Appendix G, Water Quality Technical Appendix

Attachment G.4 Methylmercury Modeling Results

The information contained in this attachment supports the quantitative assessment of the project alternatives' effects on mercury concentrations at Delta assessment locations presented in Appendix G, *Water Quality Technical Appendix*, prepared in support of the Reinitiation of Consultation on the long-term operations of the Central Valley Project (CVP) and State Water Project (SWP) Environmental Impact Statement (EIS). This attachment presents the following information.

- The mercury assessment methodology.
- The source water concentrations used in the modeling of mercury at the Delta assessment locations.
- Applicable water quality criteria/objectives for mercury used in the effects assessment.
- Tables presenting modeled mercury concentrations at the Delta assessment locations for the No Action Alternative (NAA) and the project alternatives.
- Modeling limitations and applicability.

G.4.1 Modeling Methodology

This section describes the analytical framework and use of models to estimate methylmercury concentrations in fish throughout the Delta.

G.4.1.1 Overview of the Modeling Approach and Objectives

CalSim 3.0, Delta Simulation Model II (DSM2), and the Central Valley Regional Water Quality Control Board's (CVRWQCB) fish tissue model for Largemouth Bass (*Micropterus salmoides*) developed for the Delta Methylmercury Total Maximum Daily Load (TMDL) Model (Central Valley Regional Water Quality Control Board 2010a) were used in sequence to develop modeled concentrations of methylmercury in fish tissue at select Delta locations. CalSim 3.0 simulates CVP and SWP operations and DSM2 simulates one-dimensional hydrodynamics in the Delta. One of the three DSM2 modules, QUAL, simulates one-dimensional source tracking in the Delta and outputs the flow-percentage at DSM2 nodes. The TMDL Model is based on a power curve that uses input water column methylmercury concentrations to model methylmercury concentrations in the fish fillets of standard 350-mm-long Largemouth Bass. Figure G.4-1 shows the relationships among these modeling tools.

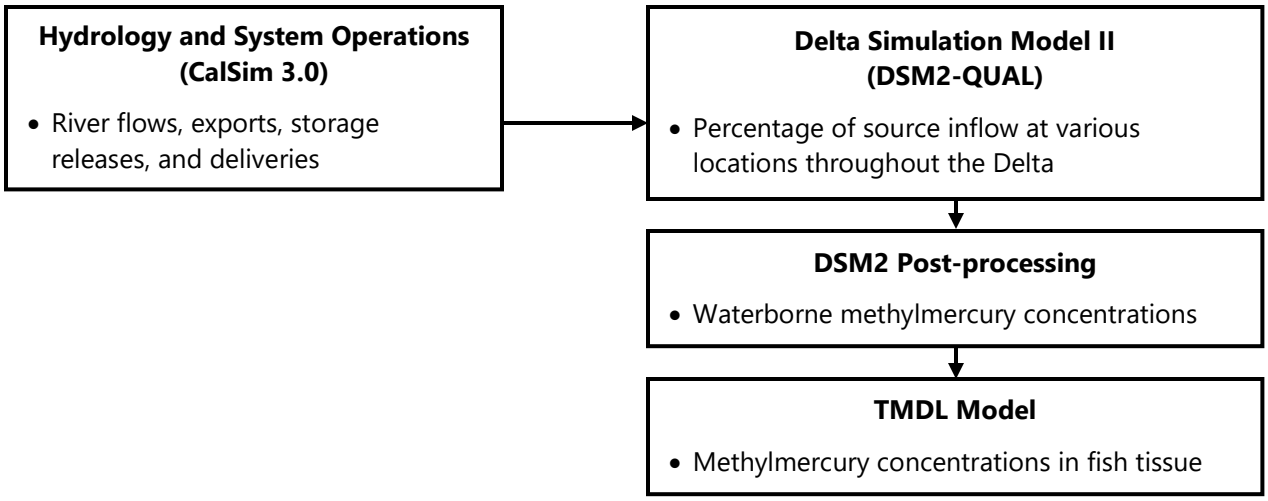

Figure G.4-1. Relationships among the Modeling Tools

G.4.1.2 DSM2 Postprocessing

The quantitative assessment for the Delta utilized a mass-balance approach that applied the DSM2-modeled average monthly source water flow fractions for each Delta assessment location. The source water flow fraction output is the percentage of water at each assessment location constituted by the six primary source waters—Sacramento River (SAC), San Joaquin River (SJR), Yolo Bypass (YOL), Eastside Tributaries (EST; represented by the Cosumnes, Mokelumne, and Calaveras Rivers), San Francisco Bay (BAY), and Delta Agricultural Return Waters (AGR). These flow fractions were used together with source water constituent concentrations to calculate a given constituent concentration at the assessment locations according to the following equation.

$$C_{water,i} = f_{SAC,i}(C_{SAC}) + f_{SJR,i}(C_{SJR}) + f_{YOL,i}(C_{YOL}) + f_{EST,i}(C_{EST}) + f_{BAY,i}(C_{BAY}) + f_{AGR,i}(C_{AGR})$$

Where:

- *Cwater,i* = methylmercury concentration in water (nanograms per liter [ng/L]) at Delta assessment location i
- *Fx,i* = average monthly flow fraction from source water X at assessment location i
- *Cx* = methylmercury concentration in water (ng/L) from each of the six inflow sources to the Delta

G.4.1.3 Source Water Methylmercury Concentrations

An input to the mass-balance calculation of methylmercury concentrations in surface water at the Delta assessment locations was the concentrations in the primary source waters to the Delta. Summary statistics for the primary source water concentrations of methylmercury used in the mass-balance calculations, as well as information on the source of the data, are provided in Table G.4-1.

