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BEFORE THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

In the matter of 2016 SWRCB Hearing re CalWaterFix Petition for Change	**TESTIMONY OF GARY KIENLEN, MBK ENGINEERS**

PROFESSIONAL BACKGROUND AND QUALIFICATIONS

1. I am a registered civil engineer in the State of California. I specialize in the areas of hydrology, hydraulics, water supply, water rights, irrigation project feasibility, and related issues. I am a principal at MBK Engineers, located at 455 University Avenue, Suite 100, Sacramento, CA 95825. MBK Engineers specializes in water resources engineering and performs these engineering services for local public agencies and private clients, principally in the Delta and the Sacramento Valley. MBK Engineers was formed in 1967 (then known as Murray, Burns and Kienlen) and currently employs 21 engineers. Exhibit NDWA-4 is a true and correct copy of my professional qualifications.

EXPERIENCE WITH NORTH DELTA WATER AGENCY

2. MBK Engineers and its predecessors have represented the North Delta Water Agency ("NDWA") since its formation in 1973 and also represented NDWA's predecessor organizations. My father Donald Kienlen, former Principal of Murray, Burns and Kienlen, participated extensively in the negotiations of the Contract between the State of California, Department of Water Resources and North Delta Water Agency for the Assurance of a Dependable Water Supply of Suitable Quality ("1981 Contract") (Exhibit DWR-306). Since the commencement of my employment with MBK Engineers in 1988, I have been involved with monitoring water quality, contract compliance, and related issues for NDWA. Since 1999, I have served as engineer for NDWA.

3. In 2010, together with Assessment Commissioners George Basye and Mike Hardesty, I prepared the Engineer's Report and Report of the Assessment Commissioners for the North Delta Water Agency Assessment Adjustment, pursuant to Article XIII D of the California Constitution ("Report"). Preparation of the Report required extensive review and analysis of water rights within NDWA; this Testimony includes a summary of that work. Landowners within NDWA approved the assessment adjustment.

SUMMARY OF TESTIMONY

4. In my professional opinion, it is unlikely to move the diversion of large quantities of water from the current location near Tracy to the proposed North Delta Diversion ("NDD"),

without causing significant physical impacts. In relation to NDWA and legal users of water within NDWA, those impacts fall into two principal categories: (i) impacts to water quality; and (ii) impacts involving changes in water surface elevations in Delta channels to the detriment of the Delta channels or water users within NDWA. As detailed below, the "California WaterFix" ("WaterFix"), as currently configured, will cause both categories of impacts to water users within NDWA.

WATER RIGHTS WITHIN NDWA

5. NDWA does not deliver water; operate or maintain water diversion, conveyance, or storage facilities; or hold water rights in its own name. Rather, the principal function of NDWA is to administer, enforce, and otherwise ensure the receipt of benefits provided by the 1981 Contract.

6. Since the 1950s, considerable technical work has been done by the U.S. Bureau of Reclamation ("Reclamation"), the California Department of Water Resources ("DWR") and the water users within NDWA, to determine and classify the water rights and water right deficiencies within NDWA. This work began with the 1956 Cooperative Study Program, with which I am familiar. The 1956 Cooperative Study Program, and subsequent related studies, determined water right deficiencies based on priority groups. These determinations served as the basis for negotiation of the project water quantities contained in the settlement contracts between Reclamation and water right holders along the Sacramento River. The priority groups used in the 1956 Cooperative Study Program for the purposes of analyzing the yields and deficiencies of water rights along the Sacramento River and the Delta are as follows:

- Riparian – All lands within the Delta Lowlands,
- Pre-1927 – Appropriative and "other" rights with priorities on or before July 30, 1927,[1]
- 1927-1938 – Appropriative and "other" rights with priorities between July 30, 1927 and August 2, 1938[2],

[1] Priority date of initial water rights filed for the Central Valley Project ("CVP")

[2] Priority date of supplemental water rights filed for the CVP

- 1938-1954 – Appropriative and "other" rights with priorities between August 2, 1938 and December 31, 1954[3], and
- Post-1954 – Appropriative and "other" rights with priorities after December 31, 1954.

7. The 1981 Contract makes up for the entire deficiency in all surface water rights within NDWA, thereby ensuring the necessary quality for all uses throughout the year, and providing a sufficient quantity to satisfy all reasonable and beneficial uses. The entire volume of water required to offset the deficiency is the collective measure of special benefit to all lands within NDWA. The proportional special benefit under the 1981 Contract to each parcel within NDWA is that parcel's share of the deficiency. The 1956 Cooperative Study Program classified each priority group by its relative water right deficiencies, and therefore, is the foundation used to define the proportional special benefit that the 1981 Contract confers upon the individual parcels within NDWA.

