4.3.4 Water Quality

The water quality changes described for Alternative 4A reflect assumed water conveyance facilities operations. Alternative 4A includes water conveyance operational criteria similar to Alternative 4 (Operational Scenario H), but would be limited to operations within the range of Scenarios H3 and H4, as fully described in Chapter 3, *Description of Alternatives*, in Appendix A of the RDEIR/SDEIS. Alternative 4A operations are represented by the Scenarios H3 and H4 as follows:

- Scenario H3 – Includes spring outflow consistent with D-1641 and fall outflow consistent with Fall X2 requirements of the FWS 2008 BiOp.
- Scenario H4 – Includes higher spring outflow requirements than D-1641, and Fall X2 requirements of the FWS 2008 BiOp.

H3 and H4 operational criteria differ in the spring outflow that is assumed, and represent the range of operational effects of Alternative 4A. The facilities operations and maintenance impact analysis compares Alternative 4A results over the range of outcomes from the operational sub-scenarios to Existing Conditions (CEQA) and the No Action Alternative (NEPA).

The water quality changes described for Alternative 4A are also affected by assumptions regarding the extent of habitat restoration to be implemented. As described in Section 4.1.2, *Description of Alternative 4A*, of this RDEIR/SDEIS, Alternative 4A does not include the full suite of conservation actions included in Alternative 4. Aside from the water conveyance facilities, the most important differences from a water quality perspective are:

- CM2 – Yolo Bypass Improvements: this is included in Alternative 4, but not included in Alternative 4A; and
- CM4 – Tidal Natural Communities Restoration: includes 65,000 acres in Alternative 4, but would be significantly less under Alternative 4A.

This results in somewhat different patterns of water withdrawals from the Delta, and potentially somewhat different effects on water quality and aquatic habitat conditions in the Plan Area than analyzed for Alternative 4. As described in Section 4.1.2, *Description of Alternative 4A*, of this RDEIR/SDEIS, actions associated with Alternative 4 that are not proposed to be implemented under Alternative 4A would continue to be pursued as part of existing, but separate, projects and programs associated with the 2008 USFWS and 2009 NMFS BiOps (e.g., 8,000 acres of tidal habitat restoration and Yolo Bypass improvements), California EcoRestore, and the 2014 California Water Action Plan.

The analysis of boron, bromide, chloride, Dissolved organic carbon (DOC), electrical conductivity (EC), and nitrate under Alternative 4A in the ELT is based on modeling conducted for Alternative 4 in the ELT, which assumes implementation of Yolo Bypass Improvements and 25,000 acres of tidal natural communities restoration. As described above, Yolo Bypass Improvements are not a component of Alternative 4A and the amount of tidal habitat restoration (i.e. Environmental Commitment 4) would be significantly less than that represented in the modeling. In general, the significance of this difference is that the assessment of bromide, chloride, and EC for Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT), likely overestimates increases in bromide, EC, and chloride that could occur, particularly in the west Delta. Nevertheless, there is notable uncertainty in the results of all quantitative assessments that refer to modeling results, due to the differing assumptions used in the modeling and the description of Alternative 4A and the No Action Alternative (ELT).

Due to the reduced suite of environmental commitments in Alternative 4A compared to Alternative 4 (in particular, significantly less tidal restoration), there generally are fewer significant impacts identified for Alternative 4A than for Alternative 4.

Impact WQ-1: Effects on Ammonia Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), substantial point and non-point sources of ammonia-N do not exist upstream of the SRWTP at Freeport in the Sacramento River watershed, in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), or upstream of the Delta in the San Joaquin River watershed. Thus, like Alternative 4, operation of the water conveyance facilities under Alternative 4A would have negligible, if any, effect on ammonia concentrations in the rivers and reservoirs upstream of the Delta relative to Existing Conditions and the No Action Alternative (ELT and LLT). Any negligible increases in ammonia-N concentrations that could occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies, with regard to ammonia.

Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), a substantial decrease in Sacramento River ammonia concentrations is expected under Alternative 4A relative to Existing Conditions, due to planned lowering of ammonia in the SRWTP effluent discharge, and this is expected to decrease ammonia concentrations for all areas of the Delta that are influenced by Sacramento River water. Concentrations of ammonia at locations not influenced notably by Sacramento River water would change little relative to Existing Conditions, due to the similarity in San Joaquin River and San Francisco Bay concentrations and the lack of expected changes in either of these concentrations. Thus, Alternative 4A would not result in substantial increases in ammonia concentrations in the Plan Area, relative to Existing Conditions.

Relative to the No Action Alternative (ELT and LLT), the primary mechanism that could potentially alter ammonia concentrations under Alternative 4A is decreased flows in the Sacramento River, which would lower dilution available to the SRWTP discharge. This flow change would be attributable only to operations of the water conveyance facilities, since the same assumptions regarding SRWTP discharge ammonia concentrations, water demands, climate change, and sea level rise apply to both Alternative 4A and the No Action Alternative (ELT and LLT). A simple mass balance calculation was performed to calculate ammonia concentrations downstream of the SRWTP discharge (i.e., downstream of Freeport) under Alternative 4A and the No Action Alternative (ELT) to assess the effects of the flow changes. Monthly average CALSIM II flows at Freeport and the upstream ammonia concentration (0.04 mg/L-N; Central Valley Water Board 2010a:5) were used, together with the SRWTP permitted average dry weather flow (181 mgd) and seasonal ammonia limitations (1.5 mg/L-N in Apr–Oct, 2.4 mg/L-N in Nov–Mar), to estimate the average change in ammonia concentrations downstream of the SRWTP. Table 4.3.4-1 shows monthly average and long-term annual average predicted concentrations under the H3 and H4 operations scenarios. As

Table 4.3.4-1 shows, average monthly ammonia concentrations in the Sacramento River downstream of Freeport (upon full mixing of the SRWTP discharge with river water) under Alternative 4A and the No Action Alternative (ELT) are expected to be similar. In comparison to the No Action Alternative (ELT), minor increases in monthly average ammonia concentrations would occur during January through March, July through September, and during November for both operations scenarios (H3 and H4). Minor decreases in ammonia concentrations are expected for scenarios H3 and H4 in April and May. A minor increase in the annual average concentration would occur under Alternative 4A, compared to the No Action Alternative (ELT). Relative to the No Action Alternative (LLT), Alternative 4A is expected to result in similar minor increases in Sacramento River ammonia concentration, because the increased water demands, climate change, and sea level rise in the LLT would occur under both alternatives, and neither would affect ammonia sources or loading. The estimated ammonia concentrations in the Sacramento River downstream of Freeport under Alternative 4A would be similar to existing source water concentrations for the San Francisco Bay and San Joaquin River. Consequently, changes in source water fraction anticipated under Alternative 4A, relative to the No Action Alternative (ELT and LLT), are not expected to substantially increase ammonia concentrations at any Delta locations.

Ammonia concentrations downstream of Freeport in the Sacramento River under Alternative 4A would be similar to those under Alternative 4 (see Table 8-67 in Appendix A of the RDEIR/SDEIS). As stated for Alternative 4, any negligible increases in ammonia concentrations that could occur at certain locations in the Delta under Alternative 4A would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the water quality at these locations, with regard to ammonia.

Table 4.3.4-1. Estimated Ammonia (mg/L as N) Concentrations in the Sacramento River Downstream of the Sacramento Regional Wastewater Treatment Plant for the No Action Alternative Early Long-term (ELT) and Alternative 4A

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Average
No Action Alternative (ELT)	0.076	0.082	0.068	0.060	0.057	0.060	0.058	0.062	0.067	0.060	0.067	0.063	0.065
Alternative 4A, Scenario H3	0.076	0.086	0.068	0.061	0.058	0.061	0.057	0.060	0.067	0.063	0.071	0.075	0.067
Alternative 4A, Scenario H4	0.076	0.086	0.068	0.061	0.058	0.061	0.057	0.060	0.067	0.063	0.071	0.066	0.066

SWP/CVP Export Service Areas

As discussed above, for areas of the Delta that are influenced by Sacramento River water, including Banks and Jones pumping plants, ammonia-N concentrations are expected to decrease under Alternative 4A, relative to Existing Conditions (in association with less diversion of water influenced by the SRWTP). Like Alternative 4, this decrease in ammonia-N concentrations for water exported via the south Delta pumps is not expected to result in an adverse effect on beneficial uses or substantially degrade water quality of exported water, with regard to ammonia. Furthermore, as discussed above, for all areas of the Delta, including Banks and Jones pumping plants, ammonia concentrations are not expected to be substantially different under Alternative 4A relative to the No Action Alternative (ELT and LLT). Thus, any negligible increases in ammonia concentrations that could occur at Banks and Jones pumping plants would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade water quality at these locations, with regard to ammonia.

NEPA Effects: In summary, ammonia concentrations in water bodies upstream of the Delta, in the Plan Area, and the waters exported to the SWP/CVP Export Service Areas are not expected to be substantially different under Alternative 4A relative to the No Action Alternative (ELT and LLT). Thus, effects of the water conveyance facilities on ammonia are considered to be not adverse.

CEQA Conclusion: The magnitude and direction of changes in ammonia concentrations in water bodies upstream of the Delta, in the Plan Area, or the waters exported to the SWP/CVP Export Service Areas would be approximately the same as expected under Alternative 4, relative to Existing Conditions. There would be no substantial, long-term increase in ammonia concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the CVP and SWP service areas under Alternative 4A relative to Existing Conditions. As such, Alternative 4A is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because ammonia concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects on beneficial uses would occur. Ammonia is not CWA Section 303(d) listed within the affected environment and thus any minor increases that could occur in some areas would not make any existing ammonia-related impairment measurably worse because no such impairments currently exist. Because ammonia is not bioaccumulative, minor increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-2: Effects on Ammonia Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Some habitat restoration activities included in Environmental Commitments 3, 4, and 6–11 would occur on lands in the Delta formerly used for irrigated agriculture. Although this may decrease ammonia loading to the Delta from agriculture, increased biota in those areas as a result of restored habitat may increase ammonia loading originating from flora and fauna. Ammonia loaded from organisms is expected to be converted rapidly to nitrate by established microbial communities. Thus, these land use changes would not be expected to substantially increase ammonia concentrations in the Delta. Implementation of Environmental Commitments 12, 15, and 16 do not include actions that would affect ammonia sources or loading. Based on these findings, the effects on ammonia from the implementation Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A are determined to not be adverse.

CEQA Conclusion: Land use changes that would occur from the environmental commitments are not expected to substantially increase ammonia concentrations, because the amount of area to be converted would be small relative to existing habitat, and any resulting ammonia would likely be rapidly converted to nitrate. Thus, it is expected there would be no substantial, long-term increase in ammonia concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 relative to Existing Conditions. As such, implementation of these environmental commitments would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. Because ammonia concentrations would not be expected to increase substantially from implementation of these environmental commitments, no long-term water quality degradation would be expected to occur and, thus, no significant impact on beneficial uses would occur. Ammonia is not CWA Section 303(d) listed within the affected environment and thus any minor increases that could occur in some areas would not make any existing ammonia-related impairment measurably worse because no such impairments currently exist. Because ammonia is not bioaccumulative, minor increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered less than significant. No mitigation is required.

Impact WQ-3: Effects on Boron Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), under Alternative 4A there would be no expected change to the sources of boron in the Sacramento River and east-side tributary watersheds and, thus, resultant changes in flows from altered system-wide operations would have negligible, if any, effects on the concentration of boron in the rivers and reservoirs of these watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease by 1%, relative to Existing Conditions (in association with the different operational components of Alternative 4A in the ELT, climate change, and increased water demands) (Table Bo-1 in Appendix B of this RDEIR/SDEIS). The reduced flow relative to Existing Conditions would result in possible increases in long-term average boron concentrations of up to about 0.5% relative to the Existing Conditions. Flows would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial boron increases relative to the No Action Alternative (ELT). The increased boron concentrations, relative to Existing Conditions, under Alternative 4A in the ELT would not increase the frequency of exceedances of any applicable objectives or criteria and would not be expected to cause further degradation at measurable levels in the lower San Joaquin River, and thus would not cause the existing impairment there to be discernibly worse. Consequently, Alternative 4A in the ELT would not be expected to cause exceedance of boron objectives/criteria or substantially degrade water quality with respect to boron, and thus would not adversely affect any beneficial uses of the Sacramento River, the east-side tributaries, associated reservoirs upstream of the Delta, or the San Joaquin River.

Effects of Alternative 4A in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect boron sources in these areas.

Delta

Effects of water conveyance facilities on boron under Alternative 4A in the Delta would be similar to the effects discussed for Alternative 4. To the extent that habitat restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. However, there would be less potential for increased boron concentrations at western Delta locations associated with restoration environmental commitments under Alternative

4A because very little would occur relative to Alternative 4. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-4. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

The effects of Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT) are discussed together because the direction and magnitude of predicted change are similar. Relative to the Existing Conditions and No Action Alternative (ELT), Alternative 4A would result in increased long-term average boron concentrations for the 16-year period modeled at most of the interior Delta locations (increases up to 8% at the S. Fork Mokelumne River at Staten Island, 11% at Franks Tract, and 15% at Old River at Rock Slough) (Tables Bo-4 and Bo-5 in Appendix B of this RDEIR/SDEIS). The long-term average boron concentrations at most of the western Delta assessment locations would not change measurably. The long-term annual average and monthly average boron concentrations, for either the 16-year period or drought period modeled, would never exceed the 2,000 µg/L human health advisory objective (i.e., for children) or the 500 µg/L agricultural objective at the majority of assessment locations, which represents no change from the Existing Conditions and No Action Alternative (ELT) (Table Bo-3 in Appendix B of this RDEIR/SDEIS). A small increase in the frequency of exceedances 500 µg/L agricultural objective at the Sacramento River at Mallard Island (i.e., as much as 7% in the drought period relative to the No Action Alternative [ELT]) would not be anticipated to substantially affect agricultural diversions which occur primarily at interior Delta locations. Minor reductions in long-term average assimilative capacity of up to 9% at interior Delta locations (i.e., Old River at Rock Slough) would occur with respect to the 500 µg/L agricultural objective (Tables Bo-6 and Bo-7 in Appendix B of this RDEIR/SDEIS). However, because the absolute boron concentrations would still be well below the lowest 500 µg/L objective for the protection of the agricultural beneficial use under Alternative 4A, the levels of boron degradation would not be of sufficient magnitude to substantially increase the risk of exceeding objectives or cause adverse effects to municipal and agricultural water supply beneficial uses, or any other beneficial uses, in the Delta (Figure Bo-1 in Appendix B of this RDEIR/SDEIS).

Effects of Alternative 4A in the Delta in the LLT, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to those described above for the ELT. Boron concentrations may be higher at western Delta locations due to greater effects of climate change on sea level rise that would occur in the LLT; however, these effects are independent of the alternative. Further, boron is of concern in waters diverted for agricultural use, which primarily occurs in the interior Delta, and based on Delta source water characteristics (see Table 8-42 in Appendix A of the RDEIR/SDEIS), boron concentrations in the interior Delta would be expected to remain suitable for agricultural use.

SWP/CVP Export Service Areas

Under the Alternative 4A, long-term average boron concentrations would decrease at the Banks pumping plant (as much as 25%) and at Jones pumping plant (as much as 22%) relative to Existing Conditions, and the reductions would be similar compared to No Action Alternative (ELT) (Tables Bo-4 and Bo-5 in Appendix B of this RDEIR/SDEIS) as a result of export of a greater proportion of low-boron Sacramento River water. Commensurate with the decrease in exported boron concentrations, boron concentrations in the lower San Joaquin River may be reduced and would likely alleviate or lessen any expected increase in boron concentrations at Vernalis associated with flow reductions (see discussion of Upstream of the Delta), as well as locations in the Delta receiving a large fraction of San Joaquin River water. Reduced export boron concentrations also may contribute to reducing the existing CWA Section 303(d) impairment in the lower San Joaquin River and associated TMDL actions for reducing boron loading. These same effects on boron at the Banks and Jones pumping plants would be expected in the LLT, because the primary effect of climate change on sea level rise and boron concentrations is expected in the western Delta.

Maintenance of SWP and CVP facilities under Alternative 4A would not be expected to create new sources of boron or contribute towards a substantial change in existing sources of boron in the affected environment.

NEPA Effects: In summary, relative to the No Action Alternative (ELT and LLT), Alternative 4A would result in relatively small increases in long-term average boron concentrations in the Delta, not measurably increase boron levels in the lower San Joaquin River, and reduce boron levels in water exported to the SWP/CVP export service areas. However, the predicted changes would not be expected to cause exceedances of applicable objectives or further measurable water quality degradation, and thus would not constitute an adverse effect on water quality.

CEQA Conclusion: Based on the above assessment, any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in boron levels upstream of the Delta. Small increases in boron levels predicted for interior Delta locations in response to a shift in the Delta source water percentages would not be expected to cause exceedances of objectives, or substantial degradation of these water bodies. Alternative 4A maintenance also would not result in any substantial increases in boron concentrations in the affected environment. Boron concentrations would be reduced in water exported from the Delta to the CVP/SWP Export Service Areas, thus reflecting a potential improvement to boron loading in the lower San Joaquin River.

Boron is not a bioaccumulative constituent, thus any increased concentrations under Alternative 4A would not result in adverse boron bioaccumulation effects to aquatic life or humans. Relative to Existing Conditions, Alternative 4A would not result in substantially increased boron concentrations such that frequency of exceedances of municipal and agricultural water supply objectives would increase. The levels of boron degradation that may occur under Alternative 4 would not be of sufficient magnitude to cause substantially increased risk for adverse effects to municipal or agricultural beneficial uses within the affected environment. Long-term average boron concentrations would decrease in Delta water exports to the SWP and CVP service area, which may contribute to reducing the existing CWA Section 303(d) impairment of agricultural beneficial uses in the lower San Joaquin River. Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-4: Effects on Boron Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 for Alternative 4A present no new direct sources of boron to the affected environment, including areas upstream of the Delta, within the Delta region, and in the SWP/CVP Export Service Areas. Habitat restoration activities in the Delta, while involving increased land and water interaction within these habitats, would not be anticipated to contribute boron which is primarily associated with source water inflows to the Delta (i.e., San Joaquin River, agricultural drainage, and Bay source water). Moreover, some habitat restoration would occur on lands within the Delta currently used for irrigated agriculture, thus replacing agricultural land uses with restored habitats. The potential reduction in irrigated lands within the Delta may result in reduced discharges of agricultural field drainage with elevated boron concentrations, which would be considered an improvement compared to the No Action Alternative (ELT and LLT). Consequently, as they pertain to boron, implementation of the environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 for Alternative 4A would not present new or substantially changed sources of boron to the affected environment upstream of the Delta, within Delta, or in the SWP/CVP Export Service Areas. As such, their implementation would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or other criteria would be exceeded in water bodies of the affected environment located upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas or substantially degrade the quality of these water bodies, with regard to boron. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-5: Effects on Bromide Concentrations Resulting from Facilities Operations and Maintenance Upstream of the Delta

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), under Alternative 4A in the ELT there would be no expected change to the sources of bromide in the Sacramento River and east-side tributary watersheds. Thus, changes in the magnitude and timing of reservoir releases north and east of the Delta would have negligible, if any, effect on the sources, and ultimately the concentration of bromide in the Sacramento River, the eastside tributaries, and the various reservoirs of the related watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease slightly (1%) compared to Existing Conditions and would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial bromide increases. Moreover, there are no existing municipal intakes on the lower San Joaquin River, which is the beneficial use most sensitive to elevated bromide concentrations. Consequently, Alternative 4A in the ELT would not be expected to adversely affect the MUN beneficial use, or any other beneficial uses, of the Sacramento River, the San Joaquin River, the eastside tributaries, or their associated reservoirs upstream of the Delta due to changes in bromide concentrations.

Effects of Alternative 4A in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect bromide sources in these areas.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-6. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the modeling methodology.

Estimates of bromide concentrations at Delta assessment locations were generated using a mass balance approach, and using relationships between EC and chloride and between chloride and bromide and DSM2 EC output. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding these modeling approaches. The assessment below identifies changes in bromide at Delta assessment locations based on both approaches.

Based on the mass balance modeling approach for bromide, relative to Existing Conditions, Alternative 4A long-term average bromide concentrations would increase in the S. Fork Mokelumne River at Staten Island, and decrease at all other assessment locations (Table Br-1 in Appendix B of this RDEIR/SDEIS). Average bromide concentrations at Staten Island would increase from 50 µg/L under Existing Conditions to 63–64 µg/L (26–28% increase depending on operations scenario) for the modeled 16-year hydrologic period (1976–1991). However, multiple interior and western Delta assessment locations would have an increased frequency of exceedance of 50 µg/L, which is the CALFED Drinking Water Program goal for bromide as a long-term average applied to drinking water intakes (Table Br-1 in Appendix B of this RDEIR/SDEIS). These locations are the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. The greatest increase in frequency of exceedance of the CALFED Drinking Water Program long-term goal of 50 µg/L would occur in the S. Fork Mokelumne River (24–25% increase depending on operations scenario) and Sacramento River at Emmaton (2–4% increase depending on operations scenario). The increase in frequency of exceedance of the 50 µg/L threshold at the other locations would be 2% or less. Similarly, these locations would have an increased frequency of exceedance of 100 µg/L, which is the concentration believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts (Table Br-1 in Appendix B of this RDEIR/SDEIS). The greatest increase in frequency of exceedance of 100 µg/L would occur at Franks Tract (6% increase) and San Joaquin River at Antioch (4–5% increase depending on operations scenario). The increase in frequency of exceedance of the 100 µg/L threshold at the other locations would be 3% or less.

Changes in long-term average bromide concentrations and changes in threshold exceedance frequencies relative to the No Action Alternative (ELT) are generally of similar magnitude to those previously described relative to Existing Conditions (Table Br-1 in Appendix B of this RDEIR/SDEIS). However, unlike the Existing Conditions comparison, relative to the No Action Alternative (ELT), long-term average bromide concentrations at Buckley Cove would increase under Alternative 4A, although the increases would be relatively small (<1%).

Results of the modeling approach which used relationships between EC and chloride and between chloride and bromide were consistent with the discussion above, and assessment of bromide using these modeling results leads to the same conclusions as are presented above for the mass balance approach (Tables Br-2 in Appendix B of this RDEIR/SDEIS).

Unlike Alternative 4, there would be no increased bromide concentration or frequency of exceedance of bromide thresholds in Barker Slough at the North Bay Aqueduct under Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT). Also, the magnitude of bromide concentration increases at Mallard Slough and in the San Joaquin River at Antioch during their historical months of use, relative to Existing Conditions and the No Action Alternative (ELT) would be generally similar to those described for Alternative 4 (Tables Br-5 and Br-6 in Appendix B of this RDEIR/SDEIS), and the frequency of exceedance of bromide thresholds would be similar (Tables Br-3 and Br-4 in Appendix B of this RDEIR/SDEIS). As described for Alternative 4, the use of seasonal intakes at these locations is largely driven by acceptable water quality, and thus has historically been opportunistic. Opportunity to use these intakes would remain, and the predicted increases in bromide concentrations at Antioch and Mallard Slough would not be expected to adversely affect MUN beneficial uses, or any other beneficial use, at these locations.

The effects of Alternative 4A in the LLT in the Delta region, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to that described above. There may be higher bromide concentrations in the LLT in the western Delta, but this would be associated with sea level rise, not the project alternative, because the primary source of bromide to the Delta is sea water intrusion.

