February 8, 2023

State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Transmitted via email to: Bay-Delta@waterboards.ca.gov

RE: Comment Letter – Draft Scientific Basis Report Supplement

Dear Staff:

On behalf of the Natural Resources Defense Council, San Francisco Baykeeper, California Sportfishing Protection Alliance, The Bay Institute, Defenders of Wildlife, and Golden State Salmon Association, we are writing to provide written comments regarding the Draft Scientific Basis Report Supplement in Support of Proposed Voluntary Agreement for the Sacramento River, Delta, and Tributaries Update to the San Francisco Bay/Sacramento-San Joaquin Delta Water Quality Control Plan ("Draft Report"). As discussed in detail below, the Draft Report fails to use the best available science, makes assertions that are inconsistent with the lack of scientific evidence that physical habitat restoration in the Bay-Delta is likely to improve survival or abundance of key fish species, fails to adequately consider the effects of water temperatures, ignores key flow thresholds (including those previously established by Board), and fails to use scientifically credible modeling assumptions. The State Water Resources Control Board ("Board") should significantly revise the Draft Report to correct these flaws, and we request that the Board share these comments with the independent scientific peer review of the Draft Report.

I. The Draft Report Fails to Adequately Acknowledge the Lack of Scientific Evidence that Physical Habitat (Tidal Marsh, Riparian, Floodplain, Spawning) is Currently Limiting Viability of Fish Populations or Abundance of Chinook Salmon and Fails to Use the Best Available Science Regarding Limiting Factors:

The Draft Report's identification of limiting factors affecting key fish species in the Bay-Delta (Chapter 2) lacks scientific rigor. In particular, it fails to adequately cite to and summarize the existing peer-reviewed studies that have not found evidence that physical habitats are currently limiting the viability of key fish species identified in the report. Equally important, the salmon habitat metrics used in the Draft Report are logically flawed and demonstrate that habitat restoration is not likely to improve salmon survival or abundance. This is unsurprising because the current water management and flow regime currently limits salmon abundance, rather than the extent of physical habitat.

A. The Draft Report's Discussion of Limiting Factors Must be Revised

Chapter 2 of the Draft Report provides vague and general statements regarding the potential effects of different stressors on fish populations, but it fails to cite scientific studies that support the assertion that these stressors are currently limiting the viability of fish populations in the Bay-Delta or attainment of the existing Chinook Salmon doubling objective. Equally important, the Draft Report fails to cite or consider existing scientific studies that have concluded these stressors are not limiting factors.

1. Chinook Salmon

The Draft Report's claims regarding physical habitat for Chinook salmon fails to use the best available science. For example, the Draft Report claims that the loss of rearing habitat (which it states affects the food supply for salmon and other fish species) is a limiting factor for salmon in the Sacramento River, yet only a few lines later the Draft Report contradicts this statement, admitting that there is not evidence that food supply is currently limiting salmon populations in the Sacramento River. Draft Report at 2-4; *see id*. at 2-6 (similar language regarding Feather River); *id*. at 2-8 (similar language regarding Yuba River); *id*. at 2-10 (similar language regarding American River); *id*. at 2-11 (similar language regarding Mokelumne River). More importantly, the Draft Report does not cite existing studies, such as Henderson et al. 2017, which found no evidence that survival of migrating juvenile salmon in the Sacramento River was affected by the amount of riparian habitat. Henderson et al. 2017 concludes that flow significantly affects survival of migrating salmon in the Sacramento River, across both reaches and years; however, neither the percentage of off-channel habitat within 50 feet of the river nor adjacent cover (defined as "the percent of non-armored river bank with adjacent natural woody vegetation") were statistically significant covariates of juvenile salmon survival. Henderson et al. 2017. The Draft Report should be revised to include a clear statement that current availability of off-channel habitat or riparian habitat has not been shown to limit survival of migrating juvenile salmon in the Sacramento River, citing Henderson et al. 2017.

Similarly, the Draft Report claims that a lack of shallow-water habitat in the Delta is a major stressor on salmon and other fish species. Draft Report at 2-19. While the Draft Report discusses studies from other regions, it fails to cite existing peer-reviewed studies and agency findings which conclude that the extent of shallow-water environments in the Delta does not currently limit Central Valley salmon populations, given the low abundance of salmon and existing river flows into and through the Delta. Most notably, Munsch et al. 2020 found that juvenile salmon were absent from restored shallow environments in the Delta and upper San Francisco Bay estuary when spawner abundance and/or river flow levels were low and that "…the efficacy of [physical habitat] restoration efforts depends on sufficient spawners and flow to promote juvenile abundances and distributions that translate to occupied restored habitats." Munsch et al. 2020. In other words, the extent of shallow-water environments in the Delta is not a limiting factor for salmon at current population levels or under the current flow regime. This suggests that without higher abundance and increased flows, restoration of shallow water environments in the Delta is unlikely to improve productivity or provide substantial population level benefits. This is particularly true in dry and critically dry years when much existing habitat is unoccupied currently and during which flow augmentation under the proposed Voluntary Agreement is negligible. Similarly, in its 2017 biological opinion regarding WaterFix, NMFS found that for winter-run Chinook salmon, "The proposed Delta habitat restoration did not improve the cohort replacement rate under this scenario because the current low abundance of the winter-run population is not limited by Delta rearing habitat." NMFS 2017 at 810.

Furthermore, any beneficial effects of tidal marsh restoration on salmon do not substitute for adequate river flows, but instead depend on adequate flows and temperatures. Recent studies have found that in years with adequate flows, juvenile salmon growth in the Delta is higher than it is in the American River, but this is not the case in drought years. Coleman et al. 2022 (concluding that "variation in water flow and temperature (Figure 1) were likely the primary abiotic factors that generated differences in growth opportunities in each habitat within and among years."). The Draft Report should be revised to include a clear statement that rearing habitat in the Delta is not currently limiting salmon populations, citing these studies.

The Draft Report also claims, erroneously and without evidence, that habitat connectivity onto and off floodplains is the "primary limiting factor" for Chinook salmon and other native migratory fish. Draft Report at 2-17. This statement is contradicted by numerous studies, some of which are cited in the Draft Report, which emphasize the importance of flow, temperature, and other factors affecting the survival and viability of salmon populations. Equally important, while there are numerous scientific studies finding that salmon that rear on floodplains are larger in size, the Draft Report never acknowledges that despite decades of research, existing studies have not demonstrated higher survival in either the freshwater or ocean environment for salmon that rear on floodplains (particularly in the Yolo Bypass). For instance, Takata et al. 2017 evaluated the results of years of paired releases of salmon to evaluate whether salmon reared on the floodplain had a survival advantage compared to those that reared in the Sacramento River, and the study concluded that,

> Despite the known growth advantages of floodplain rearing, we did not detect significant differences in survival to the ocean fishery between our paired [juvenile salmon] releases in the Yolo Bypass and Sacramento River.