8. Because the water quality benefits afforded by the 1981 Contract are dependent upon a sufficient supply of water to hold back the intrusion of salt water from the San Francisco Bay, these benefits are, in my opinion, inseparable from the water supply benefits of the 1981 Contract.

9. For the various studies conducted for the 1956 Cooperative Study Program, all of the Delta Lowlands, as depicted in the Report on 1956 Cooperative Study Program, Volume I, Plate 3, were classified as riparian to the channels of the Delta, with the correlative right to share the natural flow of the Sacramento River and other tributary streams of the Delta.[4] In my opinion, this classification is reasonable. Due to the many sloughs and other watercourses in the Delta Lowlands, most, if not all, parcels were riparian at the time of federal patenting. The ditch and distribution systems throughout the Delta Lowlands demonstrate landowners' general intention to preserve the riparian entitlement for all parcels that were ultimately separated from the

[3] End of period covered in the 1956 Cooperative Study Program and subsequent studies

[4] Department of Water Resources "Report on 1956 Cooperative Study program - Water Use and Water Rights Along Sacramento River and in Sacramento-San Joaquin Delta" Vol. 1, March 1957. (p. 21).

watercourse. The total amount of acres classified as Delta Lowlands within NDWA is approximately 205,800 acres.

10. In January 1963 Reclamation published a series of Delta Uplands Service Area Investigations Reports. These reports identify the Delta Uplands as the area between the Delta Lowlands and the exterior boundary of the Delta as described in the 1959 Water Code of California. For the purposes of these reports Reclamation divided the Delta Uplands into13 component parts. The purpose of these reports was to assemble and summarize factual information on historic use of water and water rights within each report area. Reclamation identified certain parcels in the Delta Uplands that could be credited with riparian status. This determination was made by identifying the smallest ownership parcels abutting the various unaltered natural water courses within the Delta Upland areas from a review of County Assessor's plats. The Delta Uplands Investigations identified approximately 12,000 acres within NDWA, which could be credited with riparian status. In my opinion, the Delta Uplands Investigations present a fair and reasonable analysis of riparian status of lands within the Delta Uplands areas.

11. Appropriative water rights within NDWA include pre-1914 rights, as well as post-1914 rights authorized pursuant to permits and licenses issued by the State Water Resources Control Board ("SWRCB").

12. Exhibit NDWA-11 is a figure showing the points of diversion under the water rights held by water users within NDWA. This figure is based on a map obtained from the Office of Delta Watermaster website, to which we have added the NDWA boundary, the proposed new intakes and the boundaries of reclamation districts within NDWA.

13. Protestant Reclamation Districts 999, 2060 and 2068 are located within NDWA, as depicted in Exhibit NDWA-11, and therefore, have the assurances and protections provided under the 1981 Contract. The following paragraphs provide a brief description of the water rights held, claimed, and reflected in the documents on file with the SWRCB by each of these protestant districts. In addition to documenting the water rights held, claimed, and reflected in the documents on file with the SWRCB for each of the protestant reclamation districts, I have

identified and documented the water use reports for the years 2010 through 2014 submitted and found on the SWRCB's Electronic Water Rights Information Management System (eWRIMS) by each of the protestant reclamation districts. These water use reports are submitted in the form of Supplemental Statements of Water Diversion and Use, Reports of Licensee, and Progress Reports by Permittee filed with the Division of Water Rights.

14. Reclamation District 999's service area consists of approximately 22,400 farmable acres all within the Delta Lowlands in Yolo and Solano counties. Reclamation District 999 holds four appropriative water right licenses to divert from the Sacramento River, Sacramento River Deep Water Ship Channel, Elk Sough, Miner Slough and Sutter Slough. Reclamation District 999 also claims riparian and pre-1914 appropriative rights to divert water from the Sacramento River, Sacramento River Deep Water Ship Channel, Sutter Slough and Elk Slough. True and correct copies of the documents reflecting the water rights held by Reclamation District 999, including reports of use under those rights and claims, are identified as Exhibits NDWA-94 through NDWA-124.