SWP/CVP Export Service Areas

Under Alternative 4A, long-term average bromide concentrations at the Banks and Jones pumping plants, based on the mass balance modeling approach, would decrease. Long-term average bromide concentrations for the modeled 16-year hydrologic period at the pumping plants would decrease by as much as 48% relative to Existing Conditions and 44% relative to the No Action Alternative (ELT) (Table Br-1 in Appendix B of this RDEIR/SDEIS). As a result, less frequent exceedances of the 50 µg/L and 100 µg/L assessment thresholds would occur and an overall improvement in SWP/CVP Export Service Areas water quality would occur respective to bromide. Commensurate with the decrease in exported bromide, an improvement in lower San Joaquin River bromide would also occur since bromide in the lower San Joaquin River is principally related to irrigation water deliveries from the Delta. Results of the modeling approach which used relationships between EC and chloride and between chloride and bromide are consistent with the mass balance results, and assessment of bromide using these modeling results leads to the same conclusions as are presented for the mass balance approach (Table Br-2 in Appendix B of this RDEIR/SDEIS).

The effects of Alternative 4A in the LLT in the SWP/CVP Export Service Areas, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to that described above, because the sea level rise that could occur in the LLT would not be expected to result in substantial bromide contributions to the water exported at Banks and Jones pumping plants.

Maintenance of SWP and CVP facilities under Alternative 4A would not be expected to create new sources of bromide or contribute towards a substantial change in existing sources of bromide in the affected environment. Maintenance activities would not be expected to cause any substantial change in bromide such that MUN beneficial uses, or any other beneficial use, would be adversely affected anywhere in the affected environment.

NEPA Effects: In summary, the operations and maintenance activities under Alternative 4A, relative to the No Action Alternative (ELT and LLT) would result in an increased frequency of exceedance of the 50 µg/L and 100 µg/L bromide thresholds for protecting against the formation of disinfection byproducts in treated drinking water at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. However, long-term average bromide concentrations would increase only in the S. Fork Mokelumne River at Staten Island and San Joaquin River at Buckley Cove; there would be decreases in long-term average bromide concentrations at the other assessment locations. The long-term bromide concentration in the S. Fork Mokelumne River at Staten Island would be less than the concentration believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts, and the increase in the San Joaquin River at Buckley Cove would be minimal (<1%). Thus, these increased bromide concentrations are not expected to result in adverse affects to MUN beneficial uses, or any other beneficial use, at these locations. Based on these findings, this effect is determined to not be adverse.

CEQA Conclusion: While greater water demands under Alternative 4A would alter the magnitude and timing of reservoir releases north and east of the Delta, these activities would have negligible, if any, effect on the sources of bromide, and ultimately the concentration of bromide in the Sacramento River, the San Joaquin River, the eastside tributaries, and the various reservoirs of the related watersheds, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS).

Under Alternative 4A there would be an increased frequency of exceedance of the 50 µg/L and 100 µg/L bromide thresholds for protecting against the formation of disinfection byproducts in treated drinking water at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. However, long-term average bromide concentrations would increase only in the S. Fork Mokelumne River at Staten Island and decrease at all other assessment locations. The long-term bromide concentration in the S. Fork Mokelumne River at Staten Island (63–64 µg/L) would be less than the 100 µg/L believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts. Further, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), the use of seasonal intakes at Antioch and Mallard Island is largely driven by acceptable water quality, and thus has historically been opportunistic and opportunity to use these intakes would remain. Thus, these increased bromide concentrations would not be expected to adversely affect MUN beneficial uses, or any other beneficial use, at these locations.

The assessment of effects on bromide in the SWP/CVP Export Service Areas is based on assessment of changes in bromide concentrations at Banks and Jones pumping plants. Long-term average bromide concentrations at the Banks and Jones pumping plants are predicted to decrease by as much as 48% relative to Existing Conditions and there would be less frequent exceedance of bromide concentration thresholds.

Based on the above, Alternative 4A would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria because none exist for bromide. Alternative 4A would not result in any substantial change in long-term average bromide concentration or exceed 50 and 100 µg/L assessment threshold concentrations by frequency, magnitude, and geographic extent that would result in adverse effects on any beneficial uses within affected water bodies. Bromide is not a bioaccumulative constituent and thus concentrations under this alternative would not result in bromide bioaccumulating in aquatic organisms. Increases in exceedances of the 100 µg/L assessment threshold concentration would be 6% or less at all locations assessed, which is considered to be less than substantial long-term degradation of water quality. The levels of bromide degradation that may occur under the Alternative 4A would not be of sufficient magnitude to cause substantially increased risk for adverse effects on any beneficial uses of water bodies within the affected environment. Bromide is not CWA Section 303(d) listed and thus the minor increases in long-term average bromide concentrations would not affect existing beneficial use impairment because no such use impairment currently exists for bromide. Based on these findings, this impact is less than significant. No mitigation is required.

Impact WQ-6: Effects on Bromide Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would present no new sources of bromide to the affected environment, including areas Upstream of the Delta, within the Plan Area, and the SWP/CVP Export Service Areas. Some habitat restoration activities would occur on lands in the Delta formerly used for irrigated agriculture. Such replacement or substitution of land use activity would not be expected to result in new or increased sources of bromide to the Delta. Therefore, as they pertain to bromide, implementation of these environmental commitments would not be expected to adversely affect MUN beneficial use, or any other beneficial uses, of the affected environment.

Environmental Commitment 4 would result in some tidal habitat restoration, however, the areal extent would be small relative to the existing and No Action Alternative tidal area and, thus not expected to appreciably affect the magnitude of daily tidal water exchange at the restoration areas or alter other hydrodynamic conditions in adjacent Delta channels that would result in measurable bromide concentration changes.

In summary, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A relative to the No Action Alternative (ELT and LLT), would have negligible, if any, effects on bromide concentrations. Therefore, the effects on bromide from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A would not present new or substantially changed sources of bromide to the affected environment. Some environmental commitments may replace or substitute for existing irrigated agriculture in the Delta. This replacement or substitution would not be expected to substantially increase or present new sources of bromide. Thus, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would have negligible, if any, effects on bromide concentrations throughout the affected environment, would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria because none exist for bromide, and would not cause changes in bromide concentrations that would result in significant impacts on any beneficial uses within affected water bodies. Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause significant long-term water quality degradation such that there would be greater risk of significant impacts on beneficial uses, would not cause greater bioaccumulation of bromide, and would not further impair any beneficial uses due to bromide concentrations because no uses are currently impaired due to bromide levels. Based on these findings, this impact is considered less than significant. No mitigation is required.

Impact WQ-7: Effects on Chloride Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 4A on chloride concentrations in reservoirs and rivers upstream of the Delta would be the similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). Chloride loading in these watersheds would remain unchanged and resultant changes in flows from altered system-wide operations would have negligible, if any, effects on the concentration of chloride in the rivers and reservoirs of these watersheds. There would be no expected change to the sources of chloride in the Sacramento River and east-side tributary watersheds, and changes in the magnitude and timing of reservoir releases north and east of the Delta would have negligible, if any, effect on the sources, and ultimately the concentration of chloride in the Sacramento River, the eastside tributaries, and the various reservoirs of the related watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease slightly (1%) compared to Existing Conditions and would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial chloride increases. Moreover, there are no existing municipal intakes on the lower San Joaquin River. Consequently, Alternative 4A in the ELT would not be expected to cause exceedances of chloride objectives/criteria or substantially degrade water quality with respect to chloride, and thus would not adversely affect any beneficial uses of the Sacramento River, the eastside tributaries, associated reservoirs upstream of the Delta, or the San Joaquin River.

Effects of Alternative 4A in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect chloride sources in these areas.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 4A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-8. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Estimates of chloride concentrations at Delta assessment locations were generated using a mass balance approach and EC-chloride relationships and DSM2 EC output. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding these modeling approaches. The assessment below identifies changes in chloride at Delta assessment locations based on both approaches.

Modeling of chloride using both the mass balance approach and EC-chloride relationship predicts that Alternative 4A in the ELT would result in similar or reduced long-term average chloride concentrations, relative to Existing Conditions, for the 16-year period modeled at all assessment locations except for the S. Fork Mokelumne River at Staten Island. The increase in long-term average chloride concentration at Staten Island would be 4 mg/L (25%) based on the mass balance modeling and 2 mg/L (9%) based on the EC-chloride relationship (Tables Cl-6 though Cl-9 in Appendix B of this RDEIR/SDEIS). These increases are extremely small in absolute terms and relative to applicable water quality objectives, and are within the estimated modeling uncertainty. The results differ from Alternative 4, under which there would be increased long-term average chloride concentrations also at the North Bay Aqueduct at Barker Slough. The change in long-term average chloride concentrations relative to the No Action Alternative (ELT) would be similar to those relative to Existing Conditions.

The following outlines the modeled chloride changes relative to the applicable objectives and beneficial uses of Delta waters.

Municipal Beneficial Uses Relative to Existing Conditions

Estimates of chloride concentrations generated using EC-chloride relationships were used to evaluate the 150 mg/L Bay-Delta WQCP objective for municipal and industrial beneficial uses on a basis of the percent of years the chloride objective is exceeded for the modeled 16-year period. The objective is exceeded if chloride concentrations exceed 150 mg/L for a specified number of days in a given water year at Antioch and Contra Costa Pumping Plant #1. For Alternative 4A, the modeled frequency of objective exceedance would decrease at the Contra Costa Pumping Plant #1 from 6.7% of years under Existing Conditions, to 0% of years under operations scenario H3 and H4 (Table Cl-1 in Appendix B of this RDEIR/SDEIS).

Evaluation of the 250 mg/L Bay-Delta WQCP objective for chloride utilized results from both the mass balance approach and EC-chloride relationship. The basis for the evaluation was the predicted number of days the objective would be exceeded for the modeled 16-year period.

Based on the mass balance approach, there would be a decreased frequency of exceedance of the 250 mg/L objective under Alternative 4A, relative to Existing Conditions, at all locations except in the Sacramento River at Mallard Island and the Sacramento River at Emmaton. In the Sacramento River at Mallard Island, the frequency of objective exceedance would increase from 85% under Existing Conditions to 86% under Alternative 4A for the entire period modeled under both operations scenarios (Table Cl-2 in Appendix B of this RDEIR/SDEIS). In the Sacramento River at Emmaton, there would be an increase in chloride objective exceedance during the drought period modeled, from 55% to 57% under operations scenario H3, although these changes are within the uncertainty of the modeling approach; there would be no increase in objective exceedances under operations scenario H4.

The mass balance results also indicate reduced assimilative capacity with respect to the 250 mg/L objective during certain months and at certain locations. In the San Joaquin River at Antioch, there would be a reduction in assimilative capacity in March and April of up to 18% for the 16-year period modeled, and 61% for the drought period modeled (Tables Cl-12 and Cl-14 in Appendix B of this RDEIR/SDEIS). Assimilative capacity at the Contra Costa Pumping Plant #1 also would be reduced, in February through June by up to 5% for the entire period modeled and 7% for the drought period modeled. These estimates include the effect of climate change and sea level rise, as well as the alternative. Comparisons to the No Action Alternative (ELT) below provide an assessment of the effect of the alternative alone.

When utilizing the EC-chloride relationship to model chloride concentrations for the 16-year period, trends in frequency of exceedance and use of assimilative capacity would be similar to that discussed when utilizing the mass balance modeling approach (Tables Cl-3, Cl-13, and Cl-15 in Appendix B of this RDEIR/SDEIS). However, the EC-chloride relationships predicted changes of lesser magnitude, where predictions of change utilizing the mass balance approach were generally of greater magnitude, and thus more conservative. As discussed in Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS, in cases of such disagreement, the approach that yielded the more conservative predictions was used as the basis for determining adverse impacts.

CWA Section 303(d) Listed Water Bodies–Relative to Existing Conditions

Tom Paine Slough in the southern Delta is on the state's CWA Section 303(d) list for chloride with respect to the secondary MCL of 250 mg/L. Monthly average chloride concentrations at the Old River at Tracy Road for the 16-year period modeled, which represents the nearest DSM2-modeled location to Tom Paine Slough, would be generally similar under Alternative 4A in the ELT relative to Existing Conditions, and thus, would not be further degraded on a long-term basis and Alternative 4A in the ELT would thus not make this impairment discernibly worse (Figure Cl-1 in Appendix B of this RDEIR/SDEIS).

Suisun Marsh also is on the state's CWA Section 303(d) list for chloride in association with the Bay-Delta WQCP objectives for maximum allowable salinity during the months of October through May, which establish appropriate seasonal salinity conditions for fish and wildlife beneficial uses. With respect to Suisun Marsh the monthly average chloride concentrations for the 16-year period modeled would generally increase under Alternative 4A in the ELT relative to Existing Conditions in March through May at the Sacramento River at Mallard Island (Figure Cl-2 in Appendix B of this RDEIR/SDEIS) and at Collinsville (Figure Cl-3 in Appendix B of this RDEIR/SDEIS), and increase substantially in October through May at Montezuma Slough at Beldon's Landing (i.e., over a doubling of concentration in December through February) (Figure Cl-4 in Appendix B of this RDEIR/SDEIS). However, modeling of Alternative 4A assumed no operation of the Montezuma Slough Salinity Control Gates, but the project description assumes continued operation of the Salinity Control Gates, consistent with assumptions included in the No Action Alternative. A sensitivity analysis modeling run conducted for Alternative 4 scenario H3 at the LLT with the gates operational consistent with the No Action Alternative resulted in substantially lower EC levels than indicated in the original Alternative 4 modeling results for Suisun Marsh, but EC levels were still somewhat higher than EC levels under Existing Conditions for several locations and months. Although chloride was not specifically modeled in these sensitivity analyses, it is expected that chloride concentrations would be nearly proportional to EC levels in Suisun Marsh. Additionally, although these analyses were only conducted at the LLT, they are expected to generally also apply to the ELT. Another modeling run with the gates operational and restoration areas removed resulted in EC levels nearly equivalent to Existing Conditions (see Appendix 8H Attachment 1 in Appendix A of the RDEIR/SDEIS for more information on these sensitivity analyses). Since Alternative 4A in the ELT includes operation of the gates, and includes very little tidal restoration area, it is anticipated that chloride increases in Suisun Marsh predicted via the modeling would not occur, and that chloride in Suisun Marsh under Alternative 4A in the ELT would be very similar to Existing Conditions. For these reasons, any changes in chloride in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

Municipal Beneficial Uses Relative to No Action Alternative (ELT)

Similar to the assessment conducted for Existing Conditions, estimates of chloride concentrations generated from EC-chloride relationships were used to evaluate the 150 mg/L Bay-Delta WQCP objective for municipal and industrial beneficial uses. For Alternative 4A in the ELT, the modeled frequency of objective exceedance would not change at the Contra Costa Pumping Plant #1--the No Action Alternative (ELT) and Scenarios H3 and H4 all would have 0% exceedance (Table Cl-1 in Appendix B of this RDEIR/SDEIS).

Based on the mass balance approach, the frequency of exceedance of the 250 mg/L objective under Alternative 4A in the ELT would be the same, or would decrease, at all locations relative to the No Action Alternative (ELT) (Table Cl-2 in Appendix B of this RDEIR/SDEIS). Estimates of long-term use of assimilative capacity using the mass balance results indicated the potential for reduced assimilative capacity with respect to the 250 mg/L objective for certain months and locations. Calculations using the long-term monthly average concentrations showed that in the San Joaquin River at Antioch, there would be a reduction in assimilative capacity in April of 2% for the entire period modeled and 32% for the drought period modeled under operations scenario H3, but an increase in assimilative capacity under operations scenario H4 for both the entire period modeled and the drought period (Tables Cl-12 and Cl-14 in Appendix B of this RDEIR/SDEIS). The same approach showed that assimilative capacity at the Contra Costa Pumping Plant #1 also would be reduced in March through June, by up to 5%, and in October by up to 21% for the entire period modeled. During the drought period modeled, there would be similar reductions of assimilative capacity in April through June by up to 3% and a reduction in assimilative capacity of up to 88% in September (Tables Cl-12 and Cl-14 in Appendix B of this RDEIR/SDEIS). However, this approach used long-term average chloride concentrations, which can be heavily influenced by changes in a small number of years when chloride concentrations would already be very high. Additionally, when long term averages are just below the objective, very small changes in chloride that are within the modeling uncertainty can result in very high estimates of use of assimilative capacity. To further investigate the potential for water quality degradation with respect to chloride, the concentrations of chloride during individual water years was examined.

This further examination was limited to the mass balance approach, since when utilizing the EC-chloride relationship to model monthly average chloride concentrations for the 16-year period, trends in frequency of exceedance and use of assimilative capacity were similar to that discussed for the mass balance modeling approach (Tables Cl-3, Cl-13, and Cl-15 in Appendix B of this RDEIR/SDEIS). However, utilizing the EC-chloride relationships predicted changes of lesser magnitude, where predictions of change utilizing the mass balance approach were generally of greater magnitude, and thus more conservative. As discussed in Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS, in cases of such disagreement, the approach that yielded the more conservative predictions was used as the basis for determining adverse impacts.

Figure Cl-9 shows chloride concentrations in April during the five-year drought period (1987–1991) at Antioch, where Tables Cl-12 and Cl-14 in Appendix B of this RDEIR/SDEIS indicated up to 32% use of assimilative capacity. The figure shows that during three of the five years, chloride concentrations increased relative to the No Action Alternative (ELT) and decreased in the other two years. The absolute differences estimated are fairly small and may be within modeling uncertainty. Figures Cl-10 and Cl-11 show a box and whisker plot and exceedance plot for April at Antioch for all dry and critical water years modeled (not just the 1987–1991 drought period). These graphs show that while the median chloride concentration is slightly increased relative to the No Action Alternative (ELT) under both scenarios, the maximums, 25th percentile, and 75th percentile values are all decreased. Based on this analysis, long-term degradation is not expected at Antioch in April during drought years.

Figure Cl-12 shows chloride levels in September at Contra Costa Pumping Plant #1 during the drought period (1987–1991), where Tables Cl-12 and Cl-14 in Appendix B of this RDEIR/SDEIS indicated 88% use of assimilative capacity. In general, changes in chloride concentrations relative to the No Action Alternative (ELT) are fairly small, and may be within modeling uncertainty. Figures Cl-13 and Cl-14 show a box and whisker plot and exceedance plot for September at Contra Costa Pumping Plant #1 for all dry and critical water years modeled (not just the 1987–1991 drought period). These graphs show that the median chloride concentration is slightly decreased relative to the No Action Alternative (ELT) under both scenarios, and chloride concentrations are generally similar to the No Action Alternative (ELT) throughout the range seen. The 88% use of assimilative capacity was shown because long term averages were just below the criterion, so a very small increase in chloride (that is probably within the modeling uncertainty) resulted in a very high estimate of use of assimilative capacity. Similar results are shown in Figure Cl-15, Cl-16, and Cl-17 for October at Contra Costa Pumping Plant #1. Median concentrations decreased slightly, and the exceedance plot shows generally similar concentrations throughout the range seen. Figure CI-15 shows that while some years see increased concentrations (e.g., 1978, 1989), other years see decreased concentrations (e.g., 1980, 1982). Based on this analysis, long-term degradation is not expected at Contra Costa Pumping Plant #1 in September during drought years, or October on a long-term average basis.

Furthermore, sensitivity analyses conducted of Alternative 4 Scenario H3 without restoration areas indicated lower chloride levels in the western Delta than with the restoration areas. It is thus likely that modeling of Alternative 4A that does not include restoration areas would show lower levels of chloride at Antioch in April, and at Contra Costa Pumping Plant #1 in September and October than is shown herein using the Alternative 4 (ELT) modeling.

Based on the low level of water quality degradation estimated for the western Delta, and the lack of exceedance of water quality objectives, Alternative 4A is not expected to have substantial adverse effects on municipal and industrial beneficial uses in the western Delta.

CWA Section 303(d) Listed Water Bodies–Relative to No Action Alternative (ELT)

With respect to the state's CWA Section 303(d) listing for chloride, Alternative 4A would generally result in similar changes to those discussed for the comparison to Existing Conditions. Monthly average chloride concentrations at Tom Paine Slough would not be further degraded on a long-term basis, based on changes that would occur in Old River at Tracy Road (Figure CI-1 in Appendix B of this RDEIR/SDEIS). Modeling indicated that monthly average chloride concentrations at source water channel locations for the Suisun Marsh would increase substantially in some months during October through May relative to the No Action Alternative (ELT) (Figures CI-2, CI-3, and CI-4 in Appendix B of this RDEIR/SDEIS), but the results of sensitivity analyses performed indicate that chloride increases in Suisun Marsh predicted via the modeling would not occur, and that chloride in Suisun Marsh under Alternative 4A in the ELT would be very similar to the No Action Alternative (ELT). Depending on where tidal restoration areas assumed to be included in the No Action Alternative are located, chloride concentrations under Alternative 4A could be less than under the No Action Alternative (ELT). For these reasons, any changes in chloride in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

The effects of Alternative 4A in the LLT in the Delta region, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to effects in the ELT. With greater climate change and sea level rise, additional outflow may be required at certain times to prevent increases in chloride in the west Delta. Small increases in chloride concentrations may occur in some areas, but it is not expected that these increases would cause exceedance of Bay-Delta WQCP objectives of cause substantial long-term degradation that would impact municipal and industrial beneficial uses.

SWP/CVP Export Service Areas

Under Alternative 4A in the ELT, long-term average chloride concentrations at the Banks and Jones pumping plants, based on the mass balance analysis of modeling results for the 16-year period, would decrease relative to Existing Conditions. Chloride concentrations would be reduced by 42–47% at Banks pumping plant, depending on operations scenario (Tables CI-6 and CI-8 in Appendix B of this RDEIR/SDEIS). At Jones pumping plant, chloride concentrations would be reduced 41–43%, depending on operations scenario (Tables CI-6 and CI-8 in Appendix B of this RDEIR/SDEIS). The frequency of exceedances of applicable water quality objectives would decrease relative to Existing

Conditions, for both the 16-year period and the drought period modeled (Table Cl-2 in Appendix B of this RDEIR/SDEIS). The chloride concentration changes relative to the No Action Alternative (ELT) would be similar. Consequently, water exported into the SWP/CVP Export Service Areas would generally be of similar or better quality with regard to chloride relative to Existing Conditions and the No Action Alternative (ELT). Results of the modeling approach which utilized a EC-chloride relationship are consistent these results, and assessment of chloride using these modeling output results in the same conclusions as for the mass balance approach (Tables Cl-3, Cl-7, and Cl-9 in Appendix B of this RDEIR/SDEIS).

Commensurate with the reduced chloride concentrations in water exported to the SWP/CVP Export Service Area, reduced chloride loading in the lower San Joaquin River would be anticipated which would likely reduce chloride concentrations at Vernalis.

The effects of Alternative 4A in the LLT in the SWP/CVP Export Service Areas, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be very similar to effects in the ELT.

Maintenance of SWP and CVP facilities would not be expected to create new sources of chloride or contribute towards a substantial change in existing sources of chloride in the affected environment. Maintenance activities would not be expected to cause any substantial change in chloride such that any long-term water quality degradation would occur, thus, beneficial uses would not be adversely affected anywhere in the affected environment.

NEPA Effects: In summary, relative to the No Action Alternative (ELT and LLT), Alternative 4A would not result in substantially increased chloride concentrations upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Area on a long-term average basis that would result in adverse effects on the municipal and industrial water supply beneficial use, or any other beneficial use. Additional exceedance of the 150 mg/L and 250 mg/L objectives is not expected, and substantial long-term degradation is not expected that would result in adverse effects on the municipal and industrial water supply beneficial use, or any other beneficial use. Based on these findings, this effect is determined to not be adverse.

