STATE OF CALIFORNIA – THE CALIFORNIA NATURAL RESOURCES AGENCY EDMUND G. BROWN, JR., Governor

DEPARTMENT OF WATER RESOURCES
CALIFORNIA WATER COMMISSION
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April 9, 2014

Dear Members of the Delta Independent Science Board,

The Department of Water Resources, together with the Agencies participating in the Bay Delta Conservation Plan (BDCP), would like to extend our appreciation to the Delta Independent Science Board (ISB) for their interim review of, and subsequent comments on, the Public Review Draft BDCP Plan and Draft Environmental Impact Report/Environmental Impact Statement released in December 2013. Your review and comments are an important step in ensuring our commitment to scientific rigor in the development of a comprehensive environmental review of the benefits and impacts associated with implementation of the actions covered in BDCP Plan.
It is clear from the comments that each ISB member applied their expertise to the legislatively mandated review, and DWR appreciates the feedback on the issues raised. In your March 6, 2014 cover letter to the Delta Stewardship Council and the California Department of Fish and Wildlife that accompanied your comments, you raised many important high level considerations. We have addressed some of those overarching concerns in this response letter. For the detailed responses to all comments please see the attached response table.

Uncertainty

The ISB raised concerns about how the EIR/EIS addresses uncertainty, especially with regard to climate change and sea level rise. We agree that there is uncertainty regarding the pace, magnitude and manifestation of climate change. The effects of such uncertainty have been considered to the best of our ability in the analysis. We agree that other disruptive factors such as floods or levee failures are likely to have substantial effects on the Delta; however, it is important to note that the scope of an EIR/EIS is to consider the effects of the project on the environment, and not the environment on the project. Some of these factors, including levee failures, could occur regardless of the BDCP and these secondary impacts are not included as part of the EIR/EIS analysis.

Confounding Effects

The Delta is a complex system and we agree that there is a confounding effect of actions taken. We attempt to capture that linkage in our analysis to the extent possible. We strive to use the best available science and models, and there is not a model that captures the complexity of the system. As you know, even in the areas of the system that are reasonably well understood – such as physical structure, chemical parameters

and ecological topics - we are still making discoveries every year which alter our conceptual models of the system. Noting these limitations, the BDCP does infer ecosystem scale effects of the conservation measures. Far from being ignored, these relationships are fundamental to the design of the conservation strategy. It is true that in the EIR/EIS most of this is expressed in the context of effects on one single species, but that is merely a consequence of the legal standard formatting requirements.

Adaptive Management

While the Adaptive Management process is not described at length in the draft EIR/S, it is described in detail in Chapter 3 of the draft plan, and is modeled on the process adopted by the Delta Science Program. The specifics of the Adaptive Management Team (AMT) and adaptive management process are evolving and have been further developed with each iteration of the draft documents. The final BDCP and EIR/EIS will include additional details on the AMT, which we have described in the attached response table. However, due to the length of the proposed permit (50-years), it is important to provide the AMT with the flexibility to manage the allocation of resources to achieve the biological objectives rather than prescribe that process in full detail now. We hope that this additional context and clarification is helpful in addressing some of your high level concerns. It is important to note that many of the comments or formatting issues you raised are fundamental aspects of the legal environmental review documentation process. We will continue to consider, evaluate and incorporate your comments. Your input is valued and will help to improve the scientific integrity of both the BDCP Plan and the BDCP EIR/EIS.

Sincerely,

Laura King Moon
Chief Deputy Director
Department of Water Resources

Attachment

cc: Dan Ray, Delta Stewardship Council
Maria Rea, NMFS
Mike Tucker, NMFS
Ryan Wulff, NMFS
Dan Castleberry, USFWS
Mike Chotkowski, USFWS
Michelle Banonis, USBR
Carl Wilcox, DWF
MaryLee Knect, USBR
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BDCP and EIR/EIS Review Document Comment Form

Document: ***Public Draft BDCP and EIR/EIS***

Comment Source: Delta ISB
Submittal Date: March 7, 2014

No.	Source (cover letter/ appendix)	Comment	Response
1	Main Concerns	Expectations for the effectiveness of conservation actions are too optimistic.—Throughout the EIR/EIS, the BDCP actions, supplemented by Avoidance and Minimization Measures and Mitigation Measures, are assumed to produce the anticipated benefits. This is an implausible standard of perfection for such a complex problem and plan. It is also assumed that any time lags between when impacts arise and the benefits of compensatory or mitigation actions emerge can be addressed through planned phasing of activities. Such expectations are unrealistically optimistic.	In developing and analyzing the BDCP, the preparers have endeavored to identify the assumptions underlying the analysis and conclusions reached in the Plan and the associated environmental review. Plan proponents believe that the expectations regarding effectiveness are appropriate. It is customary in restoration design to assume that proposed actions will be effective. Restoration actions are not assumed to replicate the behavior of pristine systems but to create functional ecosystem attributes within the design parameters of the system, and to this extent, result in predictable outcomes. Risks that function may fall short of goals or may be achieved later than intended are accommodated, typically, by requiring disproportionate mitigation (e.g. mitigation ratios) or by other strategies to discount the benefits of the restoration actions (e.g., conservative assumptions in the effects analysis. The effectiveness of the BDCP conservation measures evaluated in terms of achieving performance targets stated in the form of biological objectives. These targets are expected to be reiterated in the form of permit conditions. The principal agent and mechanism assuring achievement of the biological objectives is adaptive management as implemented by the

			adaptive management team.
2	Main Concerns	The potential effects of climate change and sea-level rise are underrated.—The BDCP Plan and EIR/EIS do a good job of describing how climate change and sea-level rise might influence communities and species and some aspects of hydrology, and how the BDCP actions may enhance resiliency and adaptation to these effects. However, the speed and magnitude of these changes may cause the consequences of conservation actions to not emerge as planned. The potential direct effects of climate change and sea-level rise on the effectiveness of actions, including operations that are part of new water conveyance facilities, are not adequately considered. Similar comments could be made about the treatments of other disrupting factors, such as levee failures, earthquakes, or invasive species, any of which has the potential to profoundly alter the desired outcomes of BDCP actions.	It is true that there is uncertainty regarding the pace and magnitude of climate change. There is additionally considerable, perhaps greater uncertainty regarding the manifestations of climate change. For instance, only a few years ago the importance of "atmospheric river" storm systems as a source of geomorphically influential precipitation events was not generally appreciated. However, the effects of climate change on the conservation measures have been considered to the best of our abilities, and have been incorporated in the effects analysis. With regard to other disrupting factors, it is true that a variety of environmental changes, including floods, levee failures, earthquakes, new species invasions, and changed abundances of existing dominant species, are likely to have substantial effects on Delta ecosystems in the coming decades. However specific scenarios describing how these outcomes may arise or how these factors may interact are potentially infinite in diversity. Moreover, the analysis presented in the EIR is intended to comply with CEQA and, as a result, the analysis necessarily emphasizes the impact of the proposed project on the environment (as opposed to the potential effects of the environment on the project). Nevertheless, the proposed project does consider, and attempt to deal with, future environmental changes. Rather than try to enumerate them, our conservation design strategy (as summarized in BDCP Appendix 3.A, Development of the Conservation Strategy), has been to try to restore some of the resiliency that Delta ecosystems have lost. More resilient systems are by definition more robust against the effects of most disturbance types and thus are an appropriate strategy to insure ecosystem stability in the context of unknown future disturbances.

3	Main Concerns	Confounding effects of linkages and interactions are insufficiently considered.—The Delta is a complex, interacting system. Actions in one place or for one species will affect dynamics there and elsewhere of the same or other species. Consequently, failure to meet the expectations of conservation actions will have cascading effects. By ignoring the competitive or predatory effects of one species on another, or the effects of habitat restoration in one place on downstream restoration projects, the effectiveness of actions may be compromised. Although some non-covered species are combined for analysis and some predation effects are considered, much of the EIR/EIS is focused on individual species, particular places, or specific actions that are considered in isolation from other species, places, or actions. The geographic scope of the EIR/EIS does not extend to include San Francisco Bay, although potential impacts from BDCP actions will likely affect the Bay. By failing to treat the Delta as a fully functioning and integrated ecosystem, potential synergistic or competing interactions among actions that may enhance or undermine their effectiveness may be overlooked.	We agree that the Delta is a complex system. Unfortunately, no functioning conceptual model that captures how the system responds to environmental stressors exists. In its absence we have had to work with what we know. There are aspects of the Bay-Delta system that are fairly well understood, such as patterns of variation in physical structure and chemical parameters. There are selected ecological topics that are also reasonably well understood. Even in these areas, though, fundamental discoveries are still being made on a year-to-year basis that substantially alter our conceptual model of the system, which in turn is evidence that the current conceptual model is not complete, though it does constitute "best available science" at this time. However, this does not mean that we cannot infer ecosystem scale effects of conservation measures. The BDCP does this both in the problem analysis section of each conservation measure, and in the effects analysis. In fact this is the premise of the most fundamental conservation measures – those which alter the types and distribution of habitat, and of flow, and which infer that changes which increase the production of phytoplankton and zooplankton, or which provide refuge habitat for migrant fishes, can result in benefits that may be expressed outside of the areas directly affected by these conservation actions. Far from ignoring competitive, predatory, or other symbiotic interactions, these relationships are fundamental to the design of the conservation strategy. It is true that most of this is expressed in the context of expected effects on one species or another, but this is merely a consequence of law and regulation, which have decreed that an individual species may have to be protected, but which have not extended analogous protections to entire ecosystems. Thus BDCP, as a regulatory vehicle, is overwhelmingly focused on how the Plan would

			affect a few discrete species, despite the fact that altering the mechanisms and extent of that effect is achieved by restructuring an ecosystem. The “Bay” in Bay-Delta Conservation Plan was originally meant to refer to the San Francisco Bay, but the Plan Area now ends at the Carquinez Strait. This change has occurred for several reasons. Physically, the Carquinez Strait is a major physiographic boundary. Upstream is a low-salinity deltaic depositional environment; downstream is a high-salinity tidally dominated environment. Similarly, estuarine ecosystems up and downstream of the Straits are distinct, and most organisms (primary exceptions being anadromous fish) don’t move back and forth across the boundary. The Strait is also a socially practical boundary; no BDCP restoration actions are proposed downstream of it, the BDCP Plan Area does not extend downstream of it, and so there is limited potential for BDCP to have direct effects downstream of it. That prompts the question, what effects will BDCP have on downstream systems? The potential exists for BDCP to affect downstream areas via export of water, water quality constituents, or biota. BDCP will have almost no effect on total water outflow. CM1 contains provisions ensuring this. Although changes of a few percent may occur, these effects are not discernable against the background of interannual variation or of more high-frequency variation such as may be associated with weather systems. BDCP effects on water quality, as revealed in the EIR/EIS analysis of effects, are purely local. Changes in bulk water quality, affecting water quality discharges to areas downstream of the Strait, are not anticipated and no mechanism has been identified whereby such changes might be

			measurable, let alone significant. BDCP effects on biota include changes in the abundance of aquatic weeds, changes in plankton production and export from restored tidal wetlands, and changes in the abundance of rare anadromous fishes. Changes in aquatic weeds are likely to only be locally perceived and in any case the weeds of concern would not survive in the higher salinities found downstream of the Strait. Tideland restoration, although extensive from a restoration technology point of view, will only restore about 10-15% of the historically lost tidelands in the Delta, and effects on phytoplankton, although expected to benefit adjacent subtidal environments, are not expected to extend throughout the Plan Area, let alone to alter trophic balance in downstream areas. Finally, although BDCP is expected to support the recovery of a number of anadromous fishes whose life histories include areas downstream of the Strait, nonetheless the changes in abundance anticipated for these species are not expected to have substantial ecosystem consequences, mainly because these species are rare and even with significant abundance increases are expected to remain a small component of overall fish biomass in the system. Even under the most optimistic projections, the Delta's aquatic ecosystems will continue to be dominated in most areas by nonnative fishes and the export of anadromous fish biomass to the Bay and the Pacific Ocean is expected to change only slightly compared to current conditions.
4	Main Concerns	Scientific uncertainties are inconsistently and incompletely addressed.—Every action and consequence discussed in the EIR/EIS is accompanied by uncertainties. Examples of such uncertainties include the designations of habitats for species, projections of entrainment, the effects of climate change and sea-level rise, the effectiveness of habitat restoration, the information and data available to support analyses and conclusions, the consequences of levee failures unrelated to BDCP actions, and model results used in the analyses.	The EIR/S analysis is a comparative assessment of potential impacts and benefits of implementing each alternative. Assessment methods are applied equally across the alternatives. CEQA and NEPA require lead agencies to assess the potential for environmental effects based on the best available information and tools and avoid speculation.

		When combined, these uncertainties will be compounded and propagate. Although the BDCP Plan discusses some of these uncertainties, they are treated inconsistently in the EIR/EIS (particularly in the Executive Summary). When the outcomes of an action are considered too uncertain or speculative, the uncertainty may be used as a reason not to address the issue at all. Consequently, those charged with implementing the Plan may be inadequately prepared to deal with uncertainty. Unaddressed, uncertainties pose a risk to the project as a whole.	CEQA requires impacts to be assessed against criteria used to judge the significance of an impact in order to provide decision makers enough information to make a reasoned choice about the project and its alternatives. We anticipate that the Adaptive Management Team will be a primary forum for evaluating uncertainties related to implementation of the Plan and invite input from the ISB as additional detail regarding the adaptive management process is developed.
5	Main Concerns	Assumptions are not stated clearly and consistently.—An understanding of the underlying assumptions is critical in evaluating scientific propositions or models. Although assumptions are often stated and listed in the BDCP Plan, they are noticeably absent in the EIR/EIS from many statements about the effectiveness or presumed benefits of BDCP actions. Throughout the document, the lack of clearly and consistently stated assumptions weakens the scientific foundation of the EIS/EIR.	In developing and analyzing the BDCP, the preparers have endeavored to identify the assumptions underlying the analysis and conclusions reached in the Plan and the associated environmental review. However, there may be some instances where assumptions are omitted or stated in terms that are less clear than they could be. Below we identify the location of some assumptions in the documents. If there are specific areas where the ISB believes the assumptions have not been stated or could be stated more clearly, please identify them so that we can address them. Assumptions for water supply, surface water, and water quality are largely provided in Appendix 5A of the EIR/EIS. Other assumptions for Chapter 11, Fish and Aquatic Resources, and Chapter 12, Terrestrial Biological Resources, are based on methods provided in BDCP Chapter 5, Effects Analysis. Assumptions surrounding design and construction of CM1 facilities are provided in EIR/S Appendix 3C. The analysis in the EIR/EIS is based on the successful implementation of the HCP/NCCP, as proposed in the BDCP document. The BDCP and EIR/EIS recognize that there may be circumstances in the future that require changes in Plan implementation and/or additional environmental compliance documentation to address uncertainties related to Plan

			implementation.
6	Main Concerns	The adaptive management process is not fully developed.—Adaptive management is the key to successful implementation of BDCP, and the proposed organizational infrastructure to support adaptive management is well described in the Plan. Although adaptive management is mentioned frequently in the EIR/EIS, however, details of how it will be designed and done are left to a future Adaptive Management Team to define. Consequently, it is unclear how adaptive management will be integrated into the implementation of BDCP, whether the scientific skills needed to plan and oversee adaptive management will exist in the Implementation Office and on the Adaptive Management Team, and whether the capacity to conduct the monitoring and analysis needed for adaptive management will be available. Because conditions in the Delta and responses to BDCP actions may change quickly, the adaptive management process must be nimble, yet the organizational structure may delay rather than expedite needed adjustments. Performance measures needed to evaluate actions and make adjustments in actions are not addressed substantively in the EIR/EIS (although the BDCP Plan has a detailed listing of performance measures linked to its Biological Goals and Objectives). BDCP actions are unlikely to play out as planned, so it might be useful to view them as planned experiments or hypotheses to be tested. Accordingly, it would be prudent to have contingency plans generally outlined before discovering that things aren't working. Yet contingency plans are rarely mentioned. We have misgivings about how well the adaptive management process proposed will actually function as a key component of BDCP.	Because of the length of the proposed permit term we chose to address contingency planning in a broad way: if the Adaptive Management Team (AMT) finds that a conservation measure or location of a conservation measure, is not performing as intended, it could be modified via adaptive management. Likewise funds from an underperforming [or ineffective] measure could be reallocated to a measure that has been found effective relative to the biological goals. In this way the AMT has discretion, within their authority, to best allocate resources to achieve the biological objectives. The adaptive management and monitoring program has developed substantially with each iteration of the BDCP and is currently undergoing further development. The next (final public) iteration of the BDCP is currently planned to provide additional information prescribing the monitoring and adaptive management framework, including: ● Staffing roles and responsibilities. ● Procedures for scoping monitoring work and research work. ● QA/QC and data quality standards, including metadata. ● Data storage, retrieval and reporting conventions. ● Publications and public access to data; archives of digital and other data; creation of a BDCP library. ● Independent science and other peer review of data and reports. ● Type, frequency, and mission of conferences and colloquia.

			● Procedures for Monitoring Program interaction with the Implementation Office, Adaptive Management Team (AMT), partners (other entities engaged in collection or use of relevant monitoring data), stakeholders, permittees, permitting agencies. ● More detail, as needed, on procedures followed by the AMT. ● Commonalities related to permitting, if any (e.g. securing and renewing scientific collection permits). ● Commonalities related to funding, if any. Additional detail is also planned for the adaptive management process, but as noted, much of this will be up to the AMT to determine. For this reason we are looking into ways to assemble the AMT and get them operational as soon as possible.
7	Main Concerns	Risks are not modeled or fully evaluated.—There are risks with almost every action proposed as part of BDCP. These risks can interact and cascade, with potentially major consequences. Formal tools of risk assessment and decision theory, which assign probabilities, uncertainties, and magnitudes to various risks, could be used to evaluate which aspects of BDCP may be most vulnerable to high-consequence risks and help to prepare for contingencies. We found no indications that formalized risk assessment has been used to any great extent in the development of BDCP.	Agreed, there has been limited use of formal risk assessment and decision support tools in BDCP. We reviewed the use of these tools in analogous programs (the Lower Colorado River and the Everglades) and found no tools that seemed particularly helpful. DWR used risk analysis in the evaluation of levees several years ago (independent of BDCP efforts). The outcomes of this analysis appear in the sense that they were used to develop the “changed circumstances” section of BDCP Chapter 6 dealing with levee work. We continue to review available risk analysis and decision support tools and it is quite possible that they will play a role in BDCP implementation, but thus far no such tools have been selected or implemented. We would welcome specific suggestions about tools that may be applicable.

			Risk of various changed conditions has been taken into consideration in the design of project facilities. For example, risks associated with seismic events and levee failure have informed conceptual design of CM1 facilities. For the purposes of the EIR/EIS, projecting probabilities, uncertainties, and magnitudes of risk related to other program-level BDCP actions were considered to be too speculative for the purposes of NEPA and CEQA compliance.
8	Main Concerns	Descriptions of the alternatives for conveyance structures and operations do not encourage explicit comparisons.—The central purpose of the EIR/EIS is to clearly describe the alternative water conveyance options. This includes their effects on natural communities, covered species, and selected non-covered species as well as their compliance with the regulatory requirements of NEPA and CEQA through the implementation of additional actions. Each alternative is examined in great detail, in a consistent manner, in the EIR/EIS. However, because no overall framework draws together the specifics of the alternatives in a clear way, it is difficult to compare alternatives. Consequently, it is challenging to develop a rigorous assessment of the relative strengths and weaknesses of the alternatives. Moreover, each alternative suffers from the areas of concern mentioned above, but they do so in different ways, further confounding comparisons.	Resource area summaries are currently being revised in order to provide a more explicit comparison of the effects that could result from various alternatives.
9	Improvement in the scientific framework of BDCP	Adaptive institutional, regulatory, scientific, and financial capacity must be developed.—An ability to adapt implementation to changing conditions is the most important need for BDCP. It is implausible to expect that the Delta's future will be exactly as assumed by any EIR/EIS analysis. Without the institutional, regulatory, legal, scientific, and financial capability to adapt, led by suitable governance, BDCP will be unable to achieve its state and stakeholder objectives. There is little in the Plan and the EIR/EIS to inspire confidence that the many individual agencies, each with narrow responsibilities, will have sufficiently sustained incentives and resources to approach the kind of integration needed for adaptive management to be effective for the Delta, and to implement BDCP.	Agreed that there is a need to develop institutional and financial capacity. There are challenges with developing such capacity in a program that is still under environmental review because the proposing parties are not authorized to make irrevocable commitments of resources prior to decision on the proposal. The Plan as written details available financial capacity in the "funding" section of Chapter 8, and this section is close to meeting the Endangered Species Act standard for funding assurances in habitat conservation plans. Further changes to the chapter are in the works that, per agency comments received to date, will suffice to meet that standard. Institutional capacity is currently in development within each of the principal permitting and implementing agencies, but many

			things must happen – not least approval of the BDCP and issuance of the needed permits – before more formal interagency agreements can be executed. There will be many such agreements, dealing with related agencies and conservation plans. We acknowledge that the missions of various agencies in the Delta may not always be consistent and can result in conflicting opinions. However, the agencies implementing BDCP have had success in collaboration and scientific monitoring and research as evidenced by the Interagency Ecological Program, an over 40-year program involving ten member agencies (www.water.ca.gov/iep). This collaboration serves as a model for future integration that will be necessary for a successful adaptive management program.
10	Improvement in the scientific framework of BDCP	An integrated Science Plan and Program is critical.— The science for BDCP must be clearly linked to the many related scientific problems of managing the Delta, and this scientific capability must be widely perceived as independent and transparent. Science that is fragmented and partitioned among entities is open to advocacy, which is unlikely to improve conditions in the Delta and will ultimately work against the long-term interests of the state and stakeholders. Most of the major science activity must be held in common. If Delta management is to be guided by science, then science will have to become more integrated and aggressively pursued. The Delta Science Plan provides a framework for such integration	There seems to be a perception that Science in the Delta is "fragmented" rather than "integrated." It is rather like looking at a jigsaw puzzle and seeing either pieces or a picture. Both are there. Science in the Delta is being pursued by many parties, and sometimes they have disparate missions, objectives, and sources of support. In such cases there are valid social reasons for a lack of integration. Sometimes they have compatible missions, objectives, and sources of support, in which case integration is feasible and desirable (for reasons which the ISB has stated previously). Our conception of BDCP's role in this process is that integration is a bottom-up process, where BDCP will share data and effort with other interested parties on those conservation measures and other actions where sharing (and even integration) are feasible.
11	Improvement in the	A range of pilot restoration actions should be started early.— Pilot restoration actions should be initiated as soon as possible, within a scientific framework	Yes, a range of pilot restoration actions are underway. Many of them are described briefly in

	scientific framework of BDCP	that will allow BDCP and others to test, refine, and improve the effectiveness of restoration. This approach will reduce uncertainty and costs over the time of this project.	BDCP Chapter 6. They are not addressed in the EIR/EIS because they are not part of the BDCP action – they will occur independent of BDCP; but if BDCP permits are issued, they will secure their ESA/CESA compliance through BDCP, and will be monitored and managed as part of the BDCP Reserve System. The same is true of projects currently in earlier stages of preparation through the Fish Restoration Program Agreement (FRPA). Other projects currently in "early implementation" – meaning that a substantial commitment of resources is expected to occur prior to permit issuance – include studies of predation on juvenile salmonids in the Sacramento River in the reach proposed for siting the North Delta Diversions, and various studies occurring through implementation of the CVP/SWP BiOps. Information from such efforts, where available, was used to inform development of the conservation measures and associated cost estimates.
12	Improvement in the scientific framework of BDCP	Risk-based decision analysis can provide useful insights.— A simple risk-based decision analysis is likely to provide insights into identifying and developing promising options covering a wide range of contentious issues. Although it lacks a proper accompanying risk-based decision analysis, the so-called "decision tree" for operations for fall X2 is just one example of the kind of structuring that could be useful for many of the operational aspects of BDCP and broader Delta management.	See response above (line 7).
13	Improvement in the scientific framework of BDCP	Take advantage of the current drought.—The current drought provides an opportunity to demonstrate the ability of federal, state, and local agencies to collaborate in adaptively managing a complex and changing problem for multiple objectives. In essence, this could be a test of the adaptive management process proposed in the BDCP Plan and a chance to apply these techniques early in the development of BDCP.	No adaptive management team has yet been assembled, but there is an active collaboration occurring in the development of a framework for applying adaptive management in tidal wetland restoration, an area where there are already a number of restoration projects underway and a number of different agencies involved apart from and in addition to BDCP. However, BDCP has no engagement with the drought emergency.
14	Improvements in the BDCP EIR/EIS	Provide a clear and concise comparison of water-conveyance alternatives.— The EIR/EIS is a document intended to guide the selection of alternatives based on performance and consequences, The Executive Summary should focus on	Resource area summaries (including text, tables, and/or figures that allow readers to compare the main differences between alternatives in terms of

	document	guiding the reader through a concise presentation of the alternatives and their relative impacts on major Plan objectives and operations and the physical, biological, sociological, and economic resources of the Delta.	their effects on a particular resource area [e.g. water quality]) are currently being revised in order to provide a more explicit comparison of the effects that could result from various alternatives.
15	Improvements in the BDCP EIR/EIS document	Include meaningful summaries for each chapter.— Each chapter should begin with a sharply focused summary of the main points, conclusions, and important unresolved issues.	Resource area summaries are currently being revised in order to provide a more explicit comparison of the effects that could result from various alternatives.
16	Improvements in the BDCP EIR/EIS document	Clarify performance indicators.— Including clearly defined performance indicators for BDCP actions in both the chapter texts and the Executive Summary would help to focus a discussion and comparison of alternatives and would greatly improve the usefulness of the document.	Resource area summaries are currently being revised in order to provide a more explicit comparison of the effects that could result from various alternatives. Our goal is that these summaries will help to "boil down" the most important results from each resource area.
17	Improvements in the BDCP EIR/EIS document	Discuss uncertainties in each chapter.— Presentation and discussion of the results of major analyses should include some indication of the uncertainty of those results. For quantitative and model-based analyses, this could include likely upper and lower bounds as well as an average or central tendency. For other analyses, a qualitative assessment of relative uncertainty or confidence in the results would be useful. A discussion of the implications of these uncertainties and possible actions to reduce uncertainty would be helpful.	The analysis is a comparative assessment of potential impacts and benefits of implementing each alternative. Assessment methods are applied equally across the alternatives; therefore, while uncertainty exists in model-based analysis, such uncertainty is consistent across the results of the alternatives and should make for an accurate comparison between alternatives (including the No Action Alternative). CEQA and NEPA require lead agencies to assess the potential for environmental effects based on the best available information and tools and avoid speculation. CEQA requires impacts to be assessed against criteria used to judge the significance of an impact in order to provide decision makers enough information to make a reasoned choice about the project and its alternatives.
18	Improvements in the BDCP EIR/EIS document	Bolster and consolidate the support framework for adaptive management.— As currently described (in the Plan; there is no description in the EIR/EIS), the adaptive management process seems unlikely to be workable in terms of financial and scientific support, institutional authority, or regulatory flexibility. It is critical that the management, regulation, and science supporting adaptive management for BDCP be integrated within a larger framework for adaptive management for the Delta. The EIR/EIS would benefit from a concise discussion of how the approaches to adaptive management described in the BDCP Plan, the Delta Plan, and the Delta Science Plan might be blended into an	See responses above (line 9 and line 6). To continue the thread developed in the line 6 response, we are proposing development of monitoring framework focus area plans, which will provide greater detail on development of monitoring frameworks in each of nine "focus areas" that represent largely discrete monitoring issues under BDCP. Each focus area plan will, among other things, identify all potential

		effective and facile framework.	"partners" (agencies, NGOs, academic or other entities) for integration in the collection, archiving, analysis and reporting of monitoring data. Each potential partner will be contacted and discussions initiated regarding the appropriate scope and process for integration or collaboration. We cannot predict the outcome of these discussions, but it is hoped that they will lead to formal agreements characterizing the desired integration. For most of the focus areas, the Delta Stewardship Council, Delta Science Program, and Delta Conservancy are identified as potential partners. Additional partners are specific to certain focus areas.
19	Improvements in the BDCP EIR/EIS document	Identify and list important assumptions in each chapter— Although presentation of many assumptions may best be left to appendices, the most important assumptions and their implications should be discussed in the main chapter texts. This is especially important for the more analytical chapters.	Where appropriate, we will revisit the methods sections of resource chapters to ensure that key assumptions are identified for the reader. If possible, it would be helpful to see specific instances where this is deemed particularly important.
20	Improvements in the BDCP EIR/EIS document	Include risk-based decision analysis.— An overall risk-based decision analysis of alternatives that includes some major contingencies would provide a more rigorous basis for structuring the document and developing a preferred alternative for BDCP. This analysis should explicitly incorporate uncertainty into the comparisons of alternatives, while supporting other decisions about BDCP actions.	CEQA and NEPA require evaluation of the potential environmental effects of a project and its alternatives and identification of mitigation measures to reduce effects. While these considerations may be important for agency decision makers, they are not normally included as part of an EIR/EIS.
21	Improvements in the BDCP EIR/EIS document	Refine the treatment and description of BDCP alternatives.— Continued development of BDCP alternatives and plans for their implementation will improve their performance and adaptability. Suggested improvements should be included and highlighted in the final EIR/EIS. A risk-based decision framework could be used to explore how potential adjustments in, for example, the sizing and placement of habitat restorations or the capacity of Delta conveyance might reflect opportunities or problems likely to arise in the future.	This type of analysis could be appropriate for implementation of the Plan and decisions made through the adaptive management and monitoring program. Any changes to the draft BDCP with respect to the implementation framework will be considered and, where appropriate, analyzed as part of the EIR/EIS. Site-specific design and analysis of habitat restoration under the BDCP will occur in future stages of implementation.
22	Improvements in the BDCP EIR/EIS document	Consider appropriate time frames for permitting BDCP actions.— Because of the many uncertainties in BDCP actions and their consequences and the intention to use adaptive management to adjust practices when necessary, it would be appropriate to include in permits explicit intermediate milestones	Time frames have been taken into consideration in development of the conservation strategy. Although the BDCP itself primarily discusses the near-term, early long-term and late long-term

		and opportunities for mid-course evaluation and correction within the 50-year time period of BDCP.	timeframes, more specific detail will appear in implementation plans and in the monitoring framework focus area plans (see response above, line 18). Some of the biological objectives also include performance targets for intermediate dates, e.g. for salmonid survivorship, and restoration area acreage targets are specified for each of the restored natural community types in BDCP Chapter 6.
23	Improvements in the BDCP EIR/EIS document	Spell out the details of programmatic Conservation Measures.—Currently, CM1 (water conveyance alternatives) is treated at a project level in the EIR/EIS, whereas the other Conservation Measures are dealt with at a less detailed program level. Providing more detail wherever possible would enhance evaluations of the effectiveness and consequences of these other Conservation Measures; even specifying ranges of possibilities or approximate actions would be helpful.	All conservation measures are in a process of continuous refinement. Some of this detail will appear in the final public draft BDCP, and more of it will appear in supporting documents such as the monitoring framework focus area plans and documents supporting plan implementation. We are currently in discussion with the fish and wildlife agencies concerning the degree to which such detail must be developed prior to permit issuance and the degree to which the environmental documents must portray this information. In general, all conservation measures will be more detailed regarding monitoring and adaptive management elements, most measures detailing with elements of the reserve system will include more information on site selection and prioritization, and measures dealing with other stressors will receive additional detail as available.
24	Appendix A, Completeness, Structure, and Effectiveness of Presentation	Articulation of objectives and purpose 1. Are the project objectives and purpose clearly articulated, to enable the identification of a reasonable range of alternatives? EIR/EIS Chapter 2 clearly articulates overall objectives and relates them to challenges to meeting the coequal goals. The statements of purpose address CEQA and NEPA requirements. Subsequent sections discuss problems with ecosystems, water supply, and water quality. Supporting documents include primers on the Delta and water exported from it (Appendix 1A), potential risks from earthquakes and climate change (Appendix 3E), expected consequences of reducing exports to areas south of the Delta (Appendix 5B), and background on how the alternatives were developed (Plan, Appendix 3A). Chapter 2 could frame water supplies more broadly to help show whether the range of alternative actions is "reasonable." For example, water exports from the Delta could be described as part of a portfolio of actions that include water	Appendix 3A of the EIR/S describes the development and screening of alternatives, including those that would consider other means of water supply. In particular, Section 3A.11.1.1 outlines the “portfolio-based proposal” and concludes, among other things, that many of the elements fall outside the scope of a Delta-focused HCP/NCCP. However, this does not preclude implementing these measures through the Delta Plan, the California Water Action Plan, and other regional and statewide initiatives (such as integrated regional water management).

		storage, desalination, water conservation, and regional self-sufficiency. Supporting references could include the Delta Plan (2013) and the draft California Water Action Plan (2013).	
25	Appendix A, Completeness, Structure, and Effectiveness of Presentation	Definition of alternatives 2. Are the alternatives clearly defined? EIR/EIS Chapter 3 contains detailed descriptions of action alternatives, and the meaning of "no action" is clarified by information in Appendix 3D, "Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions." The "Highlights of the EIR/EIS brochure" offers a generalized guide to the action alternatives. These efforts fall short, however, of clarifying the preferred CEQA alternative and facilitating comparison among the alternatives. The draft could identify the preferred CEQA alternative more clearly in several respects: • How strongly preferred is Alternative 4 if the eventual project need not resemble it (Chapter 3, p. 3-4; Highlights brochure sidebar, p. 7)? • "As of this EIR/EIS, the federal Lead Agencies have not identified a Preferred Alternative for the purposes of NEPA" (p. 3-3). Please explain fully. • The reasoning that led to the preference for Alternative 4 could be brought forward from the graceful discussion in Chapter 31. This discussion is far more informative than are its more prominently placed alternatives: a brief explanation in Chapter 3 (p. 3-3), a summary of an announcement by state and federal officials (p. ES-22), and descriptions that emphasize the screening process developed and used (EIR/EIS Chapter 3 and Appendix 3A; Plan Appendix 3A and Chapter 9). • The EIR/EIS blurs the most distinctive element of Alternative 4: the decision tree with four operational branches of Scenario H. The decisions are to be governed by research, but the no plan for this research is presented (Appendix B). In its description of alternatives, Chapter 3 defers first mention of any of the four by name until a footnote on page 3-67, and a table on page 3-208 defines them in obscure shorthand. The Highlights brochure cites H1, H2, H3, and H4 (p. 20) but does so without defining them (p. 10). The EIR/EIS needs to provide fuller views of the alternatives and their expected consequences. For readers keen on details the report should provide comprehensive spreadsheets, as done partially for water-related metrics in Appendix C. All readers, especially decision makers and the broader public, deserve informative graphics that provide summaries at a glance. A limited example: (see Appendix A, page 6, for figure)	Alternative 4 was the CEQA proposed project as of the time of publication of the Draft EIR/EIS. However, lead agencies may modify any alternative based on information provided during the public review process. Under NEPA CEQ guidance, lead agencies are not required to identify a preferred alternative until publishing the Record of Decision, representing an agency's decision on a particular action. Chapter 31 fulfills several requirements related to CEQA, including the explanation of the rationale behind the selection of a proposed project. We will consider these comments in revisions to the executive summary to provide summaries (including graphics) that will help readers understand the comparison between alternatives.
26	Appendix A, Completeness, Structure, and	Range of alternatives 3. From a scientific perspective, does the EIR evaluate a reasonable range of potentially feasible alternatives that would reduce or eliminate significant	Appendix 3A describes the development and screening of alternatives, including those that would consider other means of water supply. In

