California WaterFix

MBK Modeling Surrebuttal Technical Report

June 9, 2017

Introduction

Petitioners submitted exhibits DOI-36, DOI-33 Errata, DWR-78, DWR-86, DWR-549, and DWR-670 in rebuttal to MBK Engineers' exhibits and testimony regarding MBK's modeling of California WaterFix (CWF) and MBK's conclusions regarding CWF's potential effects on storage in CVP and SWP reservoirs and the associated effects on the Sacramento Valley Water Users (SWVU). Much of Petitioners' rebuttal can broadly be characterized into two general categories: 1) criticism of MBK modeling techniques and 2) criticism of MBK modeling of the discretionary actions of Central Valley Project (CVP) and State Water Project (SWP) operators with CWF.

While the Petitioners' criticisms can be broken down into these two categories, it is challenging to cleanly compartmentalize responses as the issues are often interrelated. For example, a degree of foresight is used in the process of making manual allocation adjustments based on operational rules. So to address the Petitioners' criticisms, the Petitioners' statements and MBK responses are divided into the following topics:

1. Use of foresight
2. Annual Export Estimate Adjustments Used in CVP and SWP Allocations
3. Manual Export Estimate Adjustments made in SWP Allocations in MBK Alternative 4A
4. Model Consistency with SWP Oroville Carryover "Policy"
5. MBK Operational Rules for Manual CVP Allocations
6. Reliance on Joint Point of Diversion
7. San Luis Rulecurve and Upstream Reservoir Operations
8. Use of "generalized" model logic

Finally, we respond to Petitioners' rebuttal evidence regarding Term 91 curtailments with CWF.

Unreasonable Use of Foresight

Petitioners' Criticism

<u>DWR -670 Page 9</u>

"*Incorporating foresight into the model, through iterative training and manual manipulation, is an unrealistic portrayal of real-time operations and is not appropriate for use in a planning model. The Petitioners develops export estimates based on a set of principled and reproducible guidelines, which is more reflective of the methodology used in real-time operations*".

<u>In DWR-86 (pp 11, Line 21), Mr. Munevar</u>

"Importantly, the MBK method of developing export "forecasts" was rejected because it included an unreasonable amount of foresight that would not be available to an operator."

<u>DWR-86 (pp 2, Line 5)</u>

"The MBK modeling modifications that result in the largest differences are all discretionary, which in my opinion are flawed, introduce an unreasonable amount of foresight into the modeling…".

MBK's Response

In this section, MBK shows how the Petitioners' arguments about use of foresight in MBK's analysis are based on several incorrect assumptions and inadequate understanding of MBK's modeling approach and technique.

MBK's responses are: 1) use of foresight is a common scientific method, 2) Petitioners' CalSim model employs perfect foresight in several key operational decisions, and 3) MBK's use of foresight is reasonable.

First, to explain the term "foresight", consider an example related to New Melones operations where Petitioners' modelers use foresight in making their modeled operational decisions. A description of New Melones operations using perfect foresight is described in the Exhibit SVWU-304, which is an excerpt from the Modeling appendix for the Biological Assessment for the California WaterFix.

In this example, Petitioners' models make an operational decision in February using perfect foresight of future inflows for the period March 1 through September 30. In real-world operations, operators use a scientific and conservative estimate of the future inflows to New Melones reservoir in their allocation decisions. However, in the modeling world, future hydrologic conditions are known perfectly at any time-step in the model simulation. In the example related to New Melones operations, CalSim applies perfect foresight of seven months (March through September) in the model.

In CalSim, there are several such instances where perfect foresight is used in the decision making process and these modeling characteristics actually were developed by Petitioners' modelers and are used in several of their past planning studies. Perfect foresight is used in CalSim for water year type determination. In the highlighted text in Exhibit SVWU-305, it states "*CalSim uses perfect foresight to predict water-year classification, whereas during normal operations some forecasting is necessary to predict the type of water year during the spring runoff period*."

CalSim uses water supply indices and water year types that control many regulatory flow and water quality requirements and are part of many operational decisions. Mr. Munevar in DWR-86 (pp 7, Line 8) states that "*CalSim II delivers water based on the available water supply and specified priority. For example, simulated delivery to Sacramento River Settlement Contractors, Feather River Settlement Contractors, wildlife refuges, and CVP Exchange Contractors are based on hydrologic conditions for the water year, tributary and delta minimum flow requirements, and availability of upstream storage*". "Hydrologic conditions" in CalSim are based on water year type which is pre-determined in CalSim at the beginning of each water year using foresight. This is confirmed by the reference in SVWU-305. Additional areas where water year type data or perfect foresight is used in the CalSim II model are listed below:

- All inflows and reservoir operations upstream from those included in CalSim
- Allocations to Sacramento River Settlement Contractors, Exchange contractors, and refuges
- Allocations to Feather River Settlement Contractors
- D-1641 – use of perfect foresight of water year type
    - Delta Salinity requirements
    - Rio Vista flow requirement
    - X2 requirement
    - Vernalis minimum flow requirement
- Future inflow to determine allocations and operations
    - San Joaquin River inflow to determine deliveries to the Friant Division
    - Fresno River inflow to determine deliveries to MID
    - Chowchilla River inflow to determine deliveries to CID
    - Merced River inflow to determine deliveries to MID
    - Tuolumne River inflow to determine deliveries to TID and MID
    - Stanislaus River inflow to determine deliveries to OID, SSJID
    - Calaveras River inflow to determine deliveries to SEWD
- Mokelumne River operation of EBMUD
- Delta and Sacramento and San Joaquin River basin accretion / depletions

Use of foresight in modeling is a common modeling technique. CalSim contains numerous instances where foresight is used, foresight is widely accepted, and applied by everyone using the model. MBK modelers followed the many examples of foresight used in the past, including by DWR and Reclamation modelers, and adopted an accepted technique in their effort to develop a more realistic model. The testimony by Petitioners that MBK used an unreasonable amount of foresight is misleading and inappropriately based on an inadequate assessment on the extensive use of foresight in the models. The following sections discuss in detail the specific purpose and use of foresight by MBK modelers, why those uses are reasonable, and why they result in a more realistic model.

Annual Export Estimate Adjustments Used In CVP and SWP Allocations

Petitioners' Criticism

DWR-670, Page 1, Mr. Munevar

"MBK's approach for developing export estimates is inappropriate for use in planning models because it provides the model with foresight that operators would not have when making allocation decisions. In my opinion, Petitioners' modeling more accurately mimics operator decisions and, more importantly, it applies a set of principled guidelines that does not rely on foresight and does not change from year to year. "

DWR-86, Page 10, Line 24, Mr. Munevar

"with respect to the Export Estimate logic and the San Luis Rule Curve logic, their changes in assumptions made a less realistic model; operators would have no ability to operate in a fashion similar to what they assumed in their model. [DWR-78 and DOI-32].

MBK's Response

We disagree with most of these statements.

First, with regard to foresight, to better understand CVP and SWP operators' current level of foresight as it relates to export estimates, we reviewed historical May forecasts of CVP and SWP operations available from DWR's SWP Operations Control Office CALFED Ops Group Archives at http://www.water.ca.gov/swp/operationscontrol/calfed/calfedarchives.cfm. May forecasts are most critical in the allocation process because that is when the CVP and SWP usually set final delivery allocations for the year and CVP and SWP operators use the May 1st allocation to determine how much stored water will be delivered to CVP and SWP contractors during the summer.

DWR's SWP Operations Control Office CALFED Ops Group Archives include Operations Briefing Packages from May meetings for several years. We focused our review on the five-year period of 2009 through 2013 because this period represents years when CVP and SWP operations include the most recent Biological Opinions for salmon and Delta smelt, and operations were not affected by drought conditions and Temporary Urgency Change Petitions that occurred in 2014 and 2015.

The May Operations Briefing Packages contain a figure of forecasted, combined CVP and SWP Delta exports based on a May 90 percent exceedance forecast of hydrology. An example of one of these figures is shown below as Figure 1.

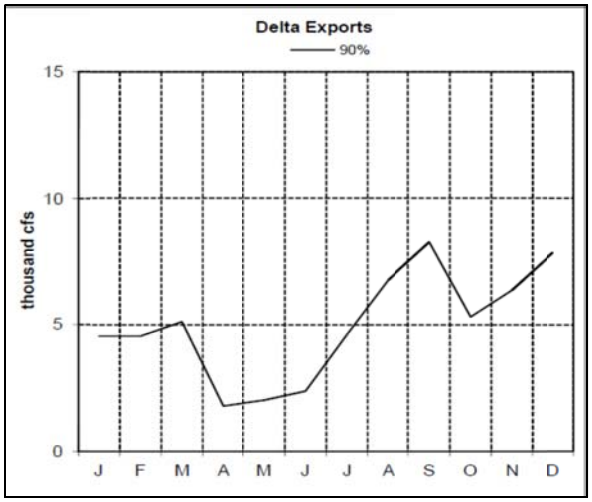

Figure 1: Example of Delta Export Forecast Figure Contained in CALFED Ops Group Briefing Packages (May 2013 Forecast)

From these figures prepared by the CVP and SWP operators, we visually estimated the forecasted May through September combined CVP and SWP Delta exports for each month and summed the total volume of forecasted export for the June through September Period. We then compared these forecasted CVP and SWP exports with actual CVP and SWP Delta exports for the same June through September period for each of the five years. We selected the June through September period because this period aligns with the period used when determining CVP allocations considering end-of-September reservoir storage and aligns with calculations used in CalSim. When making this comparison, we adjusted actual CVP and SWP Delta export data to account for the volumes of transfer water conveyed by the CVP and SWP in some years. We account for the volumes of transfer water separately because it is our understanding that the CALFED Ops Group Forecasts represent only CVP and SWP exports, and do not include forecasts of transfer pumping.

The estimate of the volume of transfer water moved across the Delta for each year was taken from a paper prepared by DWR and the State Water Resources Control Board titled, "Background and Recent History of Water Transfers in California", July 2015 available at http://www.water.ca.gov/watertransfers/docs/Background_and_Recent_History_of_Water_Transfers.pdf. Table 2 of this paper provides the annual volume of all cross-Delta transfers. In these five years, cross-Delta transfers occurred during the July through September period and therefore during the period when we are attempting to compare forecasted and actual CVP and SWP Delta exports. Therefore, the volume of cross-Delta transfer is accounted for as a portion of the observed Delta exports and the remaining Delta exports represent CVP and SWP exports.

Figure 2 compares the May CALFED Ops Group forecasts of total June through September CVP and SWP exports with the actual CVP and SWP exports. The volume of non-Project, transfer pumping each year is shown separately above the volume of actual CVP/SWP exports.

