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BEFORE THE

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

HEARING IN THE MATTER OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND UNITED STATES BUREAU OF RECLAMATION REQUEST FOR A CHANGE IN POINT OF DIVERSION FOR CALIFORNIA WATER FIX

TESTIMONY OF TARA SMITH

I, Tara Smith, do hereby declare:

I. INTRODUCTION

I am an expert in modeling the flows and water quality of the Delta. I am employed by the Department of Water Resources (DWR) as Chief of the Modeling Support Branch. Prior to moving into that position, I was Chief of the Delta Modeling Section. I received a Master of Science degree in Civil Engineering from UC Davis. I am a registered Civil Engineer in the State of California. I have over 26 years of experience in numerical modeling in hydrodynamics, water quality, and particle tracking in the Sacramento San Joaquin Delta and interpreting modeling results. More information on my experience can be found in my Statement of Qualifications, a true and correct copy of which is submitted as exhibit DWR-1009.

I have coordinated with, and directed, staff and consultants on Delta modeling for the California Water Fix. Modeling done in support of this testimony was completed by

Engineers from CH2M and DWR. I have reviewed the modeling results on which this testimony is based.

In October 2015 DWR and U.S. Bureau of Reclamation (Reclamation) (jointly Petitioners) petitioned the State Water Board for the addition of three new points of diversion on Petitioners' water rights permits. In testimony submitted in Part 1 of this hearing, the project was described as Alternative 4A with initial operational criteria that would fall within a range of operations described as H3 to H4. These operational criteria were described in the Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (RDEIR/SDEIS). (Exhibit SWRCB-3.) For purposes of Part 2 of the hearing, including this testimony, the California WaterFix project is described by Alternative 4A under an operational scenario described as H3+ that is set forth in the Final Environmental Impact Report/Environmental Impact Statement and supplemental information adopted by DWR through the issuance of a Notice of Determination in July 2017 (2017 Certified FEIR). (Collectively Exhibits SWRCB-102, SWRCB-108, SWRCB-109, SWRCB-110, SWRCB-111 and SWRCB-112.) **The adopted project is referred to as CWF H3+.** Additional information is also referenced in this testimony from documents released prior to July 2017, including the Alternative 4A described in the Final Environmental Impact Report/Environmental Impact Statement, Biological Assessment and the Biological Opinions, referred to herein as the FEIR/FEIS, BA and the BO respectively. Similarly, after July 2017 the California Department of Fish and Wildlife issued a 2081(b) Incidental Take Permit, which is referred to as the ITP. The interrelationship and use of these terms is further described in the testimony of Ms. Buchholz, DWR-1010.

II. OVERVIEW OF TESTIMONY

This testimony provides an overview of any changes in water quality, compliance with Water Rights Decision 1641 (D-1641) water quality objectives, and water levels at key locations in the Delta, associated with the CWF H3+. There will be two main sections in this

testimony. The first section will focus on the water quality (salinity) effects of CWF H3+, BA H3+, and the No Action Alternative (NAA) on fish and wildlife beneficial uses as defined by D-1641. The second section will describe CWF H3+ salinity and water level results and their relationship to BA H3+ and the NAA for locations presented previously in Part 1. The H3 and H4 results presented in Part 1 are included in the figures for reference. The results included in this testimony are based on DSM2 modeling and follows the framework presented by Ms. Buchholz and Mr. Reyes. (Exhibits DWR -1010 and DWR-1016.) The modeling results for CWF H3+ are presented specifically in comparison to the NAA, H3, H4, and BA H3+. I rely on testimony by Mr. Reyes because many DSM2 boundary conditions are provided by CalSim II results. These boundary conditions include river inflows and Delta diversions (including CVP and SWP exports).

Summary of Opinions

- The fish and wildlife beneficial use objectives for the Suisun Marsh locations were mostly met under all the scenarios. The small percentage of exceedances (less than 5%) that occurred for a few locations under the CWF H3+ scenario was in line with the percentage that occurred for the NAA.

- For the fish and wildlife beneficial use objectives for the San Joaquin River reach between Prisoners Point and Jersey Point, the objective was fully met at Jersey Point and San Andreas Landing for all alternatives. At Prisoners Point, the objective was exceeded for approximately 10% of time under CWF H3+ relative to NAA, due to the presence of a greater proportion of higher EC San Joaquin water at this location. This is due to lower south Delta exports and the closure of the Head of Old River Gate, in the spring months.

- Incremental changes in CWF H3+ salinity results are largely similar to the H3 and H4 results presented in Part 1, when compared to the NAA. Exceptions to this depend on location and are due to the following.
    - Higher spring Delta outflow requirements resulted in less southern Delta exports. With less exports, fresher Sacramento River water is not moved through sections of the interior Delta, resulting in higher salinity in those sections of the Delta.
    - The monthly average Electrical Conductivity (EC) results for CWF H3+ during the months of October and November are somewhat similar to those under NAA, with slight variations. Fall south Delta export restrictions for CWF H3+ as compared to the BA H3+ constraints were removed which resulted in a lower net Delta outflow and higher salinity in fall and winter months. D-1641 objectives were still met.

- The D-1641 municipal, industrial, and agricultural beneficial use objectives were mostly met under all scenarios. The small percentage of CWF H3+ exceedances is similar to the NAA. As explained by Dr. Nader-Tehrani in Part 1, the exceedances are mostly a result of differences in model assumptions, and SWP/CVP project operators have been able to meet their regulatory obligations and achieve a high degree of compliance, as testified by Mr. Leahigh in Part 1.

- Water level effects for CWF H3+ and BA H3+ are similar to H3 and H4. Compared to the NAA, the largest reduction in water levels is expected to occur just downstream of the NDD and mostly during high flow periods. During low flow periods, the expected reduction in daily minimum water levels is less than 0.5 feet near the three intakes and much smaller at locations farther from the three intakes.

III. DISCUSSION OF TESTIMONY

Description of DSM2

A summary of the DSM2 model is described by Dr. Nader-Tehrani in his Part 1 testimony. (Exhibit DWR-66, p.3.)

A. Water Quality Objectives for Fish and Wildlife Beneficial Uses

In this section of the testimony, I discuss the DSM2 modeling results as they relate to the D1641 Water Quality Objectives for Fish and Wildlife Beneficial Uses. The testimony provides information describing the probability of compliance with the D-1641 water quality objectives for Fish and Wildlife Beneficial Uses for Alternative CWF H3+ relative to the other alternatives.

For the Suisun Marsh objectives, which are for the protection of waterfowl habitat, the DSM2 modeling for the CWF H3+ shows that the salinity levels are similar to results for the NAA. There is a very small percentage of time (less than 5%) when there are modeled exceedances for NAA, BA H3+, and CWF H3+ for a few locations. Discussion on the operational flexibility in meeting these water quality objectives was given in the testimony of John Leahigh in Part 1. (Exhibit DWR-61.)

For the protection of Striped Bass spawning locations in the San Joaquin River between Jersey Point and Prisoners Point the results show that for locations downstream of the Mokelumne River confluence, all the scenarios meet the objective 100 percent of the time. For the CWF scenarios, the objective is exceeded about 10% more of the time at the Prisoners Point location compared to the NAA, due to the effects of land salts, as described in further detail below.

Table 1 shows the D-1641 Water Quality Objectives for Fish and Wildlife Beneficial Uses described in this section of the testimony. The figures following show the locations of the objectives and the compliance frequency with those objectives. As shown in the notes in the table, there are some instances where the graphs do not reflect meeting the less restrictive objectives. This will be discussed further when the individual graphs are

discussed.

For the compliance results, the exceedance plots are created by plotting the DSM2 results minus the objective for the year type and time period. Only results for the time period the objective is in place are plotted. The results in the graphs presented show DSM2 results for 16 years (1976-1991). If the lines in the graph are less than zero, that indicates that DSM2 for the particular run is meeting the objectives. If the lines in the graph are at times greater than zero, that indicates that the DSM2 results are exceeding the objectives for part of the time period.

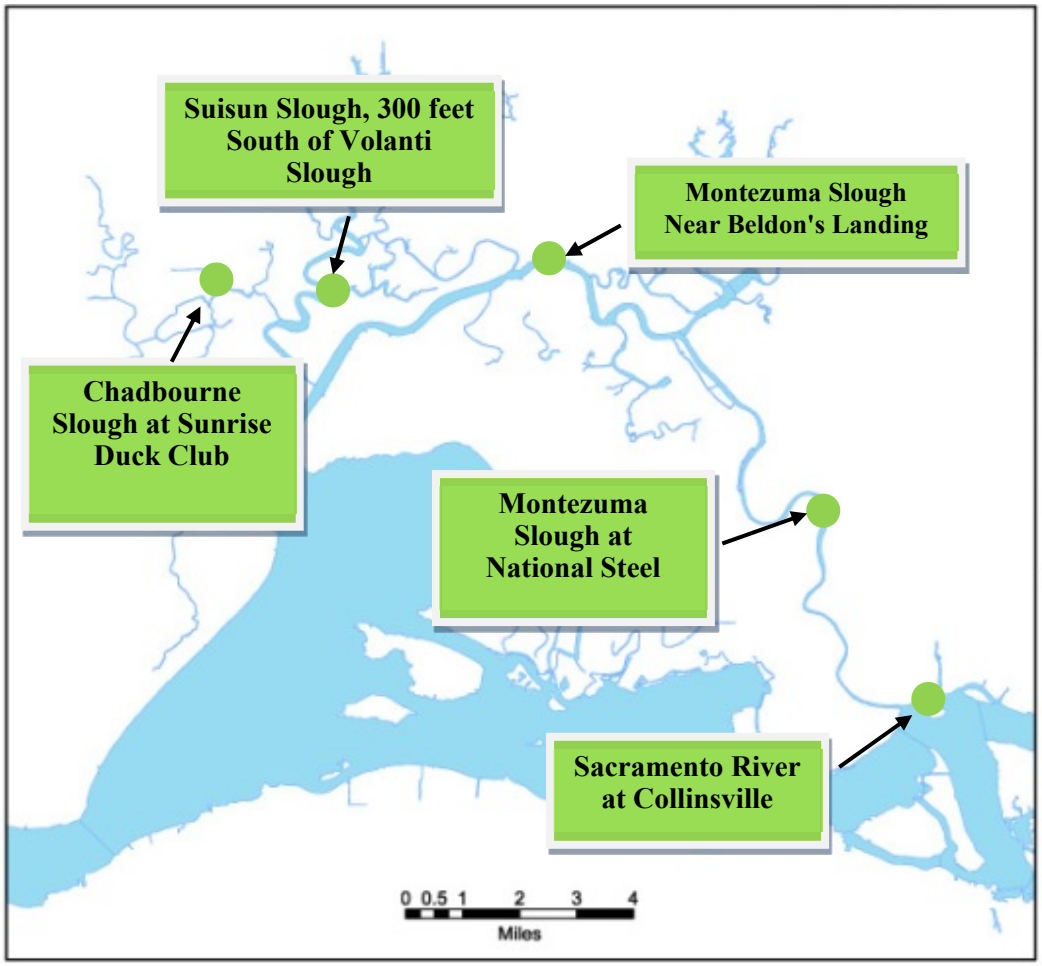
Table 1 – D-1641 Water Quality Objectives for Fish and Wildlife Beneficial Uses

Compliance Location	Description	Objective Value (mmhos/cm EC) and TimePeriod	Year Types	Notes	DSM2 Results Figure Numbers
San Joaquin River at and between Jersey Point and Prisoners Point	Maximum 14-day running average of mean daily EC (mmhos/cm)	0.44 in April-May	All year types except critical	The objective also does not apply in May when the Sacramento River Index estimate is less than 8.1 MAF at 90% exceedance level. Comparisons of modeling results to the objective do not include this exception to meeting the 0.44 mmhos/cm EC objective.	Figures C6-C8
Sacramento River at Collinsville, **Montezuma Slough at National Steel,** **Montezuma Slough near Beldon's Landing**	Maximum monthly average of both daily high tide EC values (mmhos/cm)	19.0 in Oct 15.5 in Nov-Dec 12.5 in Jan 8.0 in Feb- Mar 11.0 in Apr-May	All year types		Figures C1-C3
Chadbourne Slough at Sunrise Duck Club, **Suisun Slough, 300 feet South of Volanti Slough**	Maximum monthly average of both daily high tide EC values (mmhos/cm)	19.0 in Oct 16.5 in Nov 15.5 in Dec 12.5 in Jan 8.0 in Feb-Mar 11.0 in Apr-May	All year types except for deficiency period		Figures C4-C5
	Maximum monthly average of both daily high tide EC values (mmhos/cm)	19.0 in Oct 16.5 in Nov 15.6 in Dec-Mar 14.0 in Apr 12.5 in May	Deficiency period	Deficiency period allows for higher EC value objectives.	

a. Suisun Marsh Objectives

The purpose of the Suisun Marsh salinity objectives is to protect habitat for waterfowl in managed wetlands (D-1641). Figure L1 shows the objective locations.