CEQA Conclusion: Chloride is not a constituent of concern in the Sacramento River watershed upstream of the Delta, thus river flow rate and reservoir storage reductions that would occur under Alternative 4A relative to Existing Conditions, would not be expected to result in a substantial adverse change in chloride levels. Additionally, relative to Existing Conditions, Alternative 4A would not result in reductions in river flow rates (i.e., less dilution) or increased chloride loading such that there would be any substantial increase in chloride concentrations upstream of the Delta in the San Joaquin River watershed.

Relative to Existing Conditions, Alternative 4A would not result in substantially increased chloride concentrations in the Delta on a long-term average basis that would result in adverse effects on the municipal and industrial water supply beneficial use. Additional exceedance of the 150 mg/L and 250 mg/L objectives is not expected, and substantial long-term degradation is not expected that would result in adverse effects on the municipal and industrial water supply beneficial use.

Chloride concentrations would be reduced under Alternative 4A in water exported from the Delta to the SWP/CVP Export Service Areas thus reflecting a potential improvement to chloride loading in the lower San Joaquin River.

Chloride is not a bioaccumulative constituent, thus any increased concentrations under the Alternative 4A would not result in substantial chloride bioaccumulation impacts on aquatic life or humans. Alternative 4A maintenance would not result in any substantial changes in chloride concentration upstream of the Delta or in the SWP/CVP Export Service Areas

Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-8: Effects on Chloride Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A would present no new direct sources of chloride to the affected environment, including areas Upstream of the Delta, within the Plan Area, and the SWP/CVP Export Service Areas. Consequently, as they pertain to chloride, implementation of these environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment. Moreover, some habitat restoration activities would occur on lands within the Delta currently used for irrigated agriculture. The potential reduction in irrigated lands within the Delta may result in reduced discharges of agricultural field drainage with elevated chloride concentrations, which would be considered an improvement relative to the No Action Alternative (ELT and LLT). Therefore, the effects on chloride from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: Implementation of the Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A would not present new or substantially changed sources of chloride to the affected environment upstream of the Delta, within Delta, or in the SWP/CVP Export Service Areas. Replacement of irrigated agricultural land uses in the Delta with habitat restoration may result in some reduction in discharge of agricultural field drainage with elevated chloride concentrations, thus resulting in improved water quality conditions. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-9: Effects on Dissolved Oxygen Resulting from Facilities Operations and Maintenance

As described in detail for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), DO levels are primarily affected by water temperature, flow velocity, turbulence, amounts of oxygen demanding substances present (e.g., ammonia, organics), and rates of photosynthesis (which is influenced by nutrient levels), respiration, and decomposition. Water temperature and salinity affect the maximum DO saturation level (i.e., the highest amount of oxygen the water can dissolve). Flow velocity affects the turbulence and re-aeration of the water (i.e., the rate at which oxygen from the atmosphere can be dissolved in water). High nutrient content can support aquatic plant and algae growth, which in turn generates oxygen through photosynthesis and consumes oxygen through respiration and decomposition.

As described for Alternative 4, amounts of oxygen demanding substances present (e.g., ammonia, organics) in the reservoirs and rivers upstream of the Delta, rates of photosynthesis (which is influenced by nutrient levels/loading), and respiration and decomposition of aquatic life is not expected to change sufficiently under Alternative 4A to substantially alter DO levels relative to Existing Conditions or the No Action Alternative (ELT and LLT). Further, the rivers upstream of the Delta are well oxygenated and experience periods of supersaturation (i.e., when DO level exceeds the saturation concentration). Because these are large, turbulent rivers, any reduced DO saturation level that would be caused by an increase in temperature under Alternative 4A would not be expected to cause DO levels to be outside of the range seen historically. Flow changes that would occur under Alternative 4A would not be expected to have substantial effects on river DO levels; likely, the changes would be immeasurable. This is because sufficient turbulence and interaction of river water with the atmosphere would continue to occur to maintain water saturation levels (due to these factors) at levels similar to that of Existing Conditions and the No Action Alternative (ELT and LLT).

Also as described for Alternative 4, salinity changes would generally have relatively minor effects on Delta DO levels. Further, the relative degree of tidal exchange of flows and turbulence, which contributes to exposure of Delta waters to the atmosphere for reaeration, would not be expected to substantially change relative to Existing Conditions or the No Action Alternative (ELT and LLT), such that these factors would reduce Delta DO levels below objectives or levels that protect beneficial uses. Similarly, increased temperature under Alternative 4A would generally have relatively minor effects on Delta DO levels, relative to Existing Conditions.

Similar to Alternative 4, flows in the San Joaquin River at Stockton were evaluated, and are shown in Figure DO-1 in Appendix B of this RDEIR/SDEIS. The figure shows that while flows would change somewhat, they would generally be within the range of flows seen under Existing Conditions and the No Action Alternative. Reports indicate that the aeration facility performs adequately under the range of flows from 250-1,000 cfs (ICF International 2010). Based on the above, the expected changes in flows in the San Joaquin River at Stockton are not expected to substantially move the point of minimum DO, and therefore the aeration facility would likely still be located appropriately to keep DO levels above Basin Plan objectives. Overall, assuming continued operation of the aerators, the alternative is not expected to have a substantial adverse effect on DO in the Deep Water Ship Channel. It is expected that DO levels in the Deep Water Ship Channel, which is CWA Section 303(d) listed as impaired due to low DO, would remain similar to those under Existing Conditions and the No Action Alternative (ELT and LLT) or improve as TMDL-required studies are completed and actions are implemented to improve DO levels. DO levels in other Clean Water Act Section 303(d)-listed waterways would not be expected to change relative to Existing Conditions or the No Action Alternative (ELT and LLT), as the circulation of flows, tidal flow exchange, and re-aeration would continue to occur.

In the SWP/CVP Export Service Areas, the primary factor that would affect DO in the conveyance channels and ultimately the receiving reservoirs would be changes in the levels of nutrients and oxygen-demanding substances and DO levels in the exported water. As described above and for Alternative 4, exported water could potentially be warmer and have higher salinity relative to Existing Conditions and the No Action Alternative (ELT and LLT). Nevertheless, because the biochemical oxygen demand of the exported water would not be expected to substantially differ from that under Existing Conditions or the No Action Alternative (ELT and LLT) due to water quality regulations, canal turbulence, exposure of the water to the atmosphere, and the algal communities that exist within the canals that would establish an equilibrium for DO levels within the canals. The same would occur in downstream reservoirs.

NEPA Effects: Because DO levels are not expected to change substantially relative to the No Action Alternative (ELT and LLT), the effects on DO from implementing Alternative 4A are determined to not be adverse.

CEQA Conclusion: The effects of Alternative 4A on DO levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). Reservoir storage reductions that would occur under Alternative 4A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in DO levels in the reservoirs, because oxygen sources (surface water aeration, aerated inflows, vertical mixing) would remain. Similarly, river flow rate reductions would not be expected to result in a substantial adverse change in DO levels in the rivers upstream of the Delta, given that mean monthly flows would remain within the ranges historically seen under Existing Conditions and the affected river are large and turbulent. Any reduced DO saturation level that may be caused by increased water temperature would not be expected to cause DO levels to be outside of the range seen historically. Finally, amounts of oxygen demanding substances and salinity would not be expected to change sufficiently to affect DO levels.

It is expected there would be no substantial change in Delta DO levels in response to a shift in the Delta source water percentages under this alternative or substantial degradation of these water bodies, with regard to DO. DO levels would be affected by nutrient loading, which the state regulates the discharges of, and this loading would not be expected to lower DO levels relative to Existing Conditions based on historical DO levels. Further, the anticipated changes in salinity would have relatively minor effects on DO levels, and tidal exchange, which contribute to the reaeration of Delta waters would not be expected to change substantially.

There is not expected to be substantial, if even measurable, changes in DO levels in the SWP/CVP Export Service Areas waters, relative to Existing Conditions, because the biochemical oxygen demand of the exported water would not be expected to substantially differ from that under Existing Conditions (due to water quality regulations), canal turbulence and exposure of the water to the atmosphere and the algal communities that exist within the canals that would establish an equilibrium for DO levels within the canals. The same would occur in downstream reservoirs.

Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would result in significant impacts on any beneficial uses within affected water bodies. Because no substantial changes in DO levels are expected, long-term water quality degradation would not be expected to occur, and, thus, beneficial uses would not be adversely affected. Various Delta waterways are CWA Section 303(d)-listed for low DO, but because no substantial decreases in DO levels would be expected, greater degradation and DO-related impairment of these areas would not be expected. Based on these findings, this impact would be less than significant. No mitigation is required.

Impact WQ-10: Effects on Dissolved Oxygen Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Environmental Commitments 3, 4, and 6–11 would involve habitat restoration actions. The increased habitat provided by these environmental commitments could contribute to an increased biochemical or sediment demand, through contribution of organic carbon and plants decaying, though the areal extent of the effects would be less than under Alternative 4, because less land would be converted under Alternative 4A. The areal extent of new habitat implemented for the Environmental Commitments would be small relative to the existing and No Action Alternative tidal area, and similar habitat exists currently in the Delta and is not identified as contributing to adverse DO conditions. Although additional DOC loading to the Delta may occur (see impact WQ-18), the amount expected would be minimal and only a fraction of the DOC is available to microorganisms that would consume oxygen as part of the decay and mineralization process. Since decreases in dissolved organic carbon are not typically observed in Delta waterways due to these processes, any increase in DOC is unlikely to contribute to adverse DO levels in the Delta.

CM14, which under Alternative 4 would fund improvements to the oxygen aeration facility in the Stockton Deep Water Ship Channel to meet TMDL objectives established by the Central Valley Water Board, would not be implemented under Alternative 4A. However, the existing aeration facility would continue to be operated to enhance DO levels in the channel. Thus, DO levels would be expected similar those under the No Action Alternative (ELT and LLT).

CM19, which under Alternative 4 would fund projects to contribute to reducing pollutant discharges in stormwater, also would not be implemented under Alternative 4A. Thus, the potential for reduced biochemical oxygen demand load described for Alternative 4 would not occur in the near-term and loading of these constituents and, thus DO levels, would be expected to be similar to that which would occur under the No Action Alternative (ELT and LLT).

The remaining environmental commitments would not affect DO levels because they are actions that do not affect the presence of oxygen-demanding substances.

Based on the above findings, the effects on DO from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: It is expected that DO levels in the Upstream of the Delta Region, in the Plan Area, or in the SWP/CVP Export Service Areas following implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A would not be substantially different from existing DO conditions, because these would contribute to a minimal, localized change in oxygen-demanding substances associated with habitat restoration, if at all. Therefore, these environmental commitments are not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would result in significant impacts on any beneficial uses within affected water bodies. Because no substantial changes in DO levels would be expected, long-term water quality degradation would not be expected, and, thus, beneficial uses would not be adversely affected. Various Delta waterways are CWA Section 303(d)-listed for low DO, but because no substantial decreases in DO levels would be expected, greater degradation and impairment of these areas would not be expected. Based on these findings, this impact would be less than significant. No mitigation is required.

Impact WQ-11: Effects on Electrical Conductivity Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 4A on EC levels in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). The extent of new urban growth would be less in the ELT, thus discharges of EC-elevating parameters in runoff and wastewater discharges to water bodies upstream of the Delta would be expected to be less than in the LLT. However, the state is regulating point source discharges of EC-related parameters and implementing a program to further decrease loading of EC-related parameters to tributaries. Based on these considerations, and those described in Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS, EC levels (highs, lows, typical conditions) in the

Sacramento River and its tributaries, the eastside tributaries, or their associated reservoirs upstream of the Delta would not be expected to be outside the ranges occurring under Existing Conditions.

For the San Joaquin River, increases in EC levels under Alternative 4A could occur, but would be slightly less than those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). This is because the effects of climate change and increase water demands on flows, which could effect dilution of high EC discharges, would be less in the ELT. The implementation of the adopted TMDL for the San Joaquin River at Vernalis and the ongoing development of the TMDL for the San Joaquin River upstream of Vernalis are expected to contribute to improved EC levels. Based on these considerations, substantial changes in EC levels in the San Joaquin River relative to Existing Conditions would not be expected to be of sufficient magnitude and geographic extent that would result in adverse effects on any beneficial uses, or substantially degrade the quality of these water bodies, with regard to EC.

Delta

As mentioned at the beginning of Section 4.3.4, the analysis of EC under Alternative 4A is based on modeling conducted for Alternative 4 in the ELT, which assumes implementation of Yolo Bypass Improvements and 25,000 acres of tidal natural communities restoration. Also, the modeling was originally performed assuming the Emmaton compliance point shifted to Threemile Slough. However, Yolo Bypass Improvements are not a component of Alternative 4A and the amount of tidal habitat restoration (i.e., Environmental Commitment 4) would be significantly less than that represented in the Alternative 4A modeling. Also, Alternative 4A does not include a change in compliance point from Emmaton to Threemile Slough. Furthermore, there are several factors related to the modeling approach that may result in modeling artifacts that show objective exceedance, when in reality no such exceedance would occur. The result of all of these factors is that the quantitative modeling results presented in this assessment is not entirely predictive of actual effects under Alternative 4A, and the results should be interpreted with caution. In order to understand the significance of all of these factors on the results, sensitivity analyses and other analyses were performed to evaluate the impact of maintaining the compliance point at Emmaton, the impact of having substantially less restoration than included in the modeling that was analyzed, and whether exceedances were indeed modeling artifacts or were potential alternative-related effects that may actually occur. For more information on these sensitivity analyses, refer to Chapter 8, Section 8.3.1.7, *Electrical Conductivity*, and Appendix 8H Attachment 1, both in Appendix A of the RDEIR/SDEIS.

In this assessment, the modeling results are described and then in most cases are qualified in light of findings from the sensitivity analyses. Conclusions thus represent assessment of the combination of the modeling results and sensitivity analysis findings.

The modeling of EC under Alternative 4A included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 4A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of operations-related water quality changes (i.e., water conveyance facilities). Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-12. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Relative to Existing Conditions and the No Action Alternative (ELT), initial review of modeling results indicated that Alternative 4A would potentially result in an increase in the number of days the Bay-Delta WQCP EC objectives would be exceeded in the Sacramento River at Emmaton, and San Joaquin River at San Andreas Landing and Prisoners Point (Table EC-1 in Appendix B of this RDEIR/SDEIS). Additionally, the modeling results indicated potentially large increases in EC in Suisun Marsh. However, to understand and interpret these results, considerations must be made regarding uncertainty in the modeling, differing assumptions between the modeling and the alternative, and sensitivity analyses. These objectives and locations are addressed in the context of these considerations in detail below. At all other locations, the level of exceedance and EC in the modeling results was approximately equivalent or lower than under Existing Conditions and the No Action Alternative (ELT).

Sacramento River at Emmaton

Modeling results indicated that the Emmaton EC objective would be exceeded more often under Alternative 4A than under Existing Conditions and the No Action Alternative (ELT), and that increases in EC could cause substantial water quality degradation in summer months of dry and critical water years. However, sensitivity analyses have shown that the level of effect would be less than presented in the modeling. Remaining increases in exceedance of the objective and degradation are expected to be addressed via real-time operations, including real time management of the north Delta and south Delta intakes, as well as Delta Cross Channel operation. Further discussion is provided below.

Modeling results indicated that the percent of days the Emmaton EC objective would be exceeded for the entire period modeled (1976–1991) would increase from 6% under Existing Conditions, or 13% under the No Action Alternative (ELT), to 17–18% and the percent of days out of compliance would increase from 11% under Existing Conditions, or 21% under the No Action Alternative (ELT), to 26–28%, depending on the operations scenario. Although these results are for modeling that was originally performed for Alternative 4 at the ELT assuming the Emmaton compliance point shifted to Threemile Slough, Alternative 4A does not include a change in compliance point from Emmaton to Threemile Slough.

Sensitivity analyses were performed that modeled Alternative 4 scenario H3 at the LLT with Emmaton as the compliance point. These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT, because the factors affecting salinity findings in the sensitivity analysis (e.g., modeling assumptions, physical hydrodynamic mechanisms) are similar between the ELT and LLT (see Appendix 8H Attachment 1, in Appendix A of the RDEIR/SDEIS). Assuming the compliance location at Emmaton instead of Threemile Slough in the CALSIM II modeling decreased exceedances at Emmaton from 28% to 15% under Alternative 4, operations scenario H3 at the LLT (see Appendix 8H, Attachment 1, of the RDEIR/SDEIS for more discussion of these sensitivity analyses), which would still be greater than Existing Conditions, but is very close to the No Action Alternative (ELT). Table 2 of Appendix 8H, Attachment 1, in Appendix A of the RDEIR/SDEIS indicates that most of these exceedances are a result of modeling artifacts, but some exceedances are due to deadpool conditions that occurred in 1977, 1981, and 1990 under Alternative 4 scenario H3 at the LLT and not under Existing Conditions. As discussed in Chapter 5, *Water Supply*, Section 5.3.1, *Methods for Analysis*, of this RDEIR/SDEIS, under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements, CALSIM II uses a series of operating rules to reach a solution that is a simplified version of the very complex decision processes that SWP and CVP operators would use in actual extreme conditions. Thus, it is unlikely that the Emmaton objective would actually be violated due to dead pool conditions. However, these results indicate that water supply could be either under greater stress or under stress earlier in the year, and EC levels at Emmaton and in the western Delta may increase as a result, leading to EC degradation and increased possibility of adverse effects to agricultural beneficial uses.

This is evidenced in the modeling results, which indicated that long-term monthly average EC levels at Emmaton would increase 1–22% for the entire period modeled (1976–1991) and 4–44% during the drought period modeled (1987–1991), relative to the No Action Alternative (ELT) (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS). The largest increases in EC would occur during the summer months of the drought period, and more generally in dry and critical water year types. During these periods, additional flow in the Sacramento River at Emmaton would reduce or eliminate increases in EC. It is expected that for May–September of dry and critical water years, less pumping from the north Delta intakes and greater reliance on south Delta intakes would allow for enough flow in the Sacramento River at Emmaton to reduce water quality degradation to levels closer to the No Action Alternative that would be considered not adverse.

San Joaquin River at San Andreas Landing

Alternative 4A is not expected to have adverse effects on EC in the San Joaquin River at San Andreas Landing, relative to Existing Conditions and the No Action Alternative (ELT). Modeling results estimated that the percent of days the San Andreas Landing EC objective would be exceeded would increase from 1% under Existing Conditions to 2% under operations scenario H3, and would decrease to 0% under operations scenario H4 (Table EC-1 in Appendix B of this RDEIR/SDEIS). The percent of days out of compliance with the EC objective for San Andreas Landing would increase from 1% under Existing Conditions to 4% for operations scenario H3, and would decrease to 0% under operations scenario H4. San Andreas Landing average EC would decrease 6% for the entire period modeled, but would increase 1–3% during the drought period modeled, relative to Existing Conditions (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS). Results relative to the No Action Alternative (ELT) were similar (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS). However, sensitivity analyses performed for Alternative 4 scenario H3 at the LLT indicate that many of these exceedances are likely modeling artifacts, and the small number of remaining exceedances would be small in magnitude, lasting only a few days, and could be addressed with real time operations of the SWP and CVP (see Chapter 8, Section 8.3.1.1, *Models Used and Their Linkages*, in Appendix A of this RDEIR/SDEIS for a description of real time operations of the SWP and CVP). These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT, because the factors affecting salinity findings in the sensitivity analysis (e.g., modeling assumptions, physical hydrodynamic mechanisms) are similar between the ELT and LLT (see Appendix 8H Attachment 1, in Appendix A of the RDEIR/SDEIS).

San Joaquin River at Prisoners Point

Modeling results indicated that the EC objective that applies between the San Joaquin River at Jersey Point and Prisoners Point would be exceeded at Prisoners Point more often under Alternative 4A than under Existing Conditions and the No Action Alternative (ELT). However, modeling results without restoration areas would be expected to show a lesser effect, and remaining exceedances are expected to be able to be addressed via real-time operations, including real time management of the north Delta and south Delta intakes, as well as Head of Old River Barrier management. Further discussion is provided below.

Modeling results estimated that the percent of days the Prisoners Point EC objective would be exceeded would increase from 6% under Existing Conditions, or 1% under the No Action Alternative (ELT), to 17–20% and the percent of days out of compliance with the EC objective would increase from 10% under Existing Conditions, or 1% under the No Action Alternative (ELT), to 20–23%, depending on the operations scenario (Table EC-1 in Appendix B of this RDEIR/SDEIS). The magnitude of the exceedances is estimated to be very small—the objective is 440 µmhos/cm, and the EC during times of exceedance was generally between 440 and 550 µmhos/cm. The exceedances generally occurred in drier water years, when flows are lower. During these times, the EC in the San Joaquin River at Vernalis is greater than in the Sacramento River entering the Delta, and is high enough on its own to cause an exceedance.

There are two main drivers of the increase in exceedances under the alternative: an increase in San Joaquin River flow at Prisoners Point during April and May under the alternative, relative to Existing Conditions and the No Action Alternative (ELT), and a reduction in the amount of Sacramento River water moving past Prisoners Point under the alternative. The result is increased San Joaquin River water at Prisoners Point, and a reduction in the dilution that the Sacramento River provides the higher EC San Joaquin River. The increase in San Joaquin River flow at Prisoners Point is due to a reduction in pumping from the south Delta under the alternative, as well as due to the presence of the Head of Old River Barrier, which increases flow in the San Joaquin River downstream of Old River by preventing flow from entering Old River. The reduction in Sacramento River water influence is due to less pumping at the south Delta pumping plants (i.e., greater pumping draws more Sacramento River water through the Delta).

Sensitivity analyses conducted for Alternative 4 scenario H3 at the LLT indicated that removing all tidal restoration areas (such as is largely the case in Alternative 4A at the ELT) would reduce the number of exceedances by about 9 percentage points, but there would still be more exceedances than under Existing Conditions or the No Action Alternative. Sensitivity analyses also indicated that if the Head of Old River Barrier was open in April and May, exceedances would be reduced by about 5 percentage points. Both of these analyses also showed lower EC during April and May, including during times when modeling showed the objective to be exceeded. These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT. Results of the sensitivity analyses indicate that the exceedances are partially a function of the restoration that was assumed in the Alternative 4A modeling, but partly due also to operations of the alternative itself, due to Head of Old River Barrier assumptions and south Delta export differences (see Appendix 8H, Attachment 1, in Appendix A of the RDEIR/SDEIS for more discussion of these sensitivity analyses). Appendix 8H, Attachment 2, in Appendix A of the RDEIS/SDEIS contains a more detailed assessment of the likelihood of exceedances estimated via modeling for Alternatives 1–9 impacting aquatic life beneficial uses. Specifically, Appendix 8H, Attachment 2, in Appendix A of the RDEIR/SDEIS discusses whether these exceedances might have indirect effects on striped bass spawning in the Delta, and concludes that the high level of uncertainty precludes making a definitive determination for those alternatives. However, based on the sensitivity analyses conducted, modeling of Alternative 4A that did not contain restoration areas would likely show a lesser level of effects than presented herein (using the Alternative 4 ELT modeling), both in terms of frequency and magnitude of exceedance. Additionally, by adaptively managing the Head of Old River Barrier and the fraction of south Delta versus north Delta diversions, EC levels at Prisoners Point would likely be decreased to a level that would not adversely affect aquatic life beneficial uses.

