This document is a compilation of the fish agency "red flag" comments and ICF's responses thereto regarding the BDCP draft Effects Analysis. These informal comments were developed by agency staff to flag quickly issues that need to be resolved prior to final submittal of the plan. As such, they do not reflect an official agency position or decision. ICF's responses are preliminary and intended to facilitate further discussion and resolution of issues. ICF and the agencies will be working to address the red flag issues in the coming weeks.

DFG April 2012 BDCP EA (Ch. 5)
Staff "Red Flag" Review
Comprehensive List

STURGEON

Methodological

- The logic of section 5.5.5.4 (Net Effects) is difficult to follow and does not attempt to prioritize Plan outcomes relative the magnitude of their likely impacts on sturgeon production. The largely Best Professional Judgment discussion seems to miss rough quantification opportunities that might be derived from flow abundance-relationships, adult migration straying rates into the Yolo Bypass, and known survival and harvest rates (as they might, for example, relate to illegal harvest reduction). The conclusions in the paragraph beginning on line 29 seem essentially unsupported.

  ICF Response: We will make this discussion clearer.

- The assessment effects seems to turn the notion of uncertainty upside down. In general, the Plan reduces winter-spring outflow, and in some regards Sacramento River Flow. There is a strong historical association between flow conditions and sturgeon production, which the EA seems to dismiss, citing a lack of understanding of the mechanisms underlying the association. This would seem to be a very risky approach from a species conservation point of view, given that the anticipated offsets to the potential flow impact are Plan attributes that address "stressors" that have not been clearly associated with variation in production (e.g. food supply).

  ICF Response: We will make this discussion clearer.

- The EA seems to suggest that a reduction in entrainment of juvenile sturgeon at the south Delta offsets (justifies) the effects of reduction in winter-spring outflows. While the statement that "Entrainment of juvenile sturgeon at the south Delta pumping facilities, however, is considered an important stressor for this life stage." may be true, it is not considered to be a more important stressor on sturgeon than reduced winter-spring outflow. Entrainment of juvenile white sturgeon at the south Delta pumping facilities is not a significant stressor, when compared to the loss of winter-spring outflow. Although entrainment of green sturgeon is a somewhat different matter, reducing it in exchange for reducing winter-spring outflow is still not preferred.

  ICF Response: We will make this discussion clearer.

- There is a general tendency section 5.5.5.1 (Beneficial Effects) to overstate Plan benefits. An example, can be found in the sentence beginning at line 8 on page 5.5-114, which concludes that Plan-related changes in DCC operations will reduce entrainment and improve the ability of adult sturgeon to cue in on Sacramento River flows. These conclusions seem to ignore that adult sturgeon are rarely entrained, and that overall the Plan substantially reduces lower Sacramento River flows.

  ICF Response: We will make this discussion clearer.

Flows

- River flows are important to sturgeon production in the Sacramento River system and Delta, and PP operations are predicted to result in significant occurrences of river flow reduction during the sturgeon spawning and early rearing periods. Reductions are most pronounced in the mainstem Sacramento River downstream of the Fremont Weir and the proposed northern delta intakes, but occurrences of substantial flow reductions are also predicted in more upstream river reaches.

  As identified in the December, 2011 version of Appendix C, the PP is predicted to expose green sturgeon larvae to substantial reductions in July-September Feather River flows in most years. In addition, predicted juvenile white sturgeon migration period flows at Verona are sometimes lower under PP operations, and white sturgeon larval transport flows at Wilkins Slough fall more frequently below thresholds in dry years.

  The collective predicted negative river flow effects of the PP create the risk of a depressive effect on sturgeon production that may not be overcome by more favorable PP aspects (e.g. reduced entrainment, increased food production supply). This suggests the need to modify the PP to reduce the magnitude and frequency of river flow reduction occurrences, in both upstream and downstream areas.

  ICF Response: Changes to operations are currently under discussion with the agencies.

SALMONIDS

Effects Analysis

- Combining all salmonids into one net effects analysis is not appropriate and “averages” out the adverse effects of individual runs. The net effects analysis needs to differentiate between Sacramento and San Joaquin river salmonids; salmon and steelhead; and individual runs of salmon (i.e. winter-run, spring-run, fall and late fall-run).

  ICF Response: We agree as was noted in the Chapter 5 Admin Draft. We plan to work closely with the fish and wildlife agencies to develop separate analyses for each salmonid run and, where appropriate, each population.

- Analysis of the reduction in Sutter Bypass floodplain acreage has not been addressed in the effects analysis. This issue has been raised previously and still not been responded to. Data shows that there could be a significant reduction in floodplain habitat in the lower Sutter Bypass based on the preliminary proposal due to lowering the river stage at Verona, which will lead to a direct reduction in Butte Creek spring-run Chinook salmon rearing habitat (and splittail).

  ICF Response: We will work with the agencies to develop this analysis.

- The rationale for the degree of certainty seems unfounded for some of the stressors (e.g. transport flows, flow regulation, and flow-associated habitat (5.5-55-59)). The tables show a high degree of uncertainty regarding the effects of flow on salmon on the basis that there is no quantitative analysis or little applicable literature, which is unjustified.

  ICF Response: We can work with agencies to gather information to better justify the certainty of stressor rankings.

- Table 5.5-16 is contradictory to the statements made at spring-run egg mortality and winter-run redd dewatering.

  ICF Response: We will work with the agencies to correct this.

Implementation

- The decision on phasing of proposed North Delta Diversions (NDD) intakes needs to be determined. From a fishery management perspective it would be best to build some (e.g., two) of the intakes and operate them prior to building the rest. This phasing approach would allow us to learn and potentially correct any unforeseen issues.

  ICF Response: This is a policy-level decision.

- The timeline to complete the required environmental documentation and permitting for Conservation Measure 2 is much longer than necessary to complete this critical measure. It should not require more than three to five years to complete environmental compliance and an additional two years to acquire the necessary permits.

  ICF Response: We agree that an aggressive timeline for CM2 is needed to ensure that the substantial benefits of those actions are realized as soon as possible. The current timeline is based on the likely need to design and permit many CM2 actions separately. We will consider ways to accelerate the schedule. Changing the assumed timeline is a policy-level decision.

Upstream

- The preliminary proposal shows a reduction in the end of September storage (cold water pool storage) which is unacceptable and needs to be addressed.

- Winter-run redd dewatering and lower weighted usable spawning habitat in the Sacramento River under the preliminary proposal is not acceptable. This would lead to a significant decline in the population (as estimated by the JPE).

- Spring-run egg mortality in the mainstem of the Sacramento River is near 100 percent during dry and critical dry years. This type of egg mortality could lead to the extirpation of spring-run Chinook salmon from the mainstem of the Sacramento River during one drought cycle.

  ICF Response: We propose exploring the inclusion of upstream temperature controls in the modeling done for the effects analysis to reduce uncertainty of these effects and to offset CALSIM's modeling approach to better reflect the actual operations of the project.

<u>North Delta Flow</u>

- Reduction in flows below proposed NDD could have significant impacts on the transport flows for juvenile fish species and the upstream migration cues of adults.
- The net effects analysis shows that there would be increased reverse flows in the Sacramento River below the proposed NDD due to the preliminary proposal (5.3-4, line 10-13), this is not protective and doesn't appear to account for real time operations to minimize these effects.

  ICF Response: We will work to better explain this issue and work with the fish and wildlife agencies to find a diversion scheme that can included in the public draft BDCP.

<u>SJR Flows at Antioch (5.3.1.2.9)</u>

- The continuation of zero and (-) SJR flows at Antioch is not protective of San Joaquin Basin fish. While the PP_ELT and PP_LLT show an increase in OMR and SJR flows due to a reduction in south Delta exports, the continuation of low flows in August and September followed by 0 cfs in October and November and (-) 2000 cfs in December is not protective. Positive SJR flows during this time are important and necessary to cue upstream adult migration, reduce straying, and to help address water quality concerns (e.g., DO and temperature).

  ICF Response: Our analysis did not explicitly identify this as an area of concern, but we will work with the agencies to further examine this issue goals.

<u>Entrainment Issues</u>

- Increasing entrainment in the south delta compared to EBC in dry and critical years is a concern and should be avoided. Due to the lack of discussion on this issue, it leads the reader to believe that there will be more water export than existing conditions under the preliminary proposal.

  ICF Response: The PP does not include an E/I ratio that currently governs reverse flows (in combination with OMR) and therefore in drier years, exports from south Delta, and associated entrainment, are increased. Our analysis does not take into account the real-time operations management groups that have been effective at reducing the risk of entrainment, and therefore may overestimate the entrainment under the PP. Nonetheless, we are evaluating how to minimize entrainment in drier years.