	Effectiveness of Presentation	impacts of the project and obtain most of the basic project objectives and purpose? If potentially feasible alternatives are not fully evaluated, is a clear rationale provided as to why not? Are there potentially feasible alternatives that would reduce or eliminate significant impacts of the project and obtain most of the basic project objectives that should have been considered (and either rejected or fully evaluated) but were not? The alternatives not evaluated include reducing California's reliance on water from the Delta and its tributaries. By contrast, water conservation is at the top of the list of actions in the California Water Action Plan (2013), and the Delta Plan sets a policy of reducing reliance on this water "through improved regional water self reliance" (2013, policy WR P1, p. 102). The EIR/EIS could be amended to explain why these conservation measures were excluded as feasible alternatives. They already appear in Appendix 5B as responses to public policies, levee failures, or climate changes that would reduce supplies of water to areas south and west of the Delta.	particular, Section 3A.11.1.1 outlines the "portfolio-based proposal" and concludes, among other things, that many of the elements fall outside the scope of a Delta-focused HCP/NCCP. However, this does not preclude implementing these measures through the Delta Plan, the California Water Action Plan, and other regional and statewide initiatives (such as integrated regional water management).
27	Appendix A, Completeness, Structure, and Effectiveness of Presentation	Detail of analyses 4. Are the alternatives studied in adequate detail to differentiate outcomes among the alternatives? Overall, the EIR/EIS offers detail that overwhelms. Much of this detail is unavoidable, given the large matrix of alternatives and impacts, the complexity of many of the scientific issues, and the associated uncertainties. However, the chapters are uneven in the adequacy of the detail they provide. For instance, chapters x and y provide ample detail, whereas chapters and 9 fall short (Appendix B, chapter reviews). The question of detail raises two more fundamental concerns: First, the level of analysis differs debatably between the water-conveyance facilities (analyzed at the project level) and the habitat restoration efforts (analyzed more generally at the program level). Second, the detailed analyses mostly or entirely neglect impacts on important regional resources: San Francisco Bay, Delta levees, and irrigated agriculture. Program vs. project The EIR/EIS makes clear that concurrent actions receive different levels of analysis (p. ES-4 to ES-5; 1-13 to 1-14; 4-2). The concurrent actions include construction of new north Delta diversion and conveyance facilities (CM1) and "near-term" acquisition and restoration of natural communities (CM3-CM10) (EIR/EIS, p. 3-21; Plan, p. 6-3). CM1 receives both program-level and project-level assessment, while the other actions receive program-level assessment only. The EIR/EIS offers several explanations for the different levels of analysis: the BDCP is to be managed adaptively; few sites of ecosystem restoration have been selected; restoration is still "at a conceptual level" of design; and project-	Agreed. Typically, HCPs and NCCPs (such as BDCP) are planning-level documents and do not lend themselves to project-level detail for the purposes of NEPA and CEQA compliance. Thus, the lead agencies have considered the programmatic analysis associated with these measures appropriate for the purposes of NEPA and CEQA due to the reasons cited in this discussion (most notably, lack of specific sites selected for restoration, enhancement, and protection).

		level analysis of habitat restoration is to be carried out as the restoration efforts progress (p. 4-2). Still, the difference in level of detail presented appears to give unequal weight to the co-equal goals. We doubt that programmatic analysis suffices for the habitat Conservation Measures. Impacts neglected The impacts selected for analyzes are described as "the direct and reasonably foreseeable indirect impacts associated with implementation of the BDCP alternatives" (p. 4-10). However, the actual selections disregard: Effects of altered Delta outflows on San Pablo Bay and San Francisco Bay. Section 4.2.1.2 dismisses impacts to San Francisco Bay with hardly any justification. There are potential impacts, however (Appendix B, Chapter 4 review). Effects of and on levees. Though it cites the threat of levee failures as justification for new pipelines or canals, the EIR/EIS offers no detailed analysis of how levee failures could affect the various alternatives, nor of how the alternatives may affect the economics of levee maintenance (Appendix B, Chapter 9 review). It has been argued that CEQA guidelines do not identify levees are resources, and that levee failure is too speculative for analysis. However, the Delta has few resources more important than its levees, and their failure has happened too often (and is invoked too much) to be written off as speculation. Effects on agriculture. We found no discussion of how increased reliability will affect crop selection, applications of fertilizer and pesticides, and water quality in agricultural runoff. As with levee failure, these agricultural effects go beyond speculation. Some of the impact assessment that belongs in the EIR/EIS must be found instead in the Plan. In one set of examples, the EIR/EIS scarcely mentions the public health and ecological problems associated with potential toxicity from the alga Microcystis. By contrast in the Plan, Microcystis toxicity receives detailed coverage that includes, in the majority of cases, discussion of its potential environmental effects. This problem is considered further in our review of Chapter 25. The problem extends beyond Chapter 25 because of ambiguity about whether the EIR/EIS stands alone, or whether it includes the Plan as well; and because the documents lack an index that covers the Plan as well as the EIR/EIS.	Additional environmental analyses may be necessary, and if necessary will be conducted, prior to implementation of specific habitat projects under the BDCP (see, for example, Section 3B.1.22 of Appendix 3B, as well as Appendix 31A). Regarding consideration of San Pablo Bay and San Francisco Bay, please see the response to line 3, above. See responses to comments on Chapter 9 (line 58). As described there, because the BDCP alternatives would not increase the inherent hazard of seismic shaking and its secondary effects, it would not result in an increased likelihood of losses to persons or property. Chapter 30, Section 30.3.2.4, describes the potential for increases in water deliveries to agricultural contractors to remove obstacles to growth. Section 30.3.4.1 describes potential effects associated with reduced SWP and CVP deliveries to agricultural contractors. We will evaluate potential *Microsystis* impacts further and changes will be considered for the final EIR/EIS to this effect where necessary.
28	Appendix A, Completeness, Structure, and Effectiveness of Presentation	Assessed impacts and their comparisons 5. Overall are the analyses reasonable and scientifically defensible? How clearly are the roll-up comparisons among alternatives conveyed in the text, figures and tables? Reasonableness and scientific defensibility EIR/EIS Chapters 5 to 30 offer uneven levels of understanding and citation of	The lead agencies appreciate the opportunity to address specific issues related to citations and research presented in resource chapters to ensure that setting and impact discussions are as up-to-date and as authoritative as possible. The information in the Affected Environment section

		relevant research. Examples of chapters that appear to us authoritative and up to date include Mineral Resources (Chapter 26).... EXAMPLES Examples of chapters we found less than scholarly include Geology (Chapter 9)...Public Health (Chapter 25) EXAMPLES Each chapter and appendix needs a date stamp that describes when and how thoroughly it was last updated. The Effects Analysis appears up-to-date (Plan Chapter 5). Some of the impact assessments presented are several years out of date, as judged from the references cited (EIR/EIS Chapters 9, 10, and 12; Plan Appendices 3B and 5E). Clarity Overall accessibility to the public and decision makers. The immensity of the EIR/EIS obscures its findings about the comparative impacts of the non-action and action alternatives. Much of the draft contains excellent writing, incisive analysis, and cross-references among its various parts. But the draft needs more in the way of analytical summaries, synthesis graphics (example above), assumption lists, and navigational aids if readers are to make strategic, well-informed decisions about the alternatives presented. It could be argued that the existing draft is understandable enough to meet legal requirements. However, federal law provides grounds for expecting clarity in the EIR/EIS: "Environmental impact statements shall be written...so that decision makers and the public can readily understand them" (Council on Environmental Quality § 1502.8). It could also be argued that there simply wasn't sufficient time for the draft to be made readily understandable, given its length and complexity. However, calls for clarity from the DISB began over 18 months ago (http://deltacouncil.ca.gov/sites/default/files/documents/files/DISB_Letter_to_JMeral_and_DHoffman-Floerke_061212.pdf) and continued with comments on the 2013 Administrative EIR/EIS (pages 11 and 12 of http://deltacouncil.ca.gov/sites/default/files/documents/files/DSC_Letter_on_BDCP_Review.pdf). The public draft includes a table of impacts in the Executive Summary and chapter synopses in the Highlights Document. These summaries, while welcome, fall far short of making the draft understandable. The rather cryptic table of impacts carries forward little uncertainty, and most of the chapter synopses offer more background than analysis. Justification for the preferred alternative. The EIR/EIS gracefully summarizes its case for the preferred CEQA alternative but buries this summary in Chapter 31 (p. 31-4 to 31-8). A readily understandable report would contain an up-front, well-illustrated summary that lays out the main arguments for (and against) the preferred alternative by comparing it against other options: the no-action alternative, the through-Delta channel corridors, the east and west canals, an	of each of these chapters is provided to frame the appropriate context for impact evaluations. In some cases, sources used in these sections appear outdated but in fact contain the most relevant information needed to adequately describe baseline conditions. Resource area summaries are currently being revised in order to provide a more explicit comparison of the effects that could result from various alternatives. We will consider these comments in revisions to the executive summary to provide summaries (including graphics) that will help readers understand the comparison between alternatives, as well as the suggestions offered for providing better linkages between the two documents. .

		isolated tunnel, and dual tunnels of various capacities. The summary would go beyond that in Chapter 31 by complementing the text with one or more tables, diagrams, or both. These would help the reader visualize the main expected consequences, with respect to the co-equal goals, of the various alternatives. The diagram above illustrates one of the ways that the EIR/EIS could compare alternatives more effectively than through text and tables alone. Such diagrams would also represent expected effects on ecosystems and species, and they would also depict uncertainties in the plotted estimates. Chapter summaries. Incisive chapter summaries in the EIR/EIS are limited to its longest chapters (11 and 12). The Executive Summary provides, in addition, an overview comparison among alternatives but these are unsupported by synthesis graphics (section ES-9). The Executive Summary also provides a tabular summary of impacts that is both exhaustive and cryptic (p. ES-61 to ES-132). The Highlights Brochure summarizes chapters unevenly, in most cases with more emphasis on description than on analysis. The Plan's prodigious Effects Analysis lacks a summary that goes beyond describing the chapter's contents (Plan section 5.1). The EIR/EIS thus offers few of the summaries needed by decision makers or by the public at large. The summaries should approach, in level of detail, the sections that begin the climate appendices to the Effects Analysis (Plan part 5A). The summaries would also proceed not just impact by impact, as done well in the chapter on Terrestrial Biological Resources (p. 12-5 to 12-31), but by alternatives, e.g. no-action vs. actions, certain kinds of actions vs. other kinds of actions. As a project to be guided by best available science, the BDCP documents should strive to emulate the best features of scientific communications. Nearly every scientific journal requires articles to begin with a well-written summary or abstract that lays out the main findings and their broader implications. In much the same spirit, each abstract at the annual workshop of the Interagency Ecological Program includes a "Statement of Relevance" that puts the science in context. Navigational aids. Inconsistent statements about overlap with the Draft BDC Plan add to the challenge of understanding of the EIR/EIS. The "Highlights" document describes the EIR/EIS as being self-contained (p. 5 and 6), as does the section "EIR/EIS Organization" (p. 1-31 to 1-35). But according to footnotes on EIR/EIS pages ES-3, 1-2, and 3-3, the EIR/EIS includes Plan documents as well, including all their appendices. This expansion of EIR/EIS may reduce duplication, but it nearly orphans key sections on adaptive management and the effects analysis. A helpful 145-page index in the EIR/EIS excludes the Plan documents, which	

		appear to lack an index of their own. The documents contains many helpful cross-references. The large sizes of many of the individual files may make hyperlinks impractical for users who download each file separately.	
29	Appendix A, Approach, Analysis, Tools, and Modeling	**Evaluation methods** *1. Does the environmental impact analysis utilize appropriate evaluation methods? Were tools/analyses appropriate and described adequately?* As discussed in response to the first set of charge questions, the EIR/EIS contains a great deal of information without boiling it down into systematic comparisons of alternatives that would help decision makers or the public reason their way through a very difficult and complex problem. Remedies to this shortcoming, illustrated by the diagram on page 4 and by the spreadsheet in Appendix C, would not be hard to include in the final EIR/EIS. But beyond merely improving the final EIR/EIS, detailed yet readily grasped comparisons of the alternatives are essential for the credibility of the public process and for the usefulness of the EIR/EIS in public and policy discussion. Also pointed out above are three categories of impacts that the EIR/EIS mostly or entirely neglects (p. 5). These omissions are not mitigated by the wealth of detail provided about the screening process. In the Effects Analysis in the Plan's Chapter 5, the semi-quantitative results for each aquatic species are tabulated (e.g. Figure 5.5.1-5 for Delta smelt), but the final assessment of overall net effects is a qualitative interpretation of the tabulated effects. This analysis is highly uncertain because the combined importance of all effects was a subjective analysis of the attribute scores, and another group of experts may reach a different conclusion (Appendix B, Chapter 11 review). The hydrodynamic modeling seems to be for an unrealistic case where any and all failed island levees are quickly repaired—an outcome not always seen with recent levee failures. Simulations that include levee failures, as well as sea-level rise, may require three-dimensional modeling. The model results could then be applied to analysis of how levee failures would affect the various alternatives. The air-quality modeling excludes photochemical effects.	This comment has been primarily captured by other comments made by the ISB. Please see responses to these comments, including the chapter-specific reviews from Appendix B. Assumptions for the hydrodynamic analysis were based on detailed discussions with lead agencies and a Steering Committee to reflect Delta regulatory requirements and to be consistent with agency policy.
30	Appendix A, Approach, Analysis, Tools, and Modeling	**Uncertainty** *2. How well is uncertainty addressed and communicated?* Uncertainty is tremendously difficult to address and communicate for such a complex and dynamic problem. However, some discussion of the general order of magnitude of error or uncertainty in major results would be very useful to readers and policy-makers. Uncertainty is addressed and communicated reasonably well in parts of the BDCP Plan, but that does not carry over to the EIR/EIS, where conclusions are often stated without adequately acknowledging uncertainties or discussing	The analysis is a comparative assessment of potential impacts and benefits of implementing each alternative. Assessment methods are applied equally across the alternatives. CEQA and NEPA require lead agencies to assess the potential for environmental effects based on the best available information and tools and avoid speculation. CEQA requires impacts to be assessed against criteria used to judge the significance of an impact

		how the project might prepare for or respond to a variety of outcomes.	in order to provide decision makers enough information to make a reasoned choice about the project and its alternatives.
31	Appendix A, Approach, Analysis, Tools, and Modeling	**Sensitivity to assumptions, uncertainty, and conflicting data** *3. Do the analyses describe sensitivity of conclusions to assumptions and uncertainty and how possible conflicting data and analyses are interpreted?* This is done some in the Plan and associated appendices, but that is not carried over into the EIR/EIS. Given the complexity of problems, the deluge of data and the multitude of analysis techniques available, quantification of uncertainties will be difficult, but some estimates would be helpful. Many of the analyses need to spell out underlying assumptions in an easily identified format. Bulleted lists of key assumptions could serve that purpose in [EXAMPLES?].	Where applicable, we will revisit the methods sections of resource chapters to ensure that key assumptions are identified for the reader.
32	Appendix A, Approach, Analysis, Tools, and Modeling	**Best available science** *4. Is best available science employed in the environmental analysis of project alternatives and their effects?* The EIR/EIS uses good-enough science unevenly. For instance, the quality of the science is generally high in Chapters 11, 12, and 26, whereas it falls short in Chapters 9 and 25 MORE	Please refer to responses to chapter-specific comments.
33	Appendix A, Approach, Analysis, Tools, and Modeling	**Articulation and reasonableness of assumptions** *5. Are assumptions used in modeling and for analytical purposes clearly articulated and reasonable considering the complexity and current scientific understanding?* It would be particularly useful to see several likely sources of error in assumptions addressed: error propagation in the hydrodynamic models EXAMPLES; major limitations of the models used; assumption of one configuration of restoration projects and inadequate assessment of sensitivity of the model results to this configuration; assumptions about reservoir operations in the hydrodynamic models; assumptions about continued existence of some of the most subsided and least reliable Delta islands; assumptions on possible adaptive management [MEANING?].	Limitations associated with hydrodynamic models are described in EIR/S Appendix 5A, Section A.
34	Appendix A, Monitoring and Adaptive Management	**Description and achievability** *1. How well is the adaptive management strategy described and are the stated goals achievable?* Description of adaptive management Adaptive management is described in section 3.6 as a three-phase process: 1-plan; 2-do; 3-evaluate and respond. The process itself contains of 9 steps: 1-characterize the problem; 2-identify biological goals and objectives; 3-model linkages between objectives and proposed management actions; 4-plan and design management actions; 5-implement management actions; 6-design and implement performance measures, and monitoring and research plans; 7-	See response above (line 6) regarding additional detail on the function and role of the Adaptive Management Team (AMT) and on general statements regarding proposed further development of the adaptive management component of BDCP. Agreed that the Science Manager should be knowledgeable regarding adaptive management, monitoring, and the current state of Delta science.

		analyze, synthesize, and evaluate; 8-communicate current understanding; 9-adapt1[Note that in the BDCP, management actions are termed "implementation actions"]. This characterization of adaptive management in section 3.6 is consistent with standard works on the subject and draws from advice provided by the planning team's science advisors. Section 3.6 also describes many of the issues that need to be taken into consideration in designing a robust adaptive management experiment, as well as the pitfalls in implementing an adaptive experiment. As a description of adaptive management and some of the issues that arise in trying to implement it, we think that this section is quite good. Adaptive Management Team Although adequate, this description of adaptive management does not constitute a strategy for its implementation. In the BDCP, the specific details of design and implementation of adaptive management are left to an Adaptive Management Team, to be chaired by a Science Manager. Members of the Adaptive Management Team are drawn from the various agencies involved in the BDCP, whereas the Science Manager is a new position established as part of the Implementation Office responsible for achieving the goals of the BDCP. Given the complexity of the scientific problems and uncertainties associated with implementing BDCP and the expressed importance of adaptive management to its successful implementation, it is imperative that the Science Manager be well versed in the design and application of adaptive management. It is especially important that the Science Manager know when it is appropriate to use adaptive management and when it is not. Yet experience in design and implementation of adaptive management is not one of the qualifications of the Science Manager listed in Chapter 7. The Adaptive Management Team is to be comprised of managers because, the Plan argues, adaptive management is fundamentally a management activity. We agree that the Adaptive Management Team should be comprised of managers because buy-in by managers is important to the success of adaptive management experiments. However, adaptive management is not part of the toolbox or the experience of most resource managers. Adaptive management experiments are like clinical trials in medicine—they have requirements for planning, execution, time lines, and information gathering that differ from ordinary resource management. It is important, therefore, that the Science Manager be well versed in adaptive management practice and have the ability to interpret this powerful way of implementing and managing conservation actions to the Adaptive Management Team. It will also be important for the Science Manager to consult with the community of experts in adaptive management and to draw from the experience of practitioners involved in other large-scale adaptive management programs, both nationally and	The comment seems to presume that adaptive management will proceed solely through experimentation. This is not proposed. The topic will be further developed in the monitoring framework plans (see responses above, lines 6 and 18), but briefly, monitoring references will include reference sites, before/after comparisons, experimental interventions, and potentially other techniques. The conservation measures are not intended to be experiments. We are reasonably certain that they will have beneficial effects; uncertainties exist regarding the magnitude of those effects, their temporal continuity, and their cost: whether alternative actions can yield greater benefits from the same financial resources. However, some conservation measures have associated "key uncertainties" that likely will entail experiments. We envision experimental design to resolve key uncertainties as being developed by entities responding to requests for proposals. Thus the designs will be competitive, produced by presumably qualified applicants. We find this approach preferable to attempting, in 2014, to specify the design of experiments that will not be funded or implemented for years to come. If you are interested in current experiments of the type that BDCP will support, recent work on nonphysical fish barriers provides a good example, as do the ongoing FLaSH studies. The monitoring framework plans will also address issues such as the role of scientific review in the adaptive management process. This will include public access to data and documents, internal review, agency review, review by partners, and truly independent review through publication in peer-reviewed journals, as well as stimulation of scientific dialogue through sponsorship of symposia and conferences. These mechanisms are partly intended to ensure that the AMT gets sufficient input from the scientific community to

		globally. We find the absence of an explicit requirement for adaptive management expertise in the Science Manager disturbing. Adaptive-management experiments No specific goals are stated for adaptive management beyond its basic purposes of assisting managers to embrace uncertainty and to learn about the systems they are managing through the management actions that they implement. Because no specific adaptive management programs are described, it is not possible to determine whether the Plan will benefit from its incorporation. The BDCP recognizes that adaptive management has failed in other situations for a variety of reasons, including failure to plan adaptive experiments properly, failure to implement adaptive management plans, and failure to follow through with effective monitoring of adaptive experiments (Walters 2007). The BDCP has included measures in the Plan to prevent such failures. We commend the Plan for its acknowledgement of the need to avoid the failures of the past, but we caution that, until a culture of adaptive management is developed in the participating agencies, the kinds of obstacles to success that Walters (1997, 2007) and Allen and Gunderson (2011) describe will continue to pose a significant threat to successful implementation of BDCP. Conducting adaptive management and designing robust management experiments require a working set of models that link conservation actions to desired outcomes through species or ecosystem dynamics. The BDCP has employed a broad range of models in its effects analysis (described in Plan Chapter 5 and its appendices). However, it is not clear that these models are available or even suitable for designing adaptive-management experiments. For example, habitat suitability models are probably not sufficient on their own. It was not clear to us whether the Plan intended the Conservation Measures to be implemented *as experiments*. Instead, it appeared that uncertainties would be dealt with primarily through targeted research projects. Assuming that the BDCP will, at least in some instances, implement Conservation Measures as experiments, it is important to have an objective way to decide when conducting such experiments make sense. The Plan acknowledges that adaptive experimentation may not always be desirable but does not offer a clear approach to deciding when to experiment. Because adaptive experimentation requires resources, one way to assess the benefits of a particular experiment is to compare the cost of conducting the experiment against the value of the information that will be gained from the experiment. If the value of the incremental reduction in uncertainty likely to result from an experiment is small relative to the cost of the experiment, it may make sense not to conduct the experiment. Although it remains important to acknowledge the uncertainty, it is also important to acknowledge that the benefits of	ensure successful implementation of the adaptive management strategy.

		reducing uncertainty do not always justify the costs of experimentation. In some instances (and these may be commonplace in the Delta) adaptive experimentation may not be possible because conservation actions are confounded with one another, control over drivers of change is lacking, physical, legal, or social factors constrain the range of options that can be explored, or various other factors complicate the design. In such cases, other approaches to implementation may be better than adaptive management. Several such situations and possible alternative approaches are discussed by Williams et al. (2009) and Allen and Gunderson (2011). We could describe a range of other issues that will affect the application of adaptive management in the Delta, many of which have to do with the complexity of the conservation plan and the potential for confounding and conflict among objectives, actions, and outcomes. But suffice it to say that this complexity reinforces our view that the Science Manager must have a firm grasp of the potential and the pitfalls of adaptive management and, we hope, an appreciation of other emerging approaches to managing complex adaptive systems.	
35	Appendix A, Monitoring and Adaptive Management	**Adequacy of monitoring** *2a. Is the proposed monitoring adequate to evaluate if the goals and objectives are being achieved?* BDCP identifies three kinds of monitoring: compliance monitoring, effectiveness monitoring, and status and trends monitoring. Although this is a logical way of classifying monitoring activities, it does not necessarily mesh well with adaptive management. Adaptive management is designed to generate information that will clarify uncertainties in our understanding of the dynamics and responses of species and ecosystems. Depending on the particular issue and the information needed, the required monitoring might not fit into the categories of either effectiveness or status and trends. Compliance monitoring includes both monitoring for regulatory compliance and compliance with design standards for Conservation Measures. Potential compliance monitoring actions for each conservation measure are listed in Table 3D-1. Generally speaking, compliance monitoring needs are fairly straightforward, being dictated by a conservation measure's design criteria. Monitoring for regulatory compliance can be more complex as can, for example, monitoring to ensure compliance with flow or water-quality design criteria. As the design criteria and outcomes for most Conservation Measures are not yet developed, it is difficult to say whether the compliance monitoring actions listed in Table 3D-1 are both necessary and sufficient. Effectiveness monitoring and status and trends monitoring are combined in Appendix 3D and potential monitoring actions for each conservation measure are listed in Table 3D-2 of the Appendix. In the preamble to Table 3D-2, it is	Agreed that compliance monitoring is a relatively straightforward issue. The agencies with regulatory authority will prescribe the compliance monitoring requirements. The plan will be revised as needed, on the basis of comments provided by the relevant agencies. See response above (line 6) regarding comments on Table 3.D-2. We recognized at the time the draft was prepared that this table was not well detailed or complete. Now that most of the conservation measures are agreed upon, there are discussions occurring regarding the details of monitoring actions, as well as other details as noted above (response, line 6). Table 3.D-2 will be heavily modified in the final plan, summarizing the provisions of the monitoring focus area framework plans. The "Table 1" quoted in the comment is, in fact, serving as the model for development of comparable tables in each of the monitoring focus area framework plans. In this way the framework plans are intended to demonstrate that the proposed suite of monitoring actions is collectively sufficient to

		stated that "Precise details of each of the effectiveness monitoring actions are not presented here and will be developed and then periodically updated through the adaptive management and monitoring program." As the design details and associated outcomes of the various Conservation Measures have not yet been developed, it is difficult to comment on the proposed monitoring actions. However, we can say that Table 3D-2 does not provide any clues as to how the proposed monitoring will tie into any adaptive management experiments. Chapter 3, section 3.4 discusses each of the 22 Conservation Measures in turn and repeats some of the potential compliance and effects monitoring actions identified in Tables 3D-1 and 3D-2. In addition, for some Conservation Measures, section 3.4 provides a table of "key uncertainties" and suggested research projects to address them. Because uncertainty is central to the impetus to adopt adaptive management, we examined section 3.4 for indications of how adaptive management would be used to address the key uncertainties. We found a number of peculiarities in the treatment of key uncertainties. 1. Key uncertainties are identified for only 8 of the 22 Conservation Measures. For the others, Conservation Measures the Chapter specifically states that no key uncertainties (or needed research) were identified. Given the high uncertainty associated with *all* of the Conservation Measures, we find this statement perplexing. 2. Even where key uncertainties are identified, they seem to misrepresent the broad range of uncertainties inherent in a Conservation Measure. For example, only two key uncertainties are identified for CM-2, Yolo Bypass Fishery Enhancement: 1. Do the modifications at Yolo Bypass function as expected and are they effective; and 2. Does the increased frequency and duration of flooding in the bypass affect the health and vigor of riparian vegetation? The first uncertainty is extremely vague and, in our view, does not in any sense capture the extent and variety of uncertainties associated with such a major change in hydrology, floodplain inundation, and habitat configuration that has effects both inside and outside the Bypass itself. 3. The key uncertainties, where they are identified, are all to be addressed through targeted research projects rather than being incorporated into the adaptive management program. Although it may be more efficient to address some uncertainties through targeted research, many could be more effectively addressed in the context of a proper adaptive management design. Yet, we see no indication that this possibility is considered in the Plan. One of the principal strengths of adaptive management is that it allows managers to design their day-to-day management actions so that they provide critical information on key uncertainties. The BDCP does not appear to take advantage of this	assess the biological objectives and other performance standards for each of the conservation measures. The framework plans are also intended to provide the Adaptive Management Team with clear and detailed guidance to support the development of specific monitoring plans (e.g. for specific restoration sites), sufficient to support issuance of work orders for the required monitoring. The framework plans will perform a similar function for research actions, as well. BDCP Section 3.6 will be modified to incorporate this detail. Moving on to comments about key uncertainties: The key uncertainties were identified on the basis of recent and prior work by the consultants, the DRERIP process, and agency concerns. We expect many new key uncertainties are likely to be identified once the AMT gets to work. In discussions since the December draft was released, it has become clear that there is no consensus on what constitutes a "key uncertainty." Some people seem to think that anything that is not known with certainty is a key uncertainty. In the BDCP, though, we regard a key uncertainty as one that has a substantial potential to affect whether a conservation measure will have its intended effect. This is a relative definition that involves consideration of alternative hypotheses and selecting the ones that have the greatest potential, when tested, to reveal new insights. Use of this definition has led to some key uncertainties being stated in rather broad terms. For instance, CM2 once had nearly 20 key uncertainties. Nearly all of them, though, constituted variations on the question "do the proposed habitat modifications function as intended?" Since there are about 20 proposed projects at Yolo, there was one key uncertainty at each one (sometimes more). Since we have had some comments to the effect that the BDCP's size

		strength. Perhaps such design considerations are also to be part of the responsibilities of the Adaptive Management Team. This would be appropriate but, if so, the text should reflect this responsibility. This concern applies not only to the design of adaptive experiments but also to the clarification of key uncertainties. 4. Another benefit of incorporating uncertainties into a broader adaptive management plan is that individual uncertainties and outcomes can be linked to one another. The Delta is an interconnected system and actions in one region are impacted by actions in other regions. Although there will be times when targeted research is the best option, it will be important to embed these efforts in a broad and holistic adaptive-management framework in order to address the inter-connectedness. Although the Plan does not appear to make effective use of the adaptive management process, the monitoring and research activities described may still be sufficient to measure progress toward achieving the BDCP objectives. Given the way the Plan is structured, however, it is difficult to determine if this is the case. In assessing the suitability of monitoring, there is a logical flow of relationships from conservation objectives, to actions to achieve those objectives, to expected outcomes from the actions, to monitoring to detect those outcomes, and to evaluating criteria for success. Yet these variables are not associated in this way anywhere in the document that we have found. The necessary variables are all described in Chapter 3, however. In Table 1 below we have combined some information from two different tables to illustrate the relationship between objectives, actions, outcomes, and monitoring for CM-4 (Tidal Natural Communities Restoration). A similar assessment could be done for other Conservation Measures. **Table 1.** Examples of biological objectives, how a Conservation Measure advances those objectives, proposed monitoring actions, metrics to be measured during monitoring, and the proposed criteria for success. Compiled from Tables 3.4.4-1 and 3.4.4-3 for CM-4 (Tidal Natural Communities Restoration). [See Appendix A for table] From an examination of this table, one can certainly see that, at least at a superficial level, there is a logical connection between the conservation objective, restoration action, anticipated outcome, and the proposed monitoring. Perhaps at this stage in the planning that is the best one can expect. At a more detailed level, however, a multitude of questions remains. Consider Objective L2.5, “Maintain or increase the diversity of spawning, rearing, and migration conditions for native fish species in support of life-history diversity.” Without questioning whether this objective is meaningful as a way to strengthen the viability of covered fish species, knowing whether one has achieved the objective depends on knowing the current diversity of	is daunting, we chose to summarize those with a single key uncertainty that applies to all 20 projects. We also simplified and reduced the number of key uncertainties for a more scientific reason: many of them were stated in terms that presumed the existence of logical connections that are themselves uncertain. For instance, at one point there was a key uncertainty that dealt with the effects of ammonia in the Sacramento River on phytoplankton productivity. Since that key uncertainty came out of DRERIP in 2009, there have been a series of fundamental changes in the prevailing understanding of that topic (documented in a series of peer-reviewed publications). Thus it is more appropriate to simply cite an uncertainty regarding phytoplankton productivity and its role in supporting the foodweb for covered fishes, a topic that is very likely to remain central to Delta ecosystem studies, whatever we may learn in years to come.

		spawning, rearing, and migration conditions for native fishes (what are the metrics for these attributes of habitat?), knowing that this diversity of habitat supports life-history diversity (what are the metrics of life-history diversity?) and knowing that restoring tidal natural communities will increase habitat diversity for native species in ways that do, indeed, strengthen life-history diversity. Similar comments could be made about the objectives to create networks of dendritic channels in restored tidal marshes and to enhance plankton production. The proposed monitoring touches only on the superficial aspects of these objectives. Our purpose in pointing out these complexities is not to nit-pick about Conservation Measures but to illustrate that the objectives are more nuanced and the potential outcomes more complex than is suggested by the proposed monitoring. At this stage we cannot say whether the proposed monitoring is necessary and sufficient to evaluate whether the goals and objectives are being achieved. We assume that further refinement will be undertaken by the Adaptive Management Team. Such refinement, and the validation of monitoring actions, would be greatly strengthened if the models linking objectives to outcomes were more clearly presented.	
36	Appendix A, Monitoring and Adaptive Management	**Managing adaptive management** *2b. Are the data management, analysis, reporting, and decision-making processes adequate to create a defensible and transparent implementation of adaptive management?* <u>Decision-making</u> The Plan's Chapter 3, section 3.6.4, and Chapter 7, section 7.3.4 address issues of data management, analysis, and reporting. The proposed administrative structure for BDCP is hierarchical. At the top, providing oversight and dispute resolution, is the "Authorized Entity Group" consisting of representatives of DWR, Reclamation, and Water Contractors. State and federal fish and wildlife agencies will participate in a "Permit Oversight Group," which will ensure regulatory compliance with Plan authorizations. The actual implementation of the Plan, including adaptive management, monitoring, and research, will be the responsibility of a newly created Implementation Office headed by a Program Manager who will report to the Authorized Entity Group. A key individual in the Implementation Office will be the Science Manager, who will report to the Program Manager and will have responsibility for guiding and facilitating adaptive management, monitoring, and research. In this capacity, the Science Manager will chair an Adaptive Management Team. The Adaptive Management Team will include representatives of DWR, Reclamation, CVP and SWP water contractors, CDFW, USFWS, and NMFS. The IEP Lead Scientist, the Delta Science Program Lead Scientist, and the Director of the NOAA Southwest Fisheries Science Center will serve as nonvoting members of the Team. The Adaptive Management Team will take the lead in developing a framework	With regard to "the Science Manager and Adaptive Management Team should also identify the goals and objectives for monitoring, the desired outcomes, and an adaptive framework for evaluating when outcomes have been met": see response above (line 6); this information will be available in the monitoring framework plans. With regard to "making use of the science synthesis approaches developed in the Delta Science Plan and working with the Delta Science Program to assemble, analyze, and synthesize the large volume of data that will be accumulated" and "One Delta, One Science": see responses above (line 6 and line 10). The monitoring framework plans will provide greater specificity about monitoring partners and opportunities for integration. We agree that working with the Delta Science Program is important, and formalizing that relationship is a necessary part of integration that cannot be completed until the Implementation Office becomes a functioning entity.

		for monitoring and will enlist the assistance of the IEP in implementing the program. The Science Manager and the Adaptive Management Team will develop and implement a process for compiling, evaluating, and synthesizing the results of monitoring and will prepare a plan to maintain databases of monitoring and synthesis results. The Adaptive Management Team will also manage the BDCP research program in coordination with IEP and the Delta Science Program. The Team will identify research priorities and will administer a process to select and coordinate the researchers who will be involved in the program. In addition, the Adaptive Management Team will be responsible for the compilation and synthesis of the results of studies and analyses undertaken by other organizations that are assisting in the implementation of the Plan. The Science Manager will ensure that BDCP science activities, reporting, and reviews are coordinated with other science activities being conducted in the Delta. Based on these analyses, the Adaptive Management Team will recommend to the Program Manager any necessary changes in the Plan or the Conservation Measures. Although not stated in the documents, the Science Manager and Adaptive Management Team should also identify the goals and objectives for monitoring, the desired outcomes, and an adaptive framework for evaluating when outcomes have been met. In Table 3.E-2, Effectiveness Monitoring Actions are described, for example, and in some cases the timing and duration for monitoring are described. Without knowing the responsiveness of the system, or how different restoration actions and climate change will interact with the desired outcomes, it does not seem feasible to establish a specific timeframe. Rather, the described timeframes should be viewed as initial guides that will be revised depending upon outcomes, since it may take more (or less) time for outcomes to be achieved. This administrative structure centralizes in the Adaptive Management Team headed by the Science Manager the key administrative decisions regarding adaptive management, monitoring and research, data management, analysis, and development of recommendations concerning science-based modification to the BDCP. *If* the individuals involved have the appropriate skills, and provided provision is made to link data management and data bases with existing relevant data bases (both in-house and external to the main agencies involved in BDCP), then the centralized system should be effective. The BDCP envisions making use of the science synthesis approaches developed in the Delta Science Plan and working with the Delta Science Program to assemble, analyze, and synthesize the large volume of data that will be accumulated. We support this idea. We also support ensuring that the BDCP data are publically available so that researchers and individuals outside the BDCP can conduct their own analyses.	With regard to "It seems unlikely that there will be sufficient staff with appropriate computer, analysis, and modeling skills who are available to fill the need" and "a shortage of skilled people may hinder the implementation and success of BDCP": We disagree. There are a long line of highly qualified people in agencies, academic settings, and consulting firms who are able, ready, and eager to take on the challenges of BDCP-supported ecosystem restoration. A glance at the hundreds of presentations given at a typical Bay-Delta Science Conference provides clear evidence for this. There are dozens, perhaps hundreds of people whose careers are going to be defined by roles in BDCP implementation. Other costs of the adaptive management program are, as noted, subsumed within the Implementation Office operational budget and are thought to be reasonable. They are tracked separate from the costs for monitoring and research. With regard to the proposal that "additional funds should be allocated for up-front planning and evaluation", we considered this but actually the annualized costs are based on the "up-front" costs. Experience with comparable programs suggests that we may not know what research and adaptive management challenges may be encountered 20 or 40 years down the road, but that there will be such challenges, and thus there is NOT likely to be a gradual reduction in monitoring, research and adaptive management costs over time. With regard to "contingency plans", see the last paragraph of the line 6 response.

