Section 2
Substantive Draft EIR/EIS Revisions

The following sections provide a brief overview of the substantives changes and conclusions provided in the RDEIR/SDEIS. These changes in approach were made both in the Draft EIR/EIS which appears in this RDEIR/SDEIS as Appendix A, *Revisions to the Draft EIR/EIS*; and they are also carried forward in the analysis for Alternatives 4A, 2D, and 5A (which appear in Section 4 of this RDEIR/SDEIS). Appendix A includes modified excerpts of text that originally appeared in the Draft EIR/EIS, with underlining showing new language and strikeout showing eliminated text. Appendix A does not include Draft EIR/EIS text that was not changed or that may be modified in the Final EIR/EIR in a non-substantive manner, and is focused primarily nonimpact analysis revisions to Alternative 4, though other BDCP alternatives are addressed for some of the resources for various reasons. To give readers the best possible sense of the context in which such text changes occur, Appendix A includes section headings before and after modified passages, so that readers can understand precisely where within Draft EIR/EIS chapters the revisions occur. For a visual representation of how the document is laid out and how various segments relate to one another, please see the *Document Review Road Map* at the front of this document.

2.1 Fish and Aquatic Habitat Analyses

Draft EIR/EIS Chapter 11, *Aquatic Resources,* provided substantial information about the potential effects of the alternatives on fish and their habitats in the Plan Area and in upstream areas used by the evaluated species. Since release of the Draft EIR/EIS, the chapter has been revised to address design changes associated with the proposed project, to incorporate the latest engineering assumptions and modeling procedures, and to respond to comments raised by the public. Several comments requested elaboration on the methods used to arrive at CEQA conclusions and NEPA effects determinations and on the effects of contaminants. Additionally, commenters requested analyses of the effects on downstream bays (i.e., San Francisco Bay), and that all analyses include a NEPA conclusion. Since release of the Draft EIR/EIS, additional information has been developed pertaining to the following: the use of reusable tunnel material (RTM) for restoration efforts; the construction effects of the modification to Clifton Court Forebay; and the construction of an operable barrier at Head of Old River. This section briefly describes the revisions and their effects on the impact analysis. These revisions serve to better articulate the analysis of effects, but do not change the level of significance or magnitude of the effects. Please refer to the references to review specific sections of the revised chapter.

2.1.1 Methods Used

Several commenters noted that the analytical approach for determining the effects on fish and aquatic resources of various operational aspects of the alternatives was difficult to understand. This was especially related to the presentation of impacts for certain fish species that relied on multiple modeling results as evidence for CEQA conclusions and NEPA effects determinations. To better explain the rationale and process applied to the development of the CEQA conclusions and NEPA effects determinations, the methods section has been updated (Chapter 11, *Fish and Aquatic Resources,* Section 11.3.2, in Appendix A) to more explicitly describe for each species life stage what methods were used and how the various modeling results were weighted. This approach was applied similarly for all alternatives. Additionally, information has been added to key impact analyses to articulate the biological linkages between changes in the physical environment and biological effects. Please refer to Chapter 11, *Fish and Aquatic Resources,* Section 11.3.2, in Appendix A.

2.1.2 Effects Downstream of the Plan Area

Chapter 11, *Fish and Aquatic Resources*, of the Draft EIR/EIS included a description of the potential changes in sediment loading as a result of the creation of new points of diversion under Alternatives 1A through 8. This analysis was used to inform the impacts related to turbidity (water clarity) for delta and longfin smelt. In summary, these impacts were deemed to be less than significant/not adverse because there would be less than a 10% change in sediment loading and because restoration actions could serve to increase turbidity in some areas. Additionally, as part of an environmental commitment in Appendix 3B, *Environmental Commitments*, in this RDEIR/SDEIS (similar to Avoidance and Minimization Measure [AMM] 6), sediments collected at the intake facilities and RTM excavated during construction activities could be reintroduced into the Delta at proposed restoration sites. (See in Appendix A of this RDEIR/SDEIS) Consequently, the overall effect in the Plan Area/Delta was determined to be only a minor degradation. Based on comments received from the public and additional study of the likely characteristics of RTM material, this environmental commitment and its parallel AMM have been revised to describe the anticipated feasibility of reuse of this material, as well as the applicable regulatory standards that any such material would be required to meet prior to its beneficial reuse. For text revisions to this commitment, please refer to Appendix A, *Draft EIR/EIS In-Text Chapter Revisions*, in this RDEIR/SDEIS, which includes an expanded and modified version of Draft EIR/EIS Appendix 3B, *Environmental Commitments*.

As part of this RDEIR/SDEIS, additional analyses have been conducted to take into account sea level rise, restoration sediment demand, and the effects of the creation of new points of diversion in order to better understand the magnitude of potential changes in sediment loading into the San Francisco Bay and other areas downstream of the Plan Area (generally the Delta, Suisun Marsh, and Yolo Bypass). A range of sediment demand from existing wetlands and restoration activities was combined with the sea level rise assumptions to understand the rate at which restored areas would act as sediment sinks in order to maintain elevation as sea levels rise. Relevant literature was used to determine the overall contribution of sediments from the Delta to the Bay, and a range of volumes of potential supplemental materials from both the diversion sediment collection process at the north Delta diversions and the RTM was developed based on current engineering estimates. This RDEIR/SDEIS includes an analysis of changes in sediment loading to the Bay for all of the alternatives, with specificity to operations-related effects and restoration-related effects.

In addition to the sediment analysis, further analysis was undertaken to assess the consequences, if any, of the relatively minor changes in operations proposed across alternatives compared with the consequences already described in the Draft EIR/EIS. This new analysis evaluated the potential changes in water quality, salinity, flows, temperatures, and other factors potentially affecting fish habitat and behavior downstream of the Plan Area. The analyses indicted that these characteristics would be essentially unchanged, especially given the highly dynamic tidal environment of the Bay and its connection to the Delta. This analysis is included for Alternative 4A in Section 4.3.7, *Fish and Aquatic Resources*, for Alternative 2D in Section 4.4.7, for Alternative 5A in Section 4.5.7, and for the remainder of the alternatives in Chapter 11, *Fish and Aquatic Resources,* Section 11.3.5 in Appendix A of this RDEIR/SDEIS.

2.1.3 Selenium and Mercury

The analysis of selenium and mercury has been revised in three locations: revisions to Conservation Measure 12 *Methylmercury Management* and Avoidance and Minimization Measure 27 *Selenium Management* (see Appendix D); revisions to the CM4 tidal habitat contaminants analysis; and a new impact to specifically address effects of contaminants on fish as a result of change in operations (See Chapter 11, Impact AQUA-219 in Appendix A). Additional details on the mechanisms for mobilization of selenium and mercury into the food web and the potential for effects on aquatic resources have been added to the RDEIR/SDEIS, including details describing the uncertainties associated with the analytical methods. The conclusions regarding effects on water quality associated with BDCP water operations evaluated in Chapter 8, *Water Quality*, of the Draft EIR/EIS and the potential for effects on aquatic resources have been further evaluated, including details of the analytical methods, uncertainties and findings. This analysis is included as Impact AQUA-219, applicable to all alternatives in Chapter 11, *Fish and Aquatic Resources,* Section 11.3.5 in Appendix A.

In response to reviewers' concerns that proposed restoration in Yolo Bypass could be a significant source of mercury methylation, a comparison of existing sediment and water quality data to the modeled conditions following proposed restoration activities has been included. To address the potential for selenium mobilization resulting from BDCP restoration actions, AMM27 has been expanded with specific requirements included to reduce the potential for bioaccumulation in covered fish species. Updated water quality data have been integrated into the selenium quantitative modeling for water and fish tissue under BDCP water operations, and results have been updated in Chapter 11, as shown in Chapter 11, *Fish and Aquatic Resources,* Section 11.3.5 in Appendix A.

2.1.4 NEPA Determinations

A small number of NEPA determinations were, at the time of the Draft EIR/EIS, determined to be "uncertain," or no determination was made. These effects were related to effects of the alternatives on salmonid fish migrations through the project area, effects of outflow on delta smelt and longfin smelt, and contaminant effects on all species. As described above, substantial effort has been put forth to better understand and articulate the potential for selenium and mercury effects on fish as a result of both operations and restoration actions proposed under the alternatives. This effort has allowed a more certain determination for contaminants effects under NEPA, which have been determined to be not adverse across all alternatives:

- AQUA-8, Effects of contaminants associated with restoration measures on delta smelt
- AQUA-26, Effects of contaminants associated with restoration measures on longfin smelt
- AQUA-44, Effects of contaminants associated with restoration measures on Chinook salmon (winter-run ESU)
- AQUA-62, Effects of contaminants associated with restoration measures on Chinook salmon (spring-run ESU)
- AQUA-80, Effects of contaminants associated with restoration measures on Chinook salmon (fall-/late fall–run ESU)

- AQUA-98, Effects of contaminants associated with restoration measures on steelhead
- AQUA-116, Effects of contaminants associated with restoration measures on Sacramento splittail
- AQUA-134, Effects of contaminants associated with restoration measures on green sturgeon
- AQUA-152, Effects of contaminants associated with restoration measures on white sturgeon
- AQUA-170, Effects of contaminants associated with restoration measures on Pacific lamprey
- AQUA-188, Effects of contaminants associated with restoration measures on river lamprey
- AQUA-206, Effects of contaminants associated with restoration measures on non-covered aquatic species of primary management concern)

Regarding effects on salmonid migrations, uncertainty stemmed from contrasting model results for upstream flow conditions and effects of the north Delta diversion operations. Additional examination of modeling results, showing mixed conclusions for Alternative 4, indicates that it was modeling assumptions and not actual real-world changes in operations or criteria, that shifted the timing of releases from Lake Shasta, generating the mixed results for the upper Sacramento River. Additional coordination with NMFS and CDFW to develop the ability to make real-time adjustments to minimize effects on fish migrating past the intakes has resulted in greater confidence pertaining to migration effects. The analysis of Alternative 4A in Section 4.3.7, *Fish and Aquatic Resources*, Alternative 2D in Section 4.4.7 and Alternative 5A in Section 4.5.7 describe the analysis and determination of this effect, and the remainder of the alternatives are described in Chapter 11, *Fish and Aquatic Resources,* Section 11.3.5 in Appendix A.