Takata et al. 2017.

While the Takata et al. 2017 study appropriately caveated this conclusion by noting the small sample sizes from the ocean fishery, and although floodplain rearing can provide important benefits in terms of life history diversity, we are unaware of any studies from the Bay-Delta watershed which demonstrate increased ocean survival or abundance/production from rearing in the Yolo Bypass. Similarly, several studies have documented that salmon that rear in the Yolo Bypass do not have higher freshwater survival than salmon that rear in the Sacramento River under the same river flow conditions. *See* Pope et al. 2018; Johnston et al. 2018. The Draft

Report should be revised to clearly state that existing studies have not documented improved survival of salmon, in either freshwater or ocean life stages, nor increased production and escapement, as a result of rearing on floodplain habitats, citing these studies.

2. *Longfin Smelt*

Equally important, there is little to no evidence that the extent of shallow tidal marsh environments in the Delta is a limiting factor for Longfin Smelt. There is no empirical evidence that increasing shallow tidal marsh acreage will lead to increased abundance or productivity of SF Longfin Smelt. Despite the restoration over the past few decades of several thousand acres of shallow tidal habitat in the SFE (e.g., as a result of the CalFed program, previous biological opinions, the South Bay Salt Pond Restoration Program, and other programs), SF Longfin Smelt abundance and productivity have not increased beyond that predicted by the flow-abundance relationships; in fact, despite this restoration, the SF Longfin Smelt population has continued to decline in abundance and productivity (e.g., Rosenfield and Baxter 2007; Kimmerer et al. 2009; Thomson et al. 2010; Nobriga and Rosenfield 2016).

Nevertheless, the Draft Report erroneously concludes that improved access to spawning habitat explains the relationship between flow and Longfin Smelt abundance.[1] Draft Report at 6-29. The Draft report acknowledges that there is no known relationship between flow and larval Longfin Smelt abundance as would be expected if increases in freshwater flow increased spawning success at a population scale; production of larval Longfin Smelt is relatively consistent from year to year, showing no correlation with Delta outflow. *See, e.g.*, Dege and Brown 2004; Eakin 2021. On the other hand, juvenile abundance is strongly correlated with Delta Outflow across orders of magnitude for both variables. *See, e.g.*, Rosenfield and Baxter 2007; Nobriga and Rosenfield 2016. These findings contradict the Draft Report's assertion that creation of additional shallow tidal environments will increase abundance and productivity of the SF Longfin Smelt population by increasing larval production. Rather, they are evidence that the well-documented Longfin Smelt flow-abundance relationship is driven by the effect of flow on larval survival, not by increased production of larvae.

The Draft Report also erroneously assumes that the mere presence of Longfin Smelt larvae in or near restored tidal marsh environments is evidence that the extent of these environments limits the species' abundance or survival. Whereas Longfin Smelt larvae are observed in shallow marsh environments, they are also observed in open water habitats, and it is not clear what percentage of the population makes use of shallow marsh environments and the duration of residence in these areas appears to be very short (<1 month).

[1] The Draft Report erroneously suggests that Rosenfield and Baxter (2007) found that Longfin Smelt spawn in tidal wetlands; that paper did not study Longfin Smelt spawning habitat preferences. In fact, Rosenfield and Baxter documented a decade-long near failure to detect spawning age Longfin Smelt in Suisun Marsh, despite year-round intensive sampling.

There is little evidence for any mechanism connecting the extent of shallow sub-tidal marsh environments to viability of the estuary's Longfin Smelt population. In fact, efforts to document contribution of larval Longfin Smelt rearing in restored wetlands in the South Bay to the estuary-wide juvenile and adult population have failed to detect such evidence. *See* Lewis et al. 2019. Furthermore, even the presence of Longfin Smelt larvae in recently restored tidal marshes is not evidence that restoration improved habitat occupancy; the study that the Draft Report relies on (Lewis et al. 2020) reports findings from "…*previously undescribed aggregations* of Longfin Smelt that were attempting to spawn in restored and *underexplored* tidal wetlands of South San Francisco Bay" (emphasis added); Rosenfield 2010 indicates that the South Bay historically supported juvenile Longfin Smelt, prior to major restoration efforts.

Juvenile Longfin Smelt are not common in shallow, sub-tidal marsh (Rosenfield and Baxter 2007) and so would not be expected to benefit from restoration of such habitats. There is also little evidence for a substantial positive effect on SF Longfin Smelt of prey subsidies exported from shallow sub-tidal habitats (see below). Furthermore, there is little evidence that Longfin Smelt juvenile abundance or productivity is limited by prey abundance. Whereas Kimmerer 2002 suggested an association between a decline in Longfin Smelt abundance and the invasion of the estuary by the filter feeding clam, *Corbula amurensis*, in 1987, subsequent analyses that looked at multiple years around this period failed to detect a step-decline in Longfin Smelt abundance that is neatly coincident with the clam invasion. Thomson et al. 2010; Mac Nally et al. 2010; Nobriga and Rosenfield 2016. Nor is there evidence that Longfin Smelt abundance is strongly correlated with prey availability (Thomson et al.2010); Mac Nally et al. 2010 (Fig 3a,b at 1425) found weak, but significant, <u>*negative*</u> associations between Longfin Smelt abundance and their main prey, as compared to a very strong association with spring X_2.

The Draft Report should be revised to strike the speculative claims on page 6-29 and elsewhere regarding the purported benefits of tidal marsh restoration on Longfin Smelt.

Furthermore, the Draft Report's analysis of the Voluntary Agreement's effects on pelagic habitat area for Longfin Smelt (described in section 5.5.5 of the Draft Report and reported in Section 6.2.2) is contrary to the best available science indicating that area or volume (measured as the overlap of a few "habitat suitability" metrics) is not limiting to the Delta's native or naturalized fishes or certain zooplankton. Kimmerer et al. 2009 analyzed the effect of flow on "habitat" for several Delta fish species, including Longfin Smelt, using an approach very similar to that described in the Draft Report. They found that the change in Longfin Smelt "habitat" volume for a given change in flow was insufficient to explain the (much larger) change in Longfin Smelt abundance over the same range of flows; they concluded that variation in habitat volume did not explain most of the variation in Longfin Smelt abundance through time.[2] The Draft Report

[2] Kimmerer et al. 2009 reached the same conclusion – that changes in habitat volume did not explain changes in abundance – for the suite of Delta fish and zooplankton species they studied, including Delta Smelt. They concluded: "Therefore, other mechanisms must underlie responses of abundance to flow for most species."

should clearly state that there is no evidence that abundance or survival of Longfin Smelt or other pelagic species in the Delta are limited by variations in the volume or area of pelagic habitat.