		Large volumes of data will be generated as BDCP is implemented, but BDCP is only one of many activities in the Delta that will be generating a lot of scientific data. The National Research Council has complained that "Currently, science efforts related to the Delta are performed by multiple entities with multiple agendas and without an overarching plan for coordinating data management and information sharing" (NRC 2012). One of the foci of the Delta Science Plan is to develop coordinated data management and sharing among agencies involved in Delta science. The BDCP should work closely with the Delta Science Program to ensure that science and data management for the BDCP are well integrated into the "One Delta, One Science" concept. Ensuring that the appropriate skill sets are present in the Implementation Office, however, may be problematic. We have already noted that the listed qualifications for the Science Manager do not include expertise in adaptive management. Because this is a new position, this shortcoming is easily corrected. However, personnel for the Implementation Office, which will provide the staff to manage the data bases, analyses, modeling, etc., will be drawn from existing staff in DWR and other state agencies. It seems unlikely that there will be sufficient staff with appropriate computer, analysis, and modeling skills who are available to fill the need. In the past, ensuring that agency staff have the access to and the incentive to use the scientific literature has also posed a problem. The BDCP does not consider the possibility that a shortage of skilled people may hinder the implementation and success of BDCP. We consider this to be a real possibility, and suggest that the BDCP needs a contingency plan to deal with such skill shortages. <u>Funding</u> Funding for adaptive management can also become a contentious issue (Walters 2007). The Plan (Chapter 8) identifies a budget on the order of $500 million for monitoring (both compliance and effectiveness monitoring) and an additional approximately $400 million for research (Tables 8-30 and 8-31). No funding is specifically earmarked for adaptive management in the Plan. This is appropriate, as adaptive management should be an integral part of management planning and implementation, not a separate activity. However, adaptive management planning and implementation cost more than traditional management, both in personnel and capital expenditure. It is not clear that these extra costs were taken into account in developing the budget for the Implementation Office. Chapter 3 identifies a separate "supplemental adaptive management fund" of at least $450 million (section 3.4.23.5) that could be accessed if other resources are insufficient or cannot be accessed to support an adaptive change in Conservation Measures. These funds are not available, however, for routine costs of management. The budgets presented in Tables 8-30 and 8-31 were based on estimated staff and resources required	

		to undertake the monitoring and research actions listed in the Plan plus an additional $140 million to take account of the fact that not all monitoring and research needs were identified in the Plan. How the supplemental adaptive management fund of $450 million was decided is not clear. The budget for monitoring and research is substantial but is actually small compared to the total cost of BDCP. Even a budget of this size could easily be exhausted by the multitude of possible monitoring actions for each of the Conservation Measures. The Plan has identified a broad range of possible monitoring and research actions related to the Conservation Measures but acknowledges that these will need to be reconsidered as the detailed implementation plans develop. The Adaptive Management Team will have the difficult task of determining how to allocate the inevitably limited resources for monitoring and research. Difficult trade-offs are inevitable, highlighting the need to develop an objective, rigorous, and transparent process for prioritizing monitoring and research activities. Clearly, a great deal of planning and evaluation will need to be done during the early years of implementation. We imagine further analyses to clarify conservation actions and how to fit these into an adaptive management program, pilot testing of some conservation actions, negotiations for land acquisition, and many other tasks necessary to finalize the conservation program. This suggests a front-loading of activity in the Implementation Office. However, on an annualized basis the budget for the Implementation Office does not differ much across the 50-year term of the project. We wonder if this will be sufficient and whether additional funds should be allocated for up-front planning and evaluation. <u>Contingency plans</u> Monitoring and adaptive management are proposed to evaluate whether conservation actions are achieving their intended objectives. What if things don't go as planned? The history of ecological restoration, for example, tells one that restoration projects rarely have exactly the intended consequences in the expected time frame. Chapter 3, section 3.4.3.4.2, states that contingency measures will be developed for site-specific conservation actions to be implemented in the event that success criteria are not met. However, the Plan also states that these contingency measures differ from adaptive management because they are site-specific and targeted at meeting success criteria. Similar contingency plans are mentioned for other Conservation Measures throughout section 3.4. There will inevitably be situations, however, in which the adjustments are not possible or incur too great a cost or where there is a large-scale failure of restored habitat to function as anticipated. What happens then? Given the complexity and the high stakes of many of the actions to be	

		undertaken in BDCP, it would seem prudent to have contingency plans at least generally outlined *before* discovering that things aren't working. There is no mention of contingency plans in section 3.6, which describes adaptive management. Contingency planning is not mentioned in Chapter 7, Implementation Structure, nor in Chapter 6, Plan Implementation (nor in the EIR/EIS). We conclude, therefore, that the Plan does not consider the development of contingency plans to be part of the adaptive management process. This is a significant shortcoming of the Plan.	
37	Appendix A, "Other Comments"	How will funding and oversight of the monitoring and adaptive management plan assure the independence of the science supporting adaptive management?	We expect the science supporting adaptive management to be supported in large part by BDCP funding, which will be derived from several sources including both project proponents and the fish and wildlife agencies. Applicants who seek such support must be responsive to requirements identified in RFPs and to comply with all relevant standards and requirements. See also the provisions of monitoring framework plans, addressed in the above responses (line 6), which provides further detail on how the science would be done.
38	Appendix A, "Other Comments"	What kinds of management actions will be subject to adaptive adjustment? Are both operations and habitat Conservation Measures subject to adaptive management?	All conservation measures are subject to adaptive management, as are responses to some of the changed circumstances described in BDCP Chapter 6. Adaptive management can also be used to change the priority, schedule, and sequence of the implementation of the conservation measures.
39	Appendix A, "Other Comments"	What future conditions are likely to prompt adaptation? The draft mentions sea-level rise and changes in Delta outflow requirements. Other futures worth considering include the flooding of additional subsided islands, requirements for upstream reservoirs to release cold water, tightened water-quality standards for byproducts of disinfection, and salinity regulation for Delta and south-of-Delta agriculture.	We did not try to provide a list of all the discrete actions that might prompt adaptive management, and we do not find it constructive to do so. Neither time nor resources exist to develop detailed speculation about possible responses to all of these possibilities (of which there are many more than those mentioned in the comment). Thus design of the adaptive management program focused on what things could be changed through adaptive management, recognizing that future conditions could trigger a need to change any of those things. They are listed in BDCP Table 3.6-1 but briefly, adaptive management can change conservation measures,

			biological objectives, and certain aspects of plan implementation and changed circumstance responses. We can envision multiple sets of circumstances under which any one of the conservation measures or biological objectives may require changes.
40	Appendix A, "Other Comments"	Everyone has commented that there is far too little information presented beyond what was in the administrative draft earlier this year. As we've all seen, almost nothing is in the EIS/EIR that is more than passing mentions of Adaptive Management or how it will be used. This has been a regular criticism of the document.	See responses above (lines 6 and 18) related to the development of additional information surrounding the process for adaptive management and monitoring. The EIR/EIS will be revised to provide more information regarding the implementation of adaptive management as proposed in the Final BDCP.
41	Appendix A, "Other Comments"	The data to be used in documenting faunal response have not been clearly identified. This is a critical failing given that there is so much uncertainty in the system. Likewise, no mention is made about how the targets that will contribute to actions will be set, or what conceptual models will require alternatives or modified actions.	We may need additional detail from the ISB in order to respond to this comment. We're not sure what "documenting faunal response" means, but see above response (line 6) regarding developing monitoring framework plans and use of "targets". In particular, one framework plan will address status and trend monitoring for terrestrial species.
42	Appendix A, "Other Comments"	The DISB (2013) produced a review of Habitat Restoration; several points in that review mentioned how adaptive management should be used. This might be a useful reference for the BDCP and the Adaptive Management Team.	The DISB (2013) review has been helpful. This is where we heard about the Dutch Slough adaptive management plan, which is a helpful resource.
43	Appendix A, "Other Comments"	Requiring the Adaptive Management Team to reach consensus could significantly slow the process of implementation and lead to inaction.	We understand that the potential for delay exists. A dispute resolution process exists to resolve situations when consensus cannot be achieved.
44	Appendix A, "Other Comments"	As described in section 3.6.2.4, the Delta Science Plan has a significant role to play in the design and coordination of adaptive management and monitoring in the Delta. The BDCP scarcely acknowledges this role for the Science Program. The BDCP could benefit greatly from a close relationship with the Science Program on adaptive management and monitoring.	See response above (line 36, paragraph 2).
45	Appendix A, "Other Comments"	The interaction between the Adaptive Management Team and the Implementation Team is critical for the success of the 9-step adaptive management process described in section 3.6.3.4. More details should be provided about how these two teams will interact in actually doing adaptive management.	There is not an "Implementation Team." However, there is an Implementation Office, which provides the resources to implement decisions of the AMT. The same person (Science Manager) chairs the AMT and oversees science activities of the Implementation Office. Further detail on these functions will be developed, once the Implementation Office begins operations.

46	Appendix A, "Other Comments"	In section 3.6.3.5.4 it is stated, "The adaptive management and decision-making processes described in this section do not apply to these real-time operations." Isn't this a big limitation on the effective use of adaptive management?	Real-time operations is, in reality, one of the best working examples of adaptive management that can be found in the Delta today, changing water operations from week to week on the basis of new data and understanding. However, it is a discrete process unto itself, working within timeframes that are much shorter than what would be addressed by the operations of the Adaptive Management Team. Thus real-time operations constitutes a different "adaptive management and decision-making process", separate from the one described in BDCP Section 3.6. For further information, see the Real-Time Operations section in Conservation Measure 1.
47	Appendix A, "Other Comments"	Appendix 3-G, Page 3, lines 32-37 states: "An equally important purpose of this memorandum is to introduce a simple deterministic, stage-based life cycle approach to define BDCP objectives, periodically review and update them, and monitor progress toward achieving the intermediate and final Cohort Replacement Rate (CRR) milestones.....it is imperative to establish interim objectives in order to guide monitoring and the management decision making process in the near term." Although they are not using the term, this is really the beginnings of an Adaptive Management Program. Page 6 lists general assumptions and then introduces the models to be used. Uncertainty is discussed in the Introduction as well.	Statement noted.
48	Appendix A, "Other Comments"	Appendix 3 G, Page 8 lines 25-27 states: "Where species-specific data were available they were used directly. More often, this will not the case and adjustments were made based on how different life history characteristics would be expected to influence survival." This was followed by assumptions, and data were provided from other areas that would lend support to the assumptions. We thought that this is probably the best that could be done under the circumstances and it does seem fit into the early steps of the adaptive management process. Future challenges in model modification were also presented.	Statement noted.
49	Appendix A, "Other Comments"	Appendix 3 G, Page 11 lines 9-13 states: "There are several other factors that might be considered in further defining or revising these Interim Survival Objectives, including scaled objectives based on wet and dry years. However, at this point we are reluctant to more finely define or scale survival objectives until additional species-specific survival estimates are collected over a range of hydrologic conditions. However, as new information becomes available, the potential to define wet and dry year expectations should be revisited." Again, this statement both acknowledges and contributes to the adaptive	Statement noted.

		management process. Likewise, climate change is presented as an uncertainty issue in terms of future annual variability scenarios.	
50	Appendix A, "Other Comments"	Appendix 3E-7 lines 6-8 states: "Precise details of each of the effectiveness monitoring actions are not presented here and will be developed and then periodically updated through the adaptive management and monitoring program (Section 3.6)." In terms of effectiveness monitoring, this is not an unexpected response. Some specific monitoring actions are mentioned in Table 3E-2 but these are very general and often repetitive.	This appears to be a reference to page 9 of Appendix 3.D. See response above (line 35) regarding proposed changes to this appendix.
51	Appendix A, "Other Comments"	Research Questions. Table 3E-3. These are very broad, and in some cases somewhat repetitive in terms of data already collected in the Delta (which would require reanalysis or a meta-analysis). However, the document acknowledges that these will be modified over time.	This appears to be a reference to BDCP Table 3.D-3. See response above (line 35) regarding proposed changes to this appendix.
52	Appendix A, Statutory Questions	**Scientific basis and clarity** 1. *Comment on the scientific basis and clarity related to the EIR-EIS conclusions:* The clarity of the conclusions is summarized in Item 1 of the response to the Charge as well as in the Major Points document. Comments on the scientific merit of the conclusions are detailed in each of the individual chapters and only summarized here. Freshwater flows *a. the review and analysis of the range of flow criteria, rates of diversion, and any other operational criteria required to satisfy the criteria for approval of a natural community conservation plan as provided in subdivision (a) of Section 2820 of the Fish and Game Code, and other operational requirements and flows necessary for recovering the Delta ecosystem and restoring fisheries under a reasonable range of hydrologic conditions, which will identify the remaining water available for export and other beneficial uses.* Please see the Chapter 5 review for a full description of the analysis on water supply and flow. Chapter 5 examines the changes in surface water operations and deliveries that would likely accompany each of the project alternatives. The comparative summary and interpretation of water supply is weak. The near-absence of systematic comparison and discussion greatly reduces the ability of this analysis-filled chapter to contribute to thoughtful discussion and comparison of alternatives. There seems to be little difference between 6 kcfs and 9 kcfs alternatives. Deliveries for the 3 kcfs tunnel capacity are much less. However, much of the difference among alternatives seems likely to be driven as much or more by operating and regulatory policies than by infrastructure capacities. For each alternative, results for Delta outflow, exports, project deliveries (north and south of the Delta), and major surface reservoir storage are presented. The modeling approach employed CALSIM II, with additional	Please see responses to comments provided in the Major Points document, as well as those provided for individual chapters in Appendix B. As described above, resource area summaries are currently being revised in order to provide a more explicit comparison of the effects that could result from various alternatives.

		temperature and Delta flow and salinity modeling, for a particular climate change scenario (sea level rise and climate warming), averaging a wide range of potential climate warming scenarios for roughly 2060 conditions. The analysis of this highly complex problem for a wide range of alternatives is inherently difficult and potentially confusing. The analysis of the problem is fairly good for this problem. The amount of model results is overwhelming. But there seems to be little effort to set these numbers to a story. An explicit comparison of the range of water deliveries for major user locations (project and non-project) over the range of wet and dry conditions would be valuable. The major analytical problem is the gap between CALSIM modeling of the system and actual operations. The SWP and CVP projects represented in CALSIM are only a small part of the water management decisions and impacts in this vast system. DWR and USBR modeling has improved considerably in recent decades, but remains CVP and SWP centric, largely ignoring or oversimplifying most water management decisions in California – taken by local and regional governments and water users. This is adequate for simple SWP and CVP project analysis, but seems inadequate for statewide impact analysis of a system where the operations and decisions of local agencies is major. To this problem must be added the continuing evolution of the CALSIM model and its many variants over time. As shown by the results of the MBK modeling recently, there will be differences in results reflecting both model evolution and different professional judgments in modeling complex systems. A final problem is the continuing evolution of environmental and water regulations. Current regulations allow relatively little flexibility for operations of dual facilities (a point made by Mount et al. 2013). Overall, there are both value and limits to our ability to estimate and compare the performance of alternative, for water supply and in many other regards. Many uncertainties are inherent in estimating and comparing the performance of diverse alternatives for a complex and ever-changing system far into the future, or even today. Climate change *b. the potential effects of climate change (including possible sea level rise up to 55 inches), and possible changes in total precipitation and runoff patterns on the conveyance alternatives and habitat restoration activities considered in the EIR.* The Chapter 29 review (Appendix B) commends the Plan documents and, to a lesser extent, the EIR/EIS, for considering how climate change may affect communities and species, and how the proposed Conservation Measures may act to lessen these effects. However, the review also finds that the likelihood	The CALSIM II modeling has accounted for local and regional actions that are reasonably foreseeable (for example, increased water demands based on projected population growth; see Appendix 5A, Section B). CALSIM III is still being tested and has not been vetted through agencies or reviewed by independent reviewers. Therefore, CALSIM II is currently the best available tool.

		and magnitude of these effects are not clearly stated. Of particular concern are the potential effects of climate change and sea level rise on the effectiveness of the conservation measures. Will the Conservation Measures will have the desired or stated benefits? These concerns are further expressed in the tidal-marsh sidebar in the Chapter 12 review. Fish and aquatic resources *c. the potential effects on migratory fish and aquatic resources.* Please see the Chapter 11 review, which concludes: "Overall the EIR/EIS could demonstrate a more balanced approach by fully discussing results from an ecosystem perspective (to add to the species-by-species discussions), fully embracing uncertainty and discussing it uniformly while distinguishing knowns from unknowns, and explicitly stating assumptions and differentiating conclusions from hypotheses. The detailed piece-by-piece and part-by-part treatment of CMs and species, although perhaps necessary, dilutes the merit of the overarching ecosystem perspective of the intent of this plan. Success will depend on a fully functioning system and analyses that incorporate integration across species, within a species, and across regions. Adaptive management will require a well-planned and comprehensive research and monitoring program that will target causality and test Plan hypotheses. Our specific concerns with this chapter of the EIR-EIS include: (1) positive benefits of habitat restoration are highly uncertain, and if not realized, will invalidate the final conclusion of no net negative effect; (2) further analysis of effects of flow on entrainment is needed; (3) the decision-tree process is not adequately described; (4) interactions and synergies among species and the potential impacts on other ecologically important species are not adequately considered; (5) the qualitative nature of the effects analysis makes results more aligned with 'hypotheses' rather than 'conclusions' or 'predictions'; (6) full life cycles are not adequately considered; (6) a more complete description of adaptive management is needed; and (7) uncertainty in the conclusions is not adequately acknowledged throughout the EIR-EIS.	Please see responses to chapter-specific discussions provided in Appendix B.
53	Appendix B	**I. DRAFT BDCP PLAN** **Decision tree approach for Alternative 4** (FROM Judy Meyer) The EIR/EIS leaves open the key question of how the altered outflows would affect fish for Alternative 4. Instead it proposes a ten-year research program that is to provide, upon completion of the new conveyance, "the fall and spring outflow criteria that are required to achieve the conservation objectives of the BDCP for delta smelt and longfin smelt and to promote supply objectives of the BDCP" (p. 3-207). The proposed program would evaluate various combinations of operational spring and fall flows, some of which are expected to have adverse impacts on fish if restoration is not effective (e.g., EIR/EIS 11-1293, 11-	The monitoring framework plan for the decision trees (see response above, line 6, for more on the monitoring framework plans) is being developed to address these comments.

		1296, 11-1297). Appropriate questions to be answered by the studies and competing hypotheses are stated, but we found little basis for judging the program's adequacy and prospects. Missing elements include: (1) description of the scientific approach and monitoring to be used, (2) assessment of the range of year types (extremely wet to extremely dry) required for success, (3) consideration of which restored habitats will need to be functioning to test the hypothesis that additional habitat and improved food resources will benefit fish as much as would enhanced spring and fall outflows, (4) criteria that will be used to make the decision on which outflows will be required (e.g., a threshold population size that needs to be achieved?), and (5) the outflows that will be required if the research program does not provide a definitive answer.	
54	Appendix B	**Chapter 3, Summary of Alternatives** Three general strategies for Sacramento-San Joaquin Delta exports are examined: • Through-Delta water exports (2 alternatives, plus existing conditions), • Dual exports with a combination of intakes south and north of the confluence of the Sacramento and San Joaquin rivers (11 alternatives), and • Peripheral exports exclusively from north-of-confluence intakes (3 alternatives). These alternatives and existing conditions are summarized in Table 1 and mapped in Figure 1. All alternatives have a combined physical export capacity of about 15,000 cfs. Each physical alternative has a specific set of operating policies employed in its analysis. Dual conveyance Alternative 4 (the BDCP CEQA preferred alternative) is examined with 4 operational scenarios. Habitat restoration actions also often vary significantly between physical alternatives, as summarized in Table 2. Variants in operating policies are summarized in Table 3. A special discussion of Alternative 9, a very different through Delta alternative is included at the end of this discussion. [See Appendix B for tables and figures] **Operating policies** The operational scenarios are described briefly below and in more detail in Section 3.6.4.2, *North Delta and South Delta Water Conveyance Operational Criteria*. • Scenario A (Alternatives 1A, 1B, 1C, and 3) includes: most No Action objectives for south Delta exports and required Delta outflow; new criteria for north Delta diversion bypass flows and assumed operations of the proposed Fremont Weir (notch) during high Sacramento River flows;but not Fall X2 objectives nor the SJR inflow/export ratio. The minimum bypass flow ranges from 5,000 to	Statement noted.

		over 15,000 cfs, depending on time of year. Different north Delta diversion capacities influence the volume of pumping from the south Delta and overall Delta operations. • Scenario B (Alternatives 2A, 2B, and 2C) include the Fall X2 criteria, but not the SJR inflow/export ratio. Scenario B would also include less negative OMR flow limits, and an operable barrier at the head of Old River. All other No Action rules apply, and the north Delta intake bypass rules are as under Scenario A. • Scenario C (Alternative 5) incorporates all the No Action rules and the north Delta intake bypass flow rules are as under Scenario A. The north Delta operations were limited because of a single 3,000 cfs intake on the Sacramento River. • Scenario D (Alternatives 6) eliminates use of south Delta intakes and uses only the same north Delta intake bypass flow rules as Scenario A. Existing south Delta export rules would not apply, including the E/I ratio. All the No Action outflow rules apply. • Scenario E (Alternative 7) modified Scenario A criteria for bypass flows, Fremont Weir gate operations, Rio Vista minimum flows, Delta outflow, and south Delta export operations. • Scenario F (Alternative 8) modifies Scenario E to include specific Delta outflow criteria and cold water pool management criteria for specific reservoirs. • Scenario G is similar to Scenario A, but is modified to conform to the conveyance as separate surface corridors for Alternative 9, without north Delta intakes. Instead, water continues to flow by gravity from the Sacramento River into two existing channels, Delta Cross Channel and Georgiana Slough, without North Delta Diversion Bypass Flow Criteria and Operations for Delta Water Quality and Residence Time. The Delta Cross Channel and Georgiana Slough gates would open only under higher flow conditions, with operable barriers on the Mokelumne River system as well. Diversion restrictions include: 1) 2009 NMFS BiOp: San Joaquin River inflow/export ratio that limits combined exports based on the SJR inflows in April and May. Limits on reverse OMR flow in December–June of many years (adaptively managed based on fish monitoring). 2) Minimum monthly Delta outflows specified in D-1641 for each month, depending on the water year type (i.e., runoff conditions). 3) Maximum salinity objectives specified in D-1641 for each month or period for water users	

		4) Spring X2 location objectives introduced in the 1995 WQCP. X2, specified by month and (unimpaired) runoff in the previous month. 5) 2008 USFWS BiOp included an outflow requirement for September-November of wet and above normal water year types. Fall X2 rule requires X2 at or downstream of Collinsville in above normal years and downstream of Chipps Island in wet years. 6) State Water Board has recently explored additional operational rules that would require Delta outflow to be a specified percentage of monthly unimpaired flow. 7) North Delta bypass flows: July–September 5,000 cfs, October-November 7,000 cfs in all years. December–June allow bypass flows to increase with river inflow. Low-level pumping of 6% of the river flow would be allowed most of the time, but major diversions could not begin until the Sacramento River flow exceeds a specified threshold. **In-Delta barriers** The existing South Delta Temporary Barriers Project consists of seasonal installation and removal of three temporary rock barriers in Middle River near Victoria Canal, Old River near Tracy, and Grant Line Canal near Tracy Boulevard Bridge. These rock barriers are designed to act as flow-control structures, trapping tidal waters behind them following high tide. These barriers improve water levels and circulation for local south Delta farmers. A fourth barrier, installed at the head of Old River at the divergence from the San Joaquin River, is designed to improve migration conditions for salmon originating in the San Joaquin River watershed during adult and juvenile migrations, which occur annually in the fall and spring, respectively. In the fall, the head of Old River barrier improves downstream dissolved oxygen conditions; during the spring, the barrier is intended to prevent downstream migrating salmon smolt in the San Joaquin River from entering Old River. In 2009 and 2010, DWR installed and operated a nonphysical barrier at the head of Old River as an alternative to the spring rock barrier at this location. The nonphysical barrier uses underwater bubbles, light, and sound as a behavioral deterrent and tests the effectiveness of excluding outmigrating smolts from entering the south Delta via Old River without having to physically block the flow of water into the channel with a rock structure. In the future, DWR may install and operate the nonphysical barrier at the head of Old River as an alternative to the spring rock barrier. **Alternative 9** is a very different through Delta alternative with four separate flow corridors: (1) the north Delta separate water supply corridor that conveys water from the Sacramento River to Middle River; (2) the south Delta separate water supply corridor along Middle River and Victoria Canal that conveys water	

		from San Joaquin River to Clifton Court Forebay; (3) the San Joaquin separate fish movement corridor that provides for fish migration from upper San Joaquin River to the lower San Joaquin River downstream of Franks Tract; and (4) the Mokelumne separate fish movement corridor that diverts from the Mokelumne River through Lost Slough and Meadows Slough to the Sacramento River. Two fish-screened intakes would be constructed: one each at the Delta Cross Channel and Georgiana Slough. Once in the channel, water would flow south through the Mokelumne River and San Joaquin River to Middle River and Victoria Canal, which would be dredged to accommodate increased volumes of water. Along the way, diverted water would be guided by operable barriers. Water flowing through Victoria Canal would lead into two new canal segments and pass under two existing watercourses through culvert siphons, eventually reaching Clifton Court Forebay. Alternative 9 includes the following water conveyance-related facilities. • Operable barriers on the Mokelumne River near Lost Slough and on Snodgrass Slough near the Mokelumne River, extension of Meadows Slough to the Sacramento River, and installation of an operable barrier on Meadows Slough. These facilities would provide a path for fish migration from the Mokelumne and Cosumnes Rivers through Lost Slough and Meadows Slough to the • Sacramento River, except during flood flows. • On-bank diversions with fish screens at Delta Cross Channel and Georgiana Slough. • A boat lock and channel at the diversion structure at Georgiana Slough. • An operable barrier at Threemile Slough to reduce salinity in the San Joaquin River during low Delta outflow and potentially to reduce fish movement from the Sacramento River to the San Joaquin River. • Operable barriers along Middle River at Connection Slough, Railroad Cut, Woodward Canal, and immediately downstream of Victoria Canal to isolate Middle River from Old River. Dredging would occur at each of these locations. • Dredging along Middle River from Mildred Island to Victoria Canal and along Victoria Canal for a siphon to provide gravity flow into Clifton Court Forebay. • Expansion and extension, through dredging, of Victoria Canal under West Canal, across Coney Island, and under Old River to Clifton Court Forebay. • Intertie canal with a control gate between Clifton Court Forebay and the Tracy Fish Facility. • Closure of the Clifton Court Forebay inlet gate from Old River except during flood flows. • Closure of channel between Old River and the Tracy Fish Facility except during flood flows. • Closure would include channel modification to allow continued access to	

		River's End Marina from Old River. • Operable barriers along the San Joaquin separate fish movement corridor at the upstream confluence of Old River and the San Joaquin River (head of Old River), Fisherman's Cut at False River, and Franks Tract to isolate Old River (San Joaquin separate fish movement corridor) from the San Joaquin River. • A pumping plant on the San Joaquin River at the head of Old River to convey additional flows with organic material into Old River. • A pumping plant on Middle River upstream of Victoria. [See Table in Appendix B]	
55	Appendix B	**Chapter 4** I. Scope This chapter describes the approach to the environmental analysis. It provides a clear description of the difference between CEQA and NEPA baselines. II. Quality of Analysis A. Three geographic regions are considered: upstream of delta, delta and SWP and CVP service areas. Areas downstream of the Delta (i.e., San Francisco Bay) were not included even though the NRC scientific review specifically stated this area should be included. Adequate justification for lack of consideration of impacts to San Francisco Bay was not provided in this chapter or elsewhere in the document, although there are potential impacts. For example, the expected reduction in sediment supply has the potential for impacts: 1) tidal marshes in the Bay could be less able to keep up with sea level rise, and 2) increased water clarity in the Bay could render it more responsive to nutrient inputs. B. The chapter clarifies that the habitat restoration measures proposed are given only program level analysis for several reasons. Yet because of the uncertainty in location, implementation, and effectiveness of proposed restoration actions, the positive impacts of those actions that were considered as part of the BDCP EIR/EIS are highly uncertain. Hence the final assessment of net positive or no negative effect shown in the EIR/EIS is also highly uncertain. III. Overall The chapter does an adequate job of explaining the approach taken in the environmental analysis.	Regarding consideration of San Pablo Bay and San Francisco Bay, please see the response to line 3, above. Please see the response provided in line 27. Appendix 31A of the EIR/S has been added in recognition of the fact that additional environmental analysis may be required for many actions included under CMs 2-22 proposed under the BDCP. The assessment of no final net impact is grounded in detailed quantitative and qualitative analyses shown in BDCP Chapter 5 appendices. While it is recognized that there is a degree of uncertainty since many of these analyses are done at a programmatic level, the overall conclusions are based on the best available science and on extensive quantitative and qualitative analysis and consultation with the fishery managers. Additionally, a detailed Adaptive Management and Monitoring Program (see BDCP Section 3.1.3) has been designed in order to ensure that where

			conservation measures do not achieve expected outcomes, the flexibility exists to allow for changes to be made to the conservation measures to improve their effectiveness over time.
56	Appendix B	**Chapter 6, Surface Water** This chapter deals with environmental consequences of potential surface water changes from disturbances introduced by BDCP conveyance and related facilities [CM1], operational facilities, conservation components [CM 2-22] and restored areas. The area examined is thought to be the most affected by SWP/CVP water supply operations and/or habitat restoration in the Delta and Suisun Marsh Restoration Opportunity Areas. Surface water in the Delta, upstream areas and in export areas also will be affected by the climate change and present/future projects. The changes affect the risks of floods, flow patterns, drainage, surface-ground water interactions and streams. The construction of facilities under BDCP would occur in the Sacramento/San Joaquin river basins, and the changes of SWP/CVP operations affect the flow in the Delta and upstream. Surface water of many SJR and SR tributaries as well as surrounding hydrologic basins, where conveyance is by pipes and canal systems, are unaffected. For each BDCP alternative, nine impacts are analyzed, and in some cases mitigation measures are identified to reduce adverse impacts on run off patterns, drainage, sedimentation, flooding, potential exposure and risks to people or structures. No action alternative also is considered. Surface hydraulics in the BDCP area is complex, and is determined by circulation, transport, and mixing in Delta waters. The hydraulic network consists of over 700 miles of tidally influenced channels and sloughs, water supply facilities and about 18,000 diversions and 1,115 miles of (project and non-project) levees. The major forcing include freshwater flow into the Delta, tidal input from Pacific (as high as 600,000 cfs) and operation of water supply facilities. Sacramento River and Yolo bypass waters move south and westward is the primary contributor, followed by San Joaquin River flowing from the south. Pumping slows or reverses the flows that would naturally go north and west in the San Joaquin River (§5, §6 and §8). Operation of hydraulics structures has important tasks, including: elevating water surfaces for diversions, preventing fish from entering canals, and changing of circulation patterns. Amongst myriad of impacts possible, most critical ones have been identified for the analysis, for example, SWP/CVP reservoir storage and related changes to flood potential, peak monthly flow in SR and SJR and reverse flows in Old and Middle river as a result of changing hydraulic characteristics. The existing conditions are compared with the year 2060 scenarios of No-action/No-project	Regarding “The inferences are almost entirely based on model outputs…”, CALSIM is not a predictive model, and therefore model results are used in a comparative manner in this document. A reference to OCAP BA Appendix W (that has results of CALSIM sensitivity analyses) was provided in the Modeling Technical Appendix. We suggest adding reference in both Chapter 5 and 6 to Appendix5A. Reference: “CALSIM II model, its available outputs and limitations on use of model results are further discussed in Section A.3 of the Appendix 5A, BDCP EIR/EIS Modeling Technical Appendix.” This sentence should be placed at end of Section 5.3.1 (just above Section 5.3.1.1 title) of

		and BDCP alternatives with sea level rise and climate change (CEQA comparisons). Also compared are 2060 model conditions with BDCP alternatives that include climate change and no-alternatives with climate change only (NEPA comparisons). The surface water resources have been evaluated at project level if sufficient details are available, otherwise resorting to programmatic level analysis. The effects analysis assumes reasonable thresholds to identify adverse effects under NEPA or a significant impact under CEQA, based on the number of months the reservoir is close to the flood storage capacity and peak monthly flows. Nine impacts (SW 1 to SW9) have been established and analyzed, and the results are placed in the framework of CEQA and NEPA effects. II. Quality of Analysis Commonplace modeling tools are used (CALSIM II together with ANN; DSM2 for water quality and particle tracking; CVHM hydrologic model), which are described in Appendix 5A. Also included therein are modeling assumptions, input parameters and additional information. Impacts [SW 1-9] for each alternative are addressed in a rigorous way. The following comments are offered for consideration by the preparer. The chapter involves a comprehensive and laborious study, and has identified a wide range impacts covering storage issues related to flood potential, peak monthly flows and flow reversals at critical locations. Related issues such as water quality, fish and aquatic resources and agricultural resources are addressed in other chapters. The inferences are almost entirely based on model outputs, but the reader is left to guess the uncertainties and how uncertainties affect these inferences, which are expressed in terms of 'no impact' and 'less than significant impact' etc. Uncertainties of complex models of the sort used here can be unacceptably high, model calibrations leave much to be desired (see Kimmerer et al. *San Francisco Estuary & Watershed Sc*., Feb 2008) and inter-comparisons of different models are scarce (NRC 2012). Some recent references to model testing, if available, may help. CALSIM III has better capabilities for ground water-surface water interactions and disaggregation of demand units, and it would be useful to know whether the conclusions made would change if it is used. • Flow-salinity relationships in Delta are evaluated using DSM2, which is linked to the neural network ANN to evaluate whether certain salinity requirements are met. The training of ANN is based on the current data, and the relationships so obtained may not be applicable to future scenarios with modified flow structures. In addition, DSM2 is a one dimensional model and has inherent limitations in simulating open water areas, flow in bends and	Chapter 5 and at Section 6.3.1.2 (just above title of 6.3.1.3) of Chapter 6. Regarding "CALSIM III has better capabilities…", CALSIM III is still being tested and has not been vetted through agencies or reviewed by independent reviewers. Therefore, CALSIM II is currently the best available tool. Regarding "Flow-salinity relationships in Delta are evaluated using DSM2…", ANNs were retrained using DSM2 runs that included new facilities in the Delta; as well as the tidal marsh restoration areas and the sea level rise. Sections A.3.2 (general information), A.3.3 (application in BDCP), and A.5.3 (DSM2 application in BDCP) of Appendix 5A have more information on ANNs and how they were retrained. Table A-7 of Appendix 5A summarizes properties of all ANNs that were used in the analysis. Limitations associated with DSM2 are disclosed in Appendix 5A, Section A.5.5. Regarding "Tidal energy coming from outside the Golden Gate…", multi-dimensional (UNTRIM: 3D and RMA: 2D) models were used to capture these effects. Information regarding this is also available in Appendix 5 A Section A.5.3: "The effects of sea level rise were determined from the UNTRIM Bay-Delta model and the effects of tidal marsh restoration were determined from the RMA Bay-Delta model. DSM2 model results were corroborated for the effects of sea level rise and tidal marsh restoration using the UnTRIM and RMA model results. Detailed descriptions of the UnTRIM modeling of the sea level rise scenarios, RMA modeling of the tidal marsh restoration, and DSM2 corroboration are included in the Sections D.7, D.6 and D.8, respectively." Regarding "It is assumed that the alternatives would modify the operations of SWP/CVP

		small channels as well as inlet/outlets. The Delta circulation patterns, which are strongly influenced by horizontal mixing, diversions and freshwater input, therefore may not be adequately simulated by the modeling system used. • Tidal energy coming from outside the Golden Gate is another limited resource in the development of habitat in the Delta and its larger estuary. A major effect of many of the proposed habitat restoration activities (as well as potential island failures in the future) is likely to be the changes in tidal amplitude and mixing. This will affect the suitability of certain characteristics for restoration. It will reduce mixing of inland and coastal waters and high-tide related flooding in the Delta. This aspect needs further consideration. • Little is mentioned about the role of adaptive management, although development of hypotheses within the framework of complex BDCP alternatives would be difficult. Any information in this regard can be helpful. • It is assumed that the alternatives would modify the operations of SWP/CVP facilities but not the facilities owned and operated by other water rights holders. Thus, the surface waters of many Sacramento and San Joaquin river tributaries are assumed to be unaffected (§6.3.1). Naturally, one would expect changes to the modus operandi of other owners in response to potential changes due to BDCP alternatives. Similarly, changes in flow regulations for environmental and water quality objectives into the distant future are not examined or discussed (and would be difficult to examine). No analysis or statement regarding such feedbacks is given. • It was determined that estimating peak flows in a sub-monthly time step based on monthly flows of CALSIM II would not be reliable for flood risk analysis. Can HEC-RES-SIM or other modeling systems with higher temporal resolution be used in this regard? • The list of communities subject to flooding does not include Bethel Island, a community of a few thousand on a fairly deeply subsided island (p. 6-21). • Chapter 6 considers how the Plan and its alternative may affect levees. It provides a lucid summary of levees as essential and vulnerable in flood control (p. 6-11 to 6-18). It also analyzes potential near-term damage to levees from construction of water-conveyance facilities (impact SW-7) and from creation of subtidal habitat (SW 8). Other parts of the draft EIR/EIS consider how Delta levees affect other resources. Levees are described as vital to water supplies under current conditions (p. 5-61 to 5-64; p. 3E-16 to 3E-18). By corollary, levees remain important under most of the action alternatives, both for water supplies and for ecosystem restoration. A comprehensive levee chapter would bring these issues together. Its summary would compare alternatives by their expectable effects on levee maintenance, not just during and soon after	facilities…", any assumptions on how the regulations would be changed under climate change would be entirely speculative at this point for the No Action Alternative and other Alternatives as there is no publicly available information that can be used as a reference. Therefore, the system is assumed to be operated in compliance with current regulations in this chapter, and comparative analysis is used to identify the effects of proposed Alternatives. Details on climate change modeling assumptions are provided in Appendix 5A, Section A.3.3 under "Incorporation of Climate Change" and references to this appendix are provided in the chapter. As mentioned in Chapter 6, "In the interest of informing the public of what DWR believes to be the reasonably foreseeable impacts of the action alternatives, DWR has focused primarily on the contribution of the action alternatives, as opposed to the impacts of sea level rise and climate change, in assessing the significance of the impacts of these action alternatives." Regarding "It was determined that estimating peak flows…", detailed flood routing analysis will be done in the facility design phase when specific bathymetry is available. Regarding "The list of communities subject to flooding does not include Bethel Island…", the Existing Conditions/Affected Environment descriptions should be updated to include more recent mapping results from the FEMA FIRM program which included areas not previously mapped, including Bethel Island. Regarding "Chapter 6 considers how the Plan and its alternative [sic] may affect levees…", potential levee failures due to reasons other than Chapter 6 impacts SW-7 and SW-8 are not analyzed under BDCP. In EIR/EIS Appendix 3D, page 3D-3, the text