2.1.5 Clifton Court Forebay Modification, Head of Old River Operable Barrier Construction, and Pile Driving Effects

The Draft EIR/EIS included relatively little discussion of the impacts on fish and aquatic resources from construction of the modified Clifton Court Forebay and the Head of Old River operable barrier under Alternatives 4. The main assumptions related to construction of these facilities were provided in Appendix 3C of the Draft EIR/EIS, and consideration and analysis of potential effects is provided in this RDEIR/SDEIS. The potential sources of effects on fish from these activities are similar to those discussed for construction of north Delta diversions and barge landing sites: temporary increases in turbidity; accidental spills; disturbance of contaminated sediments; underwater noise; fish stranding; in-water work activities; loss of spawning, rearing, or migration habitat; and predation. The impacts from construction of the modified Clifton Court Forebay and the Head of Old River operable barrier would be rendered less than significant by application of appropriate AMMs and mitigation measures.

The effects of underwater noise caused by pile driving were reassessed to account for changes in the proposed construction approach as outlined in Appendix 3C, *Construction Assumptions*, of the Draft EIR/EIS. While the in-water work windows of July through October were maintained (see Tables 22B-1a through 22B-4d in Appendix 22B, *Air Quality Assumptions*, of the Draft EIR/EIS), the analysis was conducted assuming more concurrent pile-driving and without the use of attenuation structures. This analysis is included in Section 4.3.7, Fish and Aquatic Resources for Alternative 4A, Section 4.4.7 for Alternative 2D, Section 4.5.7 for Alternative 5A, and Chapter 11, *Fish and Aquatic Resources*, Sections 11.3.1.1 and 11.3.5, in Appendix A of the RDEIR/SDEIS for all other alternatives.

2.1.6 Non-Covered Fish Entrainment at the North Delta Diversion

The Draft EIR/EIS did not include a detailed analysis of the potential entrainment effects on non-covered aquatic species of primary management concern that have pelagic early life stages and therefore may be particularly susceptible to entrainment at the proposed north Delta diversions (i.e., egg and larval striped bass and American shad). An analysis has been included in this RDEIR/SDEIS to assess the potential for effects on these species because much of their spawning could occur upstream of the proposed north Delta intake locations, thus potentially subjecting eggs or larvae to entrainment. The analysis examines particle tracking model results from the Sacramento River upstream of the north Delta diversions. This impact analysis, and discussion of its relevance, is included in Chapter 11, Section 11.3.5, Impact AQUA-201, in Appendix A, and is applicable to all of the alternatives.

2.2 Water Quality Revisions

Chapter 8, *Water Quality*, of the Draft EIR/EIS evaluates effects on water quality from construction and operation of the proposed water conveyance facility (CM1) for Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9. Water quality impacts from other conservation measures (CM2–CM21) for these alternatives are evaluated at the programmatic level. Chapter 8 has been revised since release of the Draft EIR/EIS to address design changes associated with the proposed project, to include additional analysis, to make clarifications and correct errors, to update analyses based on more recent water quality data and/or criteria, and to respond to comments raised by local, state, and federal agencies and the public. Water quality constituent sections that received the most updating were electrical conductivity, chloride, selenium, bromide, and *Microcystis*. Additionally, an assessment of constituent effects downstream of the Plan Area (i.e., in San Francisco Bay) was added. Several other modifications and additions were made to the assessments for mercury, nutrients, trace metals, and dissolved oxygen. This section briefly describes the revisions to Chapter 8 and their effects on the impact analyses and impact determinations. Please refer to the document links to review specific sections of the revised chapter.

Additionally, three new alternatives – Alternative 2D, 4A, and 5A – were evaluated for effects on water quality from construction and operation of the water conveyance facility (CM1) and from other Environmental Commitments (CM 3, 4, 6, 7, 9–12, 15, and 16). The Alternatives evaluated in Chapter 8 discussed above contain many similarities to each other from a water quality perspective, and thus are often grouped together in the following discussion. The three new alternatives are also very similar to each other, but from a water quality perspective, are fundamentally different than the Alternatives evaluated in Chapter 8 that are discussed above, in that they contain substantially less tidal restoration acreage. Although this section is focused on describing changes made in Chapter 8 from the Draft EIR/EIS, differences between the alternatives assessed in Chapter 8 and the three new alternatives are highlighted where appropriate.

2.2.1 Electrical Conductivity and Chloride

In the Draft EIR/EIS, all project alternatives (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) were found to have significant and unavoidable impacts on electrical conductivity and chloride in the Delta. These impacts were due in part to apparent exceedances of Bay Delta Water Quality Control Plan D-1641 water quality objectives shown in the modeling results at several locations under Existing Conditions, the No Action Alternative, and BDCP Alternatives. It was known that 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. Appendix 8H Section 8H.1 of the Draft EIR/EIS described some of these factors, but the document did not include an evaluation of how many of these exceedances were thought to be a result of these factors and how many were expected to be actual project impacts. Furthermore, in the Draft EIR/EIS, mitigation measures for electrical conductivity and chloride called for additional modeling efforts to determine if impacts could be avoided or mitigated.

For chloride, most project alternatives evaluated in the Draft EIR/EIS were considered to have significant and unavoidable impacts in the Delta for the following reasons:

- modeling results showed exceedance of the 150 mg/L chloride objective,
- substantial increases in chloride were occurring in Suisun Marsh, and
- water quality degradation was occurring in the western Delta due to increased chloride concentrations.

For electrical conductivity, most alternatives evaluated in the Draft EIR/EIS were considered to have significant and unavoidable impacts for the following reasons:

- modeling results showed exceedance of the agricultural objective in the Sacramento River at Emmaton,
- modeling results showed exceedance of the agricultural objective in the San Joaquin River at San Andreas Landing,
- modeling results showed exceedance of the fish and wildlife objective between Prisoners Point and Jersey Point,
- modeling results showed exceedance of the agricultural objective in Old River at Tracy Bridge,
- substantial increases in EC were occurring in Suisun Marsh, and
- water quality degradation was occurring in the western Delta due to increased EC.

To address some of these issues, since publication of the Draft EIR/EIS, the Lead Agencies conducted sensitivity analyses and other analyses to evaluate whether exceedances were modeling artifacts (and thus would not occur) or were potential project-related impacts (which could occur). These included modeling runs investigating the impact of the following:

- Changing the existing Emmaton electrical conductivity compliance location to a new location at Threemile Slough, as proposed in the version of the BDCP circulated with the Draft EIR/EIS.
- Monthly-daily patterning at the Delta boundary locations (see Section 8.3.1.1 in Appendix A for a description of monthly-daily patterning), including the Suisun Marsh Salinity Control Gates, under the alternatives.

- Removing tidal restoration areas (i.e., assuming no tidal restoration, as opposed to the tidal restoration areas that were previously assumed under Alternative 4 at the late long-term) as a means of understanding the contribution of restoration vs. CM1 to exceedances.
- Revising Head of Old River Barrier operations during April and May.

Additionally, evaluation of individual exceedances was conducted in some cases to determine whether modeling time step and averaging, model imprecision, or imperfections in the Artificial Neural Network played a role in each exceedance shown by the modeling.

The findings and outcomes of the sensitivity analyses were the following.

- Regarding exceedances of the Sacramento River at Emmaton EC objective for protection of agricultural beneficial uses (which is a maximum 14-day running average of mean daily EC and applies April 1 through August 15, but varies in the specific numeric threshold by water year type and season), assuming the electrical conductivity compliance location at Emmaton instead of Threemile Slough greatly decreased exceedances of this objective at Emmaton to levels similar to those occurring under the No Action Alternative. Based on this finding, the project description for Alternative 4 was modified to remove the change in compliance point for the Emmaton electrical conductivity objective. Previously, the project descriptions for all action alternatives included a change in compliance point from Emmaton to Threemile Slough. The revised version of Alternative 4 would maintain, and not propose to change, the existing compliance point at Emmaton, while all other alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, 8, and 9) still include the proposed change to Threemile Slough. With this change, Alternative 4 no longer shows a significant impact with respect to the Bay-Delta WQCP EC objective exceedance at Emmaton, while all other alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, 8, and 9) still show significant impacts due to EC objective exceedance at Emmaton. The three new Alternatives assessed in this RDEIR/SDEIS (4A, 2D, 5A) also maintain the existing compliance point at Emmaton, and thus, for the reasons discussed above, do not show significant impacts due to EC objective exceedance at Emmaton.
- Regarding exceedances of the San Joaquin River at San Andreas Landing EC objective for protection of agricultural beneficial uses (which is a maximum 14-day running average of mean daily EC and applies April 1 through August 15, but varies in the specific numeric threshold by water year type and season), some of the modeled exceedances were found to be modeling artifacts due to monthly-daily patterning effects (see Section 8.3.1.1 in Appendix A for a description of monthly-daily patterning), and the small number of remaining exceedances were small in magnitude, lasted only a few days, and could be avoided or otherwise satisfactorily addressed with real time operations of the SWP and CVP (see Chapter 8, Section 8.3.1.1 in Appendix A for a description of real time operations of the SWP and CVP). Based on these findings, all project alternatives (those assessed in the Draft EIR/EIS, as well as the new alternatives) no longer show significant impacts with respect to EC objective exceedance at San Andreas Landing.
- Regarding exceedances of the San Joaquin River between Prisoners Point and Jersey Point EC objective (which is a maximum 14-day running average of mean daily EC of 0.44 mmhos/cm and applies April through May of all but critical water years), removing tidal restoration areas (i.e., assuming no tidal restoration, as opposed to the tidal restoration areas that were previously assumed under Alternative 4 at the late long-term) reduced the number of exceedances, but

there were still substantially more exceedances than under Existing Conditions or the No Action Alternative. Results of the sensitivity analyses indicate that the exceedances are partially a function of the operations of the alternative itself, perhaps due to Head of Old River Barrier assumptions and south Delta export differences. Appendix 8H Attachment 2 was added, which contains a more detailed assessment of the likelihood of these exceedances impacting aquatic life beneficial uses. Specifically, Appendix 8H Attachment 2 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. Thus, although uncertain, significant impacts on EC remain relative to this objective for Alternatives 2, 4, 6, 7, and 8. The physical effects and beneficial use at issue here relate to how suitable this stretch of the San Joaquin River is for spawning of striped bass, a nonnative species that preys on the Delta smelt. No such significant effects occur for Alternatives 1, 3, 5, and 9. Alternative 2D and 4A are expected to result in fewer and lower magnitude exceedances of this objective due to the lower acreage of tidal restoration, but to ensure that the objective is met, mitigation measures were introduced that would adaptively manage the split between North and South Delta intake diversions and Head of Old River Barrier operations. With the introduction of this mitigation measure, Alternatives 2D, 4A, and 5A do not show significant impacts with respect to EC objective exceedances at Prisoners Point.