SMELT(S)

(Delta Smelt, Section 5.5.1)

Methodological

- The paragraph beginning at the bottom of page 5.5-24 (and at other locations in Section 5.5.1) notes that there is no change anticipated in Fall abiotic habitat when comparing the PP with EBC1 (existing condition, sans the Fall X2 RPA action). This may be a problematic PP outcome in the context of a NCCP. Reasonable arguments have been made that recent changes in Delta water management have substantially degraded Fall abiotic habitat conditions, particularly in Falls following Above Normal and Wet water years (roughly half of all years, historically), contributing to the POD condition for delta smelt. This suggests that the "no change" outcome produced by the PP would make it difficult to demonstrate a PP contribution to species recovery.

  ICF Response: This method accounts for only a portion of the population and recovery of the species doesn't necessarily need to be driven by this one component. We believe that the Effects Analysis shows at least a minor beneficial effect on the species relative to existing conditions, and that it has great potential for larger benefits depending on actual food production and location of delta smelt population in relation to those areas. While there is uncertainty about these conclusions, we attempted to address this uncertainty in Chapter 5 by including focused studies prior to the new intake operation as well as describing how adaptive limits could be used if needed, to increase fall outflows. We hope to continue discussions with the agencies regarding how to address the Fall X2 issues.

- The paragraph beginning at line 16 on page 5.5-17 introduces the approach of examining Plan Fall abiotic habitat effects based on Feyrer et al. (2011). The text then goes on to identify several "concerns" DWR and applicants have regarding the approach. This expression of concern is reasonably presented, other than the fact that the similar concerns of other parties regarding the investigations critical of Feyrer et al. are not presented. The overarching "red flag" here is that the key technical concerns surrounding this aspect of the effects analysis are not be addressed in a systematic way, other than through non-collaborative production of "combat science." This approach is not effectively reducing uncertainty about Plan outcomes, and places a particular burden on permitting agencies who will have no choice but to assess the uncertainties and conservatively mold the permits around their perception of uncertainty.

  ICF Response: In the revised Appendix C, we have more clearly defined the issues with the method and as stated above, we hope to continue discussions with the agencies regarding how to address the Fall X2 issues.

Plan Concerns

- As Figure 5.5-1 clearly shows, the role up for delta smelt is about balancing the uncertain benefits of food , predation, and tidal habitat benefits against the uncertain negative effects of Fall abiotic habitat degradation. This is not a very comfortable assessment for such a key species. Some improvement of the Fall habitat situation would go a long way towards improving the ability of the project to achieve the conserve standard for an NCCP.

  ICF Response: We hope to continue discussions with the agencies regarding how to address the Fall X2 issues.

- Table 5.5-4 (and other similar tables) shows essentially no existing habitat in the southern Delta. This is counter-intuitive, given that the same southern Delta had lots of smelt in it in the early 1970s. This is part of a general problem that the southern Delta may be getting short shrift in considering potential restoration potential.

  ICF Response: The analysis conducted for tidal habitat restoration in the ROAs is at a broad landscape level and may not capture the full range of potential habitat benefits or suitability because of the coarse level of the analysis. As such, individual restoration areas and some existing areas may provide suitable habitat for smelt and other species. However, the relatively poor tidal wetland habitat quality assessed for the south Delta is consistent with its habitat characteristics for smelts, in particular water clarity. It is uncertain whether or not the south Delta could regain some of the more desirable habitat characteristics.

(Longfin smelt)

- Population effect of reduced winter-spring outflow identified in the effects analysis.

- On line 11 of page 5.5-48 the text raises the notion of "bottlenecks" between lifestages. The examination of existing data does not suggest the existence of such a population dynamics effect. Age 2 fish appear to be suffering the greatest effects of food limitation, but it is still the case that there is roughly a linear stock-recruitment relationship between the two age classes. It should not be assumed that benefits to one lifestage will not be realized in subsequent stages.

  ICF Response: Analyses of species population dynamics available in the scientific literature have identified life-stage bottlenecks that have an effect on setting year-class strength and dynamics. Kimmerer hypothesized a population bottleneck for delta smelt during the summer months based on high levels of population abundance variation earlier in the life history with substantially less variation in abundance of older life stages such that early life stage abundance was not a good predictor of abundance at later life stages. Rosenfield and Baxter also hypothesized that there may be a population bottleneck for longfin smelt. The discussion can be revised to add literature and other support to the notion of a bottleneck between lifestages for a species and acknowledge that benefits of conservation actions for one lifestages may not translate into population level

benefits to later lifestages in the event that a population bottleneck exists (e.g., a density-dependent mechanism).

- The conclusion of “no net effect” with “low certainty” found at line 4 on page 5.5-50 does not quite capture the essence of the accompanying analysis. Although the statement is not entirely unreasonable, it does not capture the notion of species RISK when an easily foreseeable negative outcome is matched against a pretty speculative benefit. Whereas it may suffice in the EA to have a best guess as to the net effect of the project, I think the NCCP will have to grapple with the downside risk of a likely flow impact, which is to be offset by reasonable, but highly uncertain speculation about food supply improvements.

  ICF Response: Adaptive management, coordination with agencies during permitting and design, and maintenance, the risks associated with the project can be reduced and the benefits can be enhanced.

- Section 5.5.2 devotes considerable space to discussing the expansion of subtidal (“suitable”) habitat and its potential benefits. Given the severe decline in species abundance it seems highly unlikely that expanding the amount of this very general habitat type will benefit the species. To be fair, the Plan characterizes this attribute as only a slightly positive benefit.

  ICF Response: Aquatic habitat restoration under BDCP would result in the expansion of access to substantial areas of intertidal, subtidal, and seasonally inundated floodplain habitat. These inundated habitats would also be expected to produce organic material that support the food supplies for longfin smelt and other covered fish species. Although at current levels of population abundance of delta smelt, longfin smelt, and salmonids expansion of access to subtidal habitat may provide little physical habitat benefit food production in these areas but may be important in rebuilding population growth, survival, and abundance of covered fish. The additional access to suitable shallow water subtidal habitat in the future is expected to be greater as population abundance of covered species recovers to higher levels.

FWS BDCP Effects Analysis red flags for March, 2012

Elements marked by an asterisk are provisional, and may change after review of the outstanding Chapter 5 appendices.

Issue Area 1: Incomplete conceptual foundation for the Effects Analysis

***The effects analysis deals with the critical concept of uncertainty inconsistently and does not effectively integrate, use, and report uncertainty in the Net Effects.** The BDCP Independent Science Advisors, the National Research Council review panel, the Delta Science Program panel, and we have all commented on the inherent uncertainty in the scientific understanding of certain aspects of the Bay-Delta ecosystem. This extends to difficulty predicting how the ecosystem might respond to BDCP implementation. Uncertainty needs to be used objectively and consistently, and the appendices and Net Effects need to develop and propagate uncertainty through the threads of the effects analysis. Highly important variation in the value and uncertainty of individual conservation measure features will occur over space and time as a function of implementation strategy and other factors. Many of the current conservation measures and issues are, or appear to be, overly simplified or otherwise superficially analyzed. The list includes OMR management, fish-habitat relationships, the habitat-for-flow trade-off, predator suppression, nuisance vegetation suppression, and others. Each of the foregoing issues raises uncertainties that propagate through the threads of analysis and must be reckoned with in the "net" conclusions. To the extent we can form our own conclusions about the Net Effects without having access to all the revised documents, it appears that inconsistency in dealing with uncertainty has resulted in conclusions that overly optimistically predict Preliminary Project benefits for almost all of the target fish species almost everywhere. As such, we are reluctant to rely on the conclusions of the present effects analysis. We await receipt of the outstanding appendices, and look forward to working closely with our partners to provide technical assistance as these matters are resolved.

> **ICF Response: ICF has attempted to document certainty in multiple ways throughout the EA. For example, the description of each method in each appendix highlights its limitations and assumptions made. We have also tried to explain in the results and conclusion sections the uncertainties associated with the analysis. Also, in Chapter 5, we've attempted to document the basis for each conclusion and its level of certainty. However, ICF acknowledges that additional work can be done to improve this component of the analysis, including a more robust linkage to adaptive management, research and monitoring to address specific areas of uncertainty.**

***A key missing piece from the Analytical Framework document is how the Effects Analysis will be framed in the context of fish population dynamics.** We expected this to occur in the draft Technical Appendix on the subject of fish populations, but that document did not fully analyze long-term and recent population trends in the target fishes. There is clear evidence that most of the covered fish species have been trending downward. The document should clearly and accurately lay out what is known of the foundations of each species' population dynamics (e.g., density-dependent under some circumstances?, trends in carrying capacity?, etc.) as mechanistically as possible and discuss how BDCP actions will influence these processes. Because the conceptual foundations presented to date do not frame the effects in the context of historical and present-day fish population dynamics and the most parsimonious explanations of their causes, it is unclear how the net effects should be interpreted. We await receipt of the life cycle modeling appendix to complete our review of this issue, and look forward to continuing to work with our partners to help ensure that the best available science is used in the effects analysis.