		construction, but also on a 50-year timescale. I. Overall Assessment Overall the chapter is innocuous, uses canonical tools and standard inference methods. The reason for selection of particular tools over available alternatives is not identified. Significant potential impacts are predicted for many BDCP Alternatives under categories SW 4-6, and mitigation measures are proposed. It is not clear why no determination has been made on the impacts of reverse flow conditions in Old and Middle Rivers under BDCP alternatives, although Chapter 6 lays out many of the impacts for each alternative; a clarification is needed. The existing summaries of Chapter 6 are limited to tabular entries in the Executive Summary and brief text in the Highlights Brochure. The table identifies nine surface-water impacts (p. ES-61 and ES-62), and the highlights text offers four bulleted paragraphs (p. 21 of BDCP_highlights.pdf). Like most of the rest of the draft EIR/EIS, Chapter 6 still lacks an informative summary of expected impacts of the no-action and action alternatives. It contains no up-front analysis that succinctly compares the alternatives: no-action vs. actions, certain kinds of actions vs. other kinds of actions. It also offers no summary by impact, in contrast with Chapter 12 (terrestrial biology; p. 12-5 to 12-31). Chapter 6 still needs cogent analysis of how the proposed Plan (alternative 4) stacks up against alternatives in terms of effects on, and effects of, surface water.	includes "In addition, the No Action Alternative assumes that without future engineering and environmental analyses, levee failures due to flooding, erosion, subsidence, wave action, seismic events, burrowing animals, physical encroachment (such as barge collisions), or other causes would be repaired under ongoing programs." Regarding "The reason for selection of particular tools over available alternatives is not identified," tools used for this EIR/EIS analysis are the best available surface water tools that are known to the Lead Agencies. Regarding "It is not clear why no determination was has been made on the impacts of reverse flow conditions…", the CEQA Conclusion in Chapter 6 was in relation to the degree of change in reverse flow conditions, as described in subsection 6.3.2. Specific adverse impacts on other resources are described in separate chapters, including water quality and aquatic resources chapters. Reference is provided in Chapter 6, under Impact SW-3; except for the OMR subsection under NAA. We suggest adding the same reference to comparison of NAA to Existing conditions. Regarding "Chapter 6 still lacks an informative summary…", resource area summaries are currently being revised in order to provide a more explicit comparison of the effects that could result from various alternatives.
57	Appendix B	**Water Quality** **Liz Canuel, Tracy Collier, Judy Meyer** **Overall Assessment of whether and how this chapter helps inform:** As noted for other chapters in the DEIR/S, a concise and informative summary of the chapter would be extremely useful to readers and reviewers. This chapter, covering water quality impacts of the different alternatives, is not	In section 8.4.1.1, Models Used and Their Linkages, the text states that "Input assumption details for each scenario modeled are provided in Appendix 5A, and a discussion of uncertainty and model validation is also included in Appendix 5A." This appendix includes the validation studies that

		very informative because of its reliance on a few modeling approaches, most notable CALSIM and DSR2, without an explanation of the limitations of these models. There is a noted lack of emphasis on validating model outputs with observational data, as well as a lack of any presentation or discussion of the uncertainties associated with the models. It is also unclear whether the models were run under likely scenarios of future conditions in the Delta (e.g., changing precipitation patterns, decreased snow pack, changes in timing and amount of freshwater delivery, higher temperature, etc.). **Scope of impacts covered:** This chapter covers the environmental setting and potential impacts of the different BDCP alternatives on water quality in the Delta as well as upstream of the Delta. It does not cover impacts downstream of the Delta, even though that was a specific recommendation of the National Research Council. Numerous constituents that can compromise water quality are covered, but it is difficult to tell which constituents are covered without reading the document in its entirety. For example, polycyclic aromatic hydrocarbons are covered in Section 8.2.3.14, but are not listed in Tables 8.1, 8.2, 8.3, 8.4, or 8.5. The reasons for including some constituents in those tables, and not others, are not clear. Temperature is specifically noted as being covered in Chapter 11, rather than in this chapter, but it seems sensible to include temperature impacts, or at least a summary of temperature impacts, in this chapter specifically dealing with water quality issues. This chapter does not cover ancillary effects of the BDCP on water quality. Notably, an increase in water reliability may well result in altered agricultural practices, to include changes in crops, with associated changes in pesticide and fertilizer applications. That seems to be a notable omission. **Quality of Analysis:** There is a general lack of knowledge displayed by the authors of this chapter about certain water quality constituents. This was most noted in sections covering dioxins, PAHs, and emerging pollutants [more correctly called contaminants of emerging concern (CECs)]. Nomenclature and descriptions of these classes of compounds are often incorrect, sometimes egregiously so. For example, polychlorinated biphenyls are incorrectly classified as a subset of dioxins, and then statements are made about dioxins that are incorrectly extrapolated to PCBs. Moreover, the authors do not seem to know the difference between commercial PCB mixtures (e.g. Aroclor® 1254 or 1260) and individual PCB congeners (e.g. PCB-126), listing these disparate substances as PCB-1254, PCB-1260, and PCB-126. PAHs are specified as being derived from combustion products, ignoring the very large portion of PAHs coming into ecosystems as a result of spills and leakage of petroleum and its refined products, such as gasoline and diesel fuels. Very optimistic descriptions of CECs	have been performed on DSM2, and discusses the uncertainty associated with it, especially with regards to sea level rise and restoration areas (see Appendix 5A, Section D, Attachment 4). Chapter 3 includes a description of the scenarios for which the model was run. The assumptions included in the various model runs are also summarized in section 8.4.2.2, Comparisons, in which climate change and sea level rise assumptions (the future conditions that the reviewers seem to be alluding to) are listed. Please see responses above relating to analysis of effects downstream of the Plan Area. Table 8-1 does not include water quality constituents but is a list of beneficial uses of water, Tables 8-2 and 8-4 contain 303(d) listings, Table 8-3 contains TMDLs, and Table 8-5 does actually include polycyclic aromatic hydrocarbons. Since PAHs are not 303(d) listed and do not have active TMDLs in any of the areas summarized in the tables mentioned, they are not included in Tables 8-2 through 8-4. This, however, does not mean that no concern exists with regards to these constituents. Thus, we felt it was still worthwhile to describe the environmental setting with regards to PAHs. We feel that the reasons for including some constituents in those tables, and not others, is clear from the table titles. Regarding temperature, this comment has been made by others and was considered. Because temperature primarily affects aquatic life beneficial uses, most of the effects of temperature changes on aquatic life are best described by fish biologists. To the extent that temperature changes interact with other water quality parameters, e.g., dissolved oxygen, the chapter references the temperature data as necessary.

		and their removal from wastewater by WWTPs are given, but no acknowledgment is made of many other CECs that are shown to be highly recalcitrant to such removals. Such demonstrations of unfamiliarity with the subjects covered do not engender confidence in a reviewer. For the discussion of carbon, it is recommended that carbon should be separated into its dissolved and particulate forms for consideration of water quality impacts and implications for Delta organisms. Dissolved organic carbon (DOC) is the form most likely to react with chloride and bromide and result in formation of disinfection by-products. Hence, emphasis was placed on DOC in this chapter. However, the chapter overlooks the role of carbon as a "master" ecosystem variable and the fact that dissolved and particulate forms cycle differently. DOC is mostly cycled through the microbial food web and is not typically transferred to upper trophic levels. In contrast, particulate organic carbon (POC) is comprised of microalgae as well as detritus from the watershed, marshes and aquatic environment. POC is utilized as a "food source" for primary consumers, thus this energy is transferred to higher trophic levels. In addition to concerns about "lumping" carbon into a single parameter, carbon "quality" is not addressed. Carbon quality (e.g., sources, age, biochemical composition) is a key determinant of ecosystem processes such as food and energy. Carbon quality also influences organic matter respiration and is a contributor to water quality issues such as low dissolved oxygen (hypoxia) and methylation of mercury. The treatment of nutrients is also lacking. The authors consider only ortho-phosphate and not total phosphorus (TP). In freshwater, TP is a much better predictor of algal productivity because so much P can be carried on and released from suspended sediments. There should be better linkage between the total suspended solids (TSS) section and the phosphorus section. If a regression had been done between TP and discharge rather than phosphate and discharge, it is very likely that a relationship would have been seen (p. 8-214). From this chapter, it seems as though the upgrades to the Sacramento WWTP will not decrease phosphorus inputs, or if they would, it is not considered here. It is clear that for ammonia, the biggest change (and most significant improvement) is coming from the upgrade to the Sacramento Wastewater Treatment Plant. The analysis of ammonia, nitrate and phosphorus is entirely based on regulatory water quality standards with no attention paid to the biological consequences of more or less nitrogen, phosphorus, or altered N:P ratios. In the P discussion, the authors propose that phytoplankton production is related to light, not nutrients (p. 8-214). With decreased sediment loads this may no longer be the case, or certainly it is not be expected to be the case in the future as sediment loads (from past mining activity) continue to decrease. Hence, nutrient impacts on algae do need to be	While it is true that increased water delivery reliability could impact which crops are planted, it is unknown to what extent this will happen, and which crops may be substituted out for which others. Even if crop selection and replacement could be predicted, predicting the change in the levels of fertilizers (i.e., nutrients) used, the type and amount of pesticide application, and the degree to which the fertilizers and pesticides applied runoff and impact surface water quality would be speculative. Therefore, these types of impacts were not directly assessed in the EIR/EIS. Regarding PCBs, the sentence referenced was meant to refer to "dioxins and dioxin-like compounds", which does include PCBs, but the "and dioxin-like compounds" was inadvertently left out. This change will be made in the final document. Regarding commercial PCB mixtures versus individual PCB congeners, the reviewers are correct that this error was made in this section and missed in review. This will be clarified in the final document. It should be noted that this section is only describing the environmental setting of these constituents in the Delta, and does not contain assessment of these constituents. Further discussion and assessment of these constituents is included in Appendix 8C, Screening Analysis. While PAHs sourced to spills and leakages of oil and gas can and do influence ecosystems at the local level, the discussion in this section is meant to set the stage for the regional assessment of PAHs for this project. In this context, the dominant pathway of PAHs to the Delta region is dry and mostly wet deposition of airborne PAHs that are sourced to combustion. We agree

		considered. In particular the potential of altered nutrient ratios to either encourage or reduce toxic algal blooms should have been considered. It is mentioned but discounted as unimportant in the SWP and CVP canals (p. 8-450 and 8-470). As stated above, there is an over-reliance on model outputs, both to describe existing conditions as well as to project the effects of alternatives on water quality constituents. There does not seem to be either a) attempts made to compare model outputs for existing conditions to existing water quality data, or b) calls made for monitoring of future conditions in order to inform adaptive management of BDCP implementation. Because models will always be incorrect, such observational data are obviously required. Moreover, models were run for only certain constituents and not others, and this needs to be clarified and the reasons for selective applications of models should be explained. Models should also be run under likely scenarios of future conditions in the Delta (e.g., changing precipitation patterns, decreased snow pack, changes in timing and amount of freshwater delivery, higher temperature, etc.), and measures of uncertainty associated with the models should be presented and discussed with respect to their impacts on confidence in model outputs. It is also unclear whether the model runs considered the role of changing turbidity and light levels. Recent data indicate that concentrations of suspended solids have been declining in the Sacramento River. This could impact ecological responses in the future (e.g., phytoplankton blooms). Turbidity will likely increase during the water conveyance construction phase as well as during habitat restoration due to sediment disturbance. Following construction, concentrations of suspended solids (and light levels) may be quite different than they are today or over the timeframe 1992-2003, which was used for the model conditions. This could substantially alter water quality in the Delta and adjacent waters, again in ways that might not be predicted from model outputs. There are concerns about remobilization of soils and sediments with legacy contaminants during construction of water conveyance structures and habitat restoration, that were not addressed in the DEIR/S. Reservoirs of contaminants could be disturbed during excavation and construction projects. Some of these legacy contaminants could have detrimental impacts on organisms due to their tendency to bioaccumulate. Also, in regard to bioaccumulation, mercury and selenium appear to be the only constituents that were evaluated for their bioaccumulative properties. A range of organic contaminants (e.g., PAHs, dioxins, some endocrine disrupting compounds) also bioaccumulate, but this was not acknowledged or addressed in the EIR/EIS document. The authors are rather cavalier about how they treat detection limits for analytes, especially when studies had high detection limits that are above	however that a sentence could be added to clarify that spills are another source of PAHs to the environment, and such an addition will be made in the final document. Further discussion and assessment of these constituents is included in Appendix 8C, Screening Analysis. Regarding CECs, the statements referenced are made specific to EDCs, not CECs generally. We agree, however, that the sentences seem to imply that WWTPs effectively remove all EDCs, which is not the case. This will be clarified in the final document. Nonetheless, it should be noted that this section is only describing the environmental setting of these constituents in the Delta, and does not contain assessment of these constituents. Further discussion and assessment of these constituents is included in Appendix 8C, Screening Analysis. Regarding the treatment of carbon, we agree with all of the scientific information the reviewers state here. As the reviewers state, DOC was the primary carbon constituent addressed because of its relationship to DBP formation. It was also primarily assessed because 1) 85-90% of Delta TOC is DOC (as opposed to POC), and 2) a calibrated and validated model exists to predict DOC concentrations throughout the Delta (DSM2). As with temperature, POC affects primarily aquatic and terrestrial wildlife, and is thus best addressed by practitioners in those subject areas. Thus, effects of the project on POC and consequent effects to aquatic life are discussed in Chapter 11. Because no models exist to predict changes to POC from the project, the assessment in Chapter 11 is brief and qualitative, namely that restoration areas designed to promote primary and secondary production will likely increase carbon, a beneficial effect with regards to fish. Given the state of the science and effects of the

		water quality criteria. For example, on page 8-46 they report many non-detects of PCB-1254, -1260 etc (sic), but don't report detection limits. It is later stated that SFEI data show detects, but detection limits were 0.01 pg/L, for individual PCB congeners, and that the SFEI detection limits are seven orders of magnitude lower than other studies. On the next page, they then report many non-detects (presumably with the higher detection limits in the range of 10 ng/L), and also list criteria for PCBs under various guidelines. Even though those criteria are far below the detection limits used, it is concluded that criteria have not been exceeded, presumably because PCBs were not detected. On page 8-163 the following statements are made: "Assessing pesticide-related effects is substantially challenged by: 1) limited available monitoring data in the Delta and other water bodies of the affected environment, and 2) a continually changing pesticide use market. Due to a number of factors, including historic pesticide use patterns and analytical capabilities, there is more data available for certain classes of pesticides, such as OP insecticides, than that for other classes of pesticides, including herbicides, fungicides, and insecticides such as pyrethroids and carbamates." Despite this acknowledged difficulty in predicting water quality impacts of the project, caused by lack of observational field data, as far as we could see there was no call for enhanced monitoring of pesticides in the Delta. As stated above, reliance on model outputs without validation of model outputs by comparison to observational data, is a flawed approach, especially for assessing the effects of water quality constituents with high levels of uncertainty surrounding them, such as pesticides. In the section on pesticides, it was also remarkable that there was no mention of recent investigations showing very significant synergism between carbamate and organophosphate insecticides, or research showing rapid acquisition of pesticide resistance in native copepod species in the Delta.	project on carbon quality, i.e., the physical, biological, and chemical characteristics of the carbon compounds themselves, the resultant effects on water quality and ecology would be speculative and thus were not addressed in the EIR/EIS. Regarding the treatment of nutrients, while it is true that much of the phosphorus is bound in sediment, we have limited ability to predict changes in TP concentrations. Our modeling tools assume dissolved, conservative constituents. There are no sediment transport models for the Delta. Therefore, we assumed conservative mixing to predict changes in dissolved phosphate concentrations based on the mixing of different water sources. That said, we will clarify in the final document both why orthophosphate concentrations are discussed, and also will add discussion regarding potential changes in TP concentrations, as unpredictable as they may be. Regarding the Sacramento WWTP, at the time of the draft release, it was not known whether Sacramento WWTP upgrades would increase or decrease phosphorus inputs. The draft EIR for those upgrades has since been released, and indicates that treatment will be put in place to keep phosphorus levels at or below what they are currently. We will consider updates to the discussion in the final draft to reflect this. The BDCP is not anticipated to significantly change ammonia, nitrate, or phosphorus loads to the Delta. While concentrations of these constituents are predicted to change in the Delta, with the exception of ammonia decreases not associated with the BDCP, the changes that can be estimated using conservative mixing models are small enough that predictions of what these and changes in the N:P ratios would mean to the makeup of algal communities would be

			speculative, given the current state of the science. Further, as mentioned in the text, since the Delta is thought to be light limited and nutrients are in excess relative to algal growth requirements, these types of changes would not be expected to measurably change the quantity of algae in the Delta. In the final EIR/EIS, we will consider adding statements to the nitrate and phosphorus sections to this effect where they are currently lacking. Regarding the discussion on algae, we do not agree with the commenter that it is to be expected that, because sediment loads have decreased in recent times perhaps due do the cessation of hydraulic mining, light limitation on algae will no longer be present. Research has shown that the latter half of the 20th century showed declining sediment concentrations and yield. However, it is unknown whether the trend is approaching equilibrium sediment yield, or whether factors affecting sediment yield will remain relatively unchanged in the future. In fact, creation of tidal wetlands and shallow, open-water environments in the Delta, may increase turbidity at some locations. Further, our ability to model changes in nutrient ratios attributable to the project is limited by the lack of availability of a suitable model. The research describing the link between nutrient ratios and toxic algal blooms suggests that either very low (<15:1) or very high (>40:1) N:P ratios may be conducive to Microcystis algae blooms, and is dependent on a host of other factors (including temperature, residence time, zooplankton grazing pressure, ammonia, and nitrate concentrations). It is not conclusive about what type of effect small changes in the nutrient ratios would have on such algal blooms. Regarding the reliance on modeling, model output

			for existing conditions was not validated against historical water quality data because the modeled existing conditions run represents operation of the SWP and CVP system at the time of the Notice of Preparation (NOP), which is not representative of how the system historically was operated prior to then. Thus, there is no reason to think that the modeled existing conditions run will agree with historical water quality data, which was mostly collected prior to the NOP. However, DSM2 runs for historical conditions have been validated against monitoring data, as mentioned in the response to the first comment. Regarding monitoring of future conditions in order to inform adaptive management: • Extensive monitoring programs of water quality parameters (temperature, DO, EC, flow/velocity/stage, pH, turbidity, chlorophyll, as well as chloride and bromide) in the Delta are already in place and will continue to be in the future. These will inform future efforts, so there was no need to call for enhanced monitoring for these constituents. • For those constituents that do not have extensive monitoring programs in place, and on which the assessment identified the project as having adverse effects, commitments are made to monitoring of future conditions. For selenium, a selenium monitoring and management plan (SMMP) is included as an Avoidance and Minimization Measure as part of any planned restoration efforts. For mercury, CM12 includes a mercury monitoring and management plan to be conducted as part of any planned restoration efforts. Regarding which constituents were modeled, Section 8.4.1.3, Plan Area, includes the subsection "Determining Whether Assessment is Qualitative of Quantitative", in which the factors contributing to that decision are discussed. References is made

			to tables in Appendix 8C, Screening Analysis, that contain additional information (Table SA-10 is most relevant to the specific comment). As discussed in this section of the chapter and in Appendix 8C, many constituents did not have enough data to drive a reliable modeling effort, there were no adequate modeling tools to use for the assessment, or a modeling effort was not needed given the types of changes the project includes. Regarding remobilization of sediments with legacy contaminants, These concerns were addressed in the DEIR/EIS. Impact WQ-31 discusses impacts of construction related activities and contains the following paragraph: "Some construction-related contaminants, such as PAHs that may be in some fuel and oil petroleum byproducts, may be bioaccumulative in aquatic and terrestrial organisms. Construction activities also may disturb areas where bioaccumulative constituents are present in the soil (e.g., mercury, selenium, organochlorine pesticides, PCBs, and dioxin/furan compounds), or may disturb soils that contain constituents included on the Section 303(d) lists of impaired water bodies in the affected environment. While the 303(d)-listed Delta channels impaired by mercury are widespread, impairment by selenium, pesticides, PCBs, and dioxin/furan compounds is more limited, and there are no 303(d) listings for PAH impairment. Bioaccumulation of constituents in the aquatic foodchain, and 303(d)-related impaired water bodies, arise as a result of long-term loading of a constituent or a pervasive and widespread source of constituent discharge (e.g., mercury). However, as a result of the generally localized disturbances, and intermittent and temporary nature of construction-related activities, construction would not be anticipated to result in contaminant discharges of substantial

			magnitude or duration to contribute to long-term bioaccumulation processes, or cause measureable long-term degradation such that existing 303(d) impairments would be made discernibly worse or TMDL actions to reduce loading would be adversely affected." These concerns are also addressed in Chapter 11, under impacts to different fish species from construction, "Disturbance of Contaminated Sediments". Regarding bioaccumulation, we agree that PAHs, dioxins, and some CECs are bioaccumulative. These three categories of constituents were addressed in Appendix 8C, Screening Analysis, and were not carried forward into the chapter for detailed analysis of all project alternatives. Mercury and selenium were the only bioaccumulative constituents that were carried forward from the Screening Analysis to the chapter for detailed assessment of all Project Alternatives. Regarding detection limits, not all of the studies cited reported their detection limits, and therefore we were not able to state what they were. But regardless, whatever the actual concentrations of PCBs were in the samples that demonstrated non-detects, a water quality criterion cannot be exceeded with a non-detect sample. The statement was not making judgment that levels of PCBs in the Delta were not of concern because the samples were non-detect, only that criteria had not been exceeded. Regarding the passages on page 8-163, monitoring of pesticides in the Delta does not fall specifically within the responsibilities of the project proponents. Pesticide monitoring is run by the State Water Resources Control Board and by NPDES permit holders within the Delta, as well as

			through other programs and agencies. We agree than enhanced monitoring of pesticides in the Delta would be a good thing. Effects of pesticides were considered adverse only for CM13, which includes control of non-native vegetation in which pesticides are applied specifically as part of the conservation strategy. Mitigation required in this case to reduce the effects to less than significant is implementation of integrated pest management (IPM), and enhanced monitoring is unlikely to meaningfully contribute to the reduction in potential effects. There is much research on pesticides that could have been included in the discussion for academic purposes that does not meaningfully contribute to the assessment of the project, relative to existing conditions and the no action alternative. Inclusion of the studies mentioned would not have altered the findings of the assessment on the project.
58	Appendix B	**Chapter 9, Geology** Chapter 9 makes a murky case for its plausible conclusion that the proposed BDCP actions won't add much to existing geologic risk. The scientific basis for this conclusion is clouded by problems summarized in the table of contents below. Also mentioned in this review are potential scientific benefits that the chapter overlooks. **IMPACTS CONSIDERED** Geology affects the Delta as both resource and threat. Geology comes into play as a resource where including aquifers (Chapter 7), forming parent materials for agricultural soils (Chapters 10, 14), providing aggregate or natural gas (Chapter 26), and containing fossils (Chapter 27). The geologic threat mentioned most in the draft EIR/EIS is earthquake-induced failure of Delta levees (p. 1A-8 to 1A-9; 2-3; 3E-16 to 3E-18; 5-61 to 5-64; 6-11 to 6-18). Chapter 9, a "resource chapter," assesses geology as a threat to persons and property. The chapter enumerates, for impact assessment, the 16 threats listed in summary Table ES-9 as GEO-1 to GEO-16 (p. 66-67). Most are tied to earthquakes. Five of the potential impacts would occur during construction of water-conveyance facilities under conservation measure CM-1 (GEO-1 to GEO-5); another six during operation of these facilities (GEO-6 to GEO-12); and the remainder in association with habitat restoration efforts (GEO-13 to GEO-16). As summarized in Table ES-9, the CEQA impacts are "less than significant" both	With the exception of Alternative 9, the BDCP would not directly change the existing threat of levee failure. It is beyond the scope of Chapter 9 to assess potential adverse effects on water supplies and ecosystem health caused by levee failure and on changes in the incentives and funding for levee maintenance. Potential effects of climate change on levees are assessed in Chapter 29, Climate Change. Delta levees are an important public safety resource and the BDCP would not change levee policy or replace ongoing programs and grant

		before and after mitigation for all 16 threats under all the action alternatives. The table rates the no-action alternative as having three potential impacts that are "beneficial." **CONCERNS** **Narrow assessment of levee failure** Though Delta levees figure abundantly in the EIR/EIS as a Delta resource, no resource chapter addresses impacts to levees comprehensively. Delta levees are presented as vital to water supplies (p. 3E-16 to 3E-18, 4-9, 5-61 to 5-64, 29-19 to 29-20) and to flood control (p. 6-11 to 6-18), and the threat of levee failure is cited as a reason the BDCP is needed (p. 2-3, 31-5). Yet formal assessment of levee-related impacts appear limited to Chapter 6 (surface water) and Chapter 9 (geology). These chapters ask whether the construction and operation under the various action alternatives would increase changes of levee failures from floods and earthquakes. The geology chapter limits its consideration of levees to the immediate vicinity of facilities at or near the ground surface. No chapter considers two broader effects: how Delta levee failures would affect water operations under the various alternatives (summarized p. 29-19 to 29-20); and how the various alternatives would affect the economics of maintaining Delta levees. A comprehensive assessment of levee-related impacts would treat them more broadly. It would ask how levee failures would affect each alternative in terms of water supplies and ecosystem health. It would also explore how each alternative may affect incentives and funding for levee maintenance, and it would evaluate each alternative in light of the climate-change impacts (sea-level rise, extreme floods) discussed on pages 29-19 and 29-20. The broadened assessment would consider the non-action and action alternatives in light of recent reports about Delta levees. These include discussions of hazards to Delta levees (Mount and Twiss, 2005; URS Corporation and Jack R. Benjamin & Associates Inc., 2008; Brooks et al., 2012) and of strategies for risk reduction (Suddeth et al., 2010; URS Corporation and Jack R. Benjamin & Associates Inc., 2011; Bates and Lund, 2013)	projects aimed at facilitating and supporting levee improvements in the Delta. BDCP is not intended to be a flood control project, although it does include levee impacts, levee maintenance and levee improvements as part of the Plan and the analysis. The *BDCP Chapter 4: Covered Activities* includes a breakdown of associated levee actions covered by the Conservation Measures (CMs) and the Plan in its current draft. This chapter breaks down the levee improvements and enhancements that will be included as part of the CM 1 Water Facilities and Operation, as well as other CMs (including CM 4,5,6, and 11) – this includes both temporary and permanent levees. Levees constructed as part of the BDCP in the Delta will be at 100-year flood protection. This Chapter explains that from the time the proposed north Delta intakes become operational, maintenance activities are covered activities, including levee maintenance. Levee maintenance may also include operations designed to prevent and repair damage from animals. Levees also factor into the EIR/EIS analysis. *EIR/EIS Chapter 3: Environmental Commitments* outlines the levee improvements related to construction of the proposed CM 1 Water Facilities and Operation. *Chapter 5: Water Supply, Appendix 5B* assesses the potential for abrupt disruptions of South of Delta water supplies and potential effects on the export delta water supplies from levee failures. The effect of such a failure would vary depending on the time of year from having no effect on conveyance to disruption of pumps for several days. *EIR/EIS Chapter 6: Surface Water Impacts* includes measures that will be implemented to prevent an increase in potential damage from wind or impacts from construction – this could result in levee strengthening and raising where necessary

			to mitigate for impacts. *EIR/EIS Chapter 9: Geology and Seismicity* includes impacts on related levee construction. However, it is important to note that these geological and seismic risks to levees in the Delta are present regardless of the BDCP, and thus those impacts are not analyzed because they are secondary impacts.
		Debatable choices about levels of significance The draft EIR/EIS estimates that the action alternatives would have "less than significant" impact on the potential for death, injury, or property loss from earthquakes and their effects. This assessment applies both before and after mitigation according to the summary table (p. ES-66 and ES-67). Safeguards built into engineering design and construction practices are expected to prevent "an increased likelihood of loss of property, personal injury or death of individuals (example, p. 9-53 to 9-54). Chapter 9 does not appear to factor a background threat of levee failure into these reasonable conclusions. The chapter summarizes this threat in section 9.3.3.1.1 (p. 9-49 to 9-50), and the threat looms in other parts of the draft EIR/EIS as well (p. 2-3; 3E-16 to 3E-18; 5-61 to 5-64; 6-11 to 6-18). In a further instance, a water-supply assessment cites the threat of earthquake-induced levee failures that could flood as many as twenty Delta islands at once (p. 5B-12). The impact assessments in Chapter 9 do not appear to consider action alternatives in combination with levee failures unrelated to the actions. Would these combinations result in any increased likelihood of losses to persons or property? The tabular summary of potential impacts on pages ES-66 and ES-67 can be misread as implying that benefits assigned to the no-action alternative do not extend to the action alternatives. The benefits are derived from "ongoing plans, policies, and programs" that seem largely independent of the BDCP (p. 9-50 to 9-51). **Indefinite plan for assessing liquefaction hazards** Liquefaction, in which pore-water pressure lowers the strength of granular material, is the main process by which earthquakes are likely to cause levee failure in the Sacramento - San Joaquin Delta (URS Corporation and Jack R. Benjamin & Associates Inc., 2008). The liquefiable materials may be within a levee, beneath the levee, or both. The modes of resulting damage may include	Except for the No-Action Alternative, the EIR/EIS addresses the increased potential for an impact caused by the project that could occur over and above an existing level of hazard, which in this case, is the hazard posed by ground shaking and its secondary effects on personal safety and on property. Therefore, it was not appropriate to factor in the background hazard. Because the BDCP alternatives would not increase the inherent hazard of seismic shaking and its secondary effects, it would not result in an increased likelihood of losses to persons or property. Section 9.3.1.2.3 of the EIR/EIS describes the types of inferred and in-situ soil analyses that were used as a basis for the liquefaction hazard analysis. The Conceptual Engineering Reports are part of the EIR/EIS's Administrative Record.

		sliding, settlement, cracking, and groundwater eruption. Unlike localized breaches in the Delta's written history, the failures associated with future liquefaction may extend along levees for hundreds of meters. These concerns provide ample justification for the sections in Chapter 9 accordingly that consider liquefaction hazards to Delta levees. Chapter 9 provides little information, however, about the basis for its liquefaction analyses. Such analyses commonly begin with borehole data like that in Figure 9-4. The chapter states that the analyses will use "available soil data from the [Conceptual Engineering Reports]" of proposed BDCP conveyance alignments (p. 9-46). Those reports are listed on pages 9-1 and 9-2, but they do not appear to be available online. Subsquent steps are summarized in a one-paragraph statement of approach (p. 9-70). The approach appears to follow the so-called "simplified procedure" that engineers routinely use in liquefaction-hazard assessment. This procedure originated over 40 years ago (Seed and Idriss, 1971) and was updated in the last decade (Idriss and Boulanger, 2008). Uncertainty not mentioned in Chapter 9 surrounds current implementation of the "simplified procedure" of Seed and Idriss (1971). Competing curves relate the occurrence or non-occurrence of liquefaction to material properties and ground motions (Idriss and Boulanger, 2010; Seed, 2010). The matter is under study by a National Research Council committee (http://www8.nationalacademies.org/cp/projectview.aspx?key=49573). Even if this uncertainty is set aside, Chapter 9 appears deficient in details on how liquefaction-hazard assessment under BDCP will be carried out. Such details appear to await "final facility designs" in which "site-specific geotechnical and groundwater investigations would be conducted to identify and characterize the vertical (depth) and horizontal (spatial) extents of liquefiable soil" (p. 9-70). A reviewer may reasonably wonder whether the liquefaction part of the impact assessment is to be carried out at the project level or the program level. An overview on page 3-22 states that project-level assessments are provided for conveyance facilities (CM1), while program-level assessments are made for other actions. Whatever the case for liquefaction, its assessment seems part of a mitigation measure for preventing any increase in the "likelihood of loss of property, personal injury or death of individuals" (example, p. 9-53). **Neglect of other clues to liquefaction risk** Comprehensive assessment of liquefaction risk to levees in the Delta and the Suisun Marsh was central to the Delta Risk Management Strategy (DRMS) study discussed in the next section (p. 19). The assessment was based in part on application of the "simplified procedure" of Seed and Idriss (1971) to	Section 9.9.9.6 of the EIR/EIS describes the regulatory design codes and standards that dictate the design and construction of BDCP facilities, including those relating seismic considerations. It would be beyond the scope of the EIR/EIS to describe the specific procedures that will be used to conduct the liquefaction hazard assessment on a facility-specific basis.

		borehole data from Delta levees. The assessment also took account of the steepness of levee banks. The products include maps of the Delta and Suisun Marsh that show the distribution of potentially liquefiable sand beneath levees, the presence of sand within levees, and the levee-failure vulnerability in three generalized categories ((URS Corporation and Jack R. Benjamin & Associates Inc., 2008, Figs. 6-35, 6-36, and 6-37). The sand beneath levees was found most widely liquefiable in northern and southeastern parts of the Delta, areas that include proposed BDCP conveyance facilities. Chapter 9 appears to say nothing about these findings. As its leading example of liquefaction-hazard mapping the chapter instead uses findings from the year 2000 (p. 9-22, Fig. 9-6). These findings were not built into DRMS because "all aspects of that analysis, the seismic hazard model and, the fragility analysis are out of date" and because several principals in the 2000 work advised against using it (URS Corporation and Jack R. Benjamin & Associates Inc., 2008, App. B, p. 6-1). The depiction of hazard in Figure 9-6 contrasts with that by the DRMS study. For instance, Figure 9-6 of Chapter 9 shows all Sherman Island levees as having high potential for damage from liquefaction, while DRMS Figure 6-37c assigns a majority of Sherman Island's levees to the lowest of three categories of vulnerability to earthquakes (URS Corporation and Jack R. Benjamin & Associates Inc., 2008). The liquefaction map in Figure 9-6 also neglects a common approach to sketching liquefaction hazard on a regional scale. As illustrated by damage to railroad bridges by the 1964 Alaska earthquake (McCulloch and Bonilla, 1970), the abundance and severity of liquefaction commonly varies with the age and depositional environment of geologic materials. Geologic maps may thus be transformed into liquefaction-susceptibility maps (Tinsley et al., 1985; Holzer et al., 2009). In the Delta, mapped geologic materials of greatest concern for liquefaction are the sand and silt that accumulated in stream channels during recent millenniums. Some of these form ribbons of potentially liquefiable material that extend beneath Delta levees. Many such ribbons have been delineated from historical maps and from interpretation of aerial photographs (Atwater, 1982; Whipple et al., 2012). Also of potential concern is wind-deposited sand that extends into most of the Contra Costa County part of the Delta. Chapter 9 mentions these geologic materials (p. 9-4 to 9-8) and identifies them as "liquefiable during major earthquakes" (p. 9-69). **Reliance on a superseded assessment of seismic hazards** Chapter 9 makes abundant use of a draft report from the Delta Risk Management Strategy (DRMS) study cited above. This study included a comprehensive seismic-risk assessment of seismic risk to levees of the Delta	The EIR/EIS authors acknowledge the updated mapping. The EIR/EIS authors acknowledge the validity of this approach; however, rather than prepare a non-peer reviewed map of liquefaction hazard based on the EIR/EIS authors' own inferences of age and depositional environment of geologic materials, any replacement hazard maps included in any subsequent drafts of the EIR/EIS would simply would be derived from the updated DRMS mapping.