- Regarding exceedances of the Old River at Tracy Bridge EC objective for the protection of agricultural beneficial uses (which is a maximum 30-day running average of mean daily EC of 0.7 mmhos/cm April through August and 1.0 mmhos/cm September through March), some of these exceedances were found to be modeling artifacts due to monthly-daily patterning effects (see Section 8.3.1.1 in Appendix A for a description of monthly-daily patterning), and the remaining exceedances could be resolved by assuming the continuation of historical dry year practices of installing barriers earlier in the year. Thus, no significant (CEQA) or adverse (NEPA) effects would occur. Furthermore, as noted in Chapter 8, Section 8.1.3.7 of Appendix A, SWP and CVP operations have relatively little influence on salinity levels at these locations, and the elevated salinity in south Delta channels is affected substantially by local salt contributions discharged into the San Joaquin River downstream of Vernalis.

- Modeling of all alternatives assumed no operation of the Suisun Marsh Salinity Control Gates, but the project description for all alternatives now assumes continued operation of the Salinity Control Gates, consistent with assumptions included in the No Action Alternative. A sensitivity analysis with the gates operational consistent with the No Action Alternative resulted in substantially lower EC levels in Suisun Marsh than indicated in the original modeling results, but EC levels were still somewhat higher there than EC levels under Existing Conditions and the No Action Alternative for several locations in the Marsh and for several months. Another modeling run with the gates operational and restoration areas removed resulted in EC levels nearly equivalent to those found in Existing Conditions and the No Action Alternative, indicating that design and siting of restoration areas has notable bearing on EC levels at different locations within Suisun Marsh. These analyses also indicate that increases in EC levels shown in the modeling conducted for the Draft EIR/EIS were related primarily to the hydrodynamic effects of CM4 under the alternatives assessed (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9), not operational components of CM1. Based on the sensitivity analyses, optimizing the design and siting of restoration areas for these alternatives consistent with proposed environmental commitments, avoidance and minimization measures, and mitigation measures is expected to be able to reduce EC increases, relative to Existing Conditions and the No Action Alternative, to levels that would be less than significant. Mitigation Measure WQ-11d discusses these actions.

All of the same applies to chloride levels in Suisun Marsh, and Mitigation Measure WQ-7d discusses these actions. The new alternatives 2D, 4A, and 5A, contain much lower acreage of tidal restoration, and thus are anticipated to not have significant impacts with respect to EC and chloride in Suisun Marsh.

The assessment of exceedances of the Bay Delta WQCP 150 mg/L chloride objective in the Draft EIR/EIS was also revised based on discovery of errors made in the original analysis. The Bay-Delta WQCP contains a chloride objective for Contra Costa Canal at pumping plant #1 or the San Joaquin River at Antioch Water Works intake that specifies the number of days each calendar year that the maximum mean daily chloride concentration must be less than 150 mg/L (must be provided in intervals of not less than 2 weeks' duration). The days per year depend on water-year type, ranging from 155 days for critical water-year types to 240 days in wet water-year types. In the original analysis, the predicted exceedances of this objective were based on the number of days in a calendar year that chloride is below certain specified limits at these locations. The DSM2 water quality model projects future conditions based in part on a representative recent 16-year time period reflecting varying hydrological conditions in California (i.e., water years 1976–1991). DSM2 was run for 16 *water* years (water years 1976–1991, i.e., October 1, 1975 – September 30, 1991), which only includes 15 complete *calendar* years (1976–1990). The final calendar year of the DSM2 simulation, 1991, was inadvertently included in the compliance assessment, even though modeling for 1991 did not include the whole calendar year, but stopped at the end of water year 1991 (i.e., September 30). This resulted in reporting of exceedances of the objective for calendar year 1991, when in fact the modeling results do not exist to determine if the objective was exceeded. Specifically, starting at the beginning of the calendar year, the compliance assessment algorithm keeps a running total of the number of days that meet the water quality criterion, then reports the total number of days in that year that met the criterion, and that number of days is compared to the required number of days from the water quality objective. Since modeling ended September 30, 1991, the last year only had 273 days available for counting, instead of the full 365. The minimum required number of days was usually not achieved for this year, so it was denoted as an exceedance of the objective. However, had the full 365 days been available, compliance with the objective may have occurred—the modeling results do not exist to determine this issue. The assessment was revised to remove calendar year 1991, so assessment was based on calendar years 1976–1990 of the original modeled results (i.e., 15 years instead of 16), and the impact conclusions were updated accordingly. Correcting of this error resulted in a more accurate assessment, and resulted in fewer exceedances of the objective under the project alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) than previously indicated. The specific number of exceedances predicted under the revised approach varied by alternative, and for some alternatives remained a significant impact. The new alternatives 2D, 4A, and 5A, did not contain any exceedances of this objective, likely in part due to the lower acreage of tidal restoration included in these alternatives.

Another issue that was resolved involved application of the correct water quality objectives based on the water year type appropriate to the modeled time step. As discussed above, the Draft EIR/EIS contained an assessment of compliance with Bay Delta Water Quality Control Plan electrical conductivity and chloride water quality objectives based on outputs from the DSM2 model. The modelling projects future conditions based in part on a representative recent 16-year time period reflecting varying hydrological conditions in California (i.e., water years 1976–1991). Some of the Water Quality Control Plan objectives are dependent on water year type (e.g., wet or dry). The water year type is a designation used to denote the water supply or water availability for a given water year, and is based on a formula that includes estimates of the unimpaired runoff in the Sacramento

River watershed. For each water year of the DSM2 simulation used (water years 1976–1991), the water year type that was used to define the objective was the water year type that was assigned under Existing Conditions hydrologic conditions. However, climate change assumptions alter the timing and magnitude of unimpaired runoff estimates, which alter the water year types assigned to the years in the DSM2 simulation. Because of this, 3 of the 16 water years in the simulation change their type in the late long term as a result of climate change. Thus, for the late long term scenarios, compliance should have been based on the objective defined according to the late long term water year types, not the Existing Conditions water year types. This change was made and the compliance assessment tables were updated. In general, this change resulted in the modeled predicted percent of days out of compliance increasing by 0–5% in both the No Action and the project alternatives, depending on the alternative and water quality objective evaluated. However, these changes did not fundamentally alter any of the impact conclusions at these sites.

Finally, understanding the uncertainties and limitations in the modeling and assessment approach is important for interpreting the results and effects analysis, including assessment of compliance with water quality objectives. Please refer to Chapter 8, Section 8.3.1.1, *Models Used and Their Linkages*, and Section 8.3.1.3, *Plan Area*, in Appendix A for a description of these limitations. In light of these limitations, the assessment of compliance was conducted in terms of assessing the overall direction and degree to which Delta EC or chloride would be affected relative to a baseline, and discussion of compliance did not imply that the alternative would literally cause Delta chloride to be out of compliance a certain period of time. In other words, the model results are to be used in a comparative mode, not a predictive mode. Furthermore, in reality, staff from DWR and Reclamation constantly monitor Delta water quality conditions and adjust operations of the SWP and CVP in real time as necessary to meet water quality objectives. These decisions take into account real-time conditions and are able to account for many factors that even the best available models cannot simulate. Thus, it is likely that some objective exceedances simulated in the modeling would not occur under the real-time monitoring and operational paradigm that will be in place to prevent such exceedances.

Based on the findings of all of the analyses discussed above, results of the electrical conductivity and chloride assessments were qualified, and the impact determinations were revisited. Additionally, because these efforts shed light on why certain exceedances were occurring, it was possible to revise mitigation measures to better address the causes of the exceedances. All alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9), remained significant and unavoidable for chloride and EC, but the reasons are now only the following:

- Exceedance of water quality objectives for EC in the Sacramento River at Emmaton (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 5, 6A, 6B, 6C, 7, 8, and 9 – but not Alternative 4)
- Water quality degradation in the western Delta due to increased chloride concentrations and EC (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9), and
- Exceedances of the fish and wildlife EC objective between Prisoners Point and Jersey Point (Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9).

Thus, although the impacts remain significant and unavoidable, the magnitude of the impacts is substantially less than was indicated in the Draft EIR/EIS.

