inconsistencies as you review the data.

***Review the Data Processing Modules Procedures to see how the modules are set up and the steps for calculating them.**

***Be sure to read the Decision Tree documents, part of the downloaded package, that explains the specifics of each Module. These documents are an important resource for the modules and will help with understanding the spreadsheet components.**

Priority Date Module

*The Priority Date Module is designed to assign a priority for each water right to be used in the water allocation modeling. The Module assigns a single priority date for water rights/ statements using current eWRIMS data: it assigns date code '10000000' to post-1914 riparian water rights; assigns a date code of January 1 and the year the diversion commenced (i.e. YYYY0101) for pre-1914 water rights; assigns date code '11111111' for any pre-1914 water right in which the priority date is unknown; and assigns year/month/day for all appropriative water rights. Refer to the “Assign Priority Date” in the **Decision Tree** folder (included in download) for specific information on Water Right types and which to include in the Module.*

After the Priority Date Module has been run, use filters to check that the results make sense.

- 1) First filter all water rights with “SUB_TYPE” set as *Pre1914* and check that the “YEAR_DIVERSION_COMMENCED”, is in fact before 1914. If not remove *Pre1914* designation and replace with *RIPARIAN* if not already there.

| C | F | G | H | I |
|--------------------------|-----------------------------|----------|--------------------------|------------------------|
| WATER_RIGHT_TYPE | APPLICATION_ACCEPTANCE_DATE | SUB_TYPE | YEAR_DIVERSION_COMMENCED | ASSIGNED_PRIORITY_DATE |
| Statement of Div and Use | 7/19/2012 | PRE1914, | 2002 | 20020101 |
| Statement of Div and Use | 3/23/2005 | PRE1914, | 1974 | 19740101 |
| Statement of Div and Use | 1/3/1967 | PRE1914, | 1914 | 19140101 |
| Statement of Div and Use | 1/3/1967 | PRE1914, | 1914 | 19140101 |
| Statement of Div and Use | 2/20/2004 | PRE1914, | 1914 | 19140101 |
| Statement of Div and Use | 2/19/2004 | PRE1914, | 1914 | 19140101 |
| Statement of Div and Use | 4/26/2012 | PRE1914, | 1914 | 19140101 |

Figure 1. Example of a Statement with a post-1914 “ASSIGNED_PRIORITY_DATE” with *Pre1914* “SUB_TYPE”

2) There may be inconsistencies with the “YEAR_DIVERSION_COMMENCED” value and the “SUB_TYPE”. Next filter “YEAR_DIVERSION_COMMENCED” by all pre-1914 dates and *19140101*. Double check that all “SUB_TYPE” have *PRE1914* designation.

| C | E | F | G | H |
|--------------------------|----------------|-------------|-------------------|----------------|
| WATER_RIGHT_TYPE | APPLICATION_RE | APPLICATION | SUB_TYPE | YEAR_DIVERSION |
| Statement of Div and Use | 9/13/2012 | 7/26/2013 | RIPERIAN, | 1895 |
| Statement of Div and Use | 3/3/2016 | 4/1/2016 | RIPERIAN,PRE1914, | 1860 |
| Statement of Div and Use | | 1/1/1974 | RIPERIAN, | 1910 |
| Statement of Div and Use | 11/18/1998 | 11/18/1998 | RIPERIAN, | 1905 |
| Statement of Div and Use | 7/2/2001 | 7/2/2001 | RIPERIAN, | 1903 |
| Statement of Div and Use | 7/2/2001 | 7/2/2001 | RIPERIAN, | 1903 |
| Statement of Div and Use | 8/16/2002 | 8/16/2002 | RIPERIAN, | 1850 |
| Statement of Div and Use | 5/25/2005 | 5/25/2005 | RIPERIAN, | 1900 |
| Statement of Div and Use | 7/1/2010 | 5/4/2012 | RIPERIAN, | 1872 |
| Statement of Div and Use | 7/1/2010 | 4/19/2012 | RIPERIAN, | 1872 |
| Statement of Div and Use | 7/6/2010 | 6/22/2012 | RIPERIAN, | 1905 |
| Statement of Div and Use | 7/6/2010 | 6/27/2012 | RIPERIAN, | 1905 |
| Statement of Div and Use | 7/6/2010 | 1/10/2012 | RIPERIAN, | 1905 |

Figure 2. Statements that have pre-1914 “YEAR_DIVERSION_COMMENCED”, yet *PRE1914* is not listed as “SUB_TYPE”.