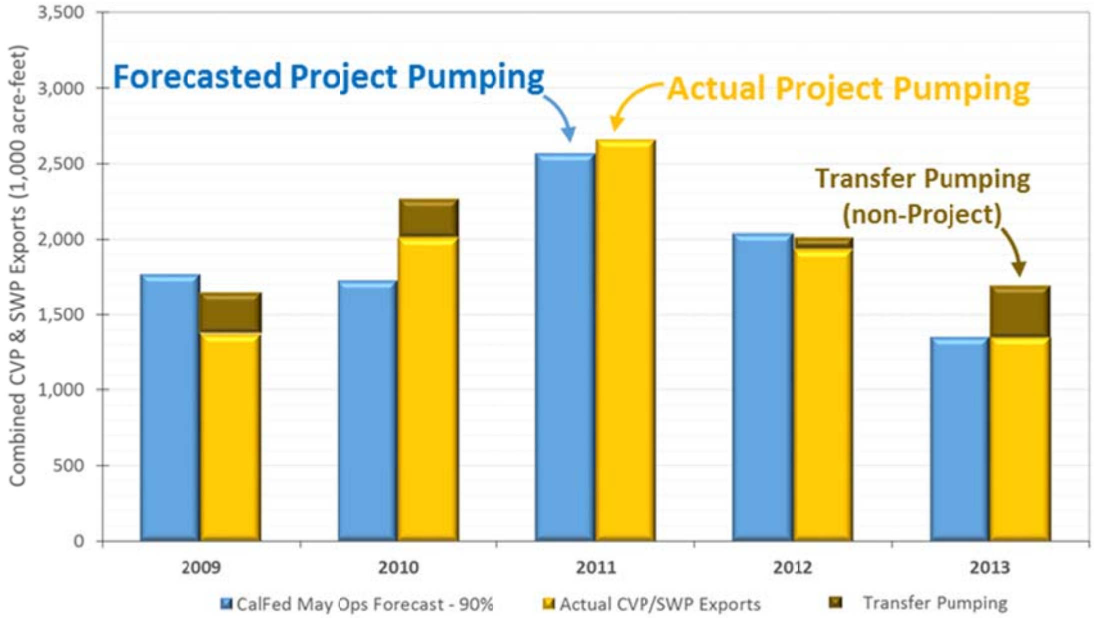

Figure 2 - Historical Export Forecast and Exports

Figure 2 illustrates several important points. First, by May CVP and SWP operators have a reasonably accurate forecast of Delta exports. Years included in Figure 2 cover a range of conditions from wet to dry. In 2011, a wet year, the Delta was in an excess condition throughout the June through September period and operators exported water that would otherwise be surplus Delta outflow. In 2013 the Delta was in a balanced condition June through September and CVP and SWP operators were exporting water released from storage specifically to support Delta exports. Even with the variability in different conditions each year, operators made reasonable forecasts of Delta exports in most years. The one year when actual exports were significantly less than the conservative, 90 percent exceedance forecast was 2009 when Reclamation, and perhaps DWR, reduced June exports to protect Delta smelt. Notwithstanding the 2009 differences, these data demonstrate that, MBK's use of foresight to develop export estimates in a model is reasonable, and aligns well with actual operators' ability to forecast Delta exports.

Second, Mr. Munevar's statements that Petitioners' methods "*…more accurately mimic operator decisions"* does not align with these actual data. A comparison of Petitioners' modeled export estimates with modeled CalSim II exports shows that operators do a significantly better job at forecasting Delta exports than the Petitioners' model. Figure 3 is a comparison of Petitioners' modeled SWP export estimates (in green) and modeled Banks exports for the June through August period (in purple, with red text) for the DWR/USBR BA NAA and the DWR/USBR BA Alternative 4A. Figure 4 is a comparison of Petitioners' modeled CVP export estimates (in green) and simulated CVP exports for the June through August period (in purple, with red text) for the DWR/USBR BA NAA and the DWR/USBR BA Alternative 4A. In years when modeled export estimates affected operations, these estimates do not adequately represent the actual modeled exports, and therefore do not adequately allocate the modeled available water supplies. These figures illustrate the deficiencies of Petitioners' modeling, which MBK corrected by making year-to-year adjustments in export estimates.

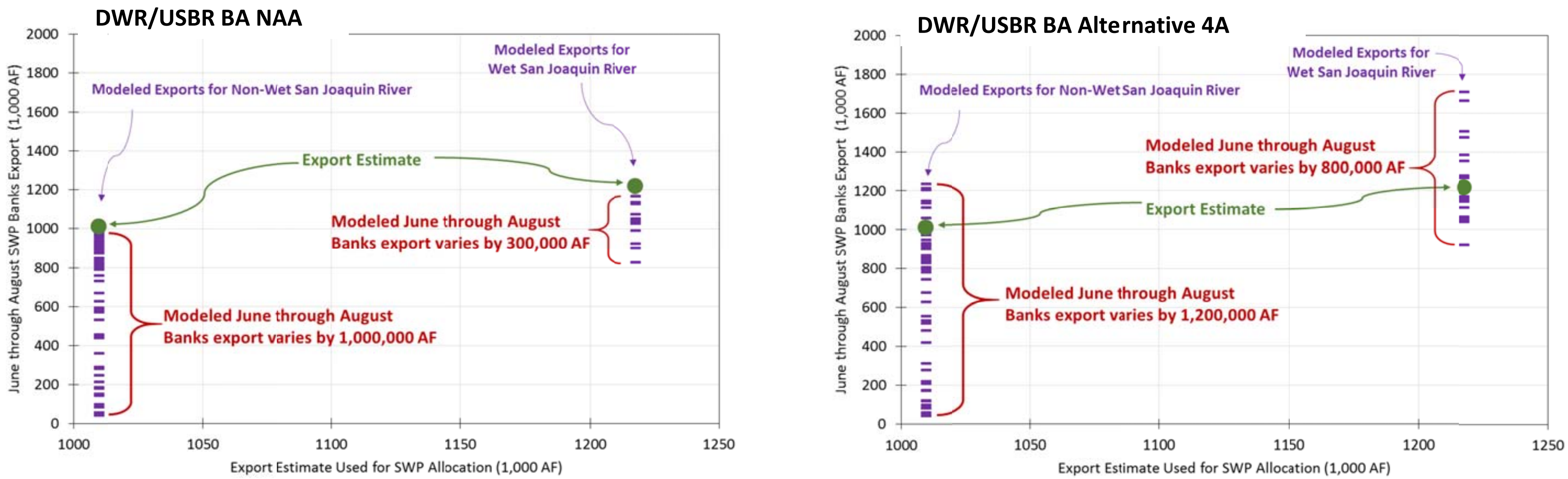

Figure 3 - June through August Modeled SWP Export Versus SWP Export Estimate

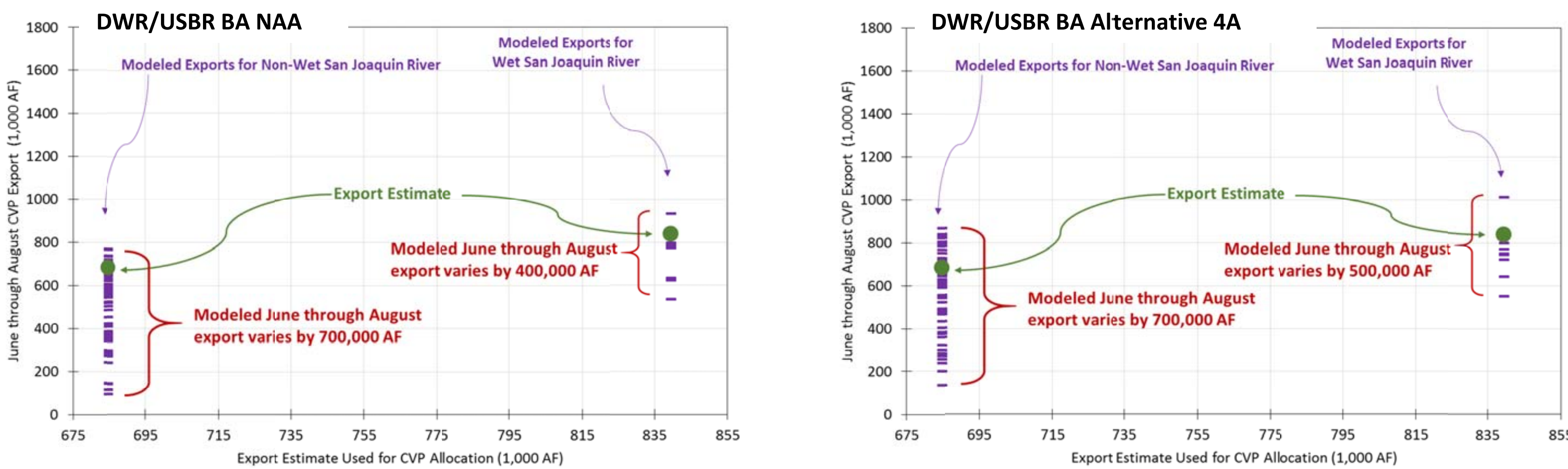

Figure 4 - June through August Modeled CVP Export Versus CVP Export Estimate

Third, Mr. Munevar's statements regarding Petitioners' methods as "…*applying a set of principled guidelines that does not rely on foresight and does not change from year to year"* [DWR-670] actually illustrates the problem with Petitioners' modeling in that the methods do not recognize the variability that exists in CVP and SWP operations from year to year. Reviewing only the five-year period illustrated in Figure 2 shows that forecasted Delta exports varied between approximately 1.5 and 2.8 MAF and were different in every year. This variation occurs because conditions are different every year and operators recognize these differences when making forecasts. The fact that Petitioners' export estimates do not change from year to year is one of the reasons why MBK developed a different method prior to analysis of CWF as explained in SVWU-306, and why this method is superior to the method used by Petitioners.

Fourth, in Petitioners' modeling average June through August exports are about 70 TAF higher in the DWR/USBR BA Alternative 4A model scenario than the DWR/USBR BA NAA model scenario, but the export estimate input table Petitioners' used for making water supply allocations is the same in both scenarios. Since CalSim uses the June through August export estimate, rather than actual exports, to allocate south of Delta water supplies to CVP and SWP contractors, Petitioners' modeling does not allocate the additional June through August exports that are likely to occur with California WaterFix. It is reasonable to assume that if water is exported during the June through August period that it will be allocated. Petitioners' failure to allocate this water results in underestimating the effects the California WaterFix may have on upstream operations and legal users of water. MBK's modeling addresses this problem.

SWP Export Estimate Adjustments Used in MBK Alternative 4A

Petitioners' Criticism

<u>Exhibit DWR-86, p. 12, lines 10-16, Mr. Munevar</u>

"Additionally, MBK disregarded its own export estimates for certain years to increase south of Delta allocations. In Figure 6 every entry that shows 9999 is an example of where MBK disregarded its own export estimate and manually bypassed the export estimate. Note that the 9999 (or manual bypass) does not show up in MBK' No Action alternative modeling, demonstrating an inconsistent implementation of discretionary decisions between alternatives. (For detailed technical information on this topic please see DWR-670)"

MBK's Response

A critique of Exhibit DWR-86, Figure 6 is necessary to understand the Petitioners' criticisms of MBK's export estimates and why these criticisms are incorrect. The values in the total column in the table are meaningless because the Petitioners are inappropriately summing annual totals to calculate annual totals. For instance, in January of 1922, the number listed is "2078". This is the January through August export forecast (2,078 TAF) used in the MBK Alternative 4A. Likewise, the numbers listed for February, March, April, and May are all the total export forecasts from that given month through August. Because each of these numbers is an estimate of total exports for the remaining months through August, it is inappropriate to add them up.

We disagree with Petitioners' argument that the manual input of "9999" is "…*an inconsistent implementation of discretionary decisions between alternatives*." It is realistic to expect that the added export capability provided by the CWF, at times, will cause SWP Table A allocations to go from being export capacity constrained to supply constrained. Put simply, if there is greater export capacity with the CWF, it is reasonable to expect the SWP and CVP to use that additional capacity at times. The MBK export estimates provide the foundation for the export capacity constrained allocation in MBK NAA and MBK Alternative 4A. MBK's entries of 9999 in given years was simply a recognition that in those years deliveries were clearly supply constrained and therefore that the modeling should use the supply based allocation methodology (WSI-DI). In such years, export capacity does not limit allocations to contractors; it is upstream reservoir carryover considerations that limit allocations. The appropriate allocation methodology in supply constrained years is WSI-DI which takes Oroville carryover guidelines into account.

