980 NINTH STREET, SUITE 1500
SACRAMENTO, CALIFORNIA 95814
WWW.DELTACOUNCIL.CA.GOV
(916) 445-5511

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September 14, 2015

To: Randy Fiorini, Chair, Delta Stewardship Council

Charlton Bonham, Director, California Department of Fish and Wildlife

From: Delta Independent Science Board

Subject: Environmental Documents for California WaterFix

The comments on this page summarize our review (attached) of the Bay Delta Conservation Plan/California WaterFix Partially Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (herein, "the Current Draft").

The Current Draft provides regulatory context, explains differences from the BDCP Draft EIR/EIS ("the Previous Draft"), and fixes some of the problems with the Previous Draft. We applaud this continuation of a mammoth effort in scientific synthesis and impact assessment.

The Current Draft falls short, however, as a basis for weighty decisions about natural resources. It leaves environmental impacts and underlying science unclear by deferring content to the Final EIR/EIS ("the Final Report") and by neglecting a number of problems inherited from the Previous Draft. The gaps include:

1. Details on the adaptive management process, collaborative science, monitoring, and the resources that these efforts will require;
2. Due regard for landscape-scale restoration, restoration timing and funding, and the strategy of avoiding damage to existing wetlands;
3. Analysis of how levee failures would affect water operations, and how the implemented project would affect the economics of levee maintenance;
4. Deficiencies concerning: uncertainties and their consequences; linkages among species, landscapes, and management actions; effects of climate change on the proposed project; and effects of changed water availability on agricultural practices in the San Joaquin Valley.
5. Concise and clear summaries—crisp yet analytical, and integrated with graphics—particularly comparing the alternatives in their expected major impacts.

Environmental impacts of California WaterFix need to be assessed more completely and clearly.

Review of the Partially Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (California WaterFix)

Conducted by the

Delta Independent Science Board

September 14, 2015

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INTRODUCTION

The Delta Reform Act of 2009, in §85320(c), directs the Delta Independent Science Board (Delta ISB) to review the environmental impact report of the Bay Delta Conservation Plan (BDCP). The BDCP's Draft Environmental Impact Report/Draft Environmental Impact Statement (herein, "the Previous Draft") was posted for review on December 9, 2013. We provided 133 pages of comments[1] on May 14, 2014.

Our 2014 review had three main parts: a summary, detailed responses to charge questions from the Delta Stewardship Council, and reviews of individual chapters. We commended the preparers for considering vast amounts of scientific information and for bringing this information to bear on the myriad potential environmental impacts of the many proposed BDCP actions. We concluded, however, that the science in the Previous Draft fell short, given the scope and importance of the BDCP.

The proposed BDCP actions have now been recast as two separate efforts: water conveyance under California WaterFix[2] and habitat restoration under California EcoRestore[3]. Environmental documents in support of California WaterFix were made available for a 120-day comment period that began July 10, 2015. These documents, termed a Partially Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement, are herein called "the Current Draft."

The Current Draft focuses on three revised alternatives for conveying Sacramento River water through the Sacramento – San Joaquin Delta. One of them, Alternative 4A, is the preferred alternative identified as California WaterFix.

Although derived from and dependent on the Previous Draft, the Current Draft differs enough to warrant additional review by the Delta ISB in the spirit of §85320(c). Accordingly, we provide this report and cover letter as the Delta ISB review of the Bay Delta Conservation Plan/California WaterFix Partially Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement.

Differences between the BDCP and California WaterFix

The proposed project differs in well-known respects from what was proposed as the BDCP. Here we briefly state our understanding of some main differences and comment on their roles on this review:

- The time period considered (15 years) is shorter than that in BDCP as a habitat conservation plan (50 years). As a result, many impacts of climate change and sea-level rise seem less important. However, long-term effects of the proposed project remain important in terms of operations and expected benefits (p. 7).
- In this shortened time frame, WaterFix's effects on fish and wildlife would be overseen by resource agencies (National Marine Fisheries Service, U.S. Fish and Wildlife Service, California Department of Fish and Wildlife). Presumably other impacts, especially to water quality and human health and well-being, would be regulated by the State Water Resources Control Board (SWRCB) and U.S. Environmental Protection Agency (USEPA), although this is not clear.

[1] http://deltacouncil.ca.gov/sites/default/files/documents/files/Attachment-1-Final-BDCP-comments.pdf
[2] http://www.californiawaterfix.com/
[3] http://resources.ca.gov/ecorestore/

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- Most actions that address ecological conditions of the Delta have been shifted to EcoRestore. That is, the construction and operation of an isolated conveyance (the tunnels in alternative 4A) have been separated from the 21 other BDCP measures that were designed to compensate or mitigate for the construction and operation impacts or implement ecological restoration. Science validating the level of this restoration seems no longer required. Our review of the Previous Draft contained many comments on the timing of restoration, species interactions, ecological linkages of conservation areas, locations of restoration areas and the science supporting the efficiency and uncertainty of effective restoration. Some of these comments apply less to the Current Draft because of its narrower focus on water conveyance.
- The greater focus on construction and operation of a water conveyance leads to an emphasis on mitigating effects of construction, especially noise and sediment loading. There is also, however, an expected reliance on cooperative science and adaptive management during operations.
- No new scientific methods could be introduced in the Current Draft, compared with what was in the Previous Draft. New analyses were permitted, however. We noticed evidence of further analyses of contaminants, application of existing methods (e.g. particle tracking) to additional species (e.g., some of the non-covered species), and occasional selection of one model in place of the combined results of two models (e.g., fish life cycle models SALMOD and SacEFT).

Methods and scope

After a preliminary briefing from Laura King-Moon of California Department of Water Resources (three Delta ISB members present), the Delta ISB considered the Current Draft in a public meeting on August 13–14, 2015 (nine of the ten members present)[4]. The meeting included a briefing on California EcoRestore by David Okita of California Natural Resources Agency and a discussion of the Current Draft and California WaterFix with Cassandra Enos of California Department of Water Resources and Steve Centerwall of ICF International.

Our review efforts included study of Sections 1, 2, and 3, and the first part of Section 4 and checks of most resource chapters in Appendix A. We doubtless overlooked information that bears on points we make, given the quantity of material under review, its complicated structure, and its minimal navigational aids and synthesis.