Alternatives 2D, 4A, and 5A did not contain significant impacts for EC related to objective exceedance in the Sacramento River at Emmaton, did not contain substantial degradation in the western Delta due to increased chloride concentrations, had less water quality effects in the western

Delta related to EC, and fewer exceedances of the fish and wildlife EC objective between Prisoners Point and Jersey Point, such that it was feasible to introduce mitigation that would prevent significant impacts related to EC increases. After introduction of these mitigation measures, Alternatives 2D, 4A, and 5A contained less than significant impacts for EC. Alternatives 2D, 4A, and 5A contained less than significant impacts for chloride as well.

Refer to Chapter 8, *Water Quality*, Sections 8.1.3.4 and 8.3.1.7 in Appendix A for a discussion of historical compliance with chloride and electrical conductivity objectives, respectively. Refer to Chapter 8, *Water Quality*, Section 8.3.1.7 (*Chloride* and *Electrical Conductivity* subsections) in Appendix A for a discussion of the change in water year types at different time steps and sensitivity analyses performed. Refer to Mitigation Measures WQ-7 and WQ-11 in Sections 8.3.3.1 through 8.3.3.16 in Appendix A for the assessment and mitigation measures, which have been updated to account for water year type changes, sensitivity analyses performed, additional context, and corrections to the chloride 150 mg/L objective assessment; and to Appendix 8G and 8H in Appendix A for updated information supporting changes to the assessment. Refer to Section 4 and associated material in Appendix B for the assessment of Water Quality for Alternatives 4A, 2D, and 5A.

2.2.2 Selenium

Modeling for selenium (water concentrations and bioaccumulation modeling) was updated on the basis of a review and update of Delta source water concentrations of selenium. Public comments on the Draft EIR/EIS indicated that the source water concentrations for both the Sacramento River and San Joaquin River were likely biased high (i.e., the modeling approach used concentrations for both rivers that indicated more selenium than is currently actually present in the rivers). This bias was due to inclusion of older monitoring data that used higher detection limits (on both rivers), as well as to the decrease of selenium concentrations on the San Joaquin River that has occurred over time. The source water concentrations for the Sacramento River, San Joaquin River, Yolo Bypass, and San Francisco Bay were reevaluated and re-derived using the most recent data available, and the water concentration and bioaccumulation modeling was updated based on these updated source water concentrations. Results showed that there was generally a greater increase from Existing Conditions and No Action concentrations to the concentrations under the alternatives than previously predicted (i.e., the relative effect of the project was greater). However, the absolute values of all of the estimated concentrations for Existing Conditions, the No Action Alternative, and all Project Alternatives were lower than modeled previously in the Draft EIR/EIS, and thus were lower relative to thresholds of concern and water quality criteria used in the assessment.

The bioaccumulation modeling methodology for bass in the Delta was also updated. Bioaccumulation modeling is dependent on the choice of K_d, the ratio of selenium concentration in particulates vs. water. The higher the value of K_d, the greater the bioaccumulation of selenium. Previously, the choice of K_d was “static” for both bass and sturgeon, and did not vary by location or concentration of selenium in the water. The model was updated for bass based on more recent understanding that K_d tends to be higher at lower water concentrations than at higher concentrations. The result of this change is that predicted bass tissue concentrations in the Delta are more consistent across location and Alternative than was determined in the Draft EIR/EIS. This update could not be made for sturgeon bioaccumulation modeling because there was insufficient monitoring data with which that model could be calibrated for such a change.

Numeric thresholds used in the selenium assessment were also updated. Current ambient water quality criteria are based on waterborne selenium concentrations, but EPA released draft water quality criteria for the protection of freshwater aquatic life from toxic effects of selenium in May 2014. The draft criteria include tissue-based concentrations, which are most closely associated with reproductive effects. The criteria also include water concentrations, which are to be used when fish tissue data is not available. The draft criteria have not been finalized, but they represent the most current science on numeric thresholds protective of beneficial uses. Accordingly, these draft criteria were used in the updated assessment. Specifically, the whole-body fish tissue threshold was lowered from 9 mg/kg to 8.1 mg/kg. Additionally, the criterion against which water concentration changes were compared was lowered from 2 µg/L to 1.3 µg/L, which is the EPA draft criterion for lentic (i.e., still or slow-moving) water bodies.

An expanded discussion of residence time in the Delta and its effect on selenium bioaccumulation in the Delta was added in response to agency comments. Increased water residence times could increase the bioaccumulation of selenium in biota, thereby potentially increasing fish tissue and bird egg concentrations of selenium. However, if increases in fish tissue or bird egg selenium were to occur due to residence time changes alone, 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, changes in residence time alone would not be expected to cause them to then approach or exceed thresholds of concern. Based on the analysis, 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. Nevertheless, estimates of residence time increases in these areas are small enough that they are not expected to substantially affect selenium bioaccumulation in the western Delta.

The changes discussed above did not result in any changes to the impact conclusions. Alternatives 6-9 remain adverse (under NEPA) and significant and unavoidable (under CEQA) due to modeled substantial increases in fish tissue concentrations for sturgeon in the western Delta, while Alternatives 1–5 remain less than significant.

Refer to Chapter 8, *Water Quality*, Section 8.1.3.15 in Appendix A for updated existing selenium concentrations in the affected environment and a description of the EPA draft criteria. Refer to Section 8.3.1.7 in Appendix A for the updated source water concentrations used in the modeling and updated thresholds used in the assessment. Refer to Impact WQ-25 in Sections 8.3.3.1 through 8.3.3.16 in Appendix A for the selenium assessment updated based on the new modeling. Further details on the updates can be found in Appendix 8M, *Selenium*, in Appendix A.

2.2.3 Bromide

Additional description was added to describe more fully the CALFED bromide goal used in the assessment. Specifically, the additions describe the background behind derivation of the EPA bromate maximum contaminant level (MCL), its relevance to the CALFED numeric bromide goals, and the non-numeric portion of the CALFED goal regarding an equivalent level of public health protection using a cost-effective combination of alternative source waters, source control, and treatment technologies.

Additional descriptions regarding modeling uncertainty and assumptions were also added. Specifically, these address assumptions regarding sea level rise and the assumed footprint and design of restoration areas, and the performance and accuracy of DSM2 in the Barker Slough area.

Sensitivity analyses were conducted to evaluate what factors were causing or contributing to bromide increases in Barker Slough. Findings from these analyses were incorporated into the assessment, and mitigation measures were revised to better address the factors contributing to the increases. With regard to bromide, all alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) remain adverse (under NEPA) and significant and unavoidable (under CEQA). However, it is now known that the cause of the modeled increases in bromide in Barker Slough, which was driving the impact determinations for almost all alternatives, is assumptions regarding CM4 implementation, not operations in CM1. Thus the mitigation measure was revised to more appropriately address actions that could lessen the projected impact, based on these findings.

Because the new alternatives (2D, 4A, and 5A) contain a lower acreage of tidal restoration, significant impacts with regards to bromide are not expected under these alternatives.

Refer to Chapter 8, *Water Quality*, Section 8.1.3.3, 8.3.1.7, and Impact WQ-5 in Sections 8.3.3.1 through 8.3.3.16 in Appendix A for the bromide additions and revisions.

2.2.4 Mercury

Modeling results and findings for Impact WQ-13 under Alternative 8 were revised and updated. Specifically, results for water column and fish tissue methylmercury under Alternative 8 contained in the Draft EIR/EIS were inadvertently based on erroneous source water concentrations for methylmercury; accordingly, these were corrected and the modeling rerun. These corrections lowered the concentrations predicted under Alternative 8, but did not change the assessment conclusions. Alternative 8 previously contained an adverse (under NEPA) and significant and unavoidable impact (under CEQA) on mercury and methylmercury, and while the magnitude of the impact is now lower, it remains adverse and significant and unavoidable due to substantial increases in modeled methylmercury concentrations in multiple locations throughout the Delta.

Additional information regarding the uncertainty inherent in the mercury bioaccumulation modeling approach was added to Appendix 8I of Appendix A and referenced in the assessment. This information is important when interpreting smaller increases or decreases in fish tissue mercury levels that were estimated via the models. Refer to Chapter 8, *Water Quality*, Section 8.3.3.15, Impact WQ-13 in Appendix A for the updated Alternative 8 mercury assessment. Refer to Appendix 8I of Appendix A for the discussion of model uncertainty.

The three new alternatives – Alternative 2D, 4A, and 5A – differed from the alternatives assessed in the Draft EIR/EIS (1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9) in their evaluation of effects on mercury from other environmental commitments (CM 3, 4, 6, 7, 9–12, 15, and 16). The three new alternatives contain substantially less tidal restoration acreage than those in the Draft EIR/EIS. Thus, although the potential types of effects on mercury resulting from implementation of the environmental commitments under the new alternatives would be generally similar to those described for alternatives assessed in the Draft EIR/EIS, the magnitude of effects on mercury and methylmercury at locations in the Delta related to habitat restoration would be considerably lower.

It is not expected that the level of tidal restoration proposed under Alternatives 2D, 4A, and 5A would cause fish tissue concentrations to increase, at a measurable level, outside of the immediate localized area of the tidal restoration sites. However, habitat restoration 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. Fish tissue concentrations in the Delta already frequently exceed the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins objective of 0.24 mg/kg for trophic level 4 fish in the Delta. The proposed tidal restoration may cause or contribute to increased fish tissue concentrations at a local level, though the magnitude of the increase is not quantifiable. The Basin Plan also includes methylmercury allocations for wetlands for various areas of the Delta. Because the proposed tidal restoration acreage is very small, it is possible that, relative to the allocations, the increased loading would be very small. However, it is still unknown how and if the allocations can be attained. The Basin Plan also requires that for many areas of the Delta (i.e., those needing reductions in methylmercury), proponents of wetland restoration projects shall (a) participate in Control Studies, or implement site-specific study plans, that evaluate practices to minimize methylmercury discharges, and (b) implement methylmercury controls as feasible. 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 to minimize methylmercury production. 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 this would constitute a potential environmental impact, these increases would not be expected to cause injury to downstream water rights holders or other downstream water users, because effects would be localized to the restoration sites. Nor would such localized impacts adversely affect any other downstream beneficial users.