When initial Statements are recorded into eWRIMS, the “SUB_TYPE” field is taken from a list of checked boxes that the diverter selects, it is not assigned by State Water Resources Control Board Division of Water Rights (Division) technical staff. If the diverter does not understand the different options, they may select the wrong one, or as often happens they select both *RIPERIAN* and *PRE1914*, and this automatically gets recorded into eWRIMS. Whether the diverter intends the Statement to represent a pre-1914 right or a riparian right is not clear without contacting them directly. They also might not be aware of the different way riparian and pre-1914 rights are assessed in our water allocation process; thus they may not realize the consequences of selecting one over the other.

3) Filter “WATER_RIGHT_TYPE” to review only *Statements of Diversion and Use*; check that all “ASSIGNED_PRIORITY_DATES” are either “10000000” (the riparian default value), “11111111” (pre-1914, unknown date) or are less than *19140101* which is the largest pre-1914 date that should be assigned.

- 4) Filter WATER_RIGHT_TYPE” to not include all *Statements of Diversion and Use*; check that all “ASSIGNED_PRIORITY_DATES” are either “1000000” (the riparian default value) or are larger than 19140101. Correct any entries with the appropriate YYYY/MM/DD.

Realize that in many watersheds, when an enforcement sweep or other Division action occurred in the past, many diverters were told they needed to file Statements even if they had an unpermitted diversion that needed a post-1914 water right. They filled a Statement to avoid penalties, but they might not have fully understood the water rights law behind what they filed or what options they selected in their Initial Statement.

There should not be many manual overrides needed in the Priority Date Module, but staff should be conscious of both the anomalies listed above, and of the larger water rights in the area they are reviewing, as the likelihood of special Division Orders or other associated license or permit terms that may affect priority date goes up with the size of the water right.

Missing Report Management System (RMS) Records Module

*****No manual corrections are made in this module but rather used to flag Water Rights/ Statements that are missing reports.*****

The Missing RMS Records Module is intended to highlight within each water right which years in the electronic record are missing annual water use reports. Note that reliable electronic records are assumed to be from 2014 to present, but actual electronic records may be available for earlier years. The Module Identifies water rights that have missing annual RMS reports and calculates the number of missing annual RMS reports based on the number of expected reports.

| ARRAY FORMULA - INDEX | FINAL RESULTS - MISSING RMS REPORTS | | |
|--|---|------------------|------------------------------|
| DO NOT MODIFY FORMULA - DO NOT FILL DOWN | FILL DOWN FORMULA - DO NOT MODIFY FORMULA - USE THESE RESULTS FOR QAQC - REFER TO E | | |
| UNIQUE_APPL_ID | ANNUAL_REPORTS_SUBMITTED | EXPECTED_REPORTS | NO_OF_MISSING_ANNUAL_REPORTS |
| A002723 | 4 | 7 | 3 |
| A002928 | 4 | 7 | 3 |
| A003421 | 4 | 7 | 3 |
| A003565 | 4 | 7 | 3 |

Figure 3. Example of applications missing multiple annual reports.

***This Module does not have anything to manually adjust, it is intended to be a binary presence/absence counter for annual water use reports for each water right in the QA/QC project area. While it may not appear to have much use, it is worth discussing the potential decisions that can be made using this Module.

One of the main goals of the QA/QC effort in a specific area is to develop an estimated set of water demands to represent each water right in that area, which can then be used in a water allocation model to predict water availability in different supply scenarios.

Specifically, this approach has been used to issue curtailments during drought based on the recent average reported use of water under different water rights in a watershed. A

question that was discussed during that process was whether artificial water use reports should be created for water rights that were missing records during the years analyzed. One use of this Module would be to quantify both how many reports are missing for the years focused on, and how many water rights are missing one or more (or all) reports in those years. This may drive any decisions on creating artificial reports to fill in missing reports.

