Appendix U, Part 1

Comment Letters on the 2019 RDEIR/SDEIS

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SMUD®

Sent Via E-Mail

March 14, 2019

Frances Mizuno
San Luis & Delta- Mendota Water Authority
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Los Ganos, CA 93635
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Subject: Long Term Water Transfers / DEIR / 2011011010

Dear Frances Mizuno,

The Sacramento Municipal Utility District (SMUD) appreciates the opportunity to provide comments on the Draft Revised EIR (DEIR) for the Long-Term Water Transfers Project (Project, 2011011010). SMUD is the primary energy provider for Sacramento County and the proposed Project area. SMUD's vision is to empower our customers with solutions and options that increase energy efficiency, protect the environment, reduce global warming, and lower the cost to serve our region. As a Responsible Agency, SMUD aims to ensure that the proposed Project limits the potential for significant environmental effects on SMUD facilities, employees, and customers. 1

We have no comments to offer at this time, but would appreciate it if the San Luis & Delta-Mendota Water Authority would continue to keep SMUD facilities in mind as environmental review of the Project moves forward. Please reroute the Project analysis for SMUD's review if there are any changes to the scope of the Project.

If you have any questions regarding this letter, please contact SMUD's Environmental Management Specialist, Amy Spitzer, at amy.spitzer@smud.org or 916.732.5384.

Sincerely,

Nicole Goi

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March 18, 2019

SENT VIA EMAIL (dcordova@usbr.gov)

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RE: Comments on Long-Term Water Transfers Revised DEIR/SDEIS

Dear Mr. Cordova:

These comments on the Long-Term Water Transfers ("Project") Revised Environmental Impact Report/Supplemental Draft Environmental Impact Statement ("RDEIR/SDEIS") are submitted on behalf of the Central Delta Water Agency, South Delta Water Agency, and Local Agencies of the North Delta.

The RDEIR/SDEIS begins with the inappropriate premise that the Bureau of Reclamation ("BOR") and San Luis-Delta Mendota Water Authority ("SLDMWA") are merely updating the document in response to the United States District Court for the Eastern District of California ("District Court") decision in *AquAlliance v. U.S. Bureau of Reclamation* (E.D. Cal. 2018) 287 F.Supp.3d 969 (*AquAlliance*). However, in doing so BOR and SLDMWA have impermissibly narrowed the scope of analysis in the RDEIR/SDEIS and ignored changes to the Project, baseline conditions, new relevant information, and cumulative circumstances. The RDEIR/SDEIS violates both the California Environmental Quality Act ("CEQA") and the National Environmental Policy Act ("NEPA") for ignoring and not analyzing these changes.

I. The RDEIR/SDEIS Relies on a Shifting and Unstable Project Description

A. Changes to the Project and Surrounding Circumstances Render the Project Description Inadequate

The RDEIR/SDEIS is framed as a mere revision of the original Draft Environmental Impact Statement/Environmental Impact Report ("EIS/R") in order to

address "the specific issues identified in the ruling." (RDEIR/SDEIS, p. ES-2.) This is misleading, as it implies that only the document has changed since 2015. In reality, just about all aspects of the Project have changed, including: a halved time period that commences five years after the original start date; increases in sellers and seller service areas; increases in the available amounts of each "source" of water; and the specious "reduction" to the total amount of water transferred annually. 2.1

"An accurate, stable, and finite project description is the sine qua non of an informative and legally sufficient EIR." (*County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 192.) On the other hand, "[a] curtailed, enigmatic or unstable project description draws are a red herring across the path of public input." (*Id*. at 198.) By only revising small portions of the RDEIR/SDEIS in response to the District Court Ruling, but failing to make any updates, the BOR and SLDMWA have created a scenario remarkably similar to that of *San Joaquin Raptor Rescue Center v. County of Merced* (2007) 149 Cal.App.4th 645 (*San Joaquin Raptor*). In *San Joaquin Raptor*, the EIR in question indicated both that no mine production increases would be sought, but provided for substantial increases in mine production if the project was approved. (*San Joaquin Raptor*, *supra*, 149 Cal.App.4th at 655.) The EIR made "assurances . . . that there would be no increase in production" but these were "entirely inconsistent" with indications of potentially higher mine production. (*Ibid*.) "These curtailed and inadequate characterizations of the Project were enough to mislead the public and thwart the EIR process." (*Id*. at 656.)

Here, the RDEIR/SDEIS discusses and analyzes a distinctly different Project than analyzed in the original EIS/R. The Project is now a five year plan, which starts five years later. (RDEIR/SDEIS, p. ES-8.) The Project now includes a naked, unenforceable assurance that transfers in any one year would not exceed 250,000 acre-feet. (*Ibid*.) There are ten new potential sellers, covering an undefined amount of unanalyzed service areas, and which create the potential for more transfers than under the original project. (See RDEIR/SDEIS, pp. 2-8 to 2-10.) Just as in *San Joaquin Raptor*, the RDEIR/SDEIS, in conjunction with the prior EIS/R, relies on a shifting project description, rendering it deficient as an informational document. 2.2

B. The Reduction in Annual Transfers Is Undefined and Unenforceable

An inaccurate project description results in an EIR that fails to disclose all of the impacts of a project. (*Santiago County Water Dist. v. County of Orange* (1981) 118 Cal.App.3d 818, 829.) A stable project description is necessary to provide the public with enough information to "ascertain the project's environmentally significant effects, assess ways of mitigating them, and consider project alternatives . . . ." (*Sierra Club v.* 2.3

City of Orange (2008) 163 Cal.App.4th 523, 533.) A project description is deficient where the characterization of expected project operations is inadequately supported by evidence that the project will operate within its described limits. (See *Center for Biological Diversity v. County of San Bernardino* (2016) 247 Cal.App.4th 326, 350.) Here the Project is described as having a limit on annual water transfers, but nothing in the EIR actually demonstrates that BOR and SLDMWA can ensure buyers and sellers adhere to this limit. Therefore, the Project's description is inaccurate.

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The RDEIR/SDEIS artificially caps off annual water transfers to 250,000 acre-feet per year because, supposedly, "[b]uyers have identified that their demand" does not exceed that amount. (RDEIR/SDEIS, p. ES-4.) A reduction in annual water transferred alone creates an unstable and misleading project description. Additionally, the RDEIR/SDEIS does not include any method of enforcing this arbitrary cap on water transfers. There is no mitigation measure, coordinated operations agreement, or any other enforcement mechanism to this effect. The RDEIR/SDEIS only includes conclusory assurances "all transfers (combined) in a year would be limited so as not to exceed 250,000 acre-feet." (RDEIR/SDEIS, p. 1-4.) SLDMWA lacks the necessary authority over the sellers to enforce such a limitation on transfers. SLDMWA's boundaries are coextensive with its member contractors, which do not overlap with any sellers let alone buyers East Bay Municipal Utilities District and Contra Costa Water District. Water could be transferred through SWP facilities, which neither BOR nor SLDMWA have authority over. Transfers from non-CVP contractors that do not use CVP facilities could occur without BOR or SLDMWA approval. The RDEIR/SDEIS concedes that such transfers could occur. (RDEIR/SDEIS, pp. 1-2 ["Other transfers not included in the RDEIR/SDEIS could occur during the same time period"], 1-4 ["For each transfer, buyers and sellers are responsible for identifying one another, initiating discussions, and negotiating the terms of the transfers"].)

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Even if one can presume that buyers and sellers will follow the law by adhering to the cap, there is nothing indicating that other agencies will even know whether their transfers fall within the arbitrary volumetric cap of 250,000 acre-feet per year. The RDEIR/SDEIS does not designate any agency or other authority to keep track of the total amount of water transferred in relationship to this Project. In light of this, it appears that the reduction in total annual transfers is merely a tactic to avoid meaningful analysis of the Project's impacts. The RDEIR/SDEIS repeatedly references that 250,000 acre-feet per year is "less than that which was included in the [Biological Opinions]" (RDEIR/SDEIS, pp. ES-6, 2-4) or that buyer demand does not exceed that figure (RDEIR/SDEIS, pp. ES-4, ES-5, 2-2.) There is absolutely nothing in the RDEIR/SDEIS substantiating the claim that buyers' demands do not exceed 250,000 acre-feet per year. Without a way to enforce or track the total amount of transfers, it is inaccurate to describe

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the Project as capped at 250,000 acre-feet of transfers per year. Again, as in S*an Joaquin Raptor*, the Project is described in one way, while the remainder of the RDEIR/SDEIS contradicts that description.

II. New Cumulative Projects Must Be Considered in All Cumulative Impact Analyses

CEQA requires agencies to evaluate any impacts of the project that may be "cumulatively considerable," and address the project's incremental effects when combined with the effects of past, current, and probable future projects. (CEQA Guidelines, §§ 15064, subd. (h)(1), 15130 subd. (a).) Cumulative impacts may result from individually less than significant but collectively significant projects taking place over a period of time. (CEQA Guidelines, § 15355 subd. (b).) The purpose of the cumulative impacts analysis is to avoid considering projects "in a vacuum," because failure to consider cumulative harm may risk "environmental disaster." (*Whitman v. Board of Supervisors* (1979) 88 Cal.App.3d 397, 408.) "[T]he greater the existing environmental problems are, the lower the threshold should be for treating a project's contribution to cumulative impacts as significant." (*Communities for a Better Env't v. California Resources Agency* (2002) 103 Cal.App.4th 98, 120.) "One of the most important environmental lessons evident from past experience is that environmental damage often occurs incrementally from a variety of small sources. These sources appear insignificant, assuming threatening dimensions only when considered in light of the other sources with which they interact." (*Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 720.)

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The duty to disclose cumulative projects, and analyze cumulative conditions, did not somehow end with the circulation of the original EIS/R. Yet the RDEIR/SDEIS fails to disclose, much less analyze, substantially changed circumstances resulting from several additional proposed projects that were not previously addressed in the original EIS/R's cumulative impact analysis, including whether the Project in conjunction with these additional projects would be substantially more severe than evaluated in the original EIS/R. (CEQA Guidelines, § 15088.5, subd. (a)(1).) As explained more fully in other comment letters, these projects include other water transfer projects as well as the Addendum to the Coordinated Operation Agreement ("COA amendments") and the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary Voluntary Settlement Agreement ("VSA"). While these projects clearly have the potential to further affect the availability of water supplies as well as various water quality parameters in the Delta, the EIS/R is simply bereft of any consideration of the combined impacts of these new cumulative projects and the Project.

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As these cumulative projects share similar features with the Project, both the COA amendments and VSA could affect the cumulative impact analysis for each resource discussed in the RDEIR/SDEIS. As both the COA amendments and VSA would result in lower Delta outflows they would impact water supply and water quality, as well as fisheries. However, without additional analysis, it is not clear whether these new projects render the Project's cumulative impacts significant. Thus, it is necessary to update the cumulative project list for the entire Project. 2.7

III. An Entirely New EIS/R Should Be Prepared and Circulated

"If the proposed changes render the previous environmental document wholly irrelevant to the decisionmaking process, then it is only logical that the agency start from the beginning under [Public Resources Code] section 21151 by conducting an initial study to determine whether the project may have substantial effects on the environment." (*Friends of College of San Mateo Gardens v. San Mateo County Community College Dist.* (2016) 1 Cal.5th 937, 951 (*San Mateo Gardens*).) The question under CEQA is "when there is a change in plans, circumstances, or available information after a project has received initial approval, the agency's environmental review obligations turn on the value of the new information to the still pending decisionmaking process." (*Id*. at 951-951, internal quotations omitted.) The CEQA lead agency must decide whether project changes require major revisions to the original document. (*Id*. at 952.) NEPA imposes a parallel obligation, requiring an agency to supplement a draft EIS where there are significant new circumstances or information relevant to a project's environmental concerns. (40 C.F.R. 1502.9, subd. (c)(ii); see also *Russell Country Sportsmen v. United States Forest Serv.* (9th Cir. 2011) 668 F.3d 1037, 1045.) 2.8

Here, despite changes in "plans, circumstances, [and] available information," BOR and SLDMWA have failed to adequately update the RDEIR/SDEIS.

The RDEIR/SDEIS is a minimalistic document, which only attempts to rectify past adjudicated mistakes, rather than a good faith effort to inform the public of the Project's impacts. The RDEIR/SDEIS fails to even consider how changes to the Project, changes in circumstances, or new information are reflected in other resource areas. The geographic area of the Project has changed considerably with the addition of new sellers. More water could be transferred under any of the described methods. As discussed above, new cumulative projects exist, but are not disclosed, let alone addressed in updated cumulative impact analysis. Several resources areas not discussed in the RDEIR/SDEIS are affected by new sellers and an increased transfer capacity. For example, the prior water supply analysis relied on the baseline conditions in the sellers' service area, yet the RDEIR/SDEIS does not include any water supply analysis to update 2.9

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the new sellers. Similarly, the Project's individual water quality impacts relied on the same baseline conditions. BOR and SLDMWA have not offered any evidence that the impacts in these areas remain the same despite the different baseline conditions. The baseline conditions relied on in the 2015 documents are irrelevant to a water transfer scheme occurring from 2019 to 2025, and the new conditions must be disclosed and used for updated analysis.

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The increase in total transferable water, coupled with the lack of enforcement measures for the 250,000 acre-feet cap, is also significant change to the Project that could result in new unanalyzed impacts. In fact, the purported reduction to 250,000 acre-feet of transfers per year distracts from the reality that more water is available for transfer now than in 2015: water available via groundwater substitution in April–June has increased by 18,535 acre-feet, and by 23,765 acre-feet in July–September; water available via crop idling/shifting in April–June has increased by 32,490 acre-feet, and by 55,320 acre-feet in July–September; and water available via reservoir release has increased by 15,000 acre-feet. Even assuming the 250,000 acre-feet cap is adhered to, there is the potential for more groundwater substitution or more crop idling than evaluated under the original EIR. This possibility necessitates full environmental review of the new Project.

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Simply put, it is not 2015, and much has changed since then. The current proposed Project is markedly different than the one originally contemplated over five years ago, having been significantly changed in scope. California and the Project area are not as they were when environmental analysis for the original project was conducted. The conditions the original project was evaluated against no longer exist. All of these changes warrant BOR and SLDMWA starting from square one, and evaluating this new Project entirely. (See *San Mateo Gardens, supra*, 1 Cal.5th at 951.)

IV. The RDEIR/SDEIS Fails as an Informational Document Regarding Climate Change Impacts

The RDEIR/SDEIS violates both NEPA and CEQA by failing to adequately address impacts associated with climate change, including the Project's potential to exacerbate the impacts of climate change.

A. The RDEIR/SDEIS Must Address Climate Change Under CEQA

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SLDMWA previously argued that it did not need to address climate change under CEQA because there is no evidence that the Project would exacerbate its impacts under *California Building Industrial Association v. Bay Area Air Quality Management District* (2015) 62 Cal.4th 369, 386. New information contained in the RDEIR/SDEIS, however,

demonstrates that the Project will exacerbate climate change impacts. RDEIR/SDEIS pages J-13 and 14 reveal that climate change will result in reducing Delta outflow during at least the months of March, April, May and August. RDEIR/SDEIS page 3.3 reveals that the Project will also reduce Delta outflow in at least some of those months. The same is true for salinity in the Delta. (See RDEIR/SDEIS pp. J-5 and 3.2.-3.) Thus, the Project will exacerbate the impact of climate change on Delta outflow and salinity, thereby triggering the need for CEQA review. A revised and recirculated document will need to include CEQA review of climate change. 2.12

B. The RDEIR/SDEIS Continues to Violate NEPA and the Court's Judgment

The district court in *AquAlliance* found that the original EIS/R violated NEPA because it failed to address the impact of climate change, specifically that "snow water equivalent will decrease by 16 percent by 2035" as well as a "decrease in inflow during the peak irrigation period of June, July and August." (*AquAlliance*, *supra*, 287 F. Supp. 3d at 1030-1032.) The RDEIR/SDEIS now purports to address the district court's decision, but leaves more questions than answers.

Specifically, the RDEIR/SDEIS appears to rely on the "CalLite-CV model" that provides various climate change scenarios such as the "Central Tendency," "Hot-Dry" and "Warm-Wet" scenarios." (RDEIR/SDEIS, p. J-6.) What the RDEIR/SDEIS and even its technical report (Appendix J) fail to explain, however, is whether the CalLite-CV model incorporates the reduced snow water equivalent and temporal inflow shifts relied upon by the District Court to invalidate the original EIS/R. While Appendix J generally discusses these changes in runoff and snowpack, there is no suggestion that the CalLite-CV model actually incorporates them. (RDEIR/SDEIS p. J-5.) In fact, the RDEIR/SDEIS's technical study suggests that it does not by stating, "[I]t remains difficult to attribute observed changes in hydroclimate to historical human influences or anthropogenic forcings." (*Ibid*.) Further, the RDEIR/SDEIS fails to explain the amount of carbon emissions underlying the CalLite-CV model. This is relevant because the District Court in *AquAlliance* specifically disagreed with BOR's claim that the "A2" emission scenario was a "worst case" scenario under NEPA. (*AquAlliance*, *supra*, 287 F. Supp. 3d at 1029.) 2.13

Further, the scope of the RDEIR/SDEIS's climate change "analysis" is impermissibly narrow because it is limited only to whether climate change will affect the physical quantity of water available for transfer. As the RDEIR/SDEIS's technical study makes clear, climate change will have impacts in other areas such as water quality in the Delta vis-à-vis outflow and salinity. (RDEIR/SDEIS p. J-5.) With respect to salinity in 2.14

particular, the "accelerating" rates of sea level rise "are associated with increasing salinity in the Delta, which influences the suitability of its water for agricultural, urban, and environmental uses." (RDEIR/SDEIS, p. J-5-6.)

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Climate change also impacts groundwater, which is directly relevant to the Project and the ability to make water "available" through groundwater substitution as the district court noted in *AquAlliance*:

> This is not academic nit-picking. As the CalSim II Appendix explains, this "decrease in inflow during the peak irrigation period of June, July and August will be particularly difficult for existing agricultural water supplies, and will likely require additional groundwater recharge in the spring with increased groundwater pumping in the summer months.

(*AquAlliance*, *supra*, 287 F. Supp. 3d at 1029.)

Despite the various ways that climate change will affect the Project and its environmental impacts, the RDEIR/SDEIS only considers whether climate change will affect the amount of water available to transfer. This narrow focus violates NEPA by failing to take a hard look at the environmental effects including all foreseeable direct and indirect effects. (*N. Alaska Envtl. Ctr v. Kempthorne* (9th Cir. 2006) 457 F.3d 969, 975 (quoting *Idaho Sporting Congress*, *Inc. v. Rittenhouse* (9th Cir. 2006) 305 F.3d 957, 963.) It also fails to consider important aspects of the problem. (*Pub. Citizen v. Nuclear Regulatory Com'n* (9th Circ. 2009) 573 F.3d 916, 923.) The RDEIR/SDEIS must incorporate climate change predictions in its analysis of cumulative water quality impacts, and every other section of the RDEIR/SDEIS where such predictions are relevant.

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V. The Cumulative Water Quality Impact Analysis Is Deficient

A. The RDEIR/SDEIS Fails to Utilize an Adequate Threshold of Significance for Cumulative Water Quality Impacts

The District Court found that the original EIS/R violated CEQA because it failed to include a threshold of significance and because of "the total absence of consideration" of the "precarious" conditions of the Delta. (*AquAlliance*, *supra*, 287 F. Supp. 3d at 1035-1037.) The District Court faulted the prior EIS/R for not explicitly imposing a three percent threshold of significance, but found that even if the implied threshold was assumed, the cumulative water quality analysis was deficient nonetheless. (*Ibid*.) The

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RDEIR/SDEIS does nothing to correct these crippling deficiencies, but rather doubles down on them. 2.16

"Adopting thresholds of significance promotes consistency, efficiency, and predictability" in evaluating environmental impacts. (See *Communities for a Better Environment v. California Resources Agency* (2002) 103 Cal.App.4th 98, 111.) With respect to cumulative impacts, the relevant inquiry is whether any additional amount of an effect is significant in the context of the existing cumulative conditions. (See *Id*. at 118.) "In the end, the greater the existing environmental problems are, the lower the threshold should be for treating a project's contribution to cumulative impacts as significant." (*Id.* at 120.) 2.17

Like the prior EIS/R, the RDEIR/SDEIS fails to include any discernable threshold of significance. The RDEIR/SDEIS claims that "[b]ecause the changes in Delta outflow associated with the potential water transfers are insubstantial" that the Project's cumulative impacts are not significant. (RDEIR/SDEIS, p. 3.2-3.) Similarly, the RDEIR/SDEIS makes the same claim with respect to salinity. (*Ibid*.) This analysis does not provide what would be considered a substantial change. The lack of a threshold of significance undermines what analysis is included in the RDEIR/SDEIS.

B. The RDEIR/SDEIS Ignores New Information and Cumulative Projects That Would Impact Water Quality

Considering the District Court's ruling that the prior EIS/R cumulative water quality analysis violated CEQA due to its limited consideration of relevant information, it would seem prudent for the RDEIR/SDEIS update to be more inclusive. And yet, the RDEIR/SDEIS water quality analysis is deficient for its failure to integrate changed circumstances. As discussed above, new cumulative projects have arisen since 2015. Two such projects would have potentially significant impacts on Delta outflows, but the RDEIR/SDEIS makes no mention of them. 2.18

One conspicuous error is the failure to acknowledge or analyze the Addendum to the COA amendments because BOR is a signatory to that agreement. (See Attachments 1 (COA Amendment), 2 (COA Amendment EA).) On December 12, 2018, DWR and BOR amended the COA to reduce the United States' storage withdrawal percentage responsibility. Under the original COA, the United States was responsible for 75%, but is now only responsible for 65% in dry years and 60% in critical years. Thus, in dry and critical years, the SWP will be required to divert 10-15% more water. This change would exacerbate water quality issues at times when conditions are most dire in the Delta. The COA amendments change when, how often, and how much water will be taken out of 2.19

California's supply. This Project does the same, as they facilitate water transfers with CVP contractors as the primary recipients. The COA amendments are a cumulative project for purposes of water quality impacts, and all analysis relying on the old COA is now inadequate.

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The other cumulative project not discussed in the RDEIR/SDEIS is the VSA, of which BOR is also a party to. (See Attachment 3.) Under the VSA, the parties would rely on non-flow related measures to benefit fish and wildlife in the Delta ecosystem at the expense of decreasing flows in normal, dry and critical years. The VSA would also modify the requirements of D-1541, which BOR is responsible for maintaining. Like the Addendum to the COA amendments, the VSA is a water transfer related project involving BOR and CVP contractors. The total failure to acknowledge these new cumulative projects renders the cumulative water quality impact analysis legally inadequate.

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The RDEIR/SDEIS once again fails to consider the "precarious" condition of the Delta in evaluating cumulative impacts to Delta outflow. The RDEIR/SDEIS makes conclusory and unsupported statements, while continuing to ignore the reality in the Delta. The District Court held that merely categorizing the Project's individual impacts as "small" and highlighting other regulatory constraints on Delta outflows was not sufficient for cumulative impact analysis. (*AquAlliance*, *supra*, 287 F. Supp. 3d at 1036-1037.) The RDEIR/SDEIS makes the same mistakes, claiming that changes to Delta outflow would be insubstantial, without providing evidence to support that qualitative assertion. (RDEIR/SDEIS, p. 3.2-3.) The RDEIR/SDEIS also includes unsupported assurances such as that "[d]uring balanced conditions, the CVP would be required to release additional flow to maintain the standards in the Central Valley Water Quality Control Plan, so the Delta outflows would not change." (RDEIR/SDEIS, p. 3.2-2.) No supporting evidence demonstrates how or whether this assurance would be enforced. In fact, the COA amendments and VSA modify the CVP's release responsibilities, which this assumption does not consider.

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NEPA requires an agency to consider how climate change will affect the environmental baseline of a project. (See *Friends of the Wild Swan v. Jewell* (D.Mont. Aug. 21, 2014, No. CV 13-61-M-DWM) 2014 U.S.Dist.LEXIS 116788, at *31-32.) As discussed above, the RDEIR/SDEIS failed to correct the fundamental flaws in its climate change impact analysis. However, the cumulative water quality impact analysis also suffers for the lack of integrating new climate change information. Appendix J to the RDEIR/SDEIS describes the anticipated climate change effects on California, but this information is not represented in the cumulative water quality impact analysis. The updated climate change figures in Appendix J are not mentioned at all, despite its direct

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relevance to Delta outflow. (See RDEIR/SDEIS, Appen. J, Table J-2.) The failure to utilize this new information in the cumulative water quality impact analysis renders the RDEIR/SDEIS deficient.

VI. The Analysis and Proposed Mitigation for Giant Garter Snake Is Deficient

The district court in *AquAlliance* not only set aside the original EIS/R's analysis and mitigation for giant garter snake ("GGS"), but also set aside the USFWS Biological Opinion ("BiOp") supporting the Project's take of GGS. While purporting to address deficiencies in those earlier documents, the RDEIR/SDEIS provides an even more convoluted and legally deficient analysis and proposed mitigation for GGS that violates the mandates of both CEQA and NEPA.

First, the RDEIR/SDEIS fails as an informational document (CEQA) and also fails to take the requisite hard look (NEPA) at the Project's impacts on GGS. Specifically, water transfers resulting from idling and shifting of rice field and groundwater substitution impact GGS individuals that rely on rice field as important habitat. As explained by the recent USFWS Recovery Plan for the Giant Garter Snake ("Recovery Plan"):

> [W]e consider the following to be current threats: changes in water availability; levee and canal maintenance, water management and water deliveries which do not account for the giant garter snake; ***water transfers (resulting from cropland idling/shifting, reservoir releases, conservation measures, or groundwater substitution***)

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(See Attachment 4 (emphasis added).)

It is noted that the RDEIR/SDEIS's technical study cites to the draft GGS recovery plan from 2015 ("Draft Recovery Plan"), but ignores the final Recovery Plan that was approved by the USFWS in 2017. Thus, the RDEIR/SDEIS relies on outdated studies and methodologies to analyze and mitigate GGS impacts. Indeed, the Recovery Plan specifically responds to one comment requesting substantiation regarding the negative impacts resulting from water transfers including specifically groundwater substitution. (See Attachment 4, p. V-6.) The RDEIR's conclusory assertion that groundwater substitution would have no impact on GGS fails to address this specific, factual analysis in the Recovery Plan.