Furthermore, the MBK NAA results show that in 26 of the 35 years for which 9999 was entered for the Export Estimate in MBK Alternative 4A, the Table A allocations in MBK NAA were also supply constrained and allocations were based on WSI-DI, just as they were in the MBK Alternative 4A. In only 9 of the 35 years that 9999 was entered was the MBK NAA Table A allocation export capacity constrained and the MBK Alternative 4A Table A allocation was WSI-DI constrained. The difference in allocation methodology in these years was not due to the "*. . . inconsistent implementation of discretionary decisions between alternatives*" as Petitioners argue. Instead, it was due to the additional export capacity that would be provided by the CWF and the discretion that operators would have to use it.

Model Consistency with SWP Oroville Carryover "Policy"

Petitioners' Criticism

Exhibit DWR-78, page 9, lines 16-24, Mr. Leahigh

"Exhibit DWR-853 shows that although total exports increase as a result of the proposed CWF project, there is actually a decrease in the volume of stored water from upstream Sacramento Valley reservoirs to be exported from the Delta. This modeling result is consistent with the SWP policy of leaving higher levels of carryover storage in Lake Oroville as current year delivery capability increases. Greater emphasis is given to the next year's objectives as the current year's objectives are increasingly satisfied. This supplementary storage is in addition to providing a reasonable level of carryover storage necessary to meet Project obligations should the following year be dry."

Exhibit DWR-78, page 9, lines 25-26, Mr. Leahigh

"The modeling results of Mr. Bourez which show a more aggressive use of stored water with the CWF (Exhibit DWR-854) are diametrically inconsistent with this [DWR Oroville carryover] *policy."*

MBK's Response

In cross-examination, Mr. Leahigh testified that current Oroville storage carryover policy used in DWR allocation procedures is expressed by the following equation (DWR-902):

Equation 1

Lake Oroville storage target = 1.000 MAF + "F" x (ORO_EOS - 1.000 MAF)

- *"F" = 1/2 x Possible Table A %*
- *ORO_EOS = End of September Oroville storage of the previous year in MAF*

Mr. Leahigh's conclusion that the Petitioners' "*… modeling result is consistent with SWP policy*," is incorrect.

In CalSim, DWR Oroville carryover policy as formulated in Equation 1 is directly implemented in the SWP WSI-DI Table A allocation procedure. (It is incorporated into the calculation of variable swp_perdel_raw2 in file delcar_swp.wresl. Variable swp_perdel_raw2 is equivalent to the variable *Possible Table A%* expressed in Equation 1.) This is true in the DWR/USBR NAA and DWR/USBR Alternative 4A, and it is just as true in MBK NAA and MBK Alternative 4A.

CalSim SWP Table A allocations can be broken down into three sub-allocations: 1) a drought (or dry) year allocation, which recognizes that allocations should not be less than the available storage in San Luis Reservoir plus some minimal Banks Pumping Plant pumping just above health and safety levels. This sub-allocation does not directly consider the DWR Oroville carryover policy because the allocation itself depends only on water in San Luis Reservoir and minimal pumping; 2) the WSI-DI based allocation which does take DWR Oroville carryover policy into account as described in the preceding paragraph (variable swp_perdel_raw2); and 3) the export estimate based allocation which is intended to limit allocations based on available export capacity so as to prevent allocating more water than can be delivered through Banks Pumping Plant. The export estimate based allocation does not consider DWR Oroville carryover policy. However, the final allocation, determined by comparing the three sub-allocations ensures that the final allocation takes DWR Oroville carryover policy into account by always taking the minimum of the WSI-DI based allocation or the export estimate based allocation. The drought year allocation only supersedes this minimum when it is greater.

Given this background, we can look at when CalSim Table A allocations are based on the Oroville carryover "policy" and when they are not. Figure 1 plots the modeled Table A allocations for all 82 years of the DWR/USBR BA NAA study versus the DWR Oroville carryover based Table A allocation "policy" for the same model scenario. The smaller purple points indicate that allocations are determined with the dry year logic. The blue points indicate WSI-DI controlled allocations. The green points indicate that export estimates control allocations. The red line is calculated using Equation 1. All of the blue points fall on this red line, which represents DWR Oroville carryover "policy" based allocations. All drought condition allocations are greater than the DWR policy based allocation. This is acceptable because the drought condition allocation itself does not depend on the availability of water stored in Lake Oroville. On the other hand, the export estimate based allocations are all less than DWR Oroville carryover "policy" based allocations. This is because there is stored water in Oroville available for allocation and there is not enough export capacity at Banks Pumping Plant given various regulatory constraints on conveyance of stored water.

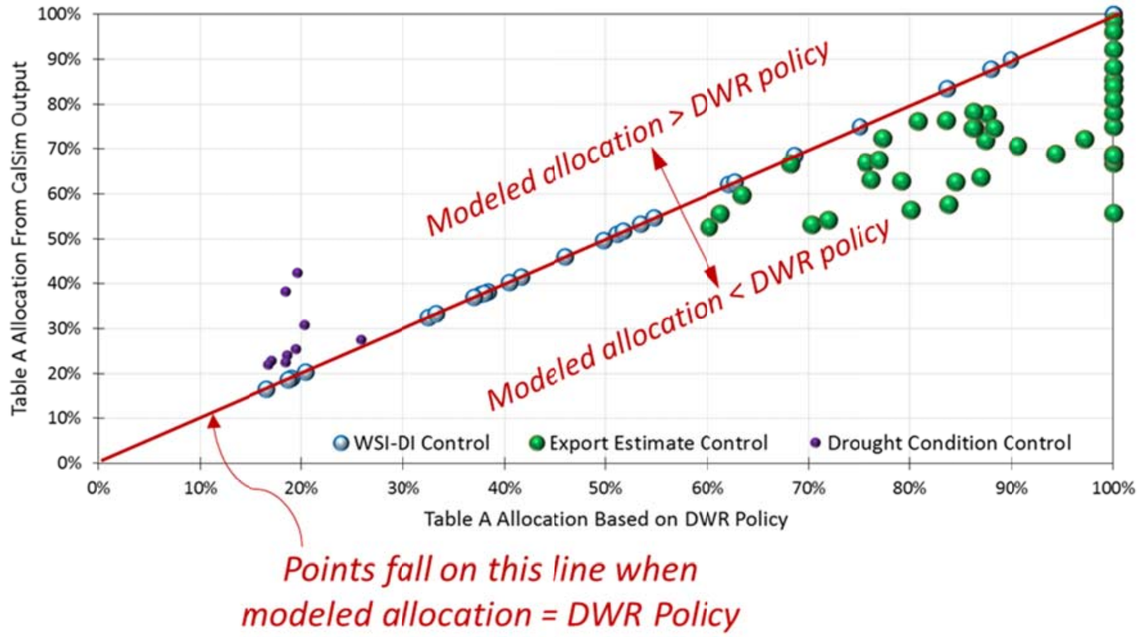

Figure 5 - CalSim II Modeled SWP Table A allocation Versus Allocation "Policy", DWR/USBR BA NAA

Figure 6 plots the modeled Table A allocation of all 82 years of the DWR/USBR BA Alternative 4A scenario versus the DWR Oroville carryover based Table A allocation "policy" for the same model scenario. There are many years where the modeled Table A allocation is less than 100% and less than what DWR Oroville carryover "policy" would allow. These allocations are controlled by the export estimate based logic. However, unlike the DWR/USBR NAA BA, there is significant available export capacity remaining in many of these years in the DWR/USBR BA Alternative 4A. In DWR/USBR BA Alternative 4A, the export estimates used to limit Table A allocations are artificially low. (For a detailed description of the effects of assuming an artificially low export estimate, please refer to Exhibit SVWU 109 Boundary Analysis pp. 13-27.) The Petitioners' use of artificially low export estimates results in DWR/USBR BA Alternative 4A allocations that do not reflect DWR Oroville carryover "policy" as applied in the Table A allocation process. The artificially low export estimates often cause modeled allocations to be lower than actually would occur under current DWR "policy" with California WaterFix in operation.

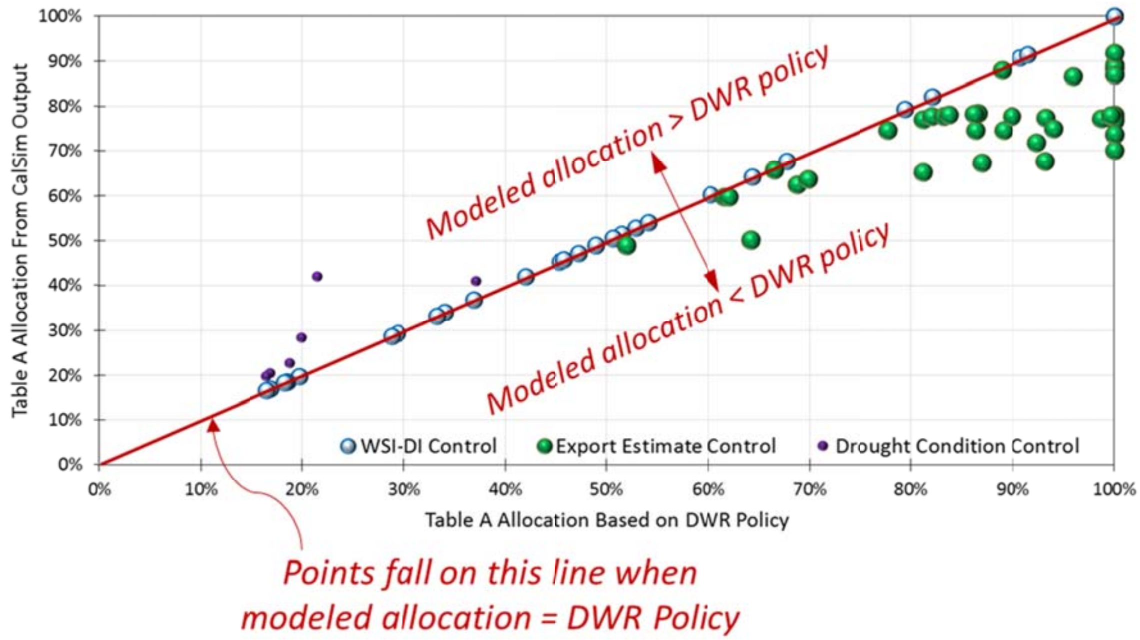

Figure 6 - CalSim II Modeled SWP Table A allocation Versus Allocation "Policy", DWR/USBR BA Alternative 4A

Exhibit DWR-78, page 9, lines 25-26, Mr. Leahigh

"The modeling results of Mr. Bourez which show a more aggressive use of stored water with the CWF (Exhibit DWR-854) are diametrically inconsistent with this [DWR Oroville carryover] *policy."*

The above statement by Mr. Leahigh is incorrect. MBK NAA and MBK Alternative 4A incorporates DWR Oroville carryover "policy" into WSI-DI based allocations in the exact same manner that the Petitioners' modeling does. The difference is that the MBK modeling does not constrain allocations in MBK Alternative 4A with artificially low export estimates. MBK allows the allocations to be based on DWR Oroville carryover "policy" when Table A allocations are not export constrained.

Figure 7 and Figure 8 compare modeled Table A allocations with the DWR Oroville carryover "policy" based allocations in MBK NAA and MBK Alternative 4A respectively. As shown, allocations are equal to or less than the DWR Oroville carryover "policy" based allocations. The added export capacity provided by the CWF in MBK Alternative 4A provides for allocations that are closer to DWR Oroville carryover "policy", but never in excess of the allocation dictated by the "policy". Therefore, MBK's use of stored water in both the MBK NAA and the MBK Alternative 4A is consistent with DWR Oroville carryover "policy" stated by Mr. Leahigh and as applied by Petitioners in their CalSim allocation procedure.