Suisun Marsh

For Suisun Marsh October–May is the period when Bay-Delta WQCP EC objectives for protection of fish and wildlife apply. Modeling results indicate that average EC for the entire period modeled would increase in the Sacramento River at Collinsville during the months of March through May relative to Existing Conditions, by 0.1–0.2 mS/cm (Table EC-3 in Appendix B of this RDEIR/SDEIS). In Montezuma Slough at National Steel, average EC levels would increase in December through March by 0.1–0.4 mS/cm (Table EC-4 in Appendix B of this RDEIR/SDEIS). The most substantial EC increase would occur in Montezuma Slough near Beldon Landing, with long-term average EC levels increasing by 1.1–5.3 mS/cm, depending on the month and operations scenario, at least doubling during some months the long-term average EC relative to Existing Conditions (Table EC-5 in Appendix B of this RDEIR/SDEIS). Sunrise Duck Club and Volanti Slough also would have long-term average EC increases during October–May ranging 0.7–3.1 mS/cm (Tables EC-6 and EC-7 in Appendix B of this RDEIR/SDEIS). Modeled long-term average EC increases in Suisun Marsh under Alternative 4A relative to the No Action Alternative (ELT) are similar to the increases relative to Existing Conditions.

However, modeling used in the assessment of Alternative 4A assumed no operation of the Montezuma Slough Salinity Control Gates, but the project description assumes continued operation of the Salinity Control Gates, consistent with assumptions included in the No Action Alternative. A sensitivity analysis modeling run conducted for Alternative 4 scenario H3 at the LLT with the gates operational consistent with the No Action Alternative resulted in substantially lower EC levels than indicated in the original Alternative 4 modeling results discussed above, but EC levels were still somewhat higher than EC levels under Existing Conditions and the No Action Alternative for several locations and months. Another modeling run with the gates operational and restoration areas removed resulted in EC levels nearly equivalent to Existing Conditions and the No Action Alternative (see Appendix 8H, Attachment 1, of the Draft EIR/EIS for more information on these sensitivity analyses). Since Alternative 4A at the ELT includes operation of the gates, and includes very little tidal restoration areas, it is anticipated that EC increases in Suisun Marsh predicted via the modeling would not occur, and that EC in Suisun Marsh under Alternative 4A would be very similar to Existing Conditions and No Action Alternative (ELT). Depending on where tidal restoration areas assumed to be included in the No Action Alternative are located, EC under Alternative 4A could be less than under the No Action Alternative (ELT). For these reasons, any changes in EC in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

SWP/CVP Export Service Areas

Under Alternative 4A, at the Banks pumping plant, there would be no exceedance of the Bay-Delta WQCP's 1,000 µmhos/cm EC objective for the entire period modeled under operations scenario H4 (Table EC-2 in Appendix B of this RDEIR/SDEIS). However, under operations scenario H3, the frequency of exceedance of the EC objective would be 1% for the entire period modeled and 2% for the drought period modeled. This differs from Alternative 4, under which there would be no exceedance of the EC objective under either operations scenario. Relative to Existing Conditions, average EC levels under Alternative 4A would decrease 25–28% for the entire period modeled and 21–27% during the drought period modeled, depending on the operations scenario. Relative to the No Action Alternative (ELT), average EC levels would similarly decrease, by 21–25% for the entire period modeled and 18–25% during the drought period modeled (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS).

At the Jones pumping plant, there would be no exceedance of the Bay-Delta WQCP s 1,000 µmhos/cm EC objective for the entire period modeled under operations scenario H3 (Table EC-2 in Appendix B of this RDEIR/SDEIS). However, under operations scenario H4, the frequency of exceedance of the EC objective would be 1% for the entire period modeled and 0% for the drought period modeled. This differs from Alternative 4, under which there would be no exceedance of the EC objective under either operations scenario. Relative to Existing Conditions, average EC levels under Alternative 4A would decrease 25% for the entire period modeled and 22–23% during the drought period modeled, depending on the operations scenario. Relative to the No Action Alternative (ELT), average EC levels would similarly decrease, by 22% for the entire period modeled and 19–20% during the drought period modeled, depending on the operations scenario (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS).

Based on the decreases in long-term average EC levels that would occur at the Banks and Jones pumping plants, Alternative 4A would not cause degradation of water quality with respect to EC in the SWP/CVP Export Service Areas rather, Alternative 4A would improve long-term average EC conditions in the SWP/CVP Export Service Areas.

Commensurate with the EC decrease in exported waters, an improvement in lower San Joaquin River average EC levels would be expected since EC in the lower San Joaquin River is, in part, related to irrigation water deliveries from the Delta. While the magnitude of this expected lower San Joaquin River improvement in EC is difficult to predict, the relative decrease in overall loading of EC-elevating constituents to the Export Service Areas would likely alleviate or lessen any expected increase in EC at Vernalis related to decreased annual average San Joaquin River flows.

The export area of the Delta is listed on the state's CWA Section 303(d) list as impaired due to elevated EC Alternative 4A would result in lower average EC levels relative to Existing Conditions and the No Action Alternative (ELT) and, thus, would not contribute to additional beneficial use impairment related to elevated EC in the SWP/CVP Export Service Areas waters.

NEPA Effects: In summary, based on the results of the modeling and sensitivity analyses conducted, it is unlikely that there would be increased frequency of exceedance of agricultural EC objectives in the western, interior, or southern Delta. However, modeling results indicate that there could be increased long-term and drought period average EC levels during the summer months that would occur in the western Delta (i.e., in the Sacramento River at Emmaton) under Alternative 4A relative to the No Action Alternative (ELT), that could contribute to adverse effects on the agricultural beneficial uses. In addition, the increased frequency of exceedance of the San Joaquin River at Prisoners Point EC objective could contribute to adverse effects on fish and wildlife beneficial uses (specifically, indirect adverse effects on striped bass spawning), though there is a high degree of uncertainty associated with this impact. Suisun Marsh is CWA Section 303(d) listed as impaired due to elevated EC, but EC levels are not expected to change substantially under Alternative 4A, relative to the No Action Alternative (ELT), and thus it is not expected that they would contribute to additional beneficial use impairment. The increases in EC in the Sacramento River at Emmaton, particularly during summer months of dry and critical water years, and the additional exceedances of water quality objectives in the San Joaquin River at Prisoners Point constitute an adverse effect on water quality. Mitigation Measure WQ-11 would be available to reduce these effects.

CEQA Conclusion: River flow rate and reservoir storage reductions that would occur under Alternative 4A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in EC levels in the reservoirs and rivers upstream of the Delta, given that: changes in the quality of watershed runoff and reservoir inflows would not be expected to occur in the future; the state's regulation of point-source discharge effects on Delta salinity-elevating parameters and the expected further regulation as salt management plans are developed; the salt-related TMDLs adopted and being developed for the San Joaquin River; and the expected improvement in lower San Joaquin River average EC levels commensurate with the lower EC of the irrigation water deliveries from the Delta.

Relative to Existing Conditions, Alternative 4A would not result in any substantial increases in long-term average EC levels in the SWP/CVP Export Service Areas, and exceedance of the Bay-Delta WQCP EC objective would be infrequent. Average EC levels for the entire period modeled would decrease at both the Banks and Jones pumping plants and, thus, this alternative would not contribute to additional beneficial use impairment related to elevated EC in the SWP/CVP Export Service Areas waters. Rather, this alternative would improve long-term EC levels in the SWP/CVP Export Service Areas, relative to Existing Conditions.

Further, relative to Existing Conditions, Alternative 4A would not result in substantial increases in long-term average EC in Suisun Marsh. Thus, EC levels in Suisun Marsh are not expected to further degrade existing EC levels and thus would not contribute additionally to adverse effects on the fish and wildlife beneficial uses. Because EC is not bioaccumulative, any changes in long-term average EC levels would not directly cause bioaccumulative problems in fish and wildlife. Suisun Marsh is CWA Section 303(d) listed as impaired due to elevated EC, but EC levels are not expected to change substantially under Alternative 4A, relative to Existing Conditions, and thus it is not expected that they would contribute to additional beneficial use impairment.

In the Plan Area, Alternative 4A is not expected to result in an increase in the frequency with which Bay-Delta WQCP EC objectives are exceeded, except for at the San Joaquin River at Prisoners Point (fish and wildlife objective; 11–14% increase). The increased frequency of exceedance of the fish and wildlife objective at Prisoners Point could contribute to adverse effects on aquatic life (specifically, indirect adverse effects on striped bass spawning), though there is a high degree of uncertainty associated with this impact. However, modeling of Alternative 4A that did not contain restoration areas would likely show a lesser level of effects than presented herein (using the Alternative 4 ELT modeling), both in terms of frequency and magnitude of exceedance. Additionally, by adaptively managing the Head of Old River Barrier and the fraction of south Delta versus north Delta diversions, EC levels at Prisoners Point would likely be decreased to a level that would not adversely affect aquatic life beneficial uses.

Average EC levels at Emmaton would increase by 4–5% during the drought period modeled. The largest monthly average increases in EC would occur during the summer months of the drought period, and more generally in dry and critical water year types. The increases in drought period average EC levels could cause substantial water quality degradation that would potentially contribute to adverse effects on the agricultural beneficial uses in the western Delta. The comparison to Existing Conditions reflects changes in EC due to both Alternative 4A operations and climate change/sea level rise. The adverse effects expected to occur at Emmaton would be due in part to the effects of climate change/sea level rise, and in part due to Alternative 4A operations. This is evidenced by the significant effects expected in the No Action Alternative (ELT) at Emmaton relative to Existing Conditions, as well as the fact that a lesser level of adverse effects is expected at

Emmaton under Alternative 4A relative to the No Action Alternative (ELT). During summer of dry and critical water years, additional flow in the Sacramento River at Emmaton would reduce or eliminate increases in EC. It is expected that for May–September of dry and critical water years, less pumping from the north Delta intakes and greater reliance on south Delta intakes would allow for enough flow in the Sacramento River at Emmaton to reduce water quality degradation to levels closer to the No Action Alternative that would not be expected to adversely affect beneficial uses. Because EC is not bioaccumulative, the increases in long-term average EC levels would not directly cause bioaccumulative problems in aquatic life or humans. The western Delta is CWA Section 303(d) listed for elevated EC and the increased EC degradation that could occur in the western Delta could make beneficial use impairment measurably worse.

Based on these findings, this impact in the Plan Area is considered to be significant. Implementation of Mitigation Measure WQ-11 would be expected to reduce these effects to a less-than-significant level.

Mitigation Measure WQ-11: Avoid or Minimize Reduced Water Quality Conditions

The implementation of mitigation actions shall be focused on avoiding or minimizing those incremental effects attributable to implementation of Alternative 4A operations only. Mitigation actions to avoid or minimize the incremental EC effects attributable to climate change/sea level rise are not required because these changed conditions would occur with or without implementation of Alternative 4A. The goal of specific actions is to reduce/avoid additional exceedances of Delta EC objectives and reduce long-term average concentration increases to levels that would not adversely affect beneficial uses within the Delta. Implementation of Mitigation Measure WQ-11 would be expected to reduce effects on EC to a less-than-significant level.

Mitigation Measure WQ-11a: Adaptively Manage Diversions at the North and South Delta Intakes to Reduce or Eliminate Water Quality Degradation in Western Delta

Modeling results for Alternative 4A indicated water quality degradation in the Sacramento River at Emmaton during May-September of dry and critical water year types, relative to the No Action Alternative (ELT). Additional flow in the Sacramento River at Emmaton would be expected to reduce EC levels under Alternative 4A to levels closer to the No Action Alternative (ELT) that would not be expected to adversely affect beneficial uses. By reducing diversions from the north Delta intakes during these periods (and consequently increasing diversions from the south Delta intakes), additional flow would be available in the Sacramento River to reduce water quality degradation with respect to EC. The BDCP proponents shall adaptively manage the split between north and south Delta diversions during May-September of dry and critical water years to limit EC in the Sacramento River at Emmaton to levels consistent with the No Action Alternative.

Mitigation Measure WQ-11b: Adaptively Manage Head of Old River Barrier and Diversions at the North and South Delta Intakes to Reduce or Eliminate Exceedances of the Bay-Delta WQCP Objective at Prisoners Point

Modeling results for Alternative 4A indicated additional exceedances of the Bay-Delta WQCP objective for protection of striped bass between Jersey Point and Prisoners Point at Prisoners Point. It is expected that by adaptively managing the Head of Old River Barrier and the fraction of south Delta versus north Delta diversions, exceedances of the EC objective at Prisoners Point could be avoided, and EC levels at Prisoners Point would be decreased to a level that would not adversely affect aquatic life beneficial uses. The BDCP proponents shall adaptively manage the Head of Old River Barrier and the split between north and south Delta diversions during April-May to avoid exceedances of the objective at Prisoners Point. These actions would not be required in critical water years, when the objective does not apply. The BDCP proponents will consult with CDFW, USFWS, and NMFS to ensure that such actions are warranted to avoid adverse impacts of salinity on striped bass spawning in the San Joaquin River, and to minimize adverse effects these mitigation actions may have on other species.

Impact WQ-12: Effects on Electrical Conductivity Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15 and 16.

NEPA Effects: The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would present no new direct sources of EC to the affected environment, including areas upstream of the Delta, within the Delta region, and in the SWP/CVP Export Service Areas. As they pertain to EC, implementation of these environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment. Moreover, some habitat restoration activities would occur on lands within the Delta currently used for irrigated agriculture. Such replacement or substitution of land use activity is not expected to result in new or increased sources of EC to the Delta and, in fact, could decrease EC through elimination of high EC agricultural runoff.

Environmental Commitment 4 would result in some tidal habitat restoration, however, the areal extent would be small relative to the existing and No Action Alternative tidal area and, thus not expected to appreciably affect the magnitude of daily tidal water exchange at the restoration areas or alter other hydrodynamic conditions in adjacent Delta channels that would result in measurable EC changes.

In summary, implementation of the environmental commitments would not be expected to adversely affect EC levels in the affected environment and thus would not adversely affect beneficial uses or substantially degrade water quality with regard to EC within the affected environment. Therefore, the effects on EC from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A would not present new or substantially changed sources of EC to the affected environment. Some environmental commitments may replace or substitute for existing irrigated agriculture in the Delta. This replacement or substitution is not expected to substantially increase or present new sources of EC, and could actually decrease EC loads to Delta waters, because agricultural drainage can be a source of elevated EC. Thus, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would have negligible, if any, adverse effects on EC levels throughout the affected environment and would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria that would result in adverse effects on any beneficial uses within affected water bodies. Further, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause significant long-term water quality degradation such that there would be greater risk of adverse effects on beneficial uses. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-13: Effects on Mercury Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of the Alternative 4A on mercury levels in surface waters upstream of the Delta relative to Existing Conditions and the No Action Alternative (ELT) would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). This is because factors which affect mercury concentrations in surface waters upstream of the Delta are similar under Alternatives 4 and 4A. The changes in flow in the Sacramento River under Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT) would not be of the magnitude of storm flows, in which substantial sediment-associated mercury is mobilized. Therefore, mercury loading should not be substantially different due to changes in flow. In addition, even though it may be flow-affected, total mercury concentrations remain well below criteria at upstream locations. Any negligible changes in mercury concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to mercury. Both waterborne methylmercury concentrations and largemouth bass fillet mercury concentrations are expected to remain above guidance levels at upstream of Delta locations, but would not change substantially because the anticipated changes in flow are not expected to substantially change mercury loading relative to Existing Conditions or the No Action Alternative (ELT).

The upstream of Delta areas in the north will benefit from the implementation of the Cache Creek, Sulfur Creek, Harley Gulch, and Clear Lake Mercury TMDLs and the American River methylmercury TMDL. These projects will target specific sources of mercury and methylation upstream of the Delta and could result in net improvement to Delta mercury loading in the future. The implementation of these projects could help to ensure that upstream of Delta environments will not be substantially degraded for water quality with respect to mercury or methylmercury.

In the LLT, the primary difference will be changes in flow regime due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 4A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-14. See Chapter 8, Section 8.3.1.3, *Plan Area,* in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

The effects of Alternative 4A on waterborne concentrations of mercury (Table Hg-1 in Appendix B of this RDEIR/SDEIS) and methylmercury (Table Hg-2 in Appendix B of this RDEIR/SDEIS), and fish tissue mercury concentrations for largemouth bass fillet (Tables Hg-3 through Hg-8 in Appendix B of this RDEIR/SDEIS) were evaluated for nine Delta locations.

Similar to Alternative 4, increases in long-term average mercury concentrations relative to Existing Conditions and the No Action Alternative (ELT) would be very small, 0.4 ng/L or less. Also, use of assimilative capacity for mercury relative to the 25 ng/L ecological threshold under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT), would be very low, approximately 2% or less for all Delta locations (Tables Hg-9 and Hg-10 in Appendix B of this RDEIR/SDEIS). These concentration changes and small changes in assimilative capacity for mercury are not expected to result in adverse (or positive) effects to beneficial uses.

Changes in methylmercury concentrations in water also are expected to be very small. The greatest annual average methylmercury concentration under Alternative 4A would be 0.166 ng/L for the San Joaquin River at Buckley Cove (all scenarios), for the drought period modeled, which would be slightly higher than Existing Conditions (0.161 ng/L) and slightly lower than the No Action Alternative (ELT) (0.168 ng/L) (Table Hg-2 in Appendix B of this RDEIR/SDEIS). All methylmercury concentrations in water were estimated to exceed the TMDL guidance objective of 0.06 ng/L under Existing Conditions and, therefore, no assimilative capacity exists.

Fish tissue estimates for largemouth bass fillet show small or no increases in mercury concentrations under Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT) based on long-term annual average concentrations for mercury at the Delta locations (Tables Hg-5 and Hg-8 in Appendix B of this RDEIR/SDEIS). Concentrations expected for scenario H3 with Equation 2 would increase by 10 percent to 12 percent in Mokelumne River (South Fork) at Staten Island, Franks Tract, Old River at Rock Slough, and San Joaquin River at Antioch relative to Existing Conditions in all years and by 11 percent to 12 percent at Staten Island and Rock Slough relative to the No Action Alternative (ELT) in all years (Table Hg-6 in Appendix B of this RDEIR/SDEIS). Concentrations expected for scenario H4 show decreases (11%) with Equation 2 in the North Bay Aqueduct at Barker Slough relative to Existing Conditions in all years and for the drought period modeled, and a decrease of 11 percent relative to the No Action Alternative (ELT) for the drought period (Table Hg-8 in Appendix B of this RDEIR/SDEIS). Because the increases are relatively small, and it is not evident that substantive increases are expected at numerous locations throughout the Delta, these changes are expected to be within the uncertainty inherent in the modeling approach, and would likely not be measurable in the environment. See Appendix 8I, *Mercury*, of the Draft EIR/EIS for a complete discussion of the uncertainty associated with the fish tissue estimates.

Briefly, the bioaccumulation models contain multiple sources of uncertainty associated with their development. These are related to: analytical variability; temporal and/or seasonal variability in Delta source water concentrations of methylmercury; interconversion of mercury species (i.e., the non-conservative nature of methylmercury as a modeled constituent); and limited sample size (both in number of fish and time span over which the measurements were made), among others. Although there is considerable uncertainty in the models used, the results serve as a reasonable approximations of a very complex process. Considering the uncertainty, small (i.e., < 20–25%) increases or decreases in modeled fish tissue mercury concentrations at a low number of Delta locations (i.e., 2–3) should be interpreted to be within the uncertainty of the overall approach, and not predictive of actual adverse effects. Larger increases, or increases evident throughout the Delta, can be interpreted as more reliable indicators of potential adverse effects.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

SWP/CVP Export Service Areas

The analysis of mercury and methylmercury in the SWP/CVP Export Service Areas was based on concentrations estimated at the Banks and Jones pumping plants. Both waterborne total and methylmercury concentrations for Alternative 4A, all scenarios, at the Jones and Banks pumping plants, would be lower than Existing Conditions and the No Action Alternative (ELT) (Tables Hg-1 and Hg-2 in Appendix B of this RDEIR/SDEIS). Therefore, mercury shows an increased assimilative capacity at these locations (Tables Hg-9 and Hg-10 in Appendix B of this RDEIR/SDEIS).

The largest improvements in bass tissue mercury concentrations and exceedance quotients ([EQs]; modeled tissue divided by TMDL guidance concentration) for Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT) at any location within the Delta are expected for the Banks and Jones pumping plant export pump locations. The greatest improvement in largemouth bass tissue mercury concentration are expected for scenario H4 at the Banks and Jones pumping plants (-14% and -16%, respectively) relative to the No Action Alternative (ELT) (Tables Hg-5 through Hg-8 in Appendix B of this RDEIR/SDEIS).

In the LLT, the primary difference will be changes in the Delta source water fractions to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

NEPA Effects: Based on the above discussion, Alternative 4A would not cause concentrations of mercury and methylmercury in water and fish tissue in the affected environment to be substantially different from the No Action Alternative (ELT and LLT) and, thus, would not cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. In comparison to the No Action Alternative (ELT and LLT), Alternative 4A would not be expected to increase levels of mercury by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of mercury in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Based on these findings, the effects of Alternative 4A on mercury in the affected environment are considered to be not adverse.

CEQA Conclusion: Under Alternative 4A, greater water demands and climate change would alter the magnitude and timing of reservoir releases and river flows upstream of the Delta in the Sacramento River watershed and east-side tributaries, relative to Existing Conditions. Concentrations of mercury and methylmercury upstream of the Delta would not be substantially different relative to Existing Conditions due to the lack of important relationships between mercury/methylmercury concentrations and flow for the major rivers.

Methylmercury concentrations exceed criteria at all locations in the Delta and no assimilative capacity exists. However, monthly average waterborne concentrations of total and methylmercury, over the period of record, under Alternative 4A would be very similar to Existing Conditions.

Similarly, estimates of fish tissue mercury concentrations show small differences would occur among sites for Alternative 4A as compared to Existing Conditions for Delta sites.

Assessment of effects of mercury in the SWP/CVP Export Service Areas were based on effects on mercury concentrations and fish tissue mercury concentrations at the Banks and Jones pumping plants. The Banks and Jones pumping plants are expected to show increased assimilative capacity for waterborne mercury and decreased fish tissue concentrations of mercury for Alternative 4A, all scenarios, as compared to Existing Conditions.

As such, Alternative 4A is expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. In comparison to Existing Conditions, Alternative 4A would not increase levels of mercury by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of mercury in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-14: Effects on Mercury Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: The potential types of effects on mercury resulting from implementation of the environmental commitments under Alternative 4A would be generally similar to those described under Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). However, the magnitude of effects on mercury and methylmercury at locations upstream of the Delta, in the Delta, and the SWP/CVP Export Service Areas related to habitat restoration would be considerably lower than described for Alternative 4. This is because the amount of habitat restoration to be implemented under Alternative 4A would be very low compared to the total proposed restoration area that would be implemented under Alternative 4. The small amount of habitat restoration to be implemented under Alternative 4A may occur on lands in the Delta formerly used for irrigated agriculture. Habitat restoration proposed under Alternative 4A has the potential to increase water residence times and increase accumulation of organic sediments that are known to enhance methylmercury bioaccumulation in biota in the vicinity of the restored habitat areas. Design of restoration sites would be guided by Environmental Commitment 12, which requires development of site-specific mercury management plans as restoration actions are implemented. The effectiveness of minimization and mitigation actions implemented according to the mercury management plans is not known at this time, although the potential to reduce methylmercury concentrations exists based on current research. Although Environmental Commitment 12 would be implemented with the goal to reduce this potential effect, there remain uncertainties related to site-specific restoration conditions and the potential for increases in methylmercury concentrations in the Delta in the vicinity of the restored areas. Therefore, the effect of Environmental Commitments 3, 4, 6–12, 15, and 16 on mercury and methylmercury is considered to be adverse.