Groundwater substitutions resulting from idling/shifting of rice fields is even more problematic because "[s]ince giant garter snake surveys were first conducted in the 1970s, results have demonstrated that active rice fields and the supporting water conveyance infrastructure consisting of a matrix of canals, levees, and ditches have served as alternative habitat that is commonly used by the giant garter snakes in the absence of suitable natural marsh habitat." (See Attachment 4, p. I-2.) Here, the RDEIR/SDEIS attempts to mislead the public by downplaying the importance of rice fields as GGS habitat in addition to canals and ditches. This is not surprising since the RDEIR acknowledges that the Project could eliminate up to "12.8 percent of the average land in rice production within the Sacramento Valley." The RDEIR fails to adequately apply this significant reduction in important GGS habitat to a meaningful significance standard. 2.23

Second, the RDEIR/SDEIS also fails to adequately analyze the effectiveness of proposed mitigation. The RDEIR proposes as mitigation to prohibit cropland idling/shifting transfers for "fields abutting or immediately adjacent to areas with known important giant garter snake populations.' (RDEIR, p. 3.8-39.) The effectiveness of limiting applicability only to "known" important populations is rebutted by the RDEIR/SDEIS's important concession:

> ***Limited data exists on the actual distribution and occurrence of the giant garter snakes*** within Central Valley rice lands, and it is difficult to anticipate the level of effects the Proposed Action would have on giant garter snakes because of the challenges associated with quantifying and monitoring giant garter snake ecology.

(RDEIR/SDEIS, p. 3.8-18 (emphasis added).)

In other words, the RDEIR/SDEIS freely concedes that important GGS populations exist that are presently not "known." Thus, limiting the prohibition on water transfers to only "known" populations significantly undercuts this mitigation strategy. Put simply, the RDEIR/SDEIS has not adequately assessed the effectiveness of this mitigation strategy in light of the acknowledged uncertainties in identifying current GGS populations. 2.24

Another proposed mitigation measure is to "keep adequate in major irrigation and drainage canals." The effectiveness of this refuted by the fact that both rice fields and their associated canals and ditches provide necessary habitat. (See Attachment 4, p. I-2 (noting that important habitat includes "active rice fields and the supporting water conveyance infrastructure").) The District Court in *AquAlliance* expressed the same

concern: "[E]ven assuming snakes are found more frequently in canals and ditches, this does not explain why it is acceptable to focus on retention of waters in canals and ditches to the detriment of maintaining appropriate rice field habitat . . . ." (*AquAlliance*, *supra*, 287 F. Supp. 3d at 1073.) Neither the RDEIR/SDEIS nor its technical report provides an adequate explanation. Indeed, the technical report supports the conclusion that both rice fields and ditches are required by noting, "the study showed that maintaining canals without neighboring rice cultivation led to a decrease in giant garter snake survival rates." (RDEIR/SDEIS, p. I-79.)

In short, the scientific authorities are all in accord that a mitigation strategy of maintaining water only in canals is simply not effective. At the very least, the RDEIR/SDEIS has not adequately assessed the effectiveness of this strategy as required by NEPA. (*South Fork Bank Council of Western Shoshone of Nevada v. US. Dept. of Interior* (9th Cir. 2009) 588 F.3d 718, 727.) Here, however, the effectiveness is even further reduced because the proposed mitigation measure would maintain water only in "major" canals. The RDEIR/SDEIS does not define the scope of "major" canals and ditches that would continue to receive water. There is no assessment of whether keeping water only in "major" canals is effective mitigation. 2.24

In short, the RDEIR fails as an informational document by not adequately assessing the Project's impacts on GGS. Further, the RDEIR has not adequately assessed, much less supported, the effectiveness of the two major elements of the GGS mitigation strategy.

* * *

Thank you for the opportunity to provide comments on the Project and its RDEIR/SDEIS. As demonstrated above, the more conservative and defensible approach is to consider the Project a new project for purposes of environmental review and thereby prepare and recirculate a new EIR/EIS for public review and comment. Even if the lead agencies are inclined to consider the Project the same project, substantially more analysis

is required to satisfy CEQA and NEPA's public disclosure mandates. We look forward to reviewing a revised and recirculated draft environmental review document for the Project.

Very truly yours,

SOLURI MESERVE
A Law Corporation

By: 
Patrick M. Soluri

PS/mre

Attachments:

Attachment 1, December 2018, Agreement between the United States of America and the Department of Water Resources of the State of California for Coordinated Operation of the Central Valley Project and State Water Project

Attachment 2, December 2018, Environmental Assessment Addendum to the Coordinated Operation Agreement Central Valley Project/State Water Project

Attachment 3, Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary Voluntary Settlement Agreement

Attachment 4, U.S. Fish and Wildlife Service. 2017. Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*). U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. vii + 71 pp.

ATTACHMENT 1

ADDENDUM TO
THE AGREEMENT BETWEEN
THE UNITED STATES OF AMERICA
AND
THE DEPARTMENT OF WATER RESOURCES
OF THE STATE OF CALIFORNIA
FOR COORDINATED OPERATION OF THE
CENTRAL VALLEY PROJECT AND THE STATE WATER PROJECT

This addendum to the 1986 Agreement Between the United States of America and the State of California for Coordinated Operation of the Central Valley Project and State Water Project ("Agreement") is entered into by the United States and the State of California, this 12 day of December, 2018, in light of the following:

EXPLANATORY RECITALS

After the execution of the Agreement in 1986, the United States added facilities to the Central Valley Project, including the Red Bluff Pumping Plant and Fish Screen and the Delta Mendota Canal California Aqueduct Intertie.

After the execution of the Agreement in 1986, the State added facilities to the State Water Project, including the Barker Slough Pumping Plant and the Harvey O. Banks Pumping Plant 4-pump expansion.

In 1995 and 2006 the California State Water Resources Control Board established New Delta Standards.

Implementation of New Delta Standards imposed restrictions on the operations of the Central Valley Project and the State Water Project, including new restrictions on Delta exports by the United States and the State and new Delta outflow for the protection of aquatic species in the Delta.

After execution of the Agreement in 1986, biological opinions for the coordinated operations of the Central Valley Project and State Water Project were issued pursuant to the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.) that further restricted operations of the Projects and affected the ability of the United States and the State to achieve their respective water supply objectives.

The United States and the State have heretofore shared responsibility for meeting New Delta Standards and export capacity when exports were constrained by biological opinions for the coordinated operations of the Central Valley Project and the State Water Project through agreements reached between operators of the Central Valley Project and operators of the State Water Project.

The United States and the State have determined that periodic review pursuant to Article 14 of the Agreement would promote achieving their respective water supply objectives considering the New Delta Standards and the restrictions imposed under the Endangered Species Act.

NOW, THEREFORE, it is agreed:

1. Article 6(c) of the Agreement is amended to provide:

(c) Sharing of Responsibility for Meeting Sacramento Valley Inbasin use With Storage Withdrawals During Balanced Water Conditions: Each party's responsibility for making available storage withdrawals to meet Sacramento Valley inbasin use of storage withdrawals shall be determined by multiplying the total Sacramento Valley inbasin use of storage withdrawals by the following percentages:

	United States	State
Wet Years	80%	20%
Above Normal Years	80%	20%
Below Normal Years	75%	25%
Dry Years	65%	35%
Critical Years	60%	40%

The water year classifications described in this Article 6(c) shall be based on the Sacramento Valley 40-30-30 Index as most recently published through the Department of Water Resources' Bulletin 120.

In a Dry or Critical Year following two Dry or Critical Years, the United States and State will meet to discuss additional changes to the percentage sharing of responsibility to meet inbasin use.

2. A new Article 10(i) is added to the Agreement to provide:

(i) Sharing of Applicable Export Capacity When Exports are Constrained: During periods when exports are constrained by non-discretionary requirements imposed on the Central Valley Project and the State Water Project South Delta exports by any federal or state agency, applicable export capacity shall be shared by the following percentages:

	United States	State
Balanced Water Conditions	65%	35%
Excess Water Conditions	60%	40%

3. Article 10(b) of the Agreement is amended to provide:

(b) The State will transport up to 195,000 acre-feet of Central Valley Project water through the California Aqueduct Reaches 1, 2A, and 2B no later than November 30 of each year by direct diversion or by rediversion of stored Central Valley Project water at times those diversions do not adversely affect the State Water Project purposes or do not conflict with State Water Project contract provisions. The State will provide available capacity at the Harvey O. Banks Pumping Plant ("Banks") to the Central Valley Project to divert or redivert 195,000 acre-feet when the diversion capacity at the south Delta intake to Clifton Court Forebay is in excess of 7,180 cubic feet per second during the July 1 through September 30, except when the Delta is in Excess Water Conditions during July 1 through September 30, the diversion capacity at the south Delta intake to Clifton Court Forebay in excess of 7,180 cubic feet per second shall be shared equally by the State and the United States. This Article does not alter the Cross-Valley Canal contractors' priority to pumping at the Harvey O. Banks Pumping Plant, as now stated in Revised Water Rights Decision 1641 (March 15, 2000).

4. Pursuant to Article 11, Exhibit A will be updated to conform with Delta standards established by the State Water Resources Control Board in the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary.

5. Exhibit B shall be updated based on a joint operations study of the amendments as agreed to in this addendum.

6. Article 14(a) of the Agreement is amended to provide:

(a) Prior to December 31 of the fifth full year following execution of this agreement, and before December 31 of each fifth year thereafter, or within 365 days of the implementation of new or revised requirements imposed jointly on Central Valley Project and State Water Project operations by any federal or state agency, or prior to initiation of operation of a new or significantly modified facility of the United States or the State or more frequently if so requested by either party, the United States and the State jointly shall review the operations of both projects. The parties shall (1) compare the relative success which each party has had in meeting its objectives, (2) review operation studies supporting this agreement, including, but not limited to, the assumptions contained therein, and (3) assess the influence of the factors and procedures of Article 6 in meeting each party's future objectives. The parties shall agree upon revisions, if any, of the factors and procedures in Article 6, Exhibits B and D, and the Operation Study used to develop Exhibit B.

7. A new Article 14(c) is added to the Agreement to provide:

(c) For any triggering event requiring review under Article 14 that occurs after December 15, 2018, either party may move directly to the Advisory Board process. The

Advisory Board. consisting of one member designated by each party and a third member chosen by both parties, shall report its unanimous recommendations to both parties at a date not to exceed 180 days from which the matter was referred to the Advisory Board and the parties shall amend this agreement and immediately begin to operate in accordance with the recommendation. If the Advisory Board fails to make unanimous recommendations with the 180 day period, either party may unilaterally terminate this agreement.

THE UNITED STATES OF AMERICA

By _____
Commissioner, Bureau of Reclamation

THE DEPARTMENT OF WATER RESOURCES
OF THE STATE OF CALIFORNIA

By Karla A Nemeth
Director, Department of Water Resources

ATTACHMENT 2

RECLAMATION

Managing Water in the West

Environmental Assessment

Addendum to the Coordinated Operation Agreement
Central Valley Project/State Water Project

18-35-MP

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Regional Office
Sacramento, CA

December 2018

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Appendix A. Temperature Analysis for COA Modeling
Appendix B. Operational Analysis for COA Modeling

List of Acronyms and Abbreviations

Agreement	Coordinated Operation Agreement
CFR	Code of Federal Regulations
CVP	Central Valley Project
D-1485	California State Water Resources Control Board Water Right Decision 1485
D-1641	California State Water Resources Control Board Water Right Decision 1641
DCR	2015 DWR Delivery Capability Report
Delta	Sacramento–San Joaquin Delta Estuary
DWR	California Department of Water Resources
EI	Export to Inflow Ratio
ESA	Federal Endangered Species Act
Metropolitan	Metropolitan Water District of Southern California
OMR	Old and Middle River Index
Projects	Central Valley Project and State Water Project collectively
Reclamation	Bureau of Reclamation
SJR IE	San Joaquin River Inflow to Export Ratio
SWP	State Water Project
SWRCB	California State Water Resources Control Board
TAF	thousand acre-feet

1 Introduction

The United States and the State of California approved and built systems of water conservation and water delivery facilities in the Central Valley, known as the Central Valley Project (CVP) and State Water Project (SWP) (Projects), to serve multiple purposes, including to protect from floods and to deliver water to affected water rights holders and Project contractors. These provide significant public safety and economic benefits to citizens of the State and United States. The Bureau of Reclamation (Reclamation) and California Department of Water Resources (DWR) operate these facilities pursuant to existing water rights. Those water rights include conditions imposed by the State Water Resources Control Board (SWRCB) to protect the beneficial uses of waters in the Sacramento–San Joaquin watershed and Bay-Delta Estuary. The United States and State recognized the need for criteria for the coordinated operation of the CVP and SWP and entered into an initial agreement in 1960 for such coordination. Pursuant to the 1960 agreement, Reclamation and DWR developed and signed a more detailed operations agreement, the "Agreement Between the United States of America and the State of California for Coordinated Operation of the Central Valley Project and the State Water Project" (Agreement) in 1986 (Reclamation and DWR 1986a). The United States Congress enacted Public Law 99-546, which authorized Reclamation to execute the Agreement. Under this Agreement, Reclamation and DWR established the terms by which they would use their respective water rights to ensure certain contractual and regulatory responsibilities were met, while maximizing Reclamation's and DWR's ability to operate the CVP and SWP to meet water right and contract obligations upstream of the Delta, Delta water quality and flow objectives, joint Delta water right requirements issued by the SWRCB, and CVP and SWP water right and contract obligations that depend upon diversions from the Delta.

1.1 Need for the Proposal

As part of the ongoing operation of the CVP and SWP facilities, implementation of the Agreement has continuously evolved since 1986 to monitor and adjust operation of the facilities to meet fluctuating conditions, additional regulatory responsibilities, and the overall physical and regulatory environment in which the coordination of CVP and SWP operations takes place. Since 1986, new facilities have been incorporated into the CVP and SWP that did not exist when the Agreement was signed. Since 1986, water quality objectives/standards and flow requirements have been adopted by SWRCB (including but not limited to Decision 1641 [D-1641]); the Central Valley Project Improvement Act has changed how the CVP is operated; and finally, restrictions imposed by biological opinions issued pursuant to Section 7 of the ESA have affected both CVP and SWP operations.

Both D-1641 and the ESA resulted in restrictions on the CVP and SWP which were not explicitly addressed in the 1986 Agreement and have not been addressed in a formal update to the Agreement. Since adopting the various updated regulations, water exports from the Delta during periods when export restrictions are in place have generally been shared equally between the projects.

The current Agreement includes an article (Article 14) regarding periodic review every 5 years (unless otherwise requested). Although there have been many informal discussions regarding the Agreement since 1986, formal review pursuant to Article 14 has not been completed since 1986. On June 1, 2016, Reclamation and DWR began review of the Agreement as prescribed in Article 14(a), for the purpose of determining if revisions to the Agreement were warranted. The process was initiated following a series of preliminary meetings that were conducted since August 2015. From June 2016 through July 2018, numerous meetings were held, which also included CVP and SWP contractors. This process did not lead to mutual agreement on revisions, and in August 2018 Reclamation issued a Notice of Negotiation pursuant to Article 14(b)(2) of the Agreement.

Reclamation and DWR subsequently met and reviewed the unresolved issues and potential benefits of alternative approaches. Reclamation and DWR recognize that both agencies have similar interests, including providing for the public's safety and economic well-being in an environmentally sound manner. As highlighted in the Agreement, both agencies are dedicated to continued utilization of the Project facilities to provide the maximum benefit to the people of the State and nation through the coordinated operation of the Projects. Based on these principles, Reclamation and DWR developed a proposal for amending the Agreement that recognizes the best interests of Reclamation and DWR, as well as all the inherent purposes served by ongoing operation of the CVP and SWP.

1.2 Description of the Agreement

The Agreement outlines operations of the CVP and SWP facilities and water supplies subject to coordinated operation at the time of execution, defines how Reclamation and DWR would coordinate operational procedures, identifies formulas for sharing joint responsibilities for meeting in-basin uses including Delta standards identified in Exhibit A to the Agreement (SWRCB Water Right Decision 1485 [D-1485]) and other legal uses of water, identifies how unstored flow will be shared, establishes a framework for exchange of water and services between the CVP and SWP, and provides for periodic review of the Agreement and processes to consider updating terms as specific conditions affecting ongoing operations change. DWR and Reclamation reached temporary operational arrangements since 1986 to address various conditions, which include buildout of Project facilities, changes in water quality standards/objectives and flow requirements, passage of the Central Valley Project Improvement Act, and requirements under the Federal Endangered Species Act (ESA), but the Agreement has not been amended to address these conditions.

Several of the key provisions of the Agreement are described below:

Sacramento Valley Inbasin Uses: Sacramento Valley Inbasin uses are defined in the Agreement as legal uses of water in the Sacramento Basin, including the water required under the SWRCB D-1485. The Agreement identifies a process to incorporate new Delta standards established by the SWRCB. Each project is obligated to ensure water is available for these uses, but the degree

of obligation is dependent on several factors and changes throughout the year, as described below:

Balanced Water Conditions: Balanced water conditions are defined in the Agreement as periods when it is mutually agreed that releases from upstream reservoirs plus unregulated flows approximately equals the water supply needed to meet Sacramento Valley in-basin uses plus exports. Excess water conditions are periods when it is mutually agreed that releases from upstream reservoirs plus unregulated flow exceed Sacramento Valley in-basin uses plus exports. Reclamation's Central Valley Operations Office and DWR's SWP Operations Control Office jointly decide when balanced or excess water conditions exist.

Excess Water Conditions: During excess water conditions, sufficient water is available to meet all beneficial needs, the CVP and SWP are not required to supplement the supply with additional releases, and unstored water is available at quantities that exceed the Projects' physical or permitted export capacities. In excess water conditions, water accounting is not required and some of the excess water is available to CVP and SWP water contractors and users located upstream of the Delta. However, during balanced water conditions, CVP and SWP are sharing the responsibility to meet in-basin uses or are sharing the storage and export of unstored water which exceeds those in-basin uses.

Article 6 Sharing: When water must be withdrawn from reservoir storage to meet in-basin uses, 75 percent of the responsibility is borne by the CVP and 25 percent is borne by the SWP. When unstored water is available for export (i.e., Delta exports exceed storage withdrawals while balanced water conditions exist), the sum of CVP stored water, SWP stored water, and the unstored water for export is allocated 55/45 to the CVP and SWP, respectively. The percentages and ratios included in the Agreement were derived from negotiations between Reclamation and DWR and informed by analyses which assumed Delta standards and operating conditions that existed at the time of the Agreement. Reclamation and DWR have continued to apply these ratios as new SWRCB Delta water quality and flow standards are adopted.

2 Proposed Action and Alternatives

2.1 No Action Alternative

Reclamation and DWR would continue to follow the process defined in Article 14 of the Agreement. This would result in amendments to the Agreement other than those identified in the Proposed Action. There is a large degree of uncertainty in what the final amendment would include, given the differences in agency positions that led to the issuance of the Notice of Negotiations. As such, for evaluation purposes, the No Action Alternative was identified as a condition whereby the CVP and SWP would continue to operate per the Agreement without amendment or addendum. Obligations imposed on ongoing operations of the CVP and SWP since 1986 through D-1641 would continue to be met through temporary operations arrangements.

2.2 Proposed Action

Reclamation and DWR propose amending four key elements of the Agreement to reflect the evolved manner in which the Projects have been operated since the Agreement was originally authorized and signed: Article 6(c) in-basin uses; Article 10(b) CVP use of Harvey O. Banks ("Banks") Pumping Plant; Article 10(i) export restrictions; and Article 14(a) the periodic review. The exhibits and operations studies would also be updated as provided for in the Agreement. These elements are proposed to be updated as follows:

Article 6(c) of the Agreement is amended to provide:

> (c) Sharing of Responsibility for Meeting Sacramento Valley inbasin use with Storage Withdrawals During Balanced Water Conditions: Each party's responsibility for making available storage withdrawals to meet Sacramento Valley inbasin use of storage withdrawals shall be determined by multiplying the total Sacramento Valley inbasin use of storage withdrawals by the following percentages:

Water Year Type	United States	State of California
Wet	80%	20%
Above Normal	80%	20%
Below Normal	75%	25%
Dry	65%	35%
Critical	60%	40%

The water year classifications described in the amended Article 6(c) shall be based on the Sacramento Valley 40-30-30 Index as most recently published through the Department of Water Resources' Bulletin 120.

In a Dry or Critical Year following two Dry or Critical Years, the United States and State will meet to discuss additional changes to the percentage sharing of responsibility to meet inbasin use.

Article 10(b) of the Agreement is amended to provide:

(b) The State will transport up to 195,000 acre-feet of Central Valley Project water through the California Aqueduct Reaches 1, 2A, and 2B no later than November 30 of each year by direct diversion or by rediversion of stored Central Valley Project water at times those diversions do not adversely affect the State Water Project purposes or do not conflict with State Water Project contract provisions. If the diversion capacity at the south Delta intake to Clifton Court Forebay is in excess of 7,180 cubic feet per second during the July 1 through September 30, the State will provide available capacity at the Banks Pumping Plant to the Central Valley Project to divert or redivert 195,000 acre-feet, except when the Delta is in Excess Water Conditions during July 1 through September 30, the diversion capacity at the south Delta intake to Clifton Court Forebay in excess of 7,180 cubic feet per second shall be shared equally by the State and the United States. This Article does not alter the Cross-Valley Canal contractors' priority to pumping at the Harvey O. Banks Pumping Plant, as now stated in Revised Water Rights Decision 1641 (March 15, 2000).

Article 10(i) is added to the Agreement to provide:

(i) Sharing of Applicable Export Capacity When Exports are Constrained. During periods when exports are constrained by non-discretionary requirements imposed on the Central Valley Project and the State Water Project South Delta exports by any federal or state agency, allowable applicable export capacity shall be shared by the following percentages:

	United States	State of California
Balanced Water Conditions	65%	35%
Excess Water Conditions	60%	40%

Sharing of applicable export capacity during Balanced Water Conditions shall be considered a first right of refusal for the United States to use up to 65% of allowable export capacity after dividing any unstored water for export in accordance with 6(d).

Article 14(a) of the Agreement is amended to provide:

(a) Prior to December 31 of the fifth full year following execution of this agreement, and before-December 31 of each fifth year thereafter, or within 365 days of the implementation of new or revised requirements imposed jointly on Central Valley Project and State Water Project operations by any federal or state agency, or prior to initiation of operation of a new or significantly modified facility of the United States or the State or more frequently if so requested by either party, the United States and the

State jointly shall review the operations of both projects. The parties shall (1) compare the relative success which each party has had in meeting its objectives, (2) review operation studies supporting this agreement, including, but not limited to, the assumptions contained therein, and (3) assess the influence of the factors and procedures of Article 6 in meeting each party's future objectives. The parties shall agree upon revisions, if any, of the factors and procedures in Article 6, Exhibits Band D, and the Operation Study used to develop Exhibit B.

In addition to the amended articles presented above, pursuant to Article 11, Exhibit A will be updated to conform with Delta standards established by the State Water Resources Control Board in the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary as implemented by D-1641. Exhibit B shall also be updated based on a joint operations study of the amendments as agreed to, which identifies nondiscretionary requirements imposed on the Central Valley Project and State Water Project by any federal or state agency.

3 Affected Environment and Environmental Consequences

3.1 Required Resource Discussions

Executive Order, Department of the Interior regulations, and Bureau of Reclamation policy requires a discussion of the following:

- Indian Sacred Sites: The Proposed Action is not on federal lands and will neither affect nor prohibit access to any ceremonial use of Indian sacred sites.

- Indian Trust Assets: While there are myriad Indian Trust Assets within the Central Valley Project boundaries, the contemplated addendum to the coordinated operating agreement would be limited to adjustments regarding ongoing operation of the Projects and how the two projects meet the inbasin needs as defined in the Agreement. As such, the anticipated amendments to the Agreement would be limited to contract supplies South of the Delta for both the CVP and SWP, and there would be no effects to Indian Trust Assets.

- Cultural Resources: The Proposed Action is limited to amending certain elements of the Agreement between Reclamation and DWR related to operational responsibilities within existing CVP and SWP facilities and service areas. Approval of the addendum constitutes an undertaking that has no potential to cause effects on historic properties, pursuant to 36 CFR § 800.3(a)(1), and would result in no effects to cultural resources. Reclamation has no further obligations under 54 U.S.C. § 306108, commonly known as Section 106 of the National Historic Preservation Act, related to the Proposed Action.

- Environmental Justice: Discussions of environmental justice are required in all environmental documentation as provided in Executive Order 12898; these considerations are discussed within the Environmental Consequences section.

3.2 Affected Environment

The project area boundaries are defined by CVP facilities and service areas; and the SWP facilities and service areas, as shown in Figure 1.

3.2.1 CVP Facilities

The CVP facilities affected by the proposed amendments to the Agreement are reservoirs on the Trinity, Sacramento, and American Rivers and associated distribution facilities; Mendota Pool on the San Joaquin River; the Jones Pumping Plant; the Delta-Mendota and San Luis Canal; San Luis Reservoir; the San Felipe Division; and the CVP service area that relies upon water from these facilities.

Stored water in CVP Reservoirs North of the Delta is provided to the Delta for delivery through the Contra Costa Canal and Jones Pumping Plant. The Contra Costa Canal originates at Rock Slough near Oakley and extends to the Martinez Reservoir. Water from the Contra Costa Canal is delivered to the Contra Costa Water District. The Jones Pumping Plant at the southern end of the Delta lifts the water into the Delta Mendota Canal delivering water to CVP contractors, who divert water directly from the Delta-Mendota Canal, and to San Joaquin River exchange contractors who also divert directly from the San Joaquin River and the Mendota Pool. In addition, CVP water is conveyed to the San Luis Reservoir for storage and subsequent delivery to CVP contractors through the San Luis Canal and the Delta-Mendota Canal. From San Luis Reservoir, water is conveyed through the Pacheco Tunnel to CVP contractors in Santa Clara and San Benito counties.

3.2.2 SWP Facilities

The SWP facilities that would be affected by amending the Agreement are Lake Oroville on the Feather River; rivers, streams, canals, and aqueducts used to convey SWP water; and the SWP service area that relies upon water from these reservoirs, specifically: Lake Oroville on the Feather River; the Banks Pumping Plant in the southern Delta; the North Bay Aqueduct; the South Bay Aqueduct; California Aqueduct; SWP reservoirs including Lake Del Valle, San Luis Reservoir, and Pyramid, Castaic, Silverwood, and Perris Lake; the SWP service areas in the Sacramento and San Joaquin Valleys, in the San Francisco Bay Area, the Central Coast region, and the Southern California regions.