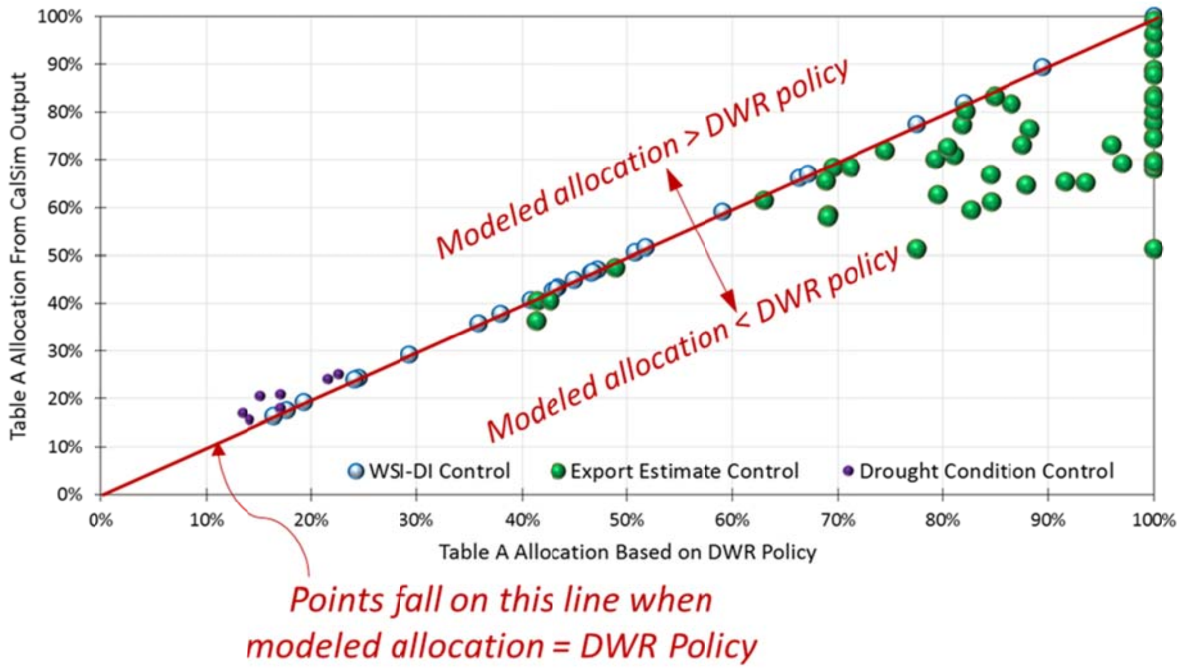

Figure 7 - CalSim II Modeled SWP Table A allocation Versus Allocation “Policy” (MBK NAA)

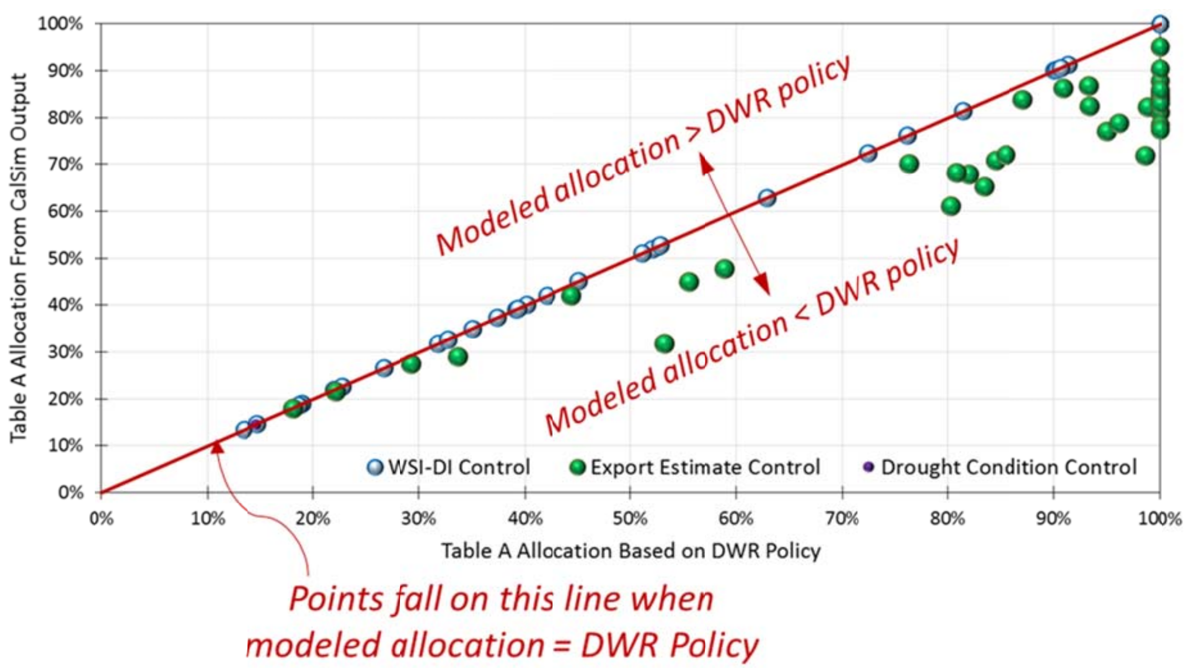

Figure 8 - CalSim II Modeled SWP Table A allocation Versus Allocation “Policy” (MBK Alternative 4A)

MBK Operational Rules for Manual CVP Allocations

Petitioners' Criticism

Exhibit No. DOI - 33 Errata, page 1, Ms. Parker
"*The degree to which MBK fixed their models' behavior is extreme, to the point that their analysis is hard to characterize as comparative planning modeling*"

Exhibit No. DOI - 33 Errata, page 8, Ms. Parker
"*MBK modeling explicitly forced higher CVP NOD allocations and lower CVP SOD allocations in their no action alternative, and conversely forced higher CVP SOD allocations in their WaterFix operation, driving their modeling to achieve adverse impacts to NOD delivery.*"

Exhibit No. DOI - 33 Errata, page 10, Ms. Parker
"*MBK's manual tinkering with the model's decisions was so extensive as to make it more a hand-crafted narrative to support the conclusion that the WaterFix would have undesirable impacts on NOD delivery and storage.*"

Exhibit No. DOI - 33 Errata, page 10, Ms. Parker
"It's easy to see how a single model run could take weeks to prepare, considering that they had to assess how a manual change in any year of a particular run affected not only that run in that year but also the differences between the NAA and Alt4 studies over the whole period of record. Fundamentally, hardwiring 80% of the delivery impacts does not appropriately comprise a comparative study.
By encouraging lower NOD allocations and higher SOD allocations with WaterFix, MBK explicitly set up the results they were looking for. MBK did not rely on model logic to achieve these results,"

CWF Hearing Transcript from May 11, 2017, page 185: Ms. Parker
"*My statement about MBK's modeling not following basic conventions is almost entirely about them fixing allocations in both the no action and in the proposed action in a way that doesn't use any logic at all. Those are manual inputs. It's the decision of a person, not of a model, not of an algorithm, not using any kind of a rule curve.*"

MBK's Response

MBK spent considerable time determining how the CWF, combined with the Joint Point of Diversion (JPOD) could be used to better integrate North of Delta (NOD) and South of Delta (SOD) CVP reservoir operations to allow the CVP SOD water service contractors to benefit from the CWF. One source of those potential benefits is water stored in upstream reservoirs above required levels that cannot be delivered due to existing export capacity constraints. The CWF, combined with JPOD, would give SOD CVP water service contractors access to that water.

A lot of the underlying allocation input adjustments that Ms. Parker saw and documented in Table 1, DOI-33 Errata, were part of MBK's draft simulations to better understand how the CWF could work, but did not ultimately inform MBK's final CVP allocations. The method used to determine final CVP allocations in both the MBK NAA and the MBK Alternative 4A is explained in SVWU-107. It is important to explain that method here as a foundation to respond to Petitioners' criticism regarding MBK's manual CVP allocations. The basic operations strategy was described as follows:

> *"The NDD would allow for greater use of water stored in upstream reservoirs. This would increase the operational efficiency of these reservoirs and allows use of the proposed NDD. Therefore, the MBK modeling assumes that if the NDD is constructed, it will be used to convey available supplies in upstream CVP and SWP reservoirs. The basic operational strategy would be, given regulatory constraints, is to divert as much surplus as possible and to operate upstream CVP and SWP reservoirs to convey surplus stored water when possible." (Exhibit SVWU 107, page 52, displayed as page 44, paragraph 1)*

The allocation logic MBK used to implement this operations strategy is consistent for both the MBK NAA and the MBK Alternative 4A. In SVWU-107, we defined CVP surplus stored water as follows:

> *"In years when Shasta and Folsom carryover storage is greater than 3 MAF (2.4 MAF for Shasta and 0.4 MAF for Folsom with a 0.2 MAF buffer) there would be enough water to satisfy upstream environmental criteria and to increase releases for SOD water supplies." (Exhibit SVWU 107, page 40, displayed as page 32, paragraph 1)*

MBK used this 3 MAF threshold to determine whether CVP water service contractor allocations should be increased in both the MBK NAA and MBK Alternative 4A.

In SVWU-107, we acknowledged there were problems with the existing CalSim II allocation methodology particularly with regard to simulating CVP allocations.

> *"Problems with the CVP allocations could not be resolved with adjustments to CalSim II's WSI-DI curve and the export forecasts alone. This is due to the frequent disconnection of CVP NOD and SOD water service contract allocations. It is CVP policy that NOD and SOD service contractors in the same category (Ag or M&I) will receive equal allocations unless SOD allocations are limited by Delta export capacity. In the MBK NAA, SOD contractor allocations are conveyance limited in 40 years of the 82 year simulation. When conveyance capacity does not limit allocations, NOD and SOD contractors share an aggregate supply. When Delta export capacity does limit SOD allocations, SOD contractors are cut off from some portion of that supply. With the Delta export capacity limitation, SOD contractor allocations are limited by the sum of forecasted exports plus current San Luis storage above targeted carryover. While CalSim II correctly quantifies the SOD allocation, the NOD allocation is based on WSI-DI which divides and aggregate supply (forecasted inflows and Shasta, Folsom, Trinity, and San Luis storage) amongst all the contractors (NOD and SOD). This tends to suppress NOD contractor allocations below what would be reasonable for the resulting Shasta and Folsom carryover. NOD contractor allocations should be limited only by Shasta and Folsom carryover considerations." (Exhibit SVWU 107, page 47, displayed as page 39, paragraph 3)*

While there are at times exceptions, the general allocation logic MBK used for CVP NOD agricultural (Ag) service contractors is that if Shasta carryover storage is expected to be higher than the RPA level of 2.2 MAF and Folsom carryover storage is reasonably high, then NOD CVP Ag service contractor allocations are 100 percent. Alternatively, if Shasta carryover is expected to drop below 1.6 MAF, then CVP Ag service contractors receive a 0 percent allocation (allocations in 1932 significantly strayed from this logic because of the uniquely wet conditions in the American River that year). MBK consistently applied these rules in the MBK NAA and MBK Alternative 4A, and differences in allocations between the two studies were analyzed to make sure they were solely due to the proposed CWF and not an arbitrary allocation decision.