		and Suisan Marsh. The risk assessment study, runs 270 pages as section 6 of the final report issued in 2008 (URS Corporation and Jack R. Benjamin & Associates Inc., 2008). A 2007 draft (URS Corporation and Jack R. Benjamin & Associates Inc., 2007), underwent abundant revision after critical review (URS Corporation and Jack R. Benjamin & Associates Inc., 2008, App. A, B). Chapter 9 uses only the 2007 draft, which it typically calls "the seismic analysis" and cites as "California Department of Water Resources (2007a) and as "DWR (2007a)." Among text and tables in Chapter 9 are about 85 such citations in all. This situation leaves the reader wondering whether use of the final 2008 report, instead of the 2007 draft, would change the impact assessment in Chapter 9. A spot check of Tables 9-7 and 9-11 shows minor differences with entries in the corresponding tables in the 2008 DRMS report (URS Corporation and Jack R. Benjamin & Associates Inc., 2008, Tables 6-1 and 6-5, respectively). A fuller assessment of the impact of the obsolete DRMS version is beyond the scope of this review. Chapter 9 recently went out of date in its citations about probabilistic estimates of earthquake shaking in California. The earthquake probabilities cited on page 9-10 were estimated more than a decade ago by the 2003 Working Group on California Earthquake Probabilities. The 2007 group released an updated assessment as Uniform California Earthquake Rupture Forecast 2 (Field et al., 2009). Table 9-12 (p. 9-21) effectively cites this assessment by referencing the related 2008 version of the USGS national seismic hazard maps. But a rigorously up-to-date version of Chapter 9 would have mentioned a further iteration, UNCERF3, that was released in part in November 2013 (Field et al., 2013), in preparation for the 2014 national update. **Carelessness with assertions and references** "These organic soils [the peat of tule marshes] formed from accumulated detritus of the tules and other vegetation." (p. 9-3)—Tidal marshes and tidal swamps aggrade by trapping sediment that tides bring in and by retaining organic matter that the wetland plants produce on site. The retained organic matter includes roots and below-ground stems (rhizomes) that the plants inject into wetland soils (Nyman et al., 2006; Mudd et al., 2009; Kirwan et al., 2010; Miller and Fujii, 2010; Takekawa et al., 2013, p. 10-11). "It was necessary to use different sources to compile the geologic map" (p. 9-3)—A new source not mentioned is mapping by Sowers et al. (2013). An example of this mapping, along the Sacramento River south of Sacramento, was presented as a poster at the 2010 Bay Delta Science Conference. "the text descriptions [of geologic map units] are taken directly (i.e., verbatim) from the work done by Graymer et al. (2002) because this work...provides the most recent and relevant general descriptions of the geologic units that occur	This version was published after the DEIR/DEIS was prepared and is therefore not included.

		in the Plan Area" (p. 9-3)— This compiler's choice is a debatable one. The Delta makes up less than 1/6 of the map area of Graymer et al. (2002), and barely 1/3 of the Delta lies within that map area. A Graymer map name adopted on page 9-4, "Delta mud deposits," poorly describes deposits that are dominated by peat in the central Delta. The associated description of Delta peatland as lowered by "compaction and deflation" misrepresents subsidence that owes more to decomposition (p. 10-11 to 10-12) (Deverel and Leighton, 2010). "This correlation [of geologic names used on two different maps] is only an approximation provided by the chapter author to aid the reader. It is not a scientific or peer-reviewed analysis." (p. 9-4, 9-6, 9-7, 9-8)—Disappointing "in 1935 the University of California Agricultural Experiment Station mapped the surface soils" (p. 9-4)—The work perhaps alluded to here, without citation, is the classic Delta-wide soil survey by Cosby (1941). "The Delta and Suisun Marsh are in...one of the most seismically active areas in the United States" (p. 9-10)—Seems add odds with another statement on the same page: "...the San Francisco Bay Area and Delta region have generally experienced low-level seismicity since 1800." "tsunami inundation area on the shores of the Sacramento River" (p. 9-25)—The statement apparently refers to Carquinez Strait. "Peak acceleration response at a period of zero seconds or PGA is also widely used to characterize the level of ground motion." (p. 9-45)—Peak ground acceleration is conventionally defined as "maximum acceleration experienced by the particle during the course of the earthquake motion" without respect to frequency (http://eqint.cr.usgs.gov/parm.php). "With respect to the hazard of a seiche, the existing water bodies in the Delta and Suisun Marsh tend to be wide and shallow." (p. 9-50)—Disregards channels "levees constructed on liquefiable foundations are expected to experience large deformations (in excess of 10 feet) under a moderate to large earthquake in the region" (p. 9-50, reiterated p. 27-22)—This unreferenced statement appears to be taken verbatim from a DRMS report; it appears on page 6-37 of the final seismic-hazard assessment (URS Corporation and Jack R. Benjamin & Associates Inc., 2008). A more nuanced statement would cite this report's Figure 6-35 as evidence that liquefiable foundations, identified through geotechnical borings, are most common in northern and southeastern parts of the Delta. In a further nuance worth mentioning: for the 1906 San Francisco Earthquake, "calculations indicate that small to moderate damage would have occurred if the levees were at today's configuration during the 1906 event" (URS Corporation and Jack R. Benjamin & Associates Inc., 2008, p. 6-36). Chapter 9 cites large reports without pointing the reader to specific pages or figures within them. A more rigorous assessment would cite by chapter and	The EIR/EIS is not a scientific paper and the citations in the EIR/EIS follow CEQA document convention and are considered adequate under CEQA. The material and conclusions in the updated studies are unlikely to substantially alter the fundamental conclusions made in the EIR/EIS

		verse. The reference list for Chapter 9 excludes not just the final DRMS reports (URS Corporation and Jack R. Benjamin & Associates Inc., 2008; URS Corporation and Jack R. Benjamin & Associates Inc., 2011) but also a prominent update on procedures for assessing liquefaction hazards (Idriss and Boulanger, 2008) and an authoritative review of Delta subsidence (Deverel and Leighton, 2010). **Lack of summary** Like most of the rest of the draft EIR/EIS, Chapter 9 lacks an informative summary of expected impacts. The chapter's existing summaries are elsewhere, and they are limited to tabular entries in the Executive Summary and to watered-down text in the Highlights Brochure. The chapter needs a summary, pitched to specialists but accessible to others, that would build on the entries on pages ES-66 and ES-67, and on the text on Highlights pages 26 and 27. The summary would make clearer how the various alternatives, including the no-action alternative, compare with one another in terms of effects on geology as a threat (and perhaps also as a scientific resource). Included would be an analysis of how the preferred CEQA alternative compares with the no-action alternative. The Executive Summary of the draft EIR/EIS could tabulate the Chapter 9 impacts more clearly. Each of the three groups of potential impacts shares identical text that could be gathered in header in the "Potential Impact" column. The text for the individual impacts could then be condensed to make clearer, at a glance, the differences among them. **Benefits overlooked** A CEQA guideline recommends assessing impacts that would "Directly or indirectly destroy...a unique geologic feature." Another CEQA guideline asks, "Does the project have the potential...to eliminate important examples of the major periods of California history or prehistory?" (http://ceres.ca.gov/ceqa/docs/Adopted_and_Transmitted_Text_of_SB97_CEQA_Guidelines_Amendments.pdf) Chapter 9 might thus consider, as incidental benefits of BDCP action alternatives, geologic discoveries along routes of proposed tunnels and canals. Such discoveries may provide long-term context for 21st-century questions about climate change and ecosystem restoration (Malamud-Roam et al., 2006; Canuel et al., 2009). Precedents include incidental use of bridge-foundation borings as guides to sea levels and marsh accretion at San Francisco Bay (Trask and Rolston, 1951; Atwater et al., 1977). Borings for proposed BDCP tunnels are already providing insights into prehistoric volcanic eruptions. The borings have sampled volcanic ash layers that erupted about 400,000 years ago near Bend, Oregon, and about 600,000 years ago near Mount Lassen, California (Maier et al., 2013). Widespread	regarding geologic and seismic hazards in the Plan Area and the measures that have been prescribed to mitigate these hazards. Similarly, updates on procedures for assessing liquefaction hazard do not have a substantial bearing on the fundamental description of liquefaction hazard as described in the EIR/EIS. The updated procedures will be incorporated onto the design of individual project facilities as more site-specific geotechnical data are obtained. Resource area summaries are currently being revised in order to provide a more explicit comparison of the effects that could result from various alternatives.

		volcanic-ash layers are important to geologists not only as signs of catastrophic hazards but also as unique tools for assigning, to the same instant in geologic time, climatic and tectonic events in widely separated places (Sarna-Wojcicki et al., 1983; Sarna-Wojcicki et al., 1985). Such scientific use of BDCP geology would complement the engineering application of the findings in Figure 9-4. [See Appendix B for references]	
59	Appendix B	**Chapter 10, Soils** Chapter 10 concludes that the proposed BDCP actions would cause significant harm to farmland soils by burying some beneath construction spoil and by inundating others in habitat-restoration areas. The chapter also determines that the soils pose little threat to the BDCP actions. These plausible findings are undercut by inadequate summaries, missing references, and minor inaccuracies. **IMPACTS CONSIDERED** Chapter 10 treats soils both as agricultural resources and as construction hazards. In five of the nine soil impacts considered, the question is how an action (or inaction) will affect soils by means of erosion or decomposition. In the four other impacts, the soils pose potential hazards to people and facilities. With four exceptions, the CEQA impacts for all options are termed "less than significant" both before and after mitigation (p. ES-67 to ES-68). In two of the exceptions, the no-action alternative is called "beneficial" because of non-BDCP efforts to arrest subsidence from decomposition of peat (SOILS-3, SOILS-8). In the other exceptions, topsoil is lost to decomposition under the non-action alternative, to burial under spoils from construction of conveyance facilities, and to inundation from habitat restoration (SOILS-2, SOILS-7). Not included among assessed impacts assessed is soil loss from unintended flooding. Lasting losses may be limited to scour ponds and their aprons if levee breaches are repaired. On islands left permanently flooded the losses are of course greater. **CONCERNS** **Inadequate summaries** Like most of the rest of the draft EIR/EIS, Chapter 10 needs to begin with an informative summary of expected impacts. The existing summaries are limited to tabular entries in the Executive Summary and brief text in the Highlights Brochure. The table enumerates nine soil-related impacts (p. ES-67 and ES-68), and the highlights text describes soil losses as a BDCP impact (p. 28 of BDCP_highlights.pdf). A useful summary, placed at the outset of Chapter 10, would quantify losses and relate them to the non-action and action alternatives. For instance, a table similar to the one on page 39 of the Highlights Brochure would itemize losses of agricultural soil from burial by tunnel waste, excavation of canals, and	Resource area summaries are currently being revised in order to provide a more explicit comparison of the effects that could result from various alternatives.

		intentional breaching of levees. The table and associated text would analyze action alternatives by broad category, as done effectively in the Chapter 12 summary. The summary would make clear, quantitatively, how the various options, including the no-action alternative, stack up in terms of effects on and of the soils. The summary might show, for instance, that the tunnel alternatives would cause fewer losses to certain kinds of agriculturally important soils than would the canal alternatives. The existing Highlights text conflates landforms and soils in a confusing fashion. This text should conform more nearly to the Chapter text, which creates no such confusion (p. 10-3 to 10-6). The Executive Summary of the draft EIR/EIS could tabulate the Chapter 10 impacts more clearly (p. ES-67 and ES-68). The impacts form two groups: SOILS-1 to SOILS-5 on conservation measure CM1, SOILS-6 to SOILS-9 on other conservation measures. Each of the two groups of potential impacts shares similar or identical text that could be gathered in header in the "Potential Impact" column. The text for the individual impacts could then be condensed to make clearer, at a glance, the differences among them. The tabular summary on pages ES-67 and ES-68 could distinguish more clearly between no-action and action alternatives in terms of no-action impacts that also apply to proposed BDCP actions. Under impacts on subsidence, the summary presents the no-action alternative as beneficial because of subsidence-reversal projects independent of the proposal BDCP actions, without applying this benefit also to the proposed BDCP actions. Similarly, "significant" soil loss, under the no-action alternative, if caused chiefly by decomposition of peat, would seem to extend to the proposed BDCP actions. **References missing** p. 10-2, lines 35-38—This summary of geological history, referenced to a report from 1950, exaggerates the roles of Carquinez Strait and inorganic sediment in building the historical channels and tidal wetlands of the Delta. Chapter 9 cites additional, newer references that could help here. p. 10-3, lines 20-21—Could also cite the classic survey by Cosby {{1863 Cosby,S.W. 1941/a;}}. p. 10-4, line 4—According to this generalization from 1950, peat with many rhizomes of *Phragmites australis* [the current species name for this reed] underlies peat with many rhizomes of *Schoenoplectus acutus* and *S. californicus* [the current names for the main bulrushes]. Subsequent work has not reproduced this finding (Atwater, 1982; Drexler, 2011). p. 10-4, footnote 1—The most up-to-date, reliable source on peat thickness is Deverel and Leighton (Deverel and Leighton, 2010, p. 8). The 2007 California Department of Water Resources reference cited in the footnote is an obsolete	

		draft of a report finalized in 2008 (URS Corporation and Jack R. Benjamin & Associates Inc., 2008). p. 10-10, lines 16-17—Prefer Galloway et al. (1999) as comprehensive and technically sound, as well as written and illustrated for broad audiences p. 10-11, lines 6-21—A standard reference not cited: Thompson (1957). p. 10-11, line 24—Update to Deverel and Leighton {{3237 Deverel,S.J. 2010/a;}}. **Other points** p. 10-2, lines 2-3 and 31-33—Distinguish between "soils" in the agricultural sense and "soils" as used by engineers. p. 10-3, line 33—This summary could identify the soils of modern tidal wetlands and compare them to the diked and drained soils of former tidal wetlands. Likewise for the summary of Suisun Marsh soils on page 10-4, lines 20-22. p. 10-5, line 16—The heading "Valley Fill" is potentially confusing because it brings to mind Sacramento Valley, San Joaquin Valley, Central Valley. p. 10-11, line 1—N ow *Schoenoplectus acutus* and *S. californicus.* p. 10-11, line 5—Is this peat depth residual (after subsidence) or original (ca. 1850)? p. 10-12, line 42—The current rates of subsidence vary with substrate. The rates are probably zero in the large part of Jersey Island where Pleistocene dune sand is exposed at the ground surface. An important point that bears on restoration opportunities in other parts of the Delta where mineral soils have already been exhumed; these areas can't subside further by decomposition of peat. This issue reappears on page 10-26, beginning on line 32, with a section that describes subsidence from decomposition of organic soils as continuing "to varying degrees." The section does not describe geographic differences. A fuller description would identify the west-central Delta as the main area where mineral soils are not widely exposed. 10-13, line 17—This section could be expanded to discuss consequences of arresting or reversing subsidence. A supporting reference: Miller and Fujii (2010). The discussion would help anticipate the benefit identified on page 10-26, line 40. [See Appendix B for references]	The peat depth is original.
60	Appendix B	**Chapter 11, Fish and Aquatic Resources** **Conclusions** Overall the EIR/EIS could demonstrate a more balanced approach by fully discussing results from an ecosystem perspective (to add to the species-by-species discussions), fully embracing uncertainty and discussing it uniformly while distinguishing knowns from unknowns, and explicitly stating assumptions and differentiating conclusions from hypotheses. The detailed piece-by-piece	The approach utilized necessarily looks at the ecosystem, to the extent it's related to fish and aquatics, in a manner that analyzes the key components of the ecosystem that support fish species. The effects of the project on the ecosystem were addressed by analyzing 20 fish species and their major life stages (spawning,

		and part-by-part treatment of CMs and species, although perhaps necessary, dilutes the merit of the overarching ecosystem perspective of the intent of this plan. Success will depend on a fully functioning system and analyses that incorporate integration across species, within a species, and across regions. Adaptive management will require a well-planned and comprehensive research and monitoring program that will target causality and test Plan hypotheses. Our specific concerns with this chapter of the EIR-EIS include: (1) positive benefits of habitat restoration are highly uncertain, and if not realized, will invalidate the final conclusion of no net negative effect; (2) further analysis of effects of flow on entrainment is needed; (3) the decision-tree process is not adequately described; (4) interactions and synergies among species and the potential impacts on other ecologically important species are not adequately considered; (5) the qualitative nature of the effects analysis makes results more aligned with 'hypotheses' rather than 'conclusions' or 'predictions'; (6) full life cycles are not adequately considered; (6) a more complete description of adaptive management is needed; and (7) uncertainty in the conclusions is not adequately acknowledged throughout the EIR-EIS. **Chapter aims and scope** This extensive and comprehensive chapter evaluates impacts of construction, maintenance, and operation of each of the alternatives of Conservation Measure (CM) 1 and many of the other conservation measures on fish and other aquatic resources. Impacts on 20 fish species are evaluated. Eleven covered fish species that are federally threatened or endangered (Delta smelt, longfin smelt, Sacramento splittail, fall-, winter-, and spring-run Chinook salmon, steelhead, green sturgeon, white sturgeon, Pacific lamprey, and river lamprey) are discussed separately for each of the alternatives and most CMs, often for multiple fish life stages. The 9 non-covered species that are California Species of Concern or of recreational and/or commercial importance (striped bass, American shad, threadfin shad, largemouth bass, Sacramento tule perch, Sacramento perch, Sacramento-San Joaquin roach, hardhead, and California bay shrimp) are discussed collectively. In addition, impacts of CM 1 and alternatives on other coldwater habitat species in upstream reservoirs are also evaluated. As stated in Chapter 11, the actual effects of the actions are dependent on a clear understanding of Chapter 5 (the Effects Analysis) in the Draft BDCP. For example, "The methods used to analyze impacts to covered and non-covered fish and aquatic species in Chapter 11 rely on the models and data included in the Effects Analysis……An understanding of the Effects Analysis will help inform a review of Chapter 11. In some instances, the description of fish species life stage timing and distribution varies between the Effects Analysis and EIR/EIS.	rearing, and migration). Understanding these specific effects provides the reader with an understanding of how the key pieces of the larger ecosystem may be affected. Additionally, the chapter does discuss uncertainty and adaptive management. There may be opportunities to expand these topics in the final document. Overall, the best available information and data was used, and the analytical approach of providing consistent analysis across all of the alternatives, and making conclusions based on the stated methodology for determining adverse effects, is appropriate for a CEQA/NEPA document. With that said, the approach taken in the BDCP HCP document may provide the broader ecosystem perspective that the commenter is requesting.

		These differences are in the process of being updated to match one another….” (p. 11-2) Sixteen of the 22 CMs are dealt with in detail for each of the covered species. These can be summarized as impacts as a result of the construction, maintenance and operations of the new water conveyance systems (CM 1), impacts from habitat restoration efforts, (principally CM 2 and CM 4 but also CM 5, CM 6, CM 7 and CM 10) and those individual activities (CM 12 – CM 19 and CM 21) that are designed to “reduce the direct and indirect adverse effects of other stressors on covered species”. The latter include reductions in predators, illegal harvest, and invasive vegetation, and enhancement of hatcheries for some species, installation of nonphysical fish barriers, and improved oxygen conditions in the Stockton Deepwater Fish Channel. In essence, a simplified summary of the primary projected impacts of the EIR-EIS are; 1) The construction, maintenance and operation of a new water conveyance system could change downstream flow rates and could have negative impacts on some species. However, the new conveyance system will allow additional flexibility in flow control that may improve resilience to climate change and may reduce fish entrainment losses by shifting intake usage between North and South intakes based on fish abundances in the area. 2) Habitat restoration, including flood plain inundation, may increase physical habitat area and food production for covered species via increased phytoplankton production. 3) Targeted activities will attempt to reduce predators, control invasive species, reduce illegal harvest, and be beneficial to certain species in various ways. There were also several mitigation measures proposed to minimize the biological effects of construction and maintenance activities. In many cases it is argued that any negative impacts caused by changes in outflow would be fully compensated for by other conservations measures, principally habitat restoration. **Areas of Concern** The DISB review focuses on overarching major points concerning the scientific approach.	
61	Appendix B	**POINT 1: Effectiveness of Habitat Restoration** A fundamental component of the overall program is the success of comprehensive habitat restoration and connectivity. If proposed habitat restoration actions are not implemented or are not as effective as assumed in the EIR-EIS, then the positive impacts of those actions would no longer be present, and the final assessment of a net positive or no net negative effect	This comment addresses three important issues (extent, timing and effectiveness of restoration actions) related to implementation feasibility of alternatives presented in the EIR/EIS. For CEQA and NEPA, alternatives must reasonably meet the purpose and need and project objectives, reduce

		would not be valid. A key uncertainty that has a profound impact on the assessment of impacts is the extent, timeliness, and effectiveness of the protection and restoration actions, particularly restoration of tidal marshes and floodplains (including the Yolo Bypass). **Extent** Specific sites for restoration activities have not been determined, nor has their ability to pass environmental review requirements been assessed. If willing land-sellers are not found or if environmental problems are identified (e.g., excess methyl mercury production), then those preservation and restoration actions and the positive benefits attributed specifically to them in the impact analysis would not occur. Likewise, the analysis of changes in hydrodynamics with new intakes and habitat restoration are central to evaluation of the effects on fishes. Yet the hydrodynamic analysis is based on one possible configuration of habitat restoration, and if that is not the final configuration, the results of the hydrodynamic analysis could change. The sensitivity of conclusions to the configuration of habitat restoration should be evaluated in the EIR-EIS. **Timeliness** Construction and flow operations may have impacts immediately, whereas the restoration impacts and benefits may lag a decade or more after construction. Often it is claimed that the negative impacts in one area (e.g., flow changes on covered species) can be compensated for by habitat restoration. Analyses suggesting this result are often based on the implicit assumption that the new habitats are 100 % effective and fully functional ecosystems that are tightly integrated physically and biologically with the rest of the Delta. The literature strongly suggests, however, that there are significant time lags between construction of a new habitat and its full functionality. This means that the benefits of habitat restoration may not occur for a long time and that the benefits may be too late for some species if negative impacts come first. These time lags were not fully considered in the EIR-EIS. The effect of time lags on overall conclusions should be evaluated in the EIR-EIS. Alternative scenarios should be considered in which habitat restoration begins sooner or is phased in to maximize the benefits (e.g., by starting with habitats that will have the largest impacts). The priority of habitats to be restored is not indicated, so it is not clear if the most critical habitats will be first on the list. **Effectiveness** Even if all acres are acquired and restoration actions are taken in a timely manner, whether those actions will deliver the anticipated benefits or not is also uncertain. For example, the analysis regarding habitat restoration assumes there will be increases in phytoplankton production and that these increases will be transferred up the food web to covered species. This largely ignores an	impacts and be feasible. For ESA permit requirements, the BDCP (Plan) actions must meet specific biological goals and objectives identified for the landscape, natural communities and individual species. Each of the issues presented in this comment are valid and are related to uncertainties associated with implementing the Plan. To address these and other uncertainties the Plan calls for monitoring all flow and physical restoration actions to assess the degree to which biological goals and objectives are achieved. If objectives are not attained, adaptive management actions would be implemented, under the direction of permitting agencies, to adjust Plan implementation until specific objectives are met. Although this approach does not eliminate uncertainty prior to Plan implementation, it is an accepted approach for an HCP. For the purposes of the EIR/EIS, Chapter 11 applies a consistent comparative methodology for each of the alternative impact analyses based on details of the Plan and alternatives as they are proposed in the BDCP and EIR/EIS. The range of Alternatives in the EIR/EIS provides varying operating regimes and amounts of habitat restoration which are fully evaluated in Chapter 11. Although the potential does exist that not all of the BDCP conservation measures will be 100% effective, the EIR/EIS analyses provide a reasonable and balanced approach for purposes of presenting comparative impact results. The EIR/EIS also provides for additional project-level environmental review for those conservation measures that were evaluated at a program-level in this EIR/EIS. This additional analysis prior to project implementation, would likely provide the necessary detail to address the commenter's concerns. However, it is also reasonable to expect that Chapter 11 analyses for this EIR/EIS be revised, if necessary, to reflect the potential

		equally likely result that the added biomass of phytoplankton will be consumed by clams, which have had substantial effects on phytoplankton abundance and species composition throughout the Delta. Moreover, new zooplankton could also be consumed by other fishes. Whether or not any increases in primary production will be transferred to zooplankton and on to covered species that may reside in the restored area or outside of it is largely unknown. Based on a thorough and credible review of the scientific literature and extensive experience in the ecosystem, Mount et al. (2013) question whether the tidal marsh and floodplain restorations will deliver the food subsidies anticipated to Delta and longfin smelt. Their concerns seem justified. Increase in habitat area is not necessarily a metric for increases in habitat quality or functionality. Although the Adaptive Management Team is tasked with assessing the effectiveness of the restoration actions, there is no description of management actions that will be considered if the positive effects are not observed. Hence we are not able to determine if those actions could possibly compensate for the negative impacts identified.	implementation uncertainty for certain conservation measures and the potential need for adaptive management actions. The EIR/EIS will be specifically reviewed to identify the potential that extent, timing and effectiveness of habitat restoration contribute to the impact conclusions presented in the Draft EIR/EIS.
	62	**POINT 2: Impacts of Flow Operations** The main impacts of new flow operations (CM 1) on fishes are 1) to allow flexibility to shift entrainment from the South Delta intakes to the new North Delta intakes and 2) to change flow rates and other associated conditions (e.g. water temperature and turbidity) downstream from the North intakes. **Entrainment** It is suggested that overall entrainment of fishes may be reduced by re-routing flows into the North or South intakes on the basis of fish distributions in the area as well as the use of improved intake structures at the North intakes (new screening processes and state-of-the-art positive barrier fish screens). However, one credible analysis of the modeled flow regimes (Mount et al. 2013) points out that, although significant uncertainties are incorporated into the CALSIM modeling, they are not given adequate consideration when statements about effects are made. In addition, both Mount et al. (2013) and a credible review by MBK Engineers (presentation at January 2014 ISB meeting) question whether the system can be operated as simulated in the CALSIM modeling and hence whether the predicted reductions in entrainment will actually occur. Therefore, estimates of entrainment should be bracketed based on model uncertainties. **Flow rates** The impact of altered outflow cannot be adequately assessed with the information given because the operational flows are not yet determined for Alternative 4. Some of the possible flow regimes have negative impacts. It has been established that the abundances of many of the covered species show a correlation with flow rates. Uncertainties about the level of spring and fall	The proposed North Delta Intakes provide added flexibility to operate the system in a way that would reduce entrainment of the covered fish species at the existing south Delta facilities. In addition, BDCP Alternative 4 operating criteria includes OMR requirements that are more stringent than the requirements under the current RPAs. Two separate modeling efforts, DWR's BDCP Modeling and the MBK's modeling of BDCP Alternative 4 (presentation at Jan 2014 ISB meeting), indicate that Old and Middle River flows are likely to be more positive under BDCP than under the No Action Alternative. As part of the review by Mount et al. (2013), the authors noted that they were uncertain about the magnitude of the positive OMR flows shown in the DWR's BDCP modeling would occur in reality. MBK's modeling noted that more exports could be diverted from the proposed North Delta Intakes instead of the existing south Delta facilities, than what was shown in the DWR's BDCP modeling. This means that, even if the Delta were to be operated per MBK's version of the modeling, it

		outflow will be addressed with two decision trees, one for fall and one for spring. It is argued that the decision-tree process will run for about 10 years and inform the initial operations of CM 1. Targeted studies will address this uncertainty before the new facilities are operational, but there is no description of these studies or a clear designation of how optimal flow rates can be balanced for different species. The decision-tree process will focus on longfin smelt and Delta smelt with consideration of salmon and sturgeon but no apparent consideration of other species. It is not clear what would be done if 'optimal' flows differ across these species. Moreover, other species abundances such as young-of-the-year striped bass also correlate with flows, and there is no consideration of potential changes in abundances of these young predators. Overall, it is stated that a science plan and data collection program will be developed and implemented but the design of that program is not stated, the amount and source of funding not identified, and the experiments to be done not determined. If the success of the studies is dependent on having years with a range of flow conditions, then success is uncertain at best. It is impossible to determine if the proposed research program will be adequate to address either the uncertainties that have been identified or the hypothesized causal mechanisms (turbidity, suspended solids, temperatures, salinity) that might lead to more informed flow operations.	should only result in more positive Old and Middle River flows under BDCP, than what was shown under the DWR's BDCP Modeling. Therefore, MBK review only reassures Mount et al.'s concern and reaffirms the potential improvement to the Old and Middle River flow conditions and the derived conclusion about potential reduction in the entrainment under BDCP. The BDCP modeling performed to date provides enough evidence regarding potential reduction in the entrainment at the existing south Delta facilities. The magnitude of the reduction can vary depending on how much exports are taken from the proposed north Delta intakes. The stringent OMR requirements along with a robust coordinated real time operations management proposed under BDCP should allow for the entrainment benefits. Regarding flow rates, the chapter provides a range of outflows in the Decision Tree, which represents the outer range of operations "bookends". Therefore, the impacts of altered outflow can indeed be adequately assessed. 'Optimal flows' are expected to vary between species, as they use different parts of the watershed and have differing timing of presence, which is why federal agencies (NMFS and USFWS), who are responsible for the protection of these species, have been involved in every step of the BDCP planning process. The Decision Tree research program is under development and a more detailed description will be provided in the Final HCP and EIR/EIS.
63	Appendix B	**POINT 3: Species Differences and Interactions** Overall, there was little consideration of interactions and synergies among species. Also, potential impacts on other ecologically important species in the ecosystem have been ignored or inadequately presented. **Species aggregation and inclusiveness**	The 11 covered and 9 non-covered species were chosen for specific regulatory reasons (take for covered species and NEPA/CEQA requirements for non-covered species). Other important species, such as clams or centrarchids, are included

		Because species were assessed individually in the evaluation of the effects of water operations, significant differences in effects among species were identified. In contrast to the detailed individual species discussions, the 9 non-covered species were lumped and considered as a group in Chapter 11 because the effects of most conservation measures 'on non-covered fish and aquatic species would be similar for all non-covered fish species included in Chapter 11". First, no reason is given as to why the 9 non-covered species are included and others excluded apart from being "identified by state or federal agencies as special status or of particular ecological, recreational, or commercial importance." (Page 11-1, lines 29-30). Clearly, one could argue that there are other species that have major ecological impacts in the Delta (e.g. two invasive clams) or that might be abundant and have competitive interactions with covered species (perhaps the centrarchids). Also, if habitat restorations become fully functional and provide predator refuge, feeding areas, or sources of food for covered species, the restorations must have impacts on many (perhaps hundreds) other species including the listed non-covered species. Some of these other species, such as nonnative predators and invasive clams, may also benefit from these expanded habitats. Benefits for the other species may dampen any benefits of the habitat restoration for covered species. Second, the 9 non-covered fish and invertebrates have a huge range of ecological tolerances and requirements, life histories and behaviors. It seems unlikely that effects would be similar across all of these species. The treatments of covered species in the EIR-EIS revealed very significant ecological differences among species and even life stages. At best, this approach seems overly simplistic because we expect that individual species will have different responses to the proposed actions. At worst, this sort of lumping could lead to wrong conclusions because both predators (e.g. striped bass) and their prey (e.g. shad, California bay shrimp) are combined. Some of the proposed actions, for example in flow conditions, might favor a particular covered species but may also favor a non-covered predator such as striped bass. Some further justification for this approach should be given particularly because some of the non-covered species have strong interactions (e.g. predation) with some covered species. Likewise, lumping phytoplankton, zooplankton and predators may also enhance uncertainty because clams can alter phytoplankton species composition, fish feed selectively on different types and sizes of zooplankton, and predator species differ in prey choice, feeding behavior, and thermal/habitat requirements. Other important elements of the food web in these habitats such as emergent and submergent macrophytes and edaphoic microalgae, were ignored. Moreover, there are literally hundreds of species of macroinvertebrates as well as other fish species that are ignored in the EIR-EIS,	indirectly (such as food production for clams or predation effects for centrarchids), but not explicitly as is done for the 20 covered and non-covered species. Only non-covered species that are expected to have similar responses to the BDCP are lumped and much has been done since the Spring 2013 draft to make better distinction of differences between species and discuss potential effects individually. As with clams and centrarchids, discussions of species interactions are largely indirect and no impacts are focused entirely on these interactions. The hundreds of species of macroinvertebrates are not "ignored in the EIR-EIS"; they are just not called out explicitly in the analyses. There is high uncertainty regarding how food production will translate into benefits to covered species. Therefore, we do what we can with the best available science, which is the regulatory standard.

		although these species play an essential role in the ecological functioning of the Delta ecosystem. It is difficult to draw species-specific conclusions based on the grouping of some species and exclusions of important food web components. We do not suggest that multispecies biological models are required but we do suggest that some sort of balance and rationale be given for species lumping and exclusions so that uncertainties in conclusions can be better understood and underlying assumptions can be formally expressed. **Species Interactions** It is not clear how the interactions among species are considered in time and space? Much of the EIR-EIS was focused on a detailed discussion of how an individual conservation measure (or a component of a conservation measure such as construction) might impact a specific species or life stage of a particular species. For example, each of the 11 fish species is discussed separately and extensively. However, there was an absence of consideration of interactions and synergies among species. We know we can't really manage species by species, and what is beneficial for one may be adverse for another. This concept has not been adequately captured or addressed. As mentioned, this becomes particularly important in the discussions of habitat restoration, which is intended to provide new food resources in the restored area and to the Delta. There is no consideration of how suggested increases in zooplankton food supply will be distributed among the target species. There is likely to be competition for these limited resources among covered species or with other species not considered. Information about who uses those resources is critical but not fully considered in the assessment. Food-web models do not adequately consider predators or competitors of the covered species. It did not appear that any biological feedbacks (e.g. resource depletion) were used in the analyses.	
64	Appendix B	**POINT 4: Delta Connectivity** Overall, there was little consideration of interactions and synergies among different proposed CM actions or between different geographic regions within the Delta and beyond the Delta. It is not clear how the cumulative effect of restoration in different parts of the Delta is addressed. Conservation measures are planned in many different locations throughout the Plan Area and it is suggested that negative impacts in one area can be offset by positive impacts in another area. This necessarily contains an implicit assumption that the entire Plan Area is functionally interconnected both physically and biologically. It assumes that CM impacts on a particular life stage of a species in one part of the Delta can be balanced by other CM impacts that may occur at other times, on other life stages, and in other locations. This has not been demonstrated. Additional consideration is needed of how factors outside the Plan Area	This is addressed in conclusions for each alternative. The discussion of this for Alt 4 is discussed in much more depth in the HCP document's Chapter 5, specifically in Section 5.5 Net Effects for fish. The information in the HCP could be summarized and included in the EIR/EIS in the final document. Consideration is being given to methods of more clearly explaining in the Final EIR/S interactions of Delta habitats and their relationship to areas downstream of the Delta.

		interact within the Plan Area. The EIR-EIS included some forcing factors (such as climate change, tides, reservoir and upstream flows) and to a certain extent the potential for new invasive species from outside the Plan Area. Yet there is little discussion of biological influences or migrations from outside the Plan Area. A good example is longfin smelt, which has a bay-wide ecosystem distribution. Changes in flows may be very important in migrations into the Plan Area and the role of these smelt in other parts of the Delta. While the connectivity of the Delta ecosystem was not addressed for longfin smelt and other species, we note that the life cycle model for salmon does acknowledge the fact that salmon spend different portions of their life in different regions of the Delta, Bay and Ocean systems, and are impacted by how long they spend in the Delta and the timing of migration through the Delta. This approach was not used for other species. Also, there has been little effort to translate biological changes in the Plan Area to downstream regions.	
65	Appendix B	**POINT 5: Qualitative Analyses** The impacts on fish are largely assessed based on qualitative analyses, including expert judgment. The relation of these analyses to the specific models presented in the Effects Analysis (Chapter 5 of the Draft BDCP) is not clear. The qualitative analyses seem to conclude that the negative impacts of construction and flow operations will be minimized through Adaptive Management of operations and that the conservation measures will be beneficial and largely make up for the negative impacts. This type of statement is invalid in a qualitative comparison because: 1) the relative degree of the negative and positive impacts is unknown, and 2) CM 1 and CM 2 -22 impacts may operate on different life stages of a species. Some life stages may be more critical than others (e.g. bottlenecks). The assessments of effects of each part of each conservation measure on fish and aquatic resources are qualitative, with considerable uncertainty in the conclusions reached. The methods used to assess effects are drawn in part from DiGennaro et al. (2012). The relative importance of a BDCP attribute (or stressor) affecting each life stage of each of the covered species was assessed largely by expert judgment (on a scale of +4 to -4) during a workshop. Scores were based on importance (none = 0, very high = 4) and on the basis of the degree of change of that attribute caused by the BDCP. These analyses could have been strengthened by: 1. Conducting an independent assessment by a second group of scientists. Conclusions are only as good as the expert judgment and without replication, uncertainty is high. 2. Qualitative analyses should include and fully document assumptions. The analyses need to recognize that conclusions largely provide a mechanism for verbal description of potential effects and provide a hypothesis of effects	Our hierarchy in choosing a type of analysis has always been to conduct a quantitative analysis first if one is available. If not, we rely on a quasi-quantitative method (such as the DRERIP process described in the comment) that is based on the best available science (but ultimately is scored through expert opinion). Qualitative analyses are reserved for when no better analytical method was available. The authors feel that the impacts are NOT largely based on qualitative analysis, but quantitative analysis primarily. The net effects section in the HCP document is more than a "verbal interpretation of the tabulated net effects." The net effects section summarizes the effects of all components of BDCP on each covered species from the Chapter 5 appendices and the rest of Chapter 5. The summary formed the basis for the table, not the other way around. Uncertainties are recited throughout the table and summaries. The reason for each score is described in detail to create transparency in the authors' thinking such that another group of experts that may reach a different conclusion will understand the authors' reasons for their conclusions.