We drafted and edited review comments in time for the public to comment on them during a teleconference on September 16, 2015. We are submitting the review to the Delta Stewardship Council and the California Department of Fish and Wildlife before the end of September to leave those agencies time to consider our comments before the public-comment period on the Current Draft closes on October 30, 2015.

We begin by applauding examples of excellence and improvement in the Current Draft. Next we describe our main concerns about the current impact assessments. These overlap with main concerns about the Previous Draft, which we revisit in reporting how the Current Draft addresses them. Finally, without attempting to comment in detail on the Current Draft in its entirety, we offer some specific comments by section and chapter.

[4] http://deltacouncil.ca.gov/docs/delta-isb-meeting-notice-meeting-notice-delta-isb/delta-independent-science-board-isb-august-13

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PRAISE

We applaud the Current Draft as a continuation of a prodigious effort in scientific synthesis and impact assessment. A proposed revamping of water conveyance through the Sacramento-San Joaquin Delta involves a multitude of diverse impacts within and outside of the Delta. Unavoidably, the EIR/EIS for such a project will be correspondingly complex and voluminous, and preparing it becomes a difficult and complex project in its own right. A revised EIR/EIS, moreover, must highlight the most important changes to keep decision-makers from drowning in details.

The new Sections 1 through 4 are well written. Section 1 spells out the regulatory context by discussing laws and agencies that establish the context for the Current Draft. Section 2 provides the great service of summarizing how the Previous Draft was revised in response to project changes and public input. Section 4 presents an impressive amount of detailed information in assessing the sources of habitat loss for various species and discussing how restoration and protection will mitigate those losses. Page 4.3.8-140, for example, clearly and thoughtfully describes a series of measures to be undertaken to minimize the take of sandhill cranes by transmission lines. Lists of "Resource Restoration and Performance Principles" are given for the biological resources that might be affected by construction or operations. These are generally comprehensive and supported by current science. If they are adhered to, the project should have minimal impacts on these resources, as claimed.

Appendix A describes revisions to the resource chapters of the Previous Draft. We noticed enhanced analyses of contaminants and application of methods such as particle tracking to additional species, including some of the non-covered taxa; a detailed treatment of *Microcyctis* toxicity; more information about disinfection byproducts; improved discussion of vector control arising from construction and operational activities; and revised depiction of surficial geology. Potential exposure of biota to selenium and methylmercury is now considered in greater detail. Evaluations will be conducted for restoration sites on a site-specific basis; if there are high levels of contaminants that cannot otherwise be addressed, alternative restoration sites will be considered (page 4.3.8-118). We mention this because it is a good example of adaptive management, although it is not highlighted as such. Explanations were provided for why the nitrogen-to-phosphorus ratio was not specifically evaluated, why dissolved vs. total phosphorus was used in the assessment, and how upgrades to the Sacramento Regional Wastewater Treatment Plant would affect phosphorus concentrations in the late long term. In general, the treatment of water quality is substantially improved.

CURRENT CONCERNS

This section states several overarching concerns about the Current Draft: overall incompleteness through deferral of content to the Final Report; specific incompleteness in treatment of adaptive management, habitat restoration, levees, and long-term effects; and difficulties in presentation. Some of these concerns overlap with those we raised with the Previous Draft (below, beginning on p. 8).

Missing content

A draft EIR/EIS released for public comment should be reasonably complete, lacking just a few details. The Current Draft is marred by key gaps in information, analyses, and summaries.

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Some of these are said to be deferred to the Final EIR/EIS (herein, "the Final Report"). The various gaps impede evaluation of the science that underpins the proposed project. Some examples:

- Details on adaptive management and collaborative science (see below). Modeling how levee failures would affect operation of dual-conveyance systems. Steve Centerwall told us on August 14 that such modeling would be presented in the Final Report.
- Analyses of the effects of climate change on expected water exports from the Delta. "[A]n explanation and analysis describing potential scenarios for future SWP/CVP system operations and uncertainties [related to climate change] will be provided in the Final Report" (p. 1-35 of the Current Draft). The potential impacts of climate change on system operations, even during the shortened time period considered by the Current Draft, are too important to defer. Concise summaries integrated with informative graphics (p. **Error! Bookmark not defined.**, below). The Current Draft states that comparisons among alternatives will be summarized in the Final Report (p. 1-35). A reasonably complete EIR/EIS would not defer a section that important.

Some of the content now missing may go beyond what is usually required for an EIR/EIS. However, providing this content is likely to assist scientists, decision-makers, and the public in evaluating California WaterFix, and Delta problems in general.

Adaptive management

Adaptive management is legally mandated for compliance with the Delta Plan and is proposed as the way to address uncertainties in the proposed project. The development of the Current Draft from the Previous Draft is itself an exercise in adaptive management, using new information to revise a project during the planning stage. Yet adaptive management continues to be considered largely in terms of how it is to be organized rather than how it is to be done. Adaptive management should be integral with planned actions and management—Plan A rather than Plan B, to be added later if conditions warrant. The lack of a substantive treatment of adaptive management in the Current Draft indicates that it is not considered a high priority or the proposers have been unable to develop a substantive idea of how adaptive management would work for the project.

There is a very general and brief mention of the steps in the adaptive-management process in Section 4 (p. 4.1-6 to 4.1-7), but nothing more about the process. There is no consideration of how the barriers and constraints that have impeded implementation of adaptive management in the Delta and elsewhere (which are detailed in the Delta Plan) are to be dealt with to make adaptive management work this time. Instead, there are general statements of how collaborative science and adaptive management will be linked with the Delta Collaborative Science and Adaptive Management Program. From this, it appears that adaptive management will be directed toward managing in the context of regulations and permits (such as biological opinions and biological assessments required under the Endangered Species Act) rather than applied to assessing—and finding ways to reduce—the environmental impacts of project construction and operations.

Project construction, mitigation, and operations provide many opportunities for adaptive management, both for the benefit of the project as well as for other Delta habitat and ecosystem initiatives, such as EcoRestore. To be effective in addressing unexpected outcomes and the need for mid-course corrections, an adaptive-management management team should evaluate a broad

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range of actions and their consequences from the beginning, as plans are being developed, and facilitate the early implementation and effectiveness of mitigation activities.