Figure L1: D-1641 Suisun Marsh Water Quality Objective Locations for Fish and Wildlife Beneficial Uses



Sacramento River at Collinsville (Figure C1)

All scenarios including the NAA and the CWF H3+ comply with the objectives more than 95% of the time. The times that the scenarios do not comply with the objective reflect the 1977 drought period. The CWF H3+ is generally similar to the NAA.

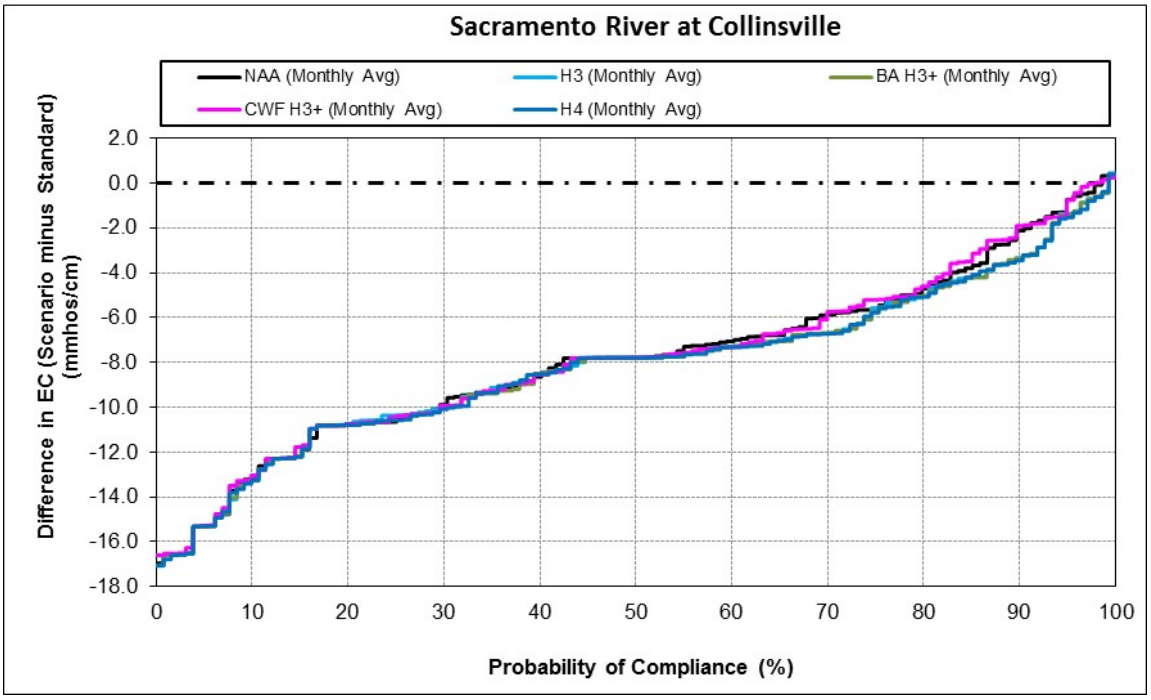
Montezuma Slough at National Steel (Figure C2)

The DSM2 results show that, for all alternatives, the Montezuma Slough at National Steel objective is met 100% of the time.

Montezuma Slough near Beldon's Landing, Chadbourne Slough near Sunrise Duck Club, and Suisun Slough 300 feet south of Volanti Slough (Figure C3 -C5)

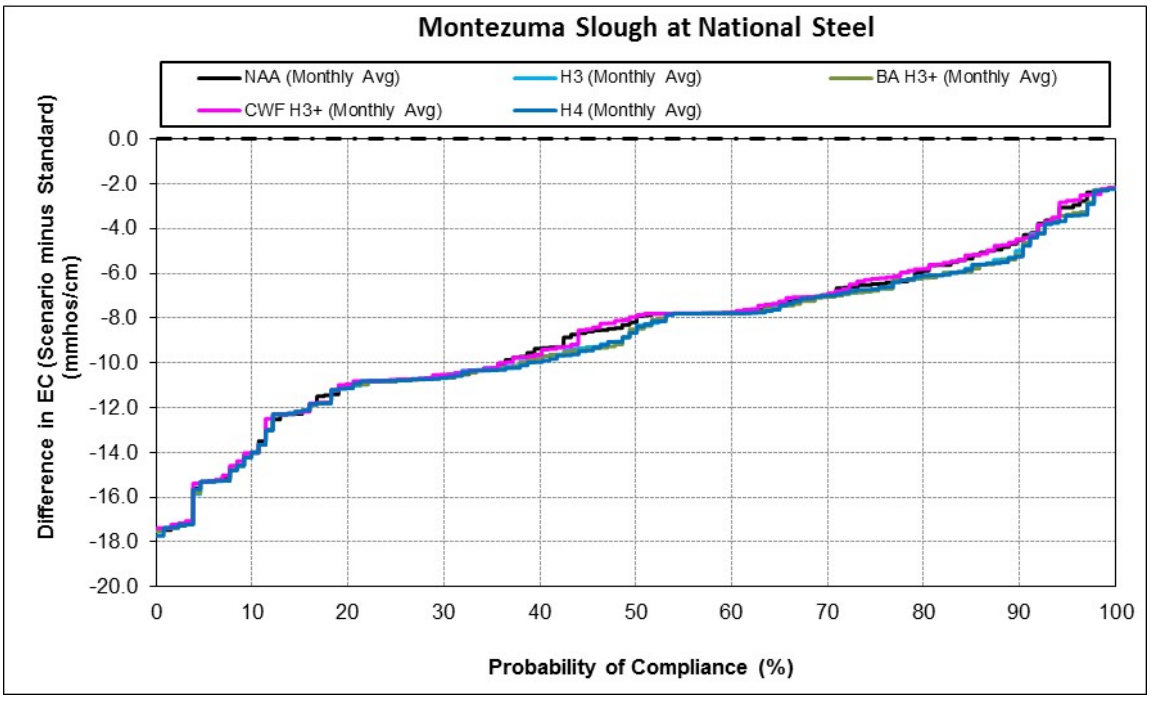
For the DSM2 results for Montezuma Slough near Beldon's Landing, Chadbourne Slough near Sunrise Duck Club, and Suisun Slough 300 ft south of Volanti Slough, all scenarios including the NAA and the CWF H3+ comply with the objectives more than 95% of the time. The times that the alternatives do not apply with the objective reflect the 1977 drought period. The CWF H3+ is generally similar to the NAA.

Figure C1: D-1641 Fish and Wildlife EC Objectives at Collinsville – Probability of meeting D-1641



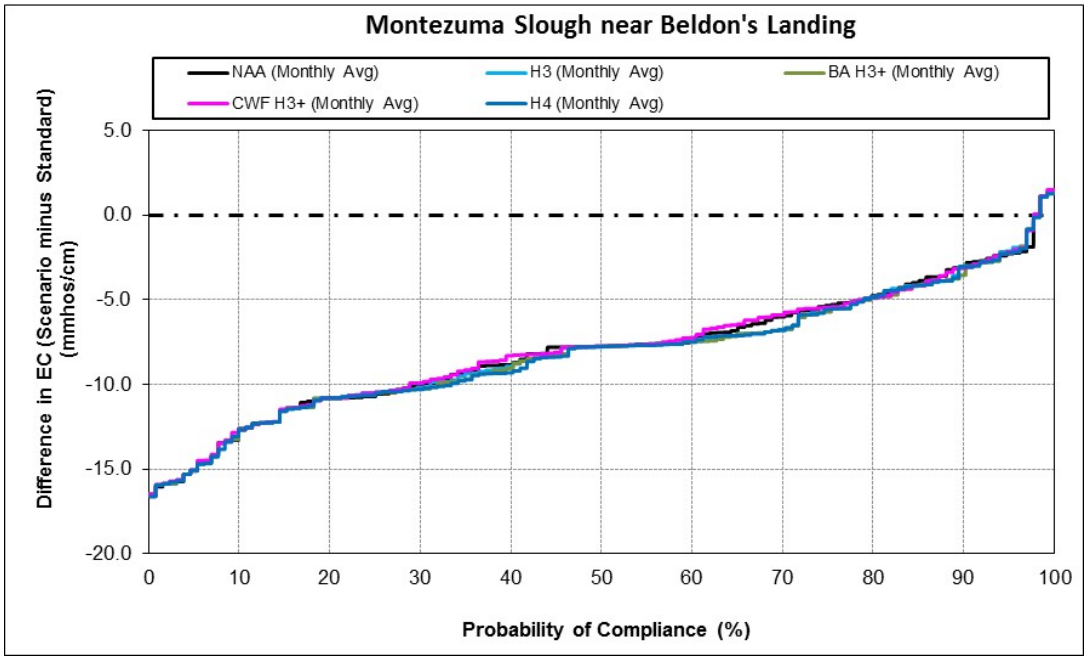
**Model results are used for comparative purposes and not for predictive purposes*

Figure C2: D-1641 Fish and Wildlife EC Objectives at Montezuma Slough at National Steel – Probability of meeting D-1641



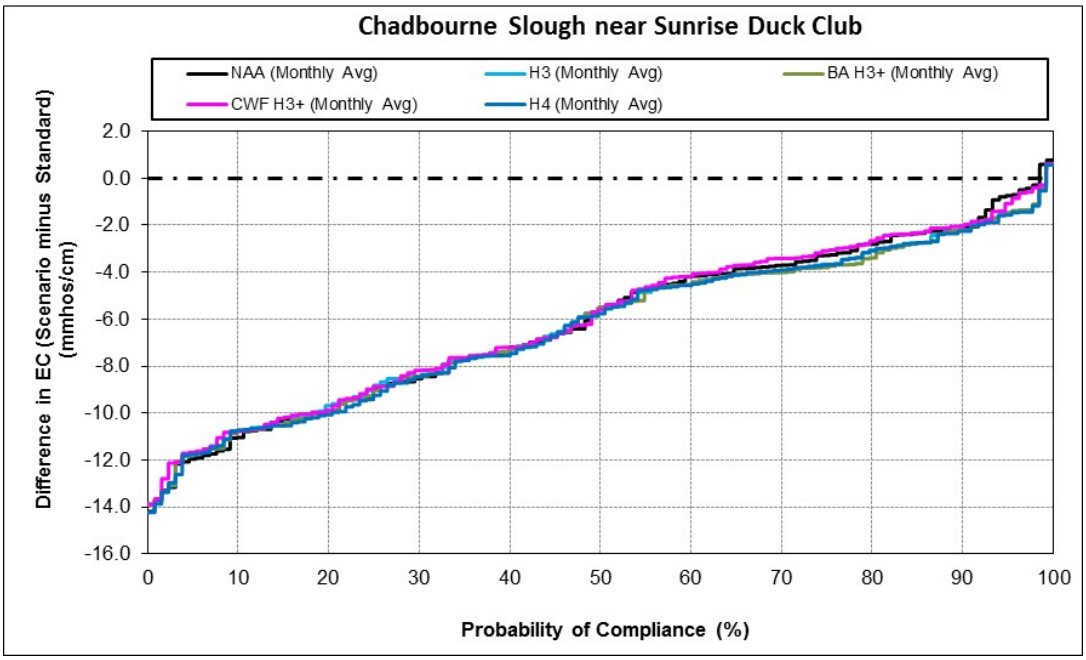
**Model results are used for comparative purposes and not for predictive purposes*

Figure C3: D-1641 Fish and Wildlife EC Objectives at Montezuma Slough near Beldon's Landing – Probability of meeting D-1641