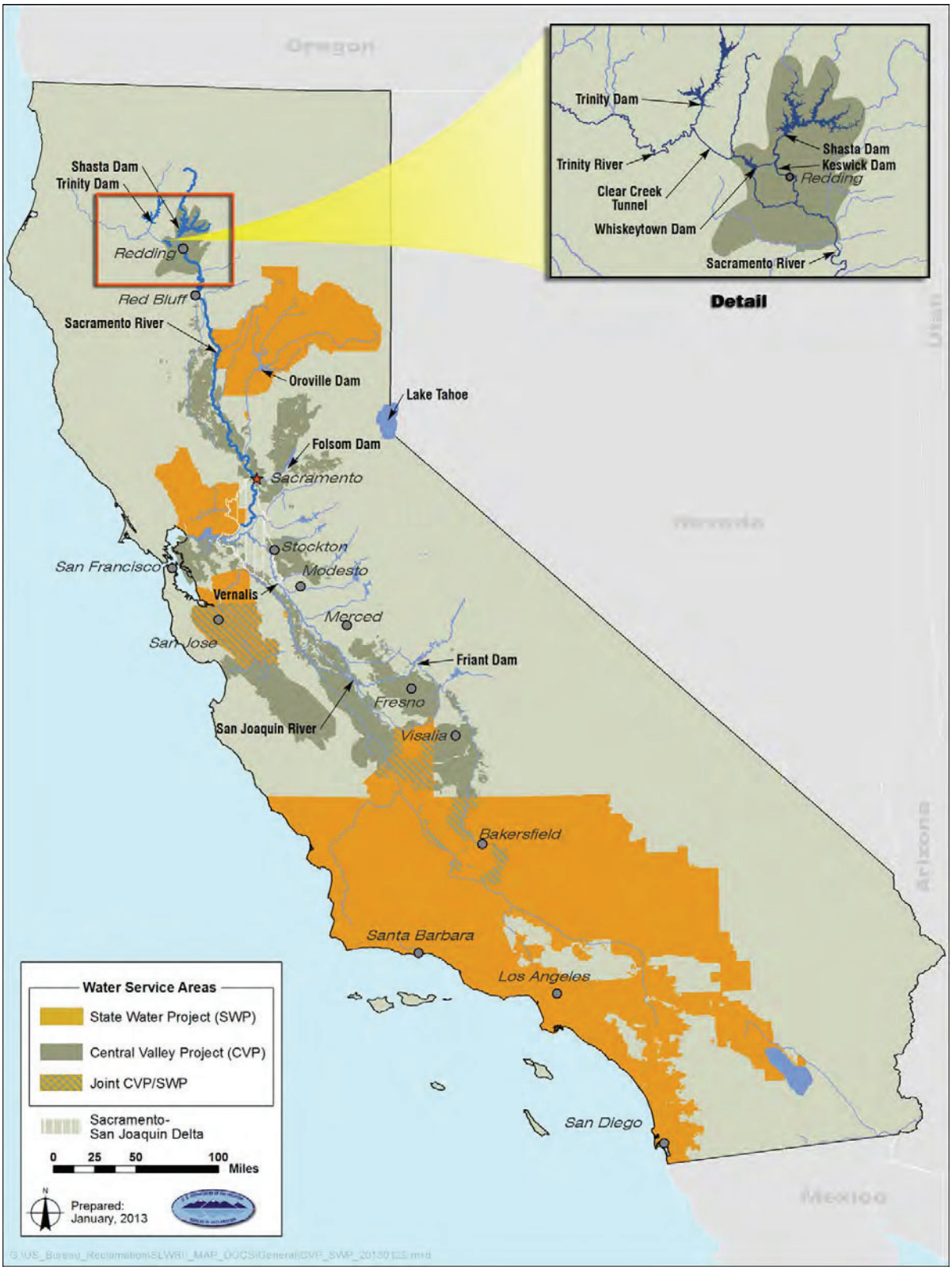

Figure 1 - Central Valley Project and State Water Project Facilities and Service Areas

3.3 Environmental Consequences

3.3.1 Scope of Analysis

CalSim II modeling results for amendments to the sharing formula are reflected in water storage and release patterns for the reservoirs associated with the CVP and SWP North of the Delta. The most notable differences are to reservoir elevations and release rates in varying year types. These amendments are also carried into the Delta, and differences in pumping rates at Jones Pumping Plant and Banks Pumping Plant.

"The essence of coordinated operations is the sharing formula, not the water supply figures in Exhibit B-1. The projects are not to be operated to meet predetermined yields, but rather to first meet the needs in the areas of origin, including the Delta water quality standards and flow requirements contained in Exhibit A." (Reclamation and DWR 1986b, S-2). In order to determine effects to operations from adjusting the sharing formula and water sharing agreement contained in Articles 6 and 10, Reclamation and DWR updated the CalSim II model and simulated 82 years of hydrology to ascertain how the adjustments might affect the Projects' ability to store and deliver water. Because reservoir storage can affect the release temperature and the volume of water available for instream flows below the dams, additional temperature models were used to determine whether meeting temperature criteria as provided in the current biological opinions would be an issue. No appreciable difference in temperature management is shown in the modeling. Therefore, no effect to downstream populations from reservoir storage changes is anticipated.

In addition, water temperature modeling on the Sacramento, Feather, and American rivers showed no appreciable difference at most times (Appendix A). The main difference shows up in critical water year types in the Sacramento River. The effects of water temperature in the Sacramento are evaluated on winter-run Chinook egg incubation, the most sensitive lifestage (i.e., lifestage requiring the coolest water). The egg mortality model, the "Martin Model" published by Dr. Martin of the National Oceanic and Atmospheric Administration Southwest Fisheries Science Center, integrates effects of water temperatures through the winter-run Chinook egg incubation period (May to October) and estimates effects to egg to fry survival attributable to water temperature. The egg mortality model results in general show no consistent appreciable difference between the alternatives. The real-time operations of Shasta in concert with the rest of the system place a focus on Shasta temperature control so that operational adjustments can be made daily as needed to best meet the temperature requirements of winter-run Chinook based on the best available science.

ESA listed salmonids, sturgeon, and delta smelt can become entrained and lost at the CVP and SWP delta pumping plants. Entrainment studies used for developing the loss equations at these facilities show that for each salmon salvaged at the CVP facility about 0.6 salmonid is lost and for each salmon salvaged at the SWP facility about four salmonids are lost. Therefore, water pumped at the CVP facility generally results in lower loss numbers (i.e., fewer fish predated upon or entrained past the salvage facility) than water pumped at the SWP, and shifting exports

through the Jones Pumping Plant rather than through Clifton Court Forebay may reduce take and benefit listed species.

Because the modeling indicates that effects to listed fish species in the Sacramento and American Rivers, and those that may be entrained at the pumps would be negligible or slightly beneficial, there is no further discussion of these resources.

The results from CalSim II modeling indicate that there would be changes in reservoir elevations, reservoir releases, and water supply delivery both North and South of the Delta that may affect water supply. For this reason, the discussion of effects is limited to water supply and socioeconomic effects associated with adjusting the sharing formula.

3.3.2 Water Supply Effects

Since 1986, several regulations have been implemented that substantially affect the way the Projects are operated. In reaction to these fluctuating conditions, and as provided for in Article 14(a) regarding periodic review, Reclamation and DWR analyzed how implementing the proposed action would affect water delivery (Appendix A). CalSim II was used to simulate the relative difference in water delivery under the adjusted sharing formula. The analysis used the adjusted sharing formula, and the amended ratios for export sharing when exports are constrained by Vernalis 1:1 April/May (D-1641), SJR I:E ratio (2009 BO RPA), OMR restrictions (2008/2009 BO RPA), and E/I ratio (D-1641). The CalSim II modeling was based on an amended 2015 DWR Delivery Capability Report (DCR) baseline. The DCR was amended to remove San Joaquin River Restoration Program flows, climate change, and sea level rise to reflect existing operations.

The proposed action includes different sharing ratios based on the Sacramento River Index and assumptions in CalSim II were adjusted to reflect the water year types for the particular ratio. The water year types are implemented in February based on final historical water year types, which does not reflect the forecast uncertainties or changes between February and May, though rarely is the sharing formula implemented in the February to May period. The sharing of exports when constrained by E/I, SJR I:E, or OMR was implemented consistent with the proposed action. If either Project could not take their share of exports, the other Project may.

The following sections discuss how adjusting the inbasin and export sharing formulas as described in the proposed action would affect reservoir storage, meeting inbasin demand as indicated by the Projects' ability to meet North of Delta deliveries, Delta outflow, and exports.

3.3.2.1 Reservoir Storage

Figures 2 and 3 indicate that the CVP and SWP end of September storage would be similar in Shasta, Folsom, Oroville, and Trinity reservoirs as with the current sharing formula. Figures 4 and 5 indicate that water stored in San Luis Reservoir would change in all months. With the proposed action, CVP storage would be higher in nearly all years, while SWP storage would be similarly reduced.

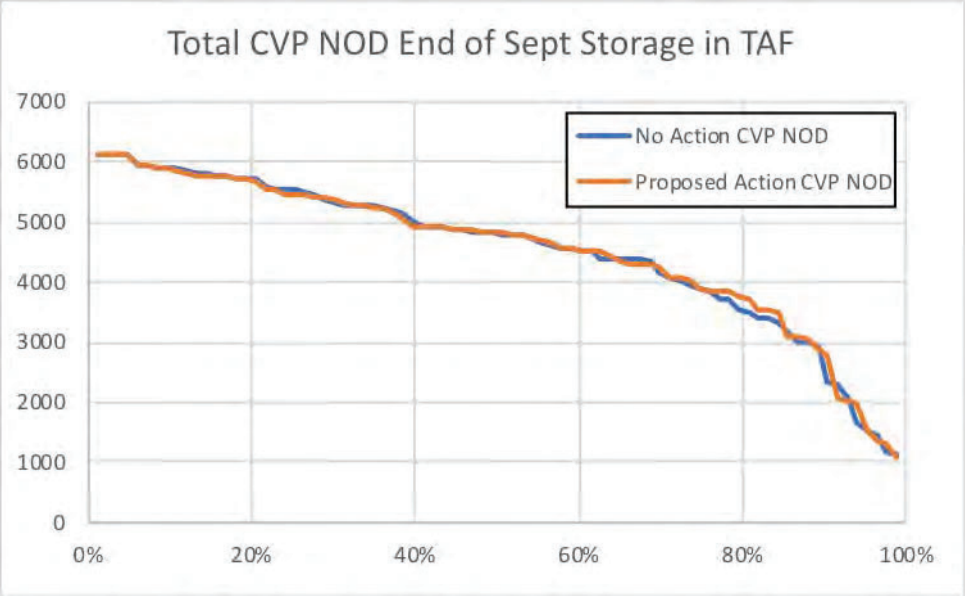

Figure 2 – Comparison of Shasta, Folsom, and Trinity Storage with and without the proposed action

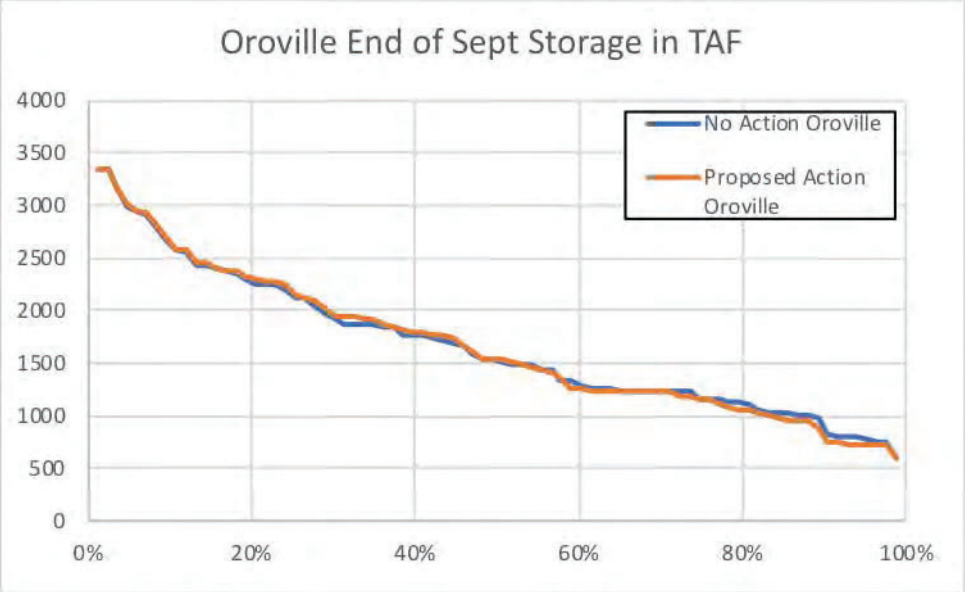

Figure 3 – Comparison of Oroville Storage with and without the proposed action

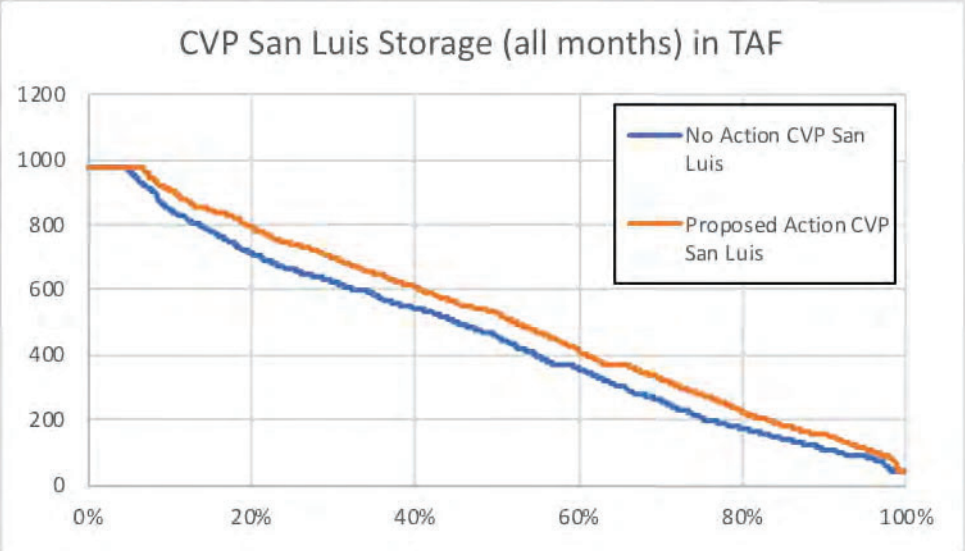

Figure 4 – Comparison of CVP Water in Storage at San Luis Reservoir with and without the proposed action

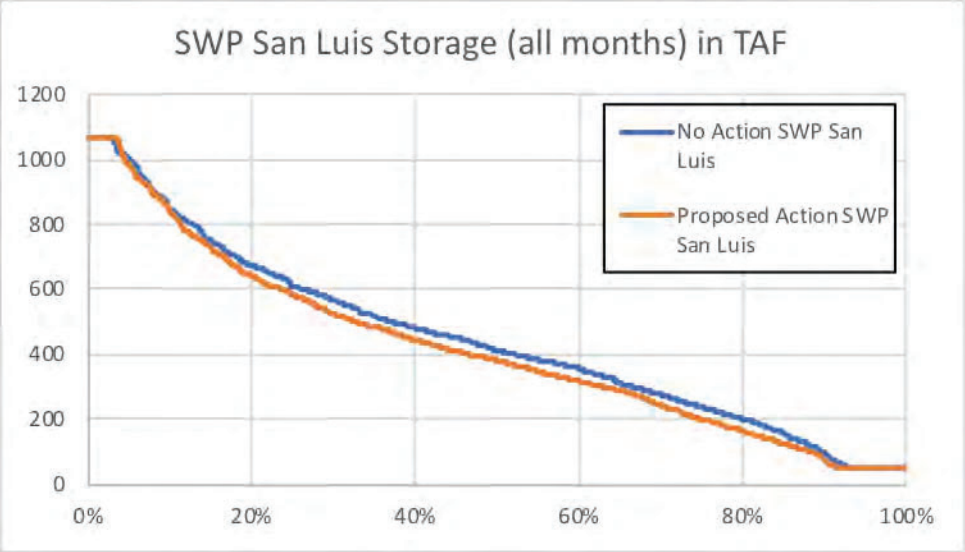

Figure 5 - Comparison of SWP Water in Storage at San Luis Reservoir with and without the proposed action

3.3.2.2 North of Delta Delivery

Figures 6 and 7 indicate the CVP and SWP would be able to maintain deliveries to water contractors and settlement contractors north of the Delta, with slight differences in the various year types. The greatest differences are seen in the drier years for both CVP and SWP deliveries, with the CVP delivering slightly more water and the SWP delivering slightly less, with the proposed action. For the CVP, the magnitude of these differences is about one percent in all year types combined, with the largest relative percent difference of approximately 1.3% in critical years.

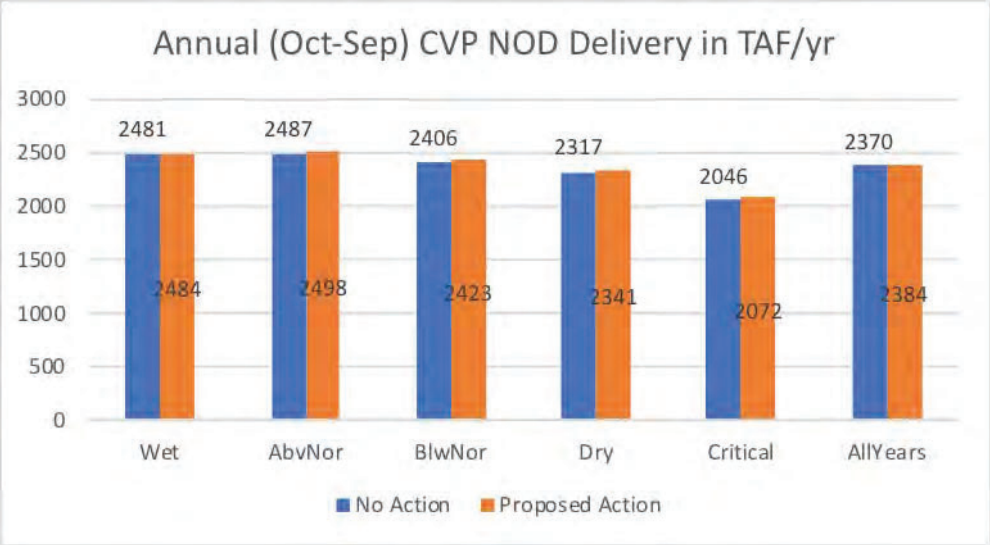

Figure 6 - Comparison of CVP deliveries North of the Delta with and without the proposed action

For the SWP, the difference for the proposed action in all year types is a reduction of 15 TAF/year, with a relative differnce of 1.2%. The largest difference in deliveries is seen in critical years, where the reduction in deliveries of 40 TAF/year would be a relative difference of about 4%.

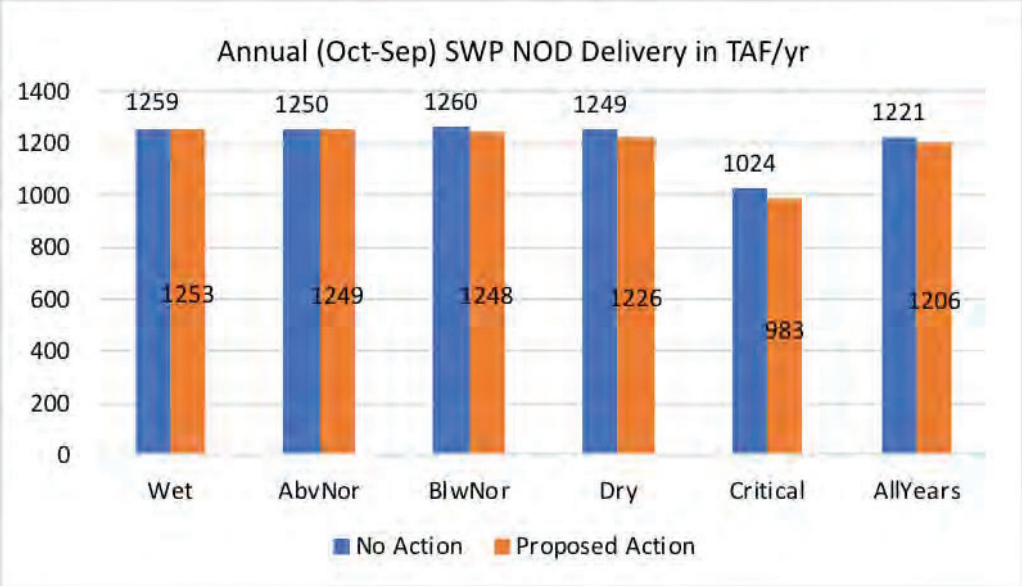

Figure 7 - Comparison of SWP deliveries North of the Delta with and without the proposed action

3.3.2.3 Delta Outflow

The following table indicates that the relative percent difference in Delta outflow would be on the order of four tenths of one percent in critical years to less than one tenth of one percent in wet

years. This indicates that the Projects would continue to meet outflow criteria designed to maintain acceptable salinity levels in the Delta as prescribed in D-1641, as well as outflow necessary for fisheries.

Table 1 – Difference in Total Delta Outflow in TAF/Year

		No Action	Proposed Action	Difference	RPD
Delta Outflow	Wet	28548	28567	19	0.07
	AbvNor	17038	17075	37	0.22
	BlwNor	9989	9997	8	0.08
	Dry	7316	7312	-4	-0.05
	Critical	5094	5075	-19	-0.37
	AllYears	15602	15611	9	0.06

3.3.2.4 Exports

As indicated in Figure 8, the total water exported from the Delta at the Jones and Banks Pumping Plants is relatively unchanged. The greatest change is a decrease in exports South of the Delta in dry year types, though the relative difference is negligible when considering a 73 TAF reduction in total exports of 4,183 TAF. The greatest relative difference is an increase of about 1.8% in critical years.

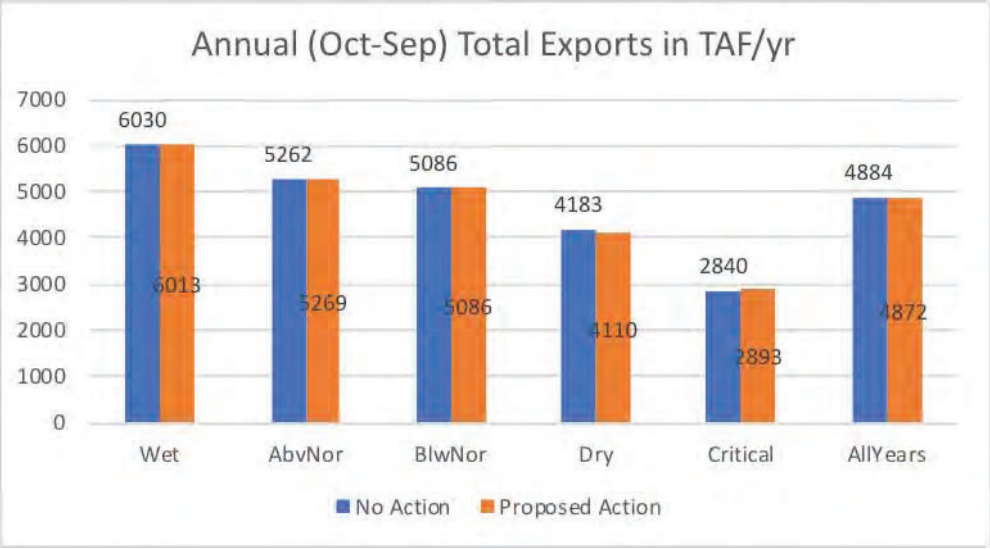

Figure 8 - Comparison of total combined export for both the CVP and SWP with and without the proposed action

Figure 9 indicates an increase in South of Delta exports through the Jones Pumping Plant, while Figure 10 indicates a correlative decrease in exports through the Banks Pumping Plant.

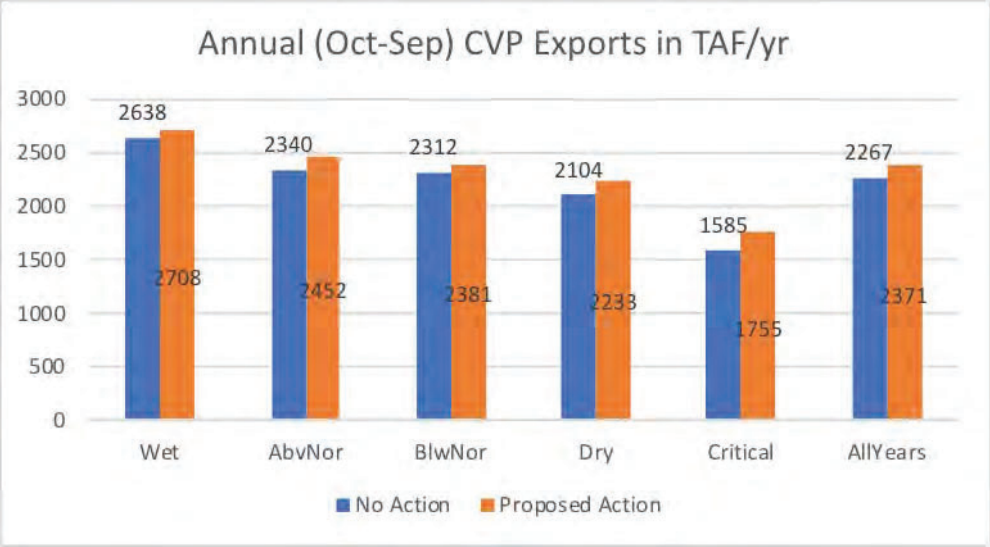

Figure 9 - Comparison of total export for the CVP with and without the proposed action

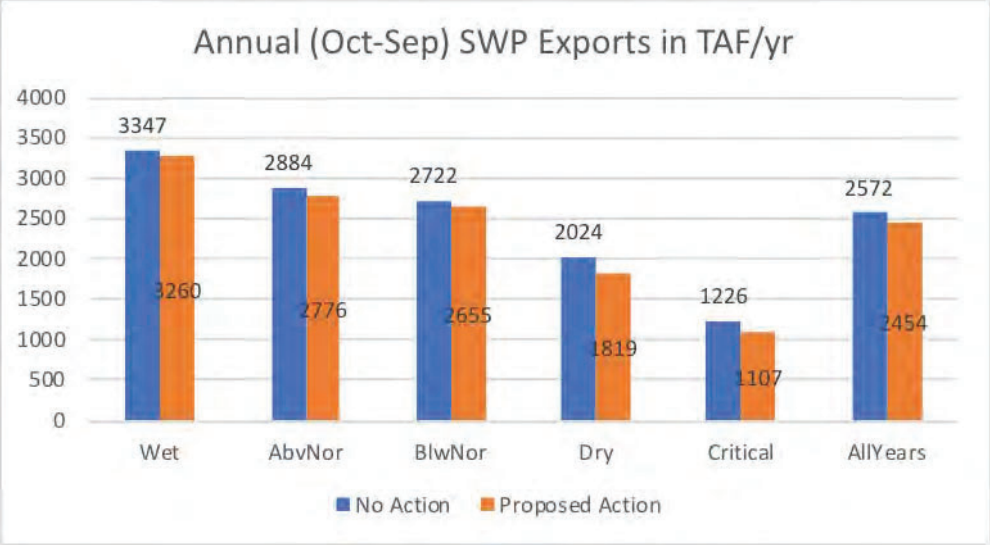

Figure 10 - Comparison of total export for the SWP with and without the proposed action

Figure 11 displays a positive shift in water delivered to CVP Contractors South of the Delta. The largest change in delivery is an additional 122 TAF during dry year types, representing a relative difference of 5.8% for the proposed action. The largest relative difference is 6.6% in critical years for an additional 106 TAF of deliveries. Overall, the CVP would see an increase of about 95 TAF over all year types, with an associated relative increase of 4%.