Critical details on how adaptive management will be made to work are deferred: "An adaptive management and monitoring program will be implemented to develop additional scientific information during the course of project construction and operations to inform and improve conveyance facility operational limits and criteria" (p. ES-17). This is too late. If adaptive management and monitoring are central to California WaterFix, then details of how they will be done and resourced should be developed at the outset (now) so they can be better reviewed, improved, and integrated into related Delta activities. The details could include setting species-specific thresholds and timelines for action; creating a Delta Adaptive Management Team; and capitalizing on unplanned experiments such as the current drought[5].

The Current Draft's sections on collaborative science (ES.4.2 and 4.1.2.4) cite recent progress toward truly collaborative efforts in monitoring and synthesis in support of adaptive management in the Delta. The text also identifies the main entities to be involved in an expected memorandum of agreement. The Final Report, however, needs to be far more specific on commitments and funding to make adaptive management and restoration science-based and likely to happen and be effective.

The needed commitments could be described in part through examples. For example, tidal restoration sites need to provide topographic heterogeneity and mosaics of soil conditions to support biological diversity and ecological functions. Sidebars on plans for the Dutch Slough and McCormack-Williamson restorations could illustrate experiments designed to test for desired outcomes on various kinds of substrate and at different spatial scales.

The iterative development of the BDCP and its successors has allowed several years for an adaptive-management plan to be fleshed out, but this has yet to happen. The Current Draft offers assurances that collaborations will occur, and that adaptive management will be implemented. This level of assurance falls short of the serious attention to adaptive management that would be consistent with the Delta Reform Act of 2009 and, more importantly, with the inevitably large uncertainties in the impacts of the proposed conveyance and restorations in the face of climate change and other Delta dynamics.

Restoration as mitigation

Restoration projects should not be planned and implemented as single, stand-alone projects but must be considered in a broader, landscape context. We highlighted the landscape scale in our review of the Previous Draft and also in an earlier review of habitat restoration in the Delta[6]. A landscape approach applies not just to projects that are part of EcoRestore, but also to projects envisioned as mitigation in the Current Draft, even though the amount of habitat restoration included (as mitigation) in the Current Draft has been greatly reduced. During our August meeting, representatives of WaterFix and EcoRestore acknowledged the importance of the landscape scale, but the Current Draft appears to give it little heed.

Wetland restoration is presented as a key measure for mitigating significant impacts (example below in comments on Chapter 12). We noticed little attention to the required sequence: first, avoid wetland loss; second, if wetland loss cannot be avoided, minimize; and third, if loss of wetlands cannot be minimized, compensate. Much of the emphasis in the Current

[5] http://deltacouncil.ca.gov/docs/adaptive-management-report-v-8

[6] http://deltacouncil.ca.gov/sites/default/files/documents/files/HABITAT%20RESTORATION%20REVIEW%20FINAL.pdf

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Draft is on the third element. It would be helpful to state the roles of avoidance and impact minimization in developing and selecting the preferred alternative.

Mitigation ratios

Restoring a former wetland or a highly degraded wetland is preferable to creating wetlands from scratch[7]. When an existing wetland is restored, however, there is no net gain of area, so it is unclear whether credits for improving existing wetlands would be considered equivalent to creating wetlands where they did not recently exist.

In view of inevitable failures and time delays in wetland restorations, mitigation ratios should exceed 1:1 for restoration of existing wetlands. The ratios should be presented, rather than making vague commitments such as "restore or create 37 acres of tidal wetland…." The Final Draft also needs to clarify how much of the wetland restoration is out-of-kind and how much is in-kind replacement of losses. It should examine whether enough tidal area exists of similar tidal amplitude for in-kind replacement of tidal wetlands, and whether such areas will exist with future sea level rise.

In Chapter 12, the text implies that jurisdictional boundaries of existing wetlands have been determined or estimated. We did not see (but may have overlooked) a map showing the wetlands for which mitigation would be required under WaterFix and its alternatives.

Restoration timing and funding

Ample opportunities for project mitigation seem to exist in advance of the project. This would reduce uncertainty about outcomes, allow for beneficial and economical adaptive management, and allow investigators to clarify benefits before the full impacts occur.

Mitigation banks are mentioned, but are any operational or planned for operation soon? The potential for landowners to develop mitigation banks could be encouraged so restoration could begin immediately, engendering better use of local knowledge, financial profit, and local support for the project.

The Final Report could discuss who would administer in-lieu fees and decide how to spend them. We noticed a reference to the Army Corps of Engineers. Other candidates include The Nature Conservancy and, for its local mandate and focus, the Delta Conservancy.

Levees

A fuller assessment of environmental impact would relate California WaterFix to levee failure by examining the consequences each may have for the other.

The Current Draft cites levee fragility as a reason to build an isolated conveyance for Sacramento River water (examples, p. 1-1, 1-7, 1-9). This rationale was also expressed in one of Cassandra Enos's slides on August 14, which identified earthquakes as one of three threats to reliable water supplies. It can be seen as well at the California WaterFix website: "Aging dirt levees are all that protect most of California's water supplies from the affects [*sic*] of climate change. Rising sea levels, intense storms, and floods could all cause these levees to fail, which would contaminate our fresh water with salt, and disrupt water service to 25 million Californians"[8].

[7] http://www.nap.edu/openbook.php?isbn=0309074320
[8] http://www.californiawaterfix.com/problem

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However, the Current Draft offers no analysis of how levee failures would affect the short-term and long-term water operations spelled out in Table 4.1-2. We were told on August 14 that the Final Report would provide such analyses.

Also lacking in the Current Draft, and no less important, is analysis of how implementing the project would affect the State's priorities for investing in Delta levees. This potential impact is illustrated by a recent scoring system of levee-project proposals that awards points for expected benefits to "export water supply reliability"[9]. Further efforts to quantify these benefits have been recommended as part of a comprehensive risk assessment that would guide the Delta Levees Investment Strategy[10]. We see little evidence that the obvious linkage between the proposed project and the Investment Strategy has been considered.

Long-term effects

With the proposed permit period shortened from 50 years to 15 years, several potential long-term impacts of the proposed project, or on the proposed project, no longer receive attention. While these effects may not become problematic during the initial 15 years, many will likely affect project operations and their capacity to deliver benefits over the long run. In our view, these long-term effects should be part of the evaluation of the science foundation of the proposed project.