Table G.4-1. Methylmercury (Total) Concentrations in Water in Inflow Sources to the Delta (in nanograms per liter)

Source Water	SAC	SJR	BAY	EST	AGR	YOL
Average	0.099	0.162	0.141	0.151	0.25	0.256
Minimum	0.02	0.09	0.025	0.011	–	0.114
Maximum	0.341	0.367	1.38	0.320	–	0.701
75th percentile	0.118	0.181	0.114	0.197	–	0.312
99th percentile	0.291	0.329	1.14	0.310	–	0.641
Data source	CEDEN 2020	CEDEN 2020	CEDEN 2020	CVRWQCB 2010b	CVRWQCB 2010b	CVRWQCB 2010b
Station(s)	SAC at Freeport, River Mile 44, Greene's Landing	SJR at Vernalis	Mallard Island	Mokelumne River at I-5 and Calaveras River at West Lane	Mid-Delta locations, median	Prospect Slough
Date range	2000–2018	2000–2017	2008–2015	2000–2004	2008	2000–2003
Non-detect results replaced with reporting limit for statistics	Yes	No	No	No	No	No
Data omitted	No	No	No	No	No	No
Number of data points	185	35	22	27	1	22

Sources: California Environmental Data Exchange Network 2020; Central Valley Regional Water Quality Board 2010.
SAC = Sacramento River; SJR = San Joaquin River; BAY = San Francisco Bay; EST = Eastside Tributaries; AGR = Delta Agricultural Return Waters; YOL = Yolo Bypass; CEDEN = California Environmental Data Exchange Network; CVRWQB = Central Valley Regional Water Quality Board; I- = Interstate.

Each source water dataset was evaluated to determine whether the primary source water concentration should be represented by a single value or a different value for each month. Analysis of the Sacramento River total methylmercury (Kruskal Wallis; $p<0.05$) dataset had sufficient monthly data for this analysis and indicated significant differences in concentration by month. Concentrations were higher in wetter months in both cases. Due to the presence of a distinct monthly pattern in the Sacramento River, monthly average concentrations were used for these locations in the mass-balance calculation. Although too few data were available from other source water locations to statistically determine if data vary significantly by month, given this was the case for the Sacramento River, monthly average concentrations were used to most accurately reflect concentrations of total methylmercury in the San Joaquin River. Concentrations from other source waters are represented by the average concentration from the entire dataset in the mass-balance calculations because data were too limited to determine monthly concentrations (Table G.4-1). Tables G.4-2 and G.4-3 provide the monthly average total methylmercury concentrations for the Sacramento River and San Joaquin River.

Table G.4-2. Monthly Average Source Water Total Methylmercury Concentrations for the Sacramento River (in nanograms per liter)

Data Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average concentration	0.128	0.103	0.113	0.098	0.116	0.130	0.091	0.074	0.075	0.068	0.097	0.111
Number of data points	10	23	12	22	15	24	12	15	5	22	9	16

Table G.4-3. Monthly Average Source Water Total Methylmercury Concentrations for the San Joaquin River (in nanograms per liter)

Data Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average concentration	0.239	0.190	0.169	0.162	0.128	0.195	0.165	0.141	0.139	0.161	0.152	0.102
Number of data points	1	3	3	6	4	4	4	3	3	2	1	1

G.4.1.4 TMDL Model

The TMDL Model is an empirical power curve that uses water column concentrations of methylmercury to estimate methylmercury concentrations in the fish fillets of standard 350-mm-long Largemouth Bass (Central Valley Regional Water Quality Control Board 2010a). The CVRWQCB developed the nonlinear model based on Largemouth Bass as grouped in large regions of the Delta (rather than specific locations) compared to average methylmercury concentrations in water for those same general regions (Central Valley Regional Water Quality Control Board 2010a). Data were grouped by subareas of the Delta such as Sacramento River, Mokelumne River, Central Delta, San Joaquin River, and West Delta (Central Valley Regional Water Quality Control Board 2010a).

Largemouth Bass are excellent indicators of mercury contamination because they have a relatively high level of mercury compared to other species, are piscivorous, are abundantly distributed throughout the Delta, are popular gamefish, and have high site fidelity. Largemouth Bass are, therefore, a conservative species for assessment and are representative of spatial patterns of tissue mercury concentrations throughout the aquatic food web, including exposure to humans.

The TMDL Model used for estimating fish tissue concentrations of methylmercury in Largemouth Bass is presented below.

$$\textit{Fish methylmercury (milligrams/kilogram, wet weight)} = 20.365 \times (\textit{methylmercury in water, ng/L})^{1.6374}$$

(with r^2=0.91, and P less than 0.05)

Modeled water column methylmercury concentrations at each assessment location were input into the above equation to generate the fish tissue methylmercury concentrations. The overall construction and calibration of the model were unchanged for the simulations described herein.

G.4.2 Fish Tissue Model Simulations and Assumptions

This section describes the assumptions for the TMDL Model simulations.

G.4.2.1 Location Assumptions

The TMDL Model was based on data for Largemouth Bass as grouped in large regions of the Delta, rather than specific locations, compared to average methylmercury concentrations in water for those same general regions (Central Valley Regional Water Quality Control Board 2010a). As such, the model provides a Delta-specific, general, long-term average relationship between co-located water column methylmercury concentrations and methylmercury concentrations in Largemouth Bass fillets.

G.4.2.2 Normalization and Tissue Type Assumptions

As discussed above, Largemouth Bass are excellent indicators of long-term average mercury exposure, risk, and the spatial pattern for both ecological and human health effects. A fish tissue mercury dataset was available for Largemouth Bass from locations across the Delta. It is important to standardize concentrations to the same length fish for establishment of the model and for model predictions because of the well-established positive relationship between fish length and age and tissue mercury concentrations (e.g., Alpers et al. 2008). This same normalization technique was used by the CVRWQCB for the TMDL Model (Central Valley Regional Water Quality Control Board 2010a). The 350-mm size fish is an appropriate size representative of human health consumption and risk. The standardized size allows the best comparison among locations and alternatives. The fillet concentrations predicted by the TMDL Model are expected to be slightly different from whole-body fish concentrations as consumed by wildlife, but allow for comparison between alternative to determine relative effects to fish and wildlife as well as estimating effects to human consumers.