		rather than any predictive forecast. Net effects and the degree of certainty are tabulated for each attribute (e.g. Figure 5.5.1-5 for Delta smelt and 5.5.3-4 for winter-run Chinook), but the final assessment of overall net effects on an individual species is a qualitative narrative description, which is essentially a verbal interpretation of the tabulated net effects. Attempts to qualitatively balance positive and negative impacts (i.e. positive benefits compensate for negative impacts) are not valid because the relative strengths of these impacts are unknown. The authors' need to fully recognize the uncertainties inherent in the EIR-EIS analysis rather than simply providing tables stating no net effect. Moreover, the net effects analysis is highly uncertain because the combined importance of all effects was a subjective analysis of the attribute scores. Another group of experts may reach a different conclusion.	
66	Appendix B	**POINT 6: Full Life cycle considerations** For the covered species, each CM is often evaluated for each life stage of the species. It is often claimed that negative impacts of one CM and usually on one life stage can be offset by another CM that may be acting on another life stage. This type of analysis assumes full biological functionality and connectivity across the region. Moreover, it assumes that all life stages are equally important. Consideration should have been given to what is currently restricting a species production and an acknowledgement that actions on that bottleneck are likely to have a higher impact than actions on other life stages. For example, if larval recruitment is a serious life-stage bottleneck, then it is not clear that any efforts to improve juvenile conditions will have population-level impacts. We recognize that it is difficult to make these kinds of assessments until after there is a better understanding of the complete life cycle and the operations of stressors. Yet this limitation or added uncertainty needs to be addressed, particularly when conclusions are being made about 'net effects'. The OBAN and IOS life-cycle models that focused exclusively on Chinook salmon do not do this and do not include most of the CMs.	What restricts the species is one of the underlying components of the Net Effects analysis. Without full life cycle models that include all components of the BDCP, we have done this "by hand". Each attribute in the Net Effects analysis has been scored for its importance to each life stage of each species. Therefore, not all life stages, locations, or attributes are assumed to be equal and this is discussed in the analysis.
67	Appendix B	**POINT 7: Adaptive Management** Several very specific Biological Goals or targets are defined in the Draft BDCP. For each species-level Biological Goal there are a variety of CMs that could contribute to that goal. Adaptive management is a key part of the overall Draft BDCP Plan. However, given that a number of CMs apply to a number of species, there is not an explanation of how adaptive management will be used to target the CM that is causing any changes observed for individual species. Research will need to be carefully designed to understand the causal relationships. There is no description of (a) how individual targets or thresholds will be determined across time to trigger an action, (b) how much progress is needed to maintain a particular action, (c) how much change would	See above responses. Line 6 addresses the use of triggers for adaptive management action. Lines 6 and 18 address further development of details in the monitoring framework plans. Line 39 addresses the scope of adaptive management actions.

		need to be observed to effect a change in the CM, or (d) what would happen if results were mixed across species (i.e., some covered species received a positive benefit and others received a negative benefit).	
68	Appendix B	**POINT 8: Uncertainty** The Delta is a physically, chemically and biologically complex ecosystem. There has been extensive research, monitoring and modeling for the Delta area but much remains unknown, particularly with respect to causal mechanisms. The ecosystem has also undergone major changes in hydrology and water flow, habitat structure, and biological composition, including a reduction in a number of species and massive invasions by others (e.g., clams). Much of this complexity and changes has been captured in the various sections of the Draft BDCP as well as some of the individual species descriptions in Appendices to Chapter 11. In this context, the EIR-EIS analyses are designed to predict the nature of the changes that might occur over the next 5 decades due to construction and operations of a massive new water conveyance system in the Delta and a series of efforts to restore habitats and institute a number of other Conservation Measures. All of this is done under major known or estimated (climate change, population increases) but also unknown (new invasive species or discovered causalities) changing environmental conditions. This is a daunting challenge. Ultimately, the question is whether and what sort of effect the combined CMs will have on key covered species and on the ecosystem as a whole. To a large degree this remains uncertain and 'conclusions' of net effects analyses could be better termed 'hypotheses'. There are uncertainties in causality, the analyses performed, the future unknowns and changes or responses of other species and ecosystem components that are not considered, any or all of which could have indirect and unintended consequences. We recommend that this uncertainty and the many underlying assumptions be dealt with upfront, forcefully and directly. There is uncertainty throughout all of these discussions. Quantitative estimates of uncertainty are rare. Moreover, the handling of uncertainty seems inconsistent throughout. The uncertainty of the level of understanding of the factors limiting species production, model validity and overall conclusions reached are more clearly acknowledged in the Draft BDCP than in the EIR-EIS. Sometimes the uncertainty in the data or models is used to outright eliminate the application of certain models (e.g., fish life cycle models). Other times the uncertainty in the output is stated as the conclusion (i.e., no conclusion can be drawn). Sometimes, the uncertainty is mentioned and yet other times the uncertainty is not mentioned at all. In general, the latter becomes more common as one moves from the Draft BDCP Plan to the EIR-EIS details to the Summary parts of the chapter. Often the rollup summaries are not reflective of the uncertainty of the issues expressed	Noted—we will look for additional opportunities to add and clarify discussions of uncertainty in the final documents.

		in the body of the report. Rollup of conclusions tend to downplay uncertainties. A typical example of this is on page 11-18 "The effects of the restored habitat conditions (CM 2…CM 4…CM 5…CM 6…and CM 7..) would be beneficial for all covered species because there would be an increase in the amount of habitat as well as food production in, and export from, the restored areas". The certainty of this conclusion is not reflective of the uncertainty of the analyses. Table 11-1A-SUM2 is another example of the problem mentioned above. Data clearly show a relationship of outflow to splittail abundance and any reduction in that flow might have a negative impact. Although the EIR-EIS claims a positive impact from the Yolo Bypass, the table itself shows the net effects of flows on splittail are not adverse, less than significant or even beneficial. These types of conclusions without precautionary notes about uncertainties or assumptions can be misleading. In addition, there are clearly many assumptions that are necessarily part of any such analyses. We suggest that the fundamental assumptions be succinctly stated up front in each section. Statements of assumptions allows a more logical evaluation of conclusions, and would provide a more balanced and understandable presentation of the methodology used.	
69	Appendix B	**POINT 9: Cumulative Effects** The analyses are targeted towards assessing impacts over a 50-year period Yet, many of the effects on individual fish are evaluated at points in time, normally only for a year or for a particular life stage. It is possible that a low impact (positive or negative) of a few percent during a year can have a significant effect if accumulated (and compounded) over each year for 50 years, but it is not clear if this been incorporated into any of the biological models.	If differences "of a few percent" are found in results based on CALSIM, it is generally concluded that these may be within the level of error in the model outputs. While we agree with this statement, the resolution of the analysis is not at a level that would allow for much interpretation of a few percent, positively or negatively. The ability to look "cumulatively" across all years is highly desired to address potential effects, as the commenter has noted. In general, the ability to do so is limited to life cycle models that can be run over several generations of fish. The BDCP Effects Analysis evaluated 17 life cycles for potential use. All but two models, IOS and OBAN for winter-run Chinook salmon, were not selected due to multiple reasons (see Table 5.G-1 in BDCP Appendix 5G for reasoning). Therefore, the analysis used these two life cycle models for winter-run Chinook salmon that were able to detect low-level impacts.

			Another way that "cumulative effects" were addressed in the analysis was by looking at the cumulative magnitude and frequency of exceedance over temperature thresholds for anadromous species in upstream waterways. This analysis calculates the total number of degree-days or degree-months (depending on temporal resolution of model outputs) to assess temperature-related impacts on salmonids and sturgeon. The technique is still limited in its ability to assess low impacts as the commenter desires because results are compared relatively among model scenarios and proportional differences are reported.
70	Appendix B	**POINT 10: Additional General Questions/Points** • Temperature plays a key role in fish growth and reproduction and fish physiology and behavior is often very sensitive to small changes in temperature. Although temperature was considered in the sturgeon analyses it is not clear that it was fully considered in other species, particular for those where temperature might be near critical thresholds. • Flows are considered important to many fish species yet the causal relationships of fish abundances with flows remains enigmatic. Will research and monitoring (e.g. as part of the decision-tree analyses) include measures of other potential forcing factors such as water temperature, predation rates, suspended solids, salinity and food densities? • How were (or will) thresholds or tipping points be considered in the analyses or adaptive management programs? • There was very little discussion of the two invasive clam species which, according to the published literature, have had a huge impact on the ecological functioning of the Delta ecosystem (e.g. changes in chlorophyll levels, species compositions, Microcystis). Were they fully considered in the analyses of habitat restoration and potential new food sources? • Wherever possible modeling should show 'bracketed results' or ranges of uncertainty. • Propagation of errors in physical/hydrodynamic/hydrological models will be compounded when then applied to biological models as forcing functions.	There is a wide breadth of analyses on temperatures for multiple life stages of upstream species. The commenter should examine the upstream sections for each species. This is not done in the Delta because it is generally agreed that there will be no effects of water operations on Delta temperatures because water temperatures are controlled by atmospheric conditions in the Delta, not by reservoir operations. We have DSM2 model results, albeit imperfect model results, of Delta water temperatures that support this that are not included in the documents but are available in the administrative record. Clams: Clams were considered in analyses of food production and habitat restoration. There is a full description included in BDCP document's Appendices 5E, Habitat Restoration, and 5F, Biological Stressors. The scientific understanding of these invasive clams and their effects is very limited, subsequently limiting our ability to discuss much about them. Bracketed results: While this is valid suggestion, most models used in the analysis are deterministic and do not provide a range of

			potential outcomes. CALSIM-based model results allow the opportunity to show a range over 82 years of historical hydrology and results are nearly always reported as exceedance plots to allow the reader to see the variability among years. Propagation of errors: this is an unavoidable issue given the way the analysis is conducted. A better discussion of this will be added to the text for the Final draft.
71	Appendix B	**Chapter 12: Terrestrial Biological Resources** ***Overall assessment*** Chapter 12 uses a logical approach, a wealth of detail, and thoughtful analysis in evaluating potential impacts to terrestrial habitats and organisms. Unlike the rest of the EIR/EIS, it makes many of its findings accessible in a comprehensive lead-off summary. Like the rest of the EIR/EIS, however, understanding and evaluating the material in Chapter 12 requires frequent referencing to other chapters, and to multiple places in the BDCP Plan. Our main concerns: 1. *Losses and gains*—To simplify estimates of losses and gains in habitat, the chapter equates a species' habitat with one or more natural communities. This simplification weakens the link between habitat value and habitat losses and gains and contributes to uncertainty in the calculations. 2. *Restoration timetables*—The chapter sets optimistic expectations about the time required to replace a mature habitat of slow-growing terrestrial species. 3. *Restoration effectiveness*—There is an implicit assumption that the projected habitat gains from restoration and protection needed to offset habitat losses associated with BDCP actions will be fully realized. Experience suggests that this is rarely the case. 4. *Performance measures*—The chapter lacks, even as summaries derived from the Plan, detailed metrics of desired ecological results of the various conservation measures. 5. *Adaptive management*—Adaptive management is frequently mentioned as the solution if things don't work out as planned, yet few details are provided (these are in the BDCP Plan) and lessons from terrestrial habitat restorations that were managed adaptively are scarce or absent. 6. *Monitoring needs*—Implementing the Plan will require extensive monitoring landward of the traditional coverage through the Interagency Ecological Program. The demands for monitoring may be underestimated (and therefore underfunded). 7. *Linkages*—In contrast with the Plan's emphasis on linking conservation	This response addresses the "areas of concern" (#s 1-8) identified at the beginning of this overall assessment. The responses take into consideration the added detail provided by the commenter later in this assessment. 1. As indicated in the comment, the approach In Chapter 12 relies heavily on the quantity of habitat lost, with less detail provided on habitat quality. With the large area involved in the Plan and the lack of project-level specificity to many of the conservation measures, the natural community –based approach is the most practical. For Conservation Measure 1, project-specific field surveys were completed, where access was available, to augment the natural community information with habitat quality assessments and species presence recorded. Based on the judgment of the surveyors, much of the habitat that would be lost to CM1 construction would be of low habitat value because of its fragmented nature and interruption by human land use practices (primarily extensive agriculture). Based on the biological goals and objectives in the Plan and the CMs that involve protection, restoration and enhancement, the replacement habitats

		measures in space and time, Chapter 12 mostly treats each species and each action independently of other species and actions. 8. *Contingency plans*—It is unlikely that all the actions and measures in BDCP will play out as planned. Beyond calling on adaptive management, there is little indication of any back-up plans if habitat restoration falls short because of funding, unwilling sellers, climate change, or other factors. ***Chapter aims and scope*** Chapter 12 of the EIR/EIS, which addresses the potential impacts of BDCP conservation measures on terrestrial biological resources, begins with an informative summary. Effects on natural communities, covered plant and animal species, and other species of concern are considered; most of the attention is on species. The general approach to gauging impacts, compensating actions, and mitigation for species is to (1) use available information to construct a habitat suitability (HSI) model for the species; (2) use the model in combination with GIS to determine where available habitat occurs, weighted by habitat value; (3) overlay the areas that will be affected by various actions under the conservation measures to determine the loss of available habitat; (4) compare with the amounts (and occasionally locations) of habitat to be restored or protected to determine whether they compensate for losses; (5) supplement with Avoidance and Minimization Measures (AMMs) and/or other specific management actions to enhance the value of restored or protected areas or reduce impacts; and (6) where necessary, implement additional Mitigation Measures to ensure sufficient habitat availability. This is a logical approach. The analyses of impacts on natural communities and species from the conservation measures associated with alternatives are comprehensive and detailed. In most cases, the proposed habitat restoration will more than compensate for the losses associated with construction and operation. Where it falls short, additional actions are proposed. For example, loss of acres of vernal pool complex is estimated to be greater than replacement through protection and restoration in the near term. The difference is anticipated to be addressed through a variety of restrictions on activities or AMMs: "With these AMMs in place, Alternative 4 would not adversely affect vernal pool complex natural community in the near-term" (p. 12-2048; unless otherwise noted, all page references are to the EIR/EIS documents). Numerous AMMs and Mitigation Measures are proposed to supplement the habitat protection and restoration measures. In many cases, these involve conducting surveys to obtain additional information on distribution in the study area (e.g., Mitigation Measure BIO-55, p. 12-2161), target and protect sensitive areas (e.g., Mitigation Measure BIO-75, p. 12-2241), or evaluate the	would be of much higher quality. The quality of the replacement habitats would be insured through strict monitoring and adaptive management requirements. Chapter 12 draws its conclusions based on this basic assumption of habitat lost versus habitat created/restored. 2. The BDCP does include aggressive timetables for habitat replacement or enhancement. Knowing that certain habitats would take time to develop appropriate value, some of the restoration, protection and enhancement activities are scheduled to proceed well before the habitat would be lost to either construction or restoration of other habitat types. This is best evidenced by the Avoidance and Minimization Measure developed for replacement of lost riparian habitat. Each natural community impact analysis deals independently with losses that would occur in the near-term (the first 10 years), so that any lag in availability of quality or quantity of habitat would be identified and rectified by early restoration schedules. 3. It is agreed that the analysis assumes all habitat restoration and protection activities would ultimately be successful. While habitat restoration is seldom completely successful in the initial effort, the BDCP requires that full replacement occur at some point in order for the Plan to be considered in compliance with its goals and objectives. 4. As indicated above, the performance standard for ecological results is tied up in the quantitative biological goals and objectives, stated at the beginning of

		potential effectiveness of proposed conservation actions. For example, the loss of managed wetland habitat for shorebirds and waterfowl in Suisun Marsh would be mitigated by the protection or restoration of 5,000 acres of seasonal wetlands, assuming that "1) existing managed seasonal wetlands on average in Suisun Marsh provide low biomass and low-quality food to wintering waterfowl and 2) protected seasonal wetlands can be managed to produce high biomass and high food quality. However, the food biomass and productivity in Suisun Marsh would need to be quantified in order to determine if the 5,000 acres was sufficient to avoid an adverse effect on wintering waterfowl in the Suisun Marsh, or if additional mitigation would be needed. Mitigation Measure BIO-179a, Conduct Food Studies and Monitoring for Wintering Waterfowl in Suisun Marsh, would be available to address this adverse effect" (p. 12-2561). Many of the AMMs or Mitigation Measures are quite detailed, evidencing sensitivity to the specific ecological requirements of the species. ***Quality of analysis*** The amount of detail provided in Chapter 12 and its appendices is impressive. There are numerous instances in which the treatment of potential impacts and the measures proposed to counteract them are thoughtful and comprehensive. In some cases, the analysis delves into great detail about what might seem to be potentially minor effects. Concerns are raised, for example, about possible alterations of the photoperiod of sandhill cranes due to lighting at construction sites or on new roadways (p. 12-2210). In other situations, however, little supporting detail is provided or the reader is referred to material in other chapters or in the BDCP Plan. ***Chapter conclusions*** The overall conclusion of the chapter is that the only non-mitigateable impacts of BDCP would potentially affect bank swallows, through disturbance and/or loss of breeding habitat, and giant garter snakes, through disruption of movement corridors by canal construction (for alternatives 1B, 2B, and 6B) (see pp. 12-3229 – 12-3243). Additionally, although sufficient conservation acreage would be provided by the conservation measures to offset near-term effects of Alternatives 1A, 2A, 3, 4, 5, 6A, 7, 8, and 9, "insufficient cultivated land would be protected (and enhanced) under Alternatives 1B, 1C, 2B, 2C, 6B and 6C to offset loss of habitat for species that use cultivated lands for foraging. Alkali seasonal wetland complex and vernal pool crustacean habitat (alkali seasonal wetland complex and/or vernal pool complex) would need to be restored and protected in addition to what is currently in the Plan under Alternatives 1C, 2C and 6C, as described in Mitigation Measures Bio-18, Bio-27, and Bio-32" (p. 12D-39). Although an EIR is required to identify the "unavoidable significant	each impact analysis, and in the restoration and protection goals identified in BDCP Chapter 3, Table 3.4. The potential for the restoration contained in the Plan to offset ecological losses from CM1 construction are dealt with in detail in the EIR/S Appendix 12D. The ecological results for other conservation actions are tied up in the biological goals and objectives of the Plan and the quantitative commitments to high quality habitat protection and restoration described in Chapter 5 of the BDCP. 5. The Chapter 12 impact analysis relies heavily on the requirements contained in the Plan to adaptively manage all conservation measures to insure that biological goals and objectives are met. The detail of adaptive management described in the Plan has not been repeated in the EIR/EIS, as these two documents are meant to be companion documents; both are already extremely lengthy. The details of adaptive management have been worked out over many months between the resource agency biologists and the consultant biologists; they will only be considered final and acceptable when and if the Plan is eventually adopted by these agencies. 6. It is agreed that extensive monitoring will be required to insure that the intent of restoration efforts are actually being achieved in the field. Funding of the monitoring is discussed in the BDCP and is not a consideration for the EIR/EIS. To maintain compliance with permit requirements eventually issued by the resource agencies, funding will need to be acquired to meet the monitoring

		environmental impacts" of a project pursuant to Section 15126.2(b) of the State CEQA Guidelines, the non-mitigateable potential impacts of BDCP on bank swallows and giant garter snakes (or, indeed, on any terrestrial biological resources) are not included in the broader listing of impacts and mitigation measures in Chapter 31 (Table 31-1). ***Areas of concern*** Finding what one needs to know to understand or evaluate a particular statement or conclusion in the EIR/EIS often involves a considerable amount of searching through thousands of pages, as well as delving into referenced (and non-referenced) material in the BDCP Plan itself. Based on our attempts to do this, we have several concerns with the treatment of terrestrial biological resources. Determinations of "habitat" and "habitat value," while often detailed, do not acknowledge several sources of uncertainty that may compromise assessments of habitat losses and restoration gains The emphasis of the analyses is on habitat. Potential impacts of BDCP actions are in most cases evaluated in terms of loss (or, in some instances, diminishment in value) of habitat, and compensation for losses is through protection, restoration, and/or management of the same or similar habitat. Additional actions are proposed if the amount of "replacement" habitat created does not balance the habitat loss. "Habitat" for natural communities is determined by classifying communities into several types, which are then mapped. For species, "habitat" is defined through the development of habitat suitability (HSI) models. The results are then used to calculate potentially available habitat and what habitat might be lost or gained as a result of BDCP actions. The details of the HSI models are not in the EIR/EIS but are provided in Chapter 2 of the BDCP Plan. These appear to be carefully done, making good use of available literature and unpublished information; Appendix 2A of the Plan discusses the assumptions and underlying rationales for each of the HSI models. The EIR/EIS correctly notes that the models "do not necessarily indicate with certainty that covered species would not occur in all areas not identified as habitat; but instead indicate that these areas have a much lower probability of species occurrence compared with areas identified as suitable habitat. Habitat suitability models are a tool used to estimate impacts to obtain a maximum allowable habitat loss. On-the-ground surveys, performed by professional biologists, will determine impacts during implementation" (p. 2A-4). In other words, lots of monitoring! The specifications of habitat for a species derived from the HSI models are often quite detailed. In a listing of principles to guide the conservation strategy for aquatic species (BDCP p. 3.2-5 to 3.2-7), the BDCP Plan correctly observed	requirements of the Plan. 7. The EIR/EIS impact analysis is organized, by design, to address each special status species independently. It is important to document whether the Plan actions, even those designed to recognize the interactions of various habitats and species, are capable of supporting the long-term survival of all species. Where individual conservation actions are designed to support interactions of species, these actions are addressed in each individual species discussion. 8. Contingency planning may be addressed in more detail in the final Plan, and the EIR/EIS should clearly summarize those Plan actions where it addresses monitoring and adaptive management. This discussion will likely be added to the Approach section of Chapter 12.

		that "habitat should be defined from the perspective of a given species. Habitat is a species-based concept reflecting the physiological and life-history requirements of species. Habitat is not synonymous with vegetation type, land (water) cover type, or land (water) use type." Nonetheless, in calculating the habitat loss/gain functions that are the foundation of assessments of BDCP impacts, habitat has been generalized to correspond with one (or more) of the natural community types. While this generalization was probably necessary to permit the analysis of habitat losses and gains using GIS analysis, much of the useful and important detail in the HSI models has been lost (although it reappears now and then in the AMMs and Mitigation Measures for individual species). Thus, there is often an unspecified (but potentially large) uncertainty associated with the habitat loss/gain calculations. This uncertainty may be exacerbated by uncertainties in the distributional data that are used in concert with the habitat information to define where a species occurs, and therefore its vulnerability to the construction and restoration actions under different alternatives. The distributional data (provided in a series of maps for the species considered) require several assumptions, most importantly that (1) the distribution has been adequately surveyed; and (2) the distribution is stable. The distributional data come from a variety of sources over an unspecified time period (although the data sources may be given in some undisclosed location in the EIR/EIS or Plan). They are based largely on records in the California Natural Diversity Data Base (CNDDB). Because this is a presence-only database, confirmed absences (0 values) are ignored and can only be inferred, compromising its value. The database is also incomplete. For example, CNDDB contains only a partial download of records of bird distributions in the California Avian Data Center (CADC). This source of uncertainty is not acknowledged, nor are its potential consequences explored. Uncertainties in the distributional information may also affect the assessment of habitat "value." There is frequent mention of the expectation that restored or protected habitat will be of greater value than the habitat that is lost to BDCP activities, so the amount of replacement acreage may actually underestimate the "functional" acreage available to a species. "Value" is determined based on recorded distribution and abundance in different vegetation cover types and/or species' ecology. For example, for giant garter snake "the modeled upland habitat is ranked as high-, moderate-, or low-value based on giant garter snake associations between vegetation and cover types (U.S. Fish and Wildlife Service 2012) and historical and recent occurrence records (Appendix 12C, 2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report), and presence of features necessary to fulfill the species' life cycle requirements" (p. 12-2131). Although this approach is reasonable, it rests on the assumptions that (1) current distribution reflects	

		optimal habitat selection; (2) the distributions have been adequately surveyed and are not undergoing rapid changes; and (3) the restored habitat will actually be better than the habitat lost. There is a clear intent to manage for improved habitat, considering such factors as spatial heterogeneity and connectivity; to the extent that this is realized, the last assumption is probably valid, but it does rest on an accurate understanding of the habitat requirements of the species. Expectations for habitat restoration and protection are unreasonably optimistic Assessing the potential impacts of BDCP actions begins by determining how much (acreage) of a given habitat is lost or converted to something different—i.e., the "footprint" of the action. The loss is then offset by restoring or protecting an equivalent or greater amount (acreage) of the lost habitat. The calculations in the EIR/EIS are therefore made in acreages. There is an implicit assumption that an acre lost can be replaced by an acre gained. The EIR/EIS discusses two approaches for dealing with cases in which the gains don't balance the losses. First, it is frequently proposed that the replacement habitat is of greater value, as discussed above. Second, the calculation of "mitigation ratios" (how many acres should be restored or protected to replace an acre lost) considers factors such as importance (value) of habitat to a species, species rarity, threat levels, and uncertainty about the effectiveness of restoration (see p. 12D-3). Although this seems to be a reasonable approach to gauging mitigation efforts, it would be good to know how uncertainties of restoration effectiveness were assessed. Habitat restoration is a complex and time-consuming process, The EIR/EIS recognizes this and devotes considerable attention to the timing of restoration efforts. In particular, plans are outlined to ensure that restoration is in phase with habitat loss, so that gaps in habitat availability to a species are minimized. Some restoration is scheduled to begin shortly after permitting of BDCP, whereas conveyance operations will not begin for at least a decade (although construction of the intake facilities will begin soon after permitting). While this difference in phasing may help to ameliorate impacts of habitat loss for aquatic species, it will be less effective for terrestrial species and communities. For slow-growing flora, such as valley/foothill riparian woody vegetation (p. 12-2015), or species that rely on mature habitats, such as black rails that occupy well-developed tidal wetlands (p. 12-2165), or Swainson's hawks, white-tailed kites, Cooper's hawks, or ospreys, which require mature trees for nesting (p. 12-2255), there may be a temporal mismatch between the loss of mature habitat components and restoration. It may take decades to redeem the lost value. For the latter species, "this time lag between impacts and restoration of habitat function would be minimized through specific requirements of AMM18	

		Swainson's Hawk and White-Tailed Kite, including transplanting mature trees in the near-term time period" (p. 12-2255). For something like a hawk, however, "habitat" depends on much more than having a suitable tree for a nest. One can't transplant an entire functioning mature riparian ecosystem. It is inevitable, therefore, that there will be a substantial gap between the loss of habitat for such species and the re-emergence of habitat that meets the full complement of a species' requirements. If this takes decades, population dynamics may be disrupted and local extirpation may follow. The analysis for salt marsh harvest mouse, for example, warns that up to 20% of the species' habitat in the Plan Area may be affected, diminishing the population and reducing genetic diversity, "thereby putting the local population at risk of local extirpation due to random environmental fluctuations or catastrophic events. This effect is expected to be greatest if large amounts of habitat are removed at one time in Suisun Marsh and are not effectively restored for many years, and if there are no adjacent lands with salt marsh harvest mouse populations to recolonize restored areas" (p. 12-2485). The expectations for restoration of mature habitats, even if supplemented by Mitigation Measures and AMMs, strike us as unrealistically optimistic. For many natural communities and species, the effects of CM1 on species are to be mitigated by the creation of restored habitat of equal or greater value in Restoration Opportunity Areas. For natural grasslands, for example, the analysis of long-term effects for NEPA projects a loss of 2,947 acres by the end of the Plan timeframe. The 2,000 acres of restoration associated with CM8 and the restoration of temporarily affected grassland required by AMM10 (431 acres for Alternative 4) would not totally replace the grassland acres lost. There would be a permanent loss of 516 acres of grassland in the Plan Area. However, "the combination of restoration, protection and enhancement of grassland associated with Alternative 4 would improve the habitat value of this community in the study area; there would not be an adverse effect on the grassland natural community (p. 12-2070). In this example, as elsewhere in this chapter, one has the impression that there is full confidence that the projected gains in habitat will in fact materialize. There may be considerable certainty about the losses, particularly those associated with construction activities, but there is far greater uncertainty about the mitigation. Will the restoration actually be done? Where will it be located ("somewhere in a Restoration Opportunity Area" leaves a lot of uncertainty)? Will funding be adequate? Will appropriate areas be obtained from willing sellers? Will the species and communities come? Will climate change and sea-level rise erase the restoration gains? These questions are not adequately addressed, and the consequences of failing to reach the	

		restoration, protection, or mitigation goals are not considered (at least in this chapter). Simply referring to adaptive management as a way to deal with such uncertainties is not sufficient. One aspect of uncertainty that *is* addressed in this chapter (in Appendix 12D) is ecological feasibility: are suitable conditions present within specified conservation zones to implement the appropriate near-term conservation measures? Although the assessment explicitly excludes consideration of socio-economic or engineering aspects of feasibility, there is a comprehensive analysis of the presence of lands supporting required unprotected natural community acreage in specified conservation zones to support natural community protection, and of the presence of lands that meet suitability criteria, such as species range, soil type, land use, natural community, and land elevation to support restoration of natural communities or species habitat (p. 12D-2). Appendix 12D is where one can find details about what goes into the determination of mitigation ratios, what principles will be used to guide the selection of areas for protection as part of the BDCP reserve system, and what criteria might be used to judge the suitability of restoration sites. Although the treatment of these factors is generally excellent, the approach fails to consider how the spatial and temporal sequencing of restoration projects can influence their effectiveness in contributing to BDCP goals. Which sites are selected for restoration of habitats at one time may depend on which sites are already being restored and where they are. These sequencing effects may be particularly important for projects associated with waterways, where flows connect places. Such considerations are mentioned in the chapter in connection with the intent to include connectivity among habitats as a factor in planning, but the implications are deeper than that. Climate change and sea-level rise can create additional uncertainty in habitat restoration efforts. We consider some implications for tidal marsh restoration in greater detail in Box 1. **Box 1. The ability of tidal wetlands to keep their heads above water as sea level rise** ***Impacts assessed*** The anticipated outcomes of tidal marsh restoration under the BDCP depend largely on whether new tidal marshes will survive the rise in sea level projected for the 21st century. Several of the BDCP documents under review consider this question: • BDCP Plan Appendix 3B, "BDCP Tidal Habitat Evolution Assessment," presents results of modeling that simulates the fate of marshes at Suisun Bay and in the Delta during the next 50 years. • BDCP Plan Appendix 5E, "Habitat Restoration," refers to this modeling and, in three main places, provides background discussion (p. 5.E-37, EA.4-18 in	

		section E.A.4, and 5E.B-9). Included is a proposed strategy of getting new marshes established soon, before sea-level rise accelerates to the rates forecast for late in the 21st century (p. 5E.B-7). • BDCP Plan Appendix 5.A.1, "Climate Change Implications for Natural Communities and Terrestrial Species," refers briefly to marsh accretion. • EIR/EIS Chapter 12 repeatedly mentions accretion without analyzing it to the level of detail in Appendices 3B and 5E. The background discussions include brief reviews of how marsh plants as well as suspended sediment can influence vertical accretion in tidal marshes. The references cited include recent journal articles about marsh accretion at the San Francisco Bay estuary (Callaway et al., 2011; Stralberg et al., 2011) and the best available measurements of below-ground productivity by *Schoenoplectus acutus*, the main bulrush among Delta tules (Miller and Fujii, 2010). ***Issues*** Doubtful projections The accretion estimates in Appendix 3B rely on simplified modeling for Suisun Marsh and on an optimistic assumption for the Delta. For accretion modeling at Suisun Marsh, Appendix 3B relies on a simplified method used by Orr et al. (2003). In this method, above- and below-ground contributions by marsh plants are assumed to raise the marsh surface by 1 mm per year, and the role of inorganic sediment is estimated from suspended-sediment concentrations. More recent models include specific factors for injected roots and rhizomes and for soil decomposition (Mudd et al., 2009; Kirwan et al., 2010; Kirwan et al., 2011; Fagherazzi et al., 2012; Takekawa et al., 2013). Such models do not appear to have been used in the BDCP projections. For the Delta, Appendix 3B assumes that marsh accretion keeps pace with sea-level rise (p. 7). The report goes on to qualify this assumption: "The ability of marshes to keep pace with higher rates of sea level rise is not yet well understood" (p. 8). Outdated references The related reference lists cite no post-2011 reports about tidal-marsh accretion excepting, in Appendix 5B, a piece by a science journalist (Kintisch, 2013). A more timely assessment might have considered the accretion modeling cited above and its implications for 21st-century tidal marshes. Also directly relevant are recently published observations of modern accretion rates in San Francisco Bay estuary marshes (Callaway et al., 2012; Thorne et al., 2013) and prior accretion rates in the Delta (Drexler et al., 2009; Drexler, 2011). Updated background on roles of inorganic sedimentation could cite recent reports on horizontal accretion (Gunnell et al., 2013) and coastal sediment starvation (Fagherazzi et al., 2013). [See Appendix B for references]	