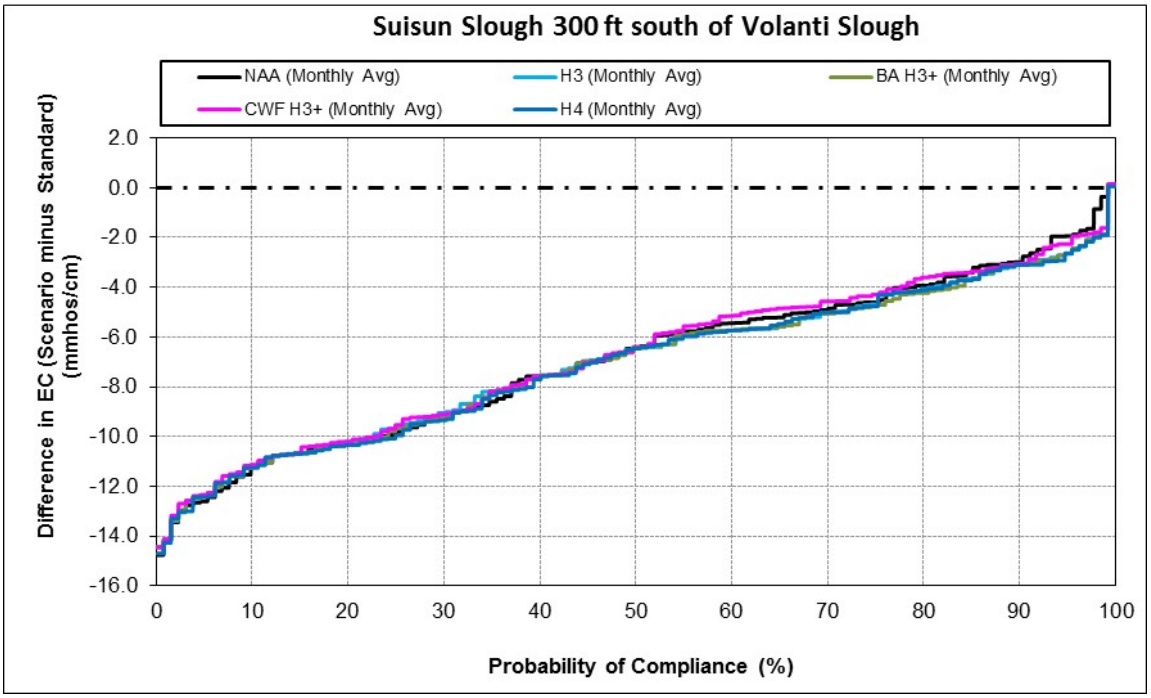
**Model results are used for comparative purposes and not for predictive purposes*

Figure C4: D-1641 Fish and Wildlife EC Objectives at Chadbourne Slough near Sunrise Duck Club – Probability of meeting D-1641



**Model results are used for comparative purposes and not for predictive purposes*

Figure C5: D-1641 Fish and Wildlife EC Objectives at Suisun Slough 300 feet south of Volanti Slough – Probability of meeting D-1641

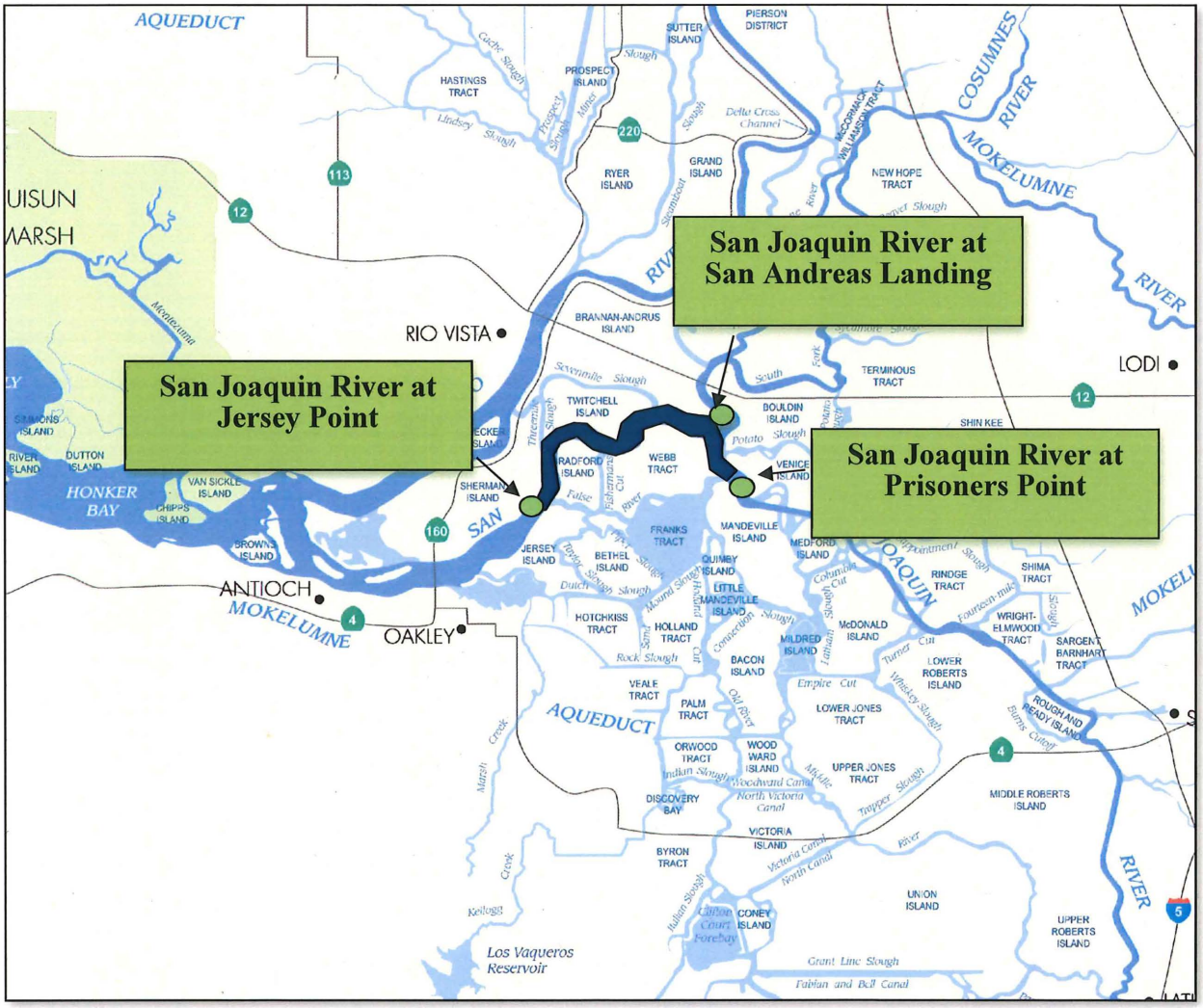


**Model results are used for comparative purposes and not for predictive purposes*

b. San Joaquin River Objectives

The purpose of the San Joaquin River salinity objectives is to protect Striped Bass spawning areas (D-1641). The objective locations are between Prisoners Point and Jersey Point on the San Joaquin River. Figure L2 shows the objective locations. Jersey Point is west of Prisoners Point and downstream of Mokelumne River and is more influenced by fresh water from Mokelumne River and ocean salinity.

Figure L2: Location of the segment of the San Joaquin River between Jersey Point and Prisoners Point – D-1641 Water Quality Objectives for Fish and Wildlife Beneficial Uses



D-1641 requires that the 14-day average salinity in the San Joaquin River at and between Jersey Point and Prisoners Point remain below 0.44 mmhos/cm EC in April and May in all year types except for critical years and in May when the 90% forecast of the Sacramento River Index is less than or equal to 8.1 million acre-feet. Figures C6-C8 show results for Jersey Point, Prisoners Point and San Andreas Landing. (The May exception to the objective is not reflected in the graphs).

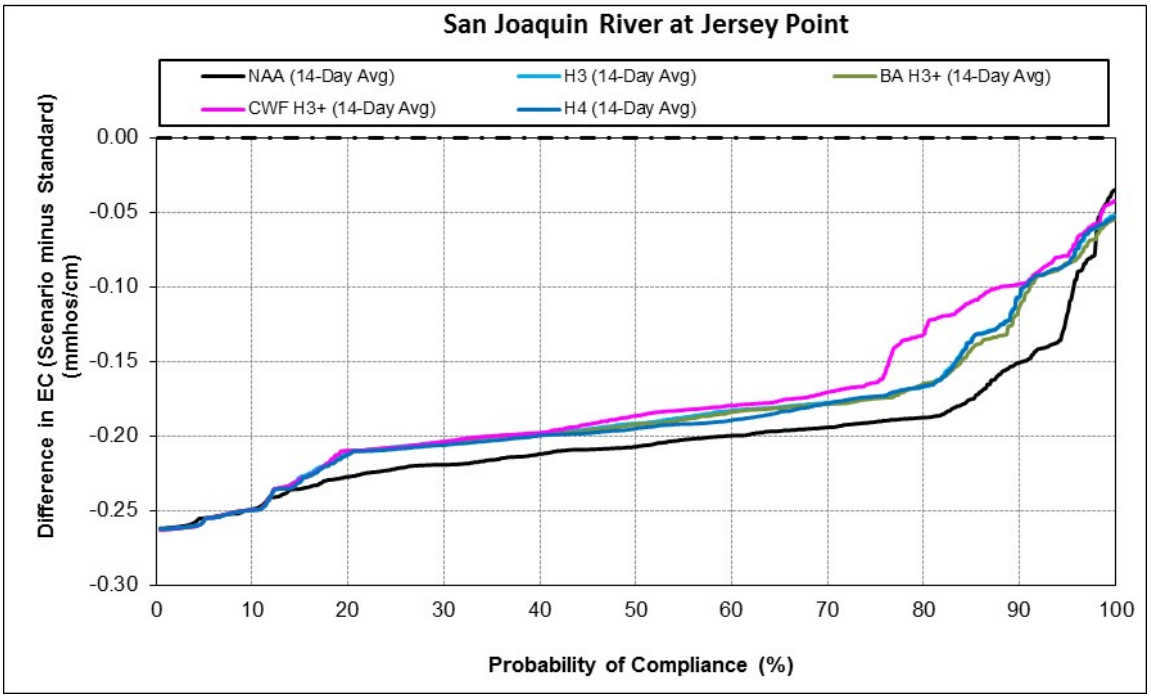
Figures C6-C8 are exceedance plots for the times when the 0.44 mmhos/cm EC objective is in place. If the lines reflect all negative values (y-axis), then the scenario meets the objective 100 percent of the time. If the lines show positive values then there is a percentage of time when the objective is not met.

For Jersey Point and San Andreas Landing (Figures C6 and C7), both the NAA and CWF H3+ remain below the 0.44 mmhos/cm EC 100% of the time.

For Prisoner's Point (Figure C8), the NAA meets or is less than 0.44 mmhos/cm EC approximately 98% of the time, the BA H3+ meets or is less than 0.44 mmhos/cm EC 90% of the time, and the CWF H3+ meets or is less than the 0.44 mmhos/cm EC approximate 87% of the time. The higher EC for both the NAA and CWF H3+ at Prisoner's Point is a reflection of the presence of higher EC San Joaquin River water compared to the water from the Sacramento River and the San Francisco Bay. The exceedances normally occur in early April. The differences between H3+ (BA and CWF) and NAA at Prisoners Point is primarily due to reduction in southern Delta diversions/exports and the closure of the head of Old River Gate. The differences between BA H3+ and CWF H3+ reflect the reduction in exports in March for the CWF H3+ needed to meet the March Net Delta Outflow requirements described in Erik Reyes' testimony. (Exhibit DWR-1016.) Because less Sacramento River water is moved south with exports, water quality at Prisoners Point reflects Vernalis water quality and in-Delta discharges. Additional information can be found in the Final EIR/S Appendix 8H, page 57. (Exhibit SWRCB-102.)

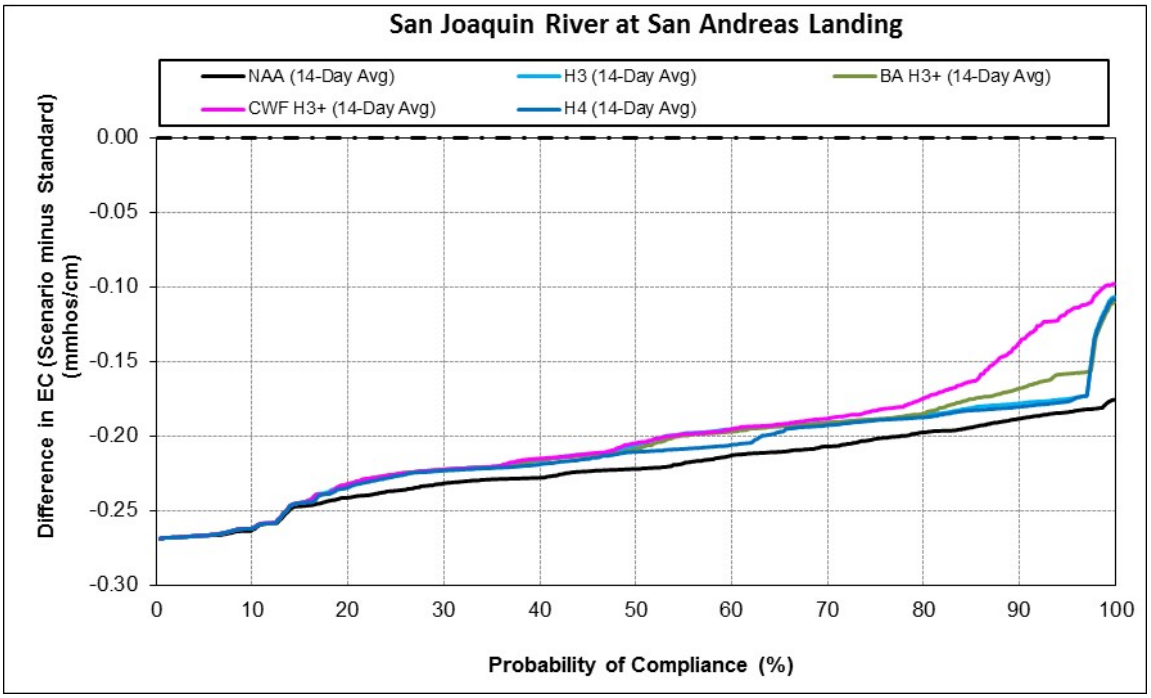
Water Quality at Jersey Point and San Andreas Landing reflect the influence of lower salinity Sacramento water moving into the San Joaquin River from the North Fork of the Mokelumne River and Three Mile Slough.