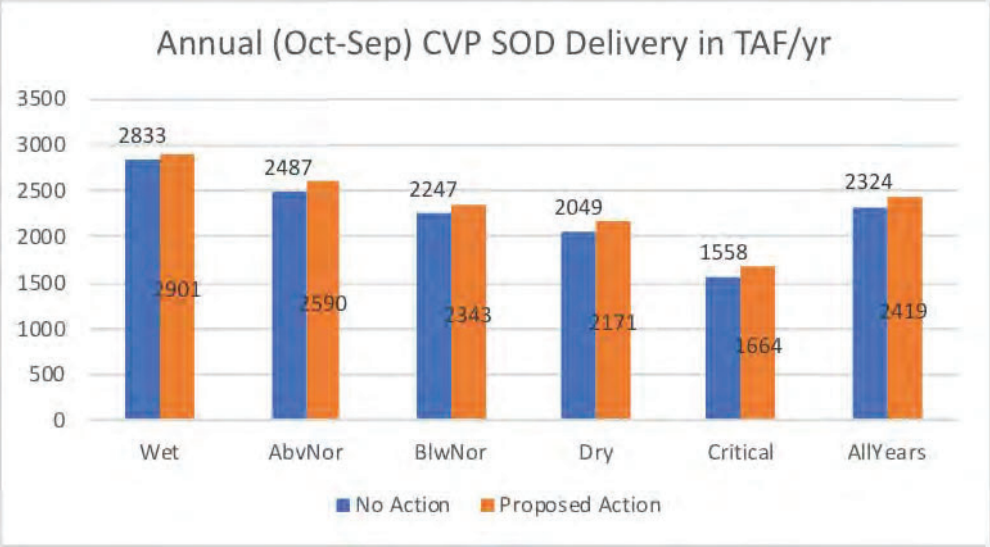

Figure 11 - Comparison of CVP South of Delta delivery with and without the proposed action

By contrast, Figure 12 displays the associated reduction in South of Delta deliveries to SWP contractors. Averaged over all year types, the reduction in deliveries is approximately 113 TAF, with a relative difference of about 4.6%. The greatest reduction is 207 TAF in dry year types, representing a relative difference of about 10.3%. The greatest relative difference is in critical year types, where a 144 TAF reduction in deliveries to South of Delta contractors equates to a relative difference of 11.3%.

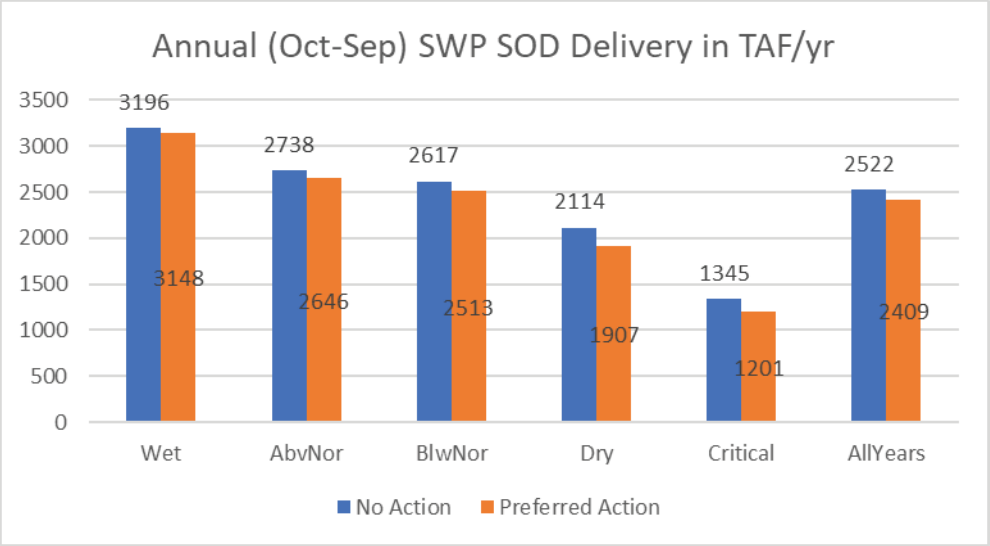

Figure 12 - Comparison of SWP South of Delta delivery with and without the proposed action

The shift in deliveries to the CVP and away from the SWP represents a reduction in water supplies from the Delta to the SWP contractors, and a gain in available water supply from the Delta for CVP contractors. Reductions in South of Delta deliveries to SWP contractors will be borne proportionately among those contractors through reductions in their Table A allocations.

Total Table A quantities for the 25 South of Delta SWP contractors is 4.056 MAF (DWR 2017, Table 1-6), an average water supply reduction of 113 TAF equates to about 2.8% of the total Table A. A dry year reduction of 207 TAF equates to about 5% of the total Table A. Forty-seven percent of these water supply reductions will be borne by Metropolitan Water District of Southern California (Metropolitan). Metropolitan's Table A quantity is 1,912 MAF, or 47% of the total Table A quantities for South of Delta SWP contractors. (DWR 2017, Table 1-6.) Metropolitan relies on the SWP for approximately 30% of its water supply (Metropolitan Water District of Southern California 2018a), and shortages experienced by Metropolitan will be spread among its 26 member public agencies, which in turn provide water to 19 million people in Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura counties (Metropolitan Water District of Southern California 2018b). Remaining water supply reductions will be spread over the other 24 South of Delta SWP contractors, which provide water for municipal and industrial uses and irrigation uses in the South San Francisco Bay Area, the San Joaquin Valley, the Central Coast Area, and Southern California (DWR 2017, Table 1-6).

3.3.3 Socioeconomic Effects

This section describes the potential socioeconomics effects of the proposed federal action and no action alternative and describes the methods used to determine and analyze those effects. The simulated differences in availability of CVP and SWP water in Section 3.3.3 were multiplied by the projected future costs of an acre-foot of water by project and water year type. For each project, there is a high variance in costs among service areas, so the effects are presented using both the average cost of an acre-foot across all service area and the median cost. For example, an acre-foot delivered to the coastal area of the SWP is projected to cost $1,384; the San Joaquin area is projected to cost $251. Within the CVP, costs range from $11 (Friant Dam, Class 2), to $111 (Cross Valley Canal). The mean cost estimates in the tables below reflect the estimated average costs while the median tends to be more statistically representative of what the actual future costs might be due to the skewed costs per service area.

3.3.3.1 State Water Project Costs

Table SWP$1 shows the simulated average and median costs of SWP service water to SWP SOD contractors by alternative and water year type. (The SWP unit water charges came from the California Department of Water Resources (DWR 2017, Table 14-12), estimated unit water charges for the year 2022.) Under the No Action Alternative, the mean annual water charge for SWP SOD contractors would be $844,660,000 in a critical year. Under the Proposed Alternative, the mean annual water charge in a critical year would be $754,228,000. This would be a difference of about -$90 million due to the differences in water volume between the alternatives, whereas the differences due to water year type (a wet year compared to a critical year) would be potentially greater: over $1 billion.

Table SWP$1 Average and median estimated water charges for 2022 for SOD contractors (dollars per acre-foot per year)

Water Year Type	No Action $628/TAF/YR[1] Average Cost	Proposal $628/TAF/YR Average Cost	No Action $438/TAF/YR[2] Median Cost	Proposal $438/TAF-YR Median Cost
Wet	$2,007,088	$1,976,944	$1,399,848	$1,378,824
Above normal	$1,719,464	$1,661,688	$1,199,244	$1,158,948
Below normal	$1,643,476	$1,578,164	$1,146,246	$1,100,694
Dry	$1,327,592	$1,197,596	$925,932	$835,266
Critical	$844,660	$754,228	$589,110	$526,038
All years	$1,583,816	$1,512,852	$1,104,636	$1,055,142

Source: DWR 2017, Table 14-12.
[1] $628 is mean water charges for 2022 from Table 14-12 (DWR 2017) for South Bay, Coastal, San Joaquin and Southern California areas.
[2] $438 is the median water charges.

3.3.3.2 Central Valley Project Water Costs

Table CVP$2 shows the simulated average and median costs of CVP service water to CVP SOD contractors by alternative and water year type. The CVP cost of service irrigation water rates came from Reclamation (2018) for the year 2019. Under the No Action Alternative, the mean annual water charge for CVP SOD contractors would be $79,458,000 in a critical year. Under the Proposed Action, the mean annual water charge would be $84,864,000 in a critical year, a difference of about $5 million. As shown in the table, the differences due to future water year types are far greater than the differences between alternatives.

Table CVP$2 Average and median estimated cost of water service rate for 2019 for SOD contractors (dollars per acre-foot per year)

Water Year Type	No Action $51/TAF/YR[1] Average Cost	Proposal $51/TAF/YR Average Cost	No Action $32/TAF/YR[1] Median Cost	Proposal $32/TAF-YR Median Cost
Wet	$144,483	$147,951	$90,656	$92,832

Above normal	$126,837	$132,090	$79,584	$82,880
Below normal	$114,597	$119,493	$71,904	$74,976
Dry	$104,499	$110,721	$65,568	$69,472
Critical	$79,458	$84,864	$49,856	$53,248
All years	$118,524	$123,369	$74,368	$77,408

Source: Reclamation 2018, Schedule A-2A, IRR 2019 Sch A-1 F.Z21.XLSM.

[1] SOD facility/contractors include Delta-Mendota Canal & Pool, Cross Valley Canal, San Felipe, San Luis Unit, Contract Costa Canal, Friant Dam & Reservoir, Friant-Kern Canal Classes 1 &2, Madera Canal Classes 1&2, Buchnan Unit, Hidden Unit.

Note that in the context of a hedonic model of CVP-SWP water (Buck et al. 2014), the projected differences between No Action and the Proposed Action in Tables SWP$1 and CVP$2 are small relative to estimates of willingness to pay rates of $1,146-$6,300/acre-foot. As indicated in the tables and text, the differences between alternatives are far less than the differences due to wet versus critical years.

3.3.4 Environmental Justice

Executive Order 12898 directs federal agencies to address disproportionately high and adverse human health and environmental effects on minority and low-income populations. Minority populations are American Indian or Alaskan Native, Asian or Pacific Islander, Black, or Hispanic individuals in the affected environment that either: a) exceed 50 percent, or b) these populations are meaningfully greater than the minority population percentage in the state (Federal Interagency Working Group on Environmental Justice and NEPA Committee 2016). Low-income populations in an affected area are identified based on the poverty thresholds from the Bureau of the Census Current Population Reports, Series P-60 on Income and Poverty.

California is a diverse state and Table EJ1 shows the minority population in CVP-SWP SOD study area is not meaningfully greater than that of the State of California as a whole. During the 2012-2016 study period, the racial category with the highest percent of population in the SOD study area is white alone (57%). The ethnic category in the table of Hispanic or Latino represents those who self-identify themselves as “other Spanish, Hispanic, or Latino” on the census questionnaire. Merced County had the highest percent of the population that self-identify as Hispanic or Latino of those in the SOD study area.

Table EJ1 also shows that the percent of low-income persons or families is not meaningfully greater than that of the rest California. Fresno County had the highest percent of families living below the poverty threshold.

Based on the data in Table EJ1 and a "meaningfully greater" analysis of percentages compared to the State of California, no minority or low-income populations are present in the study area that would be adversely affected by the proposal as described in this EA. Therefore, the proposed action is not subject to the provisions of Executive Order 12898 and no further environmental justice analysis is required.

Table EJ1 Demographic characteristics of the CVP and SWP SOD contractors, 2012-2016

	SOD	California
Population, Numbers	22,800,050	38,654,206
White alone	13,006,359	23,680,584
Black or African American alone	1,608,871	2,261,835
American Indian alone	158,251	285,512
Asian alone	3,354,564	5,354,608
Native Hawaii & Pacific Is. alone	87,066	150,908
Some other race alone	3,554,954	5,133,600
Two or more races	1,029,985	1,787,159
Hispanic or Latino (of any race)	9,461,162	14,903,982
Poverty Prevalence, Numbers		
People below Poverty	3,704,233	6,004,257
Families below Poverty	648,893	1,038,215
Percent of Total		
White alone	57.0	61.3
Black or African American alone	7.1	5.9
American Indian alone	0.7	0.7
Asian alone	14.7	13.9
Native Hawaii & Pacific Is. alone	0.4	0.4
Some other race alone	15.6	13.3
Two or more races	4.5	4.6
Hispanic or Latino (of any race)	41.5	61.4
Poverty Prevalence, Percent		
People below Poverty	16.5	15.8
Families below Poverty	12.6	11.8

Sources: U.S. Department of Commerce 2017

* Average of American Community Survey Office statistics used from 2012-2016

4 Consultation and Coordination

4.1 Agencies Consulted

Reclamation consulted with the following agencies in preparing this Environmental Assessment.

- California Department of Water Resources
- CVP Contractors
- SWP Contractors

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Appendix A. Temperature Analysis for COA Modeling

Temperature Analysis for Coordinated Operations Agreement (COA) Modeling

Michael Wright, MP-740

Executive Summary

This report presents results of temperature and salmonid mortality analyses performed on the outputs of two CalSim II model runs, the No Action Alternative (NAA) and Proposed Action (PA) scenarios. CalSim II flows and historical meteorology were inputted to temperature models for the Sacramento, Feather, and American Rivers. Sacramento River temperatures were then processed through a Winter run Chinook temperature-dependent egg mortality model developed by Dr. Martin at the National Marine Fisheries Service Southwest Fisheries Science Center (NMFS SWFSC).

The NAA and PA scenarios resulted in similar modeled temperature and Winter run Chinook temperature-dependent egg mortality.

Temperature Modeling Details and Assumptions

For the Sacramento River, a HEC-5Q model used in the NMFS-initiated effort to revise the Reasonable and Prudent Action (RPA) governing Shasta operations in 2017 was applied to both the NAA and PA runs. This model outputs daily average river temperatures at many locations, as well as daily cold water pool volume data (not presented here), and includes Shasta Dam Temperature Control Device (TCD) operation logic which seeks to achieve a daily temperature of 56 degrees Fahrenheit at Balls Ferry, releasing the coldest possible water from the side gates when the target is unreachable. A HEC-5Q model also exists for the American River and has been used in past Long-Term Operations (LTO) analyses. This model has a less robust representation of TCD operations than the Shasta one, but monthly release targets are set in an attempt to mimic real-life operations.

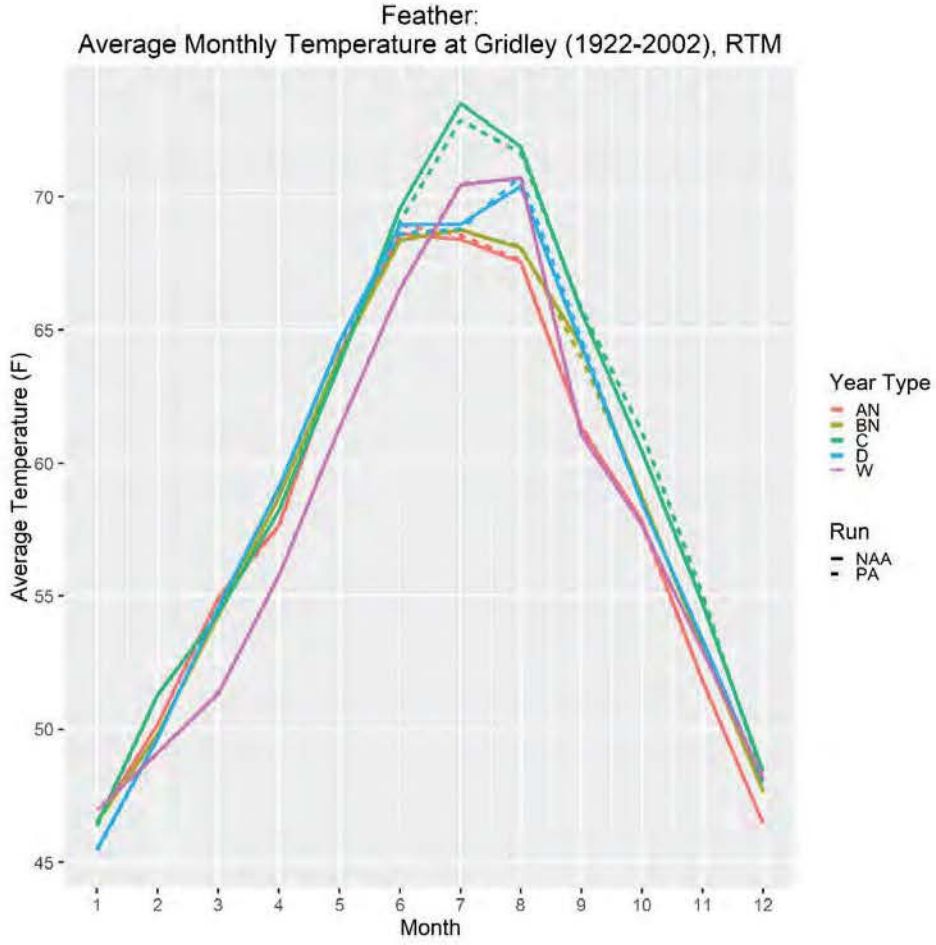
The monthly Reclamation Temperature Model (RTM) was chosen for the Feather River because no validation of newer HEC-5Q modelling on those rivers was immediately available and the RTM was used in Long Term Operations modeling alongside the above HEC-5Q models. This model outputs monthly average river temperatures and was applied to the NAA and PA runs. It does not output cold water pool volume data and does not model TCD operations in detail.

Both models used historical climatology.

Results: RTM

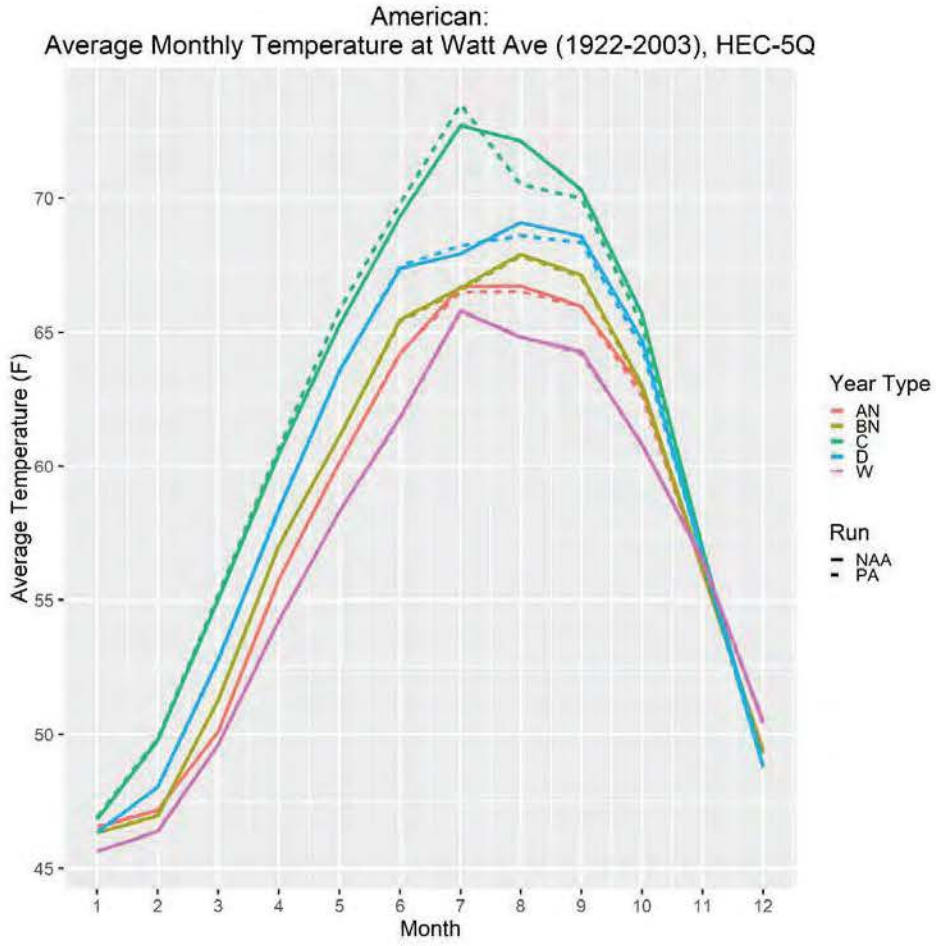
Comparisons between average temperatures outputted by the NAA and PA runs were made by finding the average river temperature at a specific location, grouped by water year type (Sacramento index used here and for Sacramento and American) and averaged for each month of the year.

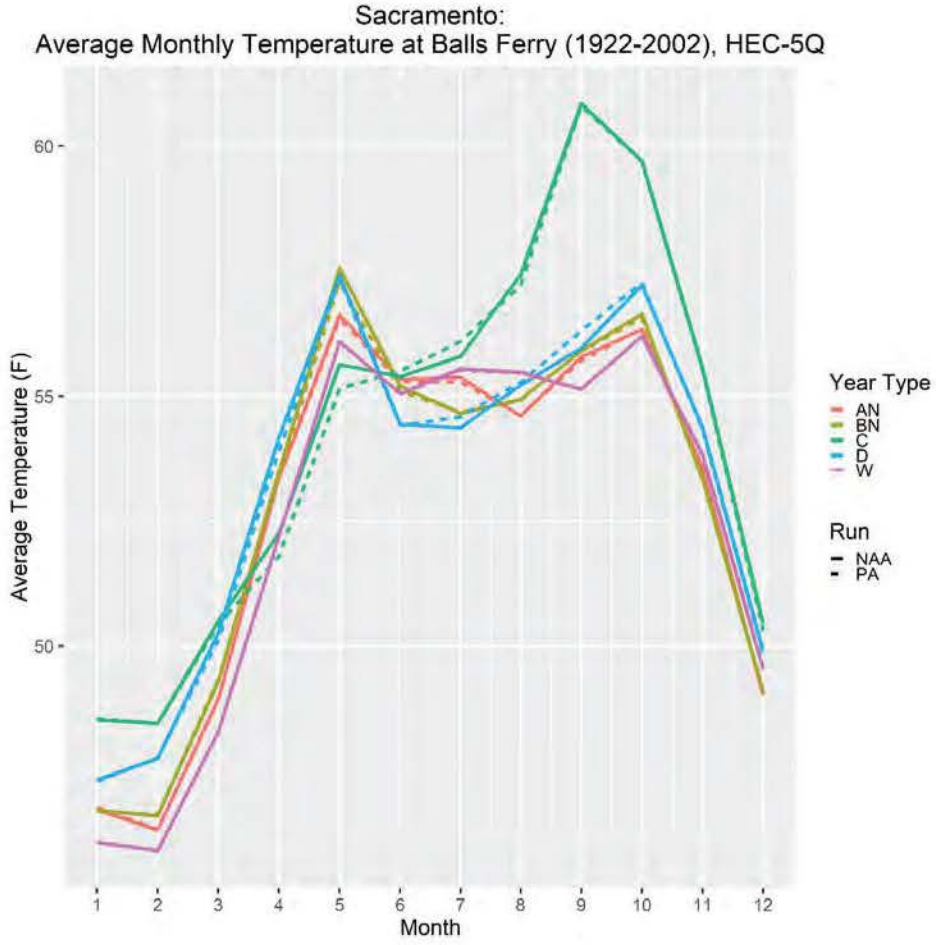
Below, Feather River monthly temperatures at Gridley are depicted across the year for each water year type; NAA is the solid line and PA is the dotted line.



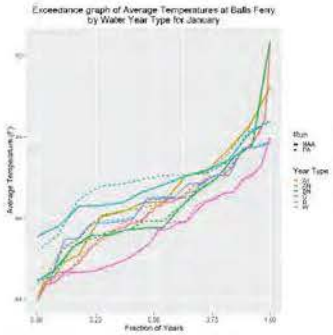
Results: HEC-5Q

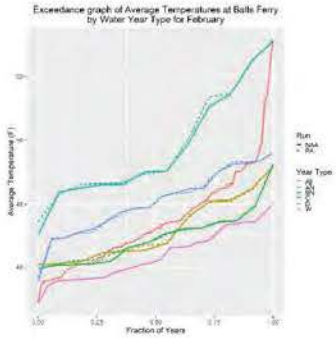
The next graphs are the same format as the above but are derived from HEC-5Q data. The subsequent graphs display HEC-5Q results for NAA and PA separated across Water Year Types for selected compliance points on the American and Sacramento Rivers.

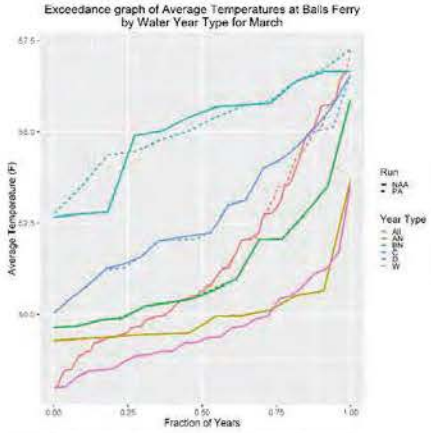

American:
Average Monthly Temperature at Watt Ave (1922-2003), HEC-5Q
Average Temperature (F)
70
65
60
55
50
45
1
2
3
4
5
6
7
8
9
10
11
12
Month
Year Type
AN
BN
C
D
W
Run
NAA
PA

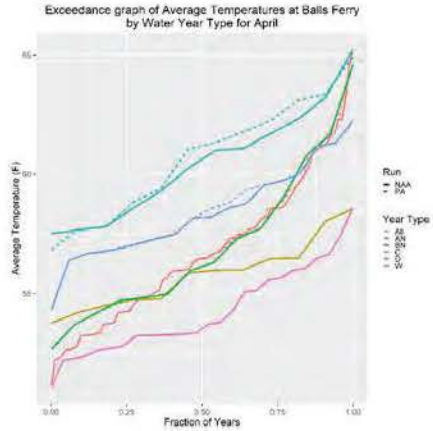


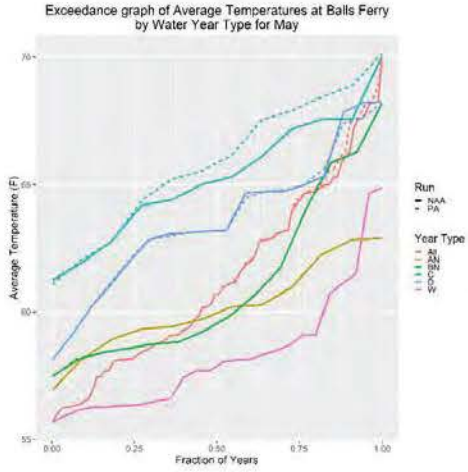
The following figures depict exceedance graphs of temperature at Balls Ferry, with one graph for each month and each graph colored by Water Year type and indicating NAA vs PA by solid vs dashed lines.