3. Delta Smelt

Similarly, the Draft report wrongly assumes that the extent of tidal marsh in the Delta currently limits Delta Smelt abundance and survival and that restoration on the scale proposed by the Voluntary Agreement would alleviate such an effect. This assumption is not supported by the empirical evidence, as Delta Smelt have continued to decline to nearly indetectable levels despite the restoration of shallow water environments, including more than 4,000 acres of restoration required under the US Fish and Wildlife Service's 2008 biological opinion that was specifically intended to support this species. Given that various fish assemblage sampling programs indicate that Delta Smelt numbers are far below those observed even two decades ago, it is extremely unlikely that the population is limited by the current extent of physically suitable habitat. It is also unlikely that habitat area will become a key constraint on the population in the near future, especially given that an additional several thousand acres of shallow tidal habitat restoration is already required under the Delta Smelt biological opinion.

4. Food Subsidy from Restored Environments

The Draft Report at times erroneously claims that tidal marsh restoration "may" export phytoplankton and zooplankton to other areas of the Delta, and assumes this would lead to Delta-wide increases in food supply for Delta Smelt and other species. *See, e.g.,* Draft Report at 6-24. Yet existing studies have largely rejected the hypothesis that tidal marsh restoration will subsidize other areas of the Delta with exported food. For example, whereas Hammock et al. 2019 found potential support for the hypothesis that tidal marshes can improve Delta Smelt foraging success on the margins of marsh habitats, Hammock et al. 2019 did not find evidence to support the hypothesis that tidal marshes export zooplankton to other parts of the estuary. In addition, Herbold et al. 2014 concluded that tidal marshes are unlikely to export significant amounts of plankton throughout the estuary, in part due to invasive clams. More recently, Yelton et al. 2022 concluded that "…there is little evidence of persistent subsidies of zooplankton from tidal wetlands to open water," and Hartman et al. 2022, who observed lower abundance of zooplankton in shallow water than in deep water environments, concluded "This runs … counter to the conceptual model which suggests that restoring shallow tidal wetlands will provide an increased supply of food for at-risk fishes."

One recent study supports the hypothesis that fish prey items are exported from large floodplain bypasses to adjacent river environments (Sturrock et al. 2022); however, this effect is ephemeral, and both the magnitude and spatial extent of prey subsidy are directly correlated with river flow. In addition, the most abundant prey items exported from the floodplain do not tolerate brackish water. Sturrock et al.2022. Thus, the ability of the inundated floodplain to subsidize the food web of brackish environments is highly constrained. This demonstrates a recuring theme in research on restored shallow-water environments: any benefits to native fishes are usually still highly dependent on maintenance of an adequate flow regime – ultimately, flow creates, maintains, and activates habitat for native fishes.

The Draft Report's assumptions about broad scale export of plankton throughout the estuary are inconsistent with the best available science. Meanwhile, it ignores peer-reviewed studies that point to other stressors on the prey base of native fishes. For example, Section 6.2.3 of the report completely ignores the effects of clam grazing on plankton production. In addition, the Draft Report's discussion of Delta food webs fails to reference the 2019 peer-reviewed study which found that SWP/CVP South Delta pumping reduces phytoplankton abundance in the Delta by 74 percent. *See* Hammock et al. 2019. The Draft Report should be revised to eliminate claims that tidal marsh restoration will increase regional productivity, citing these and other papers that have rejected this hypothesis and it should include references to studies implicating anthropogenic stressors and the effect of river flow regimes in its discussion of food-web limitation for pelagic fish in the Delta.

B. The Draft Report's Salmon Habitat Metrics are Logically Flawed and Demonstrate that Habitat Restoration is Not Likely to Improve Natural Salmon Production and Abundance

The Draft Report quantifies salmon spawning and rearing habitat that it asserts are needed to achieve salmon natural production targets, identifying acreage needed to achieve the Draft Report's proposed definition of salmon doubling[3] and 25% of that target. *See* Draft Report at Figure ES-1, ES-2. However, the results from the Mokelumne River demonstrate that these habitat targets for spawning and rearing habitat are illogical and are not likely to improve natural survival and abundance of salmon in the Central Valley.

The Draft Report indicates that the Mokelumne River provides more than 100% of the spawning and rearing habitat necessary to achieve salmon doubling. Draft Report at Figure ES-1, ES-2. However, natural salmon production on the Mokelumne River is woefully short of the salmon doubling objective, largely because of unsustainably low survival in the spawning life stage (due to inadequate water temperatures) and juvenile life stage (due to inadequate instream flows in the winter and spring). The East Bay Municipal Water District runs a very successful salmon hatchery program on the Mokelumne River, which supports relatively high returns of salmon to the Mokelumne; however, returns of hatchery-origin fish are not relevant to the existing or modified/proposed salmon doubling objective or natural production of viable fish populations. Based on the Department of Fish and Wildlife's reports from Constant Fractional Marking Program, in recent years the vast majority of salmon escapement on the Mokelumne River are hatchery salmon that did not incubate or rear in the Mokelumne River:

Year	Percentage Hatchery Fish (Mokelumne Hatchery)	Percentage Hatchery Fish (Mokelumne Spawners)
2019	89%	73%

[3] As discussed *infra*, the Draft Report's calculation of salmon doubling is arbitrary and inconsistent with the existing Bay-Delta Water Quality Control Plan and the Central Valley Project Improvement Act's Anadromous Fish Restoration Program.

2018	99%	87%
2017	94%	86%
2016	90%	81%
2015	96%	94%

As a result, the escapement of naturally produced salmon to the Mokelumne River appears to fall far short of achieving the salmon doubling objective identified in state and federal law, including the Bay-Delta Water Quality Control Plan. For instance, based on Grandtab's reported 2019 Mokelumne River escapement of 4,361 total salmon to natural areas and returns of 8,509 salmon to the Mokelumne hatchery, the Department's data from the Constant Fractional Marking Program indicates that escapement of naturally produced salmon was only 1,180 salmon to natural areas with an additional 936 naturally produced salmon returning to the hatchery.

In contrast to the East Bay Municipal Water District's successful hatchery production, egg-to-fry survival and natural production of salmon on the Mokelumne River is generally extremely low in most years, well below levels that are typical for Chinook salmon in other managed river systems. *See* Quinn 2005.

Year	Egg-to-Fry Survival (to Downstream Monitoring Location at River Kilometer 62)
2007	1%
2008	8%
2009	5%
2010	18%
2011	2%
2012	2%

See East Bay Municipal Water District, December 2013. Emigration of Juvenile Chinook Salmon (*Oncorhynchus tschawytscha*) and Steelhead (*Oncorhynchus mykiss*) in the Lower Mokelumne River, December 2012 - July 2013.[4]

Despite exceeding the spawning and rearing habitat metrics identified in the Draft Report, natural salmon production on the Mokelumne River appears to be woefully short of the salmon doubling objective. This mismatch demonstrates that the spawning and rearing habitat metrics utilized in the Draft Report are not logically related to the factors that actually limit the natural production of salmon in the Central Valley.