In the Russian River QA/QC analysis of 2021, water use reports were reviewed from 2017, 2018, and 2019, with the average of those three years being used to represent average demand for each water right. In that case, the decision was made not to create artificial reports to fill in missing reports. This decision was based on two main factors:

- 1) Filing annual water use reports is a legal obligation for all water right holders, thus failure to file should not be rewarded with an assumed demand for water availability
- 2) Creating artificial reports requires making many other big assumptions, not least of which is the fact that most water rights that do report usage do not report full use compared to their “face value”, therefore creating artificial reports that simply divides face value among allowed months of diversion would also artificially inflate the overall demand in the project area.

While it should not be considered “the” method for handling missing reports, for informational purposes here is how missing reports were handled in the Russian River. For water rights that had only one or two reports present in the record reviewed, the average demand was calculated based on the reports present, thus if only one report was present then that was used to represent demand (as opposed to considering the missing years as zero and averaging one year of use against two years of zero-use, which would diminish the average demand). Water rights that had no water use reports in the period analyzed were given a demand of zero for all months.

Primary Beneficial Use Module

*The Primary Beneficial Use Module is intended to: 1) assign one dominant beneficial use (or a hybrid dominant use in the case of larger municipalities or water agencies) to water rights where multiple uses are listed; 2) assign return flow values and identify non-consumptive use based on assigned primary beneficial use. The Module will have you verify the water right entity type, validate the assigned beneficial use, verify assigned return flow values, and designate all non-consumptive water rights. Refer to the “**Account for Water Returned Back to System**” in the **Decision Tree** folder (included in download) for specific information on beneficial use types and percent return values.*

Review of the Primary Beneficial Use Module involves a few key fields from eWRIMS and an understanding of the basic assumptions of the Module. The “Primary Owner” and “Primary Owner Type” fields are extremely helpful for quickly checking if the water right belongs to the larger types of groups that would affect demand numbers, such as water agencies, municipalities, and agricultural businesses, which can affect how you want the Primary Beneficial Use to be categorized.

- The basic assumptions to understand in the Module are that the beneficial uses are ranked (USE_RANKING) with *Irrigation* having the highest priority, and “minor” uses such as *Dust Control* or *Recreation* having lower priority.

| USE_CODE | USE_RANKING |
|------------------------------------|-------------|
| Irrigation | 1 |
| Municipal | 2 |
| Domestic | 3 |
| Power | 4 |
| Stockwatering | 5 |
| Industrial | 6 |
| Frost Protection | 7 |
| Heat Control | 8 |
| Recreational | 9 |
| Dust Control | 10 |
| Mining | 11 |
| Fire Protection | 12 |
| Aquaculture | 13 |
| Fish and Wildlife Preservation and | 14 |
| Incidental Power | 15 |
| Milling | 16 |
| Snow Making | 17 |
| Water Quality | 18 |
| Aesthetic | 19 |
| Other | 20 |

Figure 4. Water use codes and their priority ranking.

- The Module assigns the highest-ranking use as the water right’s primary beneficial use. As shown below:

| ACTION: | PASTE NEW INPUT DATA FROM [NAME OF SCRIPT] SCRIPT HERE - DELETE SAMPLE | | | | FILL DOWN FORMULA - DO NOT MC | |
|-------------|--|----------------------|---------------------------|---------------|-------------------------------|---|
| APPLICATION | USE_CODE | WATER_RIGHT_TYPE | WATER_RIGHT_PRIMARY_OWNER | USE_CODE_RANK | HIGHEST_RANK | |
| C000222 | Stockwatering | Stockpond | Certified | Individual | 5 | 5 |
| C000223 | Stockwatering | Stockpond | Certified | Individual | 5 | 5 |
| C002935 | Stockwatering | Stockpond | Certified | Corporation | 5 | 5 |
| C002936 | Stockwatering | Stockpond | Certified | Corporation | 5 | 5 |
| C005161 | Stockwatering | Stockpond | Certified | Corporation | 5 | 5 |
| C005162 | Stockwatering | Stockpond | Certified | Corporation | 5 | 5 |
| C005163 | Stockwatering | Stockpond | Certified | Corporation | 5 | 5 |
| C005164 | Stockwatering | Stockpond | Certified | Corporation | 5 | 5 |
| C005165 | Stockwatering | Stockpond | Certified | Corporation | 5 | 5 |
| C005166 | Stockwatering | Stockpond | Certified | Corporation | 5 | 5 |
| C005343 | Stockwatering | Stockpond | Certified | Corporation | 5 | 5 |
| C005521 | Stockwatering | Stockpond | Certified | Individual | 5 | 5 |
| C005522 | Stockwatering | Stockpond | Certified | Individual | 5 | 5 |
| C005624 | Stockwatering | Stockpond | Certified | Corporation | 5 | 5 |
| C005834 | Stockwatering | Stockpond | Certified | Individual | 5 | 5 |
| C006052 | Stockwatering | Stockpond | Certified | Individual | 5 | 5 |
| S000114 | Stockwatering | Statement of Div and | Claimed | Corporation | 5 | 1 |
| S000114 | Irrigation | Statement of Div and | Claimed | Corporation | 1 | 1 |
| S000114 | Domestic | Statement of Div and | Claimed | Corporation | 3 | 1 |