> **ICF Response: Each appendix provides a background on the specific issues associated with that topic. For example, the entrainment appendix describes the historical entrainment trends and how that's affected fish. However, a more comprehensive description of each covered fish species population trends and ecological status could be developed to the extent it is necessary to understand the effects of the BDCP on each covered species. This could be included in Appendix 2.A, Species Accounts. We look forward to discussing with the Agencies ways in which this comment can be addressed with the best available data.**

Issue Area 2: Inadequate conceptual models and analysis of estuarine fish habitat, and project issues resulting from same

***The objectives for restoring habitat addressed in the Chapter 5's Restoration Appendix are simply described, but it is not clear whether the plan will or can achieve them.** The draft Appendix E states that BDCP's habitat restoration has two objectives[1]. The first is to "increase the amount of available habitat for covered fish species." This first objective is reasonable, but does not clearly articulate that new habitat needs to be good habitat. We know quite a bit about what determines habitat value to covered fish species. This knowledge is partly reflected in the habitat suitability indices that are currently under development, but is often discounted elsewhere in the Chapter 5 documents. The habitat for BDCP target fishes, and all estuarine fishes for that matter, is fundamentally created by the interaction of tidal and river channel flows with the broader estuary landscape. The Preliminary Project proposes to extract larger volumes of fresh water from the Delta than are currently exported against a backdrop of rising sea level and a re-design of the estuary landscape that will change tidal flows. Whether this can be accomplished while other parts of the plan simultaneously contribute to recovery of covered species is an unanswered question of central importance. Fully incorporating existing science on the interplay of freshwater flow and the Plan Area landscape and its constituent species would provide more accurate and defensible conceptual models for the Effects Analysis. We also suggest consulting the Department of Interior Adaptive Management Technical Guide and other adaptive management resources on the role of (potentially conflicting or alternative) conceptual models in the adaptive management process. We look forward to working with our partners and providing technical assistance toward the resolution of this issue.

The second objective is "to enhance the ecological function of the Delta." This formulation is not clear. The Delta provides multiple ecological services, and alterations to different parts of the Delta may potentially contribute to them in different ways. There have been several large-scale,

[1] We note that these objectives are more akin to goals. They are not at present specific enough to function as objectives in the context of performance evaluation or adaptive management.

unintentional or quasiintentional "wetland restoration projects" in the Bay-Delta since 1920. These include Franks Tract in the 1930s, Mildred Island in the early 1980s, Liberty Island in the latter 1990s, and Napa River marsh in the past decade to name a few. There is also the seasonal fish habitat generated by large-scale floodplain restoration along the lower Cosumnes River that started in the mid-1990s. The draft appendix never mentions these events or synthesizes what is known about them. This is a critical aspect of the analysis, and needs to be done credibly. We believe these "unintended experiments" provide useful lessons in what we may expect from actions on similar spatial scales in similar circumstances in various restoration scenarios.

A close look at the estimated elevations of restored habitats shows that much of the acreage is not at intertidal elevation and thus will not readily produce the dendritic channel mosaics on a tidal marsh plain that are frequently espoused in the appendix for their fish production benefits. Particularly by the late long-term, there is a lot of the subtidal habitat types in the model outputs[2]. We do not know if unintentional habitat restorations that have occurred have increased the productivity of the Delta beyond what it would have been without them. In a pure carbon-productivity sense they might have – because productivity is just creation of biological carbon per unit of time. However, these and other "wetland restorations" have not noticeably increased the capacity of the Delta to produce BDCP-covered native fishes. As achieving this is a key premise of the BDCP, understanding these examples and learning from what has happened in each case is a matter of great importance. We look forward to providing assistance to our partners as these comments are addressed.

> **ICF Response: a. Regarding the first objective, the HSI approach used measures both the quality and quantity of habitat using habitat units as the unit of measurement. This analysis is based on CALSIM, DSM2, and RMA Bay Delta models that incorporate climate change effects and restoration in the Delta over time so that the effects of changes in flows are captured by the analysis in terms of habitat units. The larger question regarding how flow and habitat restoration interact in terms of effects on covered fish, the information and tools we would need to address this issue in the EA do not exist. Therefore, this needs to be handled with adaptive management, which requires additional coordination to develop sufficient clarity and rigor. We would like to coordinate with the agencies regarding the development and application of conceptual models, as well as a more robust adaptive management plan, to address these issues.**
>
> **Regarding the second objective, ICF has reviewed and will continue to review information available from these unintentionally restored wetlands and incorporate relevant information as appropriate. However, the habitat restoration proposed under the BDCP is substantially more than any other restoration effort implemented before. In addition, BDCP tidal restoration will be purposefully designed to maximize benefits to covered species and minimize adverse effects (e.g., submerged aquatic vegetation), and will rely on adaptive**

[2] It may be possible to manage subsided lands to raise them back to sea-level so that they can support self-sustaining intertidal marshes. However, that process can be very slow and the full realization of potential physical morphology could take many decades.

> **management and information collected from successful restoration sites, such as Liberty Island, to achieve this goal.**

***The modeling shows a gain of shallow, intertidal habitats in the Plan Area by the early long-term, which is a goal of the BDCP. However, it also shows that there is a net loss of intertidal habitat and a large increase in deep water habitat by the late long-term.** The Bay-Delta is not currently limited in terms of deep water habitats, and some relevant historical experience suggests deeper off-channel habitats are likely to be more favorable habitat to exotic species than to natives, so an increase in the depth of restored habitats does not appear to be a desirable outcome. Thus the benefits attributed to creating the proposed habitat acreages may be quite optimistic. We look forward to providing technical assistance on this issue; a good start would be a more in-depth investigation of the expected depth distribution in potentially restored areas in the early and late long-term time periods.

> **ICF Response: The current HSI analysis actually indicates substantially more intertidal habitat than under existing conditions, although there is a decreases in the quality of this habitat as a result of the combined effects of climate change and the BDCP. It describes the depths of habitats that would be created in each ROA and the benefits attributed to the BDCP take these depths into account. However, ICF is currently in the process of analyzing the habitat units Delta-wide using more accurate modeling that incorporates depth based on RMA modeling so that a better comparison of the change in habitat type units can be made. This analysis will be reviewed with the agencies.**

***The effects analysis underemphasizes Bay-Delta water flows as a system-wide driver of ecosystem services to the San Francisco Estuary.** While climate and associated hydrology affect the magnitude of watershed runoff, system hydrodynamics downstream of the big dams (e.g., exports, OMR flows, X2, gate operations, etc.) are largely driven by coordinated water operations. All of these influence the habitats and population dynamics of listed species. It is critical that the BDCP effects analysis identify changes in operations that will importantly alter hydrodynamics, and address in depth the dependency of the ecosystem and its constituent species on flows. Reduction of flows (in full consideration of timing, magnitude, variability) is the most fundamental cause of stress and driver of change to the fishes and food web that have adapted to the tidal and freshwater mixing environment that is the Bay-Delta ecosystem. In addition, some of the other stressors listed and assumed to be addressed through the conservation measures are either directly or indirectly influenced by Delta inflows, exports, and outflows. Until the roles of flows and flow alteration, for which there is substantial literature, are adequately represented in conceptual models and developed in the effects analysis, we are reluctant to rely on its conclusions. We look forward to providing technical assistance on this issue as it is resolved.

> **ICF Response: As described above, ICF looks forward to working with the agencies to develop and apply conceptual models as appropriate. The current effects analysis does include analyses using over 30 different models and methods that link biological effects to changes in flows. Appendix C, Flow, Temperature, Turbidity, and Salinity, describes the methods, results, and conclusions of these models and Chapter 5 attempts to integrate these results into a net effects analysis on each species. ICF looks forward to working with the agencies to revise the net effects analysis to more clearly describe how these**

results interact with the results from other stressors and how together, they form the net effect on each species.