		Performance measures, adaptive management, and contingency planning are treated inconsistently or not at all In view of the uncertainties that accompany many of the actions and responses that are part of BDCP, it is important to be asking continuously how well the goals and objectives are being met. Performance measures are essential. For BDCP as a whole, performance is gauged in terms of progress toward meeting the biological goals and objectives that are part of the overall conservation strategy. All mentions of performance measures in the EIR/EIS simply refer to these goals and objectives. In some instances the accounts are quite detailed. For example, in the account for loggerhead shrike we are told: "Under CM11 Natural Communities Enhancement and Management, insect prey populations would be increased on protected lands, enhancing the foraging value of these natural communities (Objectives ASWNC2.4, VPNC2.5, and GNC2.4). Cultivated lands that provide habitat for covered and other native wildlife species would provide approximately 15,400 acres of potential high-value habitat for loggerhead shrike (Objective CLNC1.1). In addition, there is a commitment in the plan (Objective CLNC1.3) to maintain and protect small patches of trees and shrubs within cultivated lands that would maintain foraging perches and nesting habitat for the species. The establishment of 20- to 30-foot-wide hedgerows along field borders and roadsides within protected cultivated lands would also provide high-value nesting habitat for loggerhead shrike (Objective SH2.2). These Plan objectives represent performance standards for considering the effectiveness of conservation actions." (p. 12-2428). Most species accounts in the EIR/EIS, however, make no mention of objectives or performance measures. Instead, the biological goals and objectives are presented in Chapter 3 of the BDCP Plan. The biological goals and objectives are either performance-based (was an action undertaken) ot results-based (did it have the anticipated effects). For terrestrial resources, the objectives are mostly performance-based (which are easier to measure); results-based objectives are more difficult to measure, but they are ultimately what BDCP is all about. Chapter 3 of the Plan includes lengthy tables and text listing the biological goals and objectives and describing the underlying rationale for each; the specific monitoring efforts for compliance effectiveness *and* the specific metrics that will be used to judge performance; the major sources of uncertainty associated with CM1; and research actions necessary to reduce the uncertainties (performance can also be judged on the basis of success in reducing the listed areas of uncertainty). These are all important details. Even though these details are included in the BDCP Plan, their absence from the EIR/EIS, even in a summary form, diminishes its comprehensibility and scientific value substantially. In a well-planned undertaking such as BDCP, performance measures should	

		provide a frequent assessment of whether actions are having the desired effects. This is the domain of adaptive management. Adaptive management is *the* key to the success of BDCP over the project duration. The adaptive management approach and administrative organization are described in detail in the BDCP Plan (Chapter 3, Section 3.6, and Chapter 7). Yet, adaptive management receives an even more cursory treatment in the EIR/EIS than do performance measures. Adaptive management is mentioned frequently in the EIR/EIS with no details about how it might be implemented; rather, it is often presented as a panacea for all problems. Even so, there are numerous instances in which the elements of adaptive management are elaborated without the term being mentioned. For example, on p. 12-2081 the amount of habitat restoration is adjusted depending on the rate at which habitat is lost (primarily through restoration of tidal wetland) and the timing of activities. Or on p. 12-2233 it is proposed that if breeding occurrences of least Bell's vireo and yellow warbler are documented in the survey area, consideration will be given to control of nest parasites and predators to foster population persistence. These are good examples of adaptive management based on field monitoring, although they are not presented as such. We consider adaptive management in detail elsewhere in this review. Monitoring and adaptive management are proposed to evaluate whether things are proceeding as planned. What if things don't go as planned? The history of ecological restoration tells one that restoration projects rarely result in exactly what is desired, when it is expected. Implementation of many of the AMMs anticipates that various activities (e.g., construction, roads) will be able to be redirected or retimed to avoid or minimize potential impacts. There will inevitably be situations, however, in which the adjustments are not possible or incur too great a cost. What then? Given the complexity and the high stakes of many of the actions to be undertaken in BDCP, it would seem prudent to have contingency plans at least generally outlined *before* discovering that things aren't working. There is little mention of contingency plans in the event that a given action does not produce the desired results. The effects of linkages and tradeoffs among species or actions are not adequately recognized The Delta is a complex, interconnected place, in which what happens in one place at one time has cascading effects elsewhere at a later time. Correspondingly, the BDCP undertaking is complex, with many things going on at different places and times, all linked together in different ways. The Plan and the EIR/EIS must acknowledge and consider these interconnections. Both the Plan and the EIR/EIS do recognize the need to connect places undergoing restoration or targeted for protection. Establishing connectivity among patches of habitat to facilitate movement of individuals is considered as	

		part of the planning for many species. Landscape ecologists distinguish between "structural" connectivity (i.e., what is seen on a map or a GIS image) and "functional" connectivity (i.e., how organisms actually use connections). The approach taken by BDCP understandably relies on the former, in particular the patterns developed in the California Essential Connectivity Project. Without knowing the specific locations for habitat restoration within the broadly defined Restoration Opportunity Areas, however, it is difficult to evaluate how structural connectivity will be established in practice (although the intent is clearly there). Elements of functional connectivity might be incorporated into the planning by relying on the details of species' ecologies contained in the HSI models. Connections among actions may be even more important than connections among places. Actions taken to benefit one species may benefit or harm other species. Thus, "Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles because riparian-adjacent grassland is an important habitat characteristic for the rabbit" (p. 12-2154). However, "the restoration programs will increase primarily wetland and riparian natural communities by converting agricultural land or managed wetland. The special-status and common plants and wildlife that rely on wetland and riparian habitats for some stage of their life will benefit from these changes over time. Other species that rely on agricultural land and managed wetland, but do not benefit from wetland and riparian expansion, may decline in the study area" (p. 12-3226). In other words, some (perhaps many) actions will entail tradeoffs. The importance of considering linkages among places and among actions is clearly stated in the conservation strategy of the BDCP Plan: "substantial benefits of the conservation strategy are derived from understanding interconnections between conservation measures across program elements, across the wide geography of the Delta, and across time. In short, the conservation strategy is intended to be greater than the sum of its parts" (BDCP p. 3.2-3; see also BDCP p. 3.2-5 to 3.2-7). Aside from brief mentions (e.g., p. 31-28 and following), however, the EIR/EIS fails to follow through on the intent of the conservation strategy, instead usually considering each species and each action independently of other species and actions (although several species are grouped together for discussion on the basis of their ecological similarities).	
72	Appendix B	**Chapter 15 Recreation** *1.Scopes of Impact Covered* Chapter 15 details the physical environment, recreation facilities, and both recreation activities and opportunities of the Delta Plan Area. There are	

		numerous parks, extensive public lands, and private areas with many interconnected waterways that offer diverse recreation opportunities ranging from boating and fishing (the principal recreational activities) to camping, bird watching, sightseeing (e.g. wineries), hunting, wildlife viewing, trail hiking and walking to picnicking. The EIS/EIR focused primarily on; 1) how the actual construction and maintenance of new structures will impact recreational use at that location or in the immediate vicinity and 2) how the operations of the water flow system (CM1) in each of the alternatives might affect recreational opportunities. Most of the latter are focused on the frequency that reservoir levels will exceed the threshold set for recreational impairment. *a) Are the impacts addressed complete (including links to other chapters)?* Readers are referred to other chapters on Socioeconomics (Chapter 16), Aesthetics and Visual Resources (any changes in resources might affect their draw for recreation, Chapter 17), Fish and Aquatic Resources (changes in abundance or mix of creational fishes or even the perception of changes might affect recreational fishing, Chapter 11), Public Services and Utilities (Chapter 20), Transportation (e.g. traffic patterns, Chapter 19), Environmental Justice (differential use of recreation facilities, Chapter 28) and Noise (Chapter 23) to review the assessment of how the BDCP will impact these resources. Unfortunately those results were not reconnected or cross-referenced to their impact on recreation including tourism. An aspect of the impacts not mentioned in this chapter that will be a consequence of all alternatives is covered in detail in Chapter 25, *Public Health* This is the increases in potential vectors of human and disease, and especially of the biting nuisance caused by mosquitoes. For example, as stated elsewhere in the EIR, "Construction of the water conveyance facilities and water supply operations under all action alternatives would result in an increase in sedimentation basins and solids lagoons. These new features could result in an increase in standing water, thereby potentially increasing vector breeding locations and vector-borne diseases in the study area" p. 25-34, lines 18-21). At individual construction sites near recreation sites or areas and in-river, construction would be primarily limited to June through October each year. This, of course, is the period of peak mosquito breeding and biting activity in the Delta. Moreover, the economic cost of nuisance mosquitoes is not discussed in either this chapter or in Chapter 25 of the EIR. Increases in mosquito populations will affect virtually all recreational activities in the Delta (e.g. fishing, camping, wildlife viewing, sightseeing) resulting in loss of recreational opportunities and increased human discomfort. This chapter of the EIR should include this topic as a direct cost on recreational activities in the Delta. *b) Are the impacts emphasized with respect to their importance?*	Opportunities to add cross-references will be reviewed and considered prior to the Final EIR/EIS. It is assumed that the design of sedimentation basins and solids lagoons would follow standard design practices and best management practices that account for abating potential mosquito problems, which would be included in the project cost. Please refer also to Appendix 3B, Section 3B.1.15, describing an environmental commitment to prepare and implement mosquito management plans.

		More attention needs to be paid to the other conservation measure because a number of these have the potential of resulting in either positive or negative impacts on recreation. For example, CM 17 reduction of illegal harvest would provide more fish for those who take fish legally. CM20 might help reduce invaders which would help the ecosystem overall but might come at a intended to reduce the local densities of 'nonnative predators' on selected species. These predators may likely include (although not specifically identified) striped bass and largemouth bass which support a lot of the recreational fishing. How will this predator reduction effort affect fishing per se or the fishers draw to this area to fish? *2. Quality of Analysis* *a) Is the literature from which the analysis builds appropriate?* The literature used is appropriate. *b) Are the formal models and/or broad patterns of reasoning relied upon the "best available"?* Formal models are generally not applied. Therefore, the questions below do not apply. *c) Are the inputs (or other basic facts) to the models/reasoning the best available?* *d) Where modeling judgments and interpretive reasoning are invoked, are they appropriate?* *e) Are the results and their uncertainties interpreted in a "balanced" way with respect to the strengths and weaknesses of the alternatives under consideration?* *3. Overall Assessment of whether and how this chapter helps inform BDCP* In general, the material in this chapter is useful and informative to BDCP. However, inclusion of information suggested above, and better linkages with other chapters would increase its applicability.	These conservation measures are discussed at a programmatic level of detail for the purposes of NEPA and CEQA compliance. Additional project-level environmental review of these measures may be required, and if required will be conducted, prior to their implementation. See Appendix 31A for a discussion regarding the potential for future environmental review of these measures.
73	Appendix B	**Chapter 22, Air Quality and Greenhouse Gases** I. Scope of Impacts Chapter 22 addresses local and regional air quality impacts of criteria air pollutants and toxic air contaminants (TACs) emitted or generated during the construction and operation of BDCP alternatives. GHG emissions associated with the project are analyzed in relation to regulatory limits as well as control measures. BDCP could facilitate new growth and development in SWP and CVP Export Service Areas, and air quality associated impacts of such growth are addressed in §30. Climate change impacts on project alternatives are discussed in §29. They all are in the category of controversial community issues (ES§ 7). The study area for air quality effects includes immediate surroundings of project activities, within 1000ft of construction and operations. For GHG, the area is much broader due to global nature of GHG forcing. Three (SVAB, SJVAB,	(Responses begin at "The following comments are offered for further consideration:" in the original text) PM10 dispersion modeling was conducted for Alternative 4 under Impact AQ-2, consistent with SMAQMD's Guide to Air Quality Assessment. Exceedances of the state and federal ambient air quality standards within the SVAB are a result of combined emissions from multiple mobile, stationary, area, and other sources throughout the basin. Determining the extent to which construction emissions generated by the BDCP

		SFBAAB) of the fifteen California air basins are identified as important for the study. Each of the air basins is described with regard to geography, climatology, air pollution and meteorology. Air pollutants are considered in the framework of EPA criteria pollutants (which are further classified in terms of regional and local pollutants) as well as TACs. Health impacts of pollutants are identified and assessed. The National Ambient Air Quality Standards (NAAQS), CAAQS and CCAA are outlined, and the attainment status of the three air basins in point are listed (Table 22-3). It appears that violations of NAAQS and CAAQS and prevalent in the three air basins with regard to ozone and PM, to the extent that they are classified as non-attainment. Increased emissions can be regarded as adverse, and BDCP proponents are expected to develop an Air Quality mitigation plan (AQMP) to ensure that regulations and recommended mitigation are incorporated into future conservation measures. The GHG emissions are discussed in relation to climate change, CEQA guidelines §15364.5, CEQA OPR Advisory, DWR climate action plan and California Global Warming Solutions Act (AB 32). TACs in California are primarily controlled through the Tanner Air Toxics Act (AB 1807) and Air Toxics Hot Spots Information and Assessment Act of 1987 (AB 2588). Local laws may trump certain Federal and CEEQA regulations. Air pollutants and GHGs are generated during the construction phase as well as operation of water conveyance facility [CM1]. In the former, the dominant emissions include those from mobile and stationary construction equipment exhaust, employee vehicle exhaust, dust from land clearing and earthmoving, electrical transmission, and concrete batching from onsite plants. As such, this EIR/EIS assumes a particular schedule and phasing of activities, which are imperative for emission modeling (Appendix 22A). The potential air quality and GHG effects of [CM1] and habitat conservation measures [CM 2–22] have been analyzed, and their implications of [CM1] on sensitive receptors associated within residential and recreational land use are evaluated quantitatively at the project level (within 1000 feet of the operations). The effects of [CM 2–22] are evaluated qualitatively at the program level. It is argued that it may be sufficient to consider only the air quality and GHG impacts of [CM 2-11]. Cumulative analyses are also presented. The three air basins cut across four air quality districts [YSAQMD, SMAQMD, BAAQMD, and SJVAPCD] that have different emission standards for criteria pollutants and TACs; *de minimis* threshold levels for each basin have been identified. Many of these districts are already either non-attainment areas or maintenance areas, so extra emissions can have significant impacts. The cases of construction and long term operations are analyzed separately for different (nine) alternatives and nineteen potential impacts (AQ 1-19) are identified and mitigation action are proposed. The analysis is fraught by the need to comply	will contribute to incremental increases in ambient pollutant concentrations that would result in a violation of the NAAQS/CAAQS is beyond the scope of a project-level environment document. Given this, SMAQMD has adopted CEQA thresholds to assist lead agencies in evaluating the potential for project-level emissions to worsen existing pollutant levels or contribute to new violations of the NAAQS/CAAQS. The SMAQMD has determined, based on existing and future ambient pollutant concentrations in the SVAB, that a "substantial" project-level PM10 contribution is considered an emission that is equal to or greater than 5% of a CAAQS. PM10 concentrations generated by the BDCP in excess of 5% of the CAAQS could therefore contribute to "extra exceedance days" at a specific receptor location, although the exact number of exceedance is cannot be reasonably determined. As shown in Table 22-88, construction of Alternative 4 would exceed this threshold at two residences near Twin Cities Road. This impact would be mitigated by relocating these receptors when PM10 concentrations generated by construction could exceed the CAAQS. Meteorological variables specific to the SVAB were used to estimate the air dispersion of PM10 on guidance adopted by the EPA and SMAQMD. Likewise, meteorological data collected by EPA-approved monitoring stations were used to characterize background PM10 concentrations in the air basin. Data collected from these stations are routinely used for permitting and air quality analyses conducted for State Implementation Plans. With respect to health risks, Impacts AQ-10 through AQ-13 evaluate human health threats associated with construction of each BDCP

		with or consideration of a myriad of federal, state and local environmental standards. CEQA standards are more stringent than NEPA, and both do not impose thresholds for GHG. No action and action alternatives are considered in detail, using projections of future climate that includes changes in temperature, precipitation, humidity, hydrology, and sea level rise. Some or all air quality districts are affected by the alternatives. Given the uncertainty of pollution emissions in construction activities, the considerations are only qualitative for [CM 2-11]. In all, the emissions appear to contribute significantly to criteria pollutants during the construction phase but not in the operation phase. Mitigation actions are required, and proposed through a series of mechanisms such as fees and offset reduction programs. II. Quality of Analysis This EIR/EIS has been done thoroughly and carefully, considering myriad of sources and project alternatives. The results are physically plausible, more the construction activities the higher the air quality impacts, and they occur during the construction phase (nine years), impacting only a selected counties. The AQ impacts of long term operation of conveyance facilities appear to be insignificant for all BDCP alternatives. Best available modeling systems have been used for AQ and GHG modeling. Emissions from heavy-duty equipment land disturbance were calculated using spreadsheets based on the methodology and default emission factors from the California Emissions Estimator Mod (CalEEMod). Emissions have been quantified for both 2025 and 2060 conditions. As expected, some of the data on personnel and equipment are unavailable, and many assumptions needed to be made, and they are clearly stated in Appendix 22A. Best available input data from DWR, EPA, ARB and ICF are used, and all conceivable sources have been incorporated in developing inventories. The effects of alternatives on air quality, criteria pollutants, and GHG emissions from construction and operations were assessed and quantified using standard and accepted software tools, techniques, and emission factors. The models employed are EMFAC 2011 (for traffic), CalFEMod (maintenance), AERMOD and variants (air quality analysis) and AERSCREEN (DPMs, assuming worst case scenarios based on individual sources). The following comments are offered for further consideration: (i) SMAQMD requires dispersion modeling of construction generated PM10 emissions, which has been performed using AERMOD. The results are presented in Appendix C in terms of tables with mammoth number of data points that are very difficult to interpret and frankly many readers would not care to read. It would have been of help if the results are presented in graphical form. This is particularly important since PM10 background	alternative. Unlike the PM10 concentration analysis completed for Alternative 4 (Impact AQ-2), human health threats are evaluated based on the incremental concentration of diesel PM2.5 generated during construction of the BDCP Alternatives. This approach considers the extent to which construction activities would increase risk levels at nearby receptors beyond acceptable exposure standards, as established by the local air districts. Accordingly, comparison to background health risks is not needed as the analysis already evaluates the added, or net, impact of the BDCP with respect to the human health threats. The maximum health risks and PM10 concentrations (Alternative 4) that would be observed at receptor locations are summarized in Chapter 22, whereas results for all modeled receptors are provided in Appendix C. Per the commenter's request, Chapter 22 can be revised to include a graphical summary of health risks and PM10 concentrations at all receptor locations. Characterizing all emissions sources and ambient pollutant concentrations in the project area would require complex geo-spatial modeling that is beyond the scope of a project-level environmental document. Accordingly, the analysis relied on monitoring data from local air quality monitoring stations. As discussed in response to comment #10, these stations are approved by the EPA and are calibrated and maintained by the ARB or local air districts based on guidance issued by the EPA. An analysis of ozone formation based on project-generated ozone precursors (e.g., ROG, NOx) would require regional photochemical modeling that is beyond the scope of a project-level environmental document. Accordingly, local air quality management districts, including SMAQMD,

		concentrations currently exceed CAAQS and comparisons between no-action alternatives and alternatives are important. How much the construction activities increase PM concentration under various [CM 1] alternatives? Are they contributing to extra exceedance days? -- These are some questions that is important to answer. AERMOD is a source dispersion model and its capabilities are limited in the absence of well-defined mean winds, such as the case of Schultz eddy formation or summer days where slope flows may dominate in complex terrain. (ii) No model evaluations have been done using current or past data, and hence the results have large uncertainties. If the models have been evaluated for the area, some references would be helpful. (iii) It is curious why the ozone issue has not been addressed although there have been lengthy discussions in the introductory sections on ozone and its health impacts. Table 22.3 shows that there are substantial number ozone 'exceedance' days and the areas concerned are in discussions and analyses on them are extensive. Perhaps it is assumed that control over precursor emissions may reduce the chemical products, but this needs to be justified and illustrated quantitatively. (iv) The suite of models used does not include any photochemical models, and hence the formation of secondary pollutants (e.g., additional PM2.5) is excluded. In the project area, there is considerable land area with agriculture, and hence secondary pollutants can be important. A statement for the reason for exclusion (mainly comes from possible growth in agriculture) is in order. (v) Prolonged and tortuous discussion on federal, state, county and local standards, guidelines and recommendations as well as discussions on modeling have made reading of this chapter very difficult. Some of the boiler plate material on criteria pollutions and their impacts may be removed (or relegated to an appendix), paving way to a more clear flow of essential material. (vi) Fundamentals of global warming is described at length in the Chapter, but some of the discussion is redundant and others would fit better in §29. III. Overall Assessment The technical content of the paper is of acceptable standards, but it leaves some clarifications to be made in a revision, especially with regard to the ozone production and transport as well as leaving out GHG fluxes from [CM2-11]. The chapter has done an admirable job in identifying the air quality impacts of CM1 and identifying the alternatives that are environmentally benign.	YSAMQD, SJVAPCD, and BAAQMD, have adopted thresholds for NOX and/or ROG (ozone precursors) to assist lead agencies in evaluating potential regional ozone impacts from project-generated emissions. The air district thresholds have been adopted to prevent further deterioration of ambient air quality, which is influenced by emissions generated by all projects within a specific air basin and to a certain extent, projects in neighboring air basins (through pollutant transport). Violation of the air district thresholds for ROG and NOX can be used as an indicator of the potential for a project to worsen existing ozone levels or contribute to new violations of the NAAQS/CAAQS. Please refer to Impacts AQ-1 through AQ-8 for an analysis of construction and operational ozone emissions generated by the BDCP Alternatives, relative to the appropriate air district thresholds for ROG and NOX. Please refer to the response for the above comment. Similar to ROG and NOx, local air districts have adopted thresholds to assist lead agencies in evaluating project-level PM impacts. These thresholds have been developed based on regional atmospheric modeling, considering existing and reasonably foreseeable growth in the local air basin. Moreover, the threshold levels are well-established in terms of existing regulations as promoting review of emissions sources to prevent the cumulative deterioration of air quality from primary and secondary pollutants. The potential for pollutant transport among air basins is briefly described in Section 22.1.1; additional text specific to ozone can be added to Section 22.1.2.1. Regarding background information, discussion of existing air quality conditions and regulations is provided for context to help characterize

			potential impacts associated with the BDCP. As discussed in Sect 22.3.1.5 of the BDCP EIR/EIS, estimating potential changes in GHG flux from habitat creation involves a considerable amount of uncertainty. Without local sampling and monitoring data, a quantified analysis of potential GHG emissions from land use change is not possible. Accordingly, a qualitative assessment of GHG flux resulting from the conservative measures was performed in Impact AQ-19. The BDCP Proponents will prepare a land use sequestration analysis to evaluate GHG flux associated with implementation of CM2–CM11 pursuant to Mitigation Measure AQ-19. In the event that the land use analysis demonstrates a net positive GHG flux, feasible strategies to reduce GHG emissions will be undertaken. While implementation of Mitigation Measure AQ-19 will reduce potential GHG increases associated with land use changes, the BDCP EIR/EIS conservatively concludes impacts to GHG emissions from implementation of CM2-11 are significant and unavoidable.
74	Appendix B	**Chapter 23, Noise** 1. Scope of Impacts This section identifies potential impacts of construction (short-term), maintenance, repair and operational (long-term) noise related to existing conveyance facilities and conservation measures as well as BDCP alternatives of the conveyance components [CM 1] and conservation measures [CM 2-CM22]. The no-action alternative does not significantly change the noise levels, and status quo is expected to continue, unless in the event of catastrophic events such as levee failures. On the other hand, project alternatives appear to have a significant impact due to new construction, operations, sensitive land use, worker-exposure and transportation-scenario changes. A comprehensive assessment of impacts and mitigation measures are proposed and analyzed for BDCP alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8 and 9 for specific operational scenarios, followed by a cumulative analysis of noise and vibration impacts. The goal was to consider BDCP plan area and areas of Additional Analysis (§ 4.2.1.1), but the EIR/EIS excludes SWP and CVP Export Service Areas Region.	

		Considering localized nature of the sound and vibration effects, this assumption is justified. Existing environment is taken as typical of a quiet rural setting. The potential noise effects due to growth inducement are addressed in §30. Chapter 23 gives a good overview of different measures of specifying environmental acoustic effects, including the daytime-nighttime noise levels (DNL, from 10 pm to 7 am) and California Community Noise Equivalent level (CNEL, specific to 7-10pm). The issues identified are groundbrone vibrations as well as noise propagation through the atmosphere. The regulatory framework includes both Federal and State. The former does not have regulatory limits for noise, but recommends limitations for specific sources such as trucks, trains and aviation (e.g., FHWA, OSHA, FRA, FTA) as well as guidance for Aquatic and Biological Resources (§11) and Terrestrial Biological Resources (§12). California Noise Control act requires the Office of Noise Control to work with communities in developing local noise control programs based on best management practices, which is addressed well in this Chapter. The procedure involves analysis and quantification of current and projected noise sources. DWR and USFWS provide guidelines for installing sound walls to shield project activities, and the decision is centered on the increase of (A- weighted) sound levels relative to a threshold of 60 dBA. In the backdrop of such an extensive but voluntary regulatory fabric, this EIS/EIR has done a thorough job of identifying existing noise levels in each potentially affected jurisdiction (which is also the NEPA/CEQA baseline) and assigning specific noise sources associated with the project. For the analysis purposes, a 40DBA level is assumed as the background, which is a reasonable value considering that most project activities are taking place in rural areas. Major sources considered are the traffic noise, groundborne vibrations and noise from construction machinery. The estimated peak hour construction generated traffic is based on Appendix 19A, the Construction Traffic Impact Analysis Report. No action alternatives, no project alternatives and cumulative impact condition are well covered (e.g., see Tables 23-15). Local and county noise restrictions are well laid out, and potential environmental impacts of noise pollution are well articulated. The EIR/EIS identifies mitigation measures to remediate for significant impacts. Some of the aspects covered are: groundborne vibration levels (VdB level) due to operation of heavy drilling and excavation equipment , noise exacerbation due to surface construction equipment, deliveries and worker commutes, and earth moving activities at off-site burrows and spill areas. Effects analyses include noise exposure of communities as well workers at conveyance facilities. Detailed discussions are given on activities that have potential to exacerbate noise, such as construction of intakes, tunnels, forebays, barge unloading facilities, pumping stations, conveyance facilities and transmission	

		lines, with focus on daytime, evening and nighttime operations. The difficulty of the analysis is clearly recognized, in that the types of equipment, times of operation and the period of usage are difficult to predict so are the periods of operation of different noise sources. As such, conservative, worst-case estimates are considered where all equipment is assumed to be operational simultaneously. In most cases, the noise is identified to produce significant effects, and thus implementation of best noise-reduction practices as well as working with communities of noise-sensitive lands are recommended to realize levels of less than 60 dBA (this is not a regulatory limit but the consensus of experts followed by USFWS). The analysis also takes into account that there are no Federal or CEQA guidelines for vibrations with regard to tunnel and conveyance facility construction, and hence reasonable methods need to be used for effect analysis. Long-term operation of conveyance facilities should consider operations during daytime (7 am to 10pm, recommended limit < 50 dBA) and nighttime (10 pm to 7 am, < 45 dBA) hours. Conversely, the FHWA and FTA have developed methods to evaluate construction noise, which is used in this chapter, although the FHWA does not recommend specific limits for dBA. Rules of thumbs commonly used for DWR projects based on CA Govt. protocols have been used in the analysis of BDCP alternatives and in recommending mitigation measures (e.g., construction of noise barriers). No action alternative includes continued implementation of SWP/CVP until 2060 and hence the effects are similar to that of the present day. II. Quality of Analysis Almost all cited literature is from reports and websites, but given the laborious nature and complexity of the analysis, the coverage is acceptable. Standard noise assessment models are used, and potential (temporary) construction noise levels were assessed using the methodology developed by FTA (2006), assuming usage of standard construction machinery and associated noise levels and exposure. Traffic Noise Modeling Lookup (TNM) model of FHWA was employed to estimate average noise levels at fixed distances from the roadway centerline based on estimated traffic volumes, types and densities. The model was programmed to produce a conservative, worst-hour estimate of traffic-generated noise levels due to heavy truck and increased commuter trips associated with construction of project and program components (§3). Some of the key aspects excluded in modeling but will have serious impacts on the project are the nocturnal atmospheric boundary layer effects and the influence of terrain and built up areas. The following comments are offered for further consideration by the preparer: • A Noise Abatement Plan (Appendix 3B, *Environmental Commitments*) will be in place during construction to avoid or minimize adverse effects. In this	Regarding long-term operation limits, this is in fact what Mitigation Measure NOI-3 states. Regarding the modeling, the specific attenuation affects associated with terrain and structures are highly site-specific and as a practical matter are not typically evaluated in an assessment such as this. The analysis presented is conservative in that it assumes that there is no additional attenuation from terrain and structures. Atmospheric effects on sound transmission associated with wind and boundary layer effects (i.e. temperature inversions) are highly complex and dependent on many factors. A receiver that is downwind from a noise source may potentially receive a higher sound level than under calm conditions. Similarly a receiver located upwind from a source may receive a lower sound level than under calm conditions. Temperature inversions can in some cases cause sound to travel farther than under non-inversion conditions. The effects of wind and inversions sound transmission are highly variable and may or may not occur at any given location. Standard practice for an analysis such as this is make an assumption that on average over a year the net effects of wind and temperature inversions are negligible relative to primary effects of geometric attenuation.

		construction plan, the contractors are required to limit off-site trucking activities (e.g., deliveries, export of materials, etc.) to 6:00 a.m. to 10:00 p.m. to minimize impacts to nearby residences. Recent studies, however, show that evening period, after the atmospheric stable stratification develops (Ovenden et al., *J. Acous. Soc. Am*., 232, 1124-1237), nearby communities becomes more vulnerable to excessive noise levels because of downward refraction of sound waves. An earlier termination of trucking and construction activities should be considered. This is also applicable for selecting noise-sensitive land sites for siting conveyance facilities. • Noise monitoring at specific locations of construction has not been mentioned in the EIR/EIS, but is recommended considering that in-situ monitoring levels can be much different than the general levels given in §23.1. Monitoring of noise during different seasons ought to be considered, considering seasonal sensitivity. • Mitigation of noise to an acceptable level may not possible in some cases, especially during construction. Thus, more attention should be paid to long-term operations, reckoning for which can be done for different times of the day and for different climatological conditions. • TNM Model does not take into account the terrain and buildings, and hence noise estimates must be treated with caution when clusters of buildings and above/below grade roadways are present. • For construction activities in areas close to freeway or cities, the assumed background condition of 40 dBA is unacceptable. III. Overall Assessment In all, the reviewer finds that this EIS/EIR with respect to noise pollution is rigorous and extensive, and some further considerations are in order to account for possible noise refraction at night. Given uncertainties, most of the inferences are qualitative, and are expressed in terms of impacts on the overall project area rather than those over individual counties, communities and cities that may have their own noise standards. Given the overall inference that the project may have adverse noise consequences (NEPA conclusions) and that cumulative noise impact is considerable (CEQA conclusions), the Noise Abatement Plan (Appendix 3B) based on BMPs needs to be carefully designed and executed.	Regarding a noise abatement plan, refer to the response above. Atmospheric effects on sound transmission are highly variable and on average are considered negligible. Earlier termination of trucking and construction activities or selecting alternate conveyance sites based on atmospheric effects is not considered warranted. Regarding noise monitoring, given how impact thresholds have been conservatively established for this assessment additional monitoring of ambient sound levels would not improve the accuracy of the assessment or change the impact conclusions. Additional monitoring is not considered warranted. Regarding construction mitigation, the fact that it may not be possible to mitigate construction noise impacts in all situations has no bearing on how noise from long term operations are evaluated. Operational noise has in fact been evaluated relative to the time of day with an impact threshold that is reduced at night. Refer to the response above regarding atmospheric effects. Regarding the TNM model, the fact that the noise-reducing effects of terrain and buildings have not been specifically considered means that the analysis is conservative and reveals all potential impacts. An incorrect assumption about attenuation from terrain and buildings could result in an impact being understated or not identified. Regarding construction activities close to freeways or cities, none of the project alternatives pass through a city or near a freeway. The assumptions and the impact assessment approach are considered reasonable given the rural nature of the project setting.
75	Appendix B	**Chapter 25 Public Health**	***Regarding* Microcystis**: Please see response 57

		1. Scope of impacts covered. Chapter 25 focuses on issues related to human health and safety that could potentially be affected by implementation of the BDCP alternatives. Topics covered include water quality, water borne illness, creation of habitat for vectors that may carry human and animal diseases, and concerns related to creation of additional electric transmission lines needed under most of the alternatives. Specifically, the chapter deals with drinking water quality as related specifically to humans, bioaccumulation of toxicants in fish and aquatic organisms that are consumed by humans, pathogens in recreational waters, disease carrying mosquitoes as vectors of human and animal diseases, and electromagnetic fields from transmission lines. Some of these topics are also included in other chapters in the EIR but pathogens in recreational waters and disease-carrying vectors are topics not addressed in any other chapters. *a) Are the impacts addressed complete (including links to other chapters)?* Although the list of topics appears to be complete, additional material should be provided in the final EIR/EIS on some of the topics covered, including potential toxicity of certain algae, biomagnification of toxic substances, control of potential vectors of disease, and consequences of water disinfection by-products. These are described below. *b) Are the impacts emphasized with respect to their importance?* Potential Toxicity of *Microcystis,* a genus of freshwater blue-green algae that can form cyanobacterial blooms, is a problem of both public health and ecological concern in the Delta .There is a large discrepancy in coverage of this topic in the BDCP and the EIR/EIS. In general, *Microcyctis* is mentioned infrequently and without detail in the EIR/EIS. Moreover, a qualitative analysis of the effects of *Microcyctis* described in the EIR/EIS indicate that in the majority of cases neither the public health nor the ecological consequences are even mentioned. In contrast, in the BDCP there is detailed coverage of this topic, and in the majority of cases the potential effects are highlighted. Most of the mentions (>10% of those found) of *Microcystis* in the EIR/EIS are in the appendices, whereas >30% in the BDCP are in the text. This discrepancy in coverage is a major shortcoming in terms of effectively evaluating effects of the alternatives and the conservation measures in this chapter in the EIR/EIS (as in other chapters as well). Moreover, in the Effects Analysis review presentation held on 28 January 2014, the issue of algal blooms was identified as a major potential impact in the Delta. In terms of the discussion on Biomagnification of Fish and Shellfish (p. 25-8), the presentation of recommendations in a summary Table (Table 25-2. Advisories for Consumption of Fish and Invertebrate Species/Guilds for Each Waterway) is an inadequate way of dealing with this problem. Are advisories on fish and shellfish consumption the only solution when biomagnification of	above regarding *Microcystis*. We will evaluate potential *Microsystis* impacts further and changes will be considered for the final EIR/EIS to this effect where necessary. ***Regarding biomagnification of fish and shellfish****:* The potential for construction and operation and maintenance of the proposed water conveyance facilities to mobilize or result in an increase in bioaccumulative water constituents is addressed in Impact PH-3. With the exception of Alternatives 6A, 6B, 6C, 7, 8 and 9, water quality modeling results indicated that there would be small insignificant changes in total mercury and methylmercury levels in water and fish tissues. Modeling results regarding operation of Alternatives 6A, 6B, 6C, 7, 8 and 9 indicate that fish tissue mercury estimates would increase substantially relative to the No Action Alternative at certain locations. BMPs implemented under the Erosion and Sediment Control Plans and the SWPPPs would help reduce turbidity and keep sediment that may contain legacy organochlorine pesticides and methylmercury within the area of disturbance. Additionally, California Office of Environmental Health Hazard Assessment (OEHHA) fish consumption guidelines would continue to be implemented for the consumption of study area fish to help protect people against the overconsumption of fish with increased body burdens of mercury. The potential for substantial mobilization of or increase in bioaccumulative water constituents as a result of implementing conservation measures (CMs) 2, 4, 5 and 10 for all alternatives are discussed under Impact PH-7. To the extent that there would be any increase in the mobilization and bioaccumulation of methylmercury, public adherence to OEHHA fish consumption guidelines

		toxics is acknowledged as a potential problem? Moreover, biomagnification is related to issues of environmental justice in that people with lower income levels are likely to eat more fish and shellfish in the Delta region. Therefore, the biomagnification issue should be also discussed in Chapter 28. There is extensive discussion of EMF impacts. However (page 25-22, lines 39-43) "There has been extensive research done over the past 20 years on the relationship of EMF exposure and human health risks. To date, the potential health risk caused by EMF exposure remains unknown and inconclusive. Two national research organizations (the National Research Council and the National Institute of Health) have concluded that there is no strong evidence showing that EMF exposures pose a health risk." Given the above statement, why is so much attention given to this topic in the EIR? *2. Quality of Analysis* *a) Is the literature from which the analysis builds appropriate?* References on vector control are representative of a few studies done within the Delta but far from complete. For example, virtually no peer review literature is included. In addition, there is little reference to the extensive literature on toxic algal blooms, biomagnification, and water-disinfection by products in the Delta. *b) Are the formal models and/or broad patterns of reasoning relied upon the "best available"?* Specific results and comparisons for disinfection byproducts are not discussed adequately nor appropriate and available models used. For example, (Page 25-2, lines 18-21) "The disinfection process for drinking water includes adding chlorine to drinking water sources prior to release into public drinking water distribution systems. The chlorine reacts with organic carbon (total [TOC] and dissolved [DOC]) and bromides that are in water sources and form DBPs." Concentrations of disinfection byproducts precursors (bromides and DOC) have often been modeled for this system. As a result, there is considerable analysis capability available for some of these contaminants that have not been performed in the presentation and discussion of these potential impacts. This topic is very important and potential public health effects should be discussed more fully. *c) Are the inputs (or other basic facts) to the models/reasoning the best available?* Although a great deal of information on modeling of disinfection-by product issues has been conducted, they are generally not included. Therefore, *d* and *e* below do not apply *d) Where modeling judgments and interpretive reasoning are invoked, are they appropriate?* *e) Are the results and their uncertainties interpreted in a "balanced" way with*	and implementation of CM12 *Methylmercury Management* would help minimize potential adverse effects on public health related to methylmercury. Implementation of CM12 would provide for project-specific mercury management plans, including a QA/QC program, and specific tidal habitat restoration design elements to reduce the potential for methylation of mercury and its bioavailability in tidal habitats. ***Regarding EMF discussion:*** With the exception of Alternative 9, each action alternative would require construction of several miles of permanent 69 and 230 kV transmission lines. Because these lines would generate EMFs and because EMFs are an issue of public concern and public misunderstanding, regardless of the scientific uncertainty regarding EMF health effects, the potential for public exposure to EMFs related to project implementation was addressed in the impact analysis. ***Regarding Use of appropriate literature***: The citations in the EIR/EIS follow CEQA document convention and are considered adequate under CEQA. ***Regarding discussion of results and specific models used***: Throughout Chapter 25, the reader is referred to Chapter 8, *Water Quality*, for a more detailed discussion of results related to water constituents. The methodology developed for assessing water quality impacts employed both quantitative and qualitative analyses (as appropriate) to estimate the changes in water quality attributable to implementation of the action alternatives, as described in detail in Chapter 8, *Water Quality*. Bromide was modeled quantitatively for the Delta in two ways. First, a quantitative assessment utilizing a mass-balance

		respect to the strengths and weaknesses of the alternatives under consideration? *3. Overall Assessment of whether and how this chapter helps inform BDCP* There are some topics in Chapter 25 that are useful in evaluating the effects of the various alternative and conservation measures. However, we have concerns about several sections of Chapter 25 and these are presented below. **Vector Control** Several issues related to vector control need to be better addressed. For example, creation of potential mosquito habitats will not just have localized effects, as indicated in the EIR. For example, Chapter 25 states that "Potential public health impacts occurring as a result of the BDCP alternatives primarily would be localized. Given downstream flows, potential health effects from water quality-related impacts would not be transported upstream" (Page 25-2 lines 25-27; see also "Potential spread of disease through mosquitoes is expected to occur only within the study area because of the life cycle of mosquitoes and the distance they travel" (Page 25-2 lines 30-32). In the case of these water-borne vectors of disease, these statements are not correct as these newly created habitats could serve as "stepping stones" for upstream migration of adult mosquitoes and eventual lead to their colonization of new sources. The California state Mosquito Abatement Districts would be aware of this possibility and likely would disagree with the statements in the EIR as well. Objections to this statement in the EIR are also reinforced by the distances that are reported for mosquito migration in Table 25-5, where mosquito adults can travel up to 30 miles. There are no concrete plans presented for controlling mosquitoes when their populations increase. Clearly, this is being left to the future and the activities (which are already overstretched) of the local Mosquito Abatement Districts. As stated in the EIR, "Construction of the water conveyance facilities and water supply operations under all action alternatives would result in an increase in sedimentation basins and solids lagoons. These new features could result in an increase in standing water, thereby potentially increasing vector breeding locations and vector-borne diseases in the study area". (Page 25-34, lines 18-21). This statement is correct and implementing measures under most Alternatives would increase the amounts of restored and enhanced habitat in the study area but also would result in a significant increase in mosquitoes. The conclusion is that BDCP would consult and coordinate with the various mosquito abatement districts to implement Best Management Practices (as is also mentioned in section 31.5.1.3). Several of these BMPs are mentioned from various wetland-mosquito management documents. Is this sufficient coverage of control activities in the EIR in terms of what could be major public heath outbreaks (e.g. West Nile virus and encephalitis)?	approach (DSM2 fingerprinting data combined with historical source water quality data) was employed. Additionally, results of a second modeling approach utilizing DSM2-QUAL modeled EC, EC to chloride, and chloride to bromide relationships were used to supplement the results of the mass-balance approach. DOC was modeled quantitatively for the Delta using DSM2-QUAL model output. ***Regarding vector control:*** Comment noted. The development and implementation of Mosquito Management Plans, in coordination with the appropriate MCVDs, would reduce the likelihood that project operations (including sedimentation basins and solids lagoons) would require an increase in abatement activities by the local MVCDs. Further, the sedimentation basins and solids lagoons would not provide ideal mosquito breeding habitat--the flow rates of the solids lagoons would be high enough to prevent water stagnation, and the water depth of the lagoons and sedimentation basins would be considered too deep for suitable mosquito habitat. The impact analysis in this chapter is limited to potential effects on public health as a result of implementing the action alternatives. Therefore, potential economic and recreational impacts are not considered. The references related to vector control within the Delta are not meant to be exhaustive. The citations in the EIR/EIS follow CEQA document convention and are considered adequate under CEQA.