[4] This report, which is the most recent such report publicly available from the District's webpage, is available online at: https://www.ebmud.com/download_file/force/1900/568?emigration-of-juvenile-chinook-salmon-and-steelhead-in-the-lower-mokelumne-river-dec.-2012-july-2013.pdf. This report, and all other scientific studies and documents cited herein which are available for download from a specific webpage, are hereby incorporated by reference.

II. <u>The Draft Report's Suggestions that Restoring Physical Habitat will Provide Unquantified "Expected Benefits" is Inconsistent with the Available Scientific Evidence:</u>

The Draft Report acknowledges that it does not quantitatively model the effects of non-flow measures on species abundance. This is because, unlike the numerous documented relationships between flow and abundance or productivity of fish populations in this ecosystem, research quantifying the presumed relationship of non-flow actions to fish population viability is either lacking or has failed to detect any relationship at all. Nevertheless, the Draft Report repeatedly suggests that physical habitat restoration will provide unquantified "expected benefits." *See* Draft Report at 7-2 ("The quantitative connection between restored non-flow habitat and species abundance was not modeled, only evaluated qualitatively, so benefits are expected but unquantified with respect to species abundance."). However, the best available science from the Bay-Delta watershed has failed to show that restored physical habitat will increase species abundance and survival, which the Draft Report fails to cite.

a. Floodplain Habitat Restoration

As discussed above, the best available science has not found that salmon that rear in the Yolo Bypass have higher survival in freshwater or ocean environments, and has not found that floodplain rearing results in higher abundance. Takata et al. 2017; Pope et al. 2018; Johnston et al. 2018. As a result, the best available scientific information from the Bay-Delta does not demonstrate that restoring floodplain habitat (including connectivity to floodplain habitat) will increase abundance and survival of salmon. While the *duration* of floodplain habitat inundation is linked to other benefits to cohorts of migrating juvenile salmon (e.g., through its correlation with the life history diversity of juvenile salmon exiting the floodplain (Takata et al. 2017; Pope et al. 2018; Johnston et al. 2018), or via food export to the river environment (Sturrock et al. 2022)), the Draft Report should be revised to clearly state that there is no scientific evidence in the Bay-Delta to conclude that there are "expected benefits" to survival and abundance of salmon from restoration of additional floodplain acreage, and that any benefits to native fish species associated with floodplains require adequate magnitude, frequency and duration of river flows that inundate the floodplain. Similarly, the existing scientific literature in the Bay-Delta has not found that riparian habitat limits survival or abundance of juvenile salmon migrating down the Sacramento River, Henderson et al.2017, and the Draft Report should be revised to clearly state that "expected benefits" to salmon survival and abundance from riparian habitat restoration in the Sacramento River are unsupported and speculative, at best.

b. Tidal Marsh Habitat Restoration

As discussed above, the best available science has found that tidal marsh habitat in the Delta is not currently limiting salmon abundance, given existing flows and salmon abundance levels. Munsch et al.2020. Because there is not evidence that tidal marsh habitats in the Delta currently limit salmon population abundance, there is not evidence that tidal marsh restoration will provide "expected benefits" to salmon abundance; this is particularly true given the findings, described above, that tidal marsh habitats in the Delta do not generally export food to open water environments. As a result, the Draft Report should be revised to clearly state that there is not scientific evidence that tidal marsh restoration in the Delta will provide "expected benefits" to salmon survival and abundance, particularly given current depressed population levels and the VAs failure to provide adequate river flows during dry and critical years.

There is similarly little to no scientific evidence that tidal marsh habitat restoration would provide "expected benefits" to the abundance and viability of Longfin Smelt and Delta Smelt. As discussed above, the mere observation of Delta Smelt or Longfin Smelt near restoration sites does not demonstrate that restoration is improving survival or abundance. With respect to Longfin Smelt, Lewis et al. 2019 states clearly that the value of restored shallow subtidal environments "remains unknown." There is no evidence that restoration activities in these areas of South San Francisco Bay generated any positive effect for Longfin Smelt. In fact, Longfin Smelt occupancy of and recruitment in these restored shallow marsh habitats in South San Francisco Bay appears to be dependent on freshwater flow. Lewis et al. 2019 observed successful recruitment of Longfin Smelt larvae to marshes in South San Francisco Bay only in years of locally high freshwater flow into the Bay; during other years, adult Longfin Smelt returning to and spawning in the vicinity of the South Bay Salt Ponds may have represented an ecological sink. There is also no evidence that Longfin Smelt benefited from the existence of the restored shallow sub-tidal habitat in years that were not wet. Regarding their detections of substantial numbers of Longfin Smelt west of Suisun Bay, which occurred primarily during the wet years 2017 and 2019 (and, for restored South Bay salt ponds, only during those two years), they state: "... it is valuable to consider whether, with high Delta outflows, it is feasible and probable that larval and juvenile Longfin Smelt found in high numbers in San Pablo Bay, and even Lower South San Francisco Bay, could have been transported from Delta and Suisun Bay spawning sites by currents, tides, and winds." *Id.*

As discussed above, there is little evidence that tidal marsh habitats limit the survival and abundance of Longfin Smelt. Similarly, in proposing to list Longfin Smelt as endangered under the federal Endangered Species Act, the U.S. Fish and Wildlife Service concluded that,

> We consider reduced and altered freshwater flows resulting from human activities and impacts associated from current climate change conditions (increased magnitude and duration of drought and associated increased temperatures) as the main threat facing the Bay-Delta longfin smelt due to the importance of freshwater flows to maintaining the life-history functions and species needs of the DPS. However, because the Bay-Delta longfin smelt is an aquatic species and the needs of the species are closely tied to freshwater input into the estuary, the impact of many of the other threats identified above are influenced by the amount of freshwater inflow into the system (i.e., reduced freshwater inflows reduce food availability, increase water temperatures, and increase entrainment potential).

87 Fed. Reg. at 60963. In its species status assessment, the Fish and Wildlife Service also concluded that,

> The loss of tidal marsh habitats may have hampered [Longfin Smelt] productivity, but to date, there are no indications that restoration has been sufficient to stem the

> decline. Therefore, we cannot conclude whether or not the species has lost resilience due to landscape changes that occurred in the 19th and 20th centuries.