***The Low Salinity Zone (LSZ) is a dynamic habitat defined by the tides and freshwater flow that requires a globally tailored conservation strategy.** It is widely recognized that estuarine habitat suitability is driven by the interaction of a flow regime with a brackish, tidally influenced landscape. Changing this interaction by reducing outflow can set a series of ecosystem changes in motion that degrade expected ecological services. In the Bay-Delta, both the flow regime and the landscape are highly altered, and the Preliminary Project proposes new changes. It is well established that variation in Delta outflow or X2 is correlated with many important ecosystem processes and the abundance or survival of estuarine biota. It is also well established that the most important mechanisms and seasons for species that use the LSZ vary. Chapter 5 does not directly grapple with the conservation implications of these and other relevant facts, arguing that the *mechanisms* causing flow effects on certain fish species are not "well-understood". But the phenomena of species-flow responses are well-developed in the scientific literature. Unless there are concerns about the adequacy of the underlying data, which there may be, flow relationships developed in the scientific literature should be used as the initial basis to predict the effects of changes in flow regime. The effects of flow regime on species and ecosystem processes in the LSZ have been an important subject of study for a long while, and, in addition to their role in the water operations consultations form part of the basis for regulatory processes underway or contemplated by the State Board and EPA. We look forward to working with our partners on resolving the framing of the LSZ habitat analysis.

ICF Response: While outflow is reduced in some months of some years, the biological meaning of these reductions is not always clear, even with the application of existing scientific literature. In the case of delta smelt, we attempted to address this uncertainty in Chapter 5 by including focused studies prior to the new intake operation as well as describing how adaptive limits could be used if needed, to increase fall outflows. We hope to continue discussions with the agencies regarding how to address the Fall X2 issues. However, it is important to understand that changes in water temperatures in the overall Delta are solely driven by atmospheric temperatures and therefore delta smelt will experience increased exposure to lethal and sublethal temperatures even without the BDCP. Regarding longfin smelt, we are looking much more closely as how outflow interacts with this species to more clearly examine the actual changes from the project and how those translate into a biological change. Similarly, we are taking into account the changes in migration flows for other species. We look forward to working with the agencies once we have information to share on this topic to discuss how the project might be modified to provide adequate flows. Additionally, we are currently working on a revised analysis of changes in turbidity.

***The Low Salinity Zone (LSZ) is the primary habitat for delta smelt and the primary rearing habitat for larval longfin smelt and juvenile to adult splittail.** The Preliminary Proposal modeling indicates that Delta outflows during February-June will more frequently be near the minima required by the SWRCB under D-1641. This will represent a substantial negative project effect on longfin smelt. The effects analysis and Net Effects only partly address this issue, reporting that Preliminary Project is expected to provide a large, positive impact to food resources that will offset the negative impact to “transport flows”. But there are multiple mechanisms by which Delta outflow can affect longfin smelt recruitment; transport flow is only one of them. Transport flows might be managed via gates or other engineering solutions. The other mechanisms for which there is stronger scientific support are kinetic energy mechanisms (low-salinity zone habitat area and retention from gravitational circulation in the estuary). The problems that reduced outflow creates by changing these processes do not have reasonable engineering solutions, and at present appear to be manageable only via outflow. Thus, although some of the potential impact of outflow reductions is reported, the analysis is too narrowly focused.

Both projected sea level rise and the Preliminary Proposal are also anticipated to cause the average location of X2 to move upstream during the summer and fall. The modeling indicates that intra-annual variability would be lost for several months in the late summer and fall in all water year types; even wet years would functionally become dry years for a third of delta smelt’s life cycle. The effects analysis acknowledges this result, but the Net Effects concludes that habitat restoration and food web enhancement will greatly offset this loss of habitat value. The conclusion is in part speculation and in part does not reflect current scientific understanding.

This has several implications for delta smelt. First, under the preliminary project delta smelt habitat would less frequently lie in Suisun Bay and Marsh during summer and fall. The habitat suitability modeling shows that this would limit the capacity of tidal marsh restoration in the Suisun region to contribute to delta smelt production. Second, lower summer outflows would increase the length of time that seasonal delta smelt habitat constriction occurs and overlaps with physiologically stressful water temperatures. This means that more food production would be required to maintain current delta smelt growth and survival rates, even in areas where temperatures remain suitable. In areas where temperatures exceed physiologically suitable levels during the summer (~ 24°C), no amount of food production will increase growth or survival rates. Third, the restricted distribution of delta smelt during most summers and essentially all falls would increase the chance that a localized catastrophic event could pose a serious threat to the survival of the delta smelt population.

Turbidity is another important component of delta smelt habitat suitability. Section C.4.1.4 (“Turbidity”) states: “[f]irm conclusions regarding changes in turbidity in the BDCP Plan Area are difficult to make.” But some large-scale changes in sediment fluxes might affect turbidity on scales important to smelt, and should be straightforward to analyze. The Sacramento River is the most important contributor of sediment to the Bay-Delta. According to the Effects Analysis it contributes an estimated 80% of its load during high flow events. The North Delta diversions in the Preliminary Project have the ability to take up to 15,000 cfs during high flow events. For a 70,000 cfs event, this could be 20% of the Sacramento River water including its suspended sediment load. The effects analysis makes no attempt to analyze how much sediment loss per year that would represent and whether it would change the ratio of supply to loss of sediment from the estuary. The same calculations should be done for the south Delta to give the results full context.

In summary, the current Effects Analysis does not appropriately deal with critical issues involving the role of the Low Salinity Zone as habitat for longfin smelt, delta smelt, and splittail. Until it addresses the right questions regarding flow, LSZ location, and turbidity, we are reluctant to rely on its conclusions. We look forward to working with our partners as these issues are resolved.

ICF Response: Same response as above.

***There is no reason to expect that invasive vegetation will not proliferate in the East and South Delta ROAs, and no reason to expect a meaningful increase in south Delta turbidity if vegetation could be successfully controlled.** There should not be an a priori assumption that SAV can be controlled via ecologically sound methods in the east, central and south Delta. These are comparatively low turbidity, high vegetation areas already, under the existing hydrodynamic regime. There is nothing in the Preliminary Proposal that would dramatically change channel geometry, increase SJR flows, or increase sediment inputs that could be expected to change the turbidity of the entire southern half of the Delta.

ICF Response: A quantitative analysis is being undertaken to examine the issue of reduced sediment input from the Sacramento River in relation to the proposed north Delta intakes. ICF agrees that a full analysis of this issue would include consideration of inputs from other tributaries such as the San Joaquin River and will investigate the potential to do so following completion of the Sacramento River analysis.

***Chapter 5 is deficient in its descriptions of channel margin, riparian, and floodplain habitat restoration outside of Yolo Bypass.** The Yolo Bypass tends to benefit native fishes because (1) it floods frequently with major inundation events; (2) it floods during times of year that BDCP target fishes can, and have evolved to, use it; and (3) upon drying it leaves very little permanent habitat for non-native fishes to colonize and reproduce in, because most non-native fishes are late spring/summer spawners. The original habitat analysis attributed seasonal floodplain benefits along the San Joaquin River that we do not believe are plausible; however, we understand there is now general agreement on this point and we will not comment on it further. However, the Sacramento River from Sacramento to about Rio Vista is also highly constrained, in this case by levees rather than regulated hydrology, and there are strict flood control capacity requirements that are enforced by USACOE. The effects analysis does not describe how this constrained reach of the river can support the proposed changes, where they will be, or assess their feasibility.

ICF Response: The January 2012 version of the habitat appendix (Appendix E) did not include an analysis of floodplain or riparian habitat restoration benefits. The revised appendix will include this analysis. If the comment is in reference to the conservation measures themselves, we can work with the agencies to identify more specific areas where this restoration can occur to both benefit covered fish and avoid interruption to the flood control system.

***Increased residence times and reduced flushing of the Delta by Sacramento River water appear likely to result in interior-Delta channels that are further dominated by agricultural runoff, invasive aquatic vegetation, warmer temperatures, and increased algal productivity with its associated dissolved oxygen swings.** These environmental conditions favor non-native/invasive species (e.g. *Egeria densa*, largemouth bass, water hyacinth, *Microcystis*) and disfavor native fishes. The Delta is already more biologically similar to a lake than it once was, due to the historical accumulation of human modifications. We expect that by reducing Delta flows, the Preliminary Project would likely facilitate the spread of habitat conditions that are unfavorable to delta smelt, and and less favorable to other target fish species survival and recovery.

ICF Response: There may be potential adverse effects related to increased residence times, but there may also be beneficial effects such as increased production of phytoplankton that result from increased residence times. ICF will consult with DWR and the fish agencies in order to determine the elements needed to produce a more robust characterization of potential changes in estuarine habitat that may be caused by residence time changes.

Issue Area 3: The Effects Analysis relies on selective use and interpretation of statistical and mathematical models

***The effects analysis did not use the available splittail life cycle model at all to support its Net Effects conclusion.** There is a published stage-based life cycle model for splittail where the effects of various environmental variables were examined for their effects on long-term trajectory of population abundance. This model helped frame the preferred time-interval for floodplain activation necessary to ensure splittail persistence in the Central Valley. This available approach to an Effects Analysis for a listed species of native fish was not discussed in the present Effects Analysis.