Given the problems with CVP allocations we identified in SVWU-107 and quoted above, our method for addressing the issue was explained as follows:

> *"There was no easily automated fix for the CVP NOD water service contract allocation issue when SOD allocations were Delta export capacity limited. Therefore, a user defined allocation override logic was used in years the combined WSI-DI and export forecast based logic was not providing a reasonable NOD water service contractor allocations. The logic allows the user to specify a percent allocation for SOD and NOD Ag service contract allocations, M&I service allocations are then set by the CVP water shortage policy. Providing control of both SOD and NOD Ag service allocations allowed the SOD allocation to be truly capacity constrained by pushing it to a limit at which SOD shortages began occurring. Once it was determined that the SOD allocation was capacity constrained, the NOD allocation was set to an appropriate level based on projected Shasta and Folsom carryover." (Exhibit SVWU 107, page 47, displayed as page 39, paragraph 4)*

Based on the method described in SVWU-107, manual adjustments were made to determine our final CVP allocations using technology developed by DWR that allows CalSim to be paused, edited, and re-simulated. We started with our draft CalSim model and paused it at the end of September 1922. We looked at reservoir carryover storage and available export capacity including available capacity at Banks Pumping Plant for JPOD. We determined whether the SOD service contractor allocations were appropriately export constrained or not. If the model was significantly underestimating SOD allocations, adjustments to SOD Ag service contractor allocations were made in 5 percent increments until either the allocation was export capacity constrained or constrained by the 3 MAF upstream carryover threshold. If allocations were controlled by upstream carryover, then NOD and SOD service contractors received equal allocations. If SOD service contractor allocations were export capacity constrained, then NOD service contractor allocations would be greater than SOD, but still subject to the upstream carryover thresholds mentioned above. Once satisfied with the 1922 allocations and the subsequent operations in that year, MBK used the DWR technology to continue the model into 1923, and the manual adjustment process was repeated. This was done through the entire 1922-2003 simulation, and it was done consistently for both the MBK NAA and the MBK Alternative 4A. When determining allocations for a given year, there was no foresight of operations into the next year. The only consideration for the next year was maintenance of reservoir carryover according to the threshold described above.

The CVP operations assumptions used in the MBK modeling are consistent with the operational philosophy expressed by Ron Milligan in Exhibit DOI-36, Page 1, where he states that "*The CVP is (and always has been) operated to make full use of excess water during wet periods and use stored water to supplement releases and deliveries when adequate water is not otherwise available. The ability to* *control storage releases heightens the value of stored water and increases the priority of building and maintaining adequate upstream storage reserves.*"

Reliance on Joint Point of Diversion (JPOD)

Petitioners' Criticism

DWR-86, Page 2, Line 13, Mr. Munevar

"MBK's two-year modeling example does not provide a sound basis for their claims that when going from a wet to critically dry year with California Water Fix, (1) RPA requirements would be difficult to meet and (2) inadequate water would be delivered to legal water users, because the results are highly sensitive to MBK's incorrect assumption regarding the use of JPOD".

DWR-86, Page 16, Line 13, Mr. Munevar

"In justifying their changes related to JPOD, MBK speculates that JPOD wheeling capacity could be included in the CVP allocation process as a reliable means to convey CVP stored water, it could be used to boost CVP SOD allocations that SOD allocations are export capacity constrained. [SVWU100, pp. 41-42.] However, as noted in Ms. Parker's testimony [DOI-33], it is not possible for Reclamation to include JPOD export wheeling capacity as part of the allocation setting process in Mar-May, given the uncertainty and unpredictability of the available Banks pumping plant capacity in the summer months."

DWR-86, Page 20 Line 23, Mr. Munevar

"*CVP operators have indicated that they do not make assumptions about presumed JPOD capacity when making allocation decisions in the spring. [See DOI-32 and DOI-33.]*"

DWR-86, Page 2 Line 12, Mr. Munevar

"The largest changes were a result of MBK's modification of the allocation logic, Joint Point of Diversion (JPOD) and the San Luis rule curve. All discretionary actions."

To summarize Mr. Munevar's statements on JPOD: 1) he criticizes the use of JPOD by MBK modelers, 2) Mr. Munevar primarily relies on DOI-36 (Mr. Milligan rebuttal) and DOI-33 (Ms. Parker rebuttal) for making his statements on JPOD, and 3) he confirms JPOD is a discretionary action. In other words, there are no set operational policies or regulations that govern the use of JPOD in the allocation process.

DOI - 33 Errata, Page 8, Ms. Parker

"In order to achieve additional exports needed to meet the much higher CVP SOD allocations, MBK relied heavily on JPOD capacity at Banks to move late summer releases from CVP NOD storage. Central Valley Operations director Ron Milligan will testify that these operations assumptions are not appropriate for long term water supply planning."

DOI - 33 Errata, Page 16, Ms. Parker

"*Central Valley Operations Director Ron Milligan's rebuttal testimony will address the advisability of MBK's JPOD assumptions for long term planning purposes. Dependability of forecasting JPOD capacity, sourcing from CVP NOD storage withdrawal, and late summer timing are all problematic.*"

Ms. Parker also criticizes MBK's use of JPOD and she refers to Mr. Milligan's testimony for advice on MBK's JPOD assumptions. Notably, Mr. Munevar and Ms. Parker both relied upon Mr. Milligan for their opinions on the use of JPOD.

MBK's Response

DOI-36 Page 3, Mr. Milligan

"*The availability to convey CVP supplies is rarely known at the time Reclamation makes the South of Delta CVP allocations in the spring. Because of this, JPOD is not typically relied upon when estimating fall deliveries nor is it incorporated into the allocation process. We further expect this to be the case with the CWF*."

This is the only conclusive statement by Mr. Milligan regarding MBK's use of JPOD in its modeling. MBK believes that there are distinct differences between Mr. Milligan's opinions on JPOD and how JPOD's use is interpreted by Petitioners' modelers, Mr. Munevar and Ms. Parker. MBK's surrebuttal responds to Mr. Milligan's statements on the important operating principles of JPOD, rather than the technical details of how it is modeled.

Mr. Milligan's statement that *"JPOD is not typically relied upon when estimating fall deliveries nor is it incorporated into the allocation process"* is not scientifically precise, and the use of the word "typically" indicates a degree of uncertainty as to how Petitioners might incorporate JPOD in project operations with the CWF in place. This uncertainty regarding how operations may change with the addition of the CWF is the primary concern of the SVWU. A review of the historical use of JPOD validates this concern related to CWF.

Figure 9 shows annual historical (not modeled) use of JPOD (i.e., federal exports at Banks Pumping Plant) in thousands of acre-feet for the water years 1977 through 2015. Blue bars represent total JPOD use for June through September for each water year. Red bars represent total JPOD use for October through May for each year.

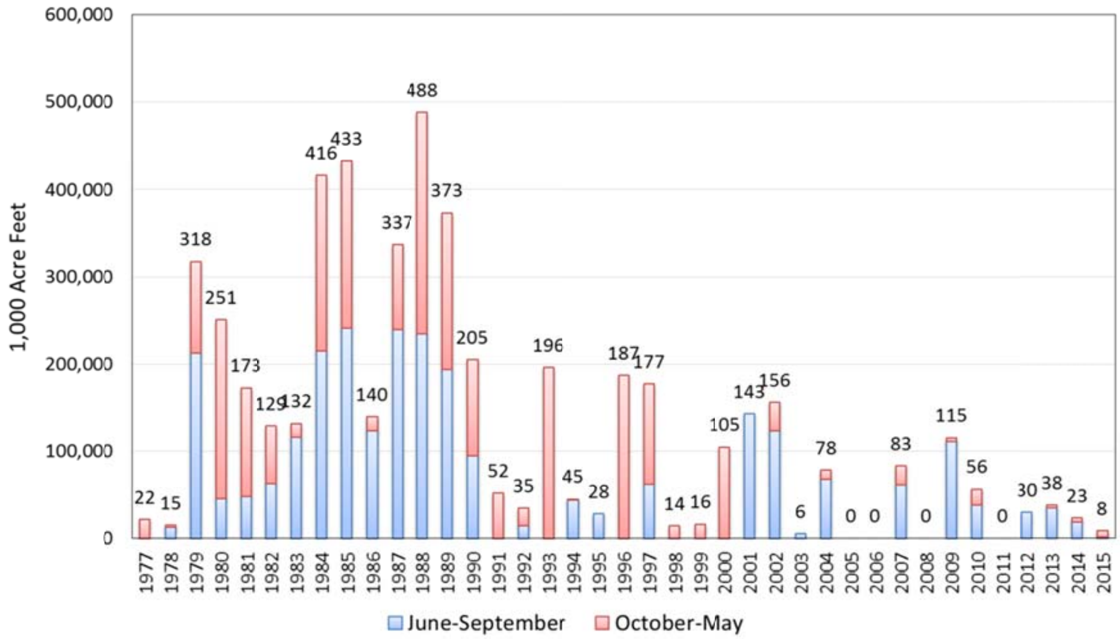

Figure 9 - Historical Federal Export at Banks Pumping Plant (JPOD)

Some of the key observations from Figure 9 are:

- JPOD has been used in all but four of the 39 years and as recently as 2015.
- Historical JPOD use has ranged from 0 TAF up to 488 TAF.
- The volume of JPOD in recent years is less than in earlier years.

Figure 10 shows a comparison of June through September JPOD against CVP end-of-September San Luis storage with the water year enclosed within the red circles. JPOD and CVP end-of-September storage in San Luis Reservoir are compared to estimate years when JPOD may have been used to support the current year's SOD allocations. When the volume of JPOD for the summer season is greater than the CVP end of September storage in San Luis Reservoir it is reasonable to assume that JPOD pumping was used to support the current year CVP allocation. Although JPOD may have supported allocations in a number of years when JPOD has been used, the most notable years are circled in green. When the volume of JPOD for the summer season is less than the CVP end of September storage in San Luis Reservoir it is reasonable to assume that JPOD pumping was used to support the next year CVP allocation. Historically, JPOD has been used to support following year allocation, some of the most notable years that this occurred are circled with a blue dashed circle.

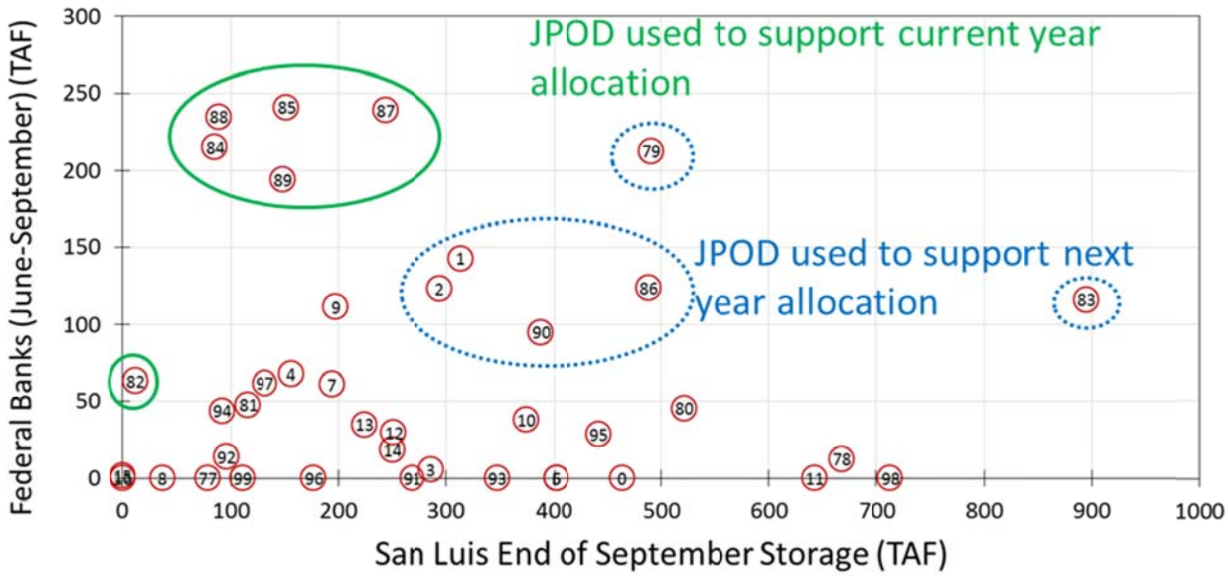

Figure 10 – Historical June-September Federal Banks Export versus San Luis End-of-September Storage