Figure C6: D-1641 Fish and Wildlife EC Objective at Jersey Point – Probability of meeting D-1641



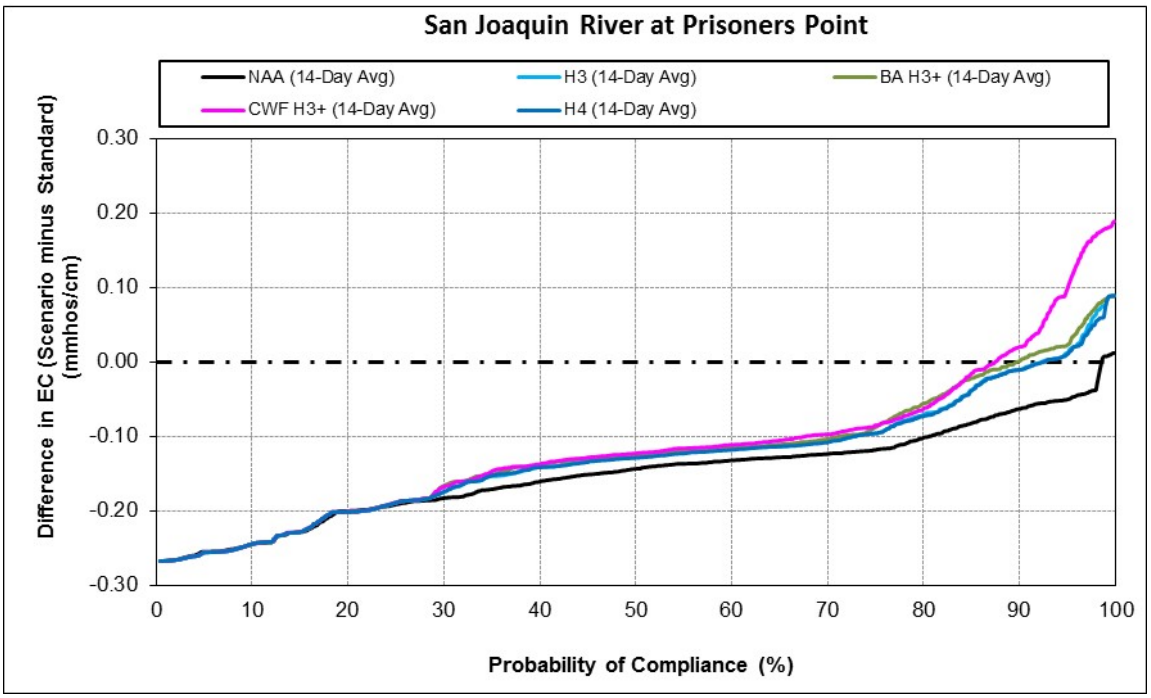
**Model results are used for comparative purposes and not for predictive purposes*

Figure C7: D-1641 Fish and Wildlife EC Objective at San Andreas Landing – Probability of meeting D-1641



**Model results are used for comparative purposes and not for predictive purposes*

Figure C8: D-1641 Fish and Wildlife EC Objective at the San Joaquin River at Prisoners Point – Probability of meeting D-1641



**Model results are used for comparative purposes and not for predictive purposes*

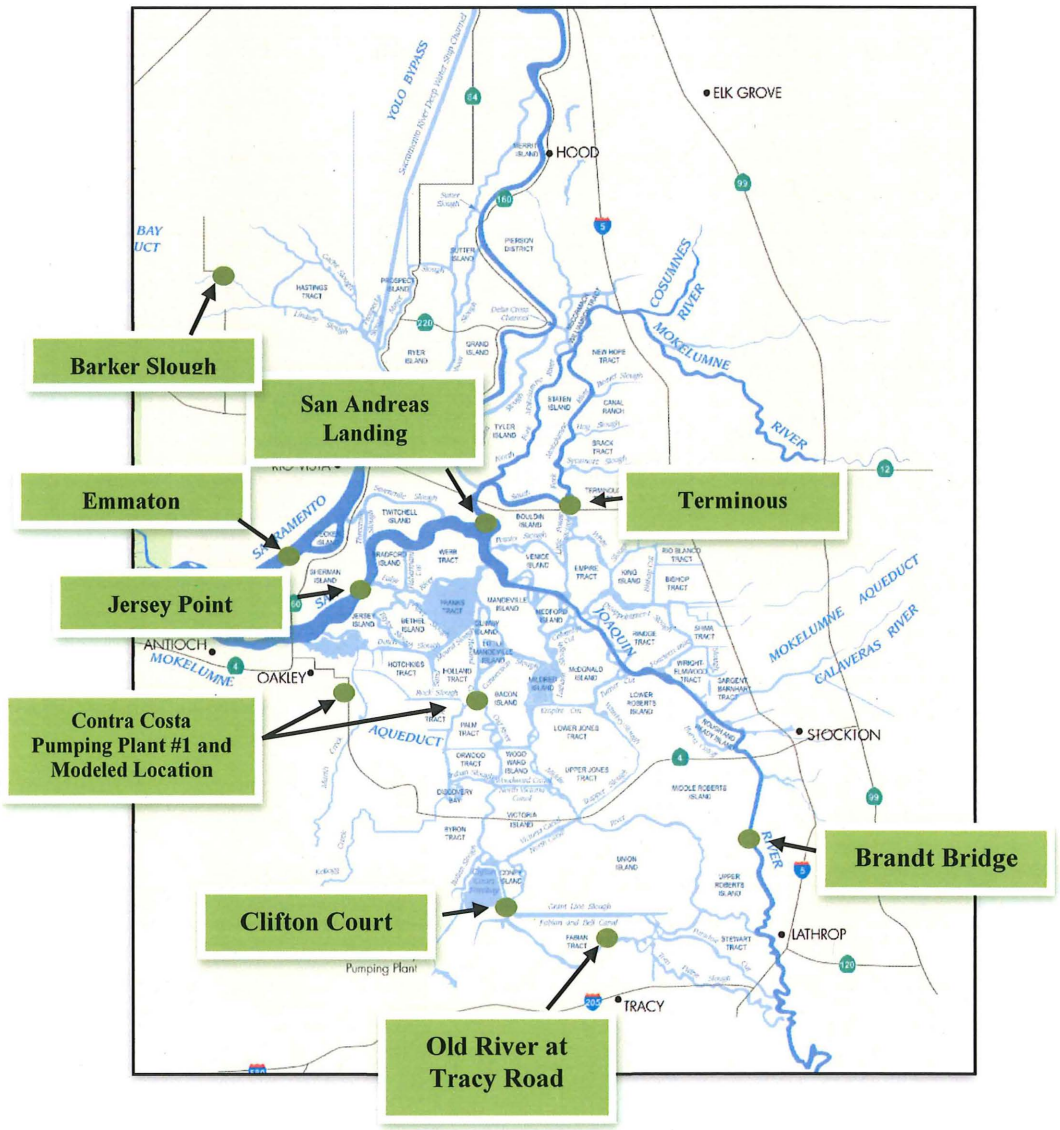
B. D-1641 Municipal and Industrial (M&I) and Agricultural Water Quality Objectives

This section of the testimony provides an overview of any changes in water quality, compliance with D-1641 water quality objectives, and water levels at key locations in the Delta, associated with CWF H3+. The DSM2 modeling results for CWF H3+, NAA, H3, H4, and BA H3+ scenarios are presented. A description of the associated operational assumptions is provided in Table 1. (Exhibit DWR-1016.) This testimony provides modeling results for water quality and water levels similar to those provided in Exhibit DWR-513.

At all Delta locations, the majority of modeling results for water quality and water levels show that the incremental changes under CWF H3+ (and BA H3+) are similar to H3 and H4, when compared to the NAA. Modeling results also show that the probability of compliance with D-1641 water quality objectives for agricultural and M&I under CWF H3+ is similar or better compared to NAA at most locations.

Figure L3 shows the locations where water quality monthly average and probability of exceedance plot results are presented.

Figure L3: Locations of M&I and Agricultural Water Quality Results



a. Water Quality (EC and Chloride)

Figures EC1through EC3 show the long-term monthly average EC concentration at Sacramento River at Emmaton, San Joaquin River at Jersey Point, and San Joaquin River at San Andreas Landing. The results for CWF H3+ for all months are fairly similar to those for H3 and H4 except for the months of October and November. Specifically, during the months of April through August (during the time the D-1641 agricultural water quality objectives apply) the water quality results for CWF H3+ are very similar to those for H3 and

H4. The main reason for the increase in EC for the months of October and November is the removal of the new restrictions on the south Delta exports, which is consistent with the assumptions for the NAA. The monthly average EC results for CWF H3+ during the months of October and November are similar to those under NAA with slight variations.

Figures EC4 through EC6 show the monthly average EC concentration at South Fork Mokelumne River at Terminous, Old River at Tracy Road, and San Joaquin River at Brandt Bridge. The water quality results for CWF H3+ for all months are very similar to those for H3, H4, and NAA with only slight variations.

Figures CL1 and CL2 show the estimated monthly average chloride concentration at Contra Costa Canal and Old River at Clifton Court. The changes in chloride concentration for CWF H3+ for all months is very similar to those for H3 and H4 with only slight variations reflected in the months of October through December for Clifton Court and November through December for Contra Costa Canal. As explained earlier, the main reason for the increase in chloride concentrations for the fall months is the removal of the new restrictions on the south Delta exports for the months of October and November. (December chloride results reflect the export reductions that occurred in October and November.) The chloride concentration for CWF H3+ for all months is lower or similar to those for NAA with some exceptions. The increase in chloride concentration in the months of April and June is most likely due to reduced South Delta diversions, associated with the new spring Delta outflow requirement. The increased Chloride concentrations, relative to the NAA, in the Fall, as mentioned earlier, are due to the removal of the restrictions on south Delta exports.

Figure CL3 shows the estimated monthly average chloride concentration at Barker Slough. The results clearly show that the CWF operations do not influence the chloride concentration at this location.

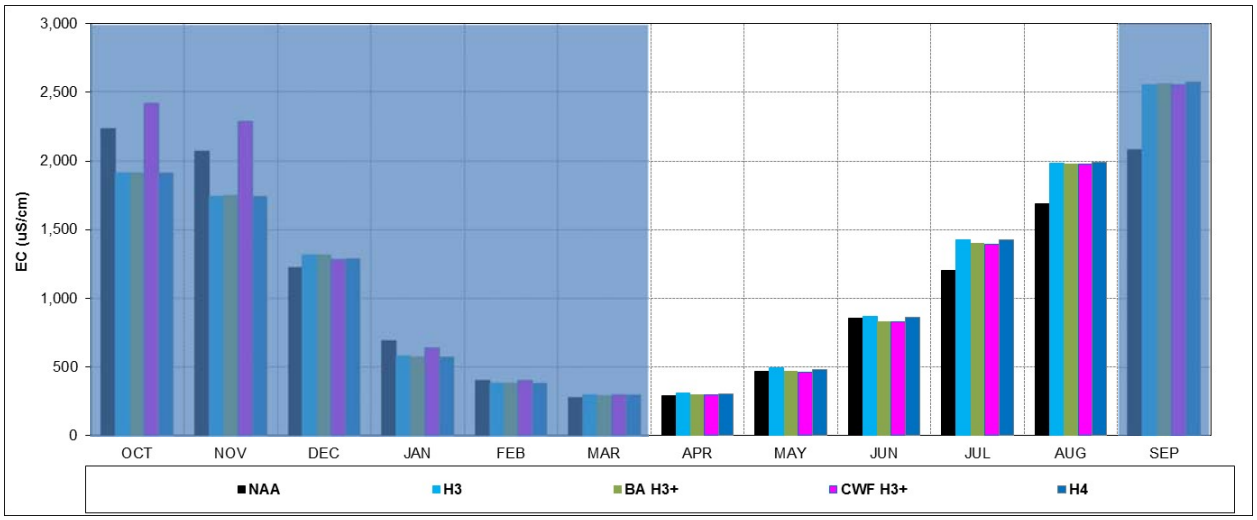
D-1641 Compliance (Agricultural and M&I)

Figures C9 through C13 show the modeled probability of meeting D-1641 water quality objectives at Emmaton, Jersey Point, San Andreas Landing, South Fork Mokelumne

River at Terminous, and Contra Costa Canal. The data shows a similar or increased ability for CWF H3+ as compared to the NAA to meet D-1641 water quality objectives at all locations except Emmaton. At Emmaton there is only a slightly lower ability to meet D-1641 water quality objectives. The results for CWF H3+ at all locations are very similar to those for H3 and H4 and NAA with only slight variations.