2.2.5 Microcystis

Assessment of the effects of the project on *Microcystis aeruginosa*, a nuisance and toxic cyanobacteria species, was added to the chapter. This section was added in response to public comments, as well as in recognition of the existing threat to water quality that *Microcystis* poses. In part because it is not technically a water quality constituent, and in part due to the lack of state or federal water quality standards, *Microcystis* did not appear in the screening analysis that was performed (Appendix 8C). Due to the combined effects of increased temperatures due to climate change (not related to the project) and increased residence times in the Delta (due primarily to the project related effects of CM1 and CM4), effects of project alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9 on Microcystis were considered adverse (under NEPA) and significant and unavoidable (under CEQA). Mitigation measure WQ-32 was created to attempt to lessen the effects of the alternatives on Microcystis.

Because the new alternatives (2D, 4A, and 5A) contain a lower acreage of tidal restoration, residence times are not expected to increase as substantially as under the other alternatives, and thus significant impacts with regards to *Microcystis* are not expected under these alternatives, relative to the No Action Alternative.

Refer to Chapter 8, *Water Quality*, Section 8.1.3.18 for a description of the existing conditions regarding Microcystis, Section 8.3.1.7 for methodological considerations used in the assessment, and Impacts WQ-33 and WQ-34 in Appendix A for the Microcystis assessment.

2.2.6 Potential Seaward Effects of the BDCP

The western seaward boundary of the BDCP Plan Area has been delineated at Carquinez Strait. There are no actions in the BDCP proposed to occur in the bays seaward of the Plan Area. Thus, the analysis in the Draft EIR/EIS focused on assessing the alternatives' effects on water quality in the upstream of the Delta Region, within the Plan Area, and in the SWP/CVP Export Service Areas. However, public and agency comments raised questions regarding water quality effects of the alternatives in the bays seaward of Carquinez Strait. Because net flows move seaward from the Delta toward the bays, water quality constituents present in the Delta water column could potentially be transported seaward. New screening and assessment of water quality constituent effects in San Francisco Bay was conducted in response to these concerns. These new assessments, which are reflected in new text added to the original Draft EIR/EIS analysis of Water Quality, did not identify any new adverse or significant impacts or any substantial increase in the severity of previously identified impacts, except in the case of selenium. For alternatives 6-9, projected increases in selenium loading and concentrations in North San Francisco Bay were considered adverse (under NEPA) and significant and unavoidable (under CEQA), while alternatives 1–5 were considered not adverse and less than significant. This is consistent with findings for the assessment of selenium in the Delta, in which the same conclusions were reached for the same alternatives. The driving factor for the adverse impacts under alternatives 6–9 in both the western Delta and the North Bay is modeled increases in selenium concentrations and loading, leading to potentially higher body burdens of selenium in certain species.

Refer to Appendix 8O, *SF Bay Analysis Tables*, in Appendix A for the assessment of seaward water quality effects of the alternatives.

2.2.7 Modeling and Methods Descriptions

The existing section describing models and methods used in the analysis was revised and expanded. Several public comments and comments by agencies requested more thorough discussion of modeling accuracy and uncertainty. In the Draft EIR/EIS, this type of information was sometimes included only through reference to Appendix 5A, and in other cases it was not in the documentation at all. As a result, many readers apparently did not see, or could not find, the relevant information. Additionally, to provide context for electrical conductivity and chloride compliance results, a description of how CALSIM and DSM2 were used to conduct this analysis was necessary. The addition of this material to Chapter 8 improves the analysis by putting results into their proper context regarding the overall uncertainty in the modeling approaches, including both the accuracy and precision of the model output, as well as the validity of input assumptions.

Refer to Chapter 8, *Water Quality*, Section 8.3.1.1, and 8.3.1.3 in Appendix A for the expanded and revised description of models used and their linkages.

2.2.8 Dissolved Oxygen

Following publication of the Draft EIR/EIS, concerns were raised that the project may increase flows on the San Joaquin River at Stockton, causing the location of the minimum DO point to shift downstream. To assess this possibility, flows in San Joaquin River at Stockton were evaluated in light of the above information.

The analysis showed that in most cases, flows in the San Joaquin River at Stockton actually decreased by a small amount. Reports indicate that the aeration facility performs adequately under the range of flows from 250–1,000 cfs (ICF International 2010). Based on the analysis, the expected changes in flows in the San Joaquin River at Stockton were 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 minimum basin plan objectives. Since the aerators are assumed to be operated under the alternatives, just as in the Existing Conditions and No Action Alternative, effects of the alternatives on DO remained less than significant.

Refer to Chapter 8, *Water Quality*, Section 8.3.1.7 for methodological considerations used in the assessment, and Impact WQ-9 in Appendix A for the updates to the DO assessment.

2.2.9 Miscellaneous Revisions and Updates

Several minor, miscellaneous revisions and updates that do not fall into the categories above were also made.

Regarding the Trace Metals assessment, although aluminum was mentioned in the Screening Analysis (Appendix 8C) as being included in the Trace Metals assessment, it was inadvertently omitted. Additional discussion of aluminum (as well as of iron and manganese) was therefore added to *Affected Environment* and additional assessment of aluminum was conducted.

Regarding the assessment of nutrients, a discussion of nutrient objectives was added and language was added to the document to explain why the N:P (nitrogen to phosphorus) ratio was not specifically evaluated, why dissolved vs. total phosphorus was used in the assessment, and how upgrades to the Sacramento Regional Wastewater Treatment Plant would affect phosphorus concentrations in the late long term.

Refer to Chapter 8, *Water Quality*, Section 8.1.3.16 in Appendix A for the discussion of aluminum, iron, and manganese, and Section 8.3.3.1 Impact WQ-27 in Appendix A for the assessment of aluminum.

Refer to Chapter 8, *Water Quality*, Section 8.1.3.10 in Appendix A for the discussion of nutrient objectives, Section 8.3.1.7 in Appendix A for a discussion of the N:P ratio and total vs. dissolved phosphorus, and Section 8.3.1.7 in Appendix A for a discussion of upgrades to the Sacramento Regional Wastewater Treatment Plant effects on phosphorus.

2.3 Air Quality, Health Risk Assessment, Traffic, and Noise Revisions

Chapter 22, *Air Quality and Greenhouse Gases*, evaluates criteria pollutant and greenhouse gas (GHG) emissions from construction and operation of the water conveyance facility (CM1). For all action alternatives other than Alternatives 4A, 2D, and 5A, air quality impacts from implementation of habitat restoration and protection activities (CM2 through CM11) are also evaluated (at the programmatic level). The chapter has been revised since release of the Draft EIR/EIS to address design changes associated with the proposed project, to incorporate the latest engineering assumptions and modeling procedures, and to respond to issues and concerns raised by the public. Where these design and engineering assumptions could result in substantive changes in other impact analyses, such revisions in other impact analyses have also been made since release of the Draft EIR/EIS. These parallel changes occur most notably in Chapter 19, *Transportation*, as well as those portions of Chapter 23, *Noise*, related to noise generated by vehicles and equipment associated with construction of water conveyance facilities. The following sections briefly describe the revisions and their effects on the impact analysis. Please refer to the Chapter 22, *Air Quality and*

Greenhouse Gases, in Appendix A and Section 4, *New Alternatives: Alternatives 4A, 2D, and 5A*, of this RDEIR/SDEIS to review the revised analysis.

2.3.1 Mass Emissions Modeling for Construction of the Water Conveyance Facility

As described in Section 3, *Conveyance Facility Modifications to Alternative 4*, of this RDEIR/SDEIS, several design parameters for the water conveyance facilities under Alternative 4 (described as the modified pipeline/tunnel option) were revised following the release of the Draft EIR/EIS to reflect changes in operation and further reduce environmental impacts. DWR prepared an updated economic analysis (2014 cost estimate) to evaluate these design changes. The 2014 cost estimate provides detailed information on equipment and vehicle activity (e.g., operating hours per day), as well as the start date and number of working days for each construction phase. The mass emissions analysis for Alternative 4, as found in the Draft EIR/EIS, was revised to utilize the 2014 cost estimate assumptions, which reflect the optimized CM1 design. Because the assumptions and methodology developed for the 2014 cost estimate supersede the 2010/2012 cost estimate that was used as the basis of the Draft EIR/EIS air quality analysis, emissions estimates associated with the alternatives were likewise revised using a combination of the 2010/2012 and 2014 cost estimate assumptions[1], where appropriate, as well as activity scaling factors based on consultation with DWR's Engineering Workgroup.

In addition to updating the cost estimate, DWR also revised the Construction Equipment Exhaust Reduction Plan, as found in Section 3B.1.9 of Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, to provide additional implementation flexibility and to improve the level of achieved environmental protection. The revised Construction Equipment Exhaust Reduction Plan, now found in Appendix 3B as revised and reissued as part of this RDEIR/SDEIS, is comprised of several conservative performance standards. Specifically, an average performance standard of model year 2013 engines is identified for offroad equipment (equivalent to a Tier 3 to Tier 4 engine, depending on the equipment type and horsepower). This performance standard must be achieved at each construction site, although construction contractors may utilize a variety of control strategies to meet an emissions output equivalent to or better than a model year 2013 fleet. Potential control strategies include engine electrification, use of Tier 3 or 4 engines, and use of diesel particulate filters. The revised Construction Equipment Exhaust Reduction Plan also includes a performance standard of model year 2010 engines for onroad vehicles, a Tier 3 engine requirement for marine vessels, and a Tier 4 engine requirement for tunneling locomotives. The air quality emissions modeling for Alternative 4 and other alternatives have been revised to reflect implementation of these commitments.