U.S. Fish and Wildlife Service, Species Status Assessment for the San Francisco Bay-Delta Distinct Population Segment of the Longfin Smelt, available online at: https://www.regulations.gov/document/FWS-R8-ES-2022-0082-0003/content.pdf, at 56. The Draft Report should be revised to include these references regarding the lack of scientific evidence that tidal marsh restoration is likely to have "expected benefits" to Longfin Smelt.

c. Spawning Habitat Restoration

The Draft Report fails to demonstrate that creation of physical habitat suitable for salmon spawning is likely to improve the productivity or abundance of salmon. Most importantly, as discussed below, the Draft Report ignores the effects of water temperatures as a key and limiting characteristic of spawning habitat for Central Valley Salmon, despite the well documented effects of water temperature on spawning and egg incubation success. *See infra*. In addition, the Draft Report indicates that spawning habitat on each of these rivers already exceeds what the Draft Report speculates is necessary to achieve 25% of the salmon doubling goal, which is the Voluntary Agreement's purported target, and in some cases already exceeds the spawning area estimated to be necessary to achieve 100% of the salmon doubling goal. *See* Draft Report at ES-1. The Draft Report should be revised to clearly state that there are not "expected benefits" from spawning habitat restoration, particularly without ensuring adequate river flows and water temperatures to support spawning and incubation.

III. <u>The Draft Report Fails to Adequately Consider Whether Habitat Restoration is Reasonably Certain to Occur</u>

The Draft Report admits that outcomes from implementation of the proposed VA are not certain, and identifies a number of "uncertainties in VA outcomes," which are in addition to the uncertainties inherent in quantitative modeling of complex ecosystems. Draft Report at ES-7. One of those uncertainties is when habitat restoration projects would be completed. Any benefits associated with non-flow actions cannot be realized until those actions are implemented. Regrettably, in recent decades the implementation of habitat restoration projects in the Delta has repeatedly missed deadlines for completion; for instance, most of the restoration projects included as part of EcoRestore were required to be fully implemented by 2018, yet the majority of acreage is still incomplete.[5] Even assuming for the sake of argument that there are no delays in permitting, funding, or execution, many non-flow actions will require years to complete, even if they are implemented with the utmost efficiency – it is extraordinarily unlikely that most non-flow actions will be implemented as quickly as flow actions. Therefore, modeling in the forthcoming Staff Report/SED that compares outcomes of the Voluntary Agreement's mix of flow and non-flow actions must reflect the inherent asynchrony in implementation between flow and most non-flow actions – the analysis should be careful not to compare expected outcomes

[5] In addition, one of the larger recent restoration projects (Lower Yolo Ranch) is apparently obtaining credits towards these existing mitigation requirements despite the fact that the vast majority of its restored "habitat" is at elevations above tidal influence.

from the first day of implementation for a flow alternative with outcomes expected only after the final non-flow action is fully implemented years later.

IV. **The Draft Report Fails to Adequately Consider the Effects of Water Temperature on Habitat, Survival and Abundance:**

The Draft Report's assessment of the Voluntary Agreement's proposed "habitat" restoration fails to use the best available science because it ignores the role of water temperatures in the formation and maintenance of suitable habitat. The 2017 Scientific Basis Report correctly concludes that "High summer and fall water temperatures is recognized as a major limiting factor for Chinook salmon and steelhead populations." 2017 Scientific Basis Report at 3-35. Despite this recognition that water temperature is a major limiting factor for salmon spawning success, the Draft Report states that water temperature is "not included in the suitability criteria for VA habitat." *See* Draft Report at 5-6 ("While water quality parameters such as dissolved oxygen and water temperature are key attributes of suitable habitat, they were not included in the suitability criteria for VA habitat."); *id*. at 7-2 (VA spawning and rearing habitat "was not informed by water temperature."). Temperature thresholds are known for most or all life stages of many native fish species and temperatures are known to limit the viability and abundance of these populations. Also, the effect on water temperatures of flow rates, reservoir management, and climate change can all be estimated by existing models. The Draft Report's assessment of spawning habitat plainly fails to use the best available science.

In addition, the Draft Report inaccurately states that, "Higher flows decrease temperatures below dams." *Id*. at 2-2. At least for dams with temperature control devices like Shasta Dam, peer-reviewed research confirms that the temperature of water released from the dam, not the volume of water that is released, is the primary factor affecting downstream water temperatures in spawning reaches. *See, e.g.*, Daniels and Danner 2021.[6] The effect of flow volume on water temperature becomes increasingly important with distance from the dam, in areas were migrating and rearing juvenile salmon are the primary life-stages. The Draft Report should be revised to clarify this important point.

The 2017 Scientific Basis Report emphasizes the importance of managing water temperatures below upstream dams and the current problems in maintaining adequate water temperatures for salmon at existing dams on the Sacramento River, Feather River, American River, and other rivers, and it proposes a new narrative objective regarding cold water habitat, which would be implemented by updating outdated temperature standards and establishing new temperature standards at existing dams. *See, e.g.*, 2017 Scientific Basis Report at 1-12, 1-22, 4-18 to 4-19, 5-34 to 5-43.[7] In contrast, the proposed Voluntary Agreement does not include a narrative

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[6] Miles Daniels and Eric Danner (2020). The Drivers of Water Temperatures Below a Large Dam. Water Resources Research, 56, e2019WR026751. https://doi.org/10.1029/2019WR026751, available online at: https://agupubs.onlinelibrary.wiley.com/doi/pdfdirect/10.1029/2019WR026751.

[7] Excessive temperature dependent mortality that resulted from the failure to adequately manage water temperatures below major dams has significantly contributed to the unsustainable egg to fry survival rates discussed *infra*.

objective regarding cold water habitat and does not propose specific measures to improve temperature management at upstream reservoirs, and the Draft Report fails to analyze or discuss the effects of the proposed Voluntary Agreement on upstream temperature management. The Draft Report should be revised to clearly state that the Voluntary Agreement would not address management of upstream water temperatures as proposed in the 2017 Scientific Basis Report.

By failing to address temperature issues, the Draft Report dramatically overstates the potential benefits of the modest habitat restoration propose in the Voluntary Agreement. Simply put, unless regulatory requirements force improved in-river temperature conditions, particularly regarding pre-spawning adult survival, spawning success and egg to fry survival, it is very likely that a high percentage of pre-spawn adults, eggs and fry will continue to be killed before they could even conceivably benefit from proposed habitat restoration downstream. In addition, these severe water temperature impacts on salmon are greatest during critically dry years and droughts, when salmon also face very low juvenile outmigration survival because of inadequate instream flows. The Draft Report should be revised to acknowledge these compounding problems of water temperatures and low flows adversely affecting salmon in droughts and critically dry years. The evaluation of the frequency of meeting flow thresholds for juvenile salmon survival during outmigration (*see infra*) will help to evaluate the effects of the Voluntary Agreement or other flow regimes on salmon survival, including during critically dry years and droughts.

Finally, recent research has also highlighted the important effects of river flow on water temperature in the Delta and the subsequent effect on predation of juvenile salmon and their survival through the Delta. *See, e.g.*, Nobriga et al.2021.[8] Similarly, other studies indicate an effect of river inflow on the distribution of estuarine temperatures, which may affect abundance, survival, and distribution of native fish in the Delta and Suisun Bay (Vroom et al. 2017[9]; Bashevkin and Mahardja 2022[10]). The failure to consider water temperature in regard to quantifying rearing habitat fails to use the best available science.