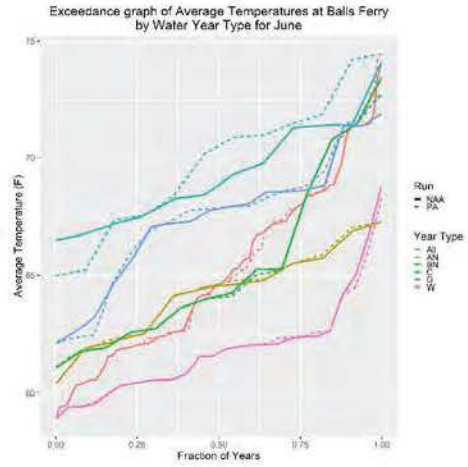

Exceedance graph of Average Temperatures at Balls Ferry
by Water Year Type for January
Average Temperature (F)
Fraction of Years
Run
NAA
PA
Year Type
All
AN
BN
C
D
W

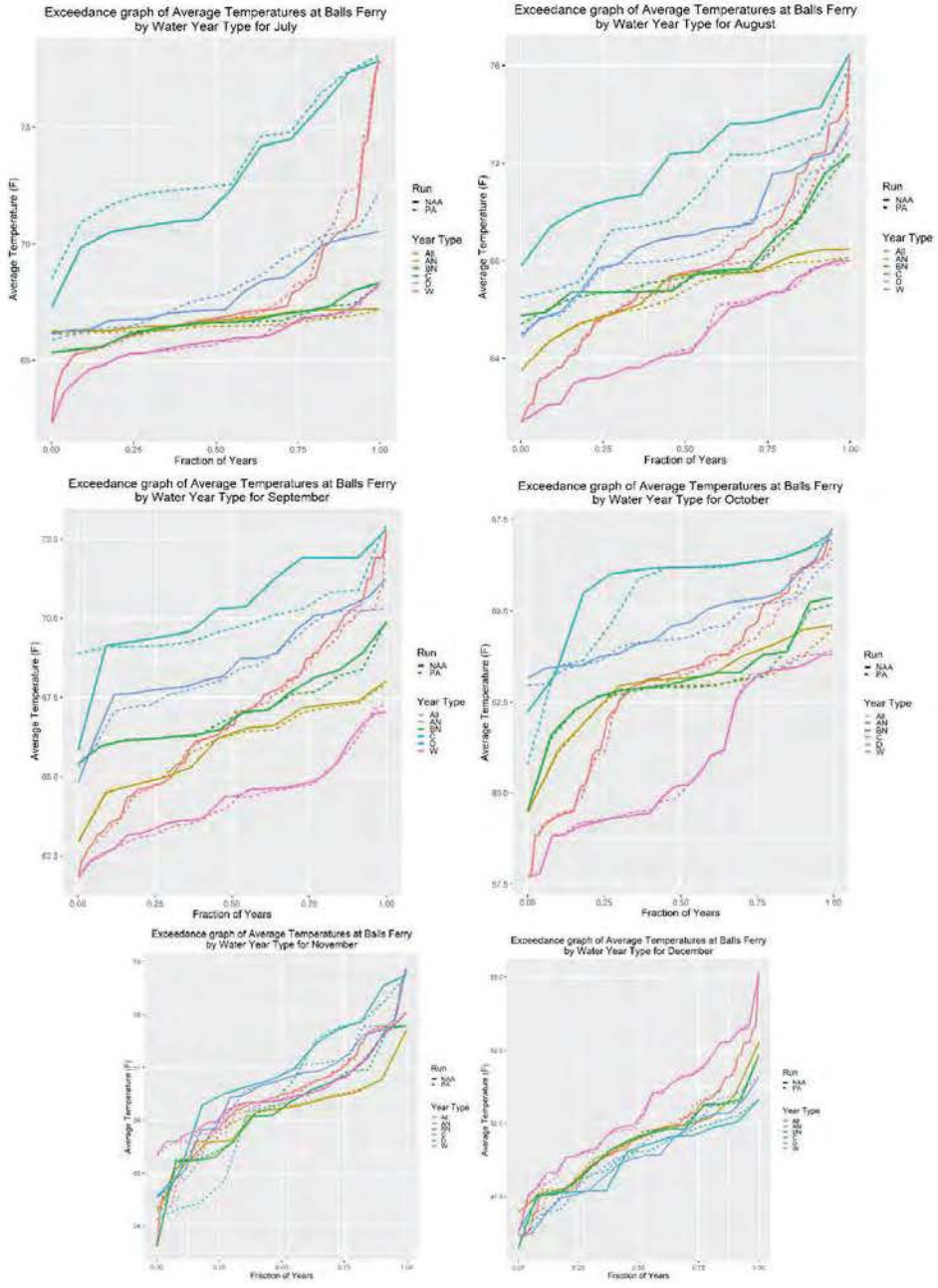

Exceedance graph of Average Temperatures at Balls Ferry
by Water Year Type for February
Average Temperature (F)
Fraction of Years
Run
NAA
PA
Year Type
All
AN
BN
C
D
W


Exceedance graph of Average Temperatures at Balls Ferry
by Water Year Type for March
Average Temperature (F)
Fraction of Years
Run
NAA
PA
Year Type
All
AN
BN
C
D
W


Exceedance graph of Average Temperatures at Balls Ferry
by Water Year Type for April
Average Temperature (F)
Fraction of Years
Run
NAA
PA
Year Type
All
AN
BN
C
D
W

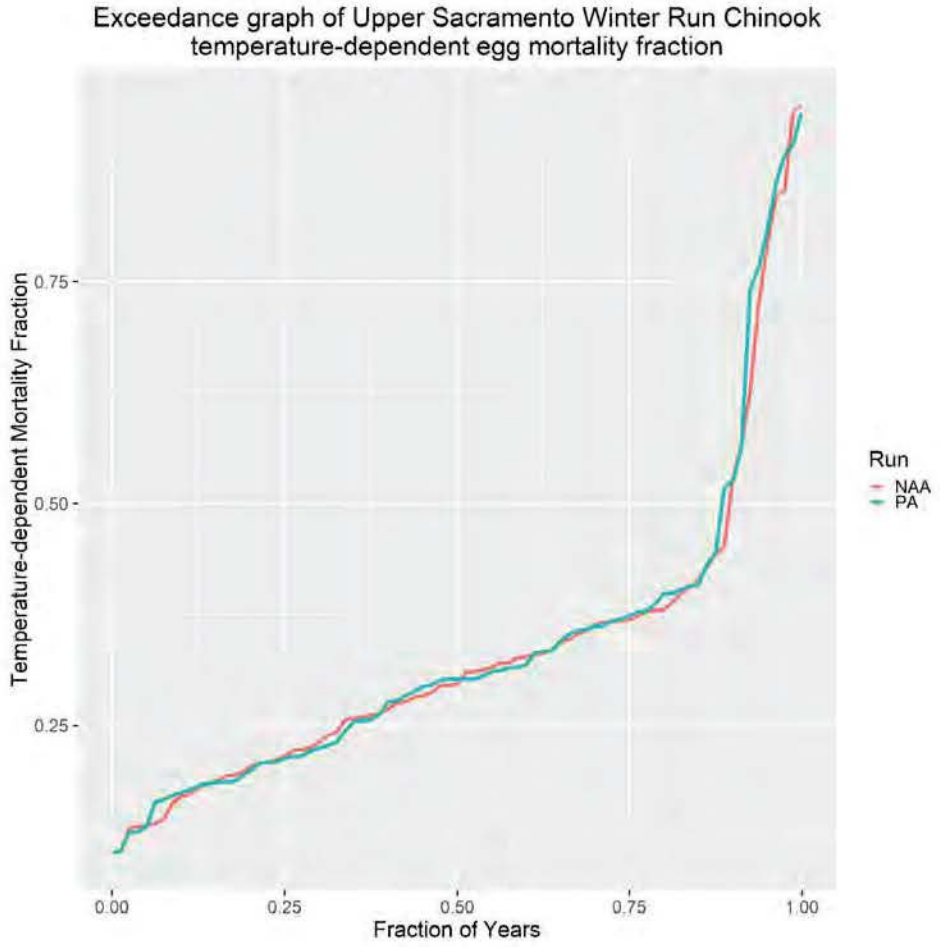

Exceedance graph of Average Temperatures at Balls Ferry
by Water Year Type for May
Average Temperature (F)
Fraction of Years
Run
NAA
PA
Year Type
All
AN
BN
C
D
W

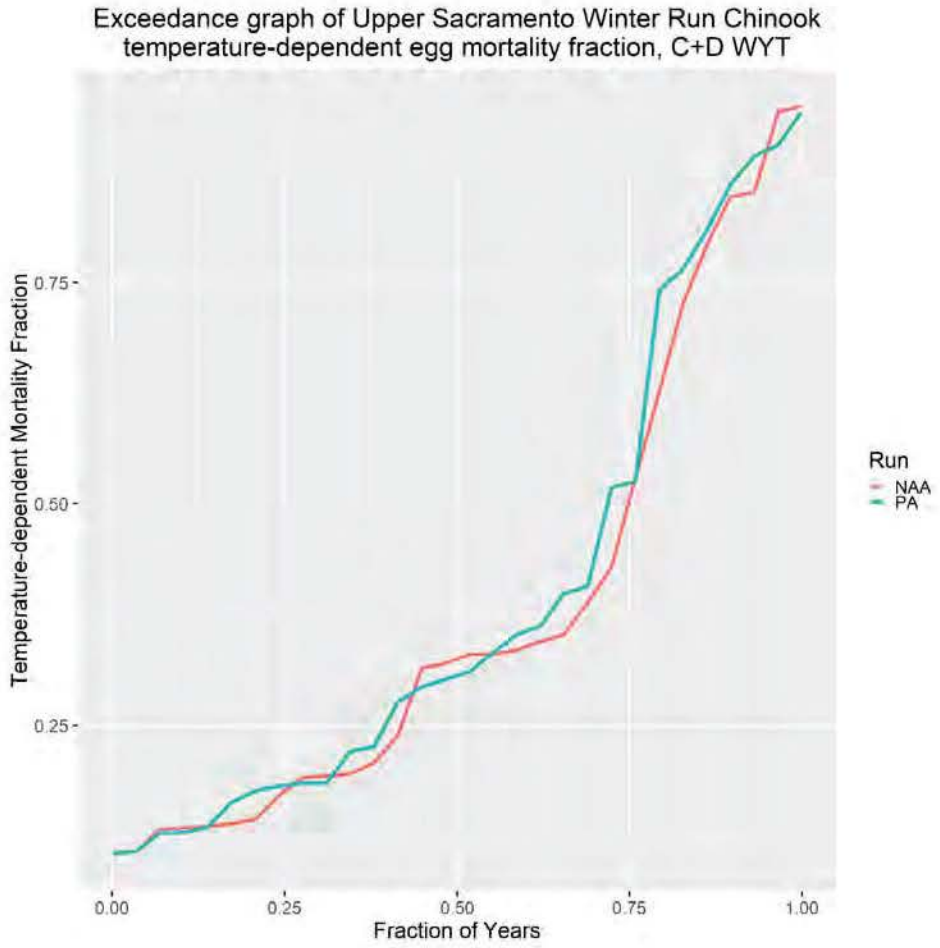

Exceedance graph of Average Temperatures at Balls Ferry
by Water Year Type for June
Average Temperature (F)
Fraction of Years
Run
NAA
PA
Year Type
All
AN
BN
C
D
W


Exceedance graph of Average Temperatures at Balls Ferry by Water Year Type for July
Exceedance graph of Average Temperatures at Balls Ferry by Water Year Type for August
Exceedance graph of Average Temperatures at Balls Ferry by Water Year Type for September
Exceedance graph of Average Temperatures at Balls Ferry by Water Year Type for October
Exceedance graph of Average Temperatures at Balls Ferry by Water Year Type for November
Exceedance graph of Average Temperatures at Balls Ferry by Water Year Type for December
Average Temperature (F)
Fraction of Years
Run
NAA
PA
Year Type
All
AN
BN
D
C
W

Temperature-dependent Winter Run Chinook Egg Mortality in the Upper Sacramento River

HEC-5Q outputs average daily temperatures at an arbitrarily large number of river miles; these were combined with a spatiotemporal redd distribution to generate annual total mortality estimates. Below are graphs depicting years ranked by temperature-dependent Winter run Chinook egg mortality for the two runs.





Modeling Details and Assumptions

Reclamation biologist Josh Israel provided best available redd timing data for the 2017 NMFS RPA revision modeling effort; data from 2007 through 2014 was used to generate both a spatial and a temporal distribution. To avoid overfitting to the data all river miles were assigned the same temporal distribution and all years were assigned the same spatiotemporal distribution. Dr. Martin of NOAA SWFSC has published his mortality model (Martin et al., 2017), which utilizes redd maturation modeling in Zeug et al., 2012. (See Citations section).

Citations

Martin B.T., Pike, A., John, S.N., Hamda, N., Roberts, J., Lindley, S.T., & Danner, E.M. (2017). Phenomenological vs. biological models of thermal stress in aquatic eggs. *Ecology Letters*, 20, 50-59.

Zeug, S.C., Bergman, P.S., Cavallo, B.J., & Jones, K.S. (2012). Application of a life cycle simulation model to evaluate impacts of water management and conservation actions on an endangered population of Chinook salmon. *Environ. Model. Assess.*, 17, 455-467.

Water Year Types taken from the Sacramento Valley table at:
http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST

Appendix B. Operational Analysis for COA Modeling

Operational Analysis for Coordinated Operations Agreement (COA) Modeling

The CVP and SWP use a common water supply in the Central Valley of California. Reclamation and DWR have built water conservation and water delivery facilities in the Central Valley in order to deliver water supplies to project contractors. The water rights of the projects are conditioned by the SWRCB to protect the beneficial uses of water within each respective project and jointly for the protection of beneficial uses in the Sacramento Valley and the Sacramento-San Joaquin Delta Estuary. The agencies coordinate and operate the CVP and SWP to meet the joint water right requirements in the Delta.

The Coordinated Operations Agreement (COA), signed in 1986, defines the project facilities and their water supplies, sets forth procedures for coordination of operations, identifies formulas for sharing joint responsibilities for meeting Delta standards as they existed in SWRCB Decision 1485 (D-1485), identifies how unstored flow will be shared, sets up a framework for exchange of water and services between the Projects, and provides for periodic review of the agreement.

Since 1986, a number of regulations have been implemented that drastically effect the way that the Projects are operated. In reaction to these changes, under the periodic review, Reclamation and DWR have been analyzing a proposed change to the COA agreement that implements a sharing of Sacramento Valley Inbasin uses (IBU) on a water year type basis and changes the sharing of exports when they are constrained under the Vernalis 1:1 April/May (D1641), the E/I ratio (D1641), I:E ratio (2009 BO RPA), or OMR restrictions (2008/2009 BO RPA).

The new IBU sharing ratio:

	CVP	SWP
W	80%	20%
AN	80%	20%
BN	75%	25%
D	65%	35%
C	60%	40%

The new export sharing when exports are constrained by Vernalis 1:1, IE, OMR, and EI:

	CVP	SWP
Excess Conditions	60%	40%
Balanced Conditions	65%	35%

These changes were implemented in CalSim in a modeling effort coordinated by Reclamation and DWR. The CalSim modeling was based on a modified 2015 DWR Delivery Capability Report (DCR) baseline. The DCR was modified to remove San Joaquin River Restoration Program flows, climate change, sea level rise to reflect existing operations.

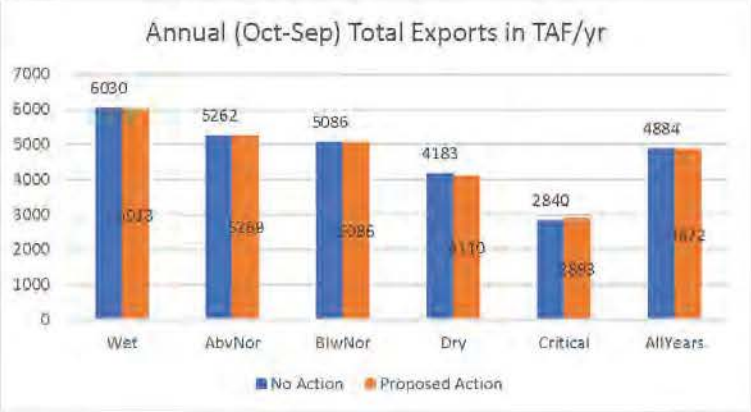
The IBU changes were implemented based on the Sacramento River Index water year types at the ratios shown above. The water year types are implemented in February based on final historical water year types, which does not reflect the forecast uncertainties or changes between February and May, but IBU is rarely used within the February to May period.

The sharing or exports when constrained by E/I, I:E, or OMR was implemented with the ratios from the table above. If either project cannot take their share of exports, the other project can use it.

The results of implementing these changes are provided below:

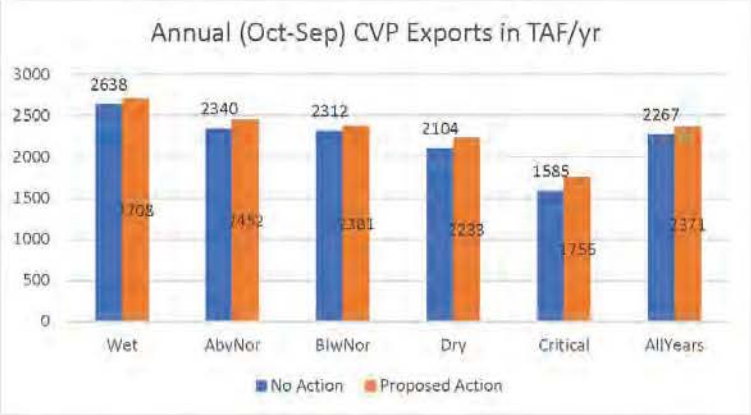
Exports

Total



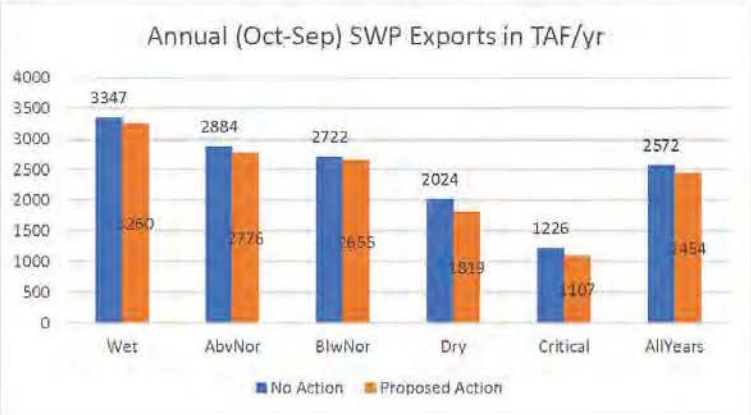
		No Action	Proposed Action	Difference	RPD
Total Export	Wet	6030	6013	-17	-0.28%
	AbvNor	5262	5269	7	0.13%
	BlwNor	5086	5086	0	0.00%
	Dry	4183	4110	-73	-1.76%
	Critical	2840	2893	52	1.81%
	AllYears	4884	4872	-13	-0.27%

CVP



		No Action	Proposed Action	Difference	RPD
Total CVP	Wet	2638	2708	70	2.6%
	AbvNor	2340	2452	112	4.7%
	BlwNor	2312	2381	69	2.9%
	Dry	2104	2233	129	6.0%
	Critical	1585	1755	170	10.2%
	AllYears	2267	2371	104	4.5%

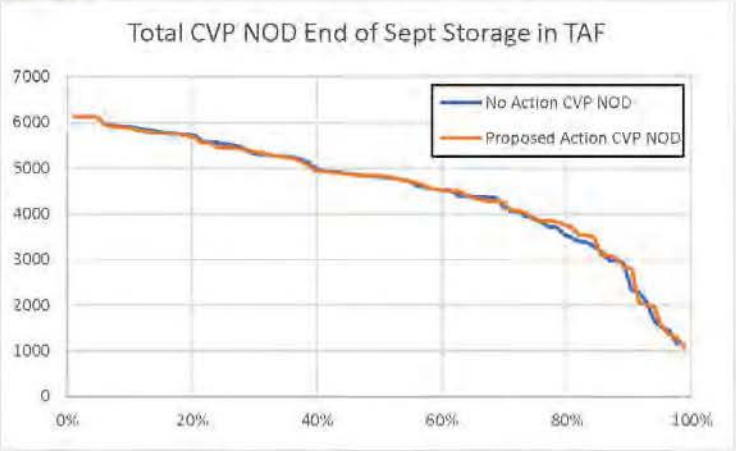
SWP



		No Action	Proposed Action	Difference	RPD
SWP Export	Wet	3347	3260	-88	-2.7%
	AbvNor	2884	2776	-107	-3.8%
	BlwNor	2722	2655	-68	-2.5%
	Dry	2024	1819	-206	-10.7%
	Critical	1226	1107	-119	-10.2%
	AllYears	2572	2454	-118	-4.7%

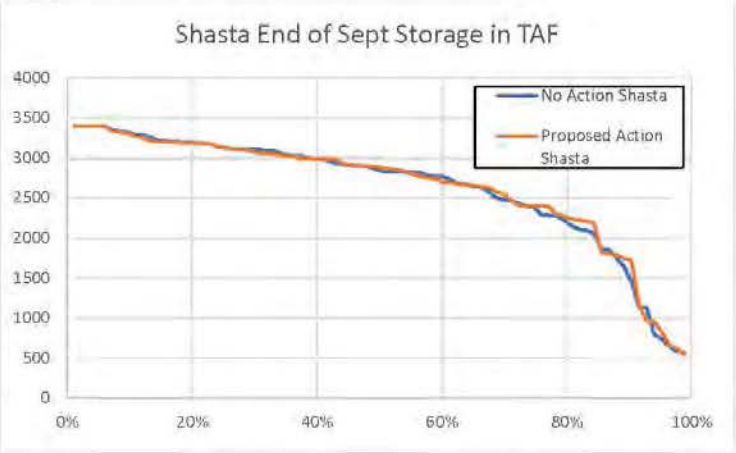
Storage

CVP NOD



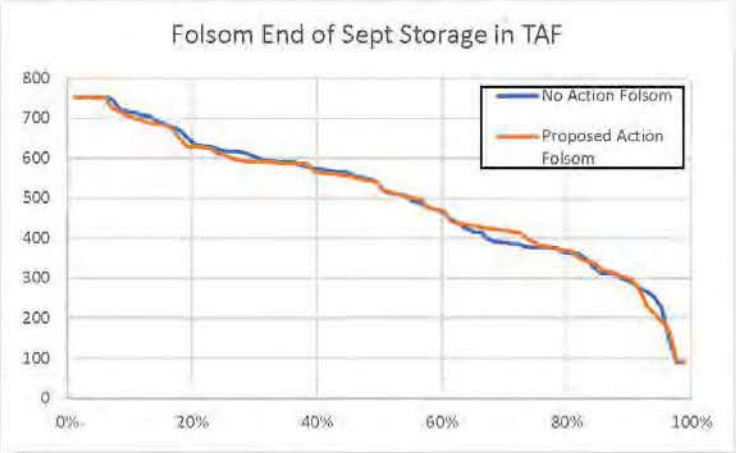
		No Action	Proposed Action	Difference	RPD
CVP NOD EOSept	Wet	5554	5524	-30	-0.54%
	AbvNor	5176	5147	-29	-0.56%
	BlwNor	4654	4627	-27	-0.58%
	Dry	4009	4076	67	1.66%
	Critical	2323	2433	110	4.63%
	AllYears	4533	4545	12	0.26%

Shasta



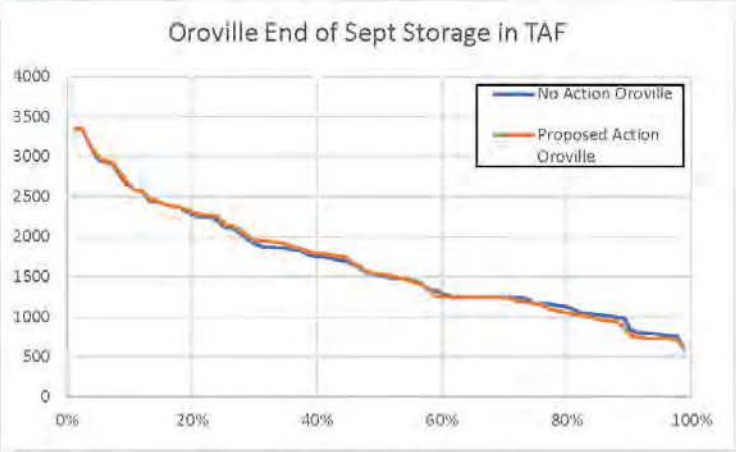
		No Action	Proposed Action	Difference	RPD
Shasta	Wet	3090	3076	-14	-0.45%
	AbvNor	3013	2982	-31	-1.03%
	BlwNor	2833	2808	-25	-0.89%
	Dry	2460	2504	44	1.77%
	Critical	1333	1430	97	7.02%
	AllYears	2639	2650	11	0.42%