The mass emissions analysis was also revised to incorporate new air quality models released since the Draft EIR/EIS, as well as to respond to public comments. The California Air Resources Board (ARB) released the EMFAC2014 model on December 30, 2014. This model supersedes the EMFAC2011 model, which was used to estimate emissions from onroad vehicles in the Draft EIR/EIS air quality analysis. Accordingly, onroad vehicle emission estimates have been revised using emission factors generated by the EMFAC2014 model. Helicopter emissions were also updated

[1] Features exclusive to the BDCP Alternatives (e.g., intake pumping plants) were not evaluated in the 2014 cost estimate for Alternative 4. Accordingly, the 2010/2012 cost estimate, which represents the best available data for the features, was used to evaluate emissions based on guidance from DWR's Engineering Working Group. Please refer to Appendix 22A, *Air Quality Analysis Methodology*, in Appendix A for additional information.

based on the Federal Aviation Administration's (FAA's) Emissions and Dispersion Modeling System (EDMS). Finally, minor technical revisions have been made in response to public input, including use of GHG emission factors that account for multiple concrete compression strengths. The revisions ensure that the mass emissions analysis and construction impact assessment use the most recent air quality modeling procedures and incorporate applicable public input.

This revised analysis is included for Alternative 4A in Section 4.3.18, for Alternative 2D in Section 4.4.18, for Alternative 5A in Section 4.5.18, and for the remainder of the alternatives in Chapter 22, *Air Quality and Greenhouse Gases* in Appendix A of this RDEIR/SDEIS. The updated modeling resulted in slightly higher mass emission estimates than those presented in the Draft EIR/EIS. However, similar to the Draft EIR/EIS, the project proponents would pursue offsets to reduce emissions below air district thresholds or to net zero. Thus, this impact would be less-than-significant.

2.3.2 Health Risk Assessment for Construction of the Water Conveyance Facility

The health risk assessment (HRA) prepared for the Draft EIR/EIS characterized cancer risks and non-cancer hazards from inhaled diesel particulate matter based on the mass emissions analysis conducted for construction of the water conveyance facilities. Because the mass emissions analysis has been revised based on changes to the project design and underlying engineering assumptions, the HRA was likewise revised to incorporate the updated modeling results. The revised HRA also reflects implementation of the modified Construction Equipment Exhaust Reduction Plan (see revised Appendix 3B), as well as changes to the onroad vehicle (EMFAC2014) and helicopter (EDMS) emission factors. These revisions ensure that the HRA utilizes the most recent engineering data and air quality modeling procedures. The cancer risk analysis was also updated to incorporate recent guidance from the Office of Environmental Health Hazard, which includes age-specific factors to account for increased sensitivity to carcinogens during early-in-life exposure.

This revised analysis is included for Alternative 4A in Section 4.3.18, for Alternative 2D in Section 4.4.18, for Alternative 5A in Section 4.5.18, and for the remainder of the alternatives in Chapter 22, *Air Quality and Greenhouse Gases* in Appendix A of this RDEIR/SDEIS. The updates identify separate health risks associated with exposure to localized particulate matter (PM) and diesel particulate matter (DPM). Significant impacts from receptor exposure to localized PM were found for all alternatives, but would be reduced to less than significant through dust suppressants, receptor relocation, or onsite paving. Receptor exposure to DPM would result in significant impacts for all alternatives except for 4, 4A, and 9. A stepped mitigation approach would ensure that this impact would be less-than-significant.

2.3.3 Mass Emissions Modeling for Operations and Maintenance of the Water Conveyance Facility

As improvements were made to the construction design, DWR similarly continued, following release of the Draft EIR/EIS, to refine operations and maintenance (O&M) protocols for the water conveyance facilities. DWR developed updated equipment and employee O&M assumptions to reflect the latest understanding of project operations. These new assumptions have been incorporated into the mass emissions modeling and operational air quality impact assessment. The analysis has also been revised to utilize onroad emission factors generated by the EMFAC2014 model. The combined revisions ensure that the analysis utilizes the most recent engineering data and air quality modeling procedures.

This revised analysis is included for Alternative 4A in Section 4.3.18, for Alternative 2D in Section 4.4.18, for Alternative 5A in Section 4.5.18, and for the remainder of the alternatives in Chapter 22, *Air Quality and Greenhouse Gases* in Appendix A of this RDEIR/SDEIS. The updated modeling resulted in slightly higher mass emission estimates than those presented in the DEIR/EIS, but all impacts would remain less than significant.

2.3.4 Air District Thresholds and Localized Health Analysis

The Lead Agencies have also added to Chapter 22, *Air Quality and Greenhouse Gases*, further discussion identifying and disclosing the purpose of local air district thresholds with respect to evaluating both regional and local air quality impacts. The added text highlights the fact that, because the regional criteria pollutant thresholds are derived from air quality plans developed to meet and attain the state and federal health-based ambient air quality standards on a regional basis, these thresholds are not indicators of potential localized human health impacts. This additional context better explains how the Plan Area air districts' criteria pollutant thresholds should be applied; and it defines their purpose in evaluating air quality impacts. In general, the thresholds are only used to assess the project's effect on *regional* attainment of the ambient air quality standards. The new language in Chapter 22 explains why localized health impacts cannot be derived from analyses of regional air quality impacts, and why localized exceedences of regional criteria pollutant thresholds recommended by Plan Area air districts do not necessarily translate into adverse health effects.

With these general principles in mind, the chapter has also been revised to explain better how both regional and localized changes in pollutant emissions associated with a project could impact human health. The revised analysis evaluates health effects from pollutants with the greatest potential to result in a significant, material impact on human health. Because health effects related to regional pollutants, such as ozone precursors (ROG and NO_X), are the products of emissions generated by numerous sources throughout a region, minor increases in regional air pollution from project-generated ROG and NO_X would have nominal or negligible impacts on human health. Consequently, potential health effects related to increases in ozone precursors are discussed with respect to cumulative air quality impacts. Project-level analysis of localized pollutants (particulate matter, carbon monoxide, and the pathogenic fungus *Coccidioides immitis*, which can cause valley fever), which can directly affect the health of certain sensitive receptors, has been added to the chapter. The additional analysis addresses concerns regarding the relationship between localized pollutant concentrations and human health by documenting the potential health outcomes induced by project-generated emissions.

This analysis is included for Alternative 4A in Section 4.3.18, for Alternative 2D in Section 4.4.18, for Alternative 5A in Section 4.5.18, and for the remainder of the alternatives in Chapter 22, *Air Quality and Greenhouse Gases* in Appendix A of this RDEIR/SDEIS (refer to Impacts AQ-9 through AQ-18 and AQ-28 through AQ-31).

2.3.5 Odor Analysis

The Draft EIR/EIS air quality analysis evaluated potential odor impacts from equipment and vehicles that would be required for construction and O&M of the water conveyance facilities. The impact analysis has been expanded to assess potential odors from excavated organic matter during removal of reusable tunnel material (RTM) and sediment. If present in the muck and sediment, anaerobic decay of organic material can generate gases, specifically hydrogen sulfide. Hydrogen sulfide is commonly described as having a foul or "rotten egg" smell. Odor analysis for implementation of CM2 through CM11 has also been added to Chapter 22, *Air Quality and Greenhouse Gases*. The additional discussion provides a more thorough analysis of potential odor impacts associated with the project.

This revised analysis is included for Alternative 4A in Section 4.3.18, for Alternative 2D in Section 4.4.18, for Alternative 5A in Section 4.5.18, and for the remainder of the alternatives in Chapter 22, *Air Quality and Greenhouse Gases* in Appendix A of this RDEIR/SDEIS (refer to Impacts AQ-19 and AQ-26). Odor impacts for all alternatives would be less than significant, consistent with what was presented in the DEIR/EIS.

2.3.6 General Conformity Determination

The project study area is in federally classified nonattainment and/or maintenance areas for ozone, carbon monoxide, and particulate matter. Consequently, to fulfill general conformity requirements, a general conformity determination was prepared for the applicant-preferred alternative (APA), Alternative 4A. Since construction and operation of the project under Alternative 4A would be identical to Alternative 4, the general conformity determination applies to those activities pertaining to both Alternative 4 and Alternative 4A (henceforth referred to as Alternative 4/4A).

The determination concluded that, with implementation of Mitigation Measures AQ-1 through AQ-4, which would develop and implement emissions offset programs, Alternative 4/4A would not conflict with or obstruct implementation of the applicable air quality plans. The Lead Agencies undertook an extensive consultation process with SJVAPCD and BAAQMD to confirm that sufficient emissions reduction credits were available to offset project-generated emissions to net zero. Copies of the air district consultation efforts have been provided in Appendix 22E, *General Conformity Determination*. The appendix also presents the complete general conformity determination for Alternative 4/4A. Consultation with SMAQMD and YSAQMD is still ongoing.

2.3.7 Transportation and Noise Analysis for Construction of the Water Conveyance Facilities

As described in Section 2.3.1, *Mass Emissions Modeling for Construction of the Water Conveyance Facility*, an updated analysis was prepared to evaluate design changes, associated changes based on detailed information of revised equipment and vehicle activity (e.g., operating hours per day), and the start date and number of working days for each construction phase. The transportation and traffic-based noise analyses for Alternative 4 were revised to utilize these revised assumptions, which reflect the optimized design of the water conveyance facilities. Because the assumptions and methodology developed as part of this effort supersede those used as the basis for the Draft EIR/EIS transportation and traffic-based noise analyses, vehicle trip estimates associated with construction of the other alternatives, along with their associated impact discussions, were likewise revised where appropriate.