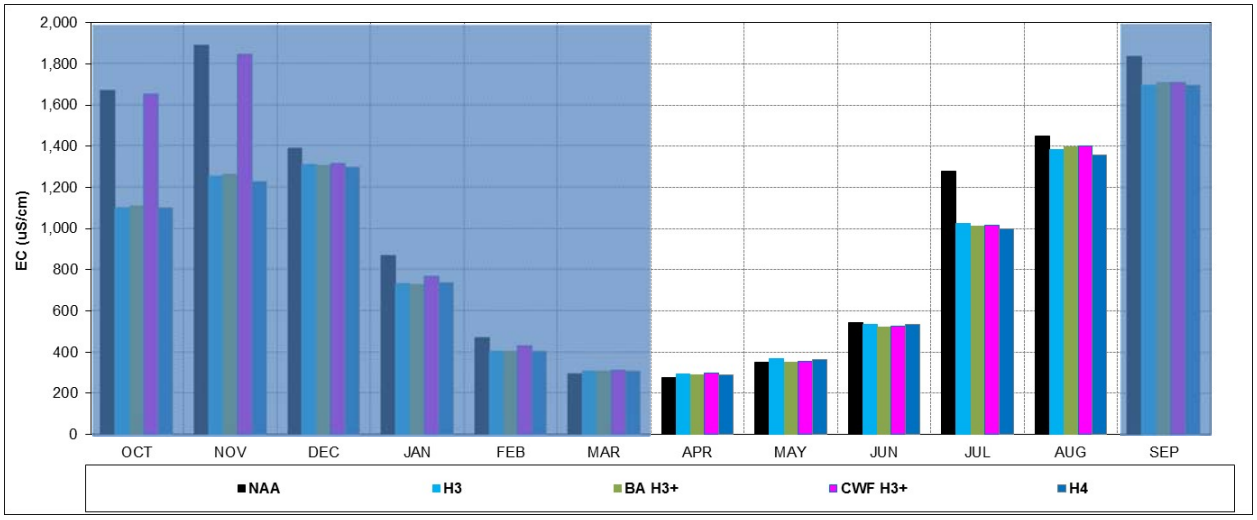
Figure C14 shows the number of days in a year meeting the 150 mg/l mean daily chloride concentration D-1641 objective at the Contra Costa Canal Intake. All scenarios meet this objective for all years simulated except in 1977. It should be noted that in general, CWF H3+ meets the 150 mg/l mean daily chloride concentration objective for a similar or a greater number of days, beyond what is required, compared to the NAA for all years except 1976, 1987, and 1988.

Figure EC1: Monthly Average EC at Emmaton



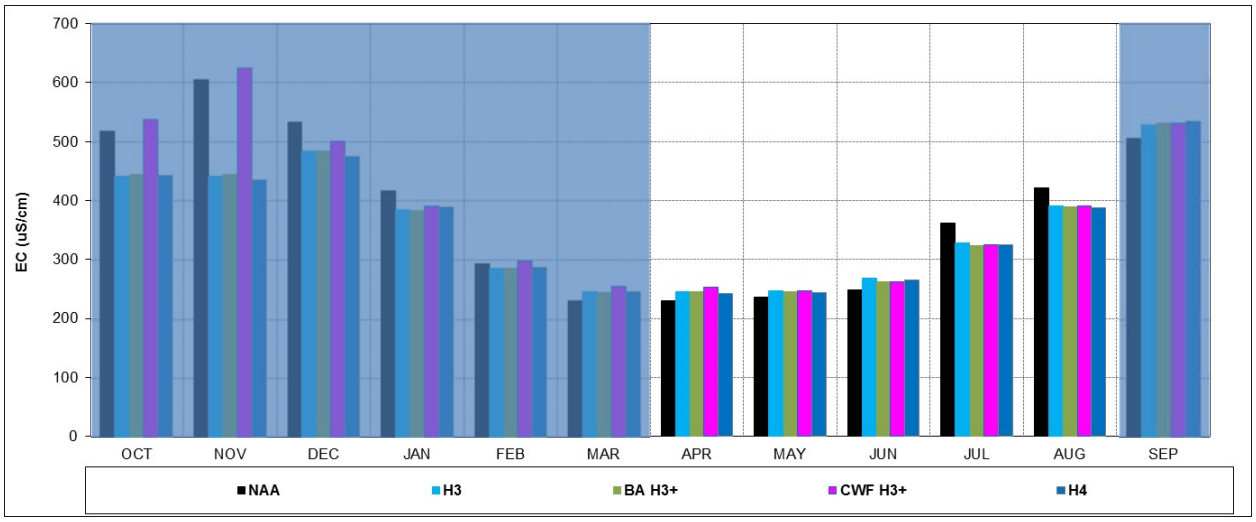
**Model results are used for comparative purposes and not for predictive purposes*

Figure EC2: Monthly Average EC at Jersey Point



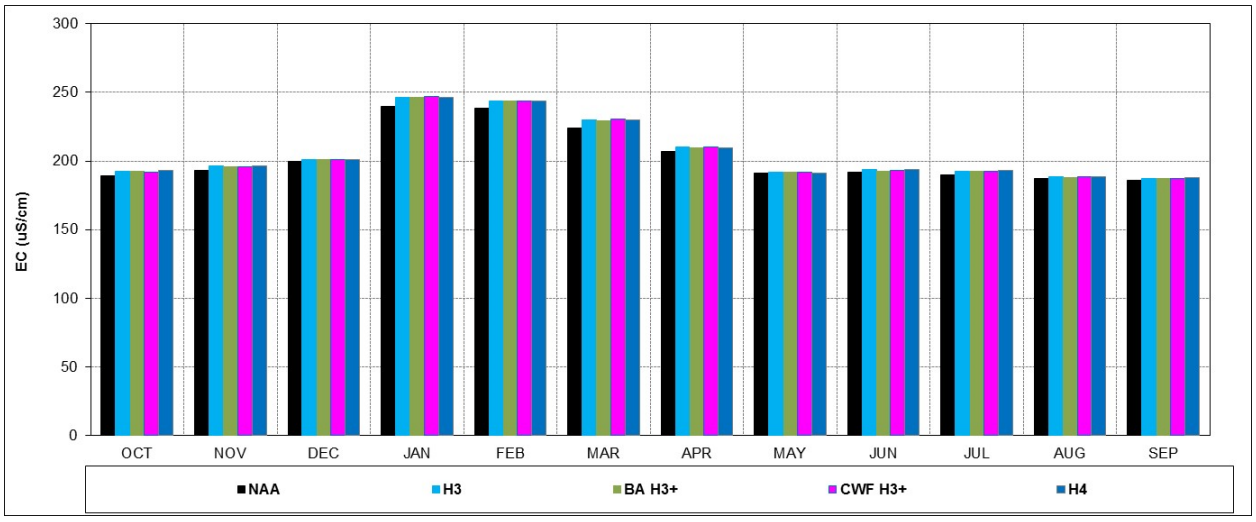
**Model results are used for comparative purposes and not for predictive purposes*

Figure EC3: Monthly Average EC at San Andreas Landing



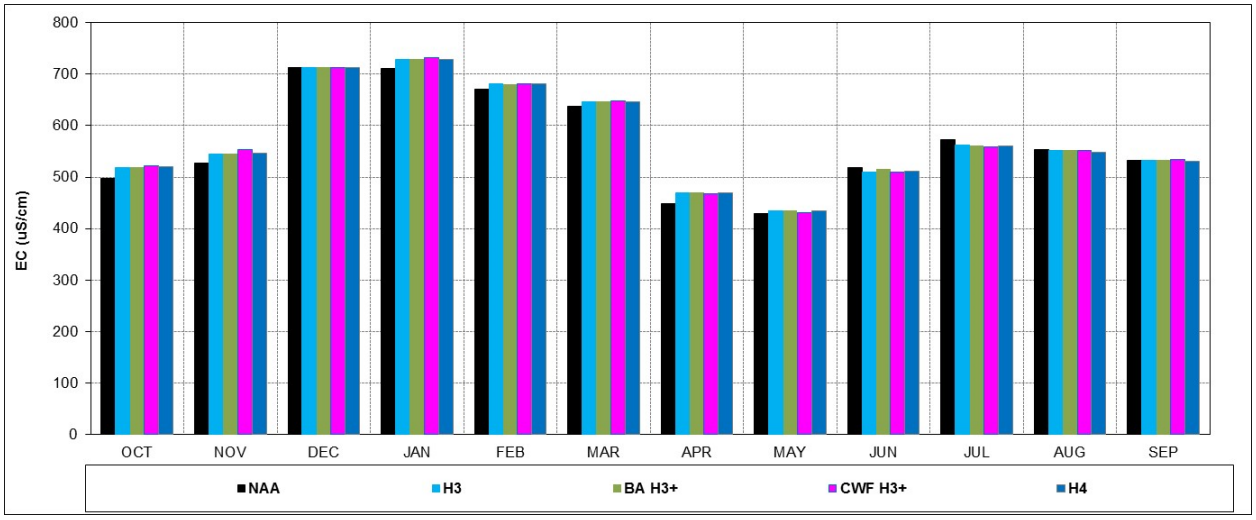
**Model results are used for comparative purposes and not for predictive purposes*

Figure EC4: Monthly Average EC at South Fork Mokelumne River at Terminous



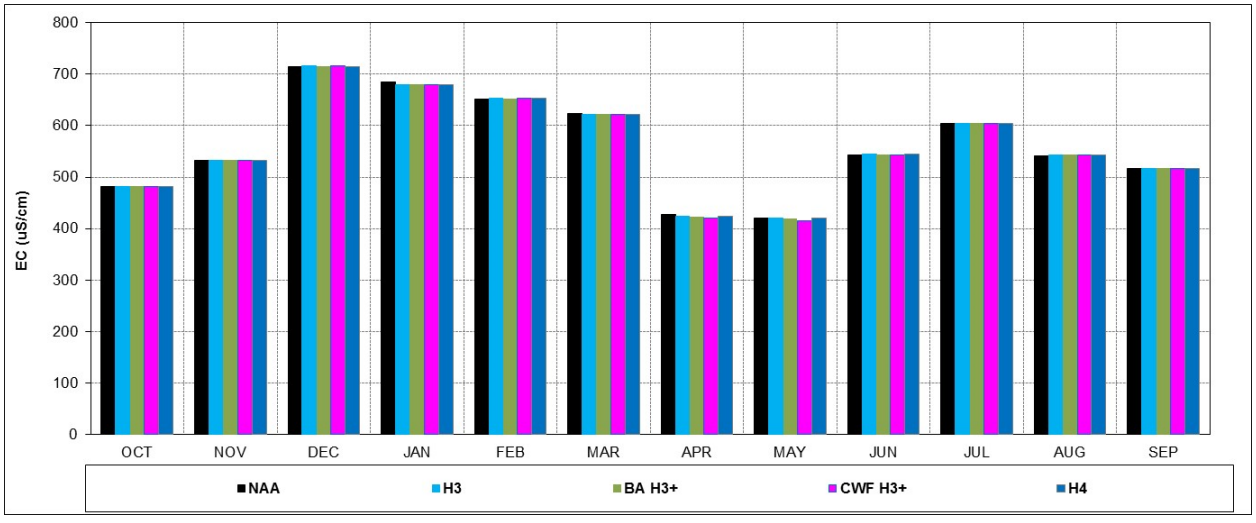
**Model results are used for comparative purposes and not for predictive purposes*