G.4.2.3 Model Application

To evaluate differences between the NAA and Alternatives 1 through 4, modeled fish tissue methylmercury concentrations were compared directly for change relative to the NAA and to the CVRWQCB's fish tissue objective of 0.24 milligrams per kilogram (mg/kg), wet weight, for trophic level 4 fish (Central Valley Regional Water Quality Control Board 2019). This concentration of concern for methylmercury in fish fillets normalized to 350-mm total length largemouth bass is protective of human health and wildlife.

G.4.3 Modeling Results

This section describes the modeling outputs for methylmercury water column concentrations and methylmercury fish tissue concentrations.

G.4.3.1 Water Column Concentrations

Average water column methylmercury concentrations from the mass balance calculations modeled by DSM2 are presented for the entire (1922–2021) period modeled and for each water year type (wet, above normal, below normal, dry, and critical) for NAA and the project alternatives. These data, and differences between project alternatives and the NAA, are presented in Tables G.4-4 through G.4-18.

Table G.4-4. Total Methylmercury Concentrations in Water (in nanograms per liter), NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.14	0.15	0.14	0.13	0.13	0.13
Turner Cut	0.15	0.16	0.15	0.15	0.15	0.15
San Joaquin River at San Andreas Landing	0.12	0.12	0.12	0.12	0.11	0.12
San Joaquin River at Jersey Point	0.12	0.13	0.12	0.12	0.12	0.12
Victoria Canal	0.14	0.15	0.14	0.14	0.14	0.14
Sacramento River at Emmaton	0.12	0.12	0.12	0.11	0.11	0.12
San Joaquin River at Antioch	0.12	0.13	0.12	0.12	0.12	0.12
Montezuma Slough near Beldon Landing	0.13	0.14	0.13	0.13	0.13	0.13
Barker Slough at North Bay Aqueduct	0.13	0.15	0.14	0.13	0.12	0.12
Contra Costa Water District Pumping Plant #1	0.13	0.13	0.13	0.12	0.12	0.12
Banks Pumping Plant	0.14	0.15	0.14	0.14	0.14	0.14
Jones Pumping Plant	0.15	0.15	0.15	0.14	0.14	0.15

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-5. Total Methylmercury Concentrations in Water (in nanograms per liter), ALT1

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.13	0.14	0.13	0.13	0.13	0.13
Turner Cut	0.15	0.16	0.15	0.15	0.15	0.15
San Joaquin River at San Andreas Landing	0.12	0.12	0.12	0.12	0.11	0.11
San Joaquin River at Jersey Point	0.12	0.13	0.12	0.12	0.12	0.12
Victoria Canal	0.14	0.15	0.14	0.14	0.13	0.14
Sacramento River at Emmaton	0.12	0.12	0.12	0.11	0.11	0.11
San Joaquin River at Antioch	0.12	0.13	0.12	0.12	0.12	0.12
Montezuma Slough near Beldon Landing	0.14	0.14	0.14	0.13	0.13	0.14
Barker Slough at North Bay Aqueduct	0.13	0.15	0.14	0.13	0.12	0.12
Contra Costa Water District Pumping Plant #1	0.12	0.13	0.12	0.12	0.12	0.12
Banks Pumping Plant	0.14	0.14	0.14	0.14	0.13	0.14
Jones Pumping Plant	0.14	0.15	0.14	0.14	0.14	0.14

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-6. Total Methylmercury Concentrations in Water (in nanograms per liter), ALT1 minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.00	0.00	0.00	0.00	0.00	0.00
Turner Cut	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	0.00	0.00	0.00	0.00	0.00	0.00
Victoria Canal	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Antioch	0.00	0.00	0.00	0.00	0.00	0.00
Montezuma Slough near Beldon Landing	0.01	0.00	0.01	0.01	0.01	0.01
Barker Slough at North Bay Aqueduct	0.00	0.00	0.00	0.00	0.00	0.00
Contra Costa Water District Pumping Plant #1	0.00	0.00	0.00	0.00	0.00	0.00
Banks Pumping Plant	0.00	0.00	-0.01	0.00	0.00	0.00
Jones Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2
% change indicates a negative change (increased concentrations) relative to the No Action Alternative when values are positive and a positive change (lowered concentrations) relative to the No Action Alternative when values are negative.

Table G.4-7. Total Methylmercury Concentrations in Water (in nanograms per liter), Alt2wTUCPwoVA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.14	0.15	0.14	0.13	0.13	0.13
Turner Cut	0.15	0.16	0.15	0.15	0.15	0.15
San Joaquin River at San Andreas Landing	0.12	0.12	0.12	0.12	0.11	0.12
San Joaquin River at Jersey Point	0.12	0.13	0.12	0.12	0.12	0.12
Victoria Canal	0.14	0.15	0.14	0.14	0.14	0.14
Sacramento River at Emmaton	0.12	0.12	0.12	0.11	0.11	0.12
San Joaquin River at Antioch	0.12	0.13	0.12	0.12	0.12	0.12
Montezuma Slough near Beldon Landing	0.13	0.14	0.13	0.13	0.13	0.13
Barker Slough at North Bay Aqueduct	0.13	0.15	0.14	0.13	0.12	0.12
Contra Costa Water District Pumping Plant #1	0.13	0.13	0.13	0.12	0.12	0.12
Banks Pumping Plant	0.14	0.15	0.14	0.14	0.14	0.14
Jones Pumping Plant	0.15	0.15	0.15	0.14	0.14	0.15

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-8. Total Methylmercury Concentrations in Water (in nanograms per liter), Alt2wTUCPwoVA minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.00	0.00	0.00	0.00	0.00	0.00
Turner Cut	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	0.00	0.00	0.00	0.00	0.00	0.00
Victoria Canal	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Antioch	0.00	0.00	0.00	0.00	0.00	0.00
Montezuma Slough near Beldon Landing	0.00	0.00	0.00	0.00	0.00	0.00
Barker Slough at North Bay Aqueduct	0.00	0.00	0.00	0.00	0.00	0.00
Contra Costa Water District Pumping Plant #1	0.00	0.00	0.00	0.00	0.00	0.00
Banks Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00
Jones Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2
% change indicates a negative change (increased concentrations) relative to the No Action Alternative when values are positive and a positive change (lowered concentrations) relative to the No Action Alternative when values are negative.