Climate change, for example, is considered under the No-Action alternative, in the Current Draft, as is sea-level rise. Climate change is expected to reduce water availability for the northern intakes, and both climate change and sea-level rise are expected to influence tidal energy and salinity intrusion within the Delta[11]. These environmental effects, in turn, are likely to influence environmental management and regulation—and from the standpoint of water quality they may even yield environmental benefits if agricultural acreage decreases and agricultural impacts are reduced. Rather than consider such effects, the Current Draft focuses on how the proposed project would affect "the Delta's resiliency and adaptability to expected climate change" (Current Draft section 4.3.25). Quite apart from the fact that "resiliency" and "adaptability" are scarcely operational terms, the failure to consider how climate change and sea-level rise could affect the outcomes of the proposed project is a concern that carries over from our 2014 review and is accentuated by the current drought (below, p. 9).

Groundwater regulation under the recently enacted Sustainable Groundwater Management Act (SGMA) can also be expected to have long-term effects on the proposed project. The value of groundwater aquifers also is likely to increase as air temperatures and surface evaporation increase, yet the current drought illustrates how agriculture turns to groundwater when surface-water availability diminishes. Ending of more than a million acre-feet of overdraft in the southern Central Valley under the SGMA is likely to increase demand for water exports from the Delta in the coming decades. It is not clear that such interactions have been fully explored in the Current Draft.

The Current Draft suggests that unnamed "other programs" that are "separate from the proposed project" will use elements of the Previous Draft to implement long-term conservation efforts that are not part of California WaterFix (Current Draft, p. 1-3). The Final Report should provide assurances that such other programs will step in, and could go further in considering their long-term prospects.

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[9] http://www.water.ca.gov/floodsafe/fessro/docs/special_PSP14_final.pdf
[10] http://deltacouncil.ca.gov/docs/delta-levee-investment-strategy/dlis-peer-review-technical-memorandum-31
[11] http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0024465

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Informative summaries and comparisons

An environmental document this complex, important, and expensive needs concise but meaty summaries, with supporting graphics, that facilitate comparisons of alternatives and express major uncertainties and assumptions. With the Previous Draft, an overview for broad audiences[12] offered little that met these needs. The Previous Draft provided text summaries for just the two longest of its resource chapters (Chapters 11 and 12). Buried in a chapter on "Other CEQA/NEPA required sections" was the nearest approximation to an incisive comparison of alternatives (part 3 of Chapter 31).

We requested summaries and readable comparisons in reviews in June 2012[13] and June 2013[14] as well as in May 2014. On August 14 Cassandra Enos and Steve Centerwall assured us that this kind of content would appear in the Final Report. This seems a long time to wait for something so critical to comprehending what is being proposed and its potential impacts. An EIR/EIS of this scope and importance should include short summaries and comparisons, excellent comparative descriptions of alternatives supported by readable tables and high-quality graphics, summary conclusions of major points, well-organized appendices, and integration of main figures with the text. The clarity in, for example, sections 1 and 2 demonstrates that the preparers are fully capable of providing this kind of material, in addition to the mind-numbing repetition apparently required for CEQA/NEPA compliance in a narrow sense.

Far-reaching decisions about California WaterFix should not hinge on environmental documents that few can grasp. "Environmental impact statements shall be written in plain language and may use appropriate graphics so that decision-makers and the public can readily understand them" (Code of Federal Regulations, 40 CFR 1502.8). It is imperative that responsible agencies provide useful and readable reports, to support public and policy discussions and the reputations of the agencies themselves.

PRIOR CONCERNS AND THEIR RELEVANCE TO THE CURRENT DRAFT

Our review of May 14, 2014 emphasized eight broad areas of concern about the scientific basis for the Previous Draft. Each is summarized below, followed by a brief appraisal of how (or whether) the concern has been dealt with in the Current Draft.

Some specific issues we raised have been addressed and many of our broader concerns about habitat restoration and other conservation measures are less relevant, given the reduced scope of the proposed project. Others, such as the treatment of uncertainties, the implementation of adaptive management, and the use of risk analysis, receive little if any further attention in the Current Draft.

We also found few revisions in response to points we raised previously about linkages among species, ecosystem components, or landscapes, or about the potential effects of changes in water availability on agricultural practices and the consequent effects on the Delta. Our previous comments about the difficult organization of the Previous Draft and the lack of concise summaries pertain no less to the Current Draft.

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[12] Highlights+of+the+Draft+EIS-EIR+12-9-13.pdf

[13] http://deltacouncil.ca.gov/sites/default/files/documents/files/DISB_Letter_to_JMeral_and_DHoffman-Floerke_061212.pdf

[14] http://deltacouncil.ca.gov/sites/default/files/documents/files /DISB%20Comments%20on%20Draft%20BDCP%20Document.doc_.pdf

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Effectiveness of conservation actions

Our prior review found that many of the impact assessments hinged on optimistic expectations about the feasibility, effectiveness, or timing of the proposed conservation actions, especially habitat restoration.

This is arguably less of a concern now, given the substantially shorter time frame of the revised project and narrower range of conservation actions. Nonetheless, the Current Draft continues an exuberant display of optimism. Thus, "By reducing stressors on the Delta ecosystem through predator control at the north Delta intakes and Clifton Court Forebay and installation of a nonphysical fish barrier at Georgiana Slough, Alternative 4A will contribute to the health of the ecosystem and of individual species populations making them stronger and more resilient to the potential variability and extremes caused by climate change." (p. 4.3.25-10). Scientific support for this statement is lacking, and an adaptive or risk-based management framework is not offered for the likely event that such optimism is unfulfilled.

Is it feasible for the mitigation and restoration actions to be done within the time period as proposed? Probably. Is it feasible that these actions will have the desired long-term mitigation effects? This is more problematic. To be effective, mitigation actions should deal with both the immediate and long-term consequences of the project. The proposed permitting should allow for monitoring long enough to assess the effectiveness of habitat restoration measures, which will need to extend beyond the initial 15-year permitting period.

Uncertainty

Our prior review found the BDCP encumbered by uncertainties that were considered inconsistently and incompletely. We observed that modeling was not used effectively enough in bracketing uncertainties or exploring how they may propagate.

In the Current Draft, uncertainties and their consequences remain inadequately considered overall, despite improvements. Uncertainties will now be dealt with by establishing "a robust program of collaborative science, monitoring, and adaptive management" (ES 4.2). No details are provided, so there is no way to assess how (or whether) uncertainties will be dealt with effectively. Modeling was apparently adjusted to reflect changes in the footprint of the revised project. However, we noted no new modeling that would bracket uncertainties or (more importantly) assess propagation of uncertainties.