ICF Response: This comment was provided to ICF on the life cycle models appendix in December 2011. This appendix is currently under revision and we are currently working on how to incorporate more and better models for all of the covered fish species, including the splittail model. However, many of the life cycle models currently available are limited in their application to the effects analysis because they cannot easily (or at all) incorporate a changed configuration of the Delta, as is proposed by the BDCP. ICF agrees that the splittail model developed by Moyle et al. (2004) was a useful effort to characterize population dynamics of the species. However, aspects of that model pose significant challenges for its use in the BDCP effects analysis. As noted by Moyle et al. (2004: 36), "While the model can be made to simulate population dynamics that mimic the natural situation, actual numbers for mortality and survival rates are lacking for the most part, so it is hard to distinguish among various sources of mortality." To our knowledge, such data shortcomings remain for splittail.

Further, Moyle et al. (2004: 37) noted that the ability of the model to estimate consequences of entrainment loss of splittail at the south Delta pumps would require the model to be sectored into spatial segments. South Delta entrainment is an important example of a stressor that would be changed because of BDCP. The required model restructuring would be a substantial effort that may be challenging to apply, given the lack of proportional entrainment loss estimates for the species. We also note that the model uses year type as a proxy for changes in spawning habitat availability and therefore does not estimate the effect of increasing inundated floodplain acreage at a given flow, which is a potential important effect of BDCP with respect to splittail.

In conclusion, ICF will acknowledge the model's main findings in the life cycle models appendix and the net effects analysis; however, without significant additional efforts to further refine the model, its application in the effects analysis would be challenging and is unlikely to alter the main conclusion for this species, i.e., that BDCP has the potential to produce substantial benefits based primarily on increased floodplain availability. However, ICF will continue to investigate the applicability of the splittail model, and other life cycle models, for use in the effects analysis.

***The effects analysis did not use the best available longfin smelt statistical models to support its net effects conclusion.** The newest published statistical analyses of longfin smelt are quasi-life cycle models that account for prior abundance and spring flow influences (among other factors) on this species. These models were discussed and discounted as not being 'life cycle models'. Dismissing them because they are not 'life cycle models' is unhelpful: they are the best available scientific tools to evaluate project effects on longfin smelt. The older regression models that were used in the effects analysis are published, but can easily be shown not to perform as well as the newer models. The older models also average the flow influence on longfin smelt across half a calendar year, which likely affects conclusions about the reduction in springtime outflow seen in modeling outputs for the Preliminary Proposal. We look forward to working with our partners and providing technical assistance as this issue is resolved.

ICF Response: In developing the effects analysis for longfin smelt consideration was given to three types of statistical approaches that included (1) simple linear regression analyses that had previously been published in the literature depicting relationships between average Delta outflow and/or X2 location during the late winter and spring months and subsequent indices of fall abundance; (2) more sophisticated statistical analyses of various potential covariates on indices of longfin smelt abundance at various life stages; and (3) statistical lifecycle models depicting the effects of various covariates on the abundance and survival of longfin smelt over their lifecycle. In reviewing the various approaches and supporting data and information consideration was given to using multivariate statistical analyses such as those developed by Thompson et al. (2010) and Mac Nally et al. (2010). These analyses, however, focus on individual life stages of longfin smelt and do not reflect the species lifecycle. In addition, these statistical models include a number of covariates (e.g., indices of zooplankton food supplies) that have been based on prior monitoring but are uncertain in the future. The effects of BDCP actions such as changes in hydrodynamics can be predicted using existing tools such as CALSIM which are compatible with the simple outflow vs. abundance relationships and were used in the analysis. Analytical tools are not available to predict the response of many other covariates such as the ability of BDCP tidal habitat restoration to produce quantitative estimates of zooplankton densities available as a food resource for various lifestages of longfin smelt in the future. Similarly, although there are currently several efforts underway to develop statistically based lifecycle models for longfin smelt no lifecycle model exists that could be applied to the Effects Analysis. In addition, many of the lifecycle model statistical analyses also include various covariates that will be difficult to predict as a response to BDCP

conservation actions. As a result of the difficulties in predicting many of the needed covariates that may respond to BDCP actions in the future and the lack of a lifecycle model that could be applied to the longfin smelt analysis these approaches (2 and 3 above) were not used in the longfin smelt effects analysis.

We agree that additional consideration can be given to refining the simple regression approach by using more biologically meaningful seasonal time periods, alternative sample data to develop indices of population abundance (e.g., CDFG bay otter trawl collections), and other refinements to the statistical tools. Further consideration can also be given to the use of focused sensitivity analysis of the multivariate covariate statistical tools to inform the range of uncertainty in the effects of various levels of response of zooplankton populations and other covariates to future BDCP actions. Further consideration can also be given to various focused experimental and monitoring efforts that could be implemented in the near-term to provide better information on the response of longfin smelt and other covariates to changes in environmental conditions such as Delta outflow. Consideration can also be given to results of longfin smelt lifecycle model analyses in the near-term when they become available and can be used as a basis for further qualitative and quantitative analysis of the potential response of longfin smelt to BDCP actions. We look forward to participating in discussions with BDCP partners to discuss these and other potential analyses and additional data collection efforts that can be conducted over the near-term to improve the Effects Analysis for longfin smelt.

***The effects analysis continues to insist on an analytical approach to entrainment that does not reflect the best available science.** The current Draft Effects Analysis (as of September 13, 2011) downplays the potential effects of entrainment to the delta smelt population: (e.g., Section B.1.1.1), “[H]owever, analyses to date have not found correlation between entrainment and population level responses of delta smelt ...” The delta smelt population is now at historically-low abundance and population losses due to entrainment may have significant population effects depending on their magnitude and frequency. While it is true that some regression-based analyses have failed to reveal an export affect to the delta smelt population, other approaches that more effectively investigate the role of fish distribution to entrainment have revealed an important relationship between water operations and the risk of population-level entrainment effects to delta smelt. Kimmerer (2011) demonstrated that entrainment losses averaging 10% per year can be “…simultaneously nearly undetectable in regression analysis, and devastating to the population.” We look forward to working with our partners to ensure that the best model-based analyses of proportional entrainment for both South- and North-Delta diversion facilities are brought to bear to resolve this issue.

ICF Response: The revised appendix (March 2012) incorporates a regression that reflects the FWS’s 2008 approach while also adjusting per Kimmerer 2011. Additionally, the appendix more clearly describes the various studies that have been performed relative to the relationship between entrainment and delta smelt. While there are no statistically established links between delta smelt abundance and entrainment, there is an appendix dedicated to entrainment in which delta smelt are thoroughly analyzed.

***We think that the delta smelt state-space model is a useful framework to explore hypotheses about what drives delta smelt abundance.** However, the Maunder-Deriso model is a new application that needs additional collaborative work before it reaches maturity. We are concerned that the present model may have identifiability problems, as we discussed in our technical comments last fall. Until that concern is resolved, we are unsure whether the parameter estimates developed in that model represent what they are described to represent. We are also unsure why the model uses the official DFG Fall Midwater Trawl Abundance indices for delta smelt, but does not use the official DFG Summer Townet Survey or 20 mm Survey abundance indices. The rationale for this (which may be simple) is not explained. The model also assumes a specific form of density dependence between generations. We have questioned the appropriateness of this choice, because on very thin ground it limits the universe of plausible explanations for delta smelt reproductive success that can be derived from the model.

The intent of this new model was to explain a specific historical dataset, and other than some broad assumptions it does not contain much of the mechanism presented in current delta smelt conceptual models (like DRERIP, or POD conceptual model, or the Fall Outflow Adaptive Management Plan conceptual model). The published version of the model used data through 2006. The model was updated for the Effects Analysis to include data through 2010. When this was done, the model fit deteriorated dramatically relative to what was reported in the paper. While this does not (at all) cause us to think it should be discarded, it does underscore questions about the maturity of the tool. The current model's success in fitting a specific set of historical data may not translate to good predictions of the the effects of flow and habitat change. The current model may perform still more poorly when CALSIM II water operations outside the envelope of historical experience are used as input.

It is important for the Effects Analysis to acknowledge that some data that may prove to be essential to modeling delta smelt or longfin smelt dynamics have been collected only recently. There are a number of studies now underway that address questions about fall outflow processes and delta smelt ecology as a whole. The novelty of the Maunder-Deriso model, and existence of other tools and analyses taking a process-oriented approach to to predicting the effects of flow and habitat changes, make the framing of the effects analysis very important. It is equally – possibly more – important that uncertainty at all levels be properly developed and acknowledged. Achieving these things, which are important to having an effects analysis we can rely on, will require work and a willingness to adapt on the part of ICF. We look forward to continuing to work with ICF and our other partners to ensure that the best science is identified and used defensibly in the effects analysis.