Figure 5. Example of an application being ranked according to its highest-ranking beneficial use code.

Each water right should be assigned, one primary beneficial use. The exception is for the “PRIMARY_OWNER_ENTITY_TYPE”, owner type “*Government/Municipal*” which causes the Module to create a hybrid beneficial use of ‘*Irrigation/Municipal*’ or ‘*Irrigation/Domestic*’ depending on which uses are relevant. The hybrid use is intended to allow the water allocation modeling to treat these differently, as the water usage patterns for these types of entities can be complicated and usually represent the largest water users in a watershed.

- 1) Another anomaly of eWRIMS that staff should be aware of is that the “Primary Owner Type” (PRIMARY_OWNER_ENTITY_TYPE) field does not always logically match the owner name (Application_Primary_Owner). For example, there are owners who are listed as being “government/municipal”, but the name of the owner is a home building company or an LLC in general, which doesn’t make sense except in the loosest sense of municipal in that the water right may serve multiple residences in the future. Staff reviewing the Module will need to look for these water rights and decide if the (PRIMARY_OWNER_ENTITY_TYPE) is wrong and needs to be corrected.
- 2) Water Rights may list multiple beneficial uses, when generally one or two of those uses, make up a majority of the water used. It is common for a small domestic water right to list ‘*Irrigation*’ as a beneficial use, even though the purpose of the water right is for ‘*Domestic*’. The ‘*Irrigation*’ beneficial use is intended for large agriculture operations that provide food/product to the public and not for small gardens. For all water rights that list both *Domestic* and *Irrigation* as beneficial use, staff will need to check the water right and decide if the main purpose is for something other than ‘*Irrigation*’. If so, the (HIGHEST_RANK) will need to be updated for the newly assigned primary beneficial use. The (ASSIGNED_BENEFICIAL_USE) will need to be updated along with the (MONTHLY_PERCENT_RETURN_FLOW).
- 3) Many water rights list multiple beneficial uses, that aren’t all reflected in Ewrims, but are included in the yearly water use reports. Verifying each water right has the correct primary beneficial use is important for the model to calculate with the correct percent return flow. Depending on the size of the area being QA/QC’d, it may not be time feasible to review all the actual water use reports. Focus on reviewing the priority water rights, those with greater than 10 Acre-feet Face Value or Initial Reported Diversion. If time allows you can continue review with the smaller water rights after. For every new beneficial use assigned be sure to update the (ASSIGNED_BENEFICIAL_USE) and (MONTHLY_PERCENT_RETURN_FLOW).
- 4) Next step of this module is identifying water rights that are ‘*Non-Consumptive*’, and all the water diverted is returned to the stream, ex) *Power, Fish and Wildlife Preservation and Enhancement*, and *Recreational*. For water rights that have these primary beneficial uses, make sure (FULLY_NON-CONSUMPTIVE) is set to “Y” and for ‘*POWER*’ also make sure (POWER_DEMAND_ZEROED) is set to “Y”. Double check all (MONTHLY_PERCENT_RETURN_FLOW) is set to “100”.
- 5) Last, we need to check for water rights that weren’t included in the module since they don’t have a beneficial use listed. These are usually found by performing a comparison of the unique water rights expected in the project with the unique water

right list produced in the Beneficial Use Module. These water rights would need to both have their record manually added to the Module results, and staff would need to try and deduce and manually assign the primary beneficial use from the eWRIMS record.