CEQA Conclusion: There would be no substantial, long-term increase in mercury or methylmercury concentrations or loads in the rivers and reservoirs upstream of the Delta or the waters exported to the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 relative to Existing Conditions. However, in the Delta, due to the small amount of tidal restoration areas proposed, relative to Existing Conditions, uptake of mercury from water and/or methylation of inorganic mercury may increase in localized areas as part of the creation of new, marshy, shallow, or organic-rich restoration areas. Although not quantifiable, on a local level, increases in methylmercury concentrations may be measurable. Methylmercury is CWA Section 303(d)-listed within the affected environment, and therefore any potential measurable increase in methylmercury concentrations would make existing mercury-related impairment measurably worse. Because mercury is bioaccumulative, increases in water-borne mercury or methylmercury that could occur in some areas could bioaccumulate to somewhat greater levels in aquatic organisms and would, in turn, pose health risks to fish, wildlife, or humans. Design of restoration sites would be guided by Environmental Commitment 12, which requires development of site-specific mercury management plans as restoration actions are implemented. The effectiveness of minimization and mitigation actions implemented according to the mercury management plans is not known at this time, although the potential to reduce methylmercury concentrations exists based on current research. Although Environmental Commitment 12 would be implemented with the goal to reduce this potential effect, the uncertainties related to site specific restoration conditions and the potential for increases in methylmercury concentrations in the Delta result in this potential impact being considered significant because, as described above, any potential measurable increase in methylmercury concentrations would make existing mercury-related impairment measurably worse. No mitigation measures would be available until specific restoration actions are proposed. Therefore, this impact is considered significant and unavoidable.

Impact WQ-15: Effects on Nitrate Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), nitrate levels in the major rivers (Sacramento, Feather, American) are low, generally due to ample dilution available in the reservoirs and rivers relative to the magnitude of the point and non-point source discharges, and there is no correlation between historical water year average nitrate concentrations and water year average flow in the Sacramento River at Freeport. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions or the No Action Alternative (ELT), are expected to have negligible, if any, effects on average reservoir and river nitrate-N concentrations in the Sacramento River watershed upstream of the Delta.

In the San Joaquin River watershed, nitrate concentrations are higher than in the Sacramento River watershed, owing to use of nitrate based fertilizers throughout the lower watershed. The correlation between historical water year average nitrate concentrations and water year average flow in the San Joaquin River at Vernalis is a weak inverse relationship—that is, generally higher flows result in lower nitrate concentrations, while low flows result in higher nitrate concentrations (linear regression r^2=0.49; Figure 2 in Appendix 8J, *Nitrate*, of the Draft EIR/EIS). Under Alternative 4A, long-term average flows at Vernalis would decrease an estimated 1% relative to Existing Conditions and would remain virtually the same relative to the No Action Alternative (ELT). Given the relatively small decreases in flows and the weak correlation between nitrate and flows in the San Joaquin

River, it is expected that nitrate concentrations in the San Joaquin River would be minimally affected, if at all, by anticipated changes in flow rates under the No Action Alternative (ELT).

In the LLT, the primary difference will be changes in flow regime due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

Any negligible changes in nitrate concentrations that may occur under Alternative 4A in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies, with regard to nitrate.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-16. See section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Mass balance calculations indicate that under Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT), nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives (Table N-1 in Appendix B of this RDEIR/SDEIS). Although changes at specific Delta locations and for specific months may be substantial on a relative basis (Tables N-4 and N-5 in Appendix B of this RDEIR/SDEIS), the absolute concentration of nitrate in Delta waters would remain low (<1.4 mg/L-N) in relation to the drinking water MCL of 10 mg/L-N, as well as all other thresholds (see *Nitrate* within Chapter 8, Section 8.3.17, *Constituent-Specific Considerations Used in the Assessment*, in Appendix A of the RDEIR/SDEIS). Long-term average nitrate concentrations are anticipated to remain below 1 mg/L-N at all 11 Delta assessment locations except the San Joaquin River at Buckley Cove, where long-term average concentrations would be somewhat above 1 mg/L-N. Nevertheless, at this location, long-term average nitrate concentrations would be somewhat reduced under Alternative 4A relative to Existing Conditions, and slightly increased relative to the No Action Alternative (ELT). Overall, the difference in long-term average nitrate concentrations at various locations throughout the Delta under Alternative 4A compared to Alternative 4 would be negligible (i.e., <0.1 mg/L). As was similarly concluded for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), no additional exceedances of the MCL are anticipated at any location under Alternative 4A, regardless of operations scenario (Table N-1 in Appendix B of this RDEIR/SDEIS).

Use of assimilative capacity relative to the drinking water MCL of 10 mg/L-N under Alternative 4A would be low or negligible (i.e., <4%) in comparison to both Existing Conditions and the No Action Alternative (ELT), for all locations and months, for all modeled years (1976–1991), and for the drought period (1987–1991) (Tables N-6 and N-7 in Appendix B of this RDEIR/SDEIS). One exception is for Buckley Cove on the San Joaquin River in August, where use of assimilative capacity available during the drought period relative to the No Action Alternative (ELT) would range from 6.3% to 6.5%. Changes in use of assimilative capacity relative to Existing Conditions and the No

Action Alternative (ELT) under Alternative 4A would be approximately the same as described for Alternative 4.

As described for Alternative 4, actual nitrate concentrations would likely be higher than the modeling results indicate in certain locations under Alternative 4A. This is the mass balance modeling does not account for contributions from the SRWTP, which would be implementing nitrification/partial denitrification, or Delta wastewater treatment plant dischargers that practice nitrification, but not denitrification. However, as described for Alternative 4, any increases in nitrate concentrations that may occur at certain locations within the Delta under Alternative 4A would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the water quality at these locations, with regard to nitrate.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

SWP/CVP Export Service Areas

Assessment of effects of Alternative 4A on nitrate in the SWP/CVP Export Service Areas is based on effects on nitrate at the Banks and Jones pumping plants.

Results of the mass balance calculations indicate that the change in nitrate concentrations and use of assimilative capacity would be similar for the two operations scenarios of Alternative 4A (Tables N-4 through N-7 in Appendix B of this RDEIR/SDEIS). Relative to Existing Conditions and the No Action Alternative (ELT), nitrate concentrations at Banks and Jones pumping plants under Alternative 4A are anticipated to decrease on a long-term average annual basis (Tables N-4 and N-5 in Appendix B of this RDEIR/SDEIS). During the late summer, particularly in the drought period assessed, concentrations are expected to increase substantially on a relative basis (i.e., >50%), but the absolute value of these changes (i.e., in mg/L-N) would be small. Additionally, given the many factors that contribute to potential algal blooms in the SWP and CVP canals within the Export Service Areas, and the lack of studies that have shown a direct relationship between nutrient concentrations in the canals and reservoirs and problematic algal blooms in these water bodies, there is no basis to conclude that these small (i.e., generally <0.3 mg/L-N), seasonal increases in nitrate concentrations would increase the potential for problem algal blooms in the SWP/CVP Export Service Areas. Overall, the difference in long-term average nitrate concentrations at Banks and Jones pumping plants under Alternative 4A compared to Alternative 4 would be negligible (i.e., <0.1 mg/L). As was similarly concluded for Alternative 4, no additional exceedances of the MCL are anticipated under Alternative 4A (Table N-1 in Appendix B of this RDEIR/SDEIS). On a monthly average basis and on a long-term annual average basis, for all modeled years and for the drought period only, use of assimilative capacity available under Existing Conditions and the No Action Alternative (ELT), relative to the 10 mg/L-N MCL, would be negligible (<3%) for both Banks and Jones pumping plants (Tables N-4 and N-5 in Appendix B of this RDEIR/SDEIS). Use of assimilative capacity relative to Existing Conditions and the No Action Alternative (ELT) for Alternative 4A would be slightly less than expected to occur under Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS).

In the LLT, the primary difference will be changes in the Delta source water fractions to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

Any increases in nitrate concentrations that may occur in water exported via Banks and Jones pumping plants are not expected to result in adverse effects to beneficial uses or substantially degrade the quality of exported water, with regard to nitrate.

NEPA Effects: Modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to the No Action Alternative (ELT and LLT), are expected to have negligible, if any, effects on reservoir and river nitrate concentrations upstream of Freeport in the Sacramento River watershed and upstream of the Delta in the San Joaquin River watershed. In the Delta, nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives. No additional exceedances of the 10 mg/L-N MCL are anticipated at any Delta location, and use of assimilative capacity available under the No Action Alternative, relative to the drinking water MCL of 10 mg/L-N, would be low. Long-term average nitrate concentrations at Banks and Jones pumping plants are anticipated to differ negligibly relative to the No Action Alternative (ELT and LLT) and no additional exceedances of the 10 mg/L-N MCL are anticipated. Therefore, the effects on nitrate from implementing water conveyance facilities are considered to be not adverse.

CEQA Conclusion: Nitrate concentrations are generally low in the reservoirs and rivers of the watersheds, owing to substantial dilution available for point sources and the lack of substantial nonpoint sources of nitrate upstream of the SRWTP in the Sacramento River watershed, and in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers).Although higher in the San Joaquin River watershed, nitrate concentrations are not well-correlated with flow rates. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions, are expected to have negligible, if any, effects on reservoir and river nitrate concentrations upstream of Freeport in the Sacramento River watershed and upstream of the Delta in the San Joaquin River watershed.

In the Delta, results of the mass balance calculations indicate that under Alternative 4A, relative to Existing Conditions, nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives. No additional exceedances of the 10 mg/L-N MCL are anticipated at any location, and use of assimilative capacity available under Existing Conditions, relative to the drinking water MCL of 10 mg/L-N, would be low or negligible (i.e., <4%) for all for virtually all locations and months.

Assessment of effects of nitrate in the SWP/CVP Export Service Areas is based on effects on nitrate concentrations at the Banks and Jones pumping plants. Results of the mass balance calculations indicate that under Alternative 4A relative to Existing Conditions, long-term average nitrate concentrations at Banks and Jones pumping plants are anticipated to change negligibly. No additional exceedances of the 10 mg/L-N MCL are anticipated, and use of assimilative capacity available under Existing Conditions, relative to the MCL would be negligible (i.e., <3%) for both Banks and Jones pumping plants for all months.

Based on the above, there would be no substantial, long-term increase in nitrate concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the SWP/CVP Export Service Areas under Alternative 4A relative to Existing Conditions. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because nitrate concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Nitrate is not CWA Section 303(d) listed within the affected environment and thus any increases that may occur in some areas and months would not make any existing nitrate-related impairment measurably worse because no such impairments currently exist. Because nitrate is not bioaccumulative, increases that may occur in some areas and months would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-16: Effects on Nitrate Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Some habitat restoration activities included in Environmental Commitments 3, 4, and 6–11 would occur on lands within the Delta formerly used for agriculture. As discussed for Impact WQ-2, increased biota that may result in those areas may increase ammonia, which in turn may be converted to nitrate by established microbial communities. However, the areal extent of new habitat implemented for the Environmental Commitments would be less than the existing and No Action Alternative habitat areas, and similar habitat exists currently in the Delta and is not identified as contributing to adverse nitrate conditions. Thus, these land use changes would not be expected to substantially increase nitrate concentrations in the Delta. Implementation of Environmental Commitments 12, 15, and 16 do not include actions that would affect nitrate sources or loading. Based on these findings, the effects on nitrate from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: Land use changes that would occur from the environmental commitments are not expected to substantially increase nitrate concentrations, because the amount of area to be converted would be small relative to existing habitat, and existing habitats are not known for contributing to adverse nitrate conditions. Thus, it is expected that implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because nitrate concentrations are not expected to increase substantially due to these environmental commitments, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Nitrate is not CWA Section 303(d) listed within the affected environment and thus any minor increases that may occur in some areas would not make any existing nitrate-related impairment measurably worse because no such impairments currently exist. Because nitrate is not bioaccumulative, minor increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-17: Effects on Dissolved Organic Carbon Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 4A on DOC concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 because factors affecting DOC concentrations (e.g., source and non-point source inputs) in these water bodies would be similar.

Moreover, long-term average flow and DOC levels in the Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated. Thus changes in system operations and resulting reservoir storage levels and river flows under Alternative 4A would not be expected to cause substantial long-term changes in DOC concentrations in the water bodies upstream of the Delta. Any changes in DOC levels in water bodies upstream of the Delta under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be of sufficient frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies.

Delta

Effects of water conveyance facilities on long-term average DOC concentrations under Alternative 4A in the Delta would be similar to the effects discussed for Alternative 4. To the extent that habitat restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. However, there would be less potential for increased DOC concentrations at western Delta locations associated with habitat restoration under Alternative 4A because very little would occur relative to Alternative 4. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-18. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Under Alternative 4A, the geographic extent of effects pertaining to long-term average DOC concentrations in the Delta would be similar to that described for Alternative 4, although the magnitude of predicted long-term change and relative frequency of concentration threshold exceedances would be lower. The effects of Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT) are discussed together because the direction and magnitude of predicted change are similar. Relative to the Existing Conditions and No Action Alternative (ELT), Alternative 4A would result in small increases in long-term average DOC concentrations for both the modeled 16-year period (1976–1991) and drought period (1987–1991) at several interior Delta locations (increases up to 0.3 mg/L at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, and Contra Costa Pumping Plant #1) (Table DOC-1 in Appendix B of this RDEIR/SDEIS). The increases in average DOC concentrations would correspond to more frequent concentration threshold exceedances, with the greatest change occurring at the Contra Costa Pumping Plant #1 locations exceeding the 3 mg/L (i.e., increase from 52% under Existing Conditions to 72% under Alternative 4A for the modeled 16-year period). The change in frequency of threshold concentration exceedances at other assessment locations would be similar or lower.

While Alternative 4A would lead to slightly higher long-term average DOC concentrations at some municipal water intakes and Delta interior locations, the predicted change would not be expected to adversely affect MUN beneficial uses, or any other beneficial use. As discussed for Alternative 4, substantial changes in ambient DOC concentrations would need to occur before significant changes in drinking water treatment plant design or operations are triggered. The increases in long-term average DOC concentrations estimated to occur at various Delta locations under Alternative 4A are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment for DOC removal above levels currently employed.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on DOC are expected to be similar to those described above.

Relative to Existing Conditions and the No Action Alternative (ELT and LLT), Alternative 4A would lead to predicted improvements in long-term average DOC concentrations at Barker Slough, as well as Banks and Jones pumping plants (discussed below).

SWP/CVP Export Service Areas

Under the Alternative 4A, long-term average DOC concentrations would decrease at Barker Slough (as much as 0.1–0.2 mg/L) and at both the Banks and Jones pumping plants (as much as 0.4 mg/L) relative to Existing Conditions and depending on operational scenario, and the reductions would be similar compared to No Action Alternative (ELT) (Table DOC-1 in Appendix B of this RDEIR/SDEIS). Decreases in long-term average DOC would result in generally lower exceedance frequencies for concentration thresholds, although the frequency of exceedances of the 3 mg/L threshold during the modeled drought period would increase at the Banks and Jones pumping plants (i.e., increase from 57% under Existing Conditions to 77% under Alternative 4A). Comparisons to the No Action Alternative (ELT) yield similar trends, but with slightly smaller magnitude drought period changes.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on DOC are expected to be similar to those described above.

Maintenance of SWP and CVP facilities under Alternative 4A would not be expected to create new sources of DOC or contribute towards a substantial change in existing sources of DOC in the affected area.

NEPA Effects: In summary, the operations and maintenance activities under Alternative 4A, relative to the No Action Alternative (ELT and LLT), would not cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas. The long-term average DOC concentrations at Banks and Jones pumping plants are predicted to decrease by about 0.4 mg/L, while long-term average DOC concentrations for some Delta interior locations are predicted to increase by as much as 0.3 mg/L. Regardless of operational scenario, the increase in long-term average DOC concentration that could occur within the Delta interior would not be of sufficient magnitude to adversely affect the MUN beneficial use, or any other beneficial uses, of Delta waters. Based on these findings, the effect of operations and maintenance activities on DOC under Alternative 4A is determined to be not adverse.

CEQA Conclusion: For the same reasons described for Alternative 4, the operations and maintenance activities under Alternative 4A, relative to the Existing Conditions, would not cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas. Any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in DOC levels upstream of the Delta. Moreover, long-term average flow and DOC at Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated; therefore, changes in river flows would not be expected to cause a substantial long-term change in DOC concentrations upstream of the Delta.

Relative to Existing Conditions, the Alternative 4A would result in relatively small increases (i.e., ≤0.3 mg/L) in long-term average DOC concentrations at some interior Delta locations. The predicted increases under the operational scenarios modeled would not substantially increase the frequency with which long-term average DOC concentrations exceeds 2, 3, or 4 mg/L. While the operational scenarios would lead to slightly higher long-term average DOC concentrations at the interior Delta locations and some municipal water intakes, the predicted changes would not be expected to adversely affect MUN beneficial uses, or any other beneficial use.

Relative to Existing Conditions, the Alternative 4A would result in reduced long-term average DOC concentrations at the Banks and Jones pumping plants and Barker Slough. However, Alternative 4A would result in slightly greater frequency of exceedance of the 3 mg/L DOC concentration threshold during the modeled drought period. Nevertheless, under any operational scenario, an overall improvement in DOC-related water quality would be predicted in the SWP/CVP Export Service Areas.

Based on the above, the operations and maintenance activities of Alternative 4A Scenarios H3–H4 would not result in any substantial change in long-term average DOC concentration. The increases in long-term average DOC concentration that could occur within the Delta would not be of sufficient magnitude to adversely affect the MUN beneficial use, or any other beneficial uses, of Delta waters or waters of the SWP/CVP Service Area. Because DOC is not bioaccumulative, the increases in long-term average DOC concentrations would not directly cause bioaccumulative problems in aquatic life or humans. Finally, DOC is not causing beneficial use impairments and thus is not CWA Section 303(d) listed for any water body within the affected environment. Because long-term average DOC concentrations are not expected to increase substantially, no long-term water quality degradation with respect to DOC is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-18: Effects on Dissolved Organic Carbon Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

The potential types of effects on DOC resulting from implementation of the environmental commitments under Alternative 4A would be generally similar to those described under Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). However, the magnitude of effects on DOC at locations upstream of the Delta, in the Delta, and the SWP/CVP export service areas would be considerably lower than described for Alternative 4.

As described for Alternative 4, Environmental Commitments 3, 9, 11, 12, 15, and 16 would present no major sources of DOC to the affected environment, including areas Upstream of the Delta, within the Plan Area, and the SWP/CVP Export Service Area that would adversely affect beneficial uses. Environmental Commitments 4, 6, 7, and 10 include habitat restoration activities known to be sources of DOC. However, the amount of new habitat restoration to be implemented would be very small compared to the areal extent of existing habitat and that proposed for the No Action Alternative. Based on the amount of habitat restoration proposed, DOC loading from these areas would be very low in these water bodies. Consequently, relative to the Existing Conditions and No Action Alternative (ELT and LLT), the potential DOC loading to the Delta would be minimal, and thus not contribute substantially to the amounts of DOC in raw drinking water supplies.

NEPA Effects: Relative to existing habitat and that to be developed under the No Action Alternative (ELT and LLT), the area of new habitat restoration implemented for the environmental commitments would be very small. Implementation of non-habitat restoration environmental commitments would not be expected to have substantial, if even measurable, effect on DOC concentrations upstream of the Delta, within the Delta, and in the SWP/CVP Export Service Areas, because they would present no major sources of DOC to the affected environment. Consequently, any increases in average DOC levels in the affected environment are not expected to be of sufficient frequency, magnitude and geographic extent that would adversely affect the MUN beneficial use, or any other beneficial uses, of the affected environment, nor would potential increases substantially degrade water quality with regard to DOC. Based on these findings, the effect of the environmental commitments on DOC is determined to be not adverse.

CEQA Conclusion: Implementation of habitat restoration environmental commitments is not expected to cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas, relative to the Existing Conditions, because the land area proposed for restoration would be relatively small compared to existing land area and sources of DOC. Implementation of other environmental commitments also would not be expected to have substantial, if even measurable, effect on DOC concentrations upstream of the Delta, within the Delta, and in the SWP/CVP Export Service Areas, because they would present no major sources of DOC to the affected environment. Consequently, increases in average DOC levels in the affected environment are not expected to be of sufficient frequency, magnitude and geographic extent that would adversely affect the MUN beneficial use, or any other beneficial uses, of the affected environment, nor would potential increases substantially degrade water quality with regard to DOC. Furthermore, DOC is not bioaccumulative, therefore changes in DOC concentrations would not cause bioaccumulative problems in aquatic life or humans. Finally, DOC is not causing beneficial use impairments and thus is not CWA Section 303(d) listed for any water body within the affected environment. Because long-term average DOC concentrations are not expected to increase substantially, no long-term water quality degradation with respect to DOC is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-19: Effects on Pathogens Resulting from Facilities Operations and Maintenance

The effects of operation of the water conveyance facilities under Alternative 4A on pathogen levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). As described for Alternative 4, pathogen concentrations in the Sacramento and San Joaquin Rivers have a minimal relationship to flow rate in these rivers. Further, urban runoff contributions during the dry season would be expected to be a relatively small fraction of the rivers' total flow rates. During wet weather events, when urban runoff contributions would be higher, the flows in the rivers also would be higher. Given the small magnitude of urban runoff contributions relative to the magnitude of river flows and that pathogen concentrations in the rivers have a minimal relationship to river flow rate, river flow rate and reservoir storage reductions that would occur under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be expected to result in a substantial adverse change in pathogen concentrations in the reservoirs and rivers upstream of the Delta.

The effects of Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be changes in the relative percentage of water throughout the Delta being comprised of various source waters (i.e., water from the Sacramento River, San Joaquin River, Bay water, eastside tributaries, and agricultural return flow), due to potential changes in inflows particularly from the Sacramento River watershed. However, as described for Alternative 4, it is expected there would be no substantial change in Delta pathogen concentrations in response to a shift in the Delta source water percentages under this alternative or substantial degradation of these water bodies, with regard to pathogens, because it is expected that pathogen sources in close proximity to Delta sites would have a greater influence on pathogen levels at the site, rather than the primary source(s) of water to the site. In-Delta potential pathogen sources, including water-based recreation, tidal habitat, wildlife, and livestock-related uses, would continue under this alternative. As such, there is not expected to be substantial, if even measurable, changes in pathogen concentrations in the SWP/CVP Export Service Area waters.

As such, Alternative 4A would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or U.S. EPA-recommended pathogen criteria would be exceeded in water bodies of the affected environment located upstream of the Delta or substantially degrade the quality of these water bodies, with regard to pathogens.

NEPA Effects: Because pathogen levels are expected to be minimally affected relative to the No Action Alternative (ELT and LLT), the effects on pathogens from implementing Alternative 4A are determined to be not adverse.

CEQA Conclusion: The effects of Alternative 4A on pathogen levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because the factors that would affect pathogen levels in the surface waters of these areas would be similar. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pathogen concentrations are not expected to increase substantially, no long-term water quality degradation for pathogens is expected to occur and, thus, no adverse effects on beneficial uses would occur. The San Joaquin River in the Stockton Deep Water Ship Channel is CWA Section 303(d) listed for pathogens. Because no measurable increase in Deep Water Ship Channel pathogen concentrations are expected to occur on a long-term basis, further degradation and impairment of this area is not expected to occur. Finally, pathogens are not bioaccumulative constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-20: Effects on Pathogens Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Environmental Commitments 3, 4, and 6–11 would involve habitat restoration actions. Tidal wetlands are known to be sources of coliforms originating from aquatic, terrestrial, and avian wildlife that inhabit these areas (Desmarais et al. 2001, Grant et al. 2001, Evanson and Ambrose 2006, Tetra Tech 2007). Specific locations of restoration areas for this alternative have not yet been established. However, most low-lying land suitable for restoration is unsuitable for livestock. Therefore, it is likely that the majority of land to be converted to wetlands would be crop-based agriculture or fallow/idle land. Because of a great deal of scientific uncertainty in the loading of coliforms from these various sources, the resulting change in coliform loading is uncertain, but it is anticipated that coliform loading to Delta waters would increase. Based on findings from the Pathogens Conceptual Model that pathogen concentrations are greatly influenced by the proximity to the source, this could result in localized increases in wildlife-related coliforms relative to the No Action Alternative (ELT and LLT). The geographic extent of the potential increases would be less than under Alternative 4, because less land would be converted under Alternative 4A. The Delta currently supports similar habitat types and, with the exception of the CWA Section 303(d) listing for the Stockton Deep Water Ship Channel, is not recognized as exhibiting pathogen concentrations that rise to the level of adversely affecting beneficial uses. As such, the potential increase in wildlife-related coliform concentrations due to tidal habitat creation is not expected to adversely affect beneficial uses.