> **ICF Response: ICF is currently coordinating with the model developers, to establish a mechanism for further review of this model as well as running sensitivity analyses to better inform the effects analysis. ICF also agrees that new information is constantly emerging that must be incorporated into the effects analysis, but just as important-or more so-must have a framework for incorporation into implementation of the BDCP. ICF looks forward to developing that framework in collaboration with the agencies to ensure a process is in place to utilize new information to benefit covered species throughout the life of the plan.**

<u>Issue Area 4: The BDCP's net effects conclusions rest on an equivocal food web conceptual model</u>

***The FWS agrees that the pelagic food web that historically supported greater abundance of estuarine fishes including longfin smelt and delta smelt has been impaired and that contributing to its restoration is a key component of a conservation strategy for the Bay-Delta. However, food limitation is a ubiquitous feature of ecology in the Bay-Delta.** It affects non-native species as well as the BDCP target species. Thus, the issue is not really "food limitation" *per se*. Rather, the issue is food web pathways and the number of steps in a food chain between primary producers (phytoplankton and plants) and the BDCP covered fishes. For the smelts, the desired food pathway would be dominated by this short food chain: diatoms → calanoid copepods and mysids → low-salinity zone fishes. The short food chain outlined above dominated the historical low-salinity zone food web. Longfin and delta smelt are highly dependent on it (and minor variations of it). The other BDCP target fishes also use it, but have more generalized diets that often include benthic organisms and riparian and floodplain insects. The draft appendix has a very long section on food web changes when a simpler summary of the major points would be more effective.

The focus of food web restoration in the effects analysis is on floodplain and tidal marsh restoration. The production of diatoms may have been limited by disconnecting floodplains from their rivers and by reclaiming tidal marshes. These are the primary hypotheses behind the BDCP habitat restoration conservation measures. However, the two best-substantiated drivers of diatom suppression are overbite clam grazing and ammonium concentrations in the estuary. The suppression of diatoms is hypothesized to have provided a competitive advantage to lower quality primary producers and primary producers like *Egeria densa* and *Microcystis* that have virtually no food web value to the BDCP target fishes. This change in the base of the food web has reduced the amount of fish production that can be supported by the historical diatom-based food chain, and forced the fish to rely on other longer and more energy-limited food pathways. Longer food chains are less productive, and do not support as many fish. Because splittail and young Chinook salmon are the covered species that most extensively utilize floodplains and tidal marsh networks, they should be expected to gain the greatest food web benefits that restoration of these habitats can provide. However, this is not what the Net Effects concluded. Rather, it concluded that habitat restoration would provide *greater* benefit for the smelts despite their limited overlap and more restricted diets.

Shortcomings in the Net Effects resulting from mischaracterization of processes limiting transfer of production in new habitat areas to native fish biomass renders the present analysis inconsistent with best available science, and we are reluctant to rely on it to judge the design of the preliminary project. As with other modeling issues, we look forward to working collaboratively with our partners as these issues are resolved.

> **ICF Response: The key role of clams on the delta food web is discussed extensively in the effects analysis. The role of ammonia is acknowledged though its source is presently beyond the scope of the BDCP. The discussion of food web effects is currently under revision and will include discussion of these issues to be as clear as possible how these factors interact with the food productivity potential for BDCP. In regard to the differences in food selection between smelt and salmon and the relative differences in response in the HSI, it is important to**

regard each of the HSI models as independent---comparisons of response between species is not appropriate as rating curves have been established for each species independently and there is no attempt to calibrate response between species. The limitations of the existing analysis are acknowledged in the effects analysis.

While multiple observers have noted the desirability of a more complete food web analysis, no method has been advanced. Most observers acknowledge that the limited quantitative analysis in the effects analysis must be combined with a firm qualitative analysis and discussion that addresses these limitations and reaches qualitative conclusions regarding the benefits of restoration on the food web.

Issue Area 5: The analysis and interpretation of BDCP are hindered by indeterminate model baselines and related issues

***A key point of continuing analytical confusion is the use of multiple baselines.** The current set-up for the BDCP employs two 'base case' model runs (EBC1 and EBC2). The EBC1 does not include the full suite of elements in the current FWS and NMFS OCAP RPAs. The EBC2 attempts to include the RPAs in their present-day form, but it does not accurately capture them all. There are numerous cases in Chapter 5 where it is not clear what Project model result is being compared to which baseline condition. This generates confusion. We look forward to continuing to work with our partners to be sure that baselines used in the effects analysis are appropriately constructed and are used clearly and correctly.

ICF Response: Please clarify what is meant that not all components of the RPA are 'adequately captured' in EBC2. Also, ICF will strive to be as clear as possible regarding which baseline is used for comparison in Chapter 5 and its appendices.

***CALSIM II demand representation in 2060 studies should have some justification.** Some explanation for, or error estimate of, assuming a 2020 level water demand for a 2060 climate change simulation should be made. Presumably portions of the State (Southern California, the American River Basin, etc.) are going to continue to grow through 2060. Some estimate in the change of cropping patterns over the 40 years (2020 – 2060) should also be made (or at least a write-up of why it cannot be made) should be included. Without clear resolution of this issue, it appears to us that the modeling may underestimate water demand in the late long-term. We are unable to provide technical assistance on this issue, but look forward to its resolution.

ICF Response: a. The water demands in the CALSIM II model are based on 2030 projected level of development. The Sacramento Valley hydrology used in the CALSIM II model reflects 2020 land-use assumptions associated with Bulletin 160-98. The San Joaquin Valley hydrology reflects draft 2030 land-use assumptions developed by Reclamation.

The water demands for Late Long-Term (Year 2060) conditions are assumed to remain the same as those at 2030 level in CALSIM II, because the demands assumed for 2030 level of development in CALSIM II for both CVP and SWP are already at the full build-out for the contracts. CVP and SWP agricultural demands south of the Delta are fixed at maximum contract amount and do not

vary year to year. Full Table A water demands are assumed for the SWP contractors. Also, full water rights are assumed for the water rights holders to account for future growth. In CALSIM II, only the demands assumed in the north-of-the-Delta are dependent on land-use as reported in the Bulletin 160-98. The implications of the resulting changes in the water deliveries on the current land use are evaluated in the Socioeconomics chapter of the EIR/EIS.

***The proposed restoration in each "Restoration Opportunity Area" (ROA) is only compared against the lands bounded within the ROAs, which themselves lie in larger regions.** These comparisons of present-day ROA habitat to future ROA habitat are inappropriate – especially in cases like the east and south Delta ROAs, which are currently dry land. Mathematically, if a terrestrial habitat is subsequently flooded, the improvement for target fishes increases by an infinite percentage even if the habitat performs poorly because a habitat suitability index that is even a tiny fraction of 1 is still infinitely higher than zero, which is the suitability of dry land to fishes. Habitat analyses need to be based on comparisons against currently available aquatic habitat acreages in the entire regions containing the ROAs. They also need to be synthesized and integrated into Plan Area-wide totals, with river flow and climate changes incorporated, in order for the analyses to be meaningful.

ICF Response: ICF is currently revising the HSI modeling to include the entire Plan Area to address this concern. We have been working with the agencies to also adjust the curves used for each species and together, these refinements should substantially improve the analysis of habitat restoration.

NMFS List of Issues Unresolved in BDCP Administrative Draft

(4/2/2012)

- **Hood Diversion Bypass Flows**

  The Effects Analysis of the Preliminary Proposal (PP) raises concerns over reduced flows downstream of the North Delta diversions, especially in winter and spring months. These flows relate to:

  A. Increased frequency of reversed Sacramento River flows at the Georgiana Slough junction. The January 2010 PP rules included a provision that north Delta pumping would not increase these reverse flows. Calsim II results provided by CH2M-Hill indicate that the PP will increase the percent of time Sacramento River flows are reversed, causing increased entrainment of juvenile salmonids into the Central Delta. If the frequency of reverse flows increases due to the PP, then the diversion amounts allotted under the PP could not be implemented. The DSM2 analysis of reverse flows in the DPM suggests that tidal marsh restoration in the Delta will nearly offset both the effects of sea-level rise and large water diversions from the Sacramento River, a conclusion which needs much more explanation in the EA (see comment on tidal marsh effects).

  B. Long-term viability of sturgeon populations. There are concerns that Sacramento River flow reductions will impact the reproductive success of white and green sturgeon, which have been documented to produce strong year classes mostly in years with high flows in April and May (AFRP study). We do not know if this has been addressed in revised Appendix C.