Diversion Out of Season Module

The Diversion Out of Season Module is intended to highlight where annual water use reports for an individual water right show use outside of the approved diversion season(s). This module will focus on Appropriative Water rights and not include any Statements or Federal Claims. Both are recorded claims rather than permitted rights and thus don't have an approved diversion season.

This Module is very complicated to produce based on the eWRIMS records, but is intended to highlight a simple concept, where an appropriative water right is recording water use outside of its approved diversion season(s). The simplest manual correction is to zero out demand in months where the diversion is not approved, so that demand is not reflected in the final demand data set for the project area.

This Module is broken into two parts:

- Part A analyzes all authorized start and end dates for direct diversion and diversion to storage from the "USE_SEASON" Flat File. This resulting table shows which months are included in the season of diversion for each water right.

| | | | | | | | | | | | | | |
|----|----------------|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| 1 | INFO: | INPUT DATA FOR SPREADSHEET - FROM PART_A | | | | | | | | | | | |
| 2 | ACTION: | PASTE AS DATA NEW INPUT DATA FROM PART_A DIRECT SEASON HERE - DELETE SAMPLE DATA BELOW | | | | | | | | | | | |
| 3 | APPL_ID_UNIQUE | JAN_DIRECT | FEB_DIRECT | MAR_DIRECT | APR_DIRECT | MAY_DIRECT | JUN_DIRECT | JUL_DIRECT | AUG_DIRECT | SEP_DIRECT | OCT_DIRECT | NOV_DIRECT | DEC_DIRECT |
| 4 | A001029 | | | | | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | | |
| 5 | A001205 | | | | | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | | |
| 6 | A001983 | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON |
| 7 | A002723 | | | | | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | | | |
| 8 | A002928 | | | | | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | | |
| 9 | A003421 | | | | | | IN_SEASON | IN_SEASON | IN_SEASON | IN_SEASON | | | |
| 10 | A003601 | | | | | | IN_SEASON | IN_SEASON | IN_SEASON | | | | |

Figure 6. Example of each application's season of diversion by month.

- Part B incorporates the diversion seasons from part A and cross references all diversion reports submitted for each water right. Any records of diversion occurring outside the authorized season of diversion as well as a count of these records are calculated in the "DIVERSION_OUT_OF_SEASON" excel tab.

| | | | | | | | | | |
|----|---|-------|--------|----------------|----------------------|--------------------|-----------------|---|---------------------------------|
| 1 | INPUT DATA FOR SPREADSHEET - FROM WATER_USE_REPORT FLAT FILES | | | | | | RESULT - OUT OF | RESULT - NO OF OUT OF SEASON DIVERSIONS BY APPLICATIO | |
| 2 | PASTE NEW INPUT DATA FROM [NAME OF SCRIPT] SCRIPT HERE - DELETE SAMPLE DATA BELOW | | | | | | FILL DOWN FORM | ARRAY - DO NOT FILL DOWN | |
| 3 | YEAR | MONTH | AMOUNT | DIVERSION_TYPE | OUT_OF_SEASON_DIRECT | OUT_OF_SEASON_STOR | DIVERSION_OUT | UNIQUE_RMS_A | NUMBER OF OUT OF SEASON RECORDS |
| 73 | 2018 | 4 | 0 | DIRECT | | | 0 | A013270 | 0 |
| 74 | 2018 | 6 | 0 | STORAGE | | | 0 | A013277 | 0 |
| 75 | 2019 | 4 | 0 | STORAGE | | | 0 | A013281A01 | 0 |
| 76 | 2020 | 11 | 1.04 | DIRECT | OUT_OF_SEASON_DIRECT | | 1 | A013281A02 | 6 |
| 77 | 2014 | 12 | 0 | STORAGE | | | 0 | A013281B | 0 |
| 78 | 2017 | 3 | 0 | STORAGE | | | 0 | A013287 | 0 |
| 79 | 2015 | 4 | 0 | DIRECT | | | 0 | A013288 | 0 |
| 80 | 2017 | 12 | 0 | DIRECT | | | 0 | A013289 | 0 |
| 81 | 2019 | 8 | 3.59 | DIRECT | | | 0 | A013301 | 7 |
| 82 | 2017 | 11 | 0 | STORAGE | | | 0 | A013317 | 0 |
| 83 | 2017 | 11 | 0.3 | DIRECT | OUT_OF_SEASON_DIRECT | | 1 | A013330 | 0 |
| 84 | 2019 | 9 | 3.04 | DIRECT | | | 0 | A013331 | 12 |
| 85 | 2019 | 3 | 0 | DIRECT | | | 0 | A013359 | 0 |

Figure 7. Example of applications with number and type of out of season diversions.