The remaining environmental commitments would not be expected to affect pathogen levels, because they are actions that do not affect the presence of pathogen sources.

Based on these findings, the effects on pathogens from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: Based on findings from the Pathogens Conceptual Model that pathogen concentrations are greatly influenced by the proximity to the source, implementation of Environmental Commitments 3, 4, and 6–11 could result in localized increases in wildlife-related coliforms relative to Existing Conditions. The geographic extent of the increase would be less than under Alternative 4, because less land would be converted under Alternative 4A. The Delta currently supports similar habitat types and, with the exception of the CWA Section 303(d) listing for the Stockton Deep Water Ship Channel, is not recognized as exhibiting pathogen concentrations that rise to the level of adversely affecting beneficial uses. As such, the potential increase in wildlife-related coliform concentrations due to tidal habitat creation is not expected to adversely affect beneficial uses. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pathogen concentrations are not expected to increase substantially, no long-term water quality degradation for pathogens is expected to occur and, thus, no adverse effects on beneficial uses would occur. The San Joaquin River in the Stockton Deep Water Ship Channel is CWA Section 303(d) listed for pathogens. Because no measurable increase in Deep Water Ship Channel pathogen concentrations are expected to occur on a long-term basis, further degradation and impairment of this area is not expected to occur. Finally, pathogens are not bioaccumulative constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-21: Effects on Pesticide Concentrations Resulting from Facilities Operations and Maintenance

The effects of Alternative 4A on pesticide levels in surface waters upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT), would be similar to those expected to occur under Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because under Alternative 4A, the primary factor that would influence pesticide concentrations in surface waters upstream of the Delta—the effect of timing and magnitude of reservoir releases on dilution capacity—is expected to change by a similar degree. As shown in Tables P-1 through P-4 in Appendix B of this RDEIR/SDEIS, changes in average winter and summer flow rates, relative to Existing Conditions and the No Action Alternative (ELT), are expected to be similar to or less than changes in flow rates expected under Alternative 4 in the Sacramento River at Freeport, American River at Nimbus, Feather River at Thermalito and the San Joaquin River at Vernalis (shown in Tables 1–4 in Appendix 8L, *Pesticides*, of the Draft EIR/EIS). Similarly, the primary factor that would influence pesticide concentrations in surface waters of the Delta and in the SWP/CVP Export Service Areas (i.e., changes in San Joaquin River, Sacramento River and Delta Agriculture source water fractions at various Delta locations, including Banks and Jones pumping plants) is expected to change by a similar degree. As shown for the two operational scenarios of Alternative 4A (Figures B.4-23 through B.4-66 in Appendix B of this RDEIR/SDEIS), the percent change in monthly average source water fractions would be similar to changes expected under Alternative 4 (Figures 133–175 in Appendix 8D, *Source Water Fingerprinting Results*, of the Draft EIR/EIS).

It was concluded for Alternative 4, and thus for Alternative 4A based on similar flow changes, that the potential average summer flow reductions would not be of sufficient magnitude to substantially increase in-river pesticide concentrations or alter the long-term risk of pesticide-related effects on aquatic life beneficial uses upstream of the Delta. Greater long-term average flow reductions, and corresponding reductions in dilution/assimilative capacity, would be necessary before long-term risk of pesticide related effects on aquatic life beneficial uses would be adversely altered. Similarly, the modeled changes in the source water fractions of Sacramento River, San Joaquin River, and Delta agriculture water under Alternative 4A would not be of sufficient magnitude to substantially alter the long-term risk of pesticide-related toxicity to aquatic life, nor adversely affect other beneficial uses of the Delta. Based on the general observation that San Joaquin River, in comparison to the Sacramento River, is a greater contributor of organophosphate insecticides in terms of greater frequency of incidence and presence at concentrations exceeding water quality benchmarks, modeled increases in Sacramento River fraction at Banks and Jones would generally represent an improvement in export water quality respective to pesticides.

The flow changes in the LLT would be expected in the ranges of that described above for Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT), and that described for Alternative 4 relative to the No Action Alternative (LLT) in Chapter 8, Section 8.3.3.9, in Appendix A of this RDEIR/SDEIS. Thus, similar to above and Alternative 4, the flow changes that would occur in the LLT under Alternative 4A, relative to Existing Conditions and the No Action Alternative (LLT), would not be expected to result in changes in dilution of pesticides of sufficient magnitude to substantially alter the long-term risk of pesticide-related toxicity to aquatic life, nor adversely affect other beneficial uses upstream of the Delta, in the Delta, or the SWP/CVP Export Service Areas.

NEPA Effects: In summary, the changes in long-term average flows on the Sacramento, Feather, American, and San Joaquin Rivers under Alternative 4A relative to the No Action Alternative (ELT and LLT) would be of insufficient magnitude to substantially increase the long-term risk of pesticide-related water quality degradation and related toxicity to aquatic life in these water bodies upstream of the Delta. Similarly, changes in source water fractions to the Delta would be of insufficient magnitude to substantially alter the long-term risk of pesticide-related water quality degradation and related toxicity to aquatic life in the Delta or CVP/SWP Export Service Areas. Therefore, the effects on pesticides from the water conveyance facilities are determined not to be adverse.

CEQA Conclusion: Based on the discussion above, the effects of Alternative 4A on pesticide levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to or slightly less than those described for the Alternative 4. The considered operational scenarios of Alternative 4A would not result in any substantial change in long-term average pesticide concentration or result in substantial increase in the anticipated frequency with which long-term average pesticide concentrations would exceed aquatic life toxicity thresholds or other beneficial use effect thresholds upstream of the Delta, at the 11 assessment locations analyzed for the Delta, or the SWP/CVP service area. Numerous pesticides are currently used throughout the affected environment, and while some of these pesticides may be bioaccumulative, those present-use pesticides for which there is sufficient evidence for their presence in waters affected by SWP and CVP operations (i.e., diazinon, chlorpyrifos, diuron, and pyrethroids) are not considered bioaccumulative, and thus changes in their concentrations would not directly cause bioaccumulative problems in aquatic life or humans. Furthermore, while there are numerous CWA Section 303(d) listings throughout the affected environment that name pesticides as the cause for beneficial use impairment, the modeled changes in upstream river flows and Delta source water fractions under Scenarios H3–H4 would not be expected to make any of these beneficial use impairments measurably worse. Because long-term average pesticide concentrations are not expected to increase substantially, no long-term water quality degradation with respect to pesticides is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-22: Effects on Pesticide Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), Environmental Commitments 3, 4, and 6–11 could involve the conversion of active or fallow agricultural lands to natural landscapes, such as wetlands, grasslands, floodplains, and vernal pools. In the long-term, conversion of agricultural land to natural landscapes could possibly result in a limited reduction in pesticide use throughout the Delta. In the short-term, tidal and non-tidal wetland restoration over former agricultural lands may include the contamination of water with pesticide residues contained in the soils. Present use pesticides typically degrade fairly rapidly, and in such cases where pesticide containing soils are flooded, dissipation of those pesticides would be expected to occur rapidly. Environmental Commitments 12, 15, and 16 do not include actions that would affect pesticide sources or loading. Unlike under Alternative 4, *CM13 Invasive Aquatic Vegetation Control* and *CM19 Urban Stormwater Treatment* would not be implemented. Because of this, benefits to water quality from treatment measures that would reduce pesticide loading from urban land uses, as well as adverse impacts to water quality from application of herbicides directly to waters in the plan area that would occur under Alternative 4 would not occur under Alternative 4A.

NEPA Effects: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of pesticides, and the potential short-term loading from former agricultural lands would be expected to degrade and dissipate rapidly. Therefore, relative to the No Action Alternative (ELT and LLT), the effects on pesticides from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

CEQA Conclusion: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of pesticides, and the potential short-term loading from former agricultural lands would be expected to degrade and dissipate rapidly, such that pesticide levels would differ little from Existing Conditions. Therefore, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause substantial long-term increases in pesticide concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the SWP/CVP Export Service Areas. As such, these environmental commitments are not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pesticide concentrations are not expected to increase substantially, no long-term water quality degradation for pesticides is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term pesticide concentrations that may occur throughout the affected environment would not be expected to make any existing beneficial use impairments measurably worse. Environmental Commitments 3, 4, 6–12, 15, 16 do not include the use of pesticides known to be bioaccumulative in animals or humans, nor do the environmental commitments propose the use of any pesticide currently named in a CWA Section 303(d) listing of the affected environment. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-23: Effects on Phosphorus Concentrations Resulting from Facilities Operations and Maintenance

The effects of Alternative 4A on phosphorus concentrations in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because factors which affect phosphorus concentrations in surface waters of these areas are the same under Alternative 4 and Alternative 4A. As described for Alternative 4, phosphorus loading to waters upstream of the Delta is not anticipated to change, and because changes in flows do not necessarily result in changes in concentrations or loading of phosphorus to these water bodies, substantial changes in phosphorus concentration are not anticipated under Alternative 4A, relative to Existing Conditions or the No Action Alternative (ELT and LLT), upstream of the Delta. Phosphorus concentrations may increase during January through March at locations in the Delta where the source fraction of San Joaquin River water increases, due to the higher concentration of phosphorus in the San Joaquin River during these months compared to Sacramento River water or San Francisco Bay water. However, based on the DSM2 fingerprinting results (Figures B.4-1 through B.4-66 in Appendix B of this RDEIR/SDEIS), together with source water concentrations (in Figure 8-56 in Appendix A of the RDEIR/SDEIS), the magnitude of increases during these months is expected to be negligible to low (i.e., <0.02 mg/L) at all Delta locations relative to Existing Conditions and the No Action Alternative (ELT and LLT). Thus, phosphorus concentrations in the Delta and waters exported from Banks and Jones pumping plants to the SWP/CVP Export Service Areas are expected to be similar to Existing Conditions and the No Action Alternative (ELT and LLT).

NEPA Effects: In summary, operation of the water conveyance facilities would have little to no effect on phosphorus concentrations in water bodies upstream of the Delta, in the Plan Area, and the waters exported to the SWP/CVP Export Service Areas, relative to the No Action Alternative (ELT and LLT). Thus, effects of the water conveyance facilities on phosphorus are considered to be not adverse.

CEQA Conclusion: The effects of Alternative 4A on phosphorus levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the Alternative 4. There would be no substantial, long-term increase in phosphorus concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the CVP and SWP service areas under Alternative 4A relative to Existing Conditions. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because phosphorus concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Phosphorus is not CWA Section 303(d) listed within the affected environment and thus any minor increases that may occur in some areas would not make any existing phosphorus-related impairment measurably worse because no such impairments currently exist. Because phosphorus is not bioaccumulative, minor increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-24: Effects on Phosphorus Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS) Environmental Commitments 3, 4, and 6–11 would include activities that create additional aquatic habitat, which may affect phosphorus dynamics and speciation in localized areas where the restoration would occur, but would not contribute to additional phosphorus loading. Therefore, phosphorus concentrations are not expected to change substantially in the affected environment as a result of these restoration activities. Unlike under Alternative 4, *CM19 Urban Stormwater Treatment* would not be implemented under Alternative 4A. Because urban stormwater is a potential source of phosphorus in the affected environment, the slight decreases in phosphorus loading expected to occur as a result of implementation of CM19 under Alternative 4, relative to Existing Conditions and the No Action Alternative, would not occur under Alternative 4A. Environmental Commitments 12, 15, and 16 do not include actions that would affect phosphorus sources or loading.

NEPA Effects: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of phosphorus. Therefore, relative to the No Action Alternative (ELT and LLT), the effects on phosphorus from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of phosphorus. Therefore, there would be no substantial, long-term increase in phosphorus concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the waters exported to the SWP/CVP Export Service Areas due to implementation of these environmental commitments relative to Existing Conditions. Because phosphorus concentrations are not expected to increase substantially due to these environmental commitments, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Phosphorus is not CWA Section 303(d) listed within the affected environment and, thus, the environmental commitments would not make any existing phosphorus-related impairment measurably worse because no such impairments currently exist. Because phosphorus is not bioaccumulative, any increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-25: Effects on Selenium Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 4A on selenium concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), because factors affecting selenium concentrations in these water bodies would be similar. Substantial point sources of selenium do not exist upstream in the Sacramento River watershed, in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), or upstream of the Delta in the San Joaquin River watershed. Nonpoint sources of selenium within the watersheds of the Sacramento River and the eastern tributaries also are relatively low, resulting in generally low selenium concentrations in the reservoirs and rivers of those watersheds. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions or the No Action Alternative (ELT and LLT), are expected to have negligible, if any, effects on reservoir and river selenium concentrations upstream of Freeport in the Sacramento River watershed or in the eastern tributaries upstream of the Delta. Similarly, it is expected that selenium concentrations in the San Joaquin River would be minimally affected, if at all, by anticipated changes in flow rates under Alternative 4A, given the relatively small decreases in flows and the considerable variability in the relationship between selenium concentrations and flows in the San Joaquin River. Any negligible changes in selenium concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to selenium.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 4A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-26. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Alternative 4A would result in small changes in average selenium concentrations in water relative to Existing Conditions and No Action Alternative (ELT) at all modeled Delta assessment locations (Table Se-1 in Appendix B of this RDEIR/SDEIS). Long-term average concentrations at some interior and western Delta locations would increase by 0.01–0.04 µg/L for the entire period modeled (1976–1991), depending on operational scenario. These small increases in selenium concentrations in water would result in small reductions (4% or less) in available assimilative capacity for selenium, relative to USEPA's draft water quality criterion of 1.3 µg/L (Tables Se-8a and Se-8b in Appendix B of this RDEIR/SDEIS). The long-term average selenium concentrations in water under Alternative 4A (range 0.09–0.40 µg/L) would be similar to Existing Conditions (range 0.09–0.41 µg/L) and the No Action Alternative (ELT) (range 0.09–0.39 µg/L), and would be below the draft water quality criterion of 1.3 µg/L (Table Se-1 in Appendix B of this RDEIR/SDEIS). These changes would be nearly identical to those under Alternative 4.

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 4A would result in small changes (about 1% or less) in estimated selenium concentrations in most biota (whole-body fish, bird eggs [invertebrate diet or fish diet], and fish fillets) throughout the Delta, with little difference among locations (Tables Se-2a, Se-2b, Se-4a and Se-4b in Appendix B of this RDEIR/SDEIS). Level of Concern Exceedance Quotients (i.e., modeled tissue divided by Level of Concern benchmarks) for selenium concentrations in those biota for all years and for drought years are less than 1.0, indicating low probability of adverse effects. Similarly, Advisory Tissue Level Exceedance Quotients for selenium concentrations in fish fillets for all years and drought years are less than 1.0. Estimated selenium concentrations in sturgeon for the San Joaquin River at Antioch are predicted to increase by about 17 to 19 percent relative to Existing Conditions and to the No

Action Alternative (ELT) in all years (from about 4.7 to about 5.6 mg/kg dry weight [dw]), and those for sturgeon in the Sacramento River at Mallard Island are predicted to increase by about 12 percent in all years (from about 4.4 to 4.9 mg/kg dw) (Tables Se-5 and Se-6 in Appendix B of this RDEIR/SDEIS). Selenium concentrations in sturgeon during drought years are expected to increase by about 4 to 7 percent at those locations (Tables Se-5 and Se-6 in Appendix B of this RDEIR/SDEIS). Detection of small changes in whole-body sturgeon such as those estimated for the western Delta would require very large sample sizes because of the inherent variability in fish tissue selenium concentrations. Low Toxicity Threshold Exceedance Quotients for selenium concentrations in sturgeon in the western Delta would exceed 1.0 for drought years at both locations (as they do for Existing Conditions and the No Action Alternative (ELT) and for all years in the San Joaquin River at Antioch (where quotient increases from 0.94 to 1.1) (Table Se-7 in Appendix B of this RDEIR/SDEIS). The High Toxicity Threshold Quotient would be less than 1.0 at both locations for all years and drought years (Table Se-7 in Appendix B of this RDEIR/SDEIS).

The disparity between larger estimated changes for sturgeon and smaller changes for other biota is attributable largely to differences in modeling approaches, as described in Appendix 8M, *Selenium*, in Appendix A of this RDEIR/SDEIS. The model for most biota was calibrated to encompass the varying concentration-dependent uptake from waterborne selenium concentrations (expressed as the K_d, which is the ratio of selenium concentrations in particulates [as the lowest level of the food chain] relative to the waterborne concentration) that was exhibited in data for largemouth bass in 2000, 2005, and 2007 at various locations across the Delta. In contrast, the modeling for sturgeon could not be similarly calibrated at the two western Delta locations and used literature-derived uptake factors and trophic transfer factors for the estuary from Presser and Luoma (2013). As noted in Appendix 8M, there was a significant negative log-log relationship of K_d to waterborne selenium concentration that reflected the greater bioaccumulation rates for bass at low waterborne selenium than at higher concentrations. There was no difference in bass selenium concentrations in the Sacramento River at Rio Vista in comparison to the San Joaquin River at Vernalis in 2000, 2005, and 2007 [Foe 2010], despite a nearly 10-fold difference in waterborne selenium. Thus, there is more confidence in the site-specific modeling based on the Delta-wide model that was calibrated for bass data than in the estimates for sturgeon based on "fixed" K_ds for all years and for drought years without regard to waterborne selenium concentration at the two locations in different time periods.

Residence time of water in the Delta is expected to increase relative to Existing Conditions primarily as a result of habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass) that is assumed to occur under the No Action Alternative (ELT) separate from Alternative 4A. Although estimates of the residence time increases are not available for Alternative 4A, estimates for Alternative 4 Scenario H3 at the Late Long Term (presented in Table 8-60a in Section 8.3.1.7 of Appendix A in the *Microcystis* subsection) which contained 65,000 acres of tidal restoration are available, and is expected that residence time increases under Alternative 4A would be substantially less than identified for Alternative 4 in the table.

If increases in fish tissue or bird egg selenium were to occur as a result of increased residence time, the increases would likely be of concern only where fish tissues or bird eggs are already elevated in selenium to near or above thresholds of concern. That is, where biota concentrations are currently low and not approaching thresholds of concern (which, as discussed above, is the case throughout the Delta, except for sturgeon in the western Delta), changes in residence time alone would not be expected to cause them to then approach or exceed thresholds of concern. Thus, the most likely area in which biota tissues would be at levels high enough that additional bioaccumulation due to increased residence time from restoration areas would be a concern is the western Delta and Suisun

Bay for sturgeon. Based on the expected minor increases in residence time in the western Delta and Suisun Bay, any increases are not expected to be of sufficient magnitude to substantially affect selenium bioaccumulation.

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 4A would result in essentially no change in selenium concentrations throughout the Delta for most biota (about 1% or less), although larger increases in selenium concentrations are predicted for sturgeon in the western Delta. Concentrations of selenium in sturgeon would exceed only the lower benchmark, indicating a low potential for effects. The modeling of bioaccumulation for sturgeon is less calibrated to site-specific conditions than that for other biota, which was calibrated on a robust dataset for modeling of bioaccumulation in largemouth bass as a representative species for the Delta. Overall, Alternative 4A would not be expected to substantially increase the frequency with which applicable water quality criterion, or toxicity and level of concern benchmarks would be exceeded in the Delta (there being only a small increase for sturgeon relative to the low benchmark and no exceedance of the high benchmark) or substantially degrade the quality of water in the Delta, with regard to selenium. These changes would be similar to those described for Alternative 4.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on selenium are expected to be similar to those described above.

SWP/CVP Export Service Areas

Alternative 4 would result in small (0.05–0.09 µg/L) decreases in long-term average selenium concentrations in water at the Banks and Jones pumping plants, relative to Existing Conditions and the No Action Alternative (ELT), for the entire period modeled (Table Se-1 in Appendix B of this RDEIR/SDEIS). These decreases in long-term average selenium concentrations in water would result in increases in available assimilative capacity for selenium at these pumping plants, relative to the USEPA's draft water quality criterion of 1.3 µg/L (Tables Se-8a and Se-8b in Appendix B of this RDEIR/SDEIS). The long-term average selenium concentrations in water for Alternative 4A (range 0.16–0.19 µg/L) would be well below the draft water quality criterion of 1.3 µg/L (Table Se-1 in Appendix B of this RDEIR/SDEIS).

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 4A would result in small changes (about 1% or less) in estimated selenium concentrations in biota (whole-body fish, bird eggs [invertebrate diet], bird eggs [fish diet], and fish fillets) (Tables Se-4a and Se-4b in Appendix B of this RDEIR/SDEIS). Concentrations in biota would not exceed any selenium toxicity or level of concern benchmarks for Alternative 4A (Tables Se-4a and Se-4b in Appendix B of this RDEIR/SDEIS).

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on selenium are expected to be similar to those described above.

NEPA Effects: Relative to the No Action Alternative (ELT and LLT), Alternative 4A would result in essentially negligible changes in selenium concentrations in water upstream of the Delta. Similarly, there would be negligible changes in selenium water and most biota concentrations in the Delta, with no exceedances of benchmarks for biological effects. For sturgeon in the Delta, there would be only a small increase of threshold exceedance relative to the low benchmark for sturgeon and no exceedance of the high benchmark. At the Banks and Jones pumping plants, Alternative 4A would cause no increases in the frequency with which applicable benchmarks would be exceeded and would slightly improve the quality of water in selenium concentrations. Therefore, the effects on selenium (both as waterborne and as bioaccumulated in biota) from Alternative 4A are considered to be not adverse.

CEQA Conclusion: There are no substantial point sources of selenium in watersheds upstream of the Delta, and no substantial nonpoint sources of selenium in the watersheds of the Sacramento River and the eastern tributaries. Nonpoint sources in the San Joaquin Valley that contribute selenium to the Delta will be controlled through a TMDL developed by the Central Valley Water Board (2001) for the lower San Joaquin River, established limits for the Grassland Bypass Project, and Basin Plan objectives (Central Valley Water Board [2010d] and State Water Board [2010b, 2010c]) that are expected to result in decreasing discharges of selenium from the San Joaquin River to the Delta. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions, are expected to cause negligible changes in selenium concentrations in water. Any negligible changes in selenium concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to selenium.

Relative to Existing Conditions, modeling estimates indicate Alternative 4A would result in essentially no change in selenium concentrations in water or most biota throughout the Delta, with no exceedances of benchmarks for biological effects. The Low Toxicity Threshold Exceedance Quotient for selenium concentrations in sturgeon for all years in the San Joaquin River at Antioch would increase slightly, from 0.94 for Existing Conditions to 1.1 for Alternative 4A. Concentrations of selenium in sturgeon would exceed only the lower benchmark, indicating a low potential for effects. Overall, Alternative 4A would not be expected to substantially increase the frequency with which applicable benchmarks would be exceeded in the Delta (there being only a small increase for sturgeon exceedance relative to the low benchmark for sturgeon and no exceedance of the high benchmark) or substantially degrade the quality of water in the Delta, with regard to selenium.