Table G.4-9. Total Methylmercury Concentrations in Water (in nanograms per liter), Alt2woTUCPwoVA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.14	0.15	0.14	0.13	0.13	0.13
Turner Cut	0.15	0.16	0.15	0.15	0.15	0.15
San Joaquin River at San Andreas Landing	0.12	0.12	0.12	0.12	0.11	0.11
San Joaquin River at Jersey Point	0.12	0.13	0.12	0.12	0.12	0.12
Victoria Canal	0.14	0.15	0.14	0.14	0.14	0.14
Sacramento River at Emmaton	0.12	0.12	0.12	0.11	0.11	0.11
San Joaquin River at Antioch	0.12	0.13	0.12	0.12	0.12	0.12
Montezuma Slough near Beldon Landing	0.13	0.14	0.13	0.13	0.13	0.13
Barker Slough at North Bay Aqueduct	0.13	0.15	0.14	0.13	0.12	0.12
Contra Costa Water District Pumping Plant #1	0.13	0.13	0.13	0.12	0.12	0.12
Banks Pumping Plant	0.14	0.15	0.14	0.14	0.14	0.14
Jones Pumping Plant	0.15	0.15	0.15	0.14	0.14	0.15

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-10. Total Methylmercury Concentrations in Water (in nanograms per liter), Alt2woTUCPwoVA minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.00	0.00	0.00	0.00	0.00	0.00
Turner Cut	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	0.00	0.00	0.00	0.00	0.00	0.00
Victoria Canal	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Antioch	0.00	0.00	0.00	0.00	0.00	0.00
Montezuma Slough near Beldon Landing	0.00	0.00	0.00	0.00	0.00	0.00
Barker Slough at North Bay Aqueduct	0.00	0.00	0.00	0.00	0.00	0.00
Contra Costa Water District Pumping Plant #1	0.00	0.00	0.00	0.00	0.00	0.00
Banks Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00
Jones Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2
% change indicates a negative change (increased concentrations) relative to the No Action Alternative when values are positive and a positive change (lowered concentrations) relative to the No Action Alternative when values are negative.

Table G.4-11. Total Methylmercury Concentrations in Water (in nanograms per liter), Alt2woTUCPDeltaVA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.14	0.15	0.14	0.14	0.13	0.13
Turner Cut	0.15	0.16	0.15	0.15	0.15	0.15
San Joaquin River at San Andreas Landing	0.12	0.12	0.12	0.12	0.11	0.11
San Joaquin River at Jersey Point	0.12	0.13	0.12	0.12	0.12	0.12
Victoria Canal	0.14	0.15	0.14	0.14	0.14	0.14
Sacramento River at Emmaton	0.12	0.12	0.12	0.11	0.11	0.11
San Joaquin River at Antioch	0.12	0.13	0.12	0.12	0.12	0.12
Montezuma Slough near Beldon Landing	0.13	0.14	0.13	0.13	0.13	0.13
Barker Slough at North Bay Aqueduct	0.13	0.15	0.14	0.13	0.12	0.12
Contra Costa Water District Pumping Plant #1	0.13	0.13	0.13	0.12	0.12	0.12
Banks Pumping Plant	0.14	0.15	0.14	0.14	0.14	0.14
Jones Pumping Plant	0.15	0.15	0.15	0.14	0.14	0.15

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-12. Total Methylmercury Concentrations in Water (in nanograms per liter), Alt2woTUCPDeltaVA minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.00	0.00	0.00	0.00	0.00	0.00
Turner Cut	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	0.00	0.00	0.00	0.00	0.00	0.00
Victoria Canal	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Antioch	0.00	0.00	0.00	0.00	0.00	0.00
Montezuma Slough near Beldon Landing	0.00	0.00	0.00	0.00	0.00	0.00
Barker Slough at North Bay Aqueduct	0.00	0.00	0.00	0.00	0.00	0.00
Contra Costa Water District Pumping Plant #1	0.00	0.00	0.00	0.00	0.00	0.00
Banks Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00
Jones Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2
% change indicates a negative change (increased concentrations) relative to the No Action Alternative when values are positive and a positive change (lowered concentrations) relative to the No Action Alternative when values are negative.

Table G.4-13. Total Methylmercury Concentrations in Water (in nanograms per liter), Alt2woTUCPAllVA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.14	0.15	0.14	0.14	0.13	0.13
Turner Cut	0.15	0.16	0.15	0.15	0.15	0.15
San Joaquin River at San Andreas Landing	0.12	0.12	0.12	0.12	0.11	0.11
San Joaquin River at Jersey Point	0.12	0.13	0.12	0.12	0.12	0.12
Victoria Canal	0.14	0.15	0.14	0.14	0.14	0.14
Sacramento River at Emmaton	0.12	0.12	0.12	0.11	0.11	0.11
San Joaquin River at Antioch	0.12	0.13	0.12	0.12	0.12	0.12
Montezuma Slough near Beldon Landing	0.13	0.14	0.13	0.13	0.13	0.13
Barker Slough at North Bay Aqueduct	0.13	0.15	0.14	0.13	0.12	0.12
Contra Costa Water District Pumping Plant #1	0.13	0.13	0.13	0.12	0.12	0.12
Banks Pumping Plant	0.14	0.15	0.14	0.14	0.14	0.14
Jones Pumping Plant	0.15	0.15	0.15	0.14	0.14	0.15

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-14. Total Methylmercury Concentrations in Water (in nanograms per liter), Alt2woTUCPAllVA minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.00	0.00	0.00	0.00	0.00	0.00
Turner Cut	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	0.00	0.00	0.00	0.00	0.00	0.00
Victoria Canal	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Antioch	0.00	0.00	0.00	0.00	0.00	0.00
Montezuma Slough near Beldon Landing	0.00	0.00	0.00	0.00	0.00	0.00
Barker Slough at North Bay Aqueduct	0.00	0.00	0.00	0.00	0.00	0.00
Contra Costa Water District Pumping Plant #1	0.00	0.00	0.00	0.00	0.00	0.00
Banks Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00
Jones Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2
% change indicates a negative change (increased concentrations) relative to the No Action Alternative when values are positive and a positive change (lowered concentrations) relative to the No Action Alternative when values are negative.