Many of our prior concerns about uncertainties pertained to impacts on fish. If addressed in Chapter 11 of the Current Draft, these uncertainties are difficult for us to evaluate because, in the version available to us, changes to that chapter have not been tracked (below, p. 15).

There are also uncertainties with the data generated from model outputs, although values are often presented with no accompanying error estimates. This situation could be improved by presenting results from an ensemble of models to see how the outputs compare, or by performing sensitivity analyses of the models to gain a better understanding of how different variables respond to changes.

Effects of climate change and sea-level rise on the proposed actions

In our 2014 review, we stated our concern that the Previous Draft underestimated these effects for the 50-year timeline of the BDCP. With the nominal duration shortened to 15 years, most of the projected impacts of climate change and sea-level rise may occur later. But climate-related issues remain.

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First, the Current Draft is probably outdated in its information on climate change and sea-level rise. It relies on information available before the December 2013 release of the Previous Draft. The absence of the climate-change chapter (Chapter 29) in the Previous Draft from Appendix A in the Current Draft suggests that no changes were made. Yet climatic extremes, in particular, are a topic of intense scientific study, illustrated by computer simulations of ecological futures[15] and a recent hypothesis about unprecedented drought[16]. The Current Draft does not demonstrate consideration of recently available climate science, and it defers to the Final Report analysis of future system operations under potential climate and sea-level conditions.

Second, climate change and sea-level rise are now included in the No-Action Alternative, as they will transpire whether or not WaterFix moves forward. A changed future thus becomes the baseline against which Alternative 4A (and the others) are compared. Changes in outflow from the Delta due to seasonal effects of climate change and the need to meet fall X2 requirements are considered in Section 4.3.1. The difference in outcomes then depends on assumptions about the facility and operations of Alternative 4A, and "Delta exports would either remain similar or increase in wetter years and remain similar or decrease in the drier years under Alternative 4A as compared to the conditions without the project." (p. 4.3.1-4). This is rather inconclusive and does not indicate adaptations to different likely outcomes. The information required to determine how the effects of proposed diversions would relate to the changed conditions under the No-Action alternative may well be in the text, but it does not emerge clearly. A more sophisticated analysis may be called for.

Interactions among species, landscapes, and the proposed actions

The Previous Draft acknowledged the complexities produced by webs of interactions, but it focused on individual species, particular places, or specific actions that were considered in isolation from other species, places, or actions. Potential predator-prey interactions and competition among covered and non-covered fish species were not fully recognized. Confounding interactions that may enhance or undermine the effectiveness of proposed actions were overlooked. In our 2014 review we recommended describing and evaluating the potential consequences of such interactions, particularly in Chapters 11 (Fish and aquatic resources) and 12 (Terrestrial resources).

The Current Draft recognizes that mitigation measures for one species or community type may have negative impacts on other species or communities, and mitigation plans may be adjusted accordingly. But the trade-offs do not seem to be analyzed or synthesized. This emphasizes the need for a broader landscape or ecosystem approach that comprehensively integrates these conflicting effects.

Effects on San Francisco Bay, levees, and south-of-Delta environments

In 2014 we pointed to three kinds of impacts that the Previous Draft overlooked: (1) effects on San Pablo Bay and San Francisco Bay in relation to Delta tides, salinity, and migratory fish; (2) effects of levee failures on the proposed BDCP actions and effects of isolated

[15] http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0024465

[16] Cook, B.I., Ault, T.R., and Smerdon, J.E., 2015, Unprecedented 21st century drought risk in the American Southwest and Central Plains: Science Advances, v. 1, doi:10.1126/sciadv.1400082.

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conveyance on incentives for levee investments; and (3) effects of increased water reliability on crops planted, fertilizers and pesticides used, and the quality of agricultural runoff.

The Current Draft responds in part to point 1 (in 11.3.2.7). Point 2 is reinforced by recent efforts to prioritize the State's levee investments (above, p. 6).

As for point 3, however, although the Current Draft considers how the project might affect groundwater levels south of the Delta (7.14 to 7.18), it continues to neglect the environmental effects of water use south of (or within) the Delta. Section 4.3.26.4 describes how increased water-supply reliability could lead to increased agricultural production, especially during dry years. Elsewhere, a benefit-cost analysis performed by ICF and the Battle Group[17] calculated the economic benefits of increased water deliveries to agriculture in the Delta. The consequences of these assumptions, or of the projections in the Current Draft that the project may enhance water-supply reliability but may or may not increase water deliveries to agriculture (depending on a host of factors), seem not to have been fully considered. Our previous concern is undiminished.

The effects or changes in water delivery extend to the question of how each intake capacity (3,000, 9,000, or 15,000 cfs) may affect population growth in Southern California. Section 4.4.1-9 treats the growth-enabling effects of alternative 2D lightly, saying that EIS review would be needed for future developments.

Implementing adaptive management

In the Previous Draft, details about adaptive management were to be left to a future management team. In our 2014 review we asked about situations where adaptive management may be inappropriate or impossible to use, contingency plans in case things do not work as planned, and specific thresholds for action.

Although most ecological restoration actions have been shifted to California EcoRestore (p. 4), we retain these and other concerns about adaptive management under California WaterFix. If the mitigation measures for terrestrial resources are implemented as described, for example, they should compensate for habitat losses and disturbance effects of the project. The test will be whether the measures will be undertaken as planned, be as effective as hoped, and continue long enough to fully mitigate effects. This is where adaptive management and having contingency plans in place becomes critically important. It is not apparent that the mitigation plans include these components.

Reducing and managing risk

Our 2014 review advised using risk assessment and decision theory in evaluating the proposed BDCP actions and in preparing contingency plans. This risk reduction and management strategy is not apparent to us in the Current Draft. There was some mention that it might be worked in later. This is not how the process should be used.