Figure EC5: Monthly Average EC at Old River at Tracy Road



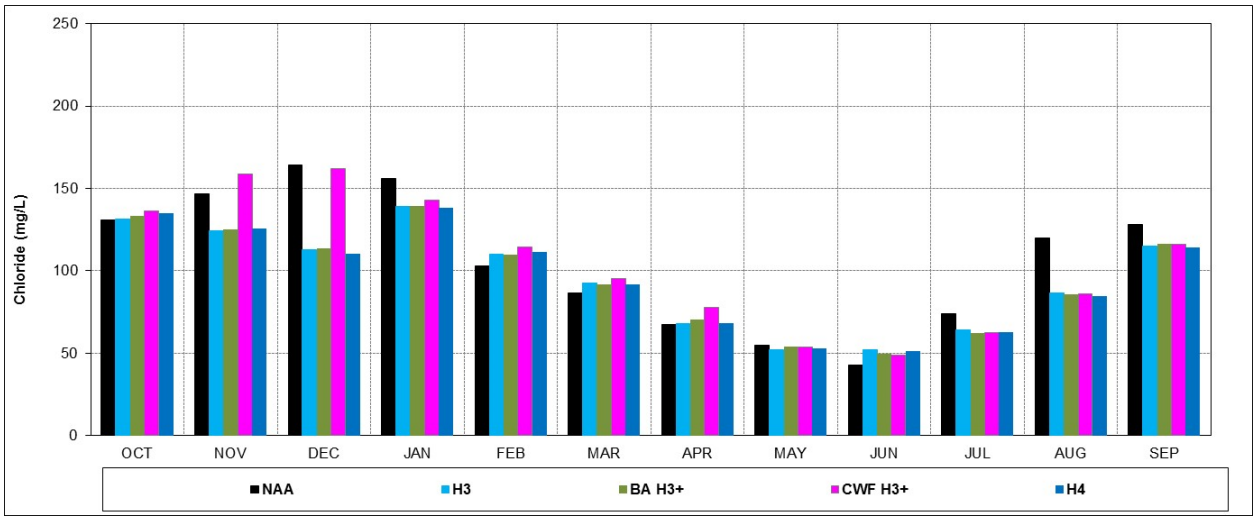
**Model results are used for comparative purposes and not for predictive purposes*

Figure EC6: Monthly Average EC at San Joaquin River at Brandt Bridge



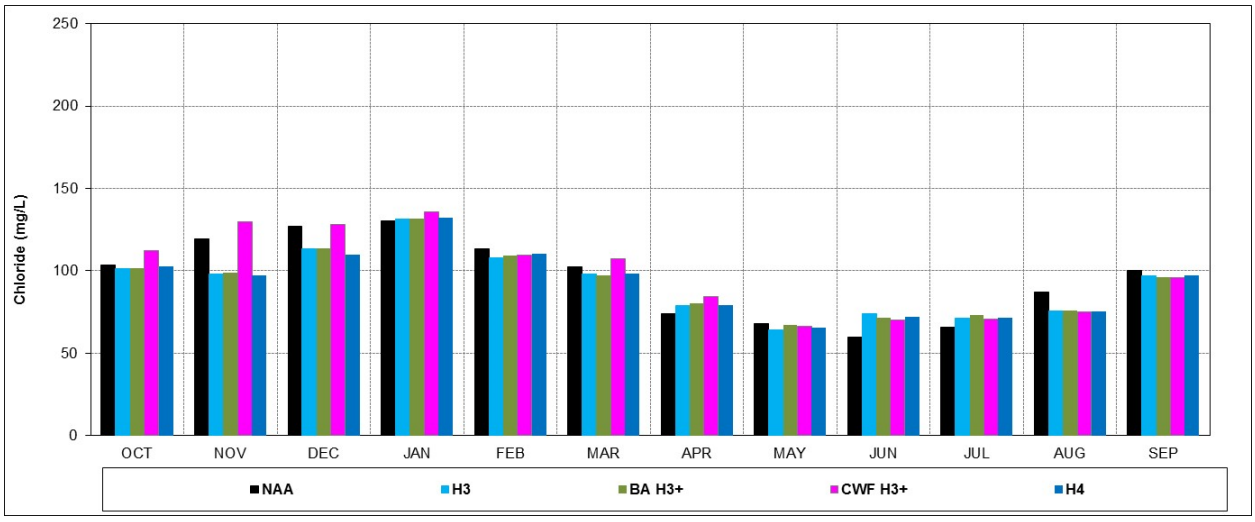
**Model results are used for comparative purposes and not for predictive purposes*

Figure CL1: Monthly Average Chloride Concentration at Contra Costa Canal



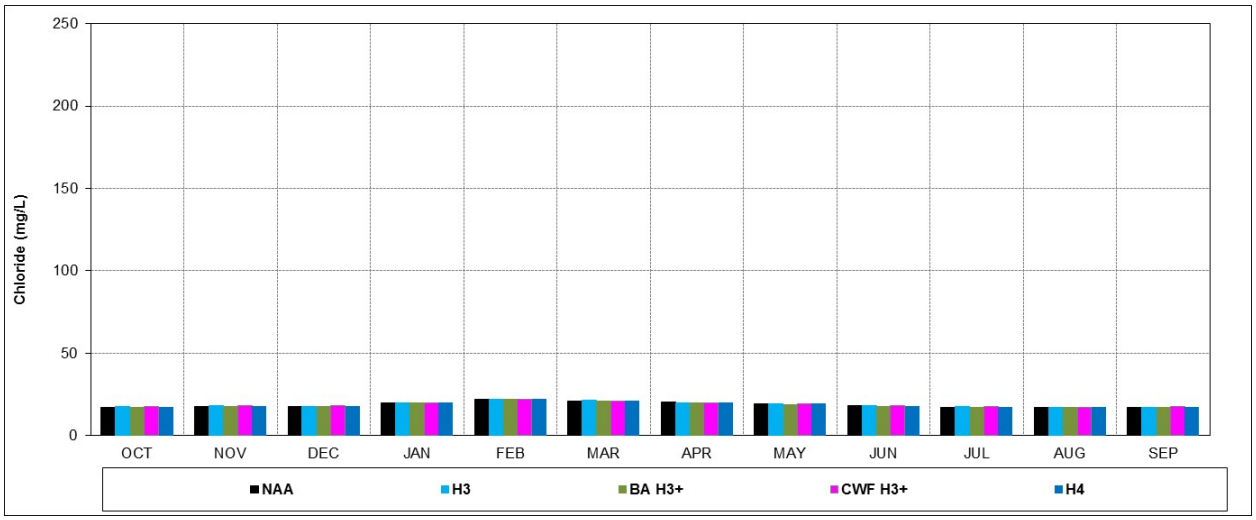
**Model results are used for comparative purposes and not for predictive purposes*

Figure CL2: Monthly Average Chloride Concentration at Old River at Clifton Court.



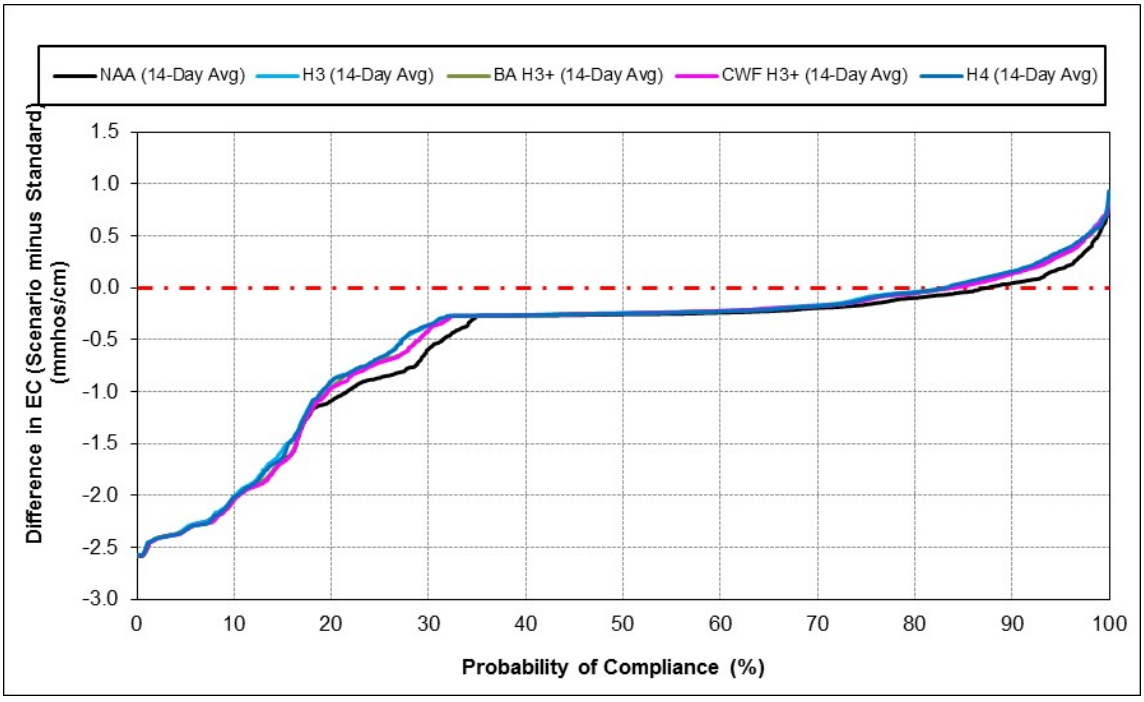
**Model results are used for comparative purposes and not for predictive purposes*

Figure CL3: Monthly Average Chloride Concentration at Barker Slough



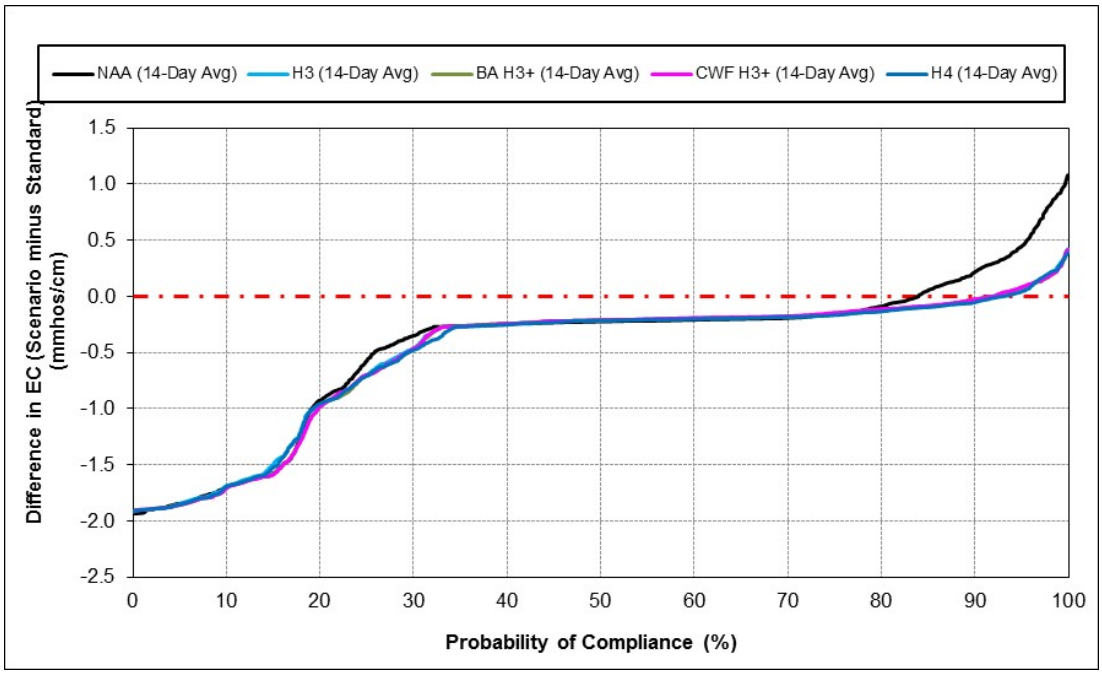
**Model results are used for comparative purposes and not for predictive purposes*

Figure C9: D-1641 Agricultural EC Objective at Emmaton –Probability of Meeting D-1641