Assessment of effects of selenium in the SWP/CVP Export Service Areas is based on effects on selenium concentrations at the Banks and Jones pumping plants. Relative to Existing Conditions, all Alternative 4A would cause no increases in the frequency with which applicable benchmarks would be exceeded, and would slightly improve the quality of water in selenium concentrations at the Banks and Jones pumping plants.

Based on the above, selenium concentrations that would occur in water under Alternative 4A would not cause additional exceedances of applicable state or federal numeric or narrative water quality objectives/criteria, or other relevant water quality effects thresholds identified for this assessment, by frequency, magnitude, and geographic extent that would result in adverse effects to one or more beneficial uses within affected water bodies. In comparison to Existing Conditions, water quality conditions under Alternative 4A would not increase levels of selenium by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of selenium in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Water quality conditions under these alternative scenarios with respect to selenium would not cause long-term degradation of water quality in the affected environment, and therefore would not result in use of available assimilative capacity such that exceedances of water quality objectives/criteria would be likely and would result in substantially increased risk for adverse effects to one or more beneficial uses. This alternative would not further degrade water quality by measurable levels, on a long-term basis, for selenium and, thus, cause the CWA Section 303(d)-listed impairment of beneficial use to be made discernibly worse. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-26: Effects on Selenium Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS) Environmental Commitments 12, 15, and 16 do not involve actions that would increase selenium loading or otherwise alter selenium concentrations or residence time such that there would be a change in selenium concentrations in water or biota. Further, with the possible exception of changes in Delta hydrodynamics resulting from habitat restoration, Environmental Commitments 3, 4, and 6–11 would not substantially increase selenium concentrations in the water bodies of the affected environment. Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics, and thus such effects of these restoration measures were included in the assessment of facilities operations and maintenance (see Impact WQ-25).

While the implementation of Environmental Commitment 4 would create shallow backwater areas that could result in local increased water residence times, the extent of these areas would be minimal relative to the area of the Delta, and environmental changes associated with their development are unlikely to be of magnitude that would measurably change selenium concentrations in water or biota, relative to Existing Conditions. Further, although water residence times associated restoration could increase, they are not expected to increase without bound, and selenium concentrations in the water column would not continue to build up and be recycled in sediments and organisms as may be the case within a closed water system. However, because increases in bioavailable selenium in habitat restoration areas are uncertain, proposed avoidance and minimization measures would require evaluating risks of selenium exposure at a project level for each restoration area, minimizing to the extent practicable potential risk of additional bioaccumulation, and monitoring selenium levels in fish and/or wildlife to establish whether, or to what extent, additional bioaccumulation is occurring. See Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS for a description of the environmental commitment project proponents are making with respect to selenium management; and Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP for additional detail on this avoidance and minimization measure (AMM27).

NEPA Effects: Environmental Commitments 3, 4, 6–12, 15, and 16 would not increase selenium loading, and the amount of restoration that would occur would be minimal relative to the area of the Delta and implemented such that any localized changes in residence time are unlikely to measurably change selenium concentrations in water or biota relative to the No Action Alternative (ELT and LLT), under which more restoration would occur. Therefore, the effects on selenium from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

CEQA Conclusion: Environmental Commitments 3, 4, 6–12, 15, and 16 would not increase selenium loading, and the amount of restoration that would occur would be minimal relative to the area of the Delta and implemented such that any localized changes in residence time are unlikely to measurably change selenium concentrations in water or biota relative to Existing Conditions. Therefore, it is expected that with implementation of these environmental commitments there would be no substantial, long-term increase in selenium concentrations in water in the rivers and reservoirs upstream of the Delta, water in the Delta, or the waters exported to the SWP/CVP Export Service Areas, relative to Existing Conditions. As such, these environmental commitments would not cause additional exceedances of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Given the factors discussed in the assessment above and for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), any increases in bioaccumulation rates from waterborne selenium that could occur in some areas as a result of increased water residence times would not be of sufficient magnitude and geographic extent that any portion of the Delta would be expected to have measurably higher body burdens of selenium in aquatic organisms, and therefore would not substantially increase risk for adverse effects to beneficial uses. Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause long-term degradation of water quality resulting in sufficient use of available assimilative capacity such that occasionally exceeding water quality objectives/criteria would be likely. Also, these environmental commitments would not result in substantially increased risk for adverse effects to any beneficial uses. Furthermore, although the Delta is a CWA Section 303(d)-listed water body for selenium, given the discussion in the assessment above, it is unlikely that restoration areas would result in measurable increases in selenium in fish tissues or bird eggs such that the beneficial use impairment would be made discernibly worse.

Because it is unlikely that substantial increases in selenium in fish tissues or bird eggs would occur such that effects on aquatic life beneficial uses would be anticipated, and because of the avoidance and minimization measures that are designed to further minimize and evaluate the risk of such increases (see Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP for more detail on AMM27) as well as the Selenium Management environmental commitment (see Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS this impact is considered less than significant. No mitigation is required.

Impact WQ-27: Effects on Trace Metal Concentrations Resulting from Facilities Operations and Maintenance

The effects of operation of the water conveyance facilities under Alternative 4A on trace metal concentrations in surface waters upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS).

Given the poor association of dissolved trace metal concentrations with flow, river flow rate and reservoir storage reductions that would occur under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be expected to result in a substantial adverse change in trace metal concentrations in the reservoirs and rivers upstream of the Delta.

In the Delta, for metals of primarily aquatic life concern (copper, cadmium, chromium, lead, nickel, silver, and zinc), average and 95th percentile trace metal concentrations of the primary source waters to the Delta are very similar, and very large changes in source water fraction would be necessary to effect a relatively small change in trace metal concentration at a particular Delta location. Moreover, average and 95th percentile trace metal concentrations for these primary source waters are all below their respective water quality criteria, including those that are hardness-based (see Tables 8-51 and 8-52 in Appendix A of this RDEIR/SDEIS). No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that the average and 95th percentile source water concentrations for copper, cadmium, chromium, led, nickel, silver, and zinc do not exceed their respective criteria, more frequent exceedances of criteria in the Delta would not occur. For metals of primarily human health and drinking water concern (arsenic, iron, manganese), average and 95th percentile concentrations are also very similar (see Tables 8–10 in Appendix 8N,*Trace Metals*, of the Draft EIR/EIS) and average concentrations are below human health criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that the average water concentrations for arsenic, iron, and manganese do not exceed water quality criteria, more frequent exceedances of drinking water criteria in the Delta would not be expected to occur.

Because Alternative 4A would not result in substantial increases in trace metal concentrations in the water exported from the Delta or diverted from the Sacramento River through the proposed conveyance facilities, there is not expected to be substantial changes in trace metal concentrations in the SWP/CVP Export Service Areas, relative to Existing Conditions or the No Action Alternative (ELT and LLT).

As such, Alternative 4A would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or CTR criteria would be exceeded in the water bodies of the affected environment or substantially degrade the quality of these water bodies, with regard to trace metals.

NEPA Effects: Alternative 4A would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or CTR criteria would be exceeded in the water bodies of the affected environment or substantially degrade the quality of these water bodies, with regard to trace metals, relative to the No Action Alternative (ELT and LLT)., Therefore, the effects on trace metals from implementing Alternative 4A are determined to not be adverse.

CEQA Conclusion: While Alternative 4A would alter the magnitude and timing of reservoir releases north, south and east of the Delta, this would have no substantial effect on the various watershed sources of trace metals. Moreover, long-term average flow and trace metals at Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated; therefore, changes in river flows would not be expected to cause a substantial long-term change in trace metal concentrations upstream of the Delta.

Average and 95th percentile trace metal concentrations are very similar across the primary source waters to the Delta. Given this similarity, very large changes in source water fraction would be necessary to effect a relatively small change in trace metal concentration at a particular Delta location. Moreover, average and 95th percentile trace metal concentrations for these primary source waters are all below their respective water quality criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that trace metals do not already exceed water quality criteria, more frequent exceedances of criteria in the Delta would not be expected to occur under Alternative 4A.

Because Alternative 4A is not expected to result in substantial changes in trace metal concentrations in Delta waters, which includes Banks and Jones pumping plants, effects on trace metal concentrations in the SWP/CVP Export Service Area are expected to be negligible.

As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because trace metal concentrations are not expected to increase substantially, no long-term water quality degradation for trace metals is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term trace metal concentrations that may occur in water bodies of the affected environment would not be expected to make any existing beneficial use impairments measurably worse. The trace metals discussed in this assessment are not considered bioaccumulative, and thus would not directly cause bioaccumulative problems in aquatic life or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-28: Effects on Trace Metal Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 present no new sources of trace metals to the affected environment, including areas upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas. CM19, which under Alternative 4 would fund projects to contribute to reducing pollutant discharges in urban stormwater, would not be implemented under Alternative 4A, thus the associated trace metal reduction described for Alternative 4 would not occur under this alternative. However, stormwater discharges would continue to be regulated by the state and contributions would be expected to be similar to Existing Conditions and the No Action Alternative (ELT and LLT). The remaining environmental commitments would not be expected to affect trace metal levels, because they are actions that do not affect the presence of trace metal sources. As they pertain to trace metals, implementation of these environmental commitments would not be expected to adversely affect beneficial uses of the affected environment or substantially degrade water quality with respect to trace metals.

NEPA Effects: Because Environmental Commitments 3, 4, 6–12, 15, and 16 present no new sources of trace metals to the affected environment, the effects on trace metal concentrations from implementing these environmental commitments are determined to be not adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause substantial long-term increase in trace metal concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the SWP/CVP Export Service Areas, because they present no new sources of trace metals to the affected environment. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because trace metal concentrations are not expected to increase substantially, no long-term water quality degradation for trace metals is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term trace metal concentrations that may occur throughout the affected environment would not be expected to make any existing beneficial use impairments measurably worse. The trace metals discussed in this assessment are not considered bioaccumulative, and thus would not directly cause bioaccumulative problems in aquatic life or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-29: Effects on TSS and Turbidity Resulting from Facilities Operations and Maintenance

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), the operation of the water conveyance facilities under Alternative 4A is expected to have a minimal effect on TSS and turbidity levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions and the No Action Alternative (ELT and LLT). This is because the factors that would affect TSS and turbidity levels in the surface waters of these areas would be the same. TSS concentrations and turbidity levels in rivers upstream of the Delta are affected primarily by: 1) TSS concentrations and turbidity levels of the water released from the upstream reservoirs, 2) erosion occurring within the river channel beds, which is affected by river flow velocity and bank protection, 3) TSS concentrations and turbidity levels of tributary inflows, point-source inputs, and nonpoint runoff as influenced by surrounding land uses; and 4) phytoplankton, zooplankton and other biological material in the water. Within the Delta, TSS concentrations and turbidity levels in Delta waters are affected by TSS concentrations and turbidity levels of inflows (and associated sediment load), as well as fluctuation in flows within the channels due to the tides, with sediments depositing as flow velocities and turbulence are low at periods of slack tide, and sediments becoming suspended when flow velocities and turbulence increase when tides are near the maximum. TSS and turbidity variations can also be attributed to phytoplankton, zooplankton and other biological material in the water. These factors would be similar under Alternative 4A and Alternative 4, are expected to be minimally different from Existing Conditions and the No Action Alternative (ELT and LLT). Because Alternative 4A is expected to have minimal effect on TSS concentrations and turbidity levels in Delta waters, including water exported at the south Delta pumps, relative to Existing Conditions or the No Action Alternative (ELT and LLT), Alternative 4A also is expected to have minimal effect on TSS concentrations and turbidity levels in the SWP/CVP Export Service Areas waters.

NEPA Effects: Because TSS concentrations and turbidity levels are expected to be minimally affected relative to the No Action Alternative (ELT and LLT), the effects on TSS and turbidity from implementing Alternative 4A are determined to not be adverse.

CEQA Conclusion: As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS) changes in river flow rate and reservoir storage that would occur under Alternative 4A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in TSS concentrations and turbidity levels in the reservoirs and rivers upstream of the Delta, given that suspended sediment concentrations are more affected by season than flow. Within the Delta, geomorphic changes associated with sediment transport and deposition are usually gradual, occurring over years, and high storm event inflows would not be substantially affected. Thus, it is expected that the TSS concentrations and turbidity levels in the affected channels would not be substantially different from the levels under Existing Conditions. There is not expected to be substantial, if even measurable, changes in TSS concentrations and turbidity levels in the SWP/CVP Export Service Areas waters under Alternative 4A, relative to Existing Conditions, because this alternative is not expected to result in substantial changes in TSS concentrations and turbidity levels at the south Delta export pumps, relative to Existing Conditions. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives where such objectives are not exceeded under Existing Conditions. Because TSS concentrations and turbidity levels are not expected to be substantially different, long-term water quality degradation is not expected, and, thus, beneficial uses are not expected to be adversely affected. Finally, TSS and turbidity are neither bioaccumulative nor CWA Section 303(d) listed constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-30: Effects on TSS and Turbidity Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

Environmental Commitments 3, 4, and 6–11 would involve habitat restoration actions. Creation of habitat and open water through implementation of these environmental commitments could affect Delta hydrodynamics and, thus, erosion and deposition potential in certain Delta channels, though the geographic extent of the effects would be substantially less than under Alternative 4, because less land would be converted under Alternative 4A. The magnitude of increases in TSS concentrations and turbidity levels in the affected channels due to higher potential of erosion cannot be readily quantified. The increases in TSS concentrations and turbidity levels in the affected channels could be substantial in localized areas, depending on how rapidly the channels equilibrate with the new tidal flux regime, after implementation of this alternative. However, geomorphic changes associated with sediment transport and deposition are usually gradual, occurring over years. Within the reconfigured channels there could be localized increases in TSS concentrations and turbidity levels, but within the greater Plan Area it is expected that the TSS concentrations and turbidity levels would not be substantially different from the levels under Existing Conditions or the No Action Alternative (ELT and LLT).

CM19, which under Alternative 4 would fund projects to contribute to reducing pollutant discharges in stormwater, would not be implemented under Alternative 4A, thus the associated TSS and turbidity reduction described for Alternative 4 would not occur under this alternative. Nevertheless, stormwater discharges would still be subject to the state's NPDES program requirements to implement control measures, which would contribute to controlling TSS and turbidity in discharges.

The remaining environmental commitments would not be expected to affect TSS concentrations and turbidity levels, because they are actions that do not affect the presence of TSS and turbidity sources.

NEPA Effects: Localized, temporary changes in TSS and turbidity could occur associated with the restoration actions of Environmental Commitments 3, 4, 6–12, 15, and 16. However, these changes would be gradual and not expected to substantially differ from No Action Alternative (ELT and LLT) conditions. Therefore, the effects on TSS and turbidity from implementing these environmental commitments are determined to be not adverse.

CEQA Conclusion: It is expected that the TSS concentrations and turbidity levels Upstream of the Delta, in the Plan Area, and the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not be substantially different relative to Existing Conditions, except within localized areas of the Delta modified through creation of habitat and open water. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives where such objectives are not exceeded under Existing Conditions. Because TSS concentrations and turbidity levels Upstream of the Delta, in the greater Plan Area, and in the SWP/CVP Export Service Areas are not expected to be substantially different, long-term water quality degradation is not expected relative to TSS and turbidity, and, thus, beneficial uses are not expected to be adversely affected. Finally, TSS and turbidity are neither bioaccumulative nor CWA Section 303(d) listed constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-31: Water Quality Effects Resulting from Construction-Related Activities for the Water Conveyance Facilities and Environmental Commitments

The potential construction-related water quality effects that would occur under Alternative 4A would be of a lower magnitude compared to the effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because the size and number of construction activities for some environmental commitments under Alternative 4A would be reduced, or not occur, compared to Alternative 4. The construction-related activities for the water conveyance facilities under Alternative 4A would be the same as described for Alternative 4. However, there would be substantially less area of in-water habitat restoration activities implemented under Alternative 4A compared to Alternative 4. Therefore, the amount of construction activity under Alternative 4A would be lower than described for Alternative 4, thus resulting in less potential for construction-related disturbances and contaminant discharges to surface waters.

The construction-related activities for Alternative 4A would be most extensive for the new water conveyance facilities. Construction of water conveyance facilities would involve vegetation removal, material storage and handling, excavation, overexcavation for facility foundations, surface grading, trenching, road construction, levee construction, construction site dewatering, soil stockpiling, reusable tunnel material (RTM) dewatering basin construction and storage operations, and other general facility construction activities (i.e., concrete, steel, carpentry, and other building trades) over approximately 7,500 acres during the course of constructing the facilities. Vegetation would be removed (via grubbing and clearing) and grading and other earthwork would be conducted at the intakes, pumping plants, the intermediate forebay, the Byron Tract Forebay, canal and gates between the Byron Tract Forebay tunnel shafts and the approach canal to the Banks Pumping Plant, borrow areas, RTM and spoil storage areas, setback and transition levees, sedimentation basins, solids handling facilities, transition structures, surge shafts and towers, substations, transmission line footings, access roads, concrete batch plants, fuel stations, bridge abutments, barge unloading facilities, and laydown areas. Construction of each intake would take nearly four years to complete.

Habitat restoration environmental commitments in the Delta, including restored tidal wetlands, floodplain, and related channel margin and off-channel habitats, also would involve substantial in-water construction-related activities in localized areas of the Delta. Other non-habitat restoration environmental commitments are not anticipated to involve construction activities that would result in substantial discharges of any constituents of concern.

NEPA Effects: Potential construction-related water quality effects may include discharges of turbidity/TSS due to the erosion of disturbed soils and associated sedimentation entering surface water bodies or other construction-related wastes (e.g., concrete, asphalt, cleaning agents, paint, and trash). Construction activities also may result in temporary or permanent changes in stormwater generation or drainage and runoff patterns (i.e., velocity, volume, and direction) that may cause or contribute to soil erosion and offsite sedimentation, such as creation of additional impervious surfaces (e.g., pavement, buildings, compacted soils), blockage or restriction of existing drainage channels, or general surface drainage changes from grading and excavation activity. Additionally, the use of heavy earthmoving equipment may result in spills and leakage of oils, gasoline, diesel fuel, and related petroleum contaminants used in the fueling and operation of such construction equipment.

Land surface grading and excavation activities, or exposure of disturbed sites immediately following construction and prior to stabilization, could result in rainfall- and stormwater-related soil erosion, runoff, and offsite sedimentation in surface water bodies. The initial runoff following construction, or return of seasonal rains to previously disturbed sites, can result in runoff with peak pollutant levels and is referred to as "first flush" storm events. Soil erosion and runoff can also result in increased concentrations and loading of organic matter, nutrients (nitrogen and phosphorus), and other contaminants contained in the soil such as trace metals, pesticides, or animal-related pathogens. Graded and exposed soils also can be compacted by heavy machinery, resulting in reduced infiltration of rainfall and runoff, thus increasing the rate of runoff (and hence contaminants) to downstream water bodies.

Construction activities also would be anticipated to involve the transport, handling, and use of a variety of hazardous substances and non-hazardous materials that may adversely affect water quality if discharged inadvertently to construction sites or directly to water bodies. Typical construction-related contaminants include petroleum products for refueling and maintenance of machinery (e.g., fuel, oils, solvents), concrete, paints and other coatings, cleaning agents, debris and trash, and human wastes. Construction activities also would involve large material storage and laydown areas, and occasional accidental spills of hazardous materials stored and used for construction may occur. Contaminants released or spilled on bare soil also may result in groundwater contamination. Dewatering operations may contain elevated levels of suspended sediment or other constituents that may cause water quality degradation.

The intensity of construction activity along with the fate and transport characteristics of the chemicals used, would largely determine the magnitude, duration, and frequency of construction-related discharges and resulting concentrations and degradation associated with the specific constituents of concern. The potential water quality concerns associated with the major categories of contaminants that might be discharged as a result of construction activity include the following.

- Suspended sediment: May increase turbidity (i.e., reduce water clarity) that can affect aquatic organisms and increase the costs and effort of removal in municipal/industrial water supplies. Downstream sedimentation can affect aquatic habitat, or cause a nuisance if it affects functions of agricultural or municipal intakes, or boat navigation.
- Organic matter: May contribute turbidity and oxygen demanding substances (i.e., reduce dissolved oxygen levels) that can affect aquatic organisms. Organic carbon may increase the potential for disinfection byproduct formation in municipal drinking water supplies.
- Nutrients: May contribute nitrogen, phosphorus, and other key nutrients that can contribute to nuisance biostimulation of algae and vascular aquatic plants, which may affect municipal water supplies, recreation, aquatic life, and aesthetics.
- Petroleum hydrocarbons: May contribute toxic compounds to aquatic life, and oily sheens may reduce oxygen/gas transfer in water, foul aquatic habitats, and reduce water quality for municipal supplies, recreation, and aesthetics.
- Trace constituents (metals, pesticides, synthetic organic compounds): Compounds in eroded soil or construction-related materials (e.g., paints, coatings, cleaning agents) may be toxic to aquatic life.
- Pathogens: Bacteria, viruses, and protozoans may affect aquatic life and increase human health risks via municipal water supplies, reduced recreational water quality, or contaminated shellfish beds.

- Other inorganic compounds: Construction-related materials can contain inorganic compounds such as acidic/basic materials which can change pH and may adversely affect aquatic life and habitats. Concrete contains lime which can increase pH levels, and drilling fluids may alter pH.

Some construction-related contaminants, such as PAHs that may be in some fuel and oil petroleum byproducts, may be bioaccumulative in aquatic and terrestrial organisms. Construction activities also may disturb areas where bioaccumulative constituents are present in the soil (e.g., mercury, selenium, organochlorine pesticides, PCBs, and dioxin/furan compounds), or may disturb soils that contain constituents included on the Section 303(d) lists of impaired water bodies in the affected environment. While the 303(d)-listed Delta channels impaired by mercury are widespread, impairment by selenium, pesticides, PCBs, and dioxin/furan compounds is more limited, and there are no 303(d) listings for PAH impairment. Bioaccumulation of constituents in the aquatic foodchain, and 303(d)-related impaired water bodies, arise as a result of long-term loading of a constituent or a pervasive and widespread source of constituent discharge (e.g., mercury).However, as a result of the generally localized disturbances, and intermittent and temporary nature of construction-related activities, construction would not be anticipated to result in contaminant discharges of substantial magnitude or duration to contribute to long-term bioaccumulation processes, or cause measureable long-term degradation such that existing 303(d) impairments would be made discernibly worse or TMDL actions to reduce loading would be adversely affected.

The environmental commitments for construction-related water quality protection would be specifically designed as a part of the final design, included in construction contracts as a required element, and would be implemented to avoid, prevent, and minimize the potential discharges of constituents of concern to water bodies and associated adverse water quality effects and comply with state water quality regulations. Additionally, temporary and permanent changes in stormwater drainage and runoff would be minimized and avoided through construction of new or modified drainage facilities, as described in the Chapter 3, *Description of Alternatives*, in Appendix A of this RDEIR/SDEIS. This alternative would include installation of temporary drainage bypass facilities, long-term cross drainage, and replacement of existing drainage facilities that would be disrupted due to construction of new facilities.

