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BEFORE THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

IN THE MATTER OF

CALIFORNIA DEPARTMENT OF WATER RESOURCES AND UNITED STATES BUREAU OF RECLATION PETITION FOR WATER RIGHT CHANGE RE: CALIFORNIA WATERFIX.	**TESTIMONY OF DANIEL B. STEINER (San Joaquin Tributaries Authority (SJTA) Case in Chief, Part 2, EXHIBIT 302)**

I, Daniel B. Steiner, declare as follows:

SUMMARY OF RESULTS

1. The No Action Alternative used in the Biological Assessment for the California Water Fix (July 2016) (Exhibit SWRCB-104) ("CWF NAA") incorporates climate change assumptions that particularly increase the frequency of critical water-year designations, and also increase the frequency of the combination of dry and critical years as compared to an analysis without climate change. Because the flow requirements at Vernalis under Water Rights Decision 1641 (D-1641) are lower in water years that are designated Dry or Critical, the use of climate change in the California Water Fix alternatives means that compliance with the Vernalis base flow requirements is depicted in the Biological Assessment as being achieved more frequently without stored or potentially stored water releases from New Melones Reservoir than would be the case under a no-climate-change (current) analysis. The incorporation of climate change into the modeling has the effect of misrepresenting the CWF NAA state of New Melones Reservoir storage,

then minimizing the relative impact on storage and other storage-dependent parameters by decreasing the D-1641 Vernalis requirements in the future.

2. My analysis also shows that the CWF NAA does not demonstrate compliance with the Vernalis pulse flow objective in D-1641 in most years. In fact, in dry years, there is an approximate average shortfall of 64,761 acre feet, and in critical years, there is an approximate average shortfall of 72,411 acre feet during the pulse flow period.

APPROACH AND ANALYSIS

3. My approach was to review CALSIM II modeled hydrology at Vernalis (CALSIM II Node 639) to make a conclusion as to the regulatory requirements met in the modeling performed by the Department of Water Resources for the California Water Fix. I analyzed the CALSIM II modeling output from the CWF No Action Alternative ("NAA") to derive my results and conclusions. I have relied upon the NAA simulation described in the "Biological Assessment for the California Water Fix", July 2016, which among other objectives include:

"Bay-Delta flow requirements are defined by D-1641 flow requirements at Vernalis (not including pulse flows during the April 15-May 16 period). These flows are met through releases from New Melones without any annual volumetric limit.

D-1641 requires the flow at Vernalis to be maintained during the February through June period. The flow requirement is based on the required location of "X2" and the San Joaquin Valley water year hydrologic classification (60-20-20 Index) as summarized in Table 5.A-7." (Exhibit SWRCB-104 [Biological Assessment for the California Water Fix, July 2016], page 5.A-25)

4. In my analysis, full compliance to D-1641 at Vernalis means meeting the objectives in the 1995 Bay-Delta Plan, Table 3. (Exhibit SWRCB-21 [D-1641], p 184.) The D-1641 flow requirements at Vernalis are also reproduced in Table 1 of Exhibit SJTA-303.

5. The CWF NAA simulation incorporates a hydrology inclusive of a level of future climate change. For reference and comparison to a depiction of current conditions (without climate change) I have also provided analysis of DWR's State Water Project Delivery Capability Report 2015 (DCR15) analysis that updates estimates of the current (2015) delivery capability for SWP and CVP operations in accordance with the 2008 United States Fish and Wildlife Service ("USFWS")

Biological Opinion and the 2009 National Marine Fisheries Service ("NMFS") Biological Opinion. The D-1641 regulatory assumptions for the San Joaquin River at Vernalis are the same as the CWF NAA.

6. Relevant CALSIM II output parameters for my analysis include (1) flow at Vernalis (C639, for monthly average periods), (2) flow at Vernalis during non-pulse periods (C639_NP_DV), (3) flow at Vernalis during pulse periods (C639_P_DV), (4) the required flow at Vernalis (VERNMIN_REQDV or X2VERNMIN_REQDV), (5) flow released from New Melones for Vernalis water quality (C520WQ), and (6) flow released from New Melones for Vernalis flow requirements (C10MIN, C10MIN_NP, C10MIN_P). I also reviewed and incorporated the modeling assumption for the San Joaquin Valley water year hydrologic classification (60-20-20) found in CALSIM II input (wytypes.table).