To further illustrate the historical use of JPOD, Figure 11 charts historical operations for year 2013. Figure 11 shows how JPOD was used in August and September to convey water stored in Shasta and Folsom reservoirs. Shasta storage at the end of September in 2013 (carryover storage) is 1.906 MAF. Between July and September, Shasta releases 1 MAF of previously stored water. Similarly, Folsom releases 300 TAF of previously stored water and is drawn down to 361 TAF at the end of September 2013. During this same July through September period when there were combined storage releases of 1.3 MAF from Shasta and Folsom; nearly 655 TAF was exported at the CVP's Jones Pumping Plant and a 35 TAF of JPOD use at Banks Pumping Plant. In this year, Shasta carryover storage was 6 TAF above the minimum RPA target level of 1.9 MAF when JPOD was used. This recent historical operation of Shasta is significantly more aggressive than the logic and rules MBK applied in modeling the use of JPOD with CWF that did not use JPOD capacity when end-of-September Shasta storage was below 2.2 MAF. In the period between August and September, CVP San Luis Reservoir storage increased from 93 TAF to 224 TAF by end of September. A review[1] of the operations data indicated that Shasta and Folsom releases

[1] A review of temperature management operations on both the upper Sacramento River and lower American River in year 2013 showed that the JPOD pumping was not an export of water that had to be released from storage for temperature management. During this period in 2013, the upper Sacramento River temperature compliance was an average daily water temperature of 56.0 degrees Fahrenheit (°F) at Airport Road, met by an average daily temperature of 56.75 °F at Balls Ferry. A comparison of the observed temperatures at Balls Ferry with the 56.75 °F requirement indicated that observed temperatures during this period were frequently less than the requirement by more than a degree and releases were not likely required for temperature compliance. A similar review on the lower American River was performed by reviewing temperatures at Watt Avenue as compared to the Watt Avenue temperature target of 69 °F for 2013, per the American River Group Annual Report. During the period of JPOD pumping, the average daily temperature at Watt Avenue on the American River was often less than the target by more than a full degree and releases from Folsom were not likely required for temperature management.

are in excess of upstream flow and temperature requirements and these releases are made to support exports.

This data shows that there has been a significant use of JPOD in the past. With the increased export capacity provided by CWF, and the lack of any terms or conditions constraining the operations of the CWF, the Petitioners could use JPOD in a manner similar to historical operations in the late 1980s, or at even a higher amount. In their modeling Petitioners artificially limited the use of JPOD to convey both excess Delta outflow and water stored in upstream reservoirs. This assumption is unrealistic, and at a minimum unexplained and unfounded. MBK made the necessary changes in their modeling based on knowledge of historical JPOD operations while considering the increased potential under CWF to move water from NOD to SOD.

MBK followed several key guidelines in modeling the use of JPOD that are demonstrated in Figure 12 and Figure 13. Figure 12 presents a comparison of MBK model results with CWF of carryover storage in Shasta to JPOD use. Figure 13 presents a comparison of MBK model results with CWF of combined carryover storage in Shasta and Folsom to JPOD use. Figure 12 and Figure 13 show that MBK used JPOD only when the carryover storage is greater than 2.2 MAF in Shasta or when combined Shasta and Folsom storages are greater than 3.0 MAF. Figure 12 and Figure 13 also show that the maximum JPOD use is approximately 425 TAF, less than the historical maximum of 488 TAF in 1987. It is clearly evident from these figures that MBK followed a definitive logic in the use of JPOD, the results are similar to the historical use of JPOD, and are more conservative than recent operations in 2013.

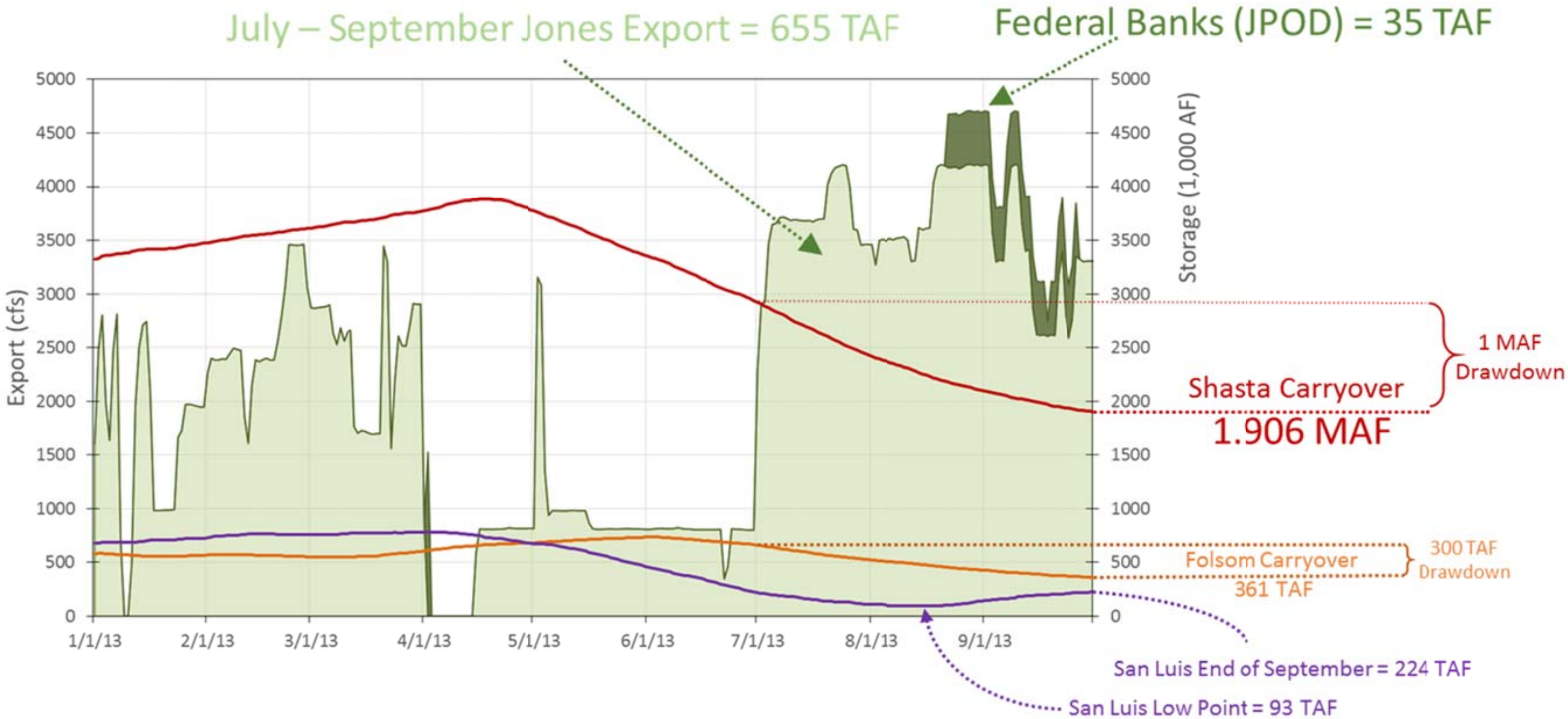

Figure 11 – Historical 2013 Shasta, Folsom, and San Luis Reservoir Storage and Federal Delta Export

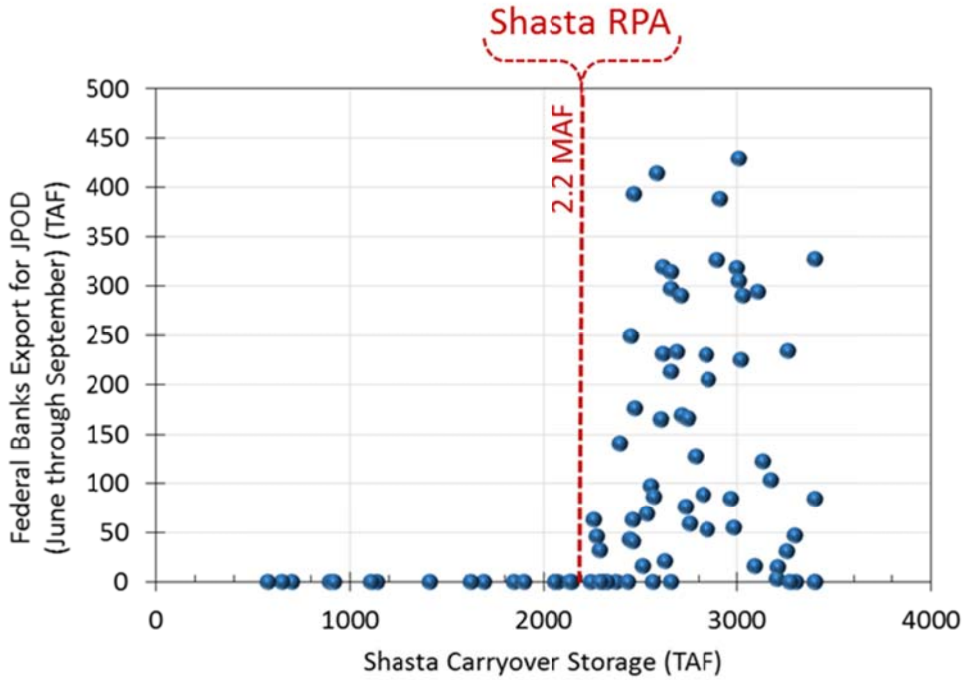

Figure 12 – Federal Banks Export (JPOD) versus Shasta Carryover Storage and

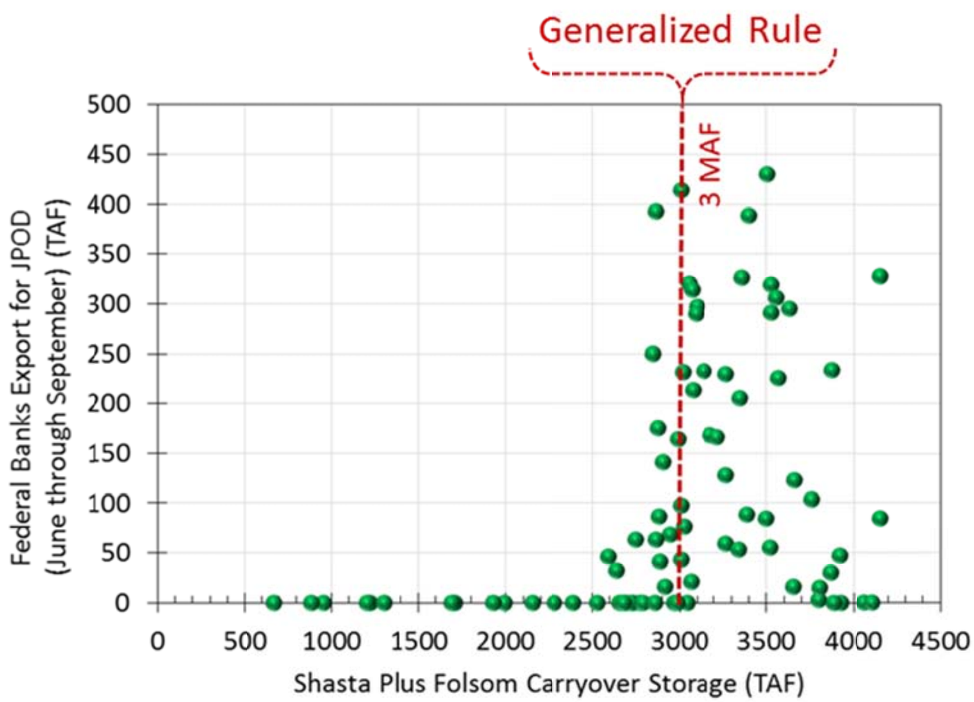

Figure 13 – Federal Banks Export (JPOD) versus Shasta Plus Folsom Carryover Storage

The historical data on CVP/SWP operations shows JPOD has been used to move water from NOD to SOD either to support current year or future allocations. Based on this historical analysis, we expect this pattern of JPOD use will continue in the future with or without the CWF. With the historical precedents for the use of JPOD and the absence of clearly defined regulations on JPOD with CWF, MBK believes CWF modeling should consider the likely increased use of JPOD given the increased export capacity provided by the CWF, and at a minimum not intentionally restrict JPOD use. Unlike the Petitioners' modeling, the MBK modeling of JPOD conforms to historical operations and utilizes the potential capacity provided by CWF.