This revised construction traffic assessment is included for Alternative 4A in Section 4.3.15, for Alternative 2D in Section 4.4.15, for Alternative 5A in Section 4.5.15, and for the remainder of the alternatives in Chapter 19, *Transportation* in Appendix A of this RDEIR/SDEIS (refer to Impacts

TRANS-1 and TRANS-2). Detailed information on the updated traffic modeling results can be found in Appendix 19A, *Air Quality Analysis Methods*, Section 22A.1 in Appendix A. This revised construction noise assessment is included for Alternative 4A in Section 4.3.19, for Alternative 2D in Section 4.4.19, for Alternative 5A in Section 4.5.19, and for the remainder of the alternatives in Chapter 23, *Noise* in Appendix A of this RDEIR/SDEIS (refer to Impact NOI-1). Traffic volumes on certain segments and construction noise levels at some receptor locations increased, relative to the DEIR/EIS. Traffic mitigation to enhance capacity of congested roadway segments and improve the physical condition of affected roadway segments would be pursued, in addition to limits on construction hours and activity. Noise-reducing measures would also be implemented to reduce construction-related noise and vibration levels. However, impacts would remain significant and unavoidable, consistent with what was presented in the DEIR/EIS.

2.4 Revised Project Descriptions and Enhanced Level of Detail

The RDEIR/SDEIS includes a number of revisions to the project description and an enhanced level of detail for Alternative 4. These include more explanation regarding the analysis of water conveyance facilities, updates to CM2–CM21, clarification on the role of the Bureau of Reclamation, and the use of CM3–CM11 to offset impacts related to CM1. As explained above, the RDEIR/SDEIS also includes new sub-alternatives 4A, 2D, and 5A. The project descriptions for these sub-alternatives are included in Section 4, *New Alternatives: Alternatives 4A, 2D, and 5A*, of this RDEIR/SDEIS.

2.4.1 Analysis of Water Conveyance Facility Impacts

Each component feature of the water conveyance facilities is analyzed at a resource-specific level, based on complete water conveyance facility project footprints developed by DWR's Division of Engineering. Analyses of Alternatives 4, 4A, 2D, and 5A in the RDEIR/SDEIS reflect GIS data from DWR that incorporate recent revisions to the alignment of water conveyance features and associated lands required for construction. The features in this GIS dataset, which represents each conveyance facility component (e.g., intakes, intermediate forebay, tunnels, spoils areas), were overlaid onto resource-specific GIS data layers to identify physical effects of conveyance facility construction. This GIS-based approach facilitated both a component-specific, or project-level, analysis of the individual features of the conveyance facilities, as well as a program-level analysis of construction of the conveyance facilities in aggregate. For example, the local effects on parcels of agricultural land associated with construction of a particular intake facility can be assessed through GIS analysis; at the same time, the overall temporary and permanent loss of agricultural lands associated with construction of the conveyance facilities as a whole can be aggregated to convey a comprehensive picture of the effects on the resource.

2.4.2 Updates to Conservation Measures, Environmental Commitments, and Avoidance and Minimization Measures

The RDEIR/SDEIS reflects changes made to the conservation measures and avoidance and minimization measures (AMMs) for Alternative 4 and, where applicable, Alternatives 4A, 2D, and 5A.

These revisions are made to ensure that CM2–CM21 are described consistently where needed in the RDEIR/SDEIS and reflect additional detail that may have been developed since publication of the Draft BDCP. A discussion of the conservation measures and AMMs that have been substantively changed and that would potentially affect the characterization of impacts can be found in Appendix D.

The list of environmental commitments incorporated into all of the action alternatives (i.e., all alternatives except for the No Action/No Project Alternative) was updated extensively to account for refined project engineering. Like the formal mitigation measures prescribed in the Draft EIR/EIS, these environmental commitments, which sometimes take the form of best management practices (BMPs), were intended to avoid or minimize potential adverse effects (a NEPA term) and potential significant impacts (a CEQA term). Both DWR and the federal Lead Agencies were aware that, in many instances, the environmental commitments, as well as related "avoidance and minimization measures," functioned as *de facto* mitigation measures. The Draft EIR/EIS is therefore written with a recognition that, where appropriate and necessary, its text should explain how the environmental commitments and avoidance and minimization measures would function, and whether particular commitments or measures would or would not be effective in reducing various significant or adverse effects to less-than-significant or less-than-adverse levels. Despite these efforts in the Draft EIR/EIS, which was issued for public review in December 2013, several commenters have asserted that the document does not comply with the requirements subsequently announced by the California Court of Appeal in a January 2014 decision known as *Lotus v. Department of Transportation*.[2] In response to these comments, Appendix 3B (in Appendix A) has been significantly modified as part of this RDEIR/SDEIS. In addition to the refinements made to some of the environmental commitments, Appendix 3B as modified now includes, after each specific environmental commitment and avoidance and minimization measure, one or more narrative discussions explaining both how it reduces the severity of environmental effects and whether the level of impact reduction is sufficient to render the effects less than significant.

2.5 Analysis of Geotechnical Investigations

As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, DWR will perform a series of geotechnical investigations along both the selected water conveyance alignment and at locations proposed for facilities or material borrow areas. The work to be performed will constitute a subsurface investigation program to provide information required to support the design and construction of the water conveyance facilities. Geotechnical investigations will be conducted to identify surface and subsurface conditions as necessary to complete design of the water conveyance facilities. The potential environmental effects resulting from conducting geotechnical investigations are described in Chapter 31, *Other CEQA/NEPA Required Sections*, Section 31.5.1.1, of the Draft EIR/EIS.

Following publication of the Draft EIR/EIS, DWR developed a Draft Geotechnical Exploration Plan (Phase 2) for the Alternative 4 conveyance alignment. The geotechnical investigation plan provides additional details regarding the rationale, investigation methods and locations, and criteria for obtaining subsurface soil information and laboratory test data (California Department of Water Resources 2014). Because this new information allows for a more detailed assessment of the

[2] 223 Cal.App.4th 645.

potential environmental effects resulting from geotechnical investigations than that which appeared in Chapter 31 of the Draft EIR/EIS, the activities described in the geotechnical plan have been incorporated into the revised impact analysis for Alternative 4 in this RDEIR/SDEIS (see Section 3, *Conveyance Facility Modifications to Alternative 4*, for a description of other revisions to facility design and Appendix A for revised Draft EIR/EIS text).

2.5.1 Draft Geotechnical Exploration Plan

The proposed exploration is designed as a two-part program (Phases 2a and 2b) to collect geotechnical data relevant to engineering issues associated with conveyance facility construction (as opposed to learning more about the environmental impacts of those facilities). The two-part program will allow refinement of the second part of the program to respond to findings from the first part. The proposed subsurface exploration will focus not on environmental impact issues, but on geotechnical considerations of the following aspects of water conveyance facility development: engineering considerations, construction-related considerations, permitting and regulatory requirements, and seismic characterization considerations.

The data obtained during the geotechnical exploration will be used to support the development of an appropriate geologic model, to characterize ground conditions, and to mitigate the geologic risks associated with construction of proposed facilities. The investigations will build on information previously gathered in geotechnical data reports (California Department of Water Resources 2010a, 2010b, 2011, 2013) and conceptual engineering reports (California Department of Water Resources 2009a, 2009b, 2010c, 2010d, 2010e, 2010f, 2010g, 2014, 2015) that supported analysis in the Draft EIR/EIS. A discussion of the environmental compliance efforts associated with previous geotechnical activities is provided in Appendix 4A, *Summary of Survey Data Collection Efforts,* in the Draft EIR/EIS.

Representative samples of subsurface materials will be collected from selected locations along the MPTO alignment and at proposed facility sites, and the collected samples will be tested to support design. The distance from Intake 2 (the northern extent of the MPTO) to the Clifton Court Forebay (the southern extent) is approximately 39 miles. The proposed facilities include river intakes, conveyance pipelines, sedimentation basins, pumping plants, transition structures, forebays, construction and vent shafts, access roads, bridges, and tunnels. The proposed subsurface exploration will consist of field tests and laboratory testing of soil samples. The field tests will consist of soil borings, cone penetration testing (CPT), geophysical testing, pressure meter testing, excavation of test pits, installation of piezometers and groundwater extraction wells, dissolved gas sampling, and aquifer tests. The field exploration program will be planned to evaluate soil characteristics and to collect samples for laboratory testing, which will include soil index properties, strength, compressibility, permeability, and specialty testing to support tunnel boring machine (TBM) selection and performance specification.

The proposed Phase 2a and 2b exploration on land will consist of approximately 1,500–1,550 exploration locations including drilling boreholes and performing CPTs as well as conducting approximately 60 shallow test pit excavations (typically 4 feet wide, 12 feet long, and 12 feet deep) in soils to evaluate bearing capacity, physical properties of the sediments, location of the groundwater table, and other typical geologic and geotechnical parameters. CPT consists of pushing a cone connected to a series of rods into the ground at a constant rate, allowing continuous measurements of resistance to penetration both at the cone tip and the sleeve behind the cone tip.

The resulting information correlates to the nature and sequence of subsurface soil strata, groundwater conditions, and physical and mechanical properties of soils.

Temporary pumping wells and piezometers may be installed at intake, forebay, pump shaft, and tunnel shaft sites to investigate soil permeability and to allow sampling of dissolved gases in the groundwater. Small test pits will be excavated to obtain near-surface soil samples for laboratory analysis. Drilling will take place at project sites that are readily accessible by truck or track-mounted drill rigs.

After each site is explored, the boring, CPTs, and/or piezometers will be backfilled with cement-bentonite grout in accordance with California regulations and industry standards (Water Well Standards, DWR 74-81 and 74-90). Test pits will be backfilled with the excavated material on the same day as they are excavated with the stockpiled topsoil placed at the surface and the area restored as closely as possible to its original condition.