7. My analysis initially compared CALSIM II model results for the modeled flow at Vernalis with model-developed D-1641 flow requirements, both available within the CALSIM II output files. Table 2 in Exhibit SJTA-303 illustrates the results. Shown in Column 1 through Column 3 are the water year of evaluation and 60-20-20 year type designation of each the CWF NAA study and the DCR15 study. Note that the year type designations of particular years are different, e.g. 1926, where the designation of the year type in the DCR15 study is 2 (Dry) while in the CWF NAA it is designated as 1 (Critical). Throughout the study, the CWF NAA is "drier" due to incorporation of climate change which occasionally triggers drier 60-20-20 designations. Since the 60-20-20 year type designation partly determines the Vernalis flow requirement, there are differences in flow requirements for certain months among the two different studies. In Table 2, Column 3, I have highlighted in green all the years in which the water-year type designation for the DCR15 study (without climate change) is different than the water-year type designation for the CWF NAA (with climate change) (SJTA-303, Table 2). Over the 82-year period, there are 20 instances where the CWF NAA results in a drier water-year designation than the DCR15 study. In other words, in 24.4% of the years analyzed, the CWF NAA reported a drier water year designation than the DCR15 study. The discrepancy was more pronounced in drier years. For instance, of the 13 years designated as Dry under the DCR15 study, 8 of those years (or approximately 60%) were

designated as Critical under CWF NAA, thus resulting in lower Vernalis flow requirements in 60% of Dry years under CWF NAA as compared to DCR15.

8. Tracking the year 1927 in Table 2 shows that the year is designated as a year type 4 (Above Normal) in both studies. In this particular year the combination of 60-20-20 designation and the X2 component being West of Chipps Island for the month results in a 3,420 cfs flow requirement at Vernalis for February per D-1641 (SJTA-303Table 2, Column 4 and Column 5). The simulated flow of the studies for February (Column 7 and Column 8) is 3,798 cfs and 3,894 cfs for CWF NAA and DCR15, respectively. This circumstance illustrates compliance to the D-1641 flow requirement for February. As the modeled flow during February 1927 is in excess of the requirement in both studies, and as there are no releases being made from New Melones during the month (see Column 9 and Column 10), compliance is incidental to the hydrology. The same tracking for March 1927 illustrates a different result. The D-1641 flow requirement for March (Column 11 and Column 12) is 3,420 cfs for both studies. However, the simulated flow (Column 14 and Column 15) is exactly equal to the D-1641 Vernalis flow requirement. The values shown in Column 16 and Column 17 represent the volume (acre-feet) of water specifically released from New Melones during the month to provide compliance to the March 1927 flow requirement. Without these releases there would not have been compliance to the requirement in the studies.

9. Although the volumes released from New Melones to achieve compliance under DCR15 and CWF NAA are similar in the March 1927 example, there are numerous occasions where releases are needed from New Melones to achieve compliance at Vernalis under DCR15, but not under CWF NAA. (*compare* Column 16 *with* Column 17 for 1926, 1947, 1964, 1972, 1993, 2002). This discrepancy is due to the difference in water-year type designations under the two studies. The incorporation of climate change in the CWF NAA study results in some water years being designated as drier than those same water years under DCR15. Since the D-1641 compliance requirement for designated drier years is less than wetter designated years, the CWF NAA study results in fewer instances where New Melones releases are needed to achieve D-1641 compliance when compared to DCR15.

10. My analysis was completed for the entire model study period, WY 1922 through WY 2003, for the months February through June, including the pulse periods of April and May. My analysis determined that except for a couple of modeling anomalies (as highlighted in orange in SJTA-303, Table 2) the simulations representing CWF NAA and DCR15 provided compliance to D-1641 Table 3 “base flow” requirements for February through June. That is, the modeling provided for compliance with the upper block of flow requirements shown in SJTA-303, Table 1, ranging from 710 cfs to 3,420 cfs and in doing so at times required the specific release of additional water from New Melones for compliance.

11. However, the modeling did not always provide compliance to the “pulse flow” requirements of D-1641 Table 3, as shown in the second block of flow requirements in SJTA-303 Table 1 ranging from 3,110 cfs to 8,620 cfs during the April 15 – May 15 period of a year.