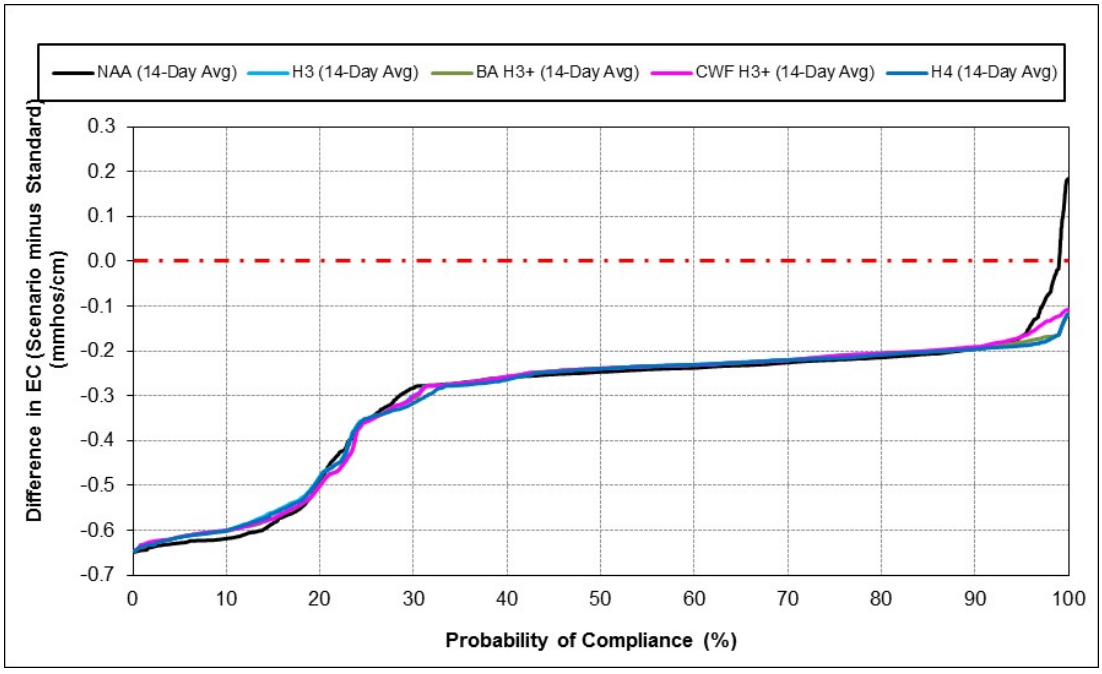
**Model results are used for comparative purposes and not for predictive purposes*

Figure C10: D-1641 Agricultural EC Objective at Jersey Point –Probability of Meeting D-1641



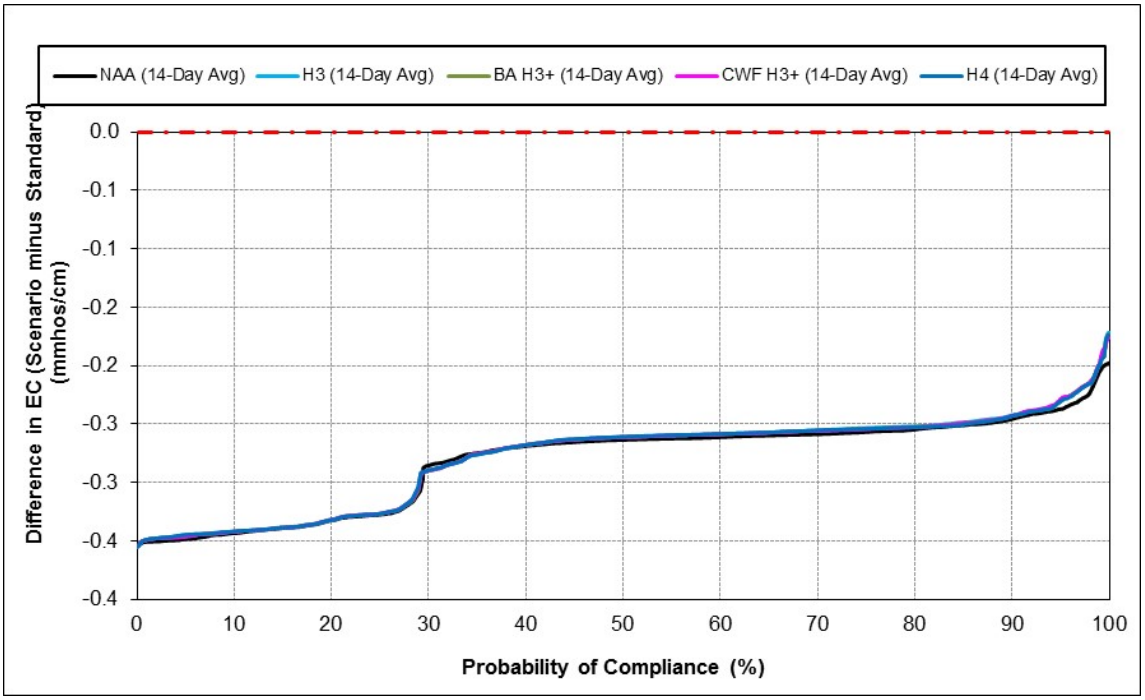
**Model results are used for comparative purposes and not for predictive purposes*

Figure C11: D-1641 Agricultural EC Objective at San Andreas Landing –Probability of Meeting D-1641



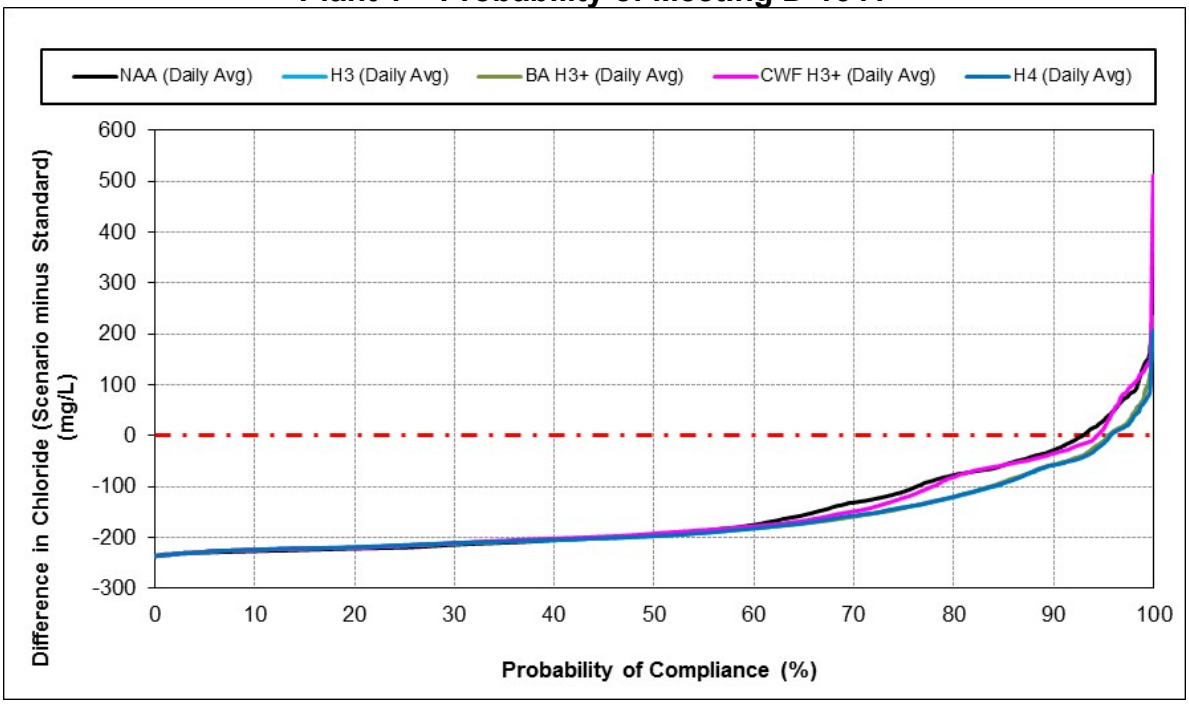
**Model results are used for comparative purposes and not for predictive purpose*

Figure C12: D-1641 Agricultural EC Objective at South Fork Mokelumne River at Terminous – Probability of Meeting D-1641



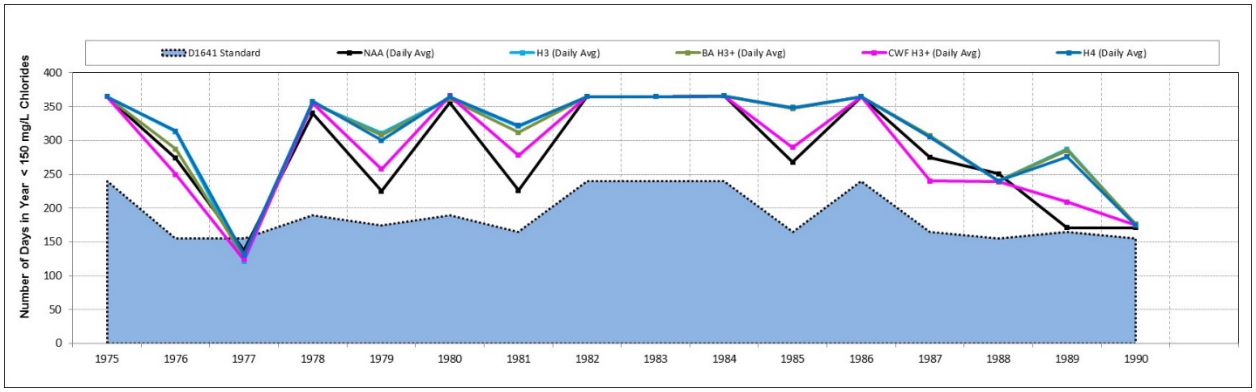
**Model results are used for comparative purposes and not for predictive purposes*

Figure C13: D-1641 250 mg/L Chloride Objective at Contra Costa Canal Pumping Plant 1 – Probability of Meeting D-1641



**Model results are used for comparative purposes and not for predictive purposes*

Figure C14: D-1641 Number of Days in a Year Meeting the Mean Daily Concentration 150 mg/L Chloride Objective at Contra Costa Canal Pumping Plant 1



**Model results are used for comparative purposes and not for predictive purposes*

b. Water Levels

Figure L4 shows the locations of water level results. Figures W1 through W5 show the probability of exceedance for daily minimum water levels at Sacramento River downstream from the proposed intakes, Sacramento River downstream of Georgiana Slough, Sacramento River at Rio Vista, Mokelumne River at Terminous, and Old River at Tracy Road. The results for CWF H3+ are very similar to H3 and H4, with only slight variations. Compared to the NAA, the largest reduction in water levels is expected to occur just downstream of the NDD and mostly during high flow periods. During low flow periods, the expected reduction in daily minimum water levels is less than 0.5 ft near the three intakes and much smaller at locations farther from the three intakes.

Summary

DSM2 modeling results for water quality and water levels are presented at locations throughout the Delta. In general, based on the model results for CWF H3+ presented in this testimony, it is my opinion that the changes in model results are very similar to H3 and H4, when compared to the NAA.