  1. Further explanation and analysis of the reverse flow issue.

  2. Work with the Services to find a diversion scheme that is still likely to be permittable after adequate modeling and analysis has been conducted.

  > **ICF Response: We agree and will work to better explain this issue and work with the fish and wildlife agencies to find a diversion scheme that can move the project forward.**

- **Salmonid Net Effects**

  All salmonid species are grouped together, with no separate evaluations for the separate ESUs of Chinook salmon or for steelhead. It is important for the net effects analysis to describe individual ESUs/species, and provide full consideration of the life-history diversity and timing exhibited by each ESU/species. We also need the Sacramento River populations and San Joaquin populations for Spring-run Chinook, Fall-run Chinook, and Central Valley steelhead summarized by river basin, prior to the roll-up by ESU/DPS. Steelhead life-history and ecology especially warrant a separate evaluation. “Net effects” is useful for comparing alternative operations, but will not provide the robust effects analysis needed for ESA purposes (see comment on ESA baseline).

  Separate all Chinook by ESU, by San Joaquin and Sacramento populations, and separate steelhead in all analyses and discussion.

ICF Response: We agree as was noted in the Chapter 5 Admin Draft. We plan to work closely with the fish and wildlife agencies to develop separate analyses for each salmonid run and, where appropriate, each population.

- **ESA Baseline, Future Conditions, and Climate Change**

In order to conduct the ESA jeopardy analysis on the PP, the baseline condition and projections of future baseline conditions, including effects of climate change, need to be re-written to be consistent with the 2009 Biological Opinion and current case law. ESA regulations define the environmental baseline as "the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process." Implicit in this definition is a need to anticipate the future baseline, which includes future changes due to natural processes and climate change. For the ESA jeopardy analysis we add the effects of the proposed action to the environmental baseline to determine if there will be an appreciable reduction in the likelihood of survival and recovery of the species (by reducing its reproduction, numbers or distribution).

Upstream effects associated with climate change need to be in the baseline and future conditions, with any effects of the project (in the Delta or associated with upstream operations) added to that future condition to determine jeopardy. A project proposed in this type of baseline conditions needs to more than offset its effects in order to alleviate a jeopardy finding.

ICF Response: This is an issue that legal staff from the fish and wildlife agencies should address with DWR legal counsel. It is critical that this issue be resolved quickly because of its implications for the effects analysis.

- **Analysis of Water Temperature Impacts**

Lethal and sub-lethal water temperature thresholds need to be examined at a finer scale. Currently the effects analysis relies heavily on a Reclamation water temperature model which can only estimate monthly values, which have limited value for predicting project effects on fish. In addition, the effects analysis has only presented frequencies of temperature threshold exceedances, while the magnitude and duration of exceedance is also very important. We do not know if this has been addressed in revised Appendix C.

1. Provide tables and probability plots of magnitude and duration of temperature exceedances at certain upstream locations, by water year type and month.

2. Technical discussion with Reclamation and CH2MHill about how to post-process data.

3. Investigate the use of SWFSC's Sacramento River temperature model to predict project effects and make hindcasts of empirical temperatures.

4. Investigate the use of the new American River temperature (and storage and flow?) model

ICF Response: Regarding the additional temperature exceedences analysis, this comment was also made on Appendix C and we would like to further discuss how this analysis would contribute to the overall net effects analysis and how it could be done in a way that is clear and useful. ICF will work with the agencies to determine the potential application of the SWFSC and American River models.

- **Assumption of Habitat Restoration CM Success**

  In several places, the EA assumes that adverse impacts of the PP will be offset by unsubstantiated benefits of habitat restoration. The EA assumes that all restoration will be successful and work as predicted, with little or no evidence to support this prediction and no attempt to analyze the potential outcomes of less than perfect success.

  1. It is imperative to avoid language such as "This conservation measure will...", because the anticipated CM outcomes are based on conceptual thinking, not execution. To be able to comprehensively think through the adaptive management and monitoring plan, implementers need to try to anticipate a range of responses that must be managed in order to be prepared for the uncertainty of the response.

  2. Alternative outcome scenarios should be evaluated to bracket the range of possible outcomes from proposed habitat restoration.

  ICF Response: We can be clearer about the assumptions that create the foundational analysis of habitat restoration benefits. With little empirical data, no site-specific plans, and a long-term planning period, even ranges of potential outcomes would not provide more meaningful analysis. However, we can be clearer that a range of outcomes can be expected, and develop the adaptive management plan, including monitoring and research, to address those outcomes. We can work with the agencies to describe what that potential range may be. We can also clarify that the success of restoration effects is expected to increase over time as more projects are implemented and we learn from each project.

- **Overreliance on Real-time Operations and Adaptive Management**

  In several places, the EA assumes that adverse impacts of the PP will be fully resolved through the implementation of real-time operations and adaptive management. This may not always be possible. For example, long-term trends towards reduced carryover storage may not be able to be mitigated using real-time operations. How adaptive management might work in this situation has not been fully assessed. There are going to be limitations on what adaptive management and real time operations can accomplish.

  Examine recent (five to ten years) real-time management of the cold water pool in Shasta Reservoir to determine both the effectiveness of real-time operations and a range of adaptive management options.

  ICF Response: We agree that recent years can be evaluated to determine how well cold-water pool and temperature standards in upstream areas can operate. Additionally, we propose exploring the inclusion of upstream temperature

controls in the modeing of the effects analysis to reduce uncertainty of these effects and to offset CALSIM's modeling approach to better reflect the actual operations of the project.

- **North Delta Diversion Effects**

  Mortality rates from predation and other screening effects are difficult to predict, as there is a high level of uncertainty associated with predation and other effects on juvenile salmonids. The estimate of <1% loss at all 5 screens is not sufficient without giving additional consideration to higher estimates of mortality (GCID empirical studies showed a 5% per screen loss rate, much higher than the <1% used in the DPM).

  1. Bracket the analysis of screen related mortality around a 5% per screen loss assumption.

  2. Investigate the use of DWR's hydrodynamic model to assess local flow alterations at the proposed diversion structures, including the creation of predator holding areas. Specific questions are whether the model can simulate on-bank structures and the additional hydrodynamic effects of active pumping.

  ICF Response: We would like to review and discuss with you the empirical data from GCID to develop the appropriate range of predation that should be evaluated for the north Delta intakes.

- **Predator Control Conservation Measure**

  We agree that predation is a significant risk factor to the listed species, but the assumed positive results of this CM are questionable and unsupported **(see F.5.4.1.4 in Appendix F).** As an example, localized control of striped bass may not be feasible as this species exists throughout the Plan area and are highly mobile. Few specific details have been presented on how the CM will be implemented, and an aggressive predator removal program could result in significant incidental take of listed species. Due to the high level of uncertainty, we find it very unlikely that we could rely on this measure for any benefits during the permit process.

  Remove this CM measure from the plan, and move it to an experimental research program and link to adaptive management. Reflect this appropriately in the EA.

  ICF Response: We propose discussing with the agencies which areas are most important targets for predator removal and further develop a description to reduce uncertainties about its effectiveness in those key areas.

- **Delta Passage Model**

  DPM is used as the sole predictor of smolt survival in baseline and PP scenarios. However, the assumptions, inputs, and results are still being validated and reviewed. The datasets used in this model are very limited and largely based on results from hatchery late-fall run Chinook, which are then being applied to other runs of Chinook.

  Continue refinement and development of DPM. Weigh validity of results against those of other models and relationships. The use of Newman, 2003 may be another tool to use for assessing the survival of fall and spring run smolts through the Delta.

ICF Response: We agree and appreciate the collaborative nature in which we've been working to move this analysis forward. We will investigate the use of Newman 2003.

- **Deficient Analysis of Fry Passage/Survival**

  Because the DPM model is only for smolt sized fish, the salmonid analysis is insufficient as it provides no information on fry-sized salmonid passage/survival.

  Add qualitative analysis of fry survival based on best available data. Perhaps add time/added mortality to a modified version of an updated DPM model.

  ICF Response: We agree and recently submitted the revised Flow Appendix (Appendix 5.C), which included a new model (Yolo Bypass Fry Growth) for analyzing the differences in survival and growth among scenarios. Although this model is currently specific to fall-run Chinook, it could be expanded to all salmonids. ICF looks forward to continued collaboration on this effort.

- **PTM Runs Inadequately Capture Altered North Delta Hydrodynamics**

  PTM model runs did not include conditions in which ND diversions would be at the upper limits of allowable pumping (high proportion of total river flow). The technical memo from NMFS and USFWS highlighted the issue and the resolution to the problem. We will need additional modeling runs to adequately assess ND diversion impacts on salmonid travel time and route entrainment.

  Do additional PTM analysis following guidelines outlined in NMFS/USFWS memo.