V. <u>**The Draft Report Fails to Use the Best Available Science Regarding the Effects of Flow on Fish Populations:**</u>

As discussed below, the Draft Report fails to adequately disclose to the public and reviewers the effects of the shifting regulatory baseline, fails to consider that modeled flows are not likely to occur, and fails to analyze whether the Voluntary Agreement would achieve key flow metrics.

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[8] Matthew L. Nobriga, Cyril J. Michel, Rachel C. Johnson, John D. Wikert, 2021. Coldwater fish in a warm water world: implications for predation of salmon smolts during estuary transit. Ecology and Evolution. 2021;11:10381–10395, available online at: https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.7840.

[9] Vroom, J., van der Wegen, M., Martyr-Koller, R. C., & Lucas, L. V. 2017. What determines water temperature dynamics in the San Francisco Bay-Delta system? Water Resources Research, 53, 9901–9921. https://doi.org/10.1002/2016WR020062.

[10] Bashevkin, S.M. and B. Mahardja. 2022. Seasonally variable relationships between surface water temperature and inflow in the upper San Francisco Estuary. Limnology and Oceanography 67(3) DOI: 10.1002/lno.12027.

a. The Draft Report Fails to Adequately Account for the Shifting Baseline

The Draft Report appropriately attempts to account for the shift in the environmental baseline from the baseline used in the 2017 Scientific Basis Report to the Voluntary Agreement's proposal to use the requirements of the Trump Administration's unlawful biological opinions as the environmental baseline. However, in several key respects the Draft Report fails to provide the reader with clear and accurate information regarding the effects of the shifting baseline.

First, the Draft Report fails to explain that its estimate of changes in abundance of certain fish species is not comparable to the estimated changes in abundance of certain fish species in the 2017 Scientific Basis Report. The Draft Report estimates changes in abundance using modeled/expected flows, whereas the 2017 Scientific Basis Report estimated changes in abundance using only flows that would be required under the alternatives it evaluates (rather than modeled or expected flows), *see* 2017 Scientific Basis Report at 5-30 to 5-31. However, modeled flows under the alternatives described in the 2017 Scientific Basis Report are significantly higher than the flows required under those same alternatives. *See* 2017 Scientific Basis Report at 5-25 to 5-31. Therefore, given the linear nature of the flow-abundance and flow-survival relationships, modeled/expected flows in the 2017 Scientific Basis Report would result in substantially greater increases in abundance of these fish species than described in that report. The Draft Report should be revised to make clear that anticipated changes in abundance estimated by the two reports are not directly comparable, and abundance increases in the 2017 Scientific Basis Report would be substantially higher if the methodology used in the Draft Report had been used in the 2017 Scientific Basis Report.

Second, the shifting baseline obscures the fact that the proposed Voluntary Agreement results in smaller increases in expected Delta outflow than its proponents contend, and in certain water years the VA results in decreased Delta outflow relative to the baseline used in the 2017 Scientific Basis Report. *See* Draft Report at Table 4-11. However, Table 4-11 does not summarize the *changes* in outflow by water year type in terms of thousands of acre feet ("TAF") or percentage change, as the table below shows:

Season	Water Year Type	CalSim 3 Baseline (TAF)	Postprocessed Baseline (TAF)	VA without lower San Joaquin (TAF)	VA with lower San Joaquin (TAF)	**Difference in Outflow: VA vs 2017 Baseline (w/o lower SJR) (TAF)**	**Percent Difference in Outflow: VA vs 2017 Baseline (w/o lower SJR)**
Jan–Jun	W	23,331	23,593	23,460	23,513	**-133**	**-0.56%**
Jan–Jun	AN	12,796	12,919	13,376	13,500	**457**	**3.54%**
Jan–Jun	BN	6,085	6,135	6,601	6,707	**466**	**7.60%**
Jan–Jun	D	5,273	5,398	5,823	5,928	**425**	**7.87%**

Jan–Jun	C	3,601	3,673	3,735	3,788	**62**	**1.69%**

Table 4-11 should be revised to include information summarizing the changes in expected Delta outflow proposed under the Voluntary Agreement in both thousands of acre feet and percentage changes, similar to the table above. The amounts of flow proposed by the Voluntary Agreement (shown on Table ES-1) are misleading to the public in light of the changes to the baseline, and this information is necessary for the public to understand the volume of water proposed under the Voluntary Agreement in light of the shifting baseline and in order for those volumes to be compared with the baseline used in the 2017 Scientific Basis Report.

Finally, the Draft Report's estimate of flow-related biological benefits is inflated by the choice of baselines because it includes flow contributions from the San Joaquin Basin, whereas the 2017 Scientific Basis Report did not include additional flows from the San Joaquin Basin in its analysis of changes in flows and abundance. Furthermore, the Draft Report treats VA flows from the San Joaquin as increases, when they actually represent decreases in San Joaquin flows relative to those required under the existing Water Quality Control Plan. In 2018 the Board adopted instream flow requirements for the Stanislaus, Tuolumne, Merced, and lower San Joaquin rivers as amendments to the Bay-Delta Plan, which requires far more water than what is proposed in the Voluntary Agreement for the San Joaquin Basin. The Draft Report should be revised to include a reference to the expected increase in Delta inflows and outflows required by the 2018 Bay-Delta Plan amendments in order to make the flows proposed under the Voluntary Agreement comparable with the analysis in the 2017 Scientific Basis Report.

b. The Draft Report Fails to Adequately Explain that Modeled Flows under the Voluntary Agreement Flows are Not Likely to Occur

The Draft Report also fails to adequately consider that the modeled flows under the Voluntary Agreement are almost certain not to occur. While the Draft Report acknowledges some uncertainty about deviations from the modeled results as a result of flexibility in when flow assets are provided, Draft Report at 7-2, the Draft Report fails to recognize several other important uncertainties that make the modeled flows unlikely to occur, which should be discussed and documented in the Draft Report.

First, the 2017 Scientific Basis Report discusses the need to establish new flow requirements in order to ensure that flow conditions are not degraded in the future as a result of new water diversion and storage projects or increased diversions under existing water rights. *See, e.g.*, 2017 Scientific Basis Report at 1-5, 5-10, 5-24. For example, the 2017 Scientific Basis Report explains that "Existing flows generally exceed minimum D-1641 Delta outflow objectives for February through June, which means that over time with increasing water development, existing outflows will likely diminish with additional diversions." *Id.* at 5-24. Similarly, it explains that,

> As previously discussed, the percent of unimpaired flow scenarios do not yet account for other regulated and unregulated flows that would also contribute to Delta outflows above the inflow-based Delta outflow requirement, and predicted flows would be higher at times. The relative magnitude of this difference can be discerned by comparing current conditions with MRDO. The Staff Report will

> include modeling analyses that include these additional expected flows. While a complete analysis of this issue will include predicted flows under the scenarios that accounts for other flows, the analysis is still useful for several reasons. First, the analysis indicates that MRDO is inadequate to ensure the current level of Delta outflow protection. **While MRDO requirements do not control operations much of the time, with increasing water diversions, adequate minimum requirements will be critical as is demonstrated in Chapter 2.**

Id. (emphasis added). The State Water Resources Control Board's 2018 Framework discussed this problem in further detail, explaining that,

> In addition to existing water right claims, new water rights may also be requested. The volume of water in active or pending water right applications, in addition to water that was set aside and reserved by the state (referred to as 'state filed water rights'), far exceeds the average annual unimpaired runoff from the Bay-Delta watershed. Further, state filings maintain the water right priority of the date they were established, which for many date back about a hundred years ago, making water rights under these filings senior to many existing water rights. Given these potential future demands and limited existing flow requirements in the Bay-Delta watershed, it is imperative that updated flow requirements be established in order to protect fish and wildlife beneficial uses in the Bay-Delta watershed.