12. The results of my analysis for the pulse flow period are shown in SJTA-303, Table 3. Full compliance to D-1641 Vernalis flow requirements establish a flow pulse period. The required flow during this period is established similar to the base flow requirements described previously, based on a combination of the 60-20-20 designation and required X2 location. The CALSIM II configuration and assumptions used to model a base flow compliance operation does not generate an output value for the pulse flow requirement. Therefore, I was required to calculate the requirement. To calculate the requirement I used information available from the CWF NAA and DCR15 studies, 60-20-20 designation and base flow requirement, to establish the pulse flow requirement as if it were included in the CALSIM II configuration. The pulse flow requirement mirrors the base flow requirement in a calculation process.

13. SJTA-303 Table 3 shows the flow requirements for each study for the April 1 – April 14 (Column 18 and Column 19) and May 16 – May 31 (Column 39 and Column 40) periods of each year of simulation. These time periods are part of the base flow period, not the pulse flow period which runs from April 15 to May 15. The modeled flows at Vernalis for these periods are shown in Columns 21 and 22 (April 1 - April 14), and Columns 42 and 43 (May 16 - May 31). This information is the same for these parameters as shown in Table 2 of SJTA-303, along with the

explicit releases from New Melones (Columns 23 & 24 [April 1 - April 14] and Columns 44 & 45 [May 16 - May 31]) for compliance to the base flow requirement during the periods.

14. Column 25 and Column 26 illustrate my calculation of the pulse flow requirement for each study for the April 15 – April 30 portion of the pulse flow period for each year. Column 32 and Column 33 show my calculation of the requirement for each study for the May 1 - May 15 portion of the pulse flow period of each year. The simulated flow for the pulse flow periods are shown in Column 28 (CWF NAA, April 15-April 30), Column 29 (DCR15, April 15-April 30), Column 35 (CWF NAA, May 1 - May 15), and Column 36 (DCR15, May 1 - May 15). The values in those columns are highlighted during instances when the simulated flow at Vernalis is less than compliance to the D-1641 pulse flow requirement.

15. In many instances compliance with the D-1641 pulse flow objective does not occur. This illustrates that the modeling did not assume full compliance with D-1641, and that operating the Basin assuming only a base flow requirement will not always incidentally meet full compliance during the pulse flow period. The columns in Table 3 of SJTA-303 labeled "Deficit" show the shortcoming, in acre-feet, between the pulse flow requirement and the incidental flow under both the CWF NAA and DCR 15 studies (see Columns 30, 31, 37, 38). On average, across all water years, the CWF NAA is short 30,502 acre feet during the April 15-April 30 portion of the pulse flow period, and 24,420 acre feet during the May 1-May 15 portion of the pulse flow period, for an approximate average shortfall during the entire pulse flow period of 54,922 acre feet. The average shortfall under CWF NAA is higher in dry and critical years. In dry years, the average deficit is 33,953 acre feet during the April 15-April 30 portion of the pulse flow period, and 30,808 acre feet during the May 1-May 15 portion of the pulse flow, for an approximate average shortfall of 64,761 acre feet. In critical years, the average deficit is 38,132 acre feet during the April 15-April 30 portion of the pulse flow period, and 34,279 acre feet during the May 1-May 15 portion of the pulse flow period, for an approximate average shortfall of 72,411 acre feet.

CONCLUSION

16. The CWF NAA which represents a future with climate change and DCR15 which represents current conditions are different in hydrology, with the CWF NAA assuming a shift to

drier San Joaquin Valley year type classifications, thus lowering requirements at Vernalis based on the existing D-1641.

17. CWF NAA and DCR15 CALSIM II modeling both assume limited D-1641 Vernalis flow compliance; that is, the modeling only assumes compliance or incidental compliance to the base flow component of the D-1641 objectives. Modeled compliance to the base flow requirements includes specific releases from New Melones for that purpose, and the releases are shown in SJTA-303 Table 4 under the category of "C10Min" for a month or period of a month.

18. CWF NAA and DCR15 CALSIM II modeling does not provide for full compliance to D-1641 objectives which include pulse flows. Based on my analysis, SJTA-303 Table 4 illustrates the amount of releases needed above those provided incidentally for other purposes to provide full compliance. Water project operations dependent on Vernalis hydrology will be differently affected by the assumption of either full or partial compliance to the D-1641 Vernalis flow objectives.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration was executed on November 29, 2017, in Sacramento, California.

DANIEL B. STEINER

Dated: November 29, 2017