Folsom



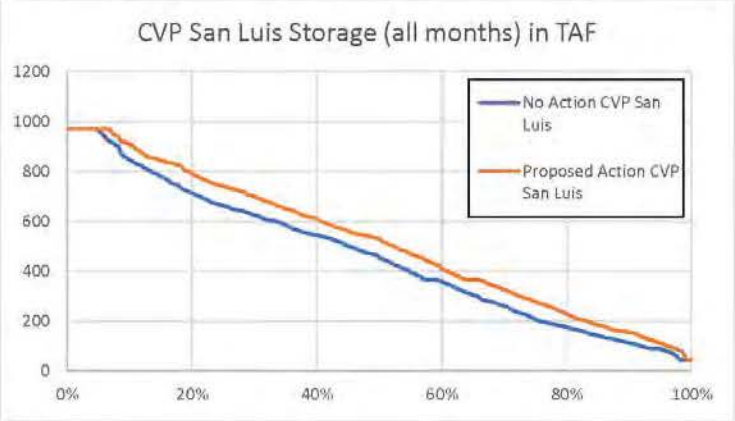
		No Action	Proposed Action	Difference	RPD
Folsom	Wet	624	608	-16	-2.6%
	AbvNor	532	522	-10	-1.9%
	BlwNor	572	569	-3	-0.5%
	Dry	418	447	29	6.6%
	Critical	260	254	-6	-2.2%
	AllYears	503	502	-1	-0.20%

Oroville

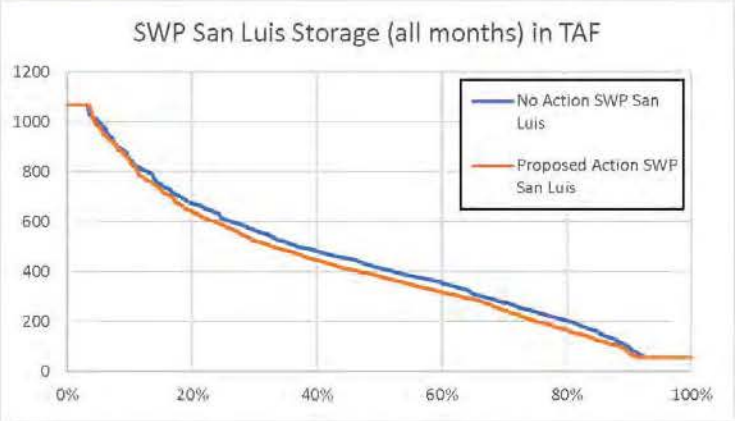


		No Action	Proposed Action	Difference	RPD
Oroville	Wet	2393	2422	28	1.2%
	AbvNor	1919	1966	47	2.4%
	BlwNor	1456	1442	-15	-1.0%
	Dry	1149	1117	-33	-2.9%
	Critical	894	838	-56	-6.5%
	AllYears	1671	1669	-2	-0.12%

CVP San Luis

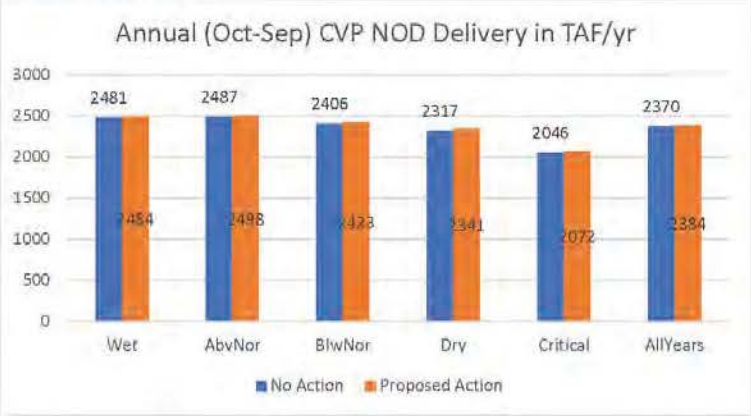


SWP San Luis



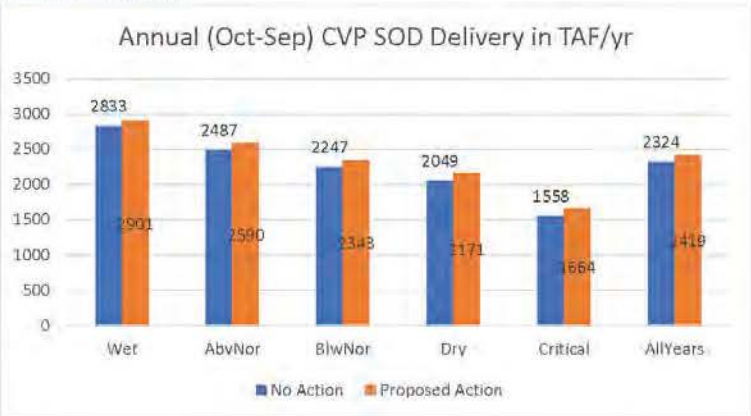
Delivery

CVP NOD Delivery



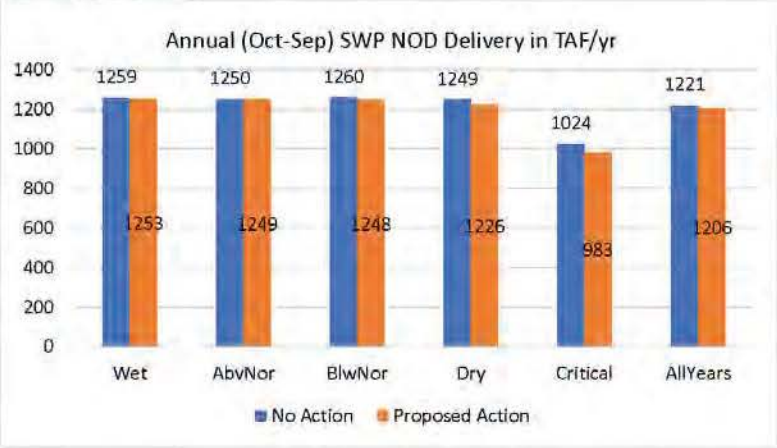
CVP NOD Deliv		No Action	Proposed Action	Difference	RPD
	Wet	2481	2484	3	0.12%
	AbvNor	2487	2498	12	0.48%
	BlwNor	2406	2423	17	0.70%
	Dry	2317	2341	24	1.03%
	Critical	2046	2072	26	1.26%
	AllYears	2370	2384	14	0.59%

CVP SOD Delivery



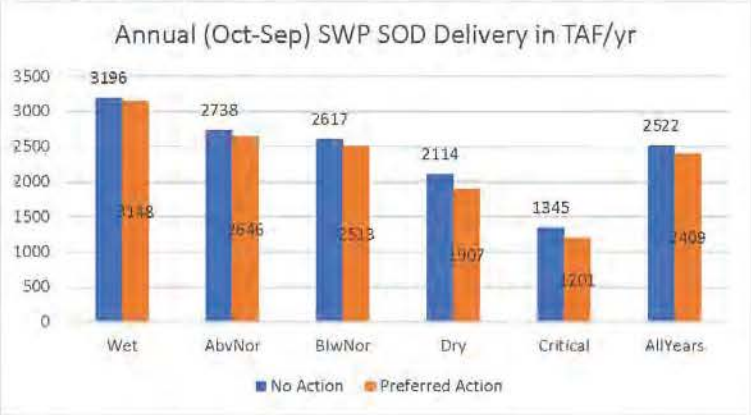
CVP SOD Deliv		No Action	Proposed Action	Difference	RPD
	Wet	2833	2901	68	2.4%
	AbvNor	2487	2590	104	4.1%
	BlwNor	2247	2343	96	4.2%
	Dry	2049	2171	122	5.8%
	Critical	1558	1664	106	6.5%
	AllYears	2324	2419	95	4.0%

SWP NOD Delivery



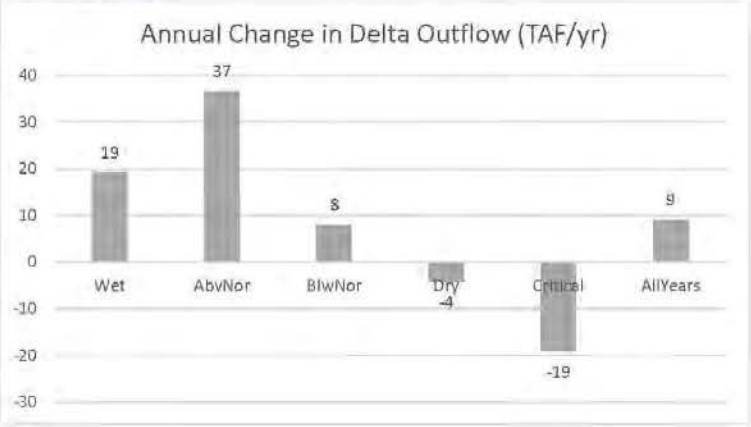
SWP NOD Deliv		No Action	Proposed Action	Difference	RPD
	Wet	1259	1253	-5	-0.40%
	AbvNor	1250	1249	0	0.00%
	BlwNor	1260	1248	-12	-0.96%
	Dry	1249	1226	-23	-1.86%
	Critical	1024	983	-40	-3.99%
	AllYears	1221	1206	-15	-1.24%

SWP SOD Delivery



SWP SOD Deliv		No Action	Preferred Action	Difference	RPD
	Wet	3196	3148	-48	-1.5%
	AbvNor	2738	2646	-92	-3.4%
	BlwNor	2617	2513	-104	-4.1%
	Dry	2114	1907	-207	-10.3%
	Critical	1345	1201	-144	-11.3%
	AllYears	2522	2409	-113	-4.6%

Delta Outflow



		No Action	Proposed Action	Difference	RPD
Delta Outflow	Wet	28548	28567	19	0.07%
	AbvNor	17038	17075	37	0.22%
	BlwNor	9989	9997	8	0.08%
	Dry	7316	7312	-4	-0.05%
	Critical	5094	5075	-19	-0.37%
	AllYears	15602	15611	9	0.06%

ATTACHMENT 3

FRAMEWORK PROPOSAL FOR VOLUNTARY AGREEMENTS TO UPDATE AND IMPLEMENT THE BAY-DELTA WATER QUALITY CONTROL PLAN

California Department of Fish and Wildlife ("CDFW"), California Department of Water Resources ("CDWR"), and other parties (collectively "Parties") submit this Agreement Framework for analysis, adoption and implementation of voluntary agreements to support amendments to the Bay-Delta Water Quality Control Plan ("Bay-Delta Plan") for protection of fish and wildlife beneficial uses.

SUMMARY

1. The fundamental principle of this Agreement Framework is that protection of fish and wildlife beneficial uses in the Sacramento River and San Joaquin River watersheds and Delta ecosystem, including maintenance of viability of native fishes, will require comprehensive approach to management of their habitats and other factors that affect viability. The Parties propose an approach that integrates flow and non-flow measures, including management of tidal energy, to optimize outcomes of implementation; and establishes a science and monitoring program to evaluate, adjust, and achieve such outcomes.

    a. The Parties will develop Agreements consistent with the terms of this Framework and Appendix 1, and will cooperate in environmental analysis, as needed for the State Water Board to take final action by December 31, 2019. Implementation will begin immediately thereafter.

    b. Implementation will maintain viability of native fishes in the Sacramento River and San Joaquin River watersheds and Delta ecosystem, while concurrently protecting and enhancing water supply reliability, consistent with the statutory requirement of providing reasonable protection for all beneficial uses.

2. This Agreement Framework results from two years of negotiations by CDFW, CDWR, California Natural Resources Agency, Bureau of Reclamation, municipal and agricultural water suppliers, and other stakeholders to develop this comprehensive approach.

3. To date, Bay-Delta Plans have required changes in flow in isolation from the multiple other factors affecting fish and wildlife beneficial uses, including physical modifications of riverine channels and wetlands. The viability of native fishes has declined notwithstanding implementation of these plans.

    a. In the update process now underway, State Water Board staff have not proposed to require measures to address such other factors that affect viability. See Phase 1 SED, Master Response 5.2, p. 6.

    b. The State Water Board has recognized that a comprehensive approach may be implemented through voluntary agreements and could provide

quicker, more effective, and more durable outcomes. This Agreement Framework implements that recognition.

LEGAL TERMS

4. The Parties respectfully request that the State Water Board adopt the following schedule and procedures leading to the adoption of amendments to the Bay-Delta Plan and supporting environmental analysis under the Porter-Cologne Water Quality Control Act and the California Environmental Quality Act ("CEQA"):

a. **February 15, 2019** – Completion of drafting the proposed voluntary agreements.

b. **March 1, 2019** – Submission by Parties to the State Water Board of a project description for the Bay-Delta Plan based on the voluntary agreements.

c. **August 1, 2019** – Submission by Parties to the State Water Board of an administrative draft of a Comprehensive SED that is based on the project description. For this purpose, "Comprehensive" means that it will supplement the Phase 1 SED and integrate information pertaining to the Phase 2 update.

d. **September 1, 2019** – Circulation by the State Water Board staff of a draft Comprehensive SED for a 45-day public comment period.

e. **December 1, 2019** – Submission by Parties to the State Water Board of an administrative draft of a final Comprehensive SED.

f. **As early as possible after December 1, 2019** – Consideration by the State Water Board of the certification of the Comprehensive SED and adoption of the proposed amendments to the Bay-Delta Plan, followed promptly by execution of the Agreements.

5. CDFW and CDWR propose to participate as CEQA responsible agencies in developing the Comprehensive SED.

6. The Parties agree that the Agreements will be enforceable under specified terms consistent with the State Water Board's responsibilities. Each Agreement will have a minimum 15-year term.

7. This Agreement Framework is not precedent on any disputed issues of law or fact.

SUBSTANTIVE TERMS

A. Flow Measures

8. The Agreement Framework builds upon and assumes that existing implementation responsibilities for the 2006 WQCP remain in effect, other than as addressed through the Agreements. The Parties propose to provide additional instream flows as summarized in Table 1. Appendix 1 states the terms the Parties have reached in principle.

Table 1. Summary of Annual Average Additional Flows in San Joaquin and Sacramento Basins

Contributing Area	Volume (TAF)	Seasons (AN, BN, Dry)	Proposed Sources
San Joaquin Basin • Tuolumne[1] • Friant[2]	140	Spring, summer	• Reservoir reoperation, storage withdrawal, restoration flow recapture reduction
South-of-Delta	300-600	Spring, summer	• SWP and CVP
Sacramento Basin • Sacramento • American[3] • Feather • Yuba • Mokelumne	300	Spring, summer	• Land fallowing (35,000 acres) • Reservoir reoperation • Potential for limited groundwater substitution
Total	**740 – 1,040 TAF**		

9. The Parties propose to provide additional flows in a manner that: (a) does not conflict with the requirements of the Sustainable Groundwater Management Act; (b) does not reduce existing flows for designated wildlife refuges; and (c) maintains reliability of water supply for other beneficial uses. The Agreements may provide for adjustment of flow amounts in successive dry years and immediately subsequent years for the purpose of ensuring reliable reservoir storage.

B. Habitat Improvements and Other Non-Flow Measures

10. The Parties propose to undertake non-flow measures to improve the current condition of fish and wildlife beneficial uses in the Delta ecosystem. Appendix 2 consists of maps which illustrate the proposed general locations and scales of habitat measures.

[1] Tuolumne's proposal also includes managed flows in Critical and Wet year types.
[2] Friant is not a party identified in the Phase I or Phase 2 Bay-Delta Plan update process.
[3] American's proposal includes managed flows in Critical year types.

11. The Parties propose to undertake measures to address multiple factors affecting fish and wildlife beneficial uses, including predation by non-native species, passage barriers, and hatchery productivity. The Parties propose to ensure timely completion of all measures specified in the Agreements. The Parties propose to maintain and adaptively manage successful restoration measures which they have already funded, constructed, or currently operate, in any combination. The Parties propose to provide a more comprehensive discussion of habitat quantities and suitability to support the development of the project description provided in 4(b) of this Framework Proposal.

12. Appendix 3 identifies environmental improvements that Parties propose to implement in 2019, assuming environmental review, the continued availability of funding that has been committed to them, and the issuance of necessary federal permits, such as permits under Clean Water Act sections 404 and 408. CDFW commits to expedite its review of any applications for permits necessary for these improvements to the maximum extent possible consistent with applicable law. CDFW and DWR respectfully request that the State Water Board similarly expedite any review of those projects that the State Water Board conducts and also to direct each applicable Regional Water Quality Control Board to also expedite any necessary reviews. CDFW and DWR will formally request that the United States Departments of Commerce and Interior, as well as the United States Army Corps of Engineers, also expedite all necessary federal approvals for these projects.

C. Integrated Management of Flow and Other Measures

13. The Parties propose to integrate management of flow and non-flow measures, to optimize benefits to fish and wildlife, including through management of existing and additional flows, tidal energy, and through habitat improvements. For anadromous fisheries, the Parties propose this approach to improve water temperatures for all life stages, and to increase access to floodplains as rearing habitats. For pelagic fisheries, the Parties propose to improve the water quality variables that affect viability, including salinity, flow velocity, and turbidity. Appendix 2 consists of maps that exemplify the integrated approach.

D. Science and Monitoring Program / Structured Decision-making

14. The Parties propose a comprehensive science and monitoring program that informs implementation of the flow and non-flow measures.

15. The science and monitoring program will include the following elements, except as specifically provided in the Agreements.

a. **Implement specific experiments**. The science and monitoring program will adopt a "safe to fail" experimental approach to maximize learning.

b. **Test hypotheses**. The science and monitoring program will identify and test key hypotheses, especially/even if conflicting, about how the

ecosystem functions and what measures will be most effective at achieving desired outcomes.

c. **Learn from the experiments**. The science and monitoring program will ensure that each measure is implemented in a manner that maximizes learning.

d. **Design the experiments to test specific outcomes**. The science and monitoring program will identify a manageable set of SMART (specific, measurable, achievable, relevant, and time-bound) objectives that describe desired environmental and biological outcomes.

e. **Facilitate a collaborative process**. All Parties will be engaged in the development and implementation of the science and monitoring program.

f. **Facilitate a transparent process**. All Parties will engage in a transparent process by collaborating, reporting, and sharing data.

16. The science and monitoring program will include a structured decision-making process to inform implementation of flow and non-flow measures. CDFW and DWR anticipate that this science and monitoring program would be overseen by an entity such as the Delta Independent Science Board in order to facilitate the production of neutral, peer-reviewed science to guide further restoration and protection efforts in the Sacramento River and San Joaquin River watersheds and Delta ecosystem. CDFW and DWR intend to propose that terms to guide this science and monitoring program will be part of the proposed amendments to the Bay-Delta Plan.

E. Funding

17. The Parties propose to utilize dedicated funds consisting of (a) contributions based on deliveries to or diversions by the Parties, and (b) repurposing of existing funding. The contributions will be collected annually during the term of the Agreements. Through the contributions, the Parties expect to secure funds totaling approximately $425 million for the additional flows, and $345 million for the science program, over the term of the Agreements. Appendix 1 contains the details of these funding arrangements. Table 2 provides the proposed contribution to the funds, except as provided for in Attachment 1.

Table 2. Contribution to Funds[4]

Delivered Water	Contribution to Water Purchase Fund	Contribution to Structural Habitat and Science Fund
CVP/SWP water	$5/acre-foot	$2/acre-foot
Water diverted by the Sacramento River Settlement Contractors (base and project) or Feather River Diversion Agreement Parties		$1/acre-foot
Non-project water diverted by party contributing water under the terms of the Agreement Framework		$2/acre-foot
Non-project water diverted by party not contributing water under the terms of the Agreement Framework	$10/acre-foot	$2/acre-foot

F. Other Terms

18. Although the State Water Board will have authority to enforce implementation of flow and non-flow measures, as stipulated in the Agreements, the State Water Board will not enforce or otherwise regulate the funding arrangements.

19. Each potential effort, project and/or activity listed in this Agreement Framework has been or will be fully evaluated in compliance with applicable law, including, but not limited to, the National Environmental Policy Act and California Environmental Quality Act. This Agreement Framework does not, and is not intended to, bind any party to a definite course of action or limit in any manner the discretion of the United States, State of California, any other public agency, as applicable, in connection with consideration of the efforts described in this Agreement Framework, including without limitation, all required environmental review, all required public notice and proceedings, consideration of comments received, and the evaluation of mitigation measures and alternatives, including the "no action" or "no project" alternatives.

[4] Except as provided for in Attachment 1.

Appendix 1: Proposed Tributary Term Sheets

Addendum A: Sacramento River

Addendum B: Feather River

Addendum C: Yuba River

Addendum D: American River

Addendum E: Mokelumne River

Addendum F: Tuolumne River

Addendum G: Friant Division

Addendum H: Delta

Addendum A
Sacramento River Mainstem Proposal

Purpose:
The Mainstem Sacramento actions include habitat restoration designed to work with existing winter and spring flows. The habitat improvements target improved growth, survival, diversity, and abundance of the four runs of Chinook salmon and steelhead on the Sacramento River. Additionally, 100,000 acre-feet of water, available from fallowing approximately 24,000 acres, would be available to increase flows improving salmonid outmigration survival and increase Delta outflow.

Proposed Commitments:

Flow

Fall Flow Stabilization (in every year type)
Minimize fall-run spawning impacts during transition from summer/fall flows to winter base flows. Other benefits include increased rearing habitat for juvenile salmonids and conserving cold water storage for winter Chinook spawning and egg incubation in the following late spring through early fall.

Description of Proposal: Demands by the National Wildlife Refuges, upstream CVP contractors, and the Sacramento River Settlement Contractors in October result in Keswick releases that are generally not maintained throughout the winter due to needs to store water for beneficial uses the following year. These releases result in some early fall Chinook redds being dewatered at winter base flows.

Following the emergence of winter Chinook and prior to the majority of fall Chinook spawning, upstream Sacramento Valley CVP contractors and the Sacramento River Settlement Contractors propose to work to synchronize their diversions to lower peak rice decomposition demand. With lower late October and early November flows, fall Chinook are less likely to spawn in shallow areas that would be subject to dewatering during winter base flows. Reductions would balance the potential for dewatering late spawning winter-run redds.

Targets for winter base flows from Keswick would be set in October and would be based on Shasta Reservoir end-of-September (EOS) storage. These base flows would be set based on historic performance to accomplish improved refill capabilities for Shasta reservoir to build cold water pool for the following year.

Below are examples of Keswick Releases based on Shasta storage condition – these would be refined through modeling efforts:

Keswick Release	Shasta EOS Storage
3,250 cfs	< 2.2MAF
4,000 cfs	< 2.8MAF
5,000 cfs	> 3.2 MAF

Governance/Decision Making: Following the emergence of winter Chinook and prior to the majority of fall Chinook spawning, upstream Sacramento Valley CVP contractors and the Sacramento River Settlement Contractors propose to work together to smooth Sacramento Valley CVP contractor diversions to improve the ability to reach the desired winter base flow targets when possible. Reclamation retains discretion over all CVP operations and propose to operate to downstream needs (e.g. Sacramento River or Delta). Furthermore, Reclamation makes operational decisions based on the CVP as a whole, and in accordance with any requirements under then-applicable Biological Opinions issued by federal fisheries agencies.

Additional Water Provided (Dry, Below Normal, Above Normal Year Types)
Dedicate 100,000 acre-feet of water for instream flow purposes focused in April and May to improve juvenile salmonid outmigration survival. This additional water would also contribute to increased Delta outflow while minimizing impacts to Shasta cold water pool.

Description of Action: In the spring, Keswick releases are typically steady until flows are needed to support instream demands on the mainstem Sacramento River and Delta requirements. As a standard practice, Reclamation operates Shasta in the spring to have storage in the reservoir high enough to use the Shasta temperature control device (TCD) upper shutters by the end of May to maximize the cold water pool potential for winter Chinook egg incubation management.

The Parties propose to utilize the 100,000 acre-feet made available through the land-fallowing program to make releases from Shasta, initially focused on April and May, for the primary purpose of increasing spring-run Chinook outmigration and survival in the lower Sacramento River, incorporating science, monitoring, and decision making and testing the hypothesis of flow and survival.

Based on initial review of historic data, the Parties believe that in the majority of these years, the spring pulse flow utilization of water can be accomplished. The fall stabilization action and targeted winter Keswick release is expected to further improve the likelihood and additional certainty regarding the ability to refill of Shasta Reservoir to attain appropriate storage levels under typical hydrological conditions associated with these year types to allow for the spring action to occur. If Reclamation determines that projected inflows to Shasta Reservoir are less than sufficient for summer temperature management pursuant to its ESA obligations, and/or taking the spring action would cause changes to water supply allocations and/or the timing of allocations (to each CVP division north or south of the Delta), or the action impacts other system-wide operations, the water would be added to releases during the summer or fall for other ecosystem benefits, and would serve to augment Delta outflows at those times.

A method for accounting for the 100,000 acre-foot release over the baseline release would be developed as the program of implementation is further refined. Timing and shaping of flows using the water would be based on testable hypotheses developed by the governance group described below.

Governance/Decision Making: Currently, the Sacramento River Temperature Task Group provides input to Reclamation on the operations in the winter/spring on Shasta Releases,

temperatures, spring flows, and cold water pool. The Parties would develop new governance to implement this action.

Actions in Wet Years (Wet Year Types only)
Proposed alteration to timing of Shasta Reservoir releases to support increased salmonid out-migration survival and floodplain habitat.

Description of Action: Reclamation currently generally operates Shasta Reservoir pursuant flood control and safety of dams requirements and procedures.

When inflow into Shasta Reservoir is forecasted to exceed the flood control requirements, Reclamation proposes early initiation of storage management releases for the purposes of spawning gravel cleaning functions, floodplain habitat, general fish migration flows and moderation of flood control-related pulse flows. The action would be subject to Reclamation's determination that there would be absolutely no elevated risk to public health, human safety, or property damage, and that there would be no water cost to the Projects.

Governance/Decision Making: Reclamation retains sole discretion over releases and other actions related to storage management for flood control.

Proposed Actions in Critical Years (Critical Year Types only)
Proposal to provide instream flows during critical years to support salmonid out-migration and temporary in-stream floodplain habitat.

Description of Proposed Action: In most critical years, the spring inflow into Shasta Reservoir is less than optimal and flows at Wilkins Slough are at times equal to or less than Shasta inflow. Significant runoff events that increase base flows on the Sacramento River are generally less frequent.

Reclamation proposes to provide a single spring pulse flow of 30,000 acre-feet in March, with a focus on last two weeks of the month. The water can be made available from Shasta or Whiskeytown reservoirs at Reclamation's sole discretion. The pulse would be timed to ensure that the water is 100% recoverable by the CVP and SWP through Delta exports (or other mechanisms at the discretion of Reclamation), as addressed through COA accounting. The action would be coupled with a storm event when possible, likely as an extension of the recession limb of rainfall runoff to ensure exportability.

