Conservation Measure #1 – Water Facilities and Operations

Claims of aquatic life benefits need more discussion/analysis in the text. It is difficult to track assumptions about benefits absent a clearer description of the operational parameters being used in the analysis. This is especially a problem when outflow manipulation is cited as a driver for benefits.
In addition, there does not appear to be a clear mechanism for estimating aquatic life benefits and costs (as there is for the water supply reliability benefits and costs.)

Based on the information presented, aquatic life benefits from northern intake bypass flows are not clear or appear to be minimal. It appears that there is minimal improvement in fish entrainment and loss from operating a new Delta Conveyance because the times and conditions when entrainment effects of present facilities are greatest concern will continue to occur after the Delta Conveyance facilities are operating (since use of the northern intakes will be limited to times of higher Sacramento River flows). At such times, entrainment at south Delta facilities has historically been low. South Delta intake facilities will continue to operate at times when Sacramento River flows are not at higher levels, including conditions when entrainment effects of the south Delta facilities are greatest for T & E species. The northern intakes will only be operable at times when entrainment and loss with the existing facilities have been of less concern.

Estimated environmental benefits from dual diversion points (north and south Delta) will potentially be reduced by issues that are not addressed in CM1. The current trash racks, fish screens and diversion facilities in the south Delta are not proposed to be changed. Invasive aquatic weeds and deferred maintenance have greatly impaired the effectiveness of the fish screens for much of the last 20 years. Redirecting diversions to these facilities will expose fish to the threats of salvage operations and ineffective screens. In addition, the impact of an invasion of Dreissenid mussels into the Delta, specifically to the southern Delta, is not discussed or addressed in CM1. The invasion of these mussels is very probable and the southern Delta provides suitable habitat for Dreissenid mussels. Impacts from these mussels on freshwater diversions in the Great Lakes and Lake Mead are informative.

Proposed reoperation of reservoirs may have negative impacts on upstream availability of cold water, in-stream flows and other essential aspects of riverine habitat. In addition, CM1 does not contain a plan for how reoperation of reservoirs for pulse flows will be coordinated. A trade-off implied in the described benefits of the new northern facilities are pulse flows resulting from coordinating reservoir releases with reductions in exports at the northern facilities to produce 'pulse flows' to guide migrating fish. The CM does not identify the potential impacts to aquatic life that may result from re-operation of the reservoirs. Identifying these impacts requires coordination with the operators of these facilities. Such reservoir-based production of pulse flows has been accomplished on the San Joaquin River as part of the Vernalis Adaptive Management Program (VAMP). VAMP required considerable planning and negotiation. CM1 does not identify such a watershed-wide water management approach. Outlining coordination methods for pulse flows would increase the understanding of how pulse flows will occur and their potential impacts, and would improve the probability that pulse flows will have their desired effect while identifying and addressing any potential negative impacts.

Also not addressed in CM1 (or in CM13) is the potential spread of harmful algal blooms (HABs) resulting from reducing exports from the south Delta. CM1 cites reduced exports from the south Delta as a positive benefit of this CM, but it will also provide better conditions for HABs. The balance between multiple ecological impacts needs to be considered.

The claimed benefits of rearing habitat and migratory corridors for lampreys and adult salmon are not supported. [3.4.2.2." ammocoetes may forage for many years in the Plan Area before beginning to metamorphose and migrate towards the sea."]. The information available to us suggests that larval lampreys are found in the Delta only as a result of high flow washouts from upstream. In addition, adult salmon migration will likely not be improved up the Sacramento by pulse flows associated with operation of the new northern facilities. These salmon are guided by the unique chemical scent of their natal waters, not by pulse flows. ["Most or all of the covered fish species (the juvenile and adult life stages of Chinook salmon, steelhead, delta smelt, longfin smelt, sturgeon, lamprey, and splittail) are expected to use hydrodynamic cues (e.g., channel flow direction and magnitude) to help guide their movement through the Delta."].

Similar benefits claimed for the migration of adult salmon up the San Joaquin River are more likely since river flows in the season of adult upmigration have in recent years been less than a fifth of the concurrent export rates. Thus, any San Joaquin River water that could reach the Bay would likely improve adult upmigration by providing the chemical cues they need but currently do not receive. However, in many years, San Joaquin River inflows are so low in the season of adult migration that reducing exports may not be adequate to establish such a migratory corridor.

The effects of north Delta diversions on the south Delta are overstated. For example: *"Operation of the new north Delta diversions is expected to substantially improve flow patterns in the south Delta by reducing exports from the south Delta and timing flows in the north Delta to improve Old River and Middle River positive (i.e., northerly) flows."* Reducing exports in the south Delta will make flows in Old and Middle rivers less negative, but flows in the Sacramento River cannot affect ("improve") flows in Old and Middle rivers.