In practice, very few instances of diversions out of season should be found, therefore it is worth taking a closer look at any water rights that are flagged and verifying in eWRIMS that the diversions really are out of season. Rather than ‘zeroing’ out of season months, we instead will take note of non-compliant diverters for future action.

Identify Duplicate reporting (Duplicate Values – Months and Years Module and Duplicate Diversion for Multiple Water Rights Module)

Duplicate reports lead to erroneous and inflated water demand estimates. Reporters will sometimes submit identical water use values for identical Points of Diversions (POD) that serve multiple water rights (e.g., report total demand for all associated water rights served by a POD under each water right instead of splitting up demand proportionately for each water right). This reporting will lead to over estimating demand and impact water right allocation. A script was generated to identify these scenarios for correction. Initially, POD measuring less than 500 meters apart are flagged as potential duplicate pairs. These pairs are then further screen for similarities in reported water use values, primary owner names, status, and use type. If these indicators are positive and the reported diversion is confirmed as a duplicate, it should be removed from the demand dataset. For all the water rights that repeated monthly/ yearly diversions amounts, they should be flagged in the master table.

Expected Demand, Diversion Exceeds Face Value, Unit Conversion, Storage vs Use vs Diversion, and Statistics Module

This Module is intended to restructure reported diversion and use data into a more understandable format, highlight where annual reports deviate significantly from what is either allowed (for appropriate rights) or what was initially reported (for riparian claims), and ultimately result in the final estimates of expected diversion (demand) and use data. The Module will have you correcting erroneous water diversion amounts to accurately represent the demand. This module is the largest and the focus will be using columns that summarize the reports to find errors then reviewing the water right and validating the monthly diversions. The following steps are recommendations for analyzing the water rights subsets and ways to identify erroneous reporting. All reporting errors should be corrected at the monthly level (Columns W–BF), and the formulas will update the associated data. A very common error is the applicant reporting in the wrong units, typically Gallons instead of Acre-feet. Use columns (BW-BZ) as a quick conversion reference for unit errors and if one of those values seems closer to face value/ more plausible.

- 1) The most obvious “bad” data is found when the total reported annual use is compared to the (FaceValue), which is either the permitted annual amount allowed in appropriate water rights or the initial reported diversion (Initial_Reported_Diversion) for riparian claims. The easiest way to analyze the results of this Module is to sort the diversions using percentage of “face value”, Column BS (Diversion_as_Percent_of_FV), with the largest percentage values on top. The amount of water (in acre-feet) reported over “face value” (Amount_over_FV), is also included and can be used for prioritizing review. You will commonly find that the largest percentage values will show reported use far above

the associated face value or initial diversion. The value of sorting by percentage of “face value” is that most watersheds or study areas will have enough water rights that reviewing every individual water use report is infeasible, however sorting can give focus to the smaller subset of records that are most likely to have errors that will have the most significant effect on the demand dataset.