Comparing BDCP alternatives

Despite clear writing and an abundance of information and analyses, the Previous Draft contained few examples of concise text and supporting graphics that compare alternatives and evaluate the critical underlying assumptions. Rudimentary comparisons of alternatives were

[17] http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/Draft_BDCP_Statewide_Economic_Impact_Report_8513.sflb.ashx

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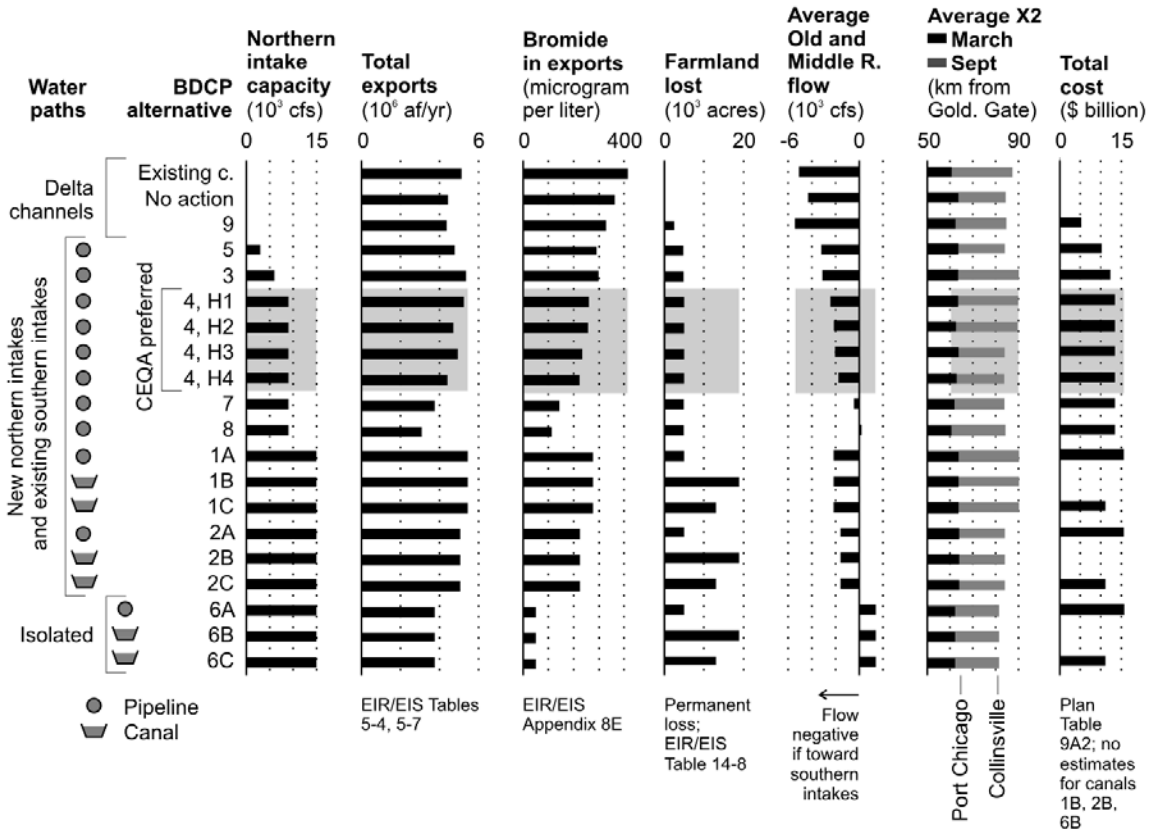
almost entirely absent. The Current Draft continues this poor practice (p. **Error! Bookmark not defined.**).

Our review of the Previous Draft urged the preparers to integrate graphics that offer informative summaries at a glance, and we drafted the example reproduced below. We have not found such graphics in the Current Draft.



COMMENTS ON INDIVIDUAL SECTIONS AND CHAPTERS

This final section of the review contains minimally edited comments on specific points or concerns. These comments are loosely organized by section or chapter in the Current Draft. Many are indexed to pages in the section or chapter named in the heading.

Alternatives 4A, 2D, and 5A (Section 4)

It is good that the proposed alternatives are seen as flexible proposals, as it is difficult to imagine that any proposal for such a complex and evolving system could be implemented precisely as proposed. Some initial and ongoing modifications seem desirable, and unavoidable.

The operating guidance for the new alternatives seems isolated from the many other water management and environmental activities in and upstream of the Delta likely to be important for managing environmental and water supply resources related to Delta diversions. While it is difficult to specify detailed operations for such a complex system, more details on the governance of operations (such as the Real Time Operations process) would be useful. The operational details offered seem to have unrealistic and inflexible specificity. Presentations of

delivery-reliability for different alternatives remain absent. Environmental regulations on Delta diversions have tended to change significantly and abruptly in recent decades, and seem likely to change in the future. How sensitive are project water supply and environmental performance to changes in operating criteria?

The collaborative science ideas seem philosophically attractive, but are not given much substance. Mentioning monitoring is nice, but details of organization, intent, and resources seem lacking. Adequate funding to support monitoring, collaborative science, and adaptive management is a chronic problem. Section ES.4.2 states that "Proponents of the collaborative science and monitoring program will agree to provide or seek additional funding when existing resources are insufficient." This suggests that these activities are lower in priority than they should be.

The three new alternatives, 4A, 2D, and 5A, seem to have modest changes over some previous alternatives, with the exception of not being accompanied by a more comprehensive environmental program. In terms of diversion capacities, they cover a wide range, 3,000 cfs (5A), 9,000 cfs (4A), and 15,000 cfs (2D). The tables comparing descriptions of the new alternatives to previous Alternative 4 are useful, but should be supplemented by a direct comparison of the three new alternatives.

The new Sustainable Groundwater Management Act (SGMA) seems likely to increase demands for water diversions from the Delta to the south to partially compensate for the loss of roughly 1.5-2 maf/year of water currently supplied by groundwater overdraft. For purposes of the EIR/EIS, the SGMA seems likely to prevent further overdraft in the long term, transferring much of these demands onto the Delta and shifting Delta water availability to address south-of-Delta water scarcity rather than regional groundwater overdraft.

The State seems embarked on a long-term reduction in urban water use, particularly outdoor irrigation. Such a reduction in urban water use is likely to have some modest effects on many of the water-demand and scarcity impacts discussed.

The climate change analysis of changes in Delta inflows and outflows is nice, but isolating the graphs in a separate document disembodies the discussion. The fragmentation of the document by removing each Section 4 figure into a separate file is inconvenient for all, and makes integrated reading practically impossible for many.