Conservation Measure #4 - Wetland restoration

Regarding the statement: "Restore tributary stream functions to establish more natural patterns of sediment transport", no description is given of how sediment from tributary streams will be made available for transport. The clearing of the Delta as a result of sediment trapping behind dams has been a large issue for salt pond restoration lower in the estuary. Wetland restoration, especially 65,000 acres, is likely to require a more positive sediment budget than the Delta currently receives. Restoration in some areas is likely to lead to sediment trapping that will deprive other areas of sediment. Combined with sea level rise, restoration may not be possible at the depths proposed or for the plant communities intended.

Conservation Measure #12 – Methylmercury Management

The Problem Statement should briefly describe the diverse sources of mercury into the Delta. CM12 states that mercury in the Delta has been brought there by tributaries that drain "former mining operations in the mountains." And while the measure goes on to reference Cache Creek and the Mokelumne-Cosumnes watersheds, it should explain that the former originates in the Coast Range (the source of cinnabar ore) and the latter originate in the Sierra Nevada (the region where mercury from the Coast Range was brought to amalgamate gold). While these "legacy sources" have delivered massive quantities of mercury to the Delta, new and ongoing mercury discharges/emissions from regional and international sources continue adding to the contaminant burden. These sources include oil refineries in the Benicia-Martinez area, wastewater treatment plants, rural and urban runoff, and international sources, i.e., coal-fired power plants in China[1]. The air deposition of mercury into the Delta occurs in wet and dry phases, and while the fraction of mercury delivered by this route is small compared to waterborne inputs and *in situ* deposits, wet phase inputs might be more reactive and lethal than the

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[1] Steding and Flegal. 2002. *Journal of Geophysical Research – Atmospheres*
http://www.agu.org/pubs/crossref/2002/2002JD002081.shtml

other forms of mercury[2]. CM 12 should acknowledge that the sources of mercury into the Delta are diverse, and that controlling the formation and transport of MeHg will be a long-term if not permanent management challenge.

The framework for Project-Specific Mercury Management Plans should be clearer.
For each restoration project, CM12 proposes to prepare a project-specific mercury plan. This seems like a sound approach, but the document should explain how costs will be covered for site characterization. Moreover, CM12 should describe potential roles for DTSC and EPA under their respective State and federal hazardous waste programs (e.g., site characterization, evaluating remedial approaches, and cost recovery from potentially responsible parties). The document rightly explains that CM12 will be developed and implemented consistent with the Delta methylmercury TMDL, but fails to mention the ongoing mercury research being done in the Delta by the USGS California Water Science Center[3]. The reconnaissance and characterization work envisioned under CM12 should be closely coordinated with USGS.

Investments should be made in research about the permanent sequestration of mercury.
The measures outlined under CM12 do not seem terribly promising. The actions proposed under *Minimize Microbial Methylation* (e.g., management of water depths and the permanent maintenance of "shallow ponded areas with extensive open expanses to promote frequent wind-driven oxygenation") seem unrealistic, economically infeasible, and unsustainable. Next, under the *Photodegradation* section, the document succinctly explains the chemical processes, but this approach seems to merely transfer mercury from one medium to another without actually solving the problem. To wit: "Once photodegraded, mercury will either be volatilized to the air (Amyot et al. 1994), hydrologically transported, or will become available for methylation once again." The *Remediate…with Iron* section describes an approach that might be consistent with USGS' studies of Low Intensity Chemical Dosing (LICD). Under this approach, MeHg in the water column is treated with Aluminum and Iron coagulants, and the MeHg precipitates out of solution along with dissolved organic carbon (DOC). If this treatment method were to be combined with the restoration of tule-based wetlands, the relatively inert flocculent of mercury and carbon could be permanently sequestered in accreting layers of tidal marsh. The sunken Delta provides ~3.4 B cubic yards of "accommodation space" within which to store carbon and mercury, and the liability presented by subsided Delta islands could be turned into an asset if the space is used for restoring wetlands and trapping these compounds that are harmful to atmosphere and water quality.

Conservation Measure #14 - Stockton Deep Water Ship Channel Dissolved Oxygen Levels

As with the likely increase in HABs discussed under CM1 and CM13, altered flow regimes due to decreased reliance on the southern delta diversion site is likely to increase residence times in south Delta channels. As suggested under CM1, this may have beneficial impacts on food production in south Delta channels, but this increase in food and longer residence time is likely to increase the incidence or degree of low dissolved oxygen in the Stockton Deep Water Ship Channel. Thus, **CM15 needs to address not only protecting DO levels as they presently occur, but more importantly, as they are likely to be as a result of the suite of conservation measures proposed in the plan.**

[2] Wood et al. (2006) concluded that wet deposition contributes ~1% of all Hg entering the Delta. Although this amount may seem insignificant, it is possible that the Hg deposited by wet deposition is more reactive than other sources and therefore may be more easily converted to MeHg and bioaccumulated. In Alpers et al. 2008. Mercury conceptual model. Sacramento (CA): Delta Regional Ecosystem Restoration Implementation Plan. http://www.science.calwater.ca.gov/pdf/drerip/DRERIP_mercury_conceptual_model_final_012408.pdf
[3] http://ca.water.usgs.gov/mercury/index.html

The role of DWR and other BDCP project applicants with respect to the San Joaquin River, Stockton Deepwater Ship Channel, Low DO TMDL should be clearly described. This information should include organization names and the actions they take and facilities they own and/or operate as a responsible party to the Low DO TMDL. For example, identify the organizations that are completing the "downstream studies," provide a status update on the completion of the downstream studies and integration with the upstream studies, and describe the current ownership status of the aerator facilities and describe how it may affect operation.