Table G.4-15. Total Methylmercury Concentrations in Water (in nanograms per liter), ALT3

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.14	0.15	0.14	0.14	0.13	0.13
Turner Cut	0.16	0.16	0.16	0.16	0.15	0.15
San Joaquin River at San Andreas Landing	0.12	0.12	0.12	0.12	0.12	0.12
San Joaquin River at Jersey Point	0.12	0.13	0.12	0.12	0.12	0.12
Victoria Canal	0.15	0.16	0.15	0.15	0.15	0.15
Sacramento River at Emmaton	0.12	0.13	0.12	0.11	0.11	0.12
San Joaquin River at Antioch	0.12	0.13	0.12	0.12	0.12	0.12
Montezuma Slough near Beldon Landing	0.13	0.14	0.13	0.13	0.13	0.13
Barker Slough at North Bay Aqueduct	0.13	0.15	0.14	0.13	0.12	0.12
Contra Costa Water District Pumping Plant #1	0.13	0.14	0.14	0.13	0.13	0.13
Banks Pumping Plant	0.15	0.15	0.15	0.15	0.15	0.15
Jones Pumping Plant	0.15	0.16	0.15	0.15	0.15	0.15

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-16. Total Methylmercury Concentrations in Water (in nanograms per liter), ALT3 minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.01	0.00	0.01	0.01	0.01	0.00
Turner Cut	0.00	0.00	0.01	0.01	0.01	0.00
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	0.00	0.00	0.00	0.00	0.00	0.00
Victoria Canal	0.01	0.01	0.01	0.01	0.01	0.00
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Antioch	0.00	0.00	0.00	0.00	0.00	0.00
Montezuma Slough near Beldon Landing	0.00	0.00	0.00	0.00	0.00	0.00
Barker Slough at North Bay Aqueduct	0.00	0.00	0.00	0.00	0.00	0.00
Contra Costa Water District Pumping Plant #1	0.01	0.01	0.01	0.01	0.01	0.00
Banks Pumping Plant	0.01	0.01	0.01	0.01	0.01	0.00
Jones Pumping Plant	0.01	0.01	0.01	0.01	0.01	0.00

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2
% change indicates a negative change (increased concentrations) relative to the No Action Alternative when values are positive and a positive change (lowered concentrations) relative to the No Action Alternative when values are negative.

Table G.4-17. Total Methylmercury Concentrations in Water (in nanograms per liter), ALT4

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.14	0.15	0.14	0.13	0.13	0.13
Turner Cut	0.15	0.16	0.15	0.15	0.15	0.15
San Joaquin River at San Andreas Landing	0.12	0.12	0.12	0.12	0.11	0.12
San Joaquin River at Jersey Point	0.12	0.13	0.12	0.12	0.12	0.12
Victoria Canal	0.14	0.15	0.14	0.14	0.14	0.14
Sacramento River at Emmaton	0.12	0.12	0.12	0.11	0.11	0.12
San Joaquin River at Antioch	0.12	0.13	0.12	0.12	0.12	0.12
Montezuma Slough near Beldon Landing	0.13	0.14	0.13	0.13	0.13	0.13
Barker Slough at North Bay Aqueduct	0.13	0.15	0.14	0.13	0.12	0.12
Contra Costa Water District Pumping Plant #1	0.13	0.13	0.13	0.12	0.12	0.12
Banks Pumping Plant	0.14	0.15	0.14	0.14	0.14	0.14
Jones Pumping Plant	0.15	0.15	0.15	0.14	0.14	0.15

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-18. Total Methylmercury Concentrations in Water (in nanograms per liter), ALT4 minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.00	0.00	0.00	0.00	0.00	0.00
Turner Cut	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	0.00	0.00	0.00	0.00	0.00	0.00
Victoria Canal	0.00	0.00	0.00	0.00	0.00	0.00
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Antioch	0.00	0.00	0.00	0.00	0.00	0.00
Montezuma Slough near Beldon Landing	0.00	0.00	0.00	0.00	0.00	0.00
Barker Slough at North Bay Aqueduct	0.00	0.00	0.00	0.00	0.00	0.00
Contra Costa Water District Pumping Plant #1	0.00	0.00	0.00	0.00	0.00	0.00
Banks Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00
Jones Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2
% change indicates a negative change (increased concentrations) relative to the No Action Alternative when values are positive and a positive change (lowered concentrations) relative to the No Action Alternative when values are negative.

G.4.3.2 Fish Tissue Concentrations

Average fish tissue methylmercury concentrations were calculated from TMDL Model calculations are presented for the entire (1922–2021) period and average concentrations by water year type (i.e., wet, above normal, below normal, dry, critical) for the NAA and the project alternatives. These data, and differences between project alternatives and the NAA, are presented in Tables G.4-19 through G.4-33.