The details of the alternative analyses seem mostly relevant and potentially useful. Much can be learned about the system and the general magnitude of likely future outcomes from patient and prolonged reading of this text. An important idea that emerges from a reading of the No Action Alternative is that the Delta, and California water management, is likely to change in many ways with or without the proposed project. The No Action and other alternatives also illustrate the significant inter-connectedness of California's water system. The range of impacts considered is impressive, if poorly organized and summarized.

The discussion of disinfection by-product precursor effects in Delta waters is improved significantly, but could be made more quantitative in terms of economic and public-health impacts.

The discussion on electromagnetic fields is suitably brief, while the tsunami discussion could be condensed.

The effects of the likely listing of additional native fish species as threatened or endangered seems likely to have major effects on project and alternative performance. These seem prudent to discuss, and perhaps analyze.

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Is Alternative 2D, with 15,000 cfs capacity, a serious alternative? Does it deserve any space at all?

Table 4.1-8 implies that tidal brackish/*Schoenoplectus* marsh. Should some of this be considered tidal freshwater marsh?

The dynamics of the Delta are largely determined by water flows. The Current Draft acknowledges that water flows and salinity will change in complex ways. There are statements about how inflows, outflows, and exports will change in Alternative 4A in relation to baseline (No-Action) conditions (p. 4.3.8-13). What is the scientific basis on which these changes will be managed? Will models be used? What confidence should we have in current projections? Have the effects of droughts or deluges been considered?

4.3.7-10, line 13: Text on disturbing sediments and releasing contaminants needs to add Nitrogen and Phosphorus to the concerns.

Water quality (Chapter 8)

8-3, line 13: *Microcystis* is singled out as a cyanobacterium that can (but doesn't always) produce the toxin, myrocystin; however, there are other cyanobacteria that sometimes produce other toxins. Different genera can differ in the nutrient that limits their blooms (see 2014 letter by Hans Paerl in Science 346(6406):175-176). For example, *Microcystis* blooms can be triggered by N additions because this species lacks heterocysts, while toxin-producing *Anabaena* blooms can be triggered by P additions, because *Anabaena* has heterocysts and can fix N. The frequently repeated discussion of cyanobacteria blooms needs to be updated. Also cite Paerl on page 8-45 line 8. Ditto on page 8-103 and 8-106 line 34.

8-8. In our earlier comments, we recommended that carbon be separated into its dissolved and particulate forms for consideration of water quality impacts because dissolved organic carbon (DOC) is the form most likely to react with chloride and bromide and result in formation of disinfection by-products. The section on bromide focuses on interactions with total organic carbon (TOC), rather than DOC. Carbon is primarily considered with respect to formation of disinfection by-products but carbon plays a central role in the dynamics of the Delta, affecting processes such as metabolism, acidity, nutrient uptake, and bioavailability of toxic compounds. Carbon cycling determines ecosystem structure and function in aquatic systems. It also modifies the influence and consequences of other chemicals and processes in aquatic systems. Dissolved organic carbon (DOC), for example, influences light and temperature regimes by absorbing solar radiation, affects transport and bioavailability of metals, and controls pH in some freshwater systems. Respiration of organic carbon influences dissolved oxygen concentrations and pH.

8-19 and 8-20: "CECs" is not defined and seems to be used incorrectly. Change "CECs" to "EDCs" on page 8-19 and to "PPCPs" on page 8-20.

8-22, lines 18 and 30: Choose either "cyanobacteria" or "blue-green algae;" using both will confuse readers who may perceive them as different.

8-21, line 18-19: Such a statement should be qualified. The conclusion that marine waters are N-limited and inland waters are P-limited is outdated. Recent papers find more complex patterns, including the above.

8-18, line 12 says that salt disposal sites were to be added in 2014; were they?

8-23, lines 15-16: Say how the N:P ratio changed composition, not just that it did change composition.

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8-23 through 8-25: Uncertainties (e.g., standard deviation or standard error of the mean) associated with the mean concentrations of DOC should be presented. It is impossible to interpret differences between the values that are presented without knowledge of the variation around the mean values (e.g., without knowledge of variation around the mean, it is difficult to evaluate whether DOC concentrations at south vs. north-of-Delta stations and Banks headworks differ from one another; 3.9 to 4.2 mg/L vs. 4.3 mg/L).

8-65, line 12: Specify if DO is for daytime or night, and for surface, bottom or mid-water column.

8-75, line 6: The failure to consider dissolved P (DP) should be addressed; there is much greater uncertainty. The adherence of some P to sediment does not prevent considerable discharge of P as DP. Also on page 8-95 line 40, qualify predictions due to lack of consideration of DP.

8-82, line 4-5: It seems unlikely that current levels of *Microcystis* growth in the Delta are dependent on the exclusive uptake of ammonia. Temperature is one of the primary factors driving *Microcystis* blooms and global warming could promote bloom occurrence.

Consider revising this section to, "Because it seems unlikely that current levels of *Microcystis* growth in the Delta are dependent on the exclusive uptake of ammonia, the frequency, magnitude and geographic extent of *Microcystis* under future scenarios is difficult to predict."

8-105, line 8: Would total nitrogen be dominated by nitrate just by increasing ammonia removal? Depending on redox and microbiota, why wouldn't nitrate be converted to ammonium?

A lot of attention is given to factors controlling *Microcystis* blooms in this chapter but little attention is given to its toxicity. Just as factors controlling blooms are not fully understood, the regulating factors of cellular toxin contents remain poorly understood. As a result, the impact of blooms on the environment can vary (e.g., large blooms of non-toxic or low toxin organisms may have impacts on environmental variables such as nutrient uptake and dissolved oxygen consumption while small blooms of highly toxic organisms could impact food webs) [see: Ma et al. (2015) Toxic and non-toxic strains of *Microcystis aeruginosa* induce temperature dependent allelopathy toward growth and photosynthesis of *Chlorella vulgaris*. Harmful Algae 48: 21–29].

Fish and aquatic resources (Chapter 11)

We found individual conclusions or new analyses difficult to identify because this chapter was not provided in tracked change format and because it lacks a table of contents to assist in side-by-side comparison of the Current Draft with the Previous Draft.

Effects of temperature

We noticed more emphasis on temperature concerning the fish 'downstream' impacts (but without tracked changes this becomes difficult to document). The main use is with percent of the time that monthly mean temperatures exceed a certain rate or fall within a certain boundary. The biological impact is difficult to assess with these numbers. If all of the change occurred just during operations or just during one day, the biological impact could be much different that a small change every day. Graphs of changes and listing of extreme highs and lows during a model run would have more biological meaning.