2018 Framework at 7.

In contrast, the Voluntary Agreement does not identify specific flow requirements or guarantee that the modeled flows will occur, nor does it propose to prohibit new water diversions, new water storage projects, or increased water diversions by existing water rights holders, all of which would reduce flows compared to the modeled results. Delta outflows are therefore almost certain to be less than the modeled results.[11] The Draft Report fails to explain the basis for assuming that modeled flows actually will occur, and what limits on new or increased water diversions would be imposed to ensure these modeled flows actually occur.

Moreover, a significant portion of the water proposed in the Voluntary Agreement is supposed to be purchased, including purchases at market rates. *See id*. at Table ES-1. However, the Draft Report does not acknowledge the numerous examples of similar water purchase programs that failed to provide the promised environmental flows, including the CVPIA Level 4 refuge water supply program, and the Voluntary Agreement does not require that these flows will be provided regardless of the cost.

Equally important, during every year identified as critically dry since 2012, the parties to the Voluntary Agreement have failed to meet the minimum Delta outflow requirements of D-1641.

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[11] Indeed, several new water storage and diversion projects are currently proposed (e.g., Sites Reservoir and Delta Conveyance Project) that would substantially reduce flows into and through the Delta compared to the environmental baseline over the longer term, according to their environmental documentation.

See also 2017 Scientific Basis Report at 1-6 ("As evidenced in the recent drought, the Projects' ability to maintain responsibility for meeting all Bay-Delta Plan flow and water quality requirements in the watershed while preserving water for cold water purposes is not realistic in the face of climate change and increasing water demands."). However, the Voluntary Agreement does not provide any assurance that the minimum requirements of D-1641 (the foundation of the Voluntary Agreement) would be met during multi-year droughts. This includes reductions in Delta outflow during the summer months, which is currently not considered in the Draft Report despite the scientific information demonstrating the importance of summer and fall flows to Delta Smelt and other native fish species. *See also* 2017 Scientific Basis Report at 3-75 to 3-77, 5-32.

Therefore, Draft Report should be revised to clearly state that modeled flows under the Voluntary Agreement are not required and are not likely to occur in the future, that water assumed to be purchased by the Voluntary Agreement is highly uncertain and not required, and that flows during droughts are likely to be much lower than modeled flows under the Voluntary Agreement.

c. The Draft Report Should be Revised to Consider Frequency of Achieving Key Flow Thresholds

The Draft Report fails to evaluate the frequency with which the proposed Voluntary Agreement would likely achieve key flow thresholds identified in the 2017 Scientific Basis Report (notwithstanding the flawed assumption that modeled flows are likely to occur). *See, e.g.,* 2017 Scientific Basis Report at 3-100, 5-25 to 5-31. The Draft Report should be revised to include this analysis, and appropriate caveats regarding the use of modeled flow results described above. In addition, the Draft Report fails to consider several flow thresholds identified in more recent scientific studies, which should be identified and referenced in the Draft Report:

- Flows of approximately 24,720 cfs at Bend Bridge were identified as a key flow threshold for survival of outmigrating juvenile winter-run Chinook salmon, with survival reduced when flows drop below this level and increased at flow levels above this threshold. Hassrick et al. 2022.[12]

[12] *Factors Affecting Spatiotemporal Variation in Survival of Endangered Winter-Run Chinook Salmon Out-migrating from the Sacramento River.* N. Amer. Journal of Fish. Mgmt., DOI: 10.1002/nafm.10748. This paper was published after Michel et al. 2021 and includes flow thresholds specific to winter-run Chinook salmon, whereas Michel et al. 2021 examined flow thresholds for spring-run and fall-run Chinook salmon. In addition, the Draft Report should be revised to clarify that Michel 2021 recommends "implementation of spring pulse flows above the 10,712 cfs flow threshold," that the 22,872 cfs flow threshold is the minimum for overtopping Tisdale Weir and that the paper's estimate of lower survival rates above this threshold may be "an artifact of lower detection efficiencies associated with fish utilizing additional high flow migration routes with less receiver coverage," and that the available data was not sufficient to distinguish the effects of flows on survival between the thresholds of 10,712 cfs and 22,872 cfs.

- Flows of approximately 35,000 cfs (1,000 m^3/second) at Freeport were identified as a key flow threshold for survival of salmon migrating through the Delta, with survival reduced when flows drop below this level. Perry et al. 2018.[13]

VI. <u>**The Draft Report Fails to Consider the Effects of the Voluntary Agreement on the Extent and Duration of Harmful Algal Blooms:**</u>

The Draft Report fails to consider the adverse effects of implementing even the modeled Voluntary Agreement flow regimes on the magnitude, duration, and intensity of harmful algal blooms ("HABs"). The best available scientific evidence uniformly indicates that baseline conditions during drier years, which results in very low Delta outflow and associated upstream shifts in X2 location during the summer, increase the likelihood of HABs, whereas substantial increases in Delta outflow reduces the likelihood of HABs.

Lehman et al. 2020 found a "strong correlation of *Microcystis* abundance with the X2 index and water temperature," with outflow and water temperatures explaining 58-78% of the variation in bloom surface. Most notably, the paper concludes that,

> Importantly, relatively small changes in the location of the X2 index may be important. A shift of the X2 index by only 3 km was associated with a factor of 3 increase in the percent abundance of subsurface Microcystis cells in the cyanobacterial community between the extreme drought years 2014 and 2015 (Lehman et al., 2018). Similarly, the increase in the X2 index from 71 km in July to between 75 and 76 km in August and September may have facilitated retention of cells in the central Delta during the peak of the bloom in 2017.