Table G.4-19. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.78	0.86	0.78	0.76	0.72	0.73
Turner Cut	0.96	1.02	0.95	0.95	0.91	0.93
San Joaquin River at San Andreas Landing	0.61	0.65	0.61	0.60	0.58	0.59
San Joaquin River at Jersey Point	0.64	0.70	0.64	0.61	0.60	0.61
Victoria Canal	0.84	0.92	0.85	0.82	0.79	0.82
Sacramento River at Emmaton	0.60	0.66	0.60	0.57	0.57	0.60
San Joaquin River at Antioch	0.65	0.70	0.64	0.62	0.61	0.64
Montezuma Slough near Beldon Landing	0.73	0.80	0.71	0.69	0.70	0.72
Barker Slough at North Bay Aqueduct	0.74	0.88	0.80	0.69	0.66	0.66
Contra Costa Water District Pumping Plant #1	0.68	0.75	0.69	0.66	0.63	0.67
Banks Pumping Plant	0.83	0.87	0.82	0.80	0.79	0.85
Jones Pumping Plant	0.87	0.91	0.86	0.84	0.82	0.88

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-20. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), ALT1

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.76	0.85	0.76	0.74	0.70	0.71
Turner Cut	0.94	1.01	0.92	0.93	0.89	0.90
San Joaquin River at San Andreas Landing	0.60	0.65	0.60	0.59	0.57	0.58
San Joaquin River at Jersey Point	0.63	0.70	0.64	0.61	0.59	0.61
Victoria Canal	0.82	0.89	0.81	0.79	0.76	0.79
Sacramento River at Emmaton	0.60	0.66	0.60	0.57	0.57	0.59
San Joaquin River at Antioch	0.65	0.71	0.65	0.62	0.61	0.63
Montezuma Slough near Beldon Landing	0.79	0.83	0.78	0.76	0.77	0.78
Barker Slough at North Bay Aqueduct	0.75	0.89	0.80	0.70	0.67	0.67
Contra Costa Water District Pumping Plant #1	0.67	0.73	0.66	0.64	0.62	0.65
Banks Pumping Plant	0.80	0.85	0.78	0.77	0.76	0.82
Jones Pumping Plant	0.85	0.90	0.84	0.82	0.81	0.86

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-21. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), ALT1 minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
Turner Cut	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
San Joaquin River at San Andreas Landing	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
San Joaquin River at Jersey Point	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
Victoria Canal	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
Sacramento River at Emmaton	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
San Joaquin River at Antioch	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
Montezuma Slough near Beldon Landing	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
Barker Slough at North Bay Aqueduct	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
Contra Costa Water District Pumping Plant #1	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02
Banks Pumping Plant	-0.03	-0.02	-0.04	-0.03	-0.03	-0.03
Jones Pumping Plant	-0.02	-0.01	-0.02	-0.02	-0.01	-0.02

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-22. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), Alt2wTUCPwoVA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.78	0.86	0.78	0.76	0.72	0.73
Turner Cut	0.96	1.02	0.95	0.95	0.91	0.93
San Joaquin River at San Andreas Landing	0.61	0.65	0.61	0.60	0.58	0.59
San Joaquin River at Jersey Point	0.63	0.70	0.63	0.61	0.60	0.61
Victoria Canal	0.84	0.91	0.84	0.82	0.79	0.82
Sacramento River at Emmaton	0.60	0.66	0.60	0.57	0.57	0.60
San Joaquin River at Antioch	0.65	0.70	0.64	0.62	0.61	0.64
Montezuma Slough near Beldon Landing	0.73	0.80	0.70	0.69	0.70	0.72
Barker Slough at North Bay Aqueduct	0.75	0.88	0.80	0.69	0.66	0.66
Contra Costa Water District Pumping Plant #1	0.68	0.75	0.68	0.65	0.64	0.67
Banks Pumping Plant	0.83	0.87	0.82	0.80	0.80	0.85
Jones Pumping Plant	0.87	0.91	0.86	0.85	0.83	0.88

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-23. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), Alt2wTUCPwoVA minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.00	0.00	0.00	0.00	0.00	0.00
Turner Cut	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	-0.01	0.00	-0.01	0.00	0.00	0.00
Victoria Canal	0.00	-0.01	-0.01	0.00	0.00	0.00
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Antioch	0.00	0.00	0.00	0.00	0.00	0.00
Montezuma Slough near Beldon Landing	0.00	0.00	-0.01	0.00	0.00	0.00
Barker Slough at North Bay Aqueduct	0.01	0.00	0.00	0.00	0.00	0.00
Contra Costa Water District Pumping Plant #1	0.00	0.00	-0.01	-0.01	0.01	0.00
Banks Pumping Plant	0.00	0.00	0.00	0.00	0.01	0.00
Jones Pumping Plant	0.00	0.00	0.00	0.01	0.01	0.00

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-24. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), Alt2woTUCPwoVA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.78	0.86	0.78	0.76	0.72	0.72
Turner Cut	0.96	1.02	0.95	0.95	0.91	0.93
San Joaquin River at San Andreas Landing	0.61	0.65	0.61	0.60	0.58	0.59
San Joaquin River at Jersey Point	0.63	0.70	0.63	0.61	0.60	0.61
Victoria Canal	0.84	0.91	0.84	0.82	0.79	0.81
Sacramento River at Emmaton	0.60	0.66	0.60	0.57	0.57	0.59
San Joaquin River at Antioch	0.64	0.70	0.64	0.62	0.61	0.63
Montezuma Slough near Beldon Landing	0.73	0.80	0.70	0.69	0.70	0.72
Barker Slough at North Bay Aqueduct	0.75	0.88	0.79	0.69	0.66	0.66
Contra Costa Water District Pumping Plant #1	0.68	0.75	0.68	0.66	0.64	0.66
Banks Pumping Plant	0.83	0.87	0.82	0.81	0.80	0.84
Jones Pumping Plant	0.87	0.91	0.86	0.85	0.83	0.87

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-25. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), Alt2woTUCPwoVA minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.00	0.00	0.00	0.00	0.00	-0.01
Turner Cut	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	-0.01	0.00	-0.01	0.00	0.00	0.00
Victoria Canal	0.00	-0.01	-0.01	0.00	0.00	-0.01
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	-0.01
San Joaquin River at Antioch	-0.01	0.00	0.00	0.00	0.00	-0.01
Montezuma Slough near Beldon Landing	0.00	0.00	-0.01	0.00	0.00	0.00
Barker Slough at North Bay Aqueduct	0.01	0.00	-0.01	0.00	0.00	0.00
Contra Costa Water District Pumping Plant #1	0.00	0.00	-0.01	0.00	0.01	-0.01
Banks Pumping Plant	0.00	0.00	0.00	0.01	0.01	-0.01
Jones Pumping Plant	0.00	0.00	0.00	0.01	0.01	-0.01