Construction-related activities would be conducted in accordance with the environmental commitment to develop and implement BMPs for all activities that may result in discharge of soil, sediment, or other construction-related contaminants to surface water bodies, and obtain authorization for the construction activities under the State Water Board's NPDES Stormwater General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009-DWQ/NPDES Permit No. CAS000002). The General Construction NPDES Permit requires the preparation and implementation of SWPPPs, which are the principal plans within the required PRDs that identify the proposed erosion control and pollution prevention BMPs that would be used to avoid and minimize construction-related erosion and contaminant discharges. The development of the SWPPPs, and applicability of other provisions of this General Construction Permit depends on the "risk" classification for the construction which is determined based on the potential for erosion to occur as well as the susceptibility of the receiving water to potential adverse effects of construction. While the determination of project risk level, and planning and development of the SWPPPs and BMPs to be implemented, would be completed as a part of final design and contracting for the work, the responsibility for compliance with the provisions of the General Construction Permit necessitates that BMPs are applied to all disturbance activities. In addition to the BMPs, the SWPPPs would include BMP inspection and monitoring activities, and identify responsibilities of all parties, contingency measures, agency contacts, and training requirements and documentation for those personnel responsible for installation, inspection, maintenance, and repair of BMPs. The General Construction Permit contains NALs and for pH and turbidity, and specifies storm event water quality monitoring to determine if construction is resulting in elevated discharges of these constituents, and monitoring for any non-visible contaminants determined to have been potentially released. If an NAL is determined to have been exceeded, the General Construction Permit requires the discharger to conduct a construction site and run-on evaluation to determine whether contaminant sources associated with the site's construction activity may have caused or contributed to the exceedance and immediately implement corrective actions if they are needed.

The BMPs that are routinely implemented in the construction industry and have proven successful at reducing adverse water quality effects include, but are not limited to, the following broad categories of actions (letters refer to categories of specific BMPs identified in Appendix 3B, *Environmental Commitments*), for which Appendix 3B identifies specific BMPs within these categories:

- Waste Management and Spill Prevention and Response (BMP categories A.2 and A.3): Waste management BMPs are designed to minimize exposure of waste materials at all construction sites and staging areas such as waste collection and disposal practices, containment and protection of wastes from wind and rain, and equipment cleaning measures. Spill prevention and response BMPs involve planning, equipment, and training for personnel for emergency event response.
- Erosion and Sedimentation Control (BMP categories A.4 and A.5): Erosion control BMPs are designed to prevent erosion processes or events including scheduling work to avoid rain events, stabilizing exposed soils; minimize offsite sediment runoff; remove sediment from onsite runoff before it leaves the site; and slow runoff rates across construction sites. Identification of appropriate temporary and long-term seeding, mulching, and other erosion control measures as necessary. Sedimentation BMPs are designed to minimize offsite sediment runoff once erosion has occurred involving drainage controls, perimeter controls, detention/sedimentation basins, or other containment features.
- Good Housekeeping and Non-Stormwater Discharge Management (BMP category A.6 and A.7): Good housekeeping BMPs are designed to reduce exposure of construction sites and materials storage to stormwater runoff including truck tire tracking control facilities; equipment washing; litter and construction debris; and designated refueling and equipment inspection/maintenance practices Non-stormwater discharge management BMPs involve runoff measures for contaminants not directly associated with rain or wind including vehicle washing and street cleaning operations.
- Construction Site Dewatering and Pipeline Testing (BMP category A.8).Dewatering BMPs involve actions to prevent discharge of contaminants present in dewatering of groundwater during construction, discharges of water from testing of pipelines or other facilities, or the indirect erosion that may be caused by dewatering discharges.
- BMP Inspection and Monitoring (BMP category A.9): Identification of clear objectives for evaluating compliance with SWPPP provisions, and specific BMP inspection and monitoring procedures, environmental awareness training, contractor and agency roles and responsibilities, reporting procedures, and communication protocols.

In addition to the Category "A" BMPs for surface land disturbances identified in the environmental commitments (Appendix 3B, *Environmental Commitments*), BMPs implemented also would include the Category "B" BMPs for tunnel/pipeline construction that involves actions primarily to avoid and minimize sediment and contaminant discharges associated with RTM excavation, hauling, and RTM dewatering operations. Additionally, habitat restoration activities under CM2 and CM4–CM10 would be subject to implementation of the Category "C" BMPs (In-Water Construction BMPs) and Category "D" BMPs (Tidal and Wetland Restoration) designed to minimize disturbance and direct discharge of turbidity/suspended solids to the water during in-water construction activities. Category "E" BMPs identify general permanent post-construction actions that would be implemented for all terrestrial, in-water, and habitat restoration activities and would involve planning, design, and development of final site stabilization, revegetation, and drainage control features.

Finally, acquisition of applicable environmental permits may be required for specific conservation measures, which may include specific WDRs or CWA Section 401 water quality certifications from the appropriate Regional Water Boards, CDFW Streambed Alteration Agreements, and USACE CWA Section 404 dredge and fill permits. These other permit processes may include requirements to implement additional action-specific BMPs that may reduce potential adverse discharge effects of constituents of concern.

The potential construction-related contaminant discharges that could result from this alternative would not be anticipated to result in adverse water quality effects at a magnitude, frequency, or regional extent that would cause substantial adverse effects to aquatic life. Relative to Existing Conditions, this assessment indicates the following.

- Projects would be managed under state water quality regulations and project-defined actions to avoid and minimize contaminant discharges.
- Individual projects would generally be dispersed, and involve infrequent and temporary activities, thus not likely resulting in substantial exceedances of water quality standards or long-term degradation.
- Potential construction-related contaminant discharges would not cause additional exceedance of applicable water quality objectives where such objectives are not exceeded under Existing Conditions. Long-term water quality degradation is not anticipated, and hence would not be expected to adversely affect beneficial uses.
- By the intermittent and temporary frequency of construction-related activities and potential contaminant discharges, the constituent-specific effects would not be of substantial magnitude or duration to contribute to long-term bioaccumulation processes, or cause measureable long-term degradation such that existing 303(d) impairments would be made discernibly worse or TMDL actions to reduce loading would be adversely affected.

Consequently, because the construction-related activities for the conservation measures would be conducted with implementation of environmental commitments, including but not limited to those identified in Appendix 3B, with respect to the No Action Alternative conditions, this alternative would not be expected to cause constituent discharges of sufficient frequency and magnitude to result in a substantial increase of exceedances of water quality objectives/criteria, or substantially degrade water quality with respect to the constituents of concern, and thus would not adversely affect any beneficial uses in the Delta.

In summary, with implementation of environmental commitments in Appendix 3B, the potential construction-related water quality effects are considered to be not adverse.

CEQA Conclusion: As explained above, water quality effects resulting from construction-related activities would be less under Alternative 4A compared to Alternative 4, which was determined to be less than significant. Moreover, because environmental commitments would be implemented under Alternative 4A for construction-related activities along with agency-issued permits that also contain construction requirements to protect water quality, the construction-related effects, relative to Existing Conditions, would not be expected to cause or contribute to substantial alteration of existing drainage patterns which would result in substantial erosion or siltation on- or off-site, substantial increased frequency of exceedances of water quality objectives/criteria, or substantially degrade water quality with respect to the constituents of concern on a long-term average basis, and thus would not adversely affect any beneficial uses in water bodies upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas. Moreover, because the construction-related activities would be temporary and intermittent in nature, the construction would involve negligible discharges, if any, of bioaccumulative or CWA Section 303(d) listed constituents to water bodies of the affected environment. As such, construction activities would not contribute measurably to bioaccumulation of contaminants in organisms or humans or cause CWA Section 303(d) impairments to be discernibly worse. Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-32: Effects on *Microcystis* Bloom Formation Resulting from Facilities Operations and Maintenance

Upstream of the Delta

Adverse effects from *Microcystis* upstream of the Delta have only been documented in lakes such as Clear Lake, where eutrophic levels of nutrients give cyanobacteria a competitive advantage over other phytoplankton during the bloom season. Large reservoirs upstream of the Delta are typically characterized by low nutrient concentrations, where other phytoplankton outcompete cyanobacteria, including *Microcystis*. In the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta under Existing Conditions, bloom development is limited by high water velocity and low residence times. These conditions are not expected to change under Alternative 4A or the No Action Alternative (ELT and LLT). Consequently, any modified reservoir operations under Alternative 4A are not expected to promote *Microcystis* production upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT and LLT).

Delta

Modeling that adequately accounted for the effects of water conveyance facilities operations and maintenance and the hydrodynamic impacts of the environmental commitments on long-term average residence times in the six Delta sub-areas was not available for Alternative 4A, so the hydrodynamic effects of this alternative on *Microcystis* were determined qualitatively. For the assessment of Alternative 4, modeling scenarios included assumptions regarding how certain habitat restoration activities of the project alternative would affect Delta hydrodynamics, so the impacts due solely to operations and maintenance of the water conveyance facilities under Alternative 4 could not be determined. Because the assessment for Alternative 4A is qualitative, the effects discussed for the Delta under water conveyance facilities are related solely to operations and maintenance, not the hydrodynamic effects of restoration actions, which are discussed in Impact WQ-33.

The effects of Alternative 4A on *Microcystis* levels, and thus microcystin concentrations in the Delta, relative to Existing Conditions, would be less than those described for Alternative 4 in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS for the reasons discussed below.

Under the two operational scenarios of Alternative 4A, a portion of the Sacramento River water which would be conveyed through the Delta to the south Delta intakes under Existing Conditions would be replaced at various locations throughout the Delta by other source water due to diversion of Sacramento River water at the north Delta intake under Alternative 4A. The change in flow paths of water through the Delta that would occur under Alternative 4A could result in localized increases in residence time in various Delta sub-regions, and decreases in residence time in other areas. In general, there is substantial uncertainty regarding the extent that operations and maintenance of Alternative 4A would result in a net increase in water residence times at various locations throughout the Delta relative to Existing Conditions. In contrast to Alternative 4A, the combination of the habitat restoration and operations and maintenance assumptions included in the hydrodynamic modeling of Alternative 4 resulted in a substantial increase in water residence times, and thus a potential increase in *Microcystis* abundance, at numerous locations throughout the Delta at the late long-term timeframe relative to Existing Conditions.

Besides the effects of operations and maintenance described above, substantial increases in water residence times due to factors unrelated to the project alternative, including habitat restoration (8,000 acres of tidal habitat and enhancements to the Yolo Bypass), sea level rise and climate change, are expected to occur in the Delta, relative to Existing Conditions. Although there is uncertainty regarding the degree to which operations and maintenance of the project alternative would affect water residence times in the Delta, it is likely that such effects would be small in comparison to the combined effects of restoration activities, sea level rise and climate change. Slight increases in ambient water temperatures (1.3–2.5°F), due to climate change in the ELT, are expected to occur in the Delta under Alternative 4A, relative to Existing Conditions. However, due to the combination of the effects of restoration activities unrelated to the project alternative, climate change, and sea level rise on increased residence times, as well as the effects of climate change on increased ambient water temperatures, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur, relative to Existing Conditions. The magnitude by which water temperatures and residence times would increase due to these factors would be less under Alternative 4A than under Alternative 4.

The effects of Alternative 4A on *Microcystis* levels, and thus microcystin concentrations in the Delta relative to the No Action Alternative (ELT and LLT) would be less than those described for Alternative 4 in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS for the reasons discussed below.

As described relative to Existing Conditions, operations and maintenance of Alternative 4A could alter source water flow paths through the Delta, which could result in localized increases in residence time in various Delta sub-regions, and decreases in residence time in other areas. In general, there is substantial uncertainty regarding the extent that operations and maintenance of Alternative 4A would result in a net increase in water residence times at various locations throughout the Delta relative to the No Action Alternative (ELT and LLT).

The previously discussed influence of factors unrelated to implementation of the project alternative, including habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass), climate change and sea level rise on increased water residence times, as well as the influence of climate change on increased ambient water temperatures in the Delta, would occur under both Alternative 4A and No Action Alternative (ELT and LLT). In summary, operations and maintenance of Alternative 4A is not expected to increase water residence times or ambient water temperatures throughout the Delta, and thus result in adverse effects on *Microcystis*, relative to No Action Alternative (ELT and LLT).

SWP/CVP Export Service Area

The effects of Alternative 4A on *Microcystis* levels, and thus microcystin concentrations, in the SWP/CVP Export Service Areas relative to Existing Conditions would be less than those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). As described above for the Delta, source waters to the south Delta intakes could be adversely affected relative to Existing Conditions by *Microcystis* both from an increase in Delta water temperatures associated with climate change and from an increase in water residence times. The impacts from increased Delta water residence times would be primarily related to habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass) that is assumed to occur separate from Alternative 4A. The combined effect of these factors on *Microcystis* in source waters to the south Delta intakes would likely be much greater than the influence of operations and maintenance of Alternative 4A, the effects of which are uncertain. In contrast to Alternative 4A, the combination of the habitat restoration and operations and maintenance assumptions included in the hydrodynamic modeling of Alternative 4 resulted in a substantial increase in water residence times, and thus a potential increase in *Microcystis* abundance, at numerous locations throughout the Delta relative to Existing Conditions. Increases in ambient air temperatures due to climate change relative to Existing Conditions are expected under this alternative. Increases in ambient air temperatures are expected to result in warmer ambient water temperatures, and thus conditions more suitable to *Microcystis* growth, in the water bodies of the SWP/CVP Export Service Areas. The incremental increase in long-term average air temperatures would be less at the ELT (2.0°F), compared to the LLT (4.0°F).

The effects of Alternative 4A on *Microcystis* levels, and thus microcystin concentrations, in the SWP/CVP Export Service Areas, relative to the No Action Alternative (ELT and LLT), are expected to be less than effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because effects of *Microcystis* on water exports from Banks and Jones pumping plants would be different between Alternative 4A and Alternative 4. Specifically, under Alternative 4A, the fraction of water flowing through the Delta that would reach the existing south Delta intakes is not expected to be adversely affected by *Microcystis* blooms, relative to the No Action Alternative (ELT and LLT), as discussed in the "Delta" section above; while under Alternative 4 this fraction of water is expected to be adversely affected by *Microcystis* blooms, relative to the No Action Alternative (LLT). Additionally, conditions in the SWP/CVP Export Service Areas under Alternative 4A are not expected to become more conducive to *Microcystis* bloom formation, relative to the No Action Alternative (ELT and LLT), because neither water residence time nor water temperatures are projected to increase in the SWP/CVP Export Service Areas.

NEPA Effects: Modified reservoir operations under Alternative 4A are not expected to promote *Microcystis* production upstream of the Delta, relative to the No Action Alternative (ELT and LLT). Similarly, operations and maintenance of Alternative 4A is not expected to increase water residence times or ambient water temperatures throughout the Delta, including at the Banks and Jones pumping plants, and thus result in adverse effects on *Microcystis* in the Delta, relative to No Action Alternative (ELT and LLT). Thus, the effects on *Microcystis* in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas from implementing water conveyance facilities are determined to be not adverse.

CEQA Conclusion: As with Alternative 4, modified reservoir operations under Alternative 4A are not expected to promote *Microcystis* production upstream of the Delta, relative to the Existing Conditions. The effects of operations and maintenance of water conveyance facilities under Alternative 4A on *Microcystis* in surface waters in the Delta and in the SWP/CVP Export Service Areas, relative to Existing Conditions, would be less than those described for the Alternative 4. Operations and maintenance of Alternative 4A is not expected to increase water residence times or ambient water temperatures throughout the Delta, including at the Banks and Jones pumping plants, and thus result in adverse effects on *Microcystis* in the Delta, relative to Existing Conditions. As such, this alternative would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. *Microcystis* and microcystins are not CWA Section 303(d) listed within the affected environment and thus any increases that could occur in some areas would not make any existing *Microcystis* impairment measurably worse because no such impairments currently exist. Because *Microcystis* and microcystins are not bioaccumulative, increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. However, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur under Alternative 4A for reasons unassociated with operations and maintenance of the project alternative, including tidal habitat restoration activities, climate change and sea level rise. While long-term water quality degradation may occur and, thus, impacts on beneficial uses could occur, these impacts are not related to implementation of Alternative 4A. Although there is considerable uncertainty regarding this impact, the effects on *Microcystis* from implementing water conveyance facilities are determined to be less than significant. No mitigation is required.

Impact WQ-33: Effects on *Microcystis* Bloom Formation Resulting from Environmental Commitments

Under Alternative 4A, Fisheries Enhancements to the Yolo Bypass would not be implemented, but under a plan separate and distinct from Alternative 4A, enhancements to the Yolo Bypass and 8,000 acres of tidal habitat restoration would be implemented in the ELT. These activities are assumed to occur under both Alternative 4A and the No Action Alternative. Implementation of Environmental Commitment 4 under Alternative 4A would result in a very small amount of tidal restoration within the Delta. In contrast, under Alternative 4, full implementation of Yolo Bypass enhancements would occur and 65,000 acres of tidal restoration would be developed. The implementation of Environmental Commitment 4 under Alternative 4A would have negligible effects compared to the development of 8,000 acres of tidal habitat and enhancements to the Yolo Bypass in the ELT that are unrelated to implementation of the alternative. These activities would create shallow backwater areas that could result in local warmer water and increased water residence time of magnitude and extent that would result in measurable changes on *Microcystis* levels in the Delta, relative to Existing Conditions.

The implementation of fisheries enhancements to the Yolo Bypass and the development of 65,000 acres of tidal restoration areas would be expected to result in widespread hydrodynamic effects that increase water residence times, and thus *Microcystis* levels, in the Delta under Alternative 4, relative to Existing Conditions and the No Action Alternative (LLT). Thus, the effects on *Microcystis* from implementing Environmental Commitment 4 under Alternative 4A, relative to Existing Conditions, would be substantially lower than expected under Alternative 4.

NEPA Effects: Based on the discussion above, the effects on *Microcystis* from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

CEQA Conclusions: Based on the discussion above, Environmental Commitments 3, 4, 6–12, 15, and 16 would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. *Microcystis* and microcystins are not CWA Section 303(d) listed within the affected environment and thus any increases that could occur in some areas would not make any existing *Microcystis* impairment measurably worse because no such impairments currently exist. Because *Microcystis* and microcystins are not bioaccumulative, increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. However, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur at the early long-term for reasons unassociated with implementation of the Environmental Commitments, including tidal habitat restoration and enhancements to the Yolo Bypass. While long-term water quality degradation may occur and, thus, significant impacts on beneficial uses could occur, these impacts are not related to implementation of the Environmental Commitments. Therefore, the effects on *Microcystis* from implementing the Environmental Commitments are determined to be less than significant. No mitigation is required.

Impact WQ-34: Effects on San Francisco Bay Water Quality Resulting from Facilities Operations and Maintenance and Environmental Commitments

The effects analysis presented in the preceding impacts (Impact WQ-1 through WQ-33) concluded that Alternative 4A would have a less-than-significant impact/no adverse effect on the following constituents in the Delta:

- Boron
- Bromide
- Chloride
- DOC
- Dissolved oxygen
- Pathogens
- Pesticides
- Trace metals
- Turbidity and TSS
- *Microcystis*

Elevated concentrations of boron are of concern in drinking and agricultural water supplies. Chloride, DOC, and bromide concentrations also are of concern in drinking water supplies. However, waters in the San Francisco Bay are not designated to support municipal water supply (MUN) and agricultural supply (AGR) beneficial uses. Changes in Delta dissolved oxygen, pathogens, pesticides, trace metals, and turbidity and TSS are not anticipated to be of a frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of the Delta. Changes in *Microcystis* would be primarily due to factors unassociated with the project alternative. Thus, changes in boron, bromide, chloride, DOC, dissolved oxygen, pathogens, pesticides, trace metals, turbidity and TSS, and *Microcystis* in Delta outflow associated with implementation of Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT) are not anticipated to be of a frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of the of San Francisco Bay, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of this RDEIR/SDEIS).

Elevated EC is of concern for its effects on the agricultural beneficial use (AGR) and fish and wildlife beneficial uses. San Francisco Bay does not have an AGR beneficial use designation. As described for Alternative 4, salinity throughout San Francisco Bay is largely a function of the tides, as well as to some extent the freshwater inflow from upstream. However, the changes in Delta outflow due to Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would be minor compared to tidal flows, and thus no substantial adverse effects on salinity, or fish and wildlife beneficial uses, downstream of the Delta are expected.

Also, as described for Alternative 4, changes in nutrient loading would not be expected to contribute to adverse effects to beneficial uses. Changes in nitrogen (ammonia and nitrate) loading to Suisun and San Pablo Bays under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not adversely impact primary productivity in these embayments because light limitation and grazing current limit algal production in these embayments. Nutrient levels and ratios are not considered a direct driver of *Microcystis* and cyanobacteria levels in the North Bay. The only postulated effect of changes in phosphorus loads to Suisun and San Pablo Bays is related to the influence of nutrient stoichiometry on primary productivity. However, there is uncertainty regarding the impact of nutrient ratios on phytoplankton community composition and abundance. As described for Alternative 4, any effect on phytoplankton community composition would likely be small compared to the effects of grazing from introduced clams and zooplankton in the estuary. Therefore, changes in total nitrogen and phosphorus loading that would occur in Delta outflow to San Francisco Bay, relative to Existing Conditions and the No Action Alternative (ELT and LLT), are not expected to result in degradation of water quality with regard to nutrients that would result in adverse effects to beneficial uses.

Similar to Alternative 4, loads of mercury, methylmercury, and selenium from the Delta to San Francisco Bay are estimated to change relatively little due to changes in source water fractions and net Delta outflow that would occur under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), because changes in Delta outflow would be similar.

NEPA Effects: Based on the discussion above, Alternative 4A, relative to the No Action Alternative (ELT and LLT), would not cause further degradation to water quality with respect to boron, bromide, chloride, dissolved oxygen, DOC, EC, mercury, pathogens, pesticides, selenium, nutrients (ammonia, nitrate, phosphorus), trace metals, turbidity and TSS, or *Microcystis* in the San Francisco Bay. Further, changes in these constituent concentrations in Delta outflow would not be expected to cause changes in Bay concentrations of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses. In summary, effects on the San Francisco Bay from implementation of water conveyance facilities and Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: As with Alternative 4, Alternative 4A would not be expected to cause long-term degradation of water quality in San Francisco Bay resulting in sufficient use of available assimilative capacity such that occasionally exceeding water quality objectives/criteria would be likely and would result in substantially increased risk for adverse effects to one or more beneficial uses. Further, this alternative would not be expected to cause additional exceedance of applicable water quality objectives/criteria in the San Francisco Bay by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. Any changes in boron, bromide, chloride, and DOC in the San Francisco Bay would not adversely affect beneficial uses, because the uses most affected by changes in these parameters, MUN and AGR, are not beneficial uses of the Bay. Further, no substantial changes in dissolved oxygen, pathogens, pesticides, trace metals, turbidity or TSS, and *Microcystis* are anticipated in the Delta due to the implementation of Alternative 4A, relative to Existing Conditions, therefore, no substantial changes to these constituents levels in the Bay are anticipated. Changes in Delta salinity would not contribute to measurable changes in Bay salinity, as the change in Delta outflow would be two to three orders of magnitude lower than (and thus minimal compared to) the Bay's tidal flow and thus, have minimal influence on salinity changes. Changes in nutrient load, relative to Existing Conditions, are expected to have minimal effect on water quality degradation, primary productivity, or phytoplankton community composition. As with Alternative 4, the change in mercury and methylmercury load (which is based on source water and Delta outflow), relative to Existing Conditions, would be within the level of uncertainty in the mass load estimate and not expected to contribute to water quality degradation, make the CWA Section 303(d) mercury impairment measurably worse or cause mercury/methylmercury to bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Similarly, based on Alternative 4 estimates, the increase in selenium load would be minimal, and total and dissolved selenium concentrations would be expected to be the same as Existing Conditions, and less than the target associated with white sturgeon whole-body fish tissue levels for the North Bay. Thus, the change in selenium load is not expected to contribute to water quality degradation, or make the CWA Section 303(d) selenium impairment measurably worse or cause selenium to bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.