| AnnualTotalDiversior | Annual_Use | FaceValue | Initial_Reported_Diversion | Units_IniDiv | IniDiv_Converted_to_AF | Diversion_as_Percent_of_F | Amount_over_FV |
|----------------------|------------|-----------|----------------------------|--------------|------------------------|---------------------------|----------------|
| 100 | 0 | 95.5 | 0 | | 0 | 1.047120419 | 4.5 |
| 100 | 0 | 95.5 | 0 | | 0 | 1.047120419 | 4.5 |
| 100 | 0 | 95.5 | 0 | | 0 | 1.047120419 | 4.5 |
| 100 | 0 | 95.5 | 0 | | 0 | 1.047120419 | 4.5 |
| 100 | 0 | 95.5 | 0 | | 0 | 1.047120419 | 4.5 |
| 75 | 0 | 95.5 | 0 | | 0 | 0.785340314 | 0 |
| 56 | 0 | 95.5 | 0 | | 0 | 0.586387435 | 0 |
| 4 | 0 | 95.5 | 0 | | 0 | 0.041884817 | 0 |
| 34 | 0 | 95.5 | 0 | | 0 | 0.356020942 | 0 |
| 34 | 0 | 95.5 | 0 | | 0 | 0.356020942 | 0 |
| 34 | 0 | 95.5 | 0 | | 0 | 0.356020942 | 0 |
| 2 | 0 | 95.5 | 0 | | 0 | 0.020942408 | 0 |
| 4 | 0 | 95.5 | 0 | | 0 | 0.041884817 | 0 |
| 345 | 0 | 95.5 | 0 | | 0 | 3.612565445 | 249.5 |
| 6.77 | 0 | 95.5 | 0 | | 0 | 0.070890052 | 0 |

Figure 8. Example of reported use of 345 acre-feet which exceeds the face value by over 249 acre feet and 361%.

Far Above Face Value (>200% face value)

Many reports that show use far above face value are indicative of major errors in the reports. The two most common errors are reporting gallons as acre-feet, and reporting rates of diversion as acre-feet. It is not always obvious which is the cause, but staff should be able to test out some conversions using the pre-calculated unit conversion fields and review the actual water use reports for each flagged water right to figure out what is the likely error. There are some differences in approach between appropriative rights and Statements, as Statements aren't limited to their initial diversion amount and changes may occur due to new ownership. The overall amount being diverted should be considered for Statements that exceed face value, a change from 200 gallons to 800 gallons a year represents a 400% increase and may be reasonable since it does not constitute as big of a difference as compared to 200 acre-feet and 800 acre-feet.

This is where use of the “amount over face value” field can become particularly useful.

The biggest QA/QC action here is deciding how to correct these records. Leaving demand values from this group unaltered could significantly increase the final demand dataset. Gallons to acre-feet conversion errors are easy to correct, the rate of diversion error is more difficult in absence of contacting the diverter for more information, which is not considered as part of the QA/QC process at this time. The best approach for rate of diversion errors is to decide on a uniform correction to apply that can be documented for the QA/QC process. The major decision point here is what length of time to apply to the rate to transform it into a monthly amount, without having to make too many assumptions about use and assuming there won't be sufficient time/resources/regulatory ability to contact the water right holder for more information. It is not uncommon for monthly diversion volumes to inadvertently be reported as diversion rates. Particularly when the user does not understand the difference between direct diversion, diversion to storage, and use. It can be common to see a diversion rate

being reported under “direct diversion”, while the diversion volume associated with that rate is reported under “use”, or similar mix-up

Close to Face Value (100%-200% face value)

This category covers tougher decision points for modifying water rights data. An appropriate right should not exceed its face value, however there is always the chance that the specific terms of a permit or license may allow more water to be taken in certain circumstances. Similarly, many appropriative water rights have seasons of diversion associated with the water year (October 1 – September 30) and not the calendar year, which can result in a total calendar annual report exceeding face value, but the diverted amount is within the face value limits permitted within the water year. This is where the total amount matters as much as the percentage over, as shown in the Statement example above. By further sorting the water rights flagged in this category by the total face value amount (FaceValue), staff can choose to focus on the largest diversions first.

An important aspect to consider however when evaluating the “face value” results is the water right type, as appropriative rights and riparian rights have very different regulatory processes. Appropriative rights have a maximum amount they can divert based on the terms of their permit or license. Riparian rights are more nebulous in that 1) They must share and share alike both in times of plentiful water and water scarcity, meaning there is not a firm limit to their usage over the general state law that prohibits waste of water, and 2) The “face value” of a Statement is really the initial reported diversion amount, which is only a recordation with us and not a limit on what they can divert. If a property using a riparian right changes owner, the new owner may put more water to use in future years than was previously reported, causing yearly reports to exceed the “face value”, however this doesn’t amount to any violation since it is not a permit or license.