		The economic cost of nuisance mosquitoes is not discussed in this chapter of the EIR. Decreases in home values, loss of recreational areas and opportunities, and increased human discomfort from increases and expansion of mosquito populations should be included. Moreover, under section 25-4 Cumulative analysis problems of disease vectors are not mentioned in the analysis. References on vector control are representative of a few studies done within the Delta but far from complete. As with many of the other chapters, there is ambiguity in wording in many parts of Chapter 25. For example, "The availability of preferable mosquito breeding habitat varies by season, and is reduced during dry periods of the year. Available open water habitat can be expected to increase during wet season; however, changes in flow volume in the Delta would result in increased flow velocities, limiting preferable mosquito breeding habitat." (p. 25-16, lines 11-15). If the statement is meant that changes in flow volume during the wet season would not affect the mosquito populations, it would be correct because breeding is minimal at this time of the year. However, if it refers to changes in flow volume during the dry season when mosquito breeding does occur, the statement is incorrect and actually numbers would increase. **Disinfection by-products and Contaminants** Specific results and comparisons for disinfection byproducts are not discussed adequately (see comments above). Consequences of mercury accumulation, bioaccumulation of other toxic compounds, and fish contamination are not adequately presented in this chapter of the EIR. All of these topics are commonly discussed public health concerns for the Delta, and require more detailed coverage in the EIR. The literature is extensive in these areas and not adequately represented. **Pathogens** Please see comments above about potential toxicity of *Microcystis* algal blooms not being included in the EIR/EIS, and the apparent different coverage presented in the BDCP. **Conclusion** Public Health concerns are of great importance to people living in the Delta, those that use it for recreation and other purposes, and those occupying outlying areas that may be affected by the proposed activities in BDCP. Additional consideration of the issues mentioned in this review should be given in the preparation of the final EIR/EIS document.	
76	Appendix B	**Chapter 26, Mineral Resources** Chapter 26 concludes that the proposed BDCP actions would harm to natural-gas production while having less-than-significant effects on aggregate. Most of the expected impact to gas production is from conservation measures	

		that would inundate production areas (impacts MIN-5 and MIN-6). The chapter's assessment of the no-action alternative appears to exclude such gas-field losses to unintended flooding. The assessed impact on aggregate includes its consumption by BDCP construction as well as burial of potential aggregate sources. The chapter lays out its findings in muscular text that shows command of the subject, and in tabular summaries (Tables 26-4 through 26-7) that ease comparison among alternatives. The chapter lacks, however, an informative up-front summary, and neither the Highlights Document (p. 57) nor the Executive Summary (p. ES-130 and ES-131) make up for its absence. Chapter 26 does not examine how natural-gas impacts MIN-5 and MIN-6 may affect the feasibility of ecosystem restoration under proposed BDCP actions. Plan Appendix 8.A, "Implementation Costs Supporting Materials" lists mitigation measures: "Avoid displacement of active natural gas wells to the extent feasible through conservation component design" and "Maintain drilling access to natural wells to the extent feasible through design of conservation components" (p. 8.A-164). Plan Chapter 8, "Implementation Costs," gives a 50-year estimate of $32 million for "mineral rights and gas-well relocation" (p. 8-14). A search on "gas" in Appendix 8.A and Chapter 8 turned up no supporting evidence for the $32 million estimate.	Potential effects of unintended flooding are addressed under 'Catastrophic Seismic Risks' in the discussion of the No Action Alternative. Resource area summaries are currently being revised in order to provide a more explicit comparison of the effects that could result from various alternatives. Specific effects of seeking to avoid natural gas wells and their associated collection systems cannot be addressed because the ecosystem restoration programs are described and analyzed at a programmatic level. Evaluation of the ability or inability to avoid or minimize impacts to the natural gas systems requires not only specific areas of inundation but the details of recontouring the ground, construction sequencing, and similar details. However, ecosystem restoration feasibility is not anticipated to be compromised because the natural gas systems will be only one of innumerable considerations during site-specific design.
77	Appendix B	**Chapter 27, Paleontology** Chapter 27 provides reasonable responses to the CEQA requirement for assessment of potential harm to fossils. The chapter provides an overview of paleontological resources in the Sacramento - San Joaquin Delta, Suisun Marsh, and vicinity, and it systematically estimates potential effects of the BDCP alternatives on paleontological resources. Two DISB members evaluated the chapter with help from a vertebrate paleontologist. Together we found identified areas of concern listed here: Impacts considered 65 Concerns 66 How valuable are the fossils in Holocene mud and peat? ..... 66 Will sensitive geologic units serve as sources of borrow material?	

		..... 66 Will protections vary from one county to the next? ..... 66 What protections will areas of medium paleontological sensitivity receive?..... 66 As the chapter states, there will be significant and unavoidable effects..... 66 What is the primary source for a statement about levee failure?..... 67 The chapter lacks a meaty summary..... 67 References cited 67 **IMPACTS CONSIDERED** The chapter considers the potential impacts to fossils, especially of vertebrates, from disturbing the ground during construction for conservation measure CM1 (water conveyance; impact PALEO-1) and for other conservation measures (habitat; impact PALEO-2). The chapter also considers such impacts from other projects that are likely to cause ground disturbance (under the non-action alternative). The chapter finds "significant" impacts in all three cases. The findings are based on reasonable assumptions about what might turn up in excavations. In some areas the digging would reach sedimentary deposits old enough (Pleistocene and earlier) to be considered "paleontologically sensitive" (defined, p. 27-6). Macroscopic plant and animal fossils in these deposits are likely to be rare enough to be considered important (p. 27-18) as "records of ancient life" (p. 27-30). The sensitivity ratings are typically based on (1) the potential for a geological unit to yield abundant or significant vertebrate fossils or to yield a few significant fossils, large or small, vertebrate, invertebrate, or paleobotanical remains; and (2) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecological, or stratigraphic data (which are citeria of the Society of Vertebrate Paleontology). The ratings range from none to high. Chapter 27 states that this full range is present in the area covered by the BDCP conservation measures. Such paleontological assessments involve a professional paleontologist examining the paleontological potential of the stratigraphic units present, the local geology and geomorphology, and any other local factors that may be germane to fossil preservation and potential yield. The chapter shows greatest concern for the fossils of vertebrates. The chapter treats vertebrates as the main fossils to be expected in the Pleistocene alluvial deposits that border much of the Delta, and which extend at shallow depths beneath it. The mitigation measures specify procedures of the Society of	Most vertebrate fossils are rare and therefore considered sensitive paleontological resources, unlike invertebrate or plant fossils, which may or may not be rare or significant. Therefore vertebrate fossils are used to determine

		Vertebrate Paleontology. The chapter proposes paleontological mitigation of the BDCP conservation measures. The mitigation efforts involve planning and training meant to encourage identification, collection, and preservation of important fossils unearthed (first spelled out, p. 27-27 to 27-32). The tabular summary pages ES-131 and ES-132 state that these efforts would reduce, to "less than significant," the effects of conveyance construction for action alternative 9 (which restricts conveyance to existing channels) and the effects of all habitat construction under all the action alternatives. **CONCERNS** **How valuable are the fossils in Holocene mud and peat?** The chapter could give deposits from recent millenniums more attention as paleontological resources. "Muds and peats [less than 10,000 years old] provide a rich source of microfossils for paleoenvironmental studies, but microfossils exist in the uncounted trillions throughout deposits of estuarine mud and peat. Therefore, because they are recent in age and because they seldom yield scientifically significant megafossils, estuarine sediments, including peat, are assigned low paleontological sensitivity" (p. 27-7 to 27-8). Viewed more broadly, paleoecology inferred from Holocene fossils offers guides to climatic change and to bygone ecosystems like those slated for restoration under the BDCP (Malamud-Roam et al., 2006; Canuel et al., 2009). **Will sensitive geologic units serve as sources of borrow material?** Stratigraphic units having undetermined to high paleontological sensitivity are present in some of the areas considered as potential sources for borrow material for construction activity. The vertebrate paleontologist stresses that these units, which include the Modesto Formation, Montezuma Formation, and Turlock Lake Alluvium, should not be used as a source for borrow material (Table 27-7). **Will protections vary from one county to the next?** Unlike counties that have specific requirements for paleontological resources, Sacramento, Yolo, and San Joaquin Counties place emphasis on the preservation of historic and cultural values and on compliance with CEQA without specifically considering paleontological resources. During implementation of the BDCP it would be important to apply, to all areas of BDCP conservation measures regardless of county, paleontological provisions of state and federal laws and the mitigation measures promised in Chapter 27. **What protections will areas of medium paleontological sensitivity receive?** Table 27-8 describes the Society of Vertebrate Paleontology's Recommended Treatment for Paleontological Resources for areas of high or underdetermined sensitivity. The vertebrate paleontologist recommends that these procedures should be applied to areas of medium sensitivity as well.	sensitivity. The mud and peat deposits are not considered sensitive for paleontological resources for two reasons: 1. they are relatively young (i.e., Holocene) and therefore not considered old enough to contain fossils. 2. the microfossils/microorganisms contained in the deposit are likely widespread in the deposit and therefore the project would not be destroying a unique resource. As described in the impact analysis Paleo-1, excavation for borrow material in units sensitive for paleontological resources could cause damage to fossils. However application of Mitigation Measures PALEO-1a through PALEO-1d would reduce this impact to a less-than-significant level. In addition, while the comment suggests that these units should not be used as a source for borrow material, it should be noted that excavation in these units is common. For instance, the Fairmead Landfill, which is underlain by the Turlock Lake, Riverbank, and Modesto Formations, is an example of how preservation of paleontological resources can occur during excavation. The website of Dundas Laboratories, headed by Robert Dundas, a Research Fellow at the University of California Museum of Paleontology at Berkeley (UCMP), many valuable fossils have been recovered during excavation at the landfill

		As the chapter states, there will be significant and unavoidable effects Chapter 27 anticipates significant and unavoidable effects from construction of conveyance facilities (PALEO-1) and significant effects from construction for habitat conservation (PALEO-2) (summary, p. ES-130 and ES-131). The text on page 27-18, lines 25- 26, makes clear that construction of the proposed water conveyance facility (CM1) and implementing CM2–CM22 could potentially result in incompatibilities with plans and policies related to paleontological resources. Ground-disturbing activities associated with construction of the intake and pipeline could disturb units sensitive for paleontological resources. Excavation for the tunnels (necessary for Alternative 4 and more damaging under some other alternatives) would most likely destroy unique or significant paleontological resources in the Plan Area and would potentially cause significant and unavoidable paleontological impacts. The vertebrate paleontologist, while finding the Mitigation Measures proposed under "Impact PALEO" consistent with the best available practices, concluded that even with this mitigation, damage to paleontological resources will occur. **What is the primary source for a statement about levee failure?** Chapter 27 reasonably identifies levee failure as a threat to paleontological resources. The evidence cited includes an unreferenced statement that "levees constructed on liquefiable foundations are expected to experience large deformations (in excess of 10 feet) under a moderate to large earthquake in the region" (p. 27-22; reiterated from p. 9-50). This statement could be credited to page 6-37 of a seismic-hazard assessment (URS Corporation and Jack R. Benjamin & Associates Inc., 2008). The citation could also mention that this assessment, on its page 6-36, includes calibration in which Delta levee damage from the 1906 San Francisco earthquake is "small to moderate" for levees having "today's configuration." . **The chapter lacks a meaty summary** Like most of the rest of the draft EIR/EIS, Chapter 27 needs an informative summary of expected impacts. The existing summaries are limited to tabular entries in the Executive Summary and text in the Highlights Brochure. A useful summary, placed up front, would build on the "overview" on page 58 of the Highlights Brochure. The summary would make clearer how the various alternatives, including the no-action alternative, compare with one another in terms of effects on paleontological resources. The key comparisons include no-action vs alternative 4. The Executive Summary of the draft EIR/EIS could summarize the "significant" non-action impact more accurately. Table ES-9 lists this impact in rows for PALEO-1 and PALEO-2, where it can be misread as a puzzling effect of BDCP actions. The Table also can be misread as implying that the significant non-action impacts would somehow be made less than significant through	(http://www.dundaspaleolab.com/index-4.html): "In May 1993, while excavating for a new five acre expansion cell at the Madera County Fairmead Landfill, north of Madera, California and just southwest of the junction of state highways 99 and 152, a Madera Disposal Systems crew encountered vertebrate fossils. Because the land is public property owned by Madera County, the California Environmental Quality Act (CEQA) requires that scientifically significant fossils be protected. Shortly after the initial discovery and at the invitation of the Madera County engineering department, J. Howard Hutchison and Robert Dundas of the University of California Museum of Paleontology (UCMP) at Berkeley travelled to Fairmead Landfill to assess the find and recommend an appropriate course of action in order that Madera County adhere to state regulations. The UCMP recommended that fossils be salvagaed and preserved as they are uncovered by landfill excavation activities. Paleontological monitoring has been ongoing ever since." Regarding county-specific protections, BDCP mitigation measures would be applied in the same way in all counties. Regarding medium sensitivity, we have taken a conservative approach by using the SVP guidelines and only assigning geologic units with potential to contain paleontological resources to a high or low category. In this way, units that might otherwise be accorded a medium sensitivity are placed in the high category and given the benefit of mitigation for units with high sensitivity for paleontological resources. In addition, I am unaware of a standard for medium sensitivity. Regarding significant and unavoidable effects, this comment is unclear. The impact analysis states

		implementation of alternative 9 (for impact PALEO-1) and of all action alternatives (for impact PALEO-2). [See Appendix B for references]	there is a difference in the findings for surface ground disturbance and tunneling ground disturbance: • Surface ground disturbance (shafts, trenches, grading, etc) can be mitigated to a less-than-significant level through application of Mitigation Measures PALEO-1a through PALEO-1d (e.g., pages 27-26 and 27) • Tunnel disturbance cannot be mitigated and would be significant and unavoidable (e.g., page 27-27). Regarding levee failure, the information on levee failure is drawn from Appendix 3E, as noted in the text. A reference will be added in the Final EIR/EIS. Regarding the chapter summary, resource area summaries are currently being revised in order to provide a more explicit comparison of the effects that could result from various alternatives. Regarding effects of the No Action alternative in the Executive Summary, we will consider ways to clarify this issue prior to the Final EIR/EIS.
78	Appendix B	**Chapter 29, Climate Change** ***Conclusions*** The BDCP Plan (and, in a less informative fashion, the EIR/EIS) does a good job of describing how climate change and sea-level rise might influence communities and species. The emphasis in Chapter 29 is on how the conservation measures of BDCP may enhance adaptation and resiliency to climate change and, especially, sea-level rise by providing flexibility in water-flow operations and additional conservation areas and habitat. Although any attempt to predict future climate at a relatively small regional scale is difficult at best, state-of-the-science modeling tools have been employed to project possible future conditions. Despite these efforts, climate change and sea-level rise, and their associated uncertainties, will remain. The likelihood and magnitude of these effects and uncertainties are not clearly stated or addressed. Both the Plan and the EIR/EIS recognize the importance of the linkages that are	Please see the response to line 5. It is true that there is uncertainty regarding the pace and magnitude of climate change. There is additionally considerable, perhaps greater uncertainty regarding the manifestations of climate change. However, the effects of climate change on the conservation measures have been considered to the best of our abilities, and have been incorporated in the effects analysis. Regarding the EIR/EIS, the authors concede that uncertainty is perhaps not discussed in great enough detail. However, the purpose of an EIR/EIS is not to explore all possibilities of extreme outcomes of climate change, and there is

		created by water flows and hydrology. Synergies that result from linkages among the actions or components of BDCP, species of concern, or species not even considered may affect the potential benefits derived from BDCP actions in enhancing adaptation and resiliency to the effects of climate change or sea-level rise, yet such synergistic effects (which may be either positive or negative) receive little attention. From a biological viewpoint, mean climate conditions are not as important as high or low extremes and their timing. Modeling and analysis of extreme events is difficult because such occurrences are unpredictable and uncertain, yet their importance merits more attention. Moreover, the potential effects of climate change and sea-level rise on water temperatures seem not to have been considered at the same level of resolution as changes in salinities. Temperature, however, is a key to most fish growth and reproductive success. Perhaps most importantly, the potential effects of climate change and sea-level rise *on* the effectiveness of the conservation measures are not adequately considered. There is an underlying assumption that the conservation measures, if implemented, will have the desired or stated benefits or mitigation effectiveness. Because of the changing conditions, the BDCP actions may not develop as anticipated. Uncertainties in the effectiveness of conservation measures due to the effects of climate change and sea-level rise should be given greater consideration. ***Chapter aims and scope*** Section 85320(b)(2)(C) of the California Water Code directs that the BDCP EIR/EIS address "[t]he potential effects of climate change, possible sea level rise up to 55 inches [140 centimeters], and possible changes in total precipitation and runoff patterns on the conveyance alternatives and habitat restoration activities considered in the [EIR]." This is the context for the treatment of climate change and sea-level rise in the EIR/EIS. The EIR/EIS addresses three questions about climate change and sea-level rise: (1) How will the BDCP activities affect climate change, via greenhouse gas emissions?; (2) How will BDCP impacts on resources be affected by climate change and will the effects increase in the future— i.e., are future changes in climate likely to exacerbate project impacts?; and (3) How will the BDCP activities affect the adaptability and resiliency of the Delta and its components to climate change? Question 1 is addressed in Chapter 22 on air quality and greenhouse gases. Question 2 is considered in most of the resource-focused chapters as summarized in Table 29-1 as well as in the BDCP Plan. Chapter 29 addresses only the third question. In particular, this chapter concerns how the project alternatives and conservation plans may enhance adaptation and resilience of the Delta system to changing rainfall, snowpack, water and air temperature, sea-level rise and intrusion, and evapotranspiration. In the	extremely high uncertainty about those extremes. Instead, we necessarily focused on changes in average conditions which we have more confidence in. Chapter 29 focuses on the project's ability to make the Delta more resilient and adaptable to the expected effects of climate change; we didn't explore all potential outcomes of climate change or the potential synergies and feedback loops that might play out between conservation measures and species in the Delta. It isn't an unreasonable assumption to conclude that based on the analysis that we did do, when one compares a given future (any degree of climate change), the "with project" condition is likely to be better than that same future with no restoration effort. Please see the response to line 1 regarding assumptions of conservation measure success.

		context of BDCP, resiliency and adaptability mean "the ability of the Plan Area to remain stable or flexibly change, as the effects of climate change increase, in order to continue providing water supply benefits with sufficient water quality and supporting ecosystem conditions that maintain or enhance aquatic and terrestrial plant and animal species" (EIR/EIS p. 29-3). The current unprecedented drought in California adds weight to any measures that will enhance adaptability and resilience of water use and management, so the focus of this chapter is especially timely. Although Chapter 29 is relatively short, the overall consideration of climate change in the EIR/EIS and the BDCP Plan is comprehensive and voluminous, but also fragmented. Thus, to evaluate how well the EIR/EIS considers the broader issues of climate change and sea-level rise and their effects, we have referred to multiple sections of the draft EIR/EIS, and to understand the foundation for the statements and conclusions we have examined parts of the Plan where the details of modeling and analysis of climate change and sea-level rise and their consequences are presented. ***Assessment of climate change impacts*** To evaluate how climate change relates to the actions envisioned in BDCP, it is first necessary to consider how it is projected to affect the Delta and its resources, independently of any of the conservation measures undertaken in BDCP (i.e., the No Action alternative). Various sections of the Plan and the EIR/EIS (particularly BDCP Appendix 2C and EIR/ERIS sections 29-4 and 29-5) describe the changes expected in California and in the Delta over the coming decades. These effects will be large and pervasive, creating a dynamically changing backdrop against which any environmental effects of BDCP will be superimposed. Overall, the effects of the climate changes expected for the Delta include, inter alia, (1) increased incidences of extreme hydrologic events such as atmospheric rivers (which provide significant precipitation to the Delta); (2) changing the mix and timing of rain and snow and their locations; (3) increased extinction risk of covered fish species, especially those whose ranges are located primarily in the Plan Area, due to changes in critical temperatures, salinities, and flow regimes; (4) continuing emergence of nonnative species (e.g., warm-water species) as dominant components of biological communities; (5) increased risk of species invasions due to range expansions into the region; (6) changes in sea level and salinity, which may cause increased duration and frequency of inundation of the existing wetlands; and (7) somewhat higher salinities in Suisun Bay, requiring increased Delta outflows to maintain X2 at the existing standard (BDCP p. 5.A.2-106-107). Although all of the natural communities and covered species will be affected in some way, the focus in the EIR/EIS is on long-term changes in sea level and Delta inflows that "will put increasing stresses on existing levees and make	

		management of Delta salinity increasingly difficult" (EIS/EIR p. 3E-3) and the increased flexibility the Plan offers to control flow rates. The potential impacts of climate change on natural communities and covered species are discussed in detail in the BDCP Plan (especially in Chapter 2, Appendix 2A, Chapter 5, and Appendix 5A). For example, the account for Delta smelt states that "modeling results projected increases in the number of days with lethal and stressful water temperatures (especially along the Sacramento River) and a shift in thermal conditions for spawning to earlier in the year, upstream movement of the LSZ, and decreasing habitat suitability" (BDCP p. 2A.1-12). These accounts, while necessarily qualitative rather than quantitative, are generally comprehensive and well-referenced. ***BDCP contributions to resilience and adaptability*** Chapter 29 focuses on how the actions undertaken as part of the conservation measures or mitigation for BDCP might help counter some of the effects of climate change on natural communities and covered species. In essence, the EIR/EIS proposes that the BDCP will enhance the adaptation and resilience of the Plan Area by (1) providing the flexibility in operating water flows to ameliorate conditions caused by climate change, and (2) enabling conservation efforts (CM2 – CM22) that will provide additional habitats or protection of key species that will help to offset any negative climate impacts. The benefits derive largely from the enhanced control and flexibility in managing hydrological flows into and through the Delta provided by the conveyance alternatives and, to a lesser extent, from the increase in quantity and/or quality of habitat created by the restoration or protection measures. For example, for tricolored blackbirds "protection, restoration, and enhancement of nesting and foraging habitat will help stabilize and increase depleted populations, helping to promote resilience to adverse effects of climate change" (BDCP p.5.A.1-28). Appendix 5.A.1 and Table 5.A.2.0-1 of the Plan provide substantial details describing which actions can enhance resilience or adaptability to climate change and sea-level rise. The benefits, while generally based on relevant literature and logical arguments, are *presumed* (or, perhaps more accurately, hoped-for) benefits; there is no assurance that they will develop as expected, and there is no discussion of what, if anything, will or can be done if they do not develop. That is, what adaptive management measures will be taken? The conclusion is that BDCP Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, and 5 would provide substantial resiliency and adaptation benefits over the No Action/No Project alternative for dealing with the combined effect of increases in sea-level rise and changes in upstream hydrology. The other alternatives would reduce resilience. Appendices 29A – 29C describe the approach to modeling and analyzing salinity effects, effects on reservoirs and inflows to the Delta, and effects on water and air temperatures.	Please see earlier responses regarding the BDCP's proposed approach to adaptive management, including those provided for line 6.

		The chapter explicitly does not include any discussion of impacts (although recognized and listed on pages 29-10 and 29-11) for which the BDCP alternatives produce no added resiliency or adaptation benefit or for which the benefits are minimal or cannot be documented; the emphasis is on potential benefits of BDCP. ***Quality of analysis*** The potential effects of climate change and, particularly, sea-level rise receive a comprehensive, detailed, and scientifically sound treatment when considered over the entirety of the EIR/EIS and the BDCP Plan. The effects on the key physical and biological components of the Plan Area and somewhat on the broader Delta ecosystem are thoroughly discussed. Most of the relevant information is contained in the Plan. The EIR/EIS is inconsistent in the level of detail used to assess impacts of climate change and sea-level rise on these components and the information is scattered over thousands of pages, making it difficult to evaluate how they have been treated. Any science-based assessment of climate change and its effects necessarily begins with historical data and predictive models. Modeling climate change at the regional scale is becoming more robust, particularly when dealing with mean conditions or frequencies of extremes, The modeling approach used to assess climate change and sea-level rise in BDCP is complex, necessarily involving many assumptions and a nesting of models used in sequence to inform one another. The climate modeling is based on a modified ensemble approach, employing a quantile analysis to condense the results of the 112 downscaled model sets into a smaller set of scenarios that emphasizes mean climate conditions while preserving some of the variability among model runs (described in the EIS/EIR on pages 5A-D37-38). The approach intentionally uses a subset of scenarios to allow development of projections in greater detail, while sacrificing a more comprehensive assessment of uncertainties that would come from considering the full range of projection scenarios. This is a robust and appropriate approach. The criteria used to select the set of climate change scenarios for the analyses (EIR/EIS p. 5A-A62; 5A-D33) seem sensible, and the sensitivity analysis approach used to define the boundaries for ensemble predictions (EIR/EIS p. 5A-A64) is canonical, especially in incorporating the effects of different starting points for the simulations. The potential importance of extreme events is acknowledged but, in view of their unpredictability, they are not included in the modeling (although they could be incorporated into probabilistic modeling). Instead, any unforeseen effects of extreme events will presumably be assessed through monitoring and adaptive management. The application of results to the biological communities requires additional assumptions. Also, use of mean conditions or forecasts is far less insightful than looking at critical biological factors such as summer high	Regarding the separation of information on climate change effects, this is largely a product of the standard CEQA and NEPA approach to discussing effects of agency actions on a resource-by-resource basis. Because a primary focus of such environmental documents is to disclose the effects of implementing various alternatives, consideration of each resource is given greater organizational focus than the effects of outside mechanisms such as those associated with climate change, even though their influence is anticipated to be substantial.

		temperatures, rate and timing of spring warming and fall cooling, and flow rates during critical times of the years. One extreme year can do a lot of biological damage. The RMA Bay-Delta (2D) and the UnTRIM Bay-Delta (3D) hydrodynamic models were used to simulate climate change effects of sea-level rise on Bay-Delta tidal flows, which were combined with DSM-2 for salinity modeling. These were then combined with BDCP effects to simulate future Delta hydrodynamic and salinity conditions. To bracket the range of potential changes in hydrodynamics and salinities associated with wetland restoration, model simulations were conducted for several alternative restoration footprints. Changing the location of restoration affected the details of flows and salinities, but all of the scenarios reduced tidal amplitude and affected salinity (X2). Overall, the hydrological modeling shows that effects of BDCP operations and proposed restorations are limited in comparison to the impacts of climate change and sea-level rise on upstream reservoir conditions, hydrologic flows, and salinities. Several of the outstanding areas of uncertainty are (quite appropriately) explored through scenario analysis. Recognizing that species differ in their responses to potential climate change, the Plan develops a vulnerability score based on sensitivity (including several contributing factors) and exposure (defined by natural community types). The vulnerability analysis would allow planners and managers to design conservation actions and monitoring programs to allow them to focus on the covered species most vulnerable to the effects of climate change and the habitats that support a large number of vulnerable species (see BDCP page 5.A.1-35). However, because different species respond differently to climate changes, some will be affected by things that can be moderated and some will be affected by things that cannot be modified. For those in the first category, each operation might benefit each species a little differently; how will choices be made? Moreover, while listing the species most vulnerable to changes in climate is an important step toward prioritizing conservation actions, we should not forget that we are dealing with an ecosystem and indirect effects of climate change (changes in rates, distributions, species interactions, food webs, etc.) are also important. Despite the attention given to developing species' vulnerability scores in the BDCP Plan, it does not figure into any of the analyses or documentations in the Plan and is not mentioned in the EIR/EIS. Overall, considering the material in both the BDCP Plan and the EIR/EIS, the potential effects of climate change and sea-level rise on components of the Delta ecosystem and the current and proposed water operations are treated comprehensively and in considerable detail. Points are supported by relevant literature (at least in the Plan), some of it quite recent. The models are carefully reasoned and are used effectively to	It is expected that such decisions would be made through the adaptive management framework.

		explore both consequences of climate change and sea-level rise and important areas of uncertainty. That said, however, there are several areas in which the presentation and analyses could be improved. ***Areas of concern*** There are several areas of concern with the treatment of climate change in the EIS/EIR that are not resolved in the coverage in the BDCP Plan itself. Most importantly, although the potential effects of climate change and sea-level rise on natural communities and covered species are discussed in detail (in the Plan) and are included in the modeling of hydrodynamics and the associated tidal wetland restoration and in the discussion of reservoir operations, the possible impacts *on* the conservation measures are apparently not considered. The EIR/EIS includes detailed calculations of the anticipated losses of habitat (acreages) due to various BDCP actions and how these losses will be balanced (in most cases exceeded) by acres of habitat (often of greater value) protected or restored. In some instances, additional measures (Avoidance or Minimization Measures or Mitigation Measures) will be required to achieve the necessary balance and avoid detrimental effects on a community or species. There is an unstated assumption that the anticipated habitat protection, restoration, and mitigation will in fact materialize. But climate change is projected to have significant effects on the amount, quality, and locations of habitat, potentially adding to the losses. The effectiveness of habitat protection and restoration may be compromised by climate change or sea-level rise, eroding (figuratively and literally) the conservation gains or benefitting less desirable species such as warm-water predators or invasives. As a result, the anticipated balancing of new conservation areas to offset climate impacts and the BDCP may not develop as planned. It is possible that these effects are included in the calculations of the EIR/EIS (e.g., in Chapter 12), but we found no indications of such adjustments. Rather, it seems apparent that the potential effects of climate change and sea-level rise on the effectiveness of habitat protection, restoration, or other conservation measures are not specifically addressed in the EIR/EIS because the intent of this document is to evaluate whether BDCP will lead to consequences that would not otherwise have occurred (this is why the effects of climate change and sea-level rise are included in the no-action alternative). BDCP actions will not alter climate change or sea-level rise (Chapter 23); rather, the effects of climate change and sea-level rise are projected to trump any effects of BDCP actions. For example, “The results [of hydrological modeling] show that the effects on the upstream operations are primarily due to the climate change effect on the reservoir inflows, river temperatures, and the increased salinity intrusion in the Delta due to the projected sea level rise. The proposed BDCP operations did not impact the upstream reservoir	Please see the response to line 1 regarding assumptions of conservation measure success.

		conditions, both at end-of-May and end-of-September, because of the increased flexibility in the system [i.e., resilience]. The proposed restoration under BDCP has limited effect on the overall system operations" (BDCP p. 5A-D157). Considering that the overall rainfall levels at reservoirs are projected to be essentially unchanged but the timing of snow and precipitation will change, there is little doubt that additional BDCP conveyance and storage capacity would be useful in managing water in the Delta, but without including such adaptive management measures in modeling it will be difficult to predict the salinity and temperature levels as well as impacts on habitats downstream. There are also considerable uncertainties associated with any potential effects of climate change and sea-level rise on BDCP actions,. This could be interpreted as providing further justification for not considering these effects in the EIR/EIS. To ignore these potential effects on the conservation measures (primarily habitat protection and restoration) that are intended to be part of achieving net benefits from BDCP, however, may be short-sighted. It is anticipated that any failures of protection and restoration (or other actions) to realize the desired outcomes will be detected by monitoring and adjusted through adaptive management. However, this relies on how well and how quickly monitoring and adaptive management can or will be implemented. We consider this issue, and the wisdom of planning for contingencies in case things don't work out as planned, elsewhere in our report. A second concern has to do with linkages. What happens or is done at one place and time for one species, for example, may have ripple effects that extend to other places at other times and affect other species. Climate change and sea-level rise will likely affect everything in and surrounding the Delta, everywhere, in one way or another. The scope of climate change as a driving force is broad in both space and time, although the consequences may be more localized and short-term or episodic. Consequently, considering the effects of climate change or calculating the potential benefits derived from separate BDCP actions in enhancing the resiliency of each ecosystem component separately may fail to recognize the synergies that result from the linkages among the actions or components, species of concern, or species not even considered. Although the web of direct and indirect linkages among components of the Delta ecosystem are tremendously complex (and therefore plagued by uncertainties), it would be worthwhile to give them more thought, particularly because recognizing linkages and feedbacks may make management actions more effective or avoid unintended consequences. Both the Plan and the EIR/EIS recognize the importance of the linkages that are created by water flows and hydrology; similar attention should be given to biological, physical, and chemical linkages between aquatic and terrestrial elements or among elements of terrestrial landscapes.	This is a fair point; however, it is similarly difficult to predict what adaptive management measures will be pursued through real-time operations and by the actions of the adaptive management team. Regarding linkages, see response to line 3 above, which describes such relationships as fundamental to the design of the conservation strategy and acknowledges that the analysis of effects treats species in a discrete manner as a consequence of law and regulation. The same can be said of the organization of analysis in the EIR/EIS.

		A third concern is about modeling. A chain of models has been used to predict the 2025/2060 hydrology, salinity, and water temperature. As pointed out above, however, the influence of local adaptive management measures can have an up-scaling effect system-wide. The models used are well studied and evaluated, but sometimes they lack critical components. For example, the CALSIM-2 runoff model does not have a good linkage to ground water, the mixing parameterizations used are not valid for very high flow rates (model calibrations may not be applied for extreme precipitations of future climate), and the DSM2 flow-salinity relations may not be valid for extreme future climate scenarios. Thus, uncertainties abound. Finally, two additional points. First, there is some discussion in both the Plan and the EIR/EIS about the changes in mean conditions, particularly changes in mean temperature. However, what may be most important to fish (and other aquatic organisms), particularly for those species living on the edge of their thermal tolerance, are increases in the highest temperatures. The timings of the increased temperatures and of the fall cooling are also important to aquatic organisms. Some species may benefit from the longer, warmer growing season while others will be stressed by a longer period of warmer temperatures. Second, although Chapter 29 deals mainly with flexibility of water-flow operations and does include climate impacts on physical conditions (e.g. precipitation and sea-level rise) outside of the Plan Area, it ignores potential regional influences of climate change on biological components elsewhere. For example, the survival of anadromous fishes in the ocean or during their migrations to and from the Delta will be affected by climate changes, and range expansions or distributional shifts of species in response to climate-driven habitat changes elsewhere may have impacts on species and communities within the Plan Area, and on the effectiveness of conservation measures undertaken to enhance their populations or mitigate the effects of BDCP actions. While such effects are couched in uncertainty, they should not be ignored.	As discussed in prior responses, there is agreement that the modeling tools are imperfect (see responses in lines 3 and 56). However, the models used are considered the best available tools for assessing the potential effects of BDCP.