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-26. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), Alt2woTUCPDeltaVA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.78	0.86	0.78	0.77	0.73	0.72
Turner Cut	0.96	1.02	0.95	0.95	0.91	0.92
San Joaquin River at San Andreas Landing	0.61	0.65	0.61	0.60	0.58	0.59
San Joaquin River at Jersey Point	0.64	0.70	0.64	0.62	0.60	0.61
Victoria Canal	0.85	0.92	0.85	0.83	0.80	0.81
Sacramento River at Emmaton	0.60	0.66	0.60	0.57	0.57	0.59
San Joaquin River at Antioch	0.65	0.70	0.64	0.63	0.62	0.63
Montezuma Slough near Beldon Landing	0.73	0.80	0.70	0.69	0.70	0.72
Barker Slough at North Bay Aqueduct	0.75	0.88	0.79	0.69	0.66	0.66
Contra Costa Water District Pumping Plant #1	0.69	0.75	0.69	0.67	0.64	0.66
Banks Pumping Plant	0.83	0.87	0.83	0.81	0.80	0.84
Jones Pumping Plant	0.87	0.91	0.87	0.85	0.83	0.87

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-27. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), Alt2woTUCPDeltaVA minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.00	0.00	0.00	0.01	0.01	-0.01
Turner Cut	0.00	0.00	0.00	0.00	0.00	-0.01
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	0.00	0.00	0.00	0.01	0.00	0.00
Victoria Canal	0.01	0.00	0.00	0.01	0.01	-0.01
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	-0.01
San Joaquin River at Antioch	0.00	0.00	0.00	0.01	0.01	-0.01
Montezuma Slough near Beldon Landing	0.00	0.00	-0.01	0.00	0.00	0.00
Barker Slough at North Bay Aqueduct	0.01	0.00	-0.01	0.00	0.00	0.00
Contra Costa Water District Pumping Plant #1	0.01	0.00	0.00	0.01	0.01	-0.01
Banks Pumping Plant	0.00	0.00	0.01	0.01	0.01	-0.01
Jones Pumping Plant	0.00	0.00	0.01	0.01	0.01	-0.01

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-28. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), Alt2woTUCPAllVA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.78	0.86	0.78	0.77	0.73	0.72
Turner Cut	0.96	1.02	0.96	0.95	0.91	0.92
San Joaquin River at San Andreas Landing	0.61	0.65	0.61	0.60	0.58	0.59
San Joaquin River at Jersey Point	0.64	0.70	0.64	0.61	0.60	0.61
Victoria Canal	0.85	0.92	0.85	0.83	0.80	0.81
Sacramento River at Emmaton	0.60	0.66	0.60	0.57	0.57	0.59
San Joaquin River at Antioch	0.65	0.70	0.64	0.62	0.62	0.63
Montezuma Slough near Beldon Landing	0.73	0.80	0.70	0.69	0.70	0.71
Barker Slough at North Bay Aqueduct	0.75	0.88	0.79	0.69	0.67	0.66
Contra Costa Water District Pumping Plant #1	0.69	0.75	0.69	0.66	0.64	0.66
Banks Pumping Plant	0.83	0.87	0.83	0.81	0.80	0.84
Jones Pumping Plant	0.87	0.91	0.87	0.85	0.83	0.87

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-29. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), Alt2woTUCPAllVA minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.00	0.00	0.00	0.01	0.01	-0.01
Turner Cut	0.00	0.00	0.01	0.00	0.00	-0.01
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	0.00	0.00	0.00	0.00	0.00	0.00
Victoria Canal	0.01	0.00	0.00	0.01	0.01	-0.01
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	-0.01
San Joaquin River at Antioch	0.00	0.00	0.00	0.00	0.01	-0.01
Montezuma Slough near Beldon Landing	0.00	0.00	-0.01	0.00	0.00	-0.01
Barker Slough at North Bay Aqueduct	0.01	0.00	-0.01	0.00	0.01	0.00
Contra Costa Water District Pumping Plant #1	0.01	0.00	0.00	0.00	0.01	-0.01
Banks Pumping Plant	0.00	0.00	0.01	0.01	0.01	-0.01
Jones Pumping Plant	0.00	0.00	0.01	0.01	0.01	-0.01

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-30. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), ALT3

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.82	0.91	0.84	0.82	0.76	0.74
Turner Cut	1.00	1.05	1.02	1.01	0.96	0.93
San Joaquin River at San Andreas Landing	0.63	0.67	0.63	0.62	0.60	0.60
San Joaquin River at Jersey Point	0.66	0.73	0.67	0.64	0.61	0.62
Victoria Canal	0.92	0.98	0.95	0.94	0.88	0.86
Sacramento River at Emmaton	0.61	0.68	0.62	0.58	0.57	0.59
San Joaquin River at Antioch	0.66	0.73	0.67	0.64	0.62	0.63
Montezuma Slough near Beldon Landing	0.74	0.81	0.72	0.70	0.72	0.72
Barker Slough at North Bay Aqueduct	0.75	0.89	0.81	0.70	0.67	0.66
Contra Costa Water District Pumping Plant #1	0.75	0.82	0.77	0.74	0.69	0.69
Banks Pumping Plant	0.90	0.94	0.92	0.90	0.86	0.87
Jones Pumping Plant	0.92	0.96	0.94	0.92	0.89	0.89