15. Reclamation District 2060's service area consists of approximately 5,350 farmable acres all within the Delta Lowlands in Solano County. Reclamation District 2060 holds one appropriative water right license to divert water from Barker Slough, Cache Slough, Lindsay Slough, Ulatis Creek and Hastings Cut. True and correct copies of the documents reflecting the water right license held by Reclamation District 2060, including reports of use under that right, are identified as Exhibits NDWA-125 through NDWA-130.

16. Reclamation District 2068's service area consists of approximately 13,200 farmable acres within the Delta Uplands in Yolo and Solano counties. Reclamation District 2068 holds two appropriative water right licenses to divert water from Haas Slough, and a water right permit for diversions from the Dixon Drain. True and correct copies of the documents reflecting the water rights held by Reclamation District 2068, including reports of use under those rights, are identified as Exhibits NDWA-131 through NDWA-148. Reclamation District 2068 also collects and distributes agricultural runoff originating from deliveries within its boundaries

and has, at times, documented such use in statements of diversion and use, true and correct copies of which are identified as Exhibits NDWA-149 through NDWA-274.

REQUIREMENTS OF THE 1981 CONTRACT RELEVANT TO THIS PROCEEDING

17. Upon its formation in 1973, NDWA entered into negotiations with the State of California and the United States for contracts to ensure adequate water quality and quantity for the water users within NDWA. In the process of those negotiations, Reclamation, on behalf of the United States, withdrew from the negotiations, which were then pursued solely with the State of California. These negotiations resulted in the 1981 Contract, executed on January 28, 1981.

18. Prior to the construction and operation of the State Water Project ("SWP") and the Central Valley Project ("CVP") water quality in the north Delta would vary seasonally, and in dry years water in Delta channels could become unusable late in the season diminishing crop yields. The release of water by DWR to offset SWP operations and meet the 1981 Contract water quality standards ensures a water quality that will be suitable for beneficial purposes within NDWA. The 1981 Contract water quality standards and the release of water by DWR, pursuant to the 1981 Contract, are intended to maintain a gradient or variation in water quality similar to that which occurs without the operation of the SWP and CVP. NDWA compensates the State for reimbursable benefits allocated to NDWA from operation of the SWP and CVP, offset by any detriments caused by those operations.

19. The 1981 Contract requires DWR to operate the SWP to meet specific water quality standards at seven locations within NDWA. These standards are in effect throughout the year and must be met, except under drought emergency conditions, as defined in the 1981 Contract.

20. As previously stated, one of the principal purposes of the 1981 Contract is to ensure adequate quality will be maintained at the respective water quality monitoring stations, as provided in Section 2 of the 1981 Contract. Specifically, Section 2(b) states: "While not committed affirmatively to achieving a better water quality at interior points upstream from Emmaton than those set forth on Attachment A, the State agrees not to alter the Delta hydraulics in such manner as to cause a measurable adverse change in the ocean salinity gradient or

relationship among the various monitoring locations shown on Attachment B and interior points upstream from those locations, with any particular flow past Emmaton" (Exhibit DWR-306). Attachment B to the 1981 Contract shows the monitoring locations for which water quality standards are established, under the Contract. Attachment A to the 1981 Contract shows the charts for the water quality standards provided under the Contract at the various monitoring locations shown in Attachment B. The charts in Attachment A are based on the Four River Basin Index, which includes the unimpaired runoff from the Sacramento River, the Feather River, the Yuba River, and the American River, as reflected in DWR Bulletin 120. The water quality standards are based on the 14-day running average of mean daily ("14-day mean") electrical conductivity ("EC").

21. In reference to Attachment A of the 1981 Contract, the water quality standards vary from month to month, and from year to year, based on the Four River Basin Index. Using a Critical Year such as 2015 as an example, the Four River Basin Index was approximately nine million acre-feet. Using a Four River Basin Index of nine million acre-feet, the water quality standard during July, as measured in millimhos or millisiemens, was as follows: 0.51 millimhos for Steamboat Slough at Sutter Slough, the North Fork of the Mokelumne River, the Sacramento River at Walnut Grove, and the Mokelumne River at Terminus; and was 0.87 millimhos for San Joaquin River at San Andreas Landing and the Sacramento River at Rio Vista. Pursuant to the 1997 amendment to the 1981 Contract (Exhibit NDWA-12 is a true and correct copy of the 1997 amendment), the water quality standard was 2.63 millimhos for the Sacramento River at Three-Mile Slough, the most downstream monitoring location in the Contract. The current compliance locations are identified on Exhibit NDWA-13, which is a map prepared by MBK to identify the water quality compliance locations together with the locations of the proposed intakes and the NDWA boundary.