Exploration activities may consist of auger and mud-rotary drilling with soil sampling using a standard penetration test (SPT) barrel (split spoon sampler) and Shelby tubes; cone penetrometer testing; temporary well installation; test pits; and electrical resistivity and other geophysical surveys. All exploration methods will require a drill rig and support vehicle for the drillers and vehicles for the geologists and environmental scientists. Best management practices applicable to geotechnical exploration, such as those set forth in *Draft Geotechnical Exploration Plan – Phase 2*; Draft BDCP Appendix 3.C, *Avoidance and Minimization Measures*; Appendix 3B, *Environmental Commitments,* in Appendix A of this RDEIR/SDEIS, as well as those incorporated as mitigation measures throughout the EIR/EIS, will also apply to the implementation of geotechnical explorations, where applicable (e.g., in-water activities may, in some cases, require application of a different set of commitments than activities taking place on land). Direct impacts to buildings, utilities, and known irrigation and drainage ditches will be avoided during geotechnical exploration activities. The various on-land exploration methods may last from a few hours to several days depending on the exploration method and depth.

Approximately 90–100 overwater geotechnical borings and CPTs are proposed to be drilled in the Delta waterways. These include approximately 30 overwater geotechnical borings and CPTs in the Sacramento River to obtain geotechnical data for the proposed intake structures. Approximately 25–35 overwater borings and CPTs are planned at the major water undercrossings along the planned MPTO tunnel alignment. An additional 30–35 overwater geotechnical borings and CPTs are proposed for the barge unloading facilities and Clifton Court Forebay modifications. The depths of borings and CPTs are planned to range between 100 and 200 feet below the mud line (i.e., river bottom).

DWR plans to conduct overwater drilling only during the period from August 1 to October 31 between the hours of sunrise and sunset. Duration of drilling at each location will vary depending on the number and depth of the holes, drill rate, and weather conditions, but activities are not expected to exceed 60 days at any one location. Overwater borings for the intake structures and river crossings for tunnels will be carried out by a drill ship and barge-mounted drill rigs. Best management practices applicable to construction of conveyance facilities, such as those set forth in Draft BDCP Appendix 3.C, *Avoidance and Minimization Measures*, Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, as well as those incorporated as mitigation measures throughout the EIR/EIS, will also apply to the implementation of geotechnical explorations, where applicable and feasible (e.g., in-water activities may, in some cases, require application of a different set of commitments than activities taking place on land).

As discussed above, the proposed subsurface exploration has been structured into two major phases: 2a and 2b. The elements of Phases 2a and 2b have been defined to support engineering design and construction as described below.

2.5.1.1 Phase 2a Geotechnical Exploration

Phase 2a exploration will focus mainly on collecting data to support preliminary engineering. This includes overwater and land-based soil borings and CPTs. The overwater explorations are planned to collect subsurface information to support the design of intake structures and the major water crossings along the MPTO. Land-based explorations are planned for the intake perimeter berms, State Route 160 (SR 160), sedimentation basins, pumping plants, forebay embankments, tunnel construction and vent shafts, and other appurtenant facilities proposed for the MPTO. Approximately 600 boring and CPT locations are proposed for the Phase 2a exploration.

For the proposed MPTO tunnels, Phase 2a would entail soil borings approximately every 2,000 feet along the tunnel alignment and CPTs approximately every 2,000 feet midway between the borings. Overwater boreholes and CPTs are planned in Potato Slough, San Joaquin River, Connection Slough, and Clifton Court Forebay. All of the land-based boreholes along the tunnel alignments will be converted into piezometers. CPTs are also proposed to be co-located at every third borehole to enable calibration of the CPT data with the in-situ geology encountered in the boreholes.

For tunnel shaft sites and Clifton Court Forebay pumping plant shaft sites (see Section 3, *Conveyance Facility Modifications to Alternative 4*, of this RDEIR/SDEIS for a description of the revised location for pumping plants under the MPTO), six soil borings and four CPTs will be advanced at each planned shaft location. Once drilling is completed at each shaft site, two of the boreholes will be converted into groundwater extraction wells and the other four boreholes will be converted into piezometers.

Boreholes and CPTs are also proposed for the intake and pumping plant sites, as well as the planned location for the realignment of SR 160 adjacent to each intake. Approximately six of the boreholes at each of the north Delta diversions would be converted into piezometers.

2.5.1.2 Phase 2b Geotechnical Exploration

Phase 2b exploration is proposed to collect geotechnical data to support final design, permitting requirements, and planning for procurement and construction-related activities. In addition to soil borings and CPTs, test pits would be created as part of Phase 2b exploration. Additional explorations may also be carried out before construction to affirm the validity of the data collected during the design phase. The Phase 2b subsurface exploration will aim to collect geotechnical data from those project site areas and facility locations that have been verified by preliminary engineering and other associated studies. Approximately 950 boring, CPT, and test pit locations are proposed for the Phase 2b exploration.

For the proposed MPTO tunnels, the Phase 2b exploration will consist of advancing soil borings near the Phase 2a CPT locations such that a borehole will have been located at approximately 1,000-foot intervals along the entire tunnel alignment. CPTs will be advanced midway between the boreholes. This configuration would provide for a land-based exploratory location (borehole or CPT) spacing of approximately 500 feet along the tunnel alignment, a spacing that generally conforms to typical design efforts for tunnels such as those proposed as part of the MPTO. The exploration proposed for the construction and ventilation shaft sites in Phase 2a would be expanded to include areas for accessing the TBMs for equipment inspection and maintenance ("safe haven intervention sites") in Phase 2b. Overwater boreholes and CPTs are planned in the Sacramento River, Snodgrass Slough, South Fork Mokelumne River, San Joaquin River, Potato Slough, Middle River, Connection Slough, Old River, North Victoria Canal, and Clifton Court Forebay.

2.5.1.3 Schedule for Geotechnical Explorations

The estimated duration to complete the proposed Phase 2a and 2b land-based explorations is about 24 months, assuming six land-based drill rigs operating concurrently for six days per week. The estimated duration to complete the Phase 2a and 2b overwater explorations is about 14 months, assuming two drill rigs operating concurrently for 6 days per week. However, to maintain the project development schedule, it is likely that 10–15 land-based drill rigs would be used simultaneously for 12–18 months to complete the exploration. The exploration duration will vary depending on the availability of site access, drilling contractors and equipment, permitting conditions, and weather. Most of the proposed explorations are planned to be performed during the first 3 years of implementation.

2.5.2 Methods for Environmental Analysis

Based on information provided in the geotechnical plan and coordination with DWR's engineering workgroup, assumptions were developed to incorporate the proposed geotechnical investigations into the analysis of relevant resource topics in this RDEIR/SDEIS. The geotechnical plan is a draft document that is based on conceptual engineering; consequently, the specific exploration locations shown on figures appended to the plan are approximate, and it is anticipated that they may be revised as engineering efforts are advanced and as access to the proposed exploration sites becomes available.

To account for this uncertainty, several steps were taken to develop assumptions for environmental analysis. First, for analyses based on the geographical extent of an impact, it was assumed that those geotechnical exploration sites will be co-located with or located adjacent to another CM1 surface feature were already considered as an affected area for the purposes of the impact analysis. For example, treating a proposed tunnel shaft location as an impact and then adding an additional impact for a geotechnical exploration proposed for the same location would lead to an overestimate of the overall impacts. However, where sites identified for on-land geotechnical explorations were not positioned with a corresponding conveyance feature or work site, several geotechnical exploration zones (GEZs) were created. These GEZs are located above the tunnel alignment, around Clifton Court Forebay, and at one existing bridge location on Bacon Island (see Mapbook Figure M3-4 for the locations of the GEZs). To account for the potential for surface impacts to take place anywhere within these zones but to avoid implying that the entire area will be affected, a proportional approach was developed to (1) estimate the typical area required for a single geotechnical investigation site (including associated access road), (2) calculate the total acreage required based on the number of sites within the GEZs, and (3) divide the total acreage required for the geotechnical investigation sites in the GEZs by the total acreage of the GEZs. This process allowed for the development of a multiplier (approximately 30%) that could be applied to specific acreage impacts in the GEZs. So, as an example for illustrative purposes, if 100 total acres within the

GEZs are identified as "prime farmland," the impact analysis would assume that geotechnical investigations would affect 30 acres. This acreage estimate would then be included as part of the overall effect reported for the MPTO water conveyance facilities.

For proximity-based analysis (such as noise), relevant "buffers" were simply applied from the outside edges of the GEZs to ensure that any effects on sensitive receptors were included in the impact analysis. For analyses associated with air quality modeling, specific assumptions regarding equipment, vehicle use, and schedule information were incorporated into the existing models used for impact analysis. Finally, it was assumed that the overwater sites identified in the geotechnical plan would be representative of the sites ultimately chosen because it is anticipated that site selection for these investigations is more constrained than sites for on-land activities. Sites for overwater exploration would be chosen at the locations for the three proposed intake structures in the Sacramento River, Clifton Court Forebay, and at major water crossings along the tunnel alignment or areas proposed for barge unloading facilities, including Snodgrass Slough, Mokelumne River, Potato Slough, San Joaquin River, Connection Slough, Middle River, Santa Fe Cut, Woodward Canal, Old River, and Italian Slough.

2.5.3 Applicability to Other Alternatives

If the Lead Agencies ultimately select an alternative that proposes an alignment different from the modified pipeline/tunnel alignment, it is anticipated that a similar plan for geotechnical exploration would be designed and implemented, as described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS. A discussion of the potential environmental effects resulting from implementation of these activities appears in Chapter 31, *Other CEQA/NEPA Required Sections,* Section 31.5.1.1 in the Draft EIR/EIS. Because additional detail pertaining to the location and extent of these efforts under the modified pipeline/tunnel alignment has been developed since the release of the Public Draft EIR/EIS, the potential effects of these activities have been incorporated into relevant portions of the impact analysis pertaining to construction of the water conveyance facilities.

2.6 References

2.1 Fish and Aquatic Habitat Analyses

None.

2.2 Water Quality Revisions

None.

2.3 Air Quality, Health Risk Assessment, Traffic, and Noise Revisions

None.

2.4 Revised Project Descriptions and Enhanced Level of Detail

None.

2.5 Analysis of Geotechnical Investigations

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