Figure L4: Locations of Water Level Results

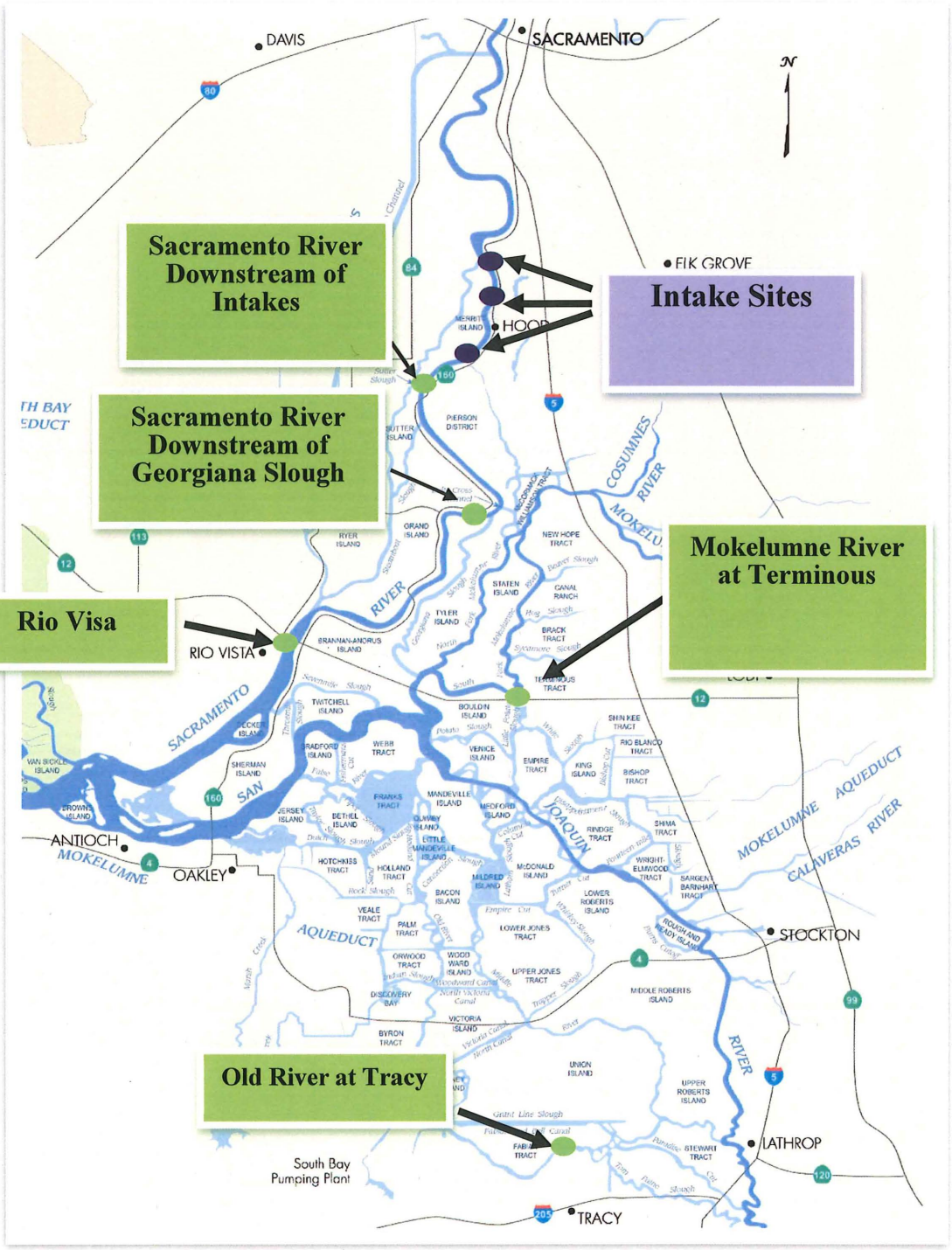
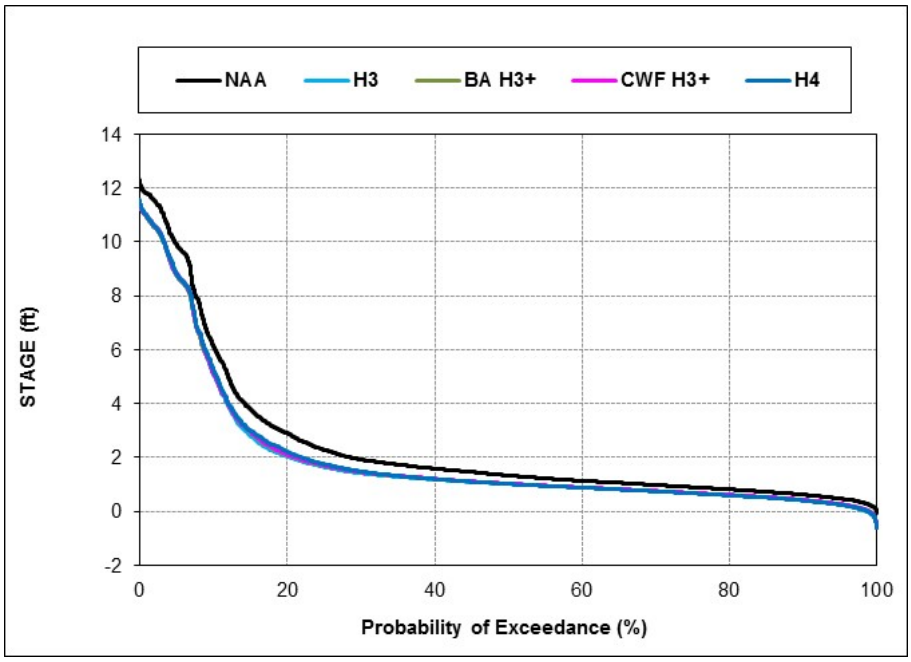
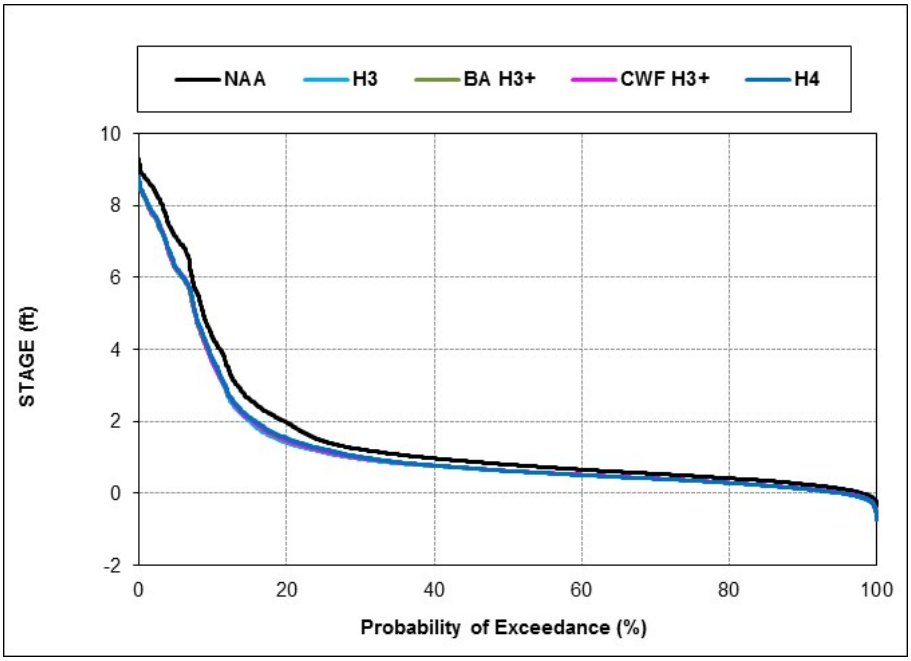


Figure W1: Probability of Exceedance for Daily Minimum Stage at Sacramento River Downstream from the Three Proposed Intakes.



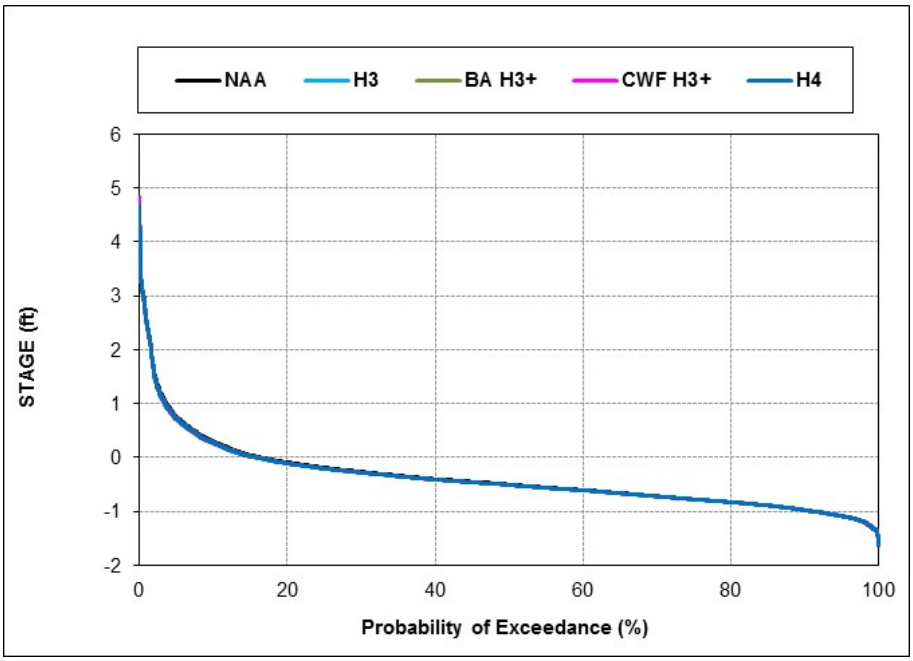
**Model results are used for comparative purposes and not for predictive purposes*

Figure W2: Probability of Exceedance for Daily Minimum Stage at Sacramento River Downstream of Georgiana Slough



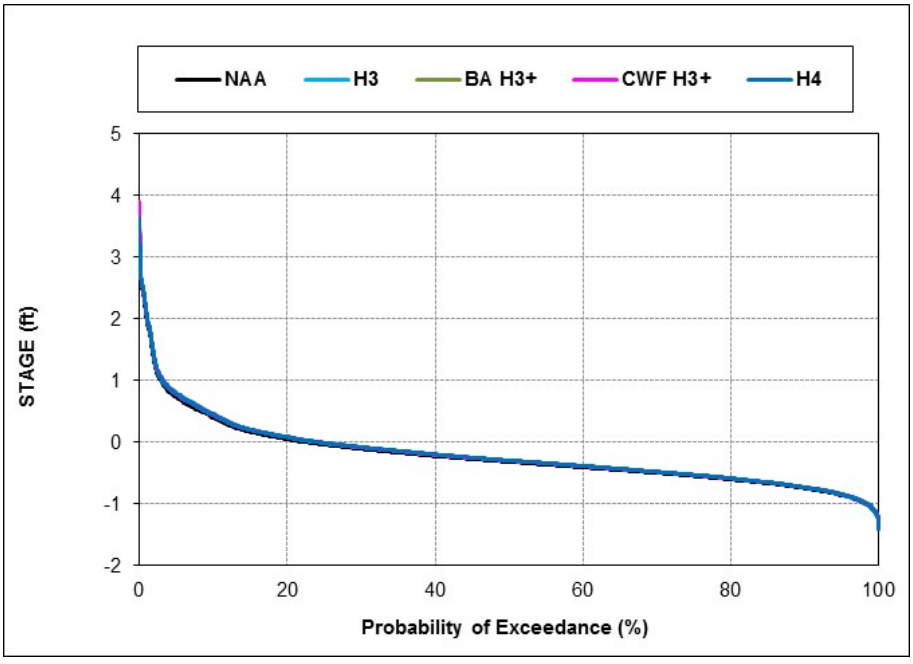
**Model results are used for comparative purposes and not for predictive purposes*

Figure W3: Probability of Exceedance for Daily Minimum Stage at Sacramento River at Rio Vista



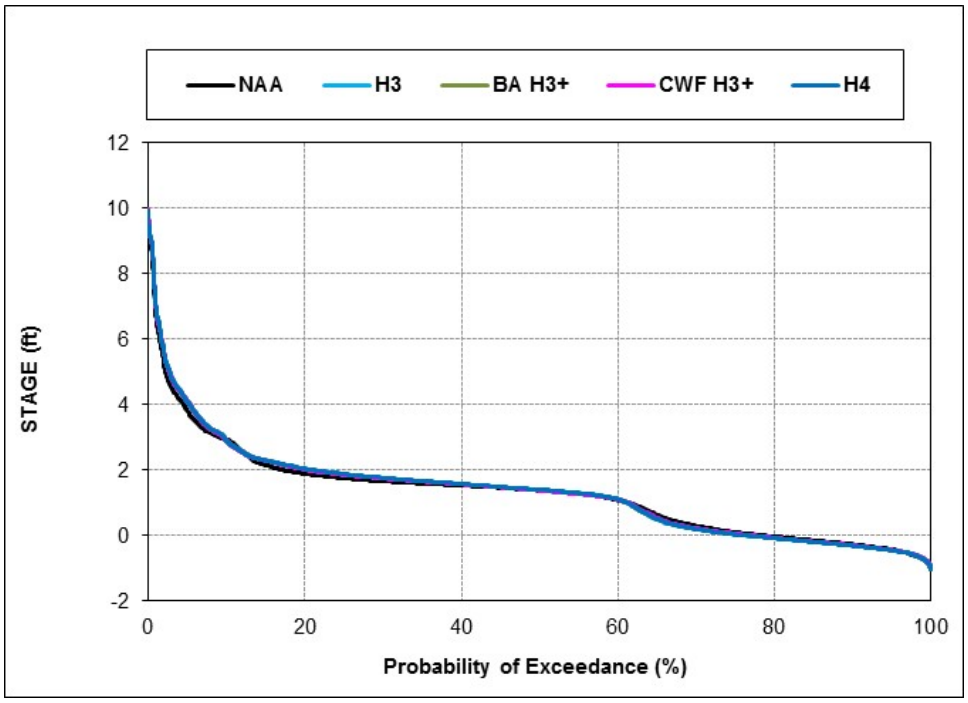
**Model results are used for comparative purposes and not for predictive purposes*

Figure W4: Probability of Exceedance for Daily Minimum Stage at Mokelumne River at Terminous



**Model results are used for comparative purposes and not for predictive purposes*

Figure W5: Probability of Exceedance for Daily Minimum Stage at Old River at Tracy Road



**Model results are used for comparative purposes and not for predictive purposes*

Executed on this 28th day of November, 2017 in Sacramento, California.

Tara Smith

(Tara Smith)