22. MBK Engineers routinely calculates the water quality standard for each of the monitoring locations shown in Attachment B, based on the most recent DWR Bulletin 120, and monitors the actual water quality throughout the year. Exhibits NDWA-14 through NDWA-20, are charts prepared by MBK showing the water quality standard and actual 14-day mean EC

based on information obtained from the California Data Exchange Center ("CDEC") for each of the monitoring locations shown in Attachment B for 2014. Exhibits NDWA-21 through NDWA-27 are charts prepared by MBK showing the water quality standard and 14-day mean EC for each of the monitoring locations, shown in Attachment B for 2015.

23. As can be seen in the chart showing the water quality in the Sacramento River at Three-Mile Slough in 2015 (Exhibit NDWA-27), the 1981 Contract water quality standard for this location was exceeded on several occasions, during the period of July through December 2015. In October 2014, water quality also exceeded the 1981 Contract water quality standard at Three-Mile Slough (Exhibit NDWA-20). Water quality at the other locations remained within the 1981 Contract water quality standards during 2014 and 2015 (Exhibits NDWA-14 through NDWA-19 and NDWA-21 through NDWA-26). Although the 14-day mean EC approached the 1981 Contract criteria for the Sacramento River at Rio Vista in the middle of July (Exhibit NDWA-22), daily EC values exceeded the 1981 Contract standard value during several days at Rio Vista as reflected in Exhibit NDWA-44.

24. The intrusion of saline water from the ocean into the lower Sacramento River, stemmed from insufficient freshwater outflows, and other factors, and resulted in exceedances of the 1981 Contract water quality standard in the Sacramento River at Three-Mile Slough in 2014 and 2015. In my opinion, once salt water intrudes into the lower Sacramento in excess of the 1981 Contract water quality standard, it can require a significant volume of water to repel the saline water and recover acceptable water quality.

25. Similar conditions occurred during the drought of the late 1980s and early 1990s. True and correct copies of charts prepared by MBK showing the 1981 Contract water quality standard for Emmaton (the compliance point at the time), and water quality data for 1989 through 1992, are identified as Exhibits NDWA-28 through NDWA-31.

26. SWRCB Revised Decision 1641 ("D-1641") was part of the SWRCB's implementation of the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary ("1995 Plan"), which in part set forth water quality objectives for various purposes within the Delta. The SWRCB conducted workshops in 2004 and 2005 to

receive new information regarding water quality objectives contained in the 1995 Plan. In December 2006, the SWRCB adopted an amended Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary ("2006 Plan"), based on an evaluation of information received. Only minor changes were made to the 1995 Plan. The water quality objectives contained in D-1641 and the 2006 Plan are identical to those identified in D-1485 for the agricultural and municipal and industrial uses identified in the 1981 Contract. However, D-1641 contains the water quality objectives for Emmaton only for the period April 1 through August 15; whereas the 1981 Contract water quality standards are year round, and are to be met upstream at Three-Mile Slough. In other words, during late summer and early fall (a critical time for irrigation in NDWA), the water quality requirements of the 1981 Contract are controlling and DWR must operate the SWP to meet the requirements of the 1981 Contract.

27. The water quality objectives for Emmaton under D-1641, and Emmaton water quality data, for 2014 and 2015 are reflected in Exhibits NDWA-20 and NDWA-27. The water quality data reflected on these exhibits was obtained from CDEC and incorporated into the charts by MBK.

28. The provisions of the 1981 Contract are supported by a May 26, 1998 Memorandum of Understanding ("MOU") between the Agency and DWR (Exhibit DWR-308). The MOU states that, it is the joint position of NDWA and DWR that any obligation imposed by the SWRCB, upon the use of water within NDWA to assist in achieving the water quality objectives under D-1641, will be satisfied by DWR, pursuant to the 1981 Contract. This is further supported by D-1641, which implements the water quality objectives for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary and assigns responsibility for any obligation within NDWA to DWR, so long as the 1981 Contract and 1998 MOU remain in effect.

29. The 1981 Contract also provides a supplemental water supply to offset the deficiencies of the water rights within the Agency. Specifically, Article 8(a)(ii) recognizes the right of water users to: divert from the channels for reasonable and beneficial uses, provides that the State will not disturb these diversions and uses so long as the 1981 Contract is in effect, and requires the State to furnish such water, as may be required within the Agency, to the extent not

otherwise available under the water rights of NDWA water users. Therefore, since execution of the 1981 Contract, landowners within the Agency are no longer subject to hydrological and regulatory deficiencies in supply. Water users within the Agency are able to continue to divert water for reasonable and beneficial use under the 1981 Contract when water right curtailment notices (such as those sent in 2014 and 2015) are sent to water right holders.