The action would not occur if any of the following conditions occur:

- The action causes any impact to the amount or timing for Reclamation's allocations to any CVP contractors (in any CVP Division, north or south of the Delta).
- The Critical year in question immediately follows a Critical or Dry Year.
- Any new or additional RPMs, RPAs, or other regulatory actions affecting Project operations occur as a result of this action.

The action would also take into consideration temperature management considerations for the remainder of the year.

If the year type turns from Critical to Dry, any water released for this pulse action would be counted towards the 100,000 acre-foot commitment as outlined above for other year types.

Habitat

Spawning Habitat Keswick to Red Bluff Diversion Dam

Propose to annually place 40,000 to 55,000 tons of gravel at the Keswick and/or Salt Creek injection site(s). Propose to create at least three site-specific gravel restoration projects upstream of Bonnyview Bridge within 5 years.

Projects that could be implemented in 2019 include: Salt Creek Gravel Injection Site; Keswick Dam Gravel Injection Site; South Shea Levee, Shea Levee; and, Tobiasson Island Side Channel.

Rearing Habitat Keswick to Red Bluff Diversion Dam

Propose to create a total of 40 to 60 acres of side channel habitat at no fewer than 10 sites in Shasta and Tehama County.

Project that could be implemented in 2019 include: Cypress Avenue; Shea Island; Anderson River Park; South Sand Slough; Rancheria Island; Tobiasson Side Channel; and, Turtle Bay.

Rearing Habitat Red Bluff Diversion Dam to Verona

Propose to enhance ~ 2,000 acres of floodplain habitat in the Sutter Bypass within the term of the Voluntary Agreement. Propose to provide fish passage and floodplain habitat at Tisdale Weir within 5 years and Colusa Weir within 10 - 15 years. Propose to complete the Hamilton City set back levee with appropriate floodplain habitat within 5 years. Inventory historic oxbows and design fish passage and floodplain projects within 5 years and implement projects within 10 years.

Projects that could be implemented in 2019 include: Tisdale Weir and Bypass Multi Benefit Project; and Hamilton City Levee Setback and Floodplain/Riparian Enhancement.

Man Made Structures Keswick-Verona

Propose to complete remaining high-priority fish screen projects. Propose to reduce lighting to 3 lux or less at fish screens and bridges within 5 years. Propose to incorporate ongoing redd dewatering coordination with Anderson Cottonwood Irrigation District into a Voluntary Agreement. Propose to address fish passage issues at Weir 1 and Weir 2 within 5 years.

Projects that could be implemented in 2019 include: reduced lighting at Sacramento River fish screens, reduced lighting at Sacramento River bridges; Sutter Bypass Weir 1 - Rehabilitation of weir structure and fish ladder (Coupled with new Lower Butte / Sutter Bypass water management plan); Sutter Bypass Weir 2 Multi Benefit Project; Screen Meridian Farms Water

Company; Screen Natomas Mutual Water Company; and, Anderson Cottonwood Irrigation District Dam operations to protect salmon redds.

Studies Keswick-Verona

Propose to design survival and predation studies within one year and implement them yearly for the term of the agreement.

Projects that could be implemented in 2019 include: Program to identify predation hot spot / adaptively manage for the reduction/improvement of predator contact points at man-made structures where predator interactions have been observed; Study route specific survival at key diversion facilities and implement appropriate devices that reduce route selection into lower survival areas; and study, design and implement modifications to known redd dewatering locations.

Funding Commitments:
The Sacramento water service and settlement contractor groups propose to contribute to the Water Purchase Fund and Structural Habitat and Science Fund.

Water Purchase Fund

- $5 per acre-foot on Project Water Diverted

Structural Habitat and Science Fund

- SRSC contribute $1 per acre-foot of all water diverted
- All other contractors contribute $2 per acre-foot on all Project Water diverted

Addendum B
Feather River Proposal

Purpose:

The Feather River proposal includes habitat restoration intended to work with existing and proposed Spring and Summer flows. The habitat improvements target improved growth, survival, diversity, and abundance of salmon and steelhead on the Feather River. Fifty-thousand acre-feet of water available from fallowing of 11,000 acres of agricultural land will be available to increase flows improving fish survival and providing for increases in Delta outflow.

Proposed Commitments:

1. **Flow**

As set forth in Table 1 below, the Feather River Settlement Contractors propose to provide for additional managed flows beyond current flow regimes on the Feather River to reestablish functionality of the habitat for native fishes.

Table 1. Additional Managed Flow

Water Quantity (TAF)	Implementation Date	Water Year Types
50	Spring or Summer[1]	Dry, Below Normal, Above Normal

In addition, DWR proposes to provide an immediate adjustment to river flow and temperature in the Feather River, as provided under the Federal Energy Regulatory Commission (FERC) Settlement Agreement (SA) for the Licensing of the Oroville Facilities, FERC Project No. 2100, to create additional spawning and rearing habitat by increasing useable area for adult and juvenile salmonids.[2]

Table 2. River Flow and Temperature Adjustments

Flow	
Flow Velocity (cfs)	**Implementation Date[3]**
700	April 1 – September 8
800	September 9 – March 31
Temperature	
Target (F, mean daily)	**Compliance Point**
56 – 63	Robinson Riffle

DWR also proposes to provide for re-operation of the Oroville facilities to maximize spawning and rearing in the Feather River for salmonids. Instead of routing flows through Thermalito Forebay and the power generation facilities at Oroville, a pulse flow would instead be routed

[1] Subject to coordination with fisheries agencies.
[2] This is included in the FERC SA. However, unlike the non-flow measures provided in the FERC SA, the Department of Water Resources would be able to implement this plan of operation immediately.
[3] Implementation would occur for the duration of the current annual and future FERC license.

directly through the low-flow channel to create optimal conditions for fish in the upper Feather River.

Table 3. Pulse Flow

Water Quantity (TAF) – Average Annual	Pulse Velocity (cfs)	Date & Duration	Water Year Types
43	2,000	14 or more continuous days between January 1 – April 15	Dry, Below Normal, Above Normal

2. Non-Flow Habitat

The Parties propose to enhance and create riverine habitat sufficient to support salmon and sturgeon populations in the Feather River with specific years of implementation, as described in Table 4 below. These projects would target specific critical life stages for fish including spawning (S), rearing (R), migration (M), and adult migration (AM).

Table 4. New Riverine Habitat

Project	Description	Targeted Habitat	Years	Life Stage
Gravel augmentation	Improve substrate conditions for spawning salmonids at key riffles	25,000 cu. yd.	0-5 years	S
Remove Sunset Pumps and associated rock dam	Remove barrier/entrainment risk for upstream salmonid and sturgeon passage	Over 25 miles upstream	0 – 5 years	AM, M
Oroville Wildlife Flood Stage Reduction Project	Weir improvements and ecosystem restoration and Oroville Wildlife Area to allow floodplain access	100 – 600 acres	3 – 8 years	R
Nelson Slough Floodplain Restoration	Provide optimal habitat for floodplain rearing and reduce stranding during high flow events	20 acres	3 – 15 years	R
Abbott Lake Re-Connection/Restoration	Provide optimal habitat for floodplain rearing and reduce stranding during high flow events	440 acres	3 – 15 years	R
Star bend Setback Levee	Provide optimal habitat for floodplain rearing and reduce stranding during high flow events	50 acres	3 – 15 years	R
Feather River Setback Levee below Yuba River on River Left Floodplain	Provide optimal habitat for floodplain rearing and reduce stranding during high flow events	1,100 acres	3 – 15 years	R
Identification of Predation Hot Spots and Adaptive Management for Predator Reduction	Improve rearing and migration conditions by reducing predation	Entire reach of river	0 – 15 years	R, M

As set forth in Table 5 below, DWR proposes to accelerate the creation of riverine habitat under FERC SA for the Licensing of the Oroville Facilities, FERC Project No. 2100. This acceleration would be an improvement over the timing for completion of projects identified in the FERC SA and would occur within the FERC jurisdictional boundary.

Table 5. Accelerated Riverine Habitat in the FERC SA

Project[4]	Description	Years after FERC License	Life Stage
Habitat Improvement Plan (A101)	Develop and adaptive management plan to respond to restoration project feedback	2 years	All
Gravel Supplementation Improvement Program (A102)	File a gravel supplementation and improvement plan to respond to restoration project feedback	2 projects within 2 years; 5 within 5; 10 within 10	S
Channel Improvement Program (A103)	Creation and improvement of side channel habitat	Develop plan within 2 years; 3 channels in 5; all channels within 7	S, R
Structural Habitat Program (A104)	Installation of large woody debris, boulders, etc. and filing a plan for implementation	Submit plan within 1 year; implement within 2 years	R
Fish Weir Program (A105)	Filing plans for weir installation, installation of monitoring and segregation weirs	Install count weir within 1 year and segregation weir within 3	AM, S
Riparian Floodplain Program (A106)	Filing of recommendations for riparian projects, physical completion of projects	Screening level within 3 years; 1 project within 10; 2 projects within 15	R
Hatchery Improvement Implementation (A107)	Implementation of temperature targets, filing a hatchery genetics management plan (HGMP), data collection – minimize straying	Target hatchery temperatures and data collection immediately; HGMP within 1 year	AM, S

3. Governance

Governance for the Feather River proposal will be consistent with the terms of the Agreement Framework.

4. Funding Commitments

The Feather River Contractors propose to help fund the science and monitoring program at a rate of $1 per acre-foot of all water diverted.

[4] Includes FERC SA project identifier (e.g., A104, A109, etc.).

Addendum C
Yuba Water Agency Proposal

This document summarizes the framework (Framework) that the California Department of Water Resources, the California Department of Fish and Wildlife (CDFW) and Yuba Water Agency (YWA) have approved in concept for the voluntary agreement (Voluntary Agreement).

1. The Voluntary Agreement will be based on foundational principles that are set forth in the Framework.
2. YWA would: (a) repurpose all Yuba Accord Released Transfer Water in April through June that cannot be accounted for as Delivered Transfer Water (as these terms are defined in the Yuba Accord Water Purchase Agreement); and (b) reoperate New Bullards Bar Dam and Reservoir by up to 50,000 acre-feet, to provide: (1) a Base Contribution of 9,000 acre-feet per year in above-normal, below-normal and dry-years; and (2) a Supplemental Contribution of up to an additional 41,000 acre-feet per year in above-normal, below-normal and dry-years, based on releases from storage with YWA's reoperation plan, to assist other agencies in meeting the Sacramento River Basin's Delta flow contribution target.
3. YWA would not receive any compensation for YWA's Base Contribution.
4. YWA would be paid $290 per acre foot for all Supplemental Contribution water.
5. The Base Contribution is comparable and proportionate to YWA's proportionate share of the Yuba River watershed's comparable and proportionate share of flow contributions for Delta inflow from the Sacramento River Basin.
6. The Supplemental Contribution exceeds what would be YWA's comparable and proportionate share of contributions to Delta inflow.
7. YWA would make an annual payment to the Structural Science Fund of $520,000.
8. All parties to the YWA Voluntary Agreement will support YWA's Amended Final License Application for the Yuba River Development Project.
9. CDFW would notify FERC of its support for the AFLA when YWA notifies it that YWA would provide the Supplemental Contribution prior to the execution of the Voluntary Agreement (i.e., early implementation of flow releases).
10. YWA would enhance a minimum of 100 acres of floodplain and in-channel habitat along the lower Yuba River.
11. YWA would contribute $10 million for Habitat Enhancement Measures.
12. The parties to the YWA Voluntary Agreement would define the process for and respective obligations of the parties to select, fund, develop, operate, maintain and repair Habitat Enhancement Measures.

Addendum D
American River Proposal

Purpose

The American River Parties believe that implementation of the flow, habitat and non-flow measures, described below, when integrated, would materially improve conditions for anadromous fish in the lower American River, maintain water supply reliability, and provide additional new water for purposes of improving ecosystem conditions in the Delta.

The American River flow, storage, habitat and infrastructure improvement actions are designed to work in harmony to improve conditions for all life stages of Central Valley steelhead and Fall-run Chinook salmon in the lower American River. The combined actions are also additive to the overall package of measures being undertaken in other tributaries and in the Delta to improve conditions for the Sacramento River and San Joaquin River watersheds and Delta ecosystem.

Proposed Commitments

A. Flows and Storage

i. Proposed Environmental Flow Commitments by American River Parties

- **Additional Water for Environmental Purposes.** The water provided by the American River Parties under the Voluntary Agreement would be in addition to and would be used to supplement the environmental flows described in the Attachment.
- **Groundwater Substitution Water**. American River Parties propose to make available a contribution of 10,000 acre-feet of groundwater substitution water in Sacramento Valley Index Critical and Dry years, for an upfront payment of $15M (from a public source).
    - Calls for this water may be made in up to 6 Critical or Dry years during the 15-year term of the Voluntary Agreement.
    - The water made available in Folsom Reservoir under the voluntary agreement would be managed in a manner to meet identified biological objectives developed in the American River Group through a collaborative process. See Monitoring, Reporting, and Adaptive Management below. The stakeholders participating in the collaborative process propose to designate a single point of contact with authority to make decisions. Reclamation, CDFW, NMFS and FWS will retain their discretion to determine the biological objectives.
    - Depletion rates would be determined by BOR and DWR (currently 8%), in consultation with American River Parties, based on local conditions and data developed by American River Parties, or, absent a determination, based on white paper.

- Groundwater recharge would occur in wetter years, consistent with sustainable groundwater management principles.

- **Reservoir Reoperation Water**. American River Parties propose to make available an additional 10,000 acre-feet of reservoir reoperation water in Sacramento Valley Index Above Normal and Below Normal years, for a payment of $290/acre-foot.
    - Calls for this water may be made in up to 6 Above Normal or Below Normal years during the 15-year term of the Voluntary Agreement.
    - The cost of this water would be paid out of the Water Purchase Fund.
    - This water would be subject to the then-applicable refill criteria.
- **Additional Dry Year Water**. In Sacramento Valley Index Dry years, American River Parties propose to make available an additional 10,000 acre-feet of water from reservoir reoperation and/or groundwater substitution, for a payment of $290/acre-foot out of the Water Purchase fund.
    - All of the caveats relating to Reservoir Reoperation Water and Groundwater Substitution Water apply to this block of water.
- **Groundwater Bank**. If American River Parties are awarded bond funding for infrastructure improvements under Public Resources Code section 80114 or another public fund identified for supporting or facilitating the voluntary agreements, the American River Parties would produce up to 20,000 acre-feet of additional water in Sacramento Valley Index Critical and Dry years, under the following terms:
    - For each $1 million dollars of funding received by the American River Parties, the American River Parties propose to make 500 acre-feet of additional water available, up to a maximum call amount of 20,000 acre-feet. Water would be made available for call within 18 months after the American River Parties receive the funding agreement.
    - Calls for this water may be made in up to 6 Critical or Dry years during the 15-year term of the Voluntary Agreement.
    - Depletion rates would be determined by BOR and DWR (currently 8%), in consultation with American River Parties, based on local conditions and data developed by American River Parties, or, absent a determination, based on white paper.
    - Groundwater recharge would occur in wetter years, consistent with sustainable groundwater management principles.

ii. <u>Lower American River Management Framework</u>:

- **Flows.** Within the Lower American River, Reclamation would adopt the minimum flow schedule and approach proposed by the Water Forum in 2017. Flows range from 500 to

2000 cfs based on time of year and annual hydrology. The flow schedule is intended to improve cold water pool and habitat conditions for steelhead and fall-run Chinook salmon.

- **Temperature Management.** The Parties would continue the existing water temperature planning and operations actions as described in the 2009 NMFS BiOps, including development of a temperature management plan every May which optimizes monthly temperature targets developed using latest reservoir operations forecast data. The purpose of the temperature management plan is to balance the habitat needs of rearing steelhead and fall-run Chinook salmon.

- **Folsom Reservoir Operations.** All of the following measures are subject to the understanding that Reclamation at all times retains all of its discretion to operate the CVP consistent with its authorizing acts and all other applicable legal authority.

    - Reclamation and the American River parties propose to work together using their expertise to define an appropriate amount of storage that represents the lower bound for typical forecasting processes in Folsom Reservoir at the end of calendar year (the "planning minimum"). The objective of the planning minimum is to preserve storage to protect against future drought conditions and to facilitate the development of the cold water pool when possible. This planning minimum will be a single value (or potentially a series of values for different hydrologic year types) to be used for each year's forecasting process into the future. To meet the objective identified above, Reclamation and American River parties propose to work together to determine the draft value(s) that they believe are appropriate. The draft value(s) for the planning minimum developed by the parties would also be shared with CVP contractors from outside of the American River Division, and the parties would meet with other CVP contractors to explain the basis of the selection of the draft value(s) and receive their comments. Reclamation would then determine its preferred value(s) for use in its forecasting process for guiding seasonal operations. The American River Parties acknowledge that Reclamation's selection of a preferred value is not a final agency action and is not subject to judicial review.

    - Reclamation and the American River Parties understand that the forecasted storage may fall below the planning level minimum due to a variety of circumstances and causes. As such, Reclamation and the American River Parties would develop a list of potential off-ramp actions that may be taken to either improve forecasted storage or decrease demand on Folsom.

    - Both the planning minimum value(s) and the list of potential off-ramp options would be completed before the Voluntary Agreement is executed.

    - In its forecasting process for guiding seasonal operations, Reclamation would plan to maintain or exceed the agreed-upon Folsom planning minimum at the end of the calendar year.

- When Reclamation estimates, using the forecasting process, that it would not be able to maintain Folsom Reservoir storage at the end-of-December planning minimum for that year type (such as in extreme hydrologic conditions) or unexpected events cause the storage level to be at risk, American River Division contractors would consult with Reclamation to identify and implement appropriate actions to improve forecasted storage conditions, and the parties would work together to educate the public on the actions that have been agreed upon and implemented and the reasons and basis for them. Reclamation would also meet with American River contractors and CVP Contractors from outside the American River Division in circumstances when potential changes to Folsom operations would have impacts on other parts of the system and when the actions need to be taken that affect the entire integrated system.

- In incorporating the planning minimum into its forecasting process, Reclamation recognizes the parties' shared goals of providing releases of salmonid-suitable temperatures to the lower American River and reliable deliveries (using the existing water supply intakes and conveyance systems) to American River water agencies that are dependent on deliveries or releases from Folsom Reservoir, as well as its obligations, including the terms of the American River settlement contracts and all of the purposes authorized for the American River Division as an integrated facility of the Central Valley Project.

- The parties recognize that, during the term of the Voluntary Agreement, changed circumstances may necessitate adjustments to the value(s) for the planning minimum. Any party may request that the technical group reconvene and that Reclamation re-evaluate its preferred value(s) based on the changed circumstances.

- Reclamation would ramp down to the revised minimum flows from Folsom Reservoir as soon as possible in the fall and maintain these flows, where possible, given all of the purposes authorized for the American River Division as an integrated facility of the Central Valley Project and consistent with required flood control operations, in the winter in an effort to maximize spring storage for the purpose of developing the largest possible annual cold-water pool.

iii. <u>Non-Flow Proposed Commitments by the American River Parties</u>

- 50 acres of anadromous fish spawning habitat, implementation costs split between local agencies and Reclamation. Parties may seek outside funding to offset their cost shares.

- 150 acres of anadromous fish rearing habitat, paid for by the Structural Habitat Science Fund and/or State bond funds.

- The Parties propose to work collaboratively to determine the highest value locations for habitat restoration within the watershed and will prioritize projects accordingly.

iv. Conditions and Assumptions for All American River Parties' Proposed Commitments

- The terms and conditions of the FERC licenses and water rights settlement agreements will be implemented.
- Final terms and conditions for the Voluntary Agreement must be acceptable to Reclamation, the Water Forum and the governing bodies of the Parties.

Monitoring, Reporting and Adaptive Management

- American River Parties propose to continue the science program established by the Water Forum, including its monitoring, reporting, and adaptive management components. As noted above, the water made available in Folsom Reservoir under the voluntary agreement would be managed in a manner to meet identified biological objectives developed in the American River Group through a collaborative process.
- The collaborative process would consider potential uses of water made available by American River Parties, including, but not limited to, the following:
    - Improving cold water pool storage for steelhead rearing and fall-run Chinook spawning
    - Augmenting spring flows and improving temperatures to support juvenile outmigration and inundate floodplain habitat
    - Augmenting flows and improving temperature for fall-run Chinook salmon spawning
    - Augmenting Delta outflow
- The stakeholders participating in the collaborative process, including the agencies, would designate a single point of contact with authority to make decisions to participate in the meetings.

Early Actions Pending Completion of Voluntary Agreement and Environmental Review

- American River Parties would cooperate with CDFW, DWR and the Water Forum to implement, in 2019, a salmonid habitat restoration project on the lower American River consisting of the following elements: (1) approximately 3.35 acres of spawning habitat, and approximately 2.14 acres of rearing habitat, at Upper Sailor Bar; and (2) approximately 2.45 acres of spawning habitat, and 0.28 acres of rearing habitat, at Lower Sailor Bar. Implementation of this project is dependent on the continued availability of $2.3 million in federal funds that have been committed to the Water Forum, as well as the issuance of Clean Water Act section 404 and 408 permits by the U.S. Army Corps of Engineers (USACE). CDFW and DWR would formally request that the USACE expedite the issuance of these permits and would coordinate with the Central Valley Flood Protection Board to support that USACE action. CDFW and DWR would expedite the issuance of any approvals for this project that are within their respective jurisdictions.

Funding Commitments

A. Proposed Contributions by American River Parties

- American River Parties would contribute $2 per acre-foot for all water delivered for consumptive use by local agencies in the American River watershed to the Structural Habitat and Science Fund.
- To offset the cost of water and habitat needed to implement the voluntary agreement, American River Parties propose to pay an additional $5 per acre-foot on all CVP water service water and Warren Act water delivered through Project facilities, except for pre-1914 water rights water conveyed subject to a Warren Act contract, which will not pay the $5 charge.
- The $5 per acre-foot fee would be deposited the Water Purchase Fund.

B. Proposed Local Expenditure of Funds Collected

- The Parties recognize that the American River Parties have a long history of managing the American River watershed for environmental purposes through a multi-party collaborative effort led by the Water Forum, which the American River Parties have funded themselves for the last twenty years, pursuant to the Water Forum Agreement.
- To continue to support the Water Forum's efforts, for every $2 contributed to the Sacramento Watershed Habitat and Science Fund over the term of the 15-year voluntary agreement, Reclamation would direct $1.75 of benefits to be returned to the American River region for the purpose of funding local science and habitat, and $0.25 would be directed to Delta science and habitat efforts.
- The Parties recognize that the American River Parties have been, for many years, investing in regional water supply infrastructure which can help reduce their reliance on flows from the American River, and the Parties desire to continue to support these efforts during the term of the Voluntary Agreement. Therefore, to offset the costs of or otherwise support the American River Parties' implementation of the voluntary agreement, of the funds collected in the Water Purchase Fund, each American River Party would be provided funds in an amount equivalent to the amount contributed by each party, to be expended locally by the water supply agencies. These funds would not be used to pay for or purchase the water made available under the Voluntary Agreement. Release of these funds would not be subject to federal budgeting processes or appropriations. These funds may be used by the local agencies for any legal purpose, including, but not limited to, projects to improve water supply reliability, infrastructure built in the service area that has reliability benefits in the service area, and projects that may have regional water supply benefits. The Parties propose to agree on an appropriate mechanism for the local agencies to claim the funds.

Proposed Implementation, Related Approvals and Support

- Provided that the improvements are deemed non-reimbursable, Reclamation would agree to support and advocate for the completion of Folsom temperature infrastructure

improvements during the term of this agreement. These improvements would include improving efficiency of the existing temperature shutters. Reclamation and the American River Parties agree that completing the planned improvements to the temperature shutters concurrently with the planned flood raise for Folsom Dam would provide multiple benefits. Reclamation would use its best efforts to urge the Corps of Engineers to complete improvements to the temperature shutters on this schedule. Reclamation would also continue to collaborate to develop a feasible modified penstock intake to access maximum extent of cold-water pool and minimize need for power production bypass to the extent reasonable.

- Reclamation and the California Department of Fish and Wildlife would agree to make physical and operational improvements to the Nimbus hatchery to ensure efficient production of healthy anadromous fish to meet the obligated mitigation spawning requirements. Reclamation would provide $2.5 M of capital funds for these improvements, subject to appropriations and limits imposed by federal law.
- The Parties propose to prepare a written agreement containing these terms and would execute it once they secure final approval from governing bodies.
- The Parties propose to agree to support all necessary regulatory, legislative and legal actions required to implement this proposal as allowed by law. It is intended that implementation of this operational framework for Folsom would resolve all of the parties' disputes regarding Folsom operations. An initial list of measures to be supported would be provided to the parties.

LOWER AMERICAN RIVER
- STANDARDS FOR MINIMUM FLOWS -

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The following are the standards for calculating Minimum Release Requirements (MRRs) that the Water Forum submitted to the State Water Resources Control Board in 2017.

1 HYDROLOGIC INDICES

Hydrologic indices of water availability are used in these Standards to scale MRRs from Nimbus Dam to water year type. Lower MRRs are prescribed in drier years and higher MRRs are prescribed in wetter years. The MRRs are updated each month from January through May based on updated forecasts and indices for the water year. During the latter portion of the year (June through December), MRRs are based on the May index, because at that time the majority of the precipitation has occurred in the watershed (i.e., the amount of water available is fairly certain). The criteria used to develop the most appropriate hydrologic index were that the index was well established, publicly available or easy to calculate, accurate, available January through May, and updated monthly as the water year progressed. The two indices that were selected to specify the MRR were the SRI for the month of January, and the ARI for the months of February through December. Each index is described below.

1.1 SACRAMENTO RIVER INDEX

The SRI, previously referred to as the "4 River Index" or "4 Basin Index," is published by the California Department of Water Resources (DWR) each year on December 1, January 1, February 1, March 1, April 1, and May 1 for several exceedance levels. The value of the SRI at 75% exceedance is used for determining the MRR in January (**Figure 1**). The SRI can be found at http://cdec.water.ca.gov/cgi-progs/iodir_ss/wsi. DWR computes the SRI by adding the forecasted unimpaired flow for the water year from the Sacramento River above Bend Bridge, the Feather River at Oroville, the Yuba River near Smartsville, and the American River below Folsom Reservoir.

Cooperative Snow Surveys Website - Snowpack

WSI (05/08/15 1506)

Department of Water Resources
California Cooperative Snow Surveys
WATER SUPPLY INDEX (WSI) FORECASTS
2015 Water Year Hydrologic Classification Indices

2015 Water Year Forecast as of May 1, 2015

SACRAMENTO RIVER UNIMPAIRED RUNOFF - SACRAMENTO RIVER INDEX (SRR)

	Probability of Exceedance					
Forecast Date	99%	90%	75%	50%	25%	10%
Dec 1, 2014	4.9 (27%)	7.2 (39%)	9.7 (53%)	13.7 (75%)	18.5(101%)	23.7(130%)
Jan 1, 2015	8.9 (49%)	11.5 (63%)	14.3 (78%)	17.1 (94%)	21.6(118%)	26.0(142%)

Figure 1. Excerpt from the California Data Exchange Center website showing the Sacramento River Index value at 75% exceedance.