San Luis Rulecurve and Upstream Reservoir Operations

Petitioners' Criticism

There has been considerable testimony offered related to the use of San Luis Reservoir rulecurve in CalSim II modeling by both Petitioners and Protestants. In several instances, Petitioners' witnesses have contradicted each other. Petitioners' modelers testified that the San Luis rulecurve should be modified from a NAA condition in order to appropriately analyze CWF.

DWR-86, Page 14, Line 22, Mr. Munevar

"*The San Luis rule curve could, and should change, when the ability to capture surplus water or export of stored water has changed due to regulatory or infrastructure modifications, and thus provide an opportunity to better maintain the balance between upstream storage flexibility and export capability.*"

DWR-86, Page 14, Line 28, Mr. Munevar

"*A rule curve that adequately utilized available export capacity and maintained an acceptable level of upstream carryover storage under the NAA is no longer appropriate under CWF.*"

DWR-86, Page 15, Line 16, Mr. Munevar

"*Based on my review of MBK's modeling, it is my opinion that MBK's implementation and application of the San Luis reservoir rule curve inadequately acknowledges the changes in operational flexibility that is afforded by the CWF, and that their prioritization of conveying upstream stored water overshadows the additional goals of CWF to maintain upstream storage flexibility.*"

MBK's Response

Mr. Munevar's statement that the San Luis rule curve used for the NAA is not appropriate under CWF was contradicted by Mr. Leahigh when he stated that the San Luis rule curve would be similar with and without the CWF.

August 11, 2016 Transcript:

MR. SALMON: *Did you offer an opinion at any time to the modelers on what an appropriate rule curve would be under the WaterFix or if the WaterFix comes into operation?*

WITNESS LEAHIGH: *Not specifically on the WaterFix. As it relates to State Water Project operations, I think it would be similar as far as -- for WaterFix as it is without WaterFix.*

MBK modeling assumptions for the San Luis rulecurve logic are in line with Mr. Leahigh's testimony. Additionally, it is important to understand that changes to the San Luis rulecurve logic in CalSim II affects the model's simulated balance between NOD storage and San Luis Reservoir storage.

The effect of rulecurve on reservoir storage is acknowledged by the Petitioners in Biological Assessment for the California WaterFix Appendix 5.A. CalSim II Modeling and Results (Page 5.A-6) where it is stated "*Some refinement of the CVP/SWP operations related to delivery allocations and San Luis target storage levels is generally necessary to have the model reflect suitable north-south reservoir balancing under future conditions".*

Further, the petitioners have stated in the Biological Assessment for the California WaterFix, Appendix 5.A. CalSim II Modeling and Results (Page 5.A-30), that

"*Additional modifications to the rule curve were included to preserve upstream carryover storage conditions while minimizing south-of Delta shortages in the fall months. Sensitivity analyses indicated that using the NAA's more aggressive rule to move water south earlier in the water year than in the PA would yield a little more delivery, but would be at the expense of upstream storage.*"

The San Luis Reservoir rulecurve logic is used to simulate discretionary operator decisions to move water from upstream reservoirs to South-of-Delta storage in CalSim II. Modeling of discretionary actions can be performed in numerous ways while still adhering to operational "policies" and philosophies. MBK maintains that the rulecurve logic in CalSim II should remain consistent between the NAA and CWF simulations. Because the decision to move water from upstream reservoirs remains a discretionary action by operators, there is no term, condition, or legal limitation that would prevent operations as depicted in MBK modeling.

Use of "Generalized" Model Logic

Petitioners' Criticism

DOI-33 Errata, Page 1,Ms. Parker

"MBK's claim of WaterFix operations resulting in lower storage conditions and impacts to NOD delivery are the result of manual manipulation of CVP allocations both north and south of the delta, forcing differences between the NAA and WaterFix scenarios…The degree to which MBK fixed their models' behavior is extreme, to the point that their analysis is hard to characterize as comparative planning modeling."

CWF Hearing Transcript from May 11, 2017, page 63-64: Parker

MR. BERLINER: *"And if -- I believe you have characterized in your testimony the MBK modeling as being more aggressive or risky than the approach that Reclamation takes to its modeling. If you were to model a more risky, aggressive operational approach such as that adopted by MBK, would you use the modeling approach that they used?"*

WITNESS PARKER:"*I would not."*

MR. BERLINER: *"Why not?"*

WITNESS PARKER*: "Because it is not consistent. The methodology that they used to depict their allocations was to predetermine a number of allocations in each of their scenarios, and this led to a skewed, in my opinion, depiction of the impact of the WaterFix relative to the no action. I f I were to choose to depict a more aggressive allocation strategy in either the no action or the proposed action, I* *believe that I, as a Reclamation employee, or anyone with DWR would try to do that using consistent model logic between the two alternatives. My impression is that it would be difficult to achieve the same level of difference between the proposed action and the no action doing that because it would be generalized logic. My opinion is that MBK was able to achieve such a large discrepancy by virtue of literally affecting 80 percent of the years in the period of record by hand selecting allocations in one run or the other. That is not consistent logic. It is not reproducible logic. It's a person deciding what the allocations would be in either one run or the other or both. So if I were to try to achieve the same aggressive curve for CVP allocations, I would try to do it using a more aggressive WSI-DI curve or a more aggressive delivery carryover curve. I would not elect to do it by hand-entering allocations for specific years."*

MBK's Response

The implication of the underlined portion of Ms. Parker's testimony is that it was the MBK modeling methodology that was largely responsible for impacts that MBK modeling showed, and that it was not the disagreement MBK has with Petitioners regarding the potential to use the CWF to convey more stored water SOD for delivery to SOD contractors. This is false. MBK's consistent modeling methodology was designed to make sure MBK did not overestimate the impacts to upstream storage while at the same time fully quantifying the risk to SVWU. The reality is that if MBK had used the "generalized logic" that Ms. Parker recommends, the effects of the CWF would have been greater than those presented in MBK testimony. MBK performed a simple sensitivity study for this surrebuttal testimony to demonstrate this point.

The two most significant disagreements that MBK has with Petitioners' modeling are: (1) Petitioners rebalanced upstream storage and San Luis using the rulecurve even though there are not proposed regulations or terms that actually make this reservoir re-operation part of the project; and (2) Petitioners did not increase export estimates in the allocation logic to represent the increased export capacity provided by the CWF, thereby artificially suppressing allocations.

MBK has run a sensitivity study (NoCC_H3+(MBK)) using the DWR/USBR No Climate Change Preferred Alternative (NoCC_H3+(DWR/USBR)) that was submitted to the hearing by Reclamation. The only changes made to the DWR/USBR Preferred Alternative are:

1) Set the SWP San Luis rulecurve to the No Action Alternative
2) Modest increases to the SWP Export Estimate to recognize the CWF

Changes to the export estimate table are displayed in Figure 14. The export estimate table on the left is input to NoCC_H3+(DWR/USBR), and table on the right is input to NoCC_H3+(MBK). The June non-Wet San Joaquin export estimate as increased by 1,000 cubic feet per second (CFS) – from 2,500 CFS to 3,500 CFS. The basis for this was that the average change in non-Wet SJR simulated exports was approximately 1,000 CFS when comparing NoCC_H3+(DWR/USBR) to NoCC_NAA(DWR/USBR). Therefore, MBK changed the export estimate by this amount. A similar analysis was done to determine the June 500 CFS change in WetSJR years (changed from 6,000 CFS to 6,500 CFS). For July and August, the increase from 7,000 CFS to 8,000 CFS is justified by the additional capacity made available at Banks Pumping Plant by the CWF. Water diverted at the North-Delta Diversion and conveyed through the tunnel is no longer subject to the 6,680 CFS permitted capacity.

SWP Export Estimate (cfs)

	DWR/USBR BA modeling NoCC_H3+(DWR/USBR)		MBK CWF modeling NoCC_H3+(MBK)	
	Non-Wet San Joaquin	Wet San Joaquin	Non-Wet San Joaquin	Wet San Joaquin
June	2500	6000	3500	6500
July	7000	NA	8000	NA
August	7000	NA	8000	NA

Figure 14 CalSim SWP export estimate input tables

The effects of the discretionary changes to SWP rulecurve and the SWP export estimates are significant to Oroville carryover storage. Figure 15 contains an exceedance plot of Oroville carryover storage for the NoCC_NAA(DWR/USBR), NoCC_H3+(DWR/USBR), and NoCC_H3+(MBK) modeling scenarios. Average Oroville Reservoir carryover increases by about 70,000 acre-feet (AF) in the NoCC_H3+(DWR/USBR) compared to the NoCC_NAA(DWR/USBR), while the NoCC_H3+(MBK) shows a decrease of about 146,000 AF. The decrease in Oroville carryover is entirely due to reverting back to the NAA SWP rulecurve and making reasonable adjustments to the SWP export estimate table.

Figure 16 contains an exceedance plot of Oroville carryover storage comparing the MBK NAA and MBK Alternative 4A to NoCC_NAA(DWR/USBR) and NoCC_H3+(MBK). All of the modeling used to produce Figure 16 are performed without Climate Change. As expected, Oroville carryover in the MBK NAA and the NoCC_NAA(DWR/USBR) are similar. However, the Oroville carryover in NoCC_H3+(MBK) is significantly reduced compared to the Oroville carryover in MBK Alternative 4A. The most significant impact is the drawdown of Oroville carryover below 1.25 MAF that occurs just beyond the 60 percent exceedance level. It is this type of impact that MBK thinks operators would manage to avoid, and it is this type of impact that MBK avoided by developing and applying a consistent modeling methodology in MBK Alternative 4A. The “generalized logic” that Ms. Parker advocates does not provide the discretionary nuance that operators need to have to make reasonable decisions.