All methods for increasing DO levels in the SDWSC should be described. Costs and benefits of actions to increase DO levels should be estimated and compared. Operating the aerator is not the only way to increase oxygen levels in the channel. Increasing water velocity by adjusting water project operations and releases is another way to increase oxygen levels in the channel, especially during critical periods for aquatic life.

Conservation Measure #15 - Predator control

Expected predation at the new intakes is addressed primarily through targeted efforts to reduce the striped bass population. Since striped bass are an abundant and wide-ranging species, predator control would have to be instituted throughout their range in order to reduce their impact at areas, like the new intakes, that afford enhanced foraging opportunities for them. Similar efforts elsewhere have had limited success. Such a program would also likely engender both regulatory and popular resistance as striped bass are a prominent feature of the sportfishing uses of the estuary.

Pikeminnow are a native fish and, as such, seems an unsupportable candidate for targeted destruction.

A more productive approach to reducing predatory impacts at the new facilities would be to incorporate and enhance those behaviors that have permitted coexistence of these predator and prey species for the last 150 years (eons in the case of pikeminnow), i.e., salmonids tend to migrate downriver at night when visual predators like striped bass and pike minnow are least effective; salmon migrate in large groups so that predators become satiated; and salmon may hide in shallow water during daylight hours where predators cannot as effectively forage. Reducing illumination at the intakes during nighttime hours was effective at Red Bluff Diversion Dam. Additional tools that might reduce predation include: provision of shallow, weed-free habitats for salmon to hide in during the day near the intakes; and, perhaps, evening releases of minnows to divert predator attention. Such behavioral tools are more likely to succeed and less likely to produce conflict with other users of aquatic resources. For localized predator control, improved fishing access at the intakes could reduce predation rates in the short term during periods of salmon outmigration.

Conservation Measure #20 – Recreational Users Invasive Species
&
Conservation Measure #13 – Invasive Aquatic Vegetation Control

These two conservation measures accurately describe the difficulties posed by the many exotic species that have invaded the Plan Area. Introduced weeds occupy areas that might otherwise be suitable for target species, provide habitat for invasive fish that prey on target species, and greatly alter the foodweb upon which target species depend. **CM #20 is solely concerned with reducing the spread of new introduced species into the Plan Area and does not address the impacts of species already here or expected to invade soon.** CM #13 does address the spread of new species as well as plants already in the Plan Area and proposes methods to reduce the area occupied by those that are seen to have the greatest effect on target species.

The proposed actions have possible downsides that should be explicitly recognized:

1. **Use of herbicides to control SAV is associated elsewhere with increased occurrence and abundance of harmful algal blooms.**
2. Most SAV in the Delta are spread by hydrodynamic processes – i.e. pieces break off and float into new areas. In years of high river flow, floating plants are found throughout the Plan Area. Therefore, **the inspection of boats in the Delta is unlikely to have any impact on the spread and abundance of weeds already in the Plan Area.**
3. Actions to control SAV repeatedly refer to prioritizing "upstream" source populations; in a tidal estuary, the concept of "upstream" has limited utility and could lead to inappropriate priorities.

Neither CM addresses the role of invasive species in the overall BDCP effort. (Perhaps this is done elsewhere?) Some questions could be addressed with information currently available include:

1. What physical aspects of Cache Slough and the freshwater portions of Suisun Marsh prevent the dominance of introduced SAV in these areas? How do areas proposed for restoration compare in these aspects and can restoration be done in a way that inhibits the domination of SAV in newly flooded areas?
2. Is spongeplant likely to make fish screens and trash racks at south Delta diversions less effective? What structural or operational changes will be needed?
3. Are quagga mussels likely to make fish screens and trash racks at south Delta diversions less effective? What structural or operational changes will be needed? What changes/technology has been instituted in large water diversions in the Great Lake that might be transferable?
4. What ecological impacts of quagga mussels and spongeplant can be reasonably expected in the Plan Area?
5. What are the most likely other invaders of this estuary, based on recent invasions in other estuaries that are connected to ours by commerce?

Programs like those described in the CM's cannot be expected to prevent invasion over the 50 year duration of the Habitat Conservation Plan. They can be a valuable tool in allowing time to prepare for likely impacts and in delaying the financial and economic impacts that future invasives might produce. Containment and eradication programs around the world give little reason to expect long-term embargo of aggressive invaders like dreissenid mussels and South American spongeplant that are already in California.

Conservation Measure 22 - Avoidance and Minimization of Take of Covered Species

Avoidance and minimization actions related to take of covered species that may occur as a result of CM 1 actions should be identified in a level of detail that supports lead federal agency decision making. That level of detail does not appear to be provided in this document at this time.