Lehman et al. 2020. This finding is consistent with other research from the Bay-Delta, which has found that the frequency of these blooms is closely linked to water residence time (i.e., flow rates). Berg M and Sutula M. 2015. Factors affecting the growth of cyanobacteria with special emphasis on the Sacramento-San Joaquin Delta. Southern California Coastal Water Research Project, Technical Report 869 August. More recently, Lehman et al.2022 concluded that X2 (Delta outflow) and water temperature predict much of the variation in *Microcystis* surface biovolume, that it was "not unexpected that the X2 index would account for most of the variation in the *Microcystis* bloom abundance" in the Delta, and that the *Microcystis* bloom in 2014 peaked when X2 was above 85 km. *See also* Kudela, R. M, Howard, M. D, Monismith, S., & Paerl, H. W. (2023). Status, Trends, and Drivers of Harmful Algal Blooms Along the Freshwater-to-Marine Gradient in the San Francisco Bay–Delta System. San Francisco Estuary and Watershed Science, 20(4). http://dx.doi.org/10.15447/sfews.2023v20iss4art6, available online at https://escholarship.org/uc/item/1dz769db.

Inexplicably, the Draft Report completely overlooks the connection between Delta flow regimes and HABs, and the effects of implementing modeled Voluntary Agreement flow regimes on this

[13] *Flow-mediated effects on travel time, routing, and survival of juvenile Chinook salmon in a spatially complex, tidally forced river delta.* Can. Journ. of Fish. & Aquatic Sci. 75:11, DOI/10.1139/cjfas-2017-0310.

relationship. Ironically, the sole mention of HABs in the Draft Report is to acknowledge that, "increases to flow may alleviate the impacts of cyanoHABs" and then to caveat this statement with reference to potential temperature impacts in hotter years that may counteract flow benefits. *See* Draft Report at 2-23.

The Draft Report should be revised to consider the effects of the modeled Voluntary Agreement flow regime on the formation and extent of HABs, including whether these flows are adequate to ameliorate the increasingly adverse effects of HABs under baseline conditions.

VII. <u>The Draft Report's Modeling Assumptions for Salmon Doubling Fail to Use the Best Available Science:</u>

Finally, the Draft Report's modeling of the habitat area necessary to achieve the salmon doubling objective fails to provide a reasoned explanation for the selected salmon escapement values and uses estimates of egg-to-fry survival that are inconsistent with the best available science. As a result, this modeling must be substantially revised.

The first major flaw in the calculation is that the Draft Report's salmon escapement targets are inconsistent with, and much lower than, the salmon doubling objective, and the Draft Report fails to provide a reasoned explanation for the selected values. The U.S. Fish and Wildlife Service's Final Restoration Plan for the Anadromous Fish Restoration Program (2001) ("AFRP") identifies a natural production target of 990,000 salmon of all runs, including 439,000 salmon in the mainstem Sacramento River, in Appendix B-1. Even accounting for the difference between production and escapement, the Draft Report's escapement targets do not appear to be consistent with the AFRP's salmon doubling natural production targets on any of the selected river systems:

	Final AFRP 2001 Production Target	**Draft Report Escapement Target**	**Percentage of AFRP Salmon Doubling Natural Production Target**
Total	990,000 salmon (all runs combined) Fall-run: 750,000 Late-fall-run: 68,000 Winter-run: 110,000 Spring-run: 68,000	366,600	37%
Sacramento River	443,000 (all runs combined): Fall-run: 230,000 Late-fall-run: 44,000 Winter-run: 110,000 Spring-run: 59,000	154,000	35%
Feather River	170,000	98,000	58%
Yuba River	66,000	26,000	39%
American River	160,000	82,000	51%

Mokelumne River	9,300	6,600	71%

The Draft Report fails to explain why its escapement targets range from a high of 71 percent of the AFRP's natural production target on the Mokelumne River to a low of 35 percent of the AFRP's production target for the Sacramento River. The Draft Report states that these escapement numbers were taken from Table 3-Xa-1 of the 1995 U.S. Fish and Wildlife Service Working Paper on Restoration Needs Volume 3. *See* Draft Report at 5-3. However, these escapement numbers are not consistent with the escapement numbers in that table (Table 3-Xa-1 of the 1995 Working Paper). Equally important, Table 3-Xa-1 of the 1995 Working Paper only provides average historical escapement values, and this table does not identify escapement targets necessary to achieve the AFRP's salmon doubling production targets. *See* U.S. Fish and Wildlife Service 1995 at 3-Xa-1 ("In general, escapement estimates were taken from Mills and Fisher (1994)."). The Draft Report and modeling used in the proposed VA must be revised to be consistent with the salmon doubling objective, and provide a reasoned explanation for the selected numbers.

Second, the modeling used in the Voluntary Agreement and Draft Report to calculate habitat area needed to achieve salmon doubling uses an assumption of egg-to-fry survival that is substantially higher than observed values in the Central Valley over the past 20 years, making the model results unreliable. The Draft Report assumes egg-to-fry survival of 38 percent. *See* Draft Report at Table 5-1. However, over the past 20 years, egg to fry survival rates in the Central Valley have been less far less than this assumed value. For the Sacramento River, the U.S. Fish and Wildlife Service has estimated that egg to fry survival for the 2002-2020 period has averaged 13.4 percent for fall-run Chinook salmon (only achieving 38 percent in 2016) and averaged 14.1 percent for winter-run Chinook salmon (achieving 38 percent only in 2011 and 2017). *See* Voss and Poytress 2022. Similarly, the 2019 final report of the Scientific Evaluation Process for the Stanislaus River estimated that egg survival was 33 percent, which would necessarily result in egg to fry survival rates lower than 38 percent. SEP 2019 at 164. Egg-to-fry survival rates on the Mokelumne River are also far lower than these assumed values for wild spawned salmon in recent years. The Draft Report fails to provide a reasoned explanation to support this assumed value, which is more than double the observed average egg-to-fry survival over the past 20 years on the Sacramento River.

Finally, the modeling includes several assumptions and omissions that further undermine its reliability. As discussed *supra*, the modeling of habitat ignores the effects of water quality or water temperatures on habitat suitability, even though the Draft Report acknowledges that these are "key attributes of suitable habitat." *See* Draft Report at 5-6. In addition, the Draft Report assumes that all spawning and floodplain environments created under the Voluntary Agreement are suitable habitat. *See id*. at 5-7 to 5-10; *id*. at 5-11 ("… assumes all VA floodplain habitat is suitable habitat when inundated."). However, the SEP 2019 report, relying on on-the-ground assessments of habitat suitability, estimates that only 7 to 30 percent of floodplain habitat is actually suitable habitat for salmon, requiring greater inundated acreage to achieve habitat targets. SEP 2019 at 165. The Draft Report fails to justify the assumption that all inundated floodplain is suitable habitat, and it should be revised to use a habitat suitability assumption of 7 to 30 percent.

VIII. Conclusion:

Thank you for consideration of our views. We hope and expect that staff can quickly revise the Draft Report to address these concerns, removing the unfounded claims of unquantified "expected benefits" resulting from habitat restoration and including more accurate information regarding the likely flows under the proposed Voluntary Agreement.

Sincerely,

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