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-31. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), ALT3 minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.04	0.05	0.06	0.06	0.04	0.01
Turner Cut	0.04	0.03	0.07	0.06	0.05	0.00
San Joaquin River at San Andreas Landing	0.02	0.02	0.02	0.02	0.02	0.01
San Joaquin River at Jersey Point	0.02	0.03	0.03	0.03	0.01	0.01
Victoria Canal	0.08	0.06	0.10	0.12	0.09	0.04
Sacramento River at Emmaton	0.01	0.02	0.02	0.01	0.00	-0.01
San Joaquin River at Antioch	0.01	0.03	0.03	0.02	0.01	-0.01
Montezuma Slough near Beldon Landing	0.01	0.01	0.01	0.01	0.02	0.00
Barker Slough at North Bay Aqueduct	0.01	0.01	0.01	0.01	0.01	0.00
Contra Costa Water District Pumping Plant #1	0.07	0.07	0.08	0.08	0.06	0.02
Banks Pumping Plant	0.07	0.07	0.10	0.10	0.07	0.02
Jones Pumping Plant	0.05	0.05	0.08	0.08	0.07	0.01

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-32. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), ALT4

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.78	0.86	0.78	0.76	0.72	0.73
Turner Cut	0.96	1.02	0.96	0.95	0.91	0.93
San Joaquin River at San Andreas Landing	0.61	0.65	0.61	0.60	0.58	0.59
San Joaquin River at Jersey Point	0.63	0.70	0.63	0.61	0.60	0.61
Victoria Canal	0.84	0.91	0.84	0.82	0.79	0.82
Sacramento River at Emmaton	0.60	0.66	0.60	0.57	0.57	0.60
San Joaquin River at Antioch	0.65	0.70	0.64	0.62	0.61	0.64
Montezuma Slough near Beldon Landing	0.73	0.80	0.70	0.69	0.71	0.72
Barker Slough at North Bay Aqueduct	0.75	0.88	0.80	0.69	0.66	0.66
Contra Costa Water District Pumping Plant #1	0.68	0.75	0.68	0.65	0.63	0.66
Banks Pumping Plant	0.83	0.87	0.82	0.80	0.79	0.85
Jones Pumping Plant	0.87	0.91	0.86	0.84	0.83	0.88

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

Table G.4-33. Total Methylmercury Concentrations in Largemouth Bass (in milligrams per kilogram wet weight), ALT4 minus NAA

Assessment Location	All Years[1]	Wet Years	Above Normal Years	Below Normal Years	Dry Years	Critical Years
San Joaquin River at Empire Tract	0.00	0.00	0.00	0.00	0.00	0.00
Turner Cut	0.00	0.00	0.01	0.00	0.00	0.00
San Joaquin River at San Andreas Landing	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Jersey Point	-0.01	0.00	-0.01	0.00	0.00	0.00
Victoria Canal	0.00	-0.01	-0.01	0.00	0.00	0.00
Sacramento River at Emmaton	0.00	0.00	0.00	0.00	0.00	0.00
San Joaquin River at Antioch	0.00	0.00	0.00	0.00	0.00	0.00
Montezuma Slough near Beldon Landing	0.00	0.00	-0.01	0.00	0.01	0.00
Barker Slough at North Bay Aqueduct	0.01	0.00	0.00	0.00	0.00	0.00
Contra Costa Water District Pumping Plant #1	0.00	0.00	-0.01	-0.01	0.00	-0.01
Banks Pumping Plant	0.00	0.00	0.00	0.00	0.00	0.00
Jones Pumping Plant	0.00	0.00	0.00	0.00	0.01	0.00

[1] "All" water years 1922–2021 represent the 100-year period modeled using DSM2

G.4.4 Model Limitations and Applicability

CalSim 3.0 and DSM2 are planning level models, not predictive models. Further, mathematical models like DSM2 can only approximate processes of physical systems. Models are inherently inexact because the mathematical description of the physical system is imperfect and the understanding of interrelated physical processes is incomplete. A key assumption for the mass-balance calculation of water column concentrations of methylmercury is that the methylmercury acts in a conservative manner as the various source waters mix and flow through the Delta, which it does not. Mercury concentrations for inflow sources to the Delta (for example, agriculture in the Delta, Yolo Bypass, Eastside Tributaries) also present uncertainty in the modeling because of limited data.

The goal of the TMDL Model was to establish the linkage between the 0.24 mg/kg tissue mercury TMDL target (which is now the Delta water quality objective for trophic level 4 fish) to a water column concentration goal for methylmercury of 0.066 ng/l. The model results are presented with the recognition of the imprecision of predicting fish tissue concentrations from estimates of methylmercury concentrations for specific Delta locations, but with the knowledge that Largemouth Bass are probably the best indicator of fish tissue contamination. Results provide an estimated mean tissue concentration as would be expected based on the input water column concentration.

For the reasons discussed above, the water column concentration and fish tissue concentration results presented herein are not predictive in nature. Rather, they are for comparative assessment to identify the effect the alternatives would have on fish tissue methylmercury concentrations relative to the NAA.

G.4.5 References

Alpers, C. N., C. Eagles-Smith, C. Foe, S. Klasing, M. C. Marvin-DiPasquale, D. G. Slotton, and L. Windham-Meyers. 2008. *Sacramento–San Joaquin Delta Regional Ecosystem Restoration Implementation Plan, Ecosystem Conceptual Model. Mercury.* January 24.

California Environmental Data Exchange Network. 2020. *California Environmental Data Exchange Network.* Available: https://ceden.waterboards.ca.gov/AdvancedQueryTool. Accessed: December 12, 2020.

Central Valley Regional Water Quality Control Board. 2010a. *Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Methylmercury and Total Mercury in the Sacramento-San Joaquin Delta Estuary, Staff Report.* Rancho Cordova, CA. April.

Central Valley Regional Water Quality Control Board. 2010b. *Sacramento–San Joaquin Delta Estuary TMDL for Methylmercury, Final Staff Report.* April. Rancho Cordova, CA.

Central Valley Regional Water Quality Control Board. 2019. *The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board Central Valley Region-Fifth Edition.* Revised February 2019 (with Approved Amendments). California Regional Water Quality Control Board, Central Valley Region. Rancho Cordova, CA.