IMPACTS TO LEGAL USERS OF WATER WITHIN NDWA

30. The change petition filed by DWR and Reclamation seeks authorization to add points of diversion and rediversion, from the Sacramento River at locations within NDWA, upstream of the water quality monitoring locations identified in Attachment B of the 1981 Contract (the "NDD" points of diversion).

31. There is significant uncertainty as to how the WaterFix, if approved and built, would actually be operated. More specifically, DWR and Reclamation have not developed an operations plan for the WaterFix. As described in the testimony of Walter Bourez (Exhibit SVWU-100), the CalSim II modeling performed for the CWF BA makes certain assumptions about how the WaterFix will be operated. According to Mr. Bourez, the operational assumptions embedded in the CalSim II modeling are unrealistic in terms of how the WaterFix would likely be operated, if built. (See Testimony of Walter Bourez, Exhibit SVWU-100). I concur with Mr. Bourez's opinions regarding the unrealistic nature of the operational assumptions embedded in the CalSim II modeling.

32. As described in the technical memorandum prepared by MBK Engineers (the "MBK Tech Memo") (Exhibit NDWA-32), the DSM2 modeling conducted by DWR and Reclamation for the Biological Assessment for the California WaterFix ("CWF BA") shows degradation to water quality and reductions in water levels within NDWA resulting from the WaterFix. The CWF BA modeling focuses on WaterFix Alternative 4A ELT ("Alt4A ELT"). It is my understanding based on the information provided by DWR and Reclamation that the impacts of CWF BA fall between H3 and H4. I have reviewed water quality, flow and water level results from the DSM2 modeling for the CWF BA.

33. In addition to the water quality and water level impacts described in the following paragraph, I have concerns about the reduction in daily flow in the Sacramento River as reflected in the CWF BA modeling results. In the 1981 Contract, DWR agrees not to alter the Delta hydraulics in such manner as to cause a measurable adverse change in the ocean salinity gradient or relationship among the various monitoring locations within NDWA. Reductions in the flow in the Sacramento River as a result of the operation of the WaterFix will result in reduction in flow in the Sacramento River downstream of the intakes. This reduction in Sacramento River flow will also result in reductions in flows in the sloughs and channels fed by the Sacramento River and the areas that rely on water originating from the Sacramento River. As an example, flow from the Sacramento River provides freshwater inflow to the Cache Slough Complex located in the western and southwestern portion of the NDWA via Cache Slough, and water from the Sacramento River that flows through Steamboat Slough and Miner Slough. This source of high quality water from the Sacramento River helps maintain the water quality within the Cache Slough Complex. Reductions in flow in the Sacramento River result in a reduction in the freshwater inflow to the Cache Slough Complex through Miner Slough. DWR has not provided any detailed analysis of the complex hydrodynamic processes in the Cache Slough Complex and how WaterFix may result in changes in flow, water level and water quality at the different locations within the sloughs and channels in the western portion of NDWA.

IMPACTS ARISING FROM DEGRADED WATER QUALITY

34. I have reviewed the Testimony of Parviz Nader-Tehrani (Exhibit DWR-66) submitted in this proceeding, including the DSM2 modeling results as shown in DWR-513. The summary plots in Exhibit DWR-513 provide a general understanding of the nature of WaterFix impacts to Delta water quality and hydrodynamics but lack sufficient detail required to understand the seasonal and temporal changes resulting from the WaterFix. DWR testimony on water level impacts (Exhibits DWR-66 and DWR-513) is primarily based on exceedance analyses that do not contain chronological information needed to assess changes in water level at a temporal scale.

35. The DSM2 modeling performed by DWR shows impacts to legal users of water within NDWA. For example, in his testimony Dr. Nader-Tehrani states in relevant part: "For all scenarios except Boundary 2, in the months of July and August there is an increase in EC at Emmaton of about 18-19 percent when compared to the [No Action Alternative] NAA." (Exhibit DWR-66, p. 5, lines 16-20). While Dr. Nader-Tehrani apparently concludes that a 19 percent average increase in EC at Emmaton in July and August is not a significant impact, I have a contrary opinion.