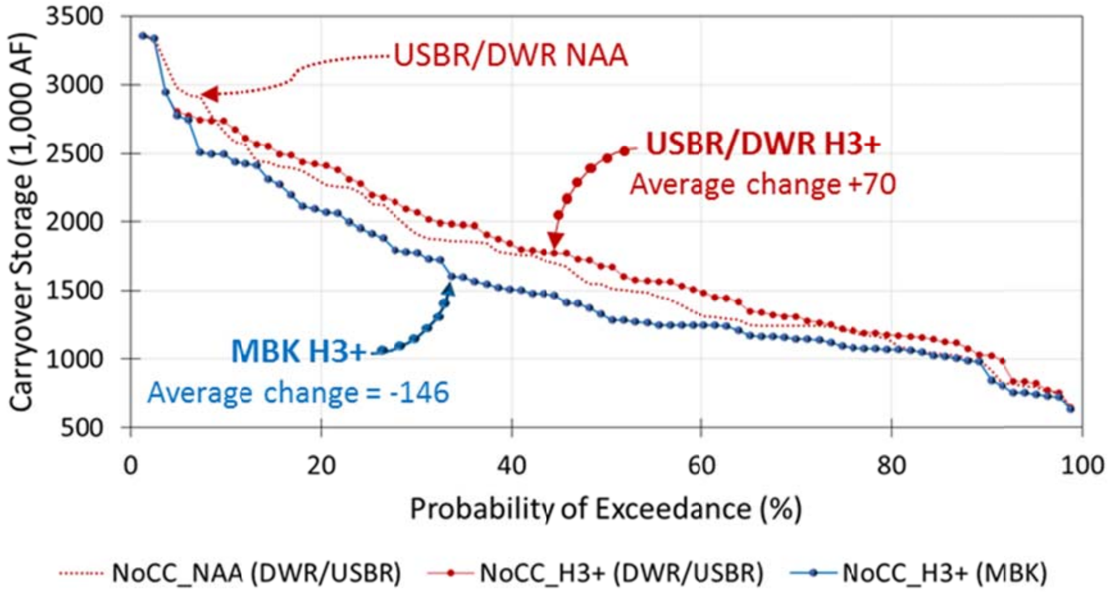

Figure 15 - Oroville Carryover Storage comparing the NoCC_H3+ (DWR/USBR) to NoCC_H3+ (MBK)

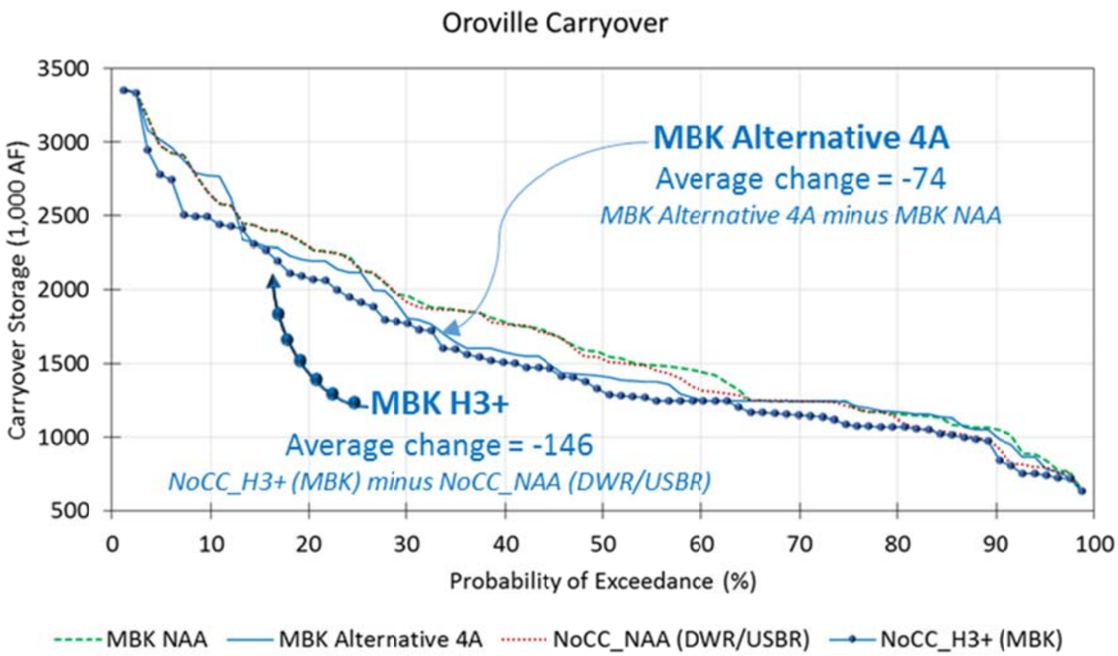

Figure 16 Oroville carryover storage comparing MBK NAA and Alternative 4A to NoCC_NAA(DWR/USBR) and NoCC_H3+(MBK)

The SWP allocation procedure in NoCC_H3+(MBK) continues to incorporate the DWR "policy" for Oroville carryover storage targets just as it did in NoCC_H3+(DWR/USBR). None of the export based allocations in NoCC_H3+(MBK) are greater than the DWR "policy" based allocations in Figure 17. This MBK analysis shows that average annual and dry year reduction in Oroville storage is much greater when using the generalized rules in CalSim than the modeling performed by MBK for evaluating effects of the California WaterFix.

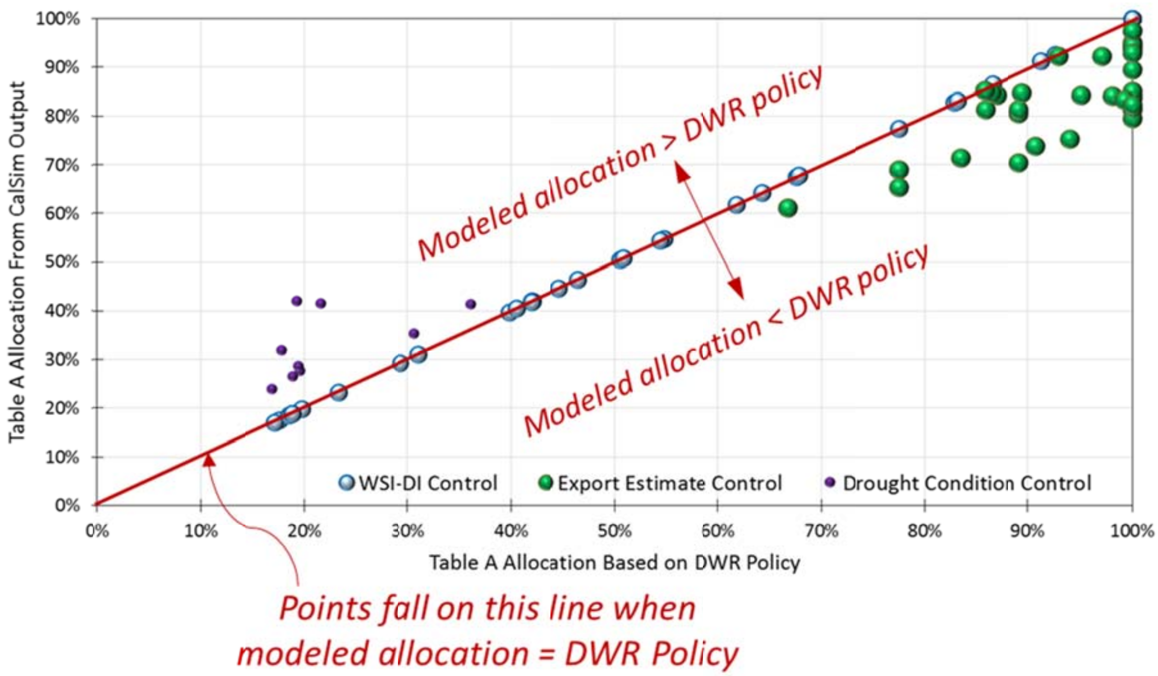

Figure 17 CalSim II Modeled SWP Table A allocation Versus Allocation "Policy" (NoCC_H3+(MBK))

Term 91

Petitioners' Criticism

In DWR-78, Mr. Leahigh states: "*I do not expect the frequency of Term 91 curtailments to change with construction of the CWF facilities.*"

MBK's Response

While we agree that simply constructing the CWF facilities will not change the frequency of Term 91 curtailments, we assume Mr. Leahigh also included the operation of the CWF facilities after construction in his conclusion regarding Term 91. We disagree with this conclusion and believe that construction and operation of the CWF has the potential to increase the frequency of Term 91 curtailments.

In DWR-78, Mr. Leahigh opines that only through an increase in either in-basin use or Delta requirements would the frequency of Term 91 curtailments increase. While this appears to be true when examining the terms used to calculate the unavailability of water under the Term 91 method, it ignores the first of two conditions that must exist simultaneously to impose Term 91 curtailments, which is that Delta must be “in balance”. Term 91 is described in the State Water Board’s Order 81-15, Water Right Decision 1594, and State Water Board Order WR 84-2. The 1986 Agreement Between the United States of America and the State of California For Coordinated Operation of the Central Valley Project and the State Water Project defines balanced conditions as, “…periods when it is agreed that releases from upstream reservoirs plus unregulated flow approximately equal the water supply needed to meet Sacramento Valley inbasin uses, plus exports.” This definition is essentially the same as provided in the orders and decisions that describe Term 91.

Mr. Leahigh describes the CWF project as a storm water capture program (DWR-78) used to capture excess Delta flows in wetter periods. When operated in this manner, CWF has the potential to transition the Delta from an excess condition to a balanced condition earlier in the year than the transition would occur absent CWF by increasing the “plus exports” in the definition of “in balance”. This would in turn satisfy the first of the two conditions of Term 91 earlier in the year. Then, with the Delta “in balance”, the second of the two conditions of Term 91 is dictated or controlled by CVP and SWP operations, specifically through storage releases and exports. The second of the two conditions is the calculation of Supplemental Project Water which is when storage releases and imports from CVP and SWP facilities are in excess of Exports, Carriage Water, and Project inbasin entitlements. During the expanded period of “in balance” conditions due to CWF operations, CVP and SWP operators could increase storage releases or decrease exports such that Supplemental Project Water would occur and Term 91 could be implemented more often than without the CWF. Analysis of MBK modeling results presented in SVWU 107, Figure 60, quantify the possible increase in the frequency of Term 91 curtailments when these conditions occur more frequently with CWF than in the No Action Alternative.

In addition, it must be recognized that it has not been determined whether or not modified Delta requirements, beyond export limits, could be imposed on the CVP and SWP as a result of the future potential permit changes from the current petition and proposed CWF. It is possible that modified Delta requirements could, by definition, cause in balance conditions to occur more frequently. This potential change in Delta conditions as a result of the CWF petition poses the risk of Term 91 being imposed more frequently.

Conclusions

This technical report has addressed two general categories of Petitioners’ rebuttal to MBK modeling of CWF:

1. criticism of MBK modeling techniques and
2. criticism of MBK modeling of discretionary actions by CVP and SWP operators with CWF.

In response to item 1, MBK modeling of both the NAA and with CWF scenarios was performed using a consistent set of logic and rules. Logic and rules applied by MBK for SWP allocations and operations are similar to those employed by Petitioners with the exception of estimates of export capacity used in the model. Logic and rules for CVP allocations and operations are based on the available water supply, conservative carryover storage targets, and estimates of export capacity. The level of foresight used in MBK modeling is similar to CVP and SWP operators’ ability to forecast operations in May when determining allocations, as demonstrated by comparisons between May forecasts and actual operations. MBK modeling techniques are an improvement over some of the methods employed by Petitioners, and recognize the additional capacity to move water from NOD to SOD provided by CWF.

In response to item 2, MBK modeling of discretionary actions by CVP and SWP operators has been shown to be consistent with:

1. historical operations of JPOD
2. SWP policy and CVP philosophy as described by Petitioners.

Therefore, MBK modeling of discretionary actions by CVP and SWP operators is a reasonable representation of potential operations with CWF.

Finally, in several instances, Petitioners' witnesses state that CWF can be operated as modeled by Petitioners.

<u>DOI-33 Errata, Page 2, Ms. Parker</u>

"*…which demonstrates Petitioners' claim that the WaterFix* ***can*** [emphasis added] *be operated without causing reduced carryover storage.*"

<u>DOI-33 Errata, Page 18, Ms. Parker</u>

"*By contrast, Petitioners' modeling was done using standard modeling practices to show that the project* ***could*** [emphasis added] *be operated without causing harm to legal users of water…"*

<u>DWR-86, Page 15, Line 5, Mr. Munevar</u>

"Using this strategy, it is ***possible*** [emphasis added] *to use the north-Delta-Diversion to both develop increased water supply and maintain upstream storage flexibility."*

Whether the CWF <u>can be</u> operated as Petitioners' modeling indicates or without injuring other legal users of water was never the concern of SVWU. Petitioners' criticisms of MBK modeling obfuscates the key issue; **there are no physical, legal, or regulatory conditions that prevent Petitioners from operating CWF as modeled by MBK.**