Fish screens

It is unclear how (and how well) the fish screens would work. The description of fish screens indicates that fish >20 mm are excluded, but what about fish and larvae that are <20 mm,

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as well as eggs? Table 11-21 seems out of date, because some fish screens appear to have been installed, but data on their effects are not given. Despite the lack of specific data on how well screens function, the conclusion that there will be no significant impact is stated as certain (e.g., page 1-100 line 38). Here, as in many other places, measures are assumed to function as planned, with no evidence to support the assumptions. The level of certainty seems optimistic, and it is unclear whether there are any contingency plans in case things don't work out as planned (a point we made in responses to the Previous Draft).

Invasive plants

Cleaning equipment is mentioned, but it is not specifically stated that large machinery must be cleaned before entering the Delta. Section 4.3.8-358 says equipment would be cleaned if being moved within the Delta. Cleaning is essential to reduce transfer of invasive species; a mitigating measure is to wash equipment, but it must also be enforced.

Weed control (fire, grazing) is suggested, but over what time frame? It may be needed in perpetuity. That has been our experience at what is considered the world's oldest restored prairie (the 80-yr-old Curtis Prairie, in Madison, WI).

Weed invasions can occur after construction is completed; how long will the project be responsible for weed control? 3-5 years won't suffice.

4.3.8-347. Herbicides are prescribed to keep shorebird nesting habitat free of vegetation, but toxic effects of herbicides on amphibians etc. are not considered.

4.3.8-354. Impacts of invasive plants seem underestimated. Impact analysis implies that the project disturbance area is the only concern, when dispersal into all areas will also be exacerbated. At the Arboretum, a 1200-ac area dedicated to restoration of pre-settlement vegetation, invasive plants are the main constraint. A judgment of no significant impact over just the disturbance area is overly optimistic.

4.3.8-356. Does not mention need to clean equipment to minimize import of seeds on construction equipment.

Cryptic acronym and missing unit

Figure 2: SLR x year: y axis lacks units; reader has to continue on to table 11-20 to find that it is cm.

Terrestrial biological resources (Chapter 12)

Effects on wetlands and waters of the United States (WOTUS)

Page 12-1, line 18-19 says: "Under Alternatives 2D, 4 , 4A , and 5A, larger areas of non-wetland waters of the United States would be filled due to work in Clifton Court Forebay; however, the Forebay would ultimately expand by 450 acres and thus largely offset any losses there." Is the assumption that, acre for acre, all jurisdictional waters are interchangeable, whether of different type or existing vs. created? The literature does not support this assumption.

The text argues that the wetlands would be at risk with levee deterioration, sea-level rise, seismic activity, etc. But the solution is for "other programs" to increase wetlands and riparian communities. What if this project causes the problem, e.g. via vibration?

CM1 alternative 4A would fill 775 acres of WOTUS (491 wetland acres); Alt 2D would fill 827 (527 wetland) + 1,931 ac temporary fill at Clifton Court Forebay; Alt 5A would fill 750 (470 wetland). That's a lot of area. The timing and details of mitigation measures are not provided. References to the larger Delta plan suggest that compensations would come at unknown times. Piecemeal losses such as indicated here: "Only 1% of the habitat in the study

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area would be filled or converted" (Chapter 12, line 29, page 12-22) is how the US has lost its historical wetlands. What are the overall cumulative impacts of wetland losses in the Delta? What is the tipping point beyond which further wetland losses must be avoided? The proposed project is one part of the broader array of management actions in the Delta and should be considered in that broader context.

Habitat descriptions

How will mudflats be sustained for shorebirds? Exposed mud above half-tide can become vegetated rapidly. In the Delta, the bulrush *Schoenoplectus californicus* tolerates nearly continuous tidal submergence.

Are soils clayey enough for the proposed restoration of up to 34 acres of vernal pool and alkali seasonal wetland near Byron? These areas will need to pond water, not just provide depressions.

12-243, line 18: How would adding lighting to electrical wires eliminate any potential impact to black rails? This mitigation is overstated.

Several of the species accounts (e.g., bank swallow) indicate that there is uncertainty about how construction or operations will impact the species. In most cases, monitoring is proposed to assess what is happening. But to be effective, the monitoring results need to be evaluated and fed into decision-making, as visualized in the adaptive-management process. There is little explicit indication of how this will be done or funded.

Land use (Chapter 13)

Alternative 4A would allow water diversion from the northern Delta, with fish screens, multiple intakes, and diversions limited to flows that exceed certain minima, e.g. 7000 cfs. This would reduce flood-pulse amplitudes and, presumably, downstream flooding. How does this alter opportunities for riparian restoration? Which downstream river reaches are leveed and not planned to support riparian restoration? Where would riparian floodplains still be restorable?

Over what surface area does the pipeline transition to the tunnel? At some point along the pipeline-tunnel transition, wouldn't groundwater flow be affected?

Up to 14 years of construction activities were predicted for some areas (e.g., San Joaquin Co.); this would have cumulative impacts (e.g., dewatering would affect soil compaction, soil carbon, microbial functions, wildlife populations, and invasive species). What about impacts of noise on birds; e.g., how large an area would still be usable by greater sandhill cranes?

State how jurisdictional wetlands have been mapped and how the overall project net gain or net loss of wetland area has been estimated. If mitigation consists only of restoration actions in areas that are currently jurisdictional wetlands, then there would be an overall net loss of wetland area due to the project. A mitigation ratio >1:1 would be warranted to compensate for reduced wetland area. This was also a concern for Chapter 12.

Up to 277 ac of tidal wetlands are indicated as restorable; text should indicate if these are tidal freshwater or tidal brackish wetlands (or saline, as is the typical use of "tidal wetlands").

13-19. On the need to store removed aquatic vegetation until it can be disposed: There are digesters for this purpose, and they might be efficient means of mitigation if management of harvested aquatic plants will be long-term. A waste product could be turned into a resource (methane fuel).

13-19, line 12: Text says that "predator hiding spots" will be removed—What are these? Line 20: What are the E16 nonphysical fish barriers? An electrical barrier?

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13-20, line 19: Boat-washing stations are mentioned; would these discharge pollutants (soap, organic debris?)

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