36. The average increase of 18-19 percent for July and August does not provide information regarding the range of the increases included in the average. First, an 18-19 percent increase in July and August (during the peak of the summer irrigation season) is a significant increase. Second, the use of 16-year monthly averages masks the extent of the impacts to crops within the NDWA. The CWF BA modeling indicates an increase in EC at Emmaton of 16-17 percent in July and August under Alt4a ELT when compared to the No Action Alternative ("NAA"). This increase in EC at Emmaton is similar to the 18-19 percent identified by Dr. Nader-Tehrani.

37. As identified in the MBK Tech Memo, although the average increase in EC at Emmaton was approximately 16-17 percent across all years analyzed during the months of July and August, the average monthly increase in July and August of individual years ranges from 1 to 69 percent. Dr. Nader-Tehrani's testimony does not identify increases in September, which as identified in the MBK Tech Memo, average approximately 23 percent across all years and range from 4 to 78 percent in any individual year (Exhibit NDWA-32).

38. In September 1989, the CWF BA modeling indicates an increase in EC in the Sacramento River at Emmaton from 2.19 millimhos under the NAA to 3.91 millimhos under the WaterFix, an increase of approximately 78 percent. For the Sacramento River at Three-Mile Slough the CFW BA modeling shows an increase in EC of approximately 62 percent; 1.71 millimhos under the NAA and 2.77 millimhos under the WaterFix, which would exceed the 1981 Contract water quality standard of 1.97 millimhos for September 1989. Based on my review of the CWF BA modeling results, it is my opinion that WaterFix (as operated pursuant to Alt4A

ELT) will result in increased violations of the 1981 Contract water quality standards at Three-Mile Slough, especially during September when D-1641 does not impose water quality requirements at Emmaton.

39. Under certain conditions, application of water with levels of additional salt identified in paragraph 38 would have negative effects on crop yields for moderately sensitive crops, including crops such as cherries, chestnuts, figs, and pomegranates that are grown in the area between Rio Vista and Three-Mile Slough as described by Mr. Mello (Exhibit NDWA-9, at ¶25).

40. Dr. Nader-Tehrani states that "in general all scenarios including the NAA meet D-1641 water quality objectives most of the time", and relies on probability of exceedance plots. (Exhibit DWR-66, at p. 8, lines 10 through 11.) The exceedance plots provide information as to the likelihood of the D-1641 water quality objectives being met; however, they do not contain chronological information needed to assess seasonal or temporal changes. As identified in the MBK Tech Memo, the CWF BA modeling indicates both increases and decreases in EC at Emmaton, Three-Mile Slough, and Rio Vista when looking at all months during the 16-year study period. The CWF BA modeling indicates increases in EC occur under Alt4A ELT in approximately 35 percent of the months in the 16-year study period. However, when looking at the April through September irrigation season, the EC is increased in in approximately 45 percent of the months and over 70 percent in the months of July through September.

IMPACTS ARISING FROM REDUCED SURFACE WATER ELEVATIONS

41. Exhibit DWR-513, pp. 11-15, Figures W1 through W5 show the probability of exceedance for daily minimum water levels for locations throughout the Delta. Dr. Nader-Tehrani's testimony states in relevant part: "The highest changes to water levels correspond to locations close to the proposed North Delta Diversion (NDD) intakes and can be up to 1.2 ft (during high flows) to 0.5 ft (during low flows). The modeled daily minimum water level for Boundary 1, which results in the most NDD diversions, drops below the lowest water level under the NAA only during 73 days out of the 16 years simulated, which represents less than 5 days in a year" (Exhibit DWR-66, p. 3, lines 11-16). In my opinion, use of a 16-year average masks the

potential impact of reduced water levels by removing the temporal component of the occurrence. Furthermore, the use of the average does not indicate when during the year lower water levels could be expected or if these occurrences could be expected on consecutive days.

42. As identified in the MBK Tech Memo (NDWA-32), modeled daily minimum river stage at Steamboat Slough is consistently lower under the proposed WaterFix particularly during the irrigation season, between April and September.

43. Any reduction in water levels caused by the WaterFix will result in reduced siphon efficiencies due to a reduction in head differential, i.e., the difference in elevation between water level of the river and the point of discharge of the siphon. In addition, if minimum water levels are reduced to levels below which a siphon was designed to operate, the siphon will break or cease to operate.

44. Reductions in water levels caused by the WaterFix will also result in impacts to pumped diversions including reduced pumping efficiencies and increased energy costs.