  ICF Response: We plan to work with the agencies to develop more informative PTM runs for this issue as well as others in the north Delta subregion (i.e., agricultural diversions).

- **D1641 Export/Inflow Ratio**

  Combined north and south Delta exports under the PP exceed the current D-1641 Delta Export/Inflow standard. (The PP calculation method measures Sac River inflow below the North Delta diversions and does not include ND diversions as part of total exports).

  1) Provide summary analysis of differences between PP and EBC by month and water year type using alternate E/I calculations.

  2) Show resulting flow data for both calculation methods.

  ICF Response: We will work with the agencies to develop this analysis.

- **Yolo Bypass**

  Yolo Bypass has great potential for fisheries benefits, but the current EA may be overstating the benefits without adequate studies or data to support these conclusions. Without project specific plans to help quantify the effects, concerns remain about issues such as sturgeon passage, juvenile salmonid survival under lower flow regimes, ability to get juveniles into the floodplain through notch and reduction of flows in the mainstem

Sacramento River to accommodate additional flooding in Yolo Bypass. Also, some races/runs of salmon may not have access to Yolo Bypass.

Provide project specific plans and consider the risks of managing the floodplain under lower flows related to issues above.

ICF Response: Project-specific plans for the bypass have not yet been developed, but through adaptive management, coordination with agencies during permitting and design, and maintenance, the uncertainties associated with CM2 can be reduced. Additionally, we propose exploring a sturgeon rescue program as part of this CM to ensure reduced uncertainities.

- **Channel Margin Habitat**

Altered flows resulting from the North Delta diversions may result in reduced water levels affecting the percentage of time that current wetland and riparian benches are inundated.

Compare anticipated water levels under future scenarios with those in the design documents of restored wetlands and riparian benches to analyze potential dewatering of those features.

ICF Response: We agree and this analysis is included in the revised Appendix C.

- **Construction and Maintenance Impacts**

The EA does not adequately address the potential for adverse impacts on sturgeon, fall-run Chinook adults, and steelhead adults, which are generally present in the project area during the proposed in-river work windows described for construction and maintenance of North Delta facilities.

Discuss ways of minimizing impacts and implementing mitigation for species not protected by work windows.

ICF Response: We can discuss additional methods for minimization besides restoration.

- **Tidal Marsh Impacts on Riverine Flow**

The effect analysis assumes that restored tidal marsh will act to decrease flow reversals, which has not been well explained. It seems that tidal marsh restoration was modeled as a single configuration; there has been no description of that configuration to indicate how they were implemented in the hydrodynamic models. Therefore, there is a lot of uncertainty regarding model results.

Document changes to hydrodynamic models that were implemented to characterize tidal marsh restoration.

ICF Response: While some information will not be made available to the public, and therefore won't appear in the EA, we have substantially expanded the discussion of assumptions and modeling efforts used for the analyses. Some of this information is in the revised App C.

- **Cumulative Effects Show Long-Term Viability Concerns for Salmon**

  The analysis indicates that the cumulative effects of climate change along with the impacts of the PP may result in the extirpation of mainstem Sacramento River populations of winter-run and spring-run Chinook salmon over the term of the permit.

  1) Incorporate operational criteria into the PP that will protect and conserve suitable habitat conditions in the upper river for the species under the 50 year HCP (these operational criteria should be designed to meet the performance criteria in the NMFS BiOp RPA).

  2) Convene a 5-agency team of experts specialized in Shasta operations and temperature management to develop the above described operational criteria.

  ICF Response: As NMFS and others have pointed out, the projected adverse temperature regimes under both existing conditions and the PP in early and late-long term, are unlikely to occur under current real-time operation practices. As a result, the potential cumulative effect of both climate change and the project may be misinterpreted. As described above, we would like to discuss the inclusion of temperature controls in the modeling, which would likely eliminate or substantially reduce the actual likelihood of BDCP contribution to extinction, and may help to offset some of the climate change effects under some circumstances.

- **Holistic Estuarine Evaluation**

  The effect analysis should examine synergistic and cumulative ecological impacts associated with reducing inflows to an estuary that is already severely degraded, and discuss the importance that water quantity, quality, and the natural hydrograph have to the ecosystem, as well as the direct impacts on native fish species. So far, the impacts to fish have mostly been examined in a piecemeal fashion (e.g., examining impacts of flow reduction on adult homing).

  Incorporate a holistic evaluation of impacts on the estuarine ecosystem. Include discussion of the importance of water quantity, quality, and the natural hydrograph to the ecosystem, and the direct impact that changes to these conditions have on native fish species.

  ICF Response: We would like to discuss this comment and request additional detail about what is meant. The net effects analysis is an attempt to weave together all of the various effects on the species, including the interaction of various effects. For example, we examined how changes in the location of the low salinity zone could affect distribution of delta smelt and how that would change their exposure to microcystis. Likewise, the hydrodynamic modeling integrates the changed tidal exchange based on a restoration configuration. Because the net effects analysis is qualitative in nature, our ability to evaluate synergistic or interactive effects is mostly limited to pairwise comparisons or linear sequences of effects, as opposed to multivariate effects. However, we agree that more information can be developed to demonstrate the similarities and differences between the project and historical conditions. If the fish and wildlife agencies

could provide examples of the synergies that are missing from the effects analysis, we could focus on those effects.

- **Burden of Proof**

  Deference should be given to known population drivers and documented relationships (e.g., sturgeon recruitment relationship with flows is well documented, though the exact mechanism is not completely understood). Since flow is a key component of habitat for aquatic species, do not assume that it can be substituted for by other actions.

  Do not assume that incremental benefits in a conservation measure will compensate for known population drivers related to flow.

  ICF Response: The analysis considers all of the potential effects together to determine the total effect on the species. We can work with the agencies to determine how to weight different analyses or include an improved description or justification for certainty ratings.

- **Incomplete Analyses and Documentation**

  The full appendices were not released concurrently with Chapter 5 which makes review of the results problematic.

  Provide all appendices/analysis simultaneously so Services can have all pertinent information used in Effects Analysis summaries without having to backtrack weeks later.

  ICF Response: We have been coordinating with the agencies to develop these revisions and expect that these revisions address agency concerns. A revised Appendix C was released on 4/13/12 and the revised Appendix B was released on 3/30/12.

- **Insufficient Biological Goals and Objectives**

  The conservation measures are sometimes defining the BDCP species objectives, which is insufficient. 30% juvenile through-Delta survival is not a suitable goal for a 50 year conservation plan.

  The BDCP objectives should be biological, species-level outcomes.

  ICF Response: We are coordinating with the agencies to refine the BGOs.

- **OMR Flows Unimproved in Drier Water Years**

  Improved OMR flows under the PP occur during wetter years when OMR is less of an issue for covered fish. PP OMR flows are often worse than, or similar to, EBC in drier years. Sacramento Basin fish are most vulnerable to entrainment into the central Delta in drier years when Sacramento River flows have the potential to reverse and OMR levels are below -2,500 cfs. San Joaquin basin fish are best protected by increased Vernalis flows and/or a HORB which the PP does not address.

  1. Analyze the risk in different water year types and with different flow levels in the Sacramento River.

2. Implement Scenario-6 to help address the adverse impacts seen under the PP.

ICF Response: We are working on a proposal to address water operations issues, including those occurring in dry years in the south Delta. We plan to coordinate with the agencies soon.

- **Non-Physical Barriers**

  Assessment of non-physical barriers is inadequate, and the potential negative effects of predation associated with non-physical barriers haven't been assessed.

  Include analysis of potential adverse effects of non-physical barriers.

  ICF Response: Appendix F includes this analysis, but we agree that additional information could be gleaned from the HORB and Georgiana Slough studies.

- **Carry-over of OCAP RPA's on technological improvements to the South Delta Facilities**

  By not carrying forward technological fixes in the South Delta called for in the OCAP RPAs into the Conservation Measures, we would expect the effects analysis to specifically flag this and analyze it as a degradation to future conditions (as compared to the baseline which should include the RPA improvements) .

  Add south Delta technological improvement RPA's to Conservation Measures

  ICF Response: We will work with the agencies to determine how to integrate this into the project.

- **Feasibility of 65K acres of Habitat Restoration**

  Recent evaluation of land available for habitat restoration indicates potential roadblocks to acquiring all the land proposed in the PP. DWR's own analysis suggests that 65K acres is very unlikely.

  Analyze the potential effects of partial implementation of habitat restoration and incorporate alternative actions or measures to compensate for this possibility.

  ICF Response: We believe that 65,000 acres of tidal restoration is feasible based on recent assessments. We would like to discuss these results with the fish and wildlife agencies and ways to improve the documentation to demonstrate feasibility.