- 2) Reported diversions under Statements should still be reviewed for reasonableness, however the “face value” should be used as a guide rather than as a hard limit. What makes this section particularly hard to QA/QC is that an understanding of both trends in how diverters make errors in reporting and of the changes in the reporting form itself over the years is required. A common error is diverters recording the same value for “Direct Diversions” and “Diversions to Storage”, effectively doubling the reported amount. There is a pre-calculated field that will identify this specific potential type of duplicate reporting in the Module.

| 3 | APPL_ID | WATER_RIGHT_ID | YEAR | MONTH | AMOUNT | DIVERSION_TYPE |
|-----|---------|----------------|------|-------|-------------|----------------|
| 122 | A001029 | 147 | 2016 | 8 | 1.23 | DIRECT |
| 123 | A001029 | 147 | 2014 | 4 | 0 | DIRECT |
| 124 | A001029 | 147 | 2014 | 3 | 0 | STORAGE |
| 125 | A001029 | 147 | 2014 | 5 | 1.232961264 | DIRECT |
| 126 | A001029 | 147 | 2019 | 8 | 0 | STORAGE |
| 127 | A001029 | 147 | 2020 | 4 | 0 | DIRECT |
| 128 | A001029 | 147 | 2016 | 7 | 0 | STORAGE |
| 129 | A001029 | 147 | 2016 | 8 | 0 | STORAGE |
| 130 | A001029 | 147 | 2014 | 6 | 1.232961264 | DIRECT |
| 131 | A001029 | 147 | 2014 | 5 | 1.232961264 | STORAGE |
| 132 | A001029 | 147 | 2018 | 3 | 0 | DIRECT |

Figure 9. Example of reporting identical values for both direct diversions and diversions to storage for the same month and year.

The total may still be far below their face value, however it is still an incorrect representation of water usage, especially when there is not a storage component on their water right. This reflects an essential misunderstanding of what the Division is requesting when asking diverters to submit annual reports of water usage. To add to this, prior to 2014 the Division had a combined “Diversion” field where the total of both direct and storage diversions was reported, which makes diagnosing errors in reporting harder (and perhaps leading to the later trend of reporters putting the same number in multiple fields when water use reports changed).

- 3) A final check is reviewing the yearly average diversions (ANNUAL_TOTAL_DIVERSION). First sort from largest to smallest and validate the water rights that may be within their ‘Face Value’/ ‘Initial Reported Diversion’, but are still diverting a large amount of water. Verify that all larger diversions are correct and assigned the appropriate beneficial use. For water rights that only have one or two ‘high’ demand year(s), check their other yearly water use reports to determine if the outlier report is correct. Some diverters will mess up on their units but due to their larger ‘allowable’ diversion will get past the ‘face value’ check from earlier.

The same check can be done by sorting the (ANNUAL_TOTAL_DIVERSION) from smallest to largest and make sure the applicant didn’t report the wrong units and is under-reporting their water use. This may be harder to determine so look at the water rights yearly water use reports on Ewrims for consistency and check if stated amount is appropriate for the beneficial use.

Calculation of diversion data for final master demand table.

The “Expected Demand, Statistics, Diversion Exceeds Face Value, and Unit Conversion, Storage vs Use vs Diversion, and Statistics Module” calculates monthly average diversion data based on the diversion and use data reported to RMS by the water right holders. Use the Data Processing Module Tabs of the QAQC Working File to identify errors or other changes that need to be made. Use these QAQC Suggested Review Guidelines for considerations to make when evaluating the results of the Data Processing Modules. If it’s determined that any changes need to be made, overwrite the corresponding data field in the Intermediate Diversion and Use tab within the QA/QC Working File and update the three QA/QC action columns to document whether a change was made, what the specific change was, and the reason for the change. This will be used to generate a final QAQC’d demand dataset that will go into the final master demand table in the QAQC Working File spreadsheet. This will aid in transparency by providing a clear record of which individual reported values were modified to generate the QAQC’d demand dataset.

The final table is called the (MasterDemandTable) and pulls values from the previous modules you reviewed. The MasterDemandTable gives a more concise and now accurate description of each water right and to be used in the demand modeling. This table should be reviewed to make sure all the columns are filled but no edits should be done in this spreadsheet. Use the formula reference to correct any errors that may have been missed in a previous spreadsheet. This table can be adjusted if more information is needed for the final table, but be careful about moving columns around and breaking the

formulas.