1.2 AMERICAN RIVER INDEX

The ARI is a measure of the unimpaired inflow to Folsom Reservoir minus the amount of "spill" water that could not be captured at the reservoir (unimpaired runoff minus spill flows). The equations for calculating the ARI are provided in **Table 1**.

The unimpaired inflow used in the ARI is based on the DWR "Bulletin 120, Water Conditions in California" (B120) estimate of unimpaired water year runoff in the "American River below Folsom Lake." DWR initially publishes the B120 each year in early February, and subsequently publishes the March, April, and May B120 on the 6th working day of each month. Between the monthly B120 publications and after the May publication, DWR publishes weekly updates reflecting current snow pack and precipitation monitoring information. The final weekly update is typically released in early June, but depending on conditions, the release of weekly updates can extend into mid-or late-June.

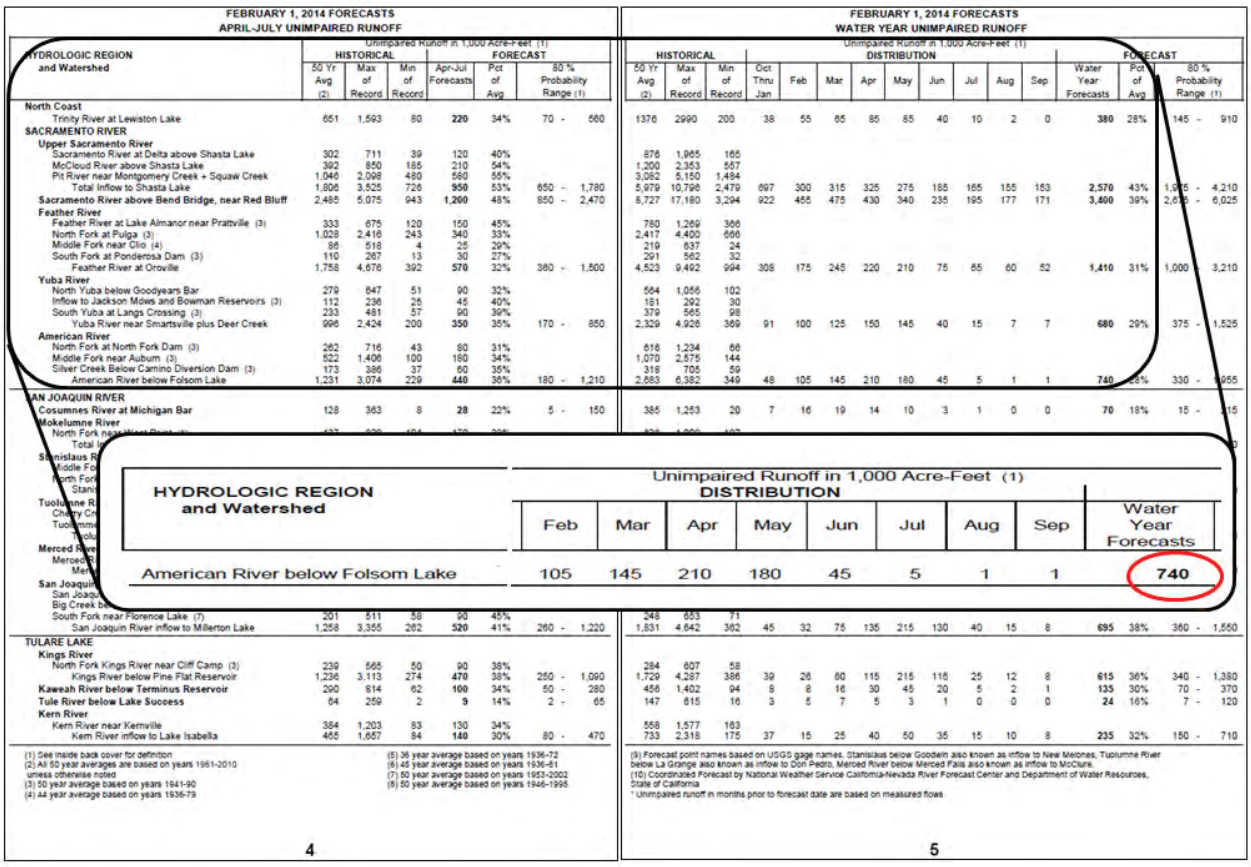
Table 1. Equations to calculate the American River Index.

Variable & Units	Equation/Calculation Method	Description and Citations
$ARI_{i,j}$ (TAF)	$ARI_{i,j} = B120\ WY\ Forecast_{i,j} - Folsom\ WYTD\ Spill_{i,j}$	American River Index for water year i estimated based on data available in month j.
B120 WY $Forecast_{i,j}$ (TAF)	Published Bulletin 120.	DWR Bulletin 120, 50% exceedance "water year forecast" in the "American River below Folsom Lake" for water year (WY) i published in month j.
Folsom WYTD $Spill_{i,j}$ (TAF)	$\sum_{k=Oct\ 1}^{End\ of\ Month\ j-1}(Spill_{k\ (cfs)} + ContReg_{k\ (cfs)})\ 0.001983$	The water-year-to-date (WYTD) i volume of the Folsom Dam spillway and/or control regulating discharge (ContReg) for each day k through the end of month j as reported by DWR's California Data Exchange Center website; where Spill = spillway discharge (cfs) and ContReg = control regulating discharge (cfs), but only control regulating discharges related to avoiding reservoir spills, not releases used for temperature control in the fall or other discretionary releases

B120 provides both a forecast of monthly unimpaired flows for the water year (October through September), a forecast of water year unimpaired runoff, commonly referred to as the median forecast, and an 80 percent probability range, that essentially defines the 10 percent and 90 percent exceedance levels. DWR's B120 publications can be found at http://cdec.water.ca.gov/snow/bulletin120/index.html. An excerpt of pages 4 and 5 from B120 is shown in **Figure 2**. The median value ("Water Year Forecast") is used in computing the ARI.

The amount of spill water in the ARI computation is the cumulative water-year-to-date (WYTD) amount of discharge from the Folsom Dam Spillway and the Control Regulating Gates as reported by DWR's California Data Exchange Center (CDEC) website (http://cdec.water.ca.gov/cgi-progs/queryCSV?station_id=FOL) as shown in **Figure 3**. However, only "Control Regulating Gate" discharges related to avoiding reservoir spills are used in the calculation, not releases used

for temperature control in the fall (or other discretionary releases). The WYTD discharge is calculated from October 1 through the end of the month preceding the forecast (e.g., October 1 through January 31 for the February forecast).



FEBRUARY 1, 2014 FORECASTS
APRIL-JULY UNIMPAIRED RUNOFF

Unimpaired Runoff in 1,000 Acre-Feet (1)

HYDROLOGIC REGION and Watershed	HISTORICAL 50 Yr Avg (2)	HISTORICAL Max of Record	HISTORICAL Min of Record	FORECAST Apr-Jul Forecasts	FORECAST Pct of Avg	FORECAST 80 % Probability Range (1)
North Coast						
Trinity River at Lewiston Lake	651	1,593	80	220	34%	70 - 560
SACRAMENTO RIVER						
Upper Sacramento River						
Sacramento River at Delta above Shasta Lake	302	711	39	120	40%	
McCloud River above Shasta Lake	392	850	185	210	54%	
Pit River near Montgomery Creek + Squaw Creek	1,046	2,098	480	560	54%	
Total Inflow to Shasta Lake	1,806	3,525	726	950	53%	650 - 1,780
Sacramento River above Bend Bridge, near Red Bluff	2,485	5,075	943	1,200	48%	850 - 2,470
Feather River						
Feather River at Lake Almanor near Prattville (3)	333	675	120	150	45%	
North Fork at Pulga (3)	1,028	2,416	243	340	33%	
Middle Fork near Clio (4)	86	518	4	25	29%	
South Fork at Ponderosa Dam (3)	110	267	13	30	27%	
Feather River at Oroville	1,758	4,676	392	570	32%	380 - 1,500
Yuba River						
North Yuba below Goodyears Bar	279	647	51	90	32%	
Inflow to Jackson Mdws and Bowman Reservoirs (3)	112	236	25	45	40%	
South Yuba at Langs Crossing (3)	233	481	57	90	39%	
Yuba River near Smartsville plus Deer Creek	996	2,424	200	350	35%	170 - 850
American River						
North Fork at North Fork Dam (3)	262	716	43	80	31%	
Middle Fork near Auburn (3)	522	1,406	100	180	34%	
Silver Creek Below Camino Diversion Dam (3)	173	386	37	60	35%	
American River below Folsom Lake	1,231	3,074	229	440	36%	180 - 1,210
SAN JOAQUIN RIVER						
Cosumnes River at Michigan Bar	128	363	8	28	22%	5 - 150
Mokelumne River						
North Fork near West Point (5)	137	339	104	170	33%	
Total [illegible]						
Stanislaus R						
Middle Fo						
North Fork						
Stani						
Tuolumne R						
Cherry Cr						
Tuolumne						
Merced Riv						
Merced F						
Merc						
San Joaquin						
San Joaqu						
Big Creek be						
South Fork near Florence Lake (7)	201	511	58	90	45%	
San Joaquin River inflow to Millerton Lake	1,258	3,355	262	520	41%	260 - 1,220
TULARE LAKE						
Kings River						
North Fork Kings River near Cliff Camp (3)	239	565	50	90	38%	
Kings River below Pine Flat Reservoir	1,236	3,113	274	470	38%	250 - 1,090
Kaweah River below Terminus Reservoir	290	814	62	100	34%	50 - 280
Tule River below Lake Success	64	259	2	9	14%	2 - 65
Kern River						
Kern River near Kernville	384	1,203	83	130	34%	
Kern River inflow to Lake Isabella	466	1,657	84	140	30%	80 - 470

(1) See inside back cover for definition
(2) All 50 year averages are based on years 1961-2010 unless otherwise noted
(3) 50 year average based on years 1941-90
(4) 44 year average based on years 1936-79
(5) 36 year average based on years 1936-72
(6) 45 year average based on years 1936-81
(7) 50 year average based on years 1953-2002
(8) 50 year average based on years 1946-1995

4

FEBRUARY 1, 2014 FORECASTS
WATER YEAR UNIMPAIRED RUNOFF

Unimpaired Runoff in 1,000 Acre-Feet (1)

HYDROLOGIC REGION and Watershed	HISTORICAL 50 Yr Avg (2)	HISTORICAL Max of Record	HISTORICAL Min of Record	DISTRIBUTION Oct Thru Jan	DISTRIBUTION Feb	DISTRIBUTION Mar	DISTRIBUTION Apr	DISTRIBUTION May	DISTRIBUTION Jun	DISTRIBUTION Jul	DISTRIBUTION Aug	DISTRIBUTION Sep	FORECAST Water Year Forecasts	FORECAST Pct of Avg	FORECAST 80 % Probability Range (1)
North Coast															
Trinity River at Lewiston Lake	1376	2990	200	38	55	65	85	85	40	10	2	0	380	28%	145 - 910
SACRAMENTO RIVER															
Upper Sacramento River															
Sacramento River at Delta above Shasta Lake	876	1,965	165												
McCloud River above Shasta Lake	1,200	2,353	557												
Pit River near Montgomery Creek + Squaw Creek	3,082	5,150	1,484												
Total Inflow to Shasta Lake	5,979	10,796	2,479	697	300	315	325	275	185	165	155	153	2,570	43%	1,975 - 4,210
Sacramento River above Bend Bridge, near Red Bluff	8,727	17,180	3,294	922	455	475	430	340	235	195	177	171	3,400	39%	2,675 - 6,025
Feather River															
Feather River at Lake Almanor near Prattville (3)	780	1,269	366												
North Fork at Pulga (3)	2,417	4,400	666												
Middle Fork near Clio (4)	219	637	24												
South Fork at Ponderosa Dam (3)	291	562	32												
Feather River at Oroville	4,523	9,492	994	308	175	245	220	210	75	65	60	52	1,410	31%	1,000 - 3,210
Yuba River															
North Yuba below Goodyears Bar	564	1,056	102												
Inflow to Jackson Mdws and Bowman Reservoirs (3)	181	292	30												
South Yuba at Langs Crossing (3)	379	565	98												
Yuba River near Smartsville plus Deer Creek	2,329	4,926	369	91	100	125	150	145	40	15	7	7	680	29%	375 - 1,525
American River															
North Fork at North Fork Dam (3)	616	1,234	68												
Middle Fork near Auburn (3)	1,070	2,575	144												
Silver Creek Below Camino Diversion Dam (3)	318	705	59												
American River below Folsom Lake	2,683	6,382	349	48	105	145	210	180	45	5	1	1	740	28%	330 - 1,955
SAN JOAQUIN RIVER															
Cosumnes River at Michigan Bar	385	1,253	20	7	16	19	14	10	3	1	0	0	70	18%	15 - 315
Mokelumne River															
North Fork near West Point (5)	438	1,099	167												
Total [illegible]															
Stanislaus R															
Middle Fo															
North Fork															
Stani															
Tuolumne R															
Cherry Cr															
Tuolumne															
Merced Riv															
Merced F															
Merc															
San Joaquin															
San Joaqu															
Big Creek be															
South Fork near Florence Lake (7)	248	653	71												
San Joaquin River inflow to Millerton Lake	1,831	4,642	362	45	32	75	135	215	130	40	15	8	695	38%	360 - 1,550
TULARE LAKE															
Kings River															
North Fork Kings River near Cliff Camp (3)	284	607	58												
Kings River below Pine Flat Reservoir	1,729	4,287	386	39	26	60	115	215	115	25	12	8	615	36%	340 - 1,380
Kaweah River below Terminus Reservoir	456	1,402	94	8	8	16	30	45	20	5	2	1	135	30%	70 - 370
Tule River below Lake Success	147	615	16	3	5	7	5	3	1	0	0	0	24	16%	7 - 120
Kern River															
Kern River near Kernville	558	1,577	163												
Kern River inflow to Lake Isabella	733	2,318	175	37	15	25	40	50	35	15	10	8	235	32%	150 - 710

(9) Forecast point names based on USGS gage names. Stanislaus below Goodwin also known as inflow to New Melones; Tuolumne River below La Grange also known as inflow to Don Pedro, Merced River below Merced Falls also known as inflow to McClure.
(10) Coordinated Forecast by National Weather Service California-Nevada River Forecast Center and Department of Water Resources, State of California
* Unimpaired runoff in months prior to forecast date are based on measured flows

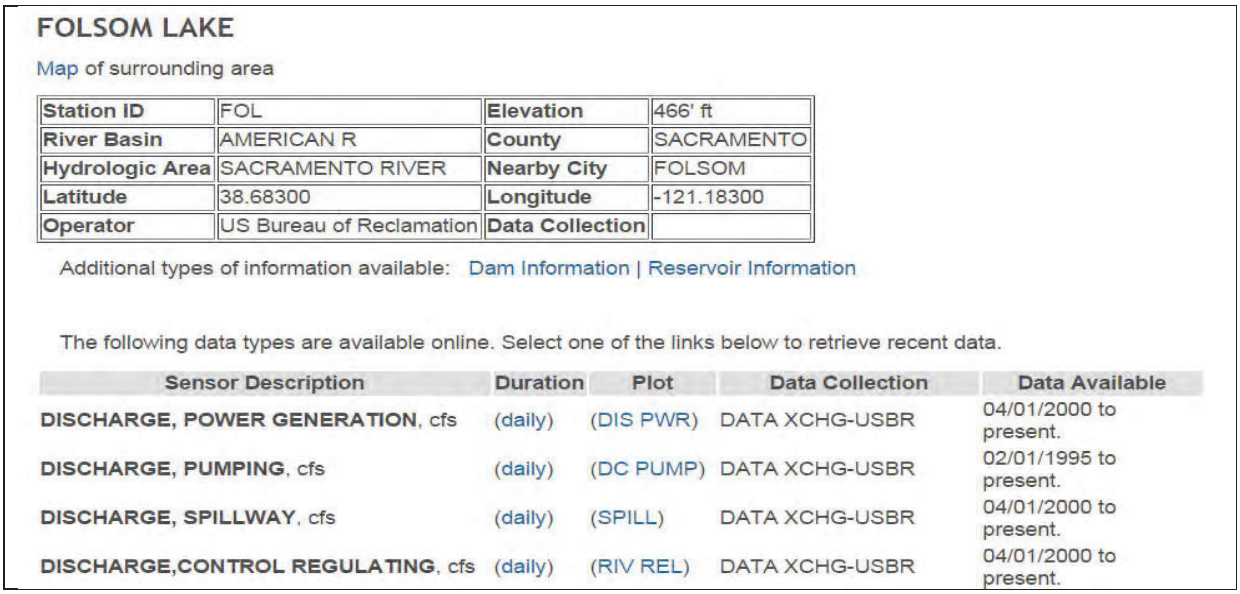
5

HYDROLOGIC REGION and Watershed

Unimpaired Runoff in 1,000 Acre-Feet (1) DISTRIBUTION

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Forecasts
American River below Folsom Lake	105	145	210	180	45	5	1	1	740

Figure 2. Excerpt from Bulletin 120 showing the water year 50% exceedance forecast ("Water Year Forecasts" column) of unimpaired flow in the "American River below Folsom Lake" circled in red.



FOLSOM LAKE

Map of surrounding area

Station ID	FOL	**Elevation**	466' ft
River Basin	AMERICAN R	**County**	SACRAMENTO
Hydrologic Area	SACRAMENTO RIVER	**Nearby City**	FOLSOM
Latitude	38.68300	**Longitude**	-121.18300
Operator	US Bureau of Reclamation	**Data Collection**	

Additional types of information available: Dam Information | Reservoir Information

The following data types are available online. Select one of the links below to retrieve recent data.

Sensor Description	Duration	Plot	Data Collection	Data Available
DISCHARGE, POWER GENERATION, cfs	(daily)	(DIS PWR)	DATA XCHG-USBR	04/01/2000 to present.
DISCHARGE, PUMPING, cfs	(daily)	(DC PUMP)	DATA XCHG-USBR	02/01/1995 to present.
DISCHARGE, SPILLWAY, cfs	(daily)	(SPILL)	DATA XCHG-USBR	04/01/2000 to present.
DISCHARGE,CONTROL REGULATING, cfs	(daily)	(RIV REL)	DATA XCHG-USBR	04/01/2000 to present.

Figure 3. Excerpt from the California Data Exchange Center website for the Folsom (FOL) Station showing hyperlinks to the daily flow data for the "Spillway" and "Control Regulating" discharges.

The ARI is initially determined in early February when the February B120 is released. The ARI is then updated for each B120 publication for the months of March, April, and May, and subsequent updates after the May publication, by subtracting the spills through the end of the preceding month from the B120 forecast (e.g., for the May ARI, October 1 through April 30 spills are subtracted from the May B120 forecast). The ARI value computed from the final B120 update each year is the final ARI for the year and remains in effect until the end of December.

2 DETERMINATION OF THE MONTHLY MINIMUM RELEASE REQUIREMENTS

The monthly MRR at Nimbus Dam is determined using SRI index values (for January) and ARI index values (for February through December), and the MRR implementation curves. **Table 2** summarizes the specified values associated with points A, B, and C in **Figures 4** through **9**, which show the specific MRR implementation curves for various months of the year. The MRR for index values between points specified on the table are calculated by linearly interpolating between specified points. At any point on the curves, the MRR value would specify the minimum release, but would not preclude releases at rates above the MRR.

Table 2. Summary of Hydrologic Indices and specified values for the Minimum Release Requirements.

Months	Hydrologic Index Used	Point A		Point B		Point C	
		Index Value (TAF)	MRR Value (cfs)	Index Value (TAF)	MRR Value (cfs)	Index Value (TAF)	MRR Value (cfs)
Jan	SRI	5,500	500	7,800	800	11,500	1,750
Feb – Mar	ARI	800		1,000		1,958	1,750
Apr – Jun						2,210	1,500
Jul – Sep[1]						1,958	1,750
Oct				1,500		1,914	1,500
Nov – Dec						2,210	2,000

[1]The July through September curve includes an additional point between points B and C, corresponding to an ARI of 1,200 TAF and an MRR of 1,500 cfs.

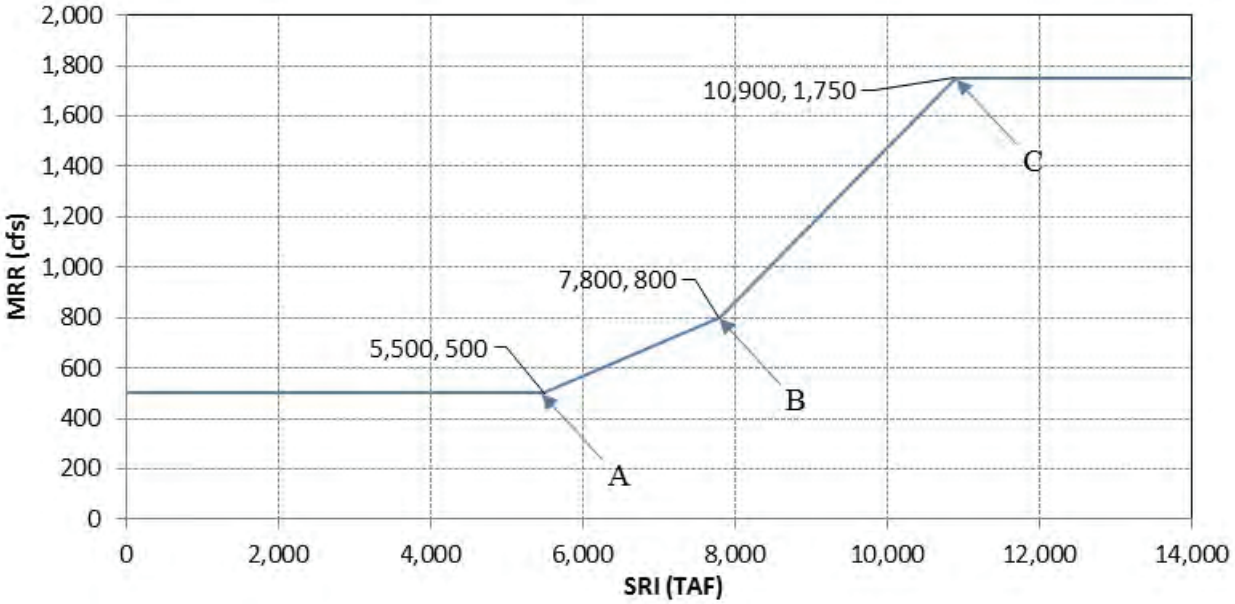


Figure 4. Relationship between the Sacramento River Index and monthly Minimum Release Requirements for January.

For January, the following equations can be used to determine the MRR for a given SRI:

- If SRI <= 5,500 TAF, then MRR = 500 cfs
- If 5,500 TAF < SRI <= 7,800 TAF, then MRR = 0.1304 * SRI -217 cfs
- If 7,800 TAF < SRI <= 11,500 TAF, then MRR = 0.2568 * SRI -1203 cfs
- If SRI > 11,500 TAF, then MRR = 1,750 cfs

In recognition of the uncertainty associated with the SRI forecast, the January MRR is not allowed to be greater than the December MRR.

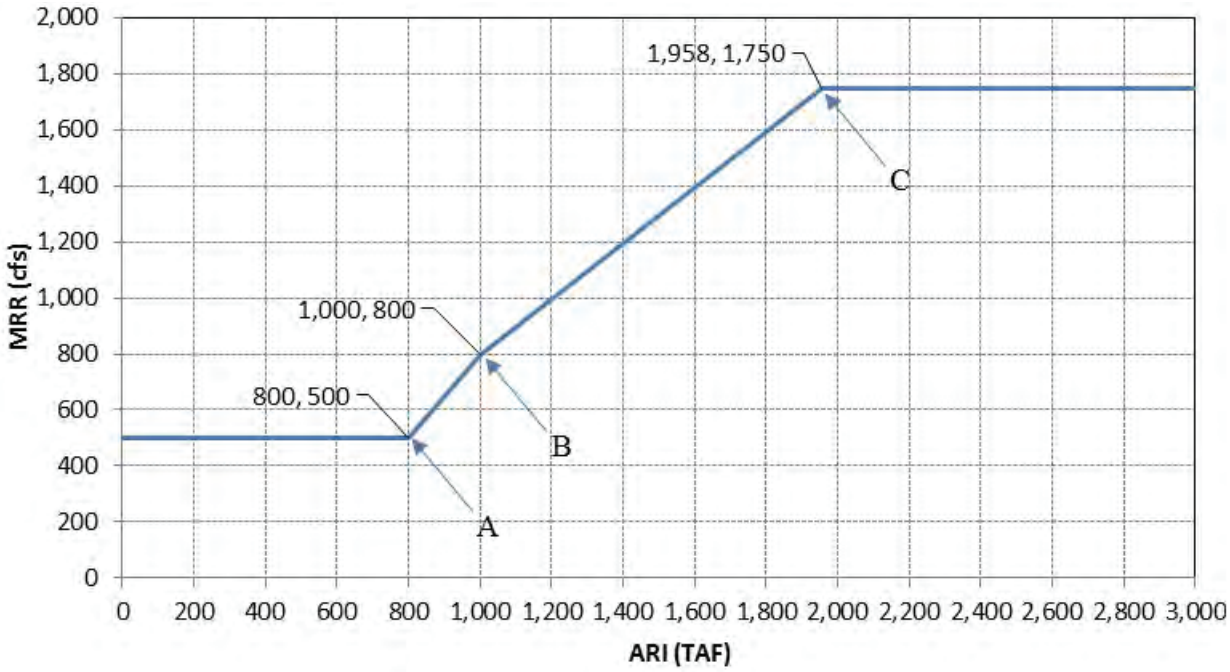


Figure 5. Relationship between the American River Index and monthly Minimum Release Requirements for February and March.

For February through March, the following equations can be used to determine the MRR for a given ARI:

- If ARI <= 800 TAF, then MRR = 500 cfs
- If 800 TAF < ARI <= 1,000 TAF, then MRR = 1.500 * ARI -700 cfs
- If 1,000 TAF < ARI <= 1,958 TAF, then MRR = 0.9916 * ARI -192 cfs
- If ARI > 1,958 TAF, then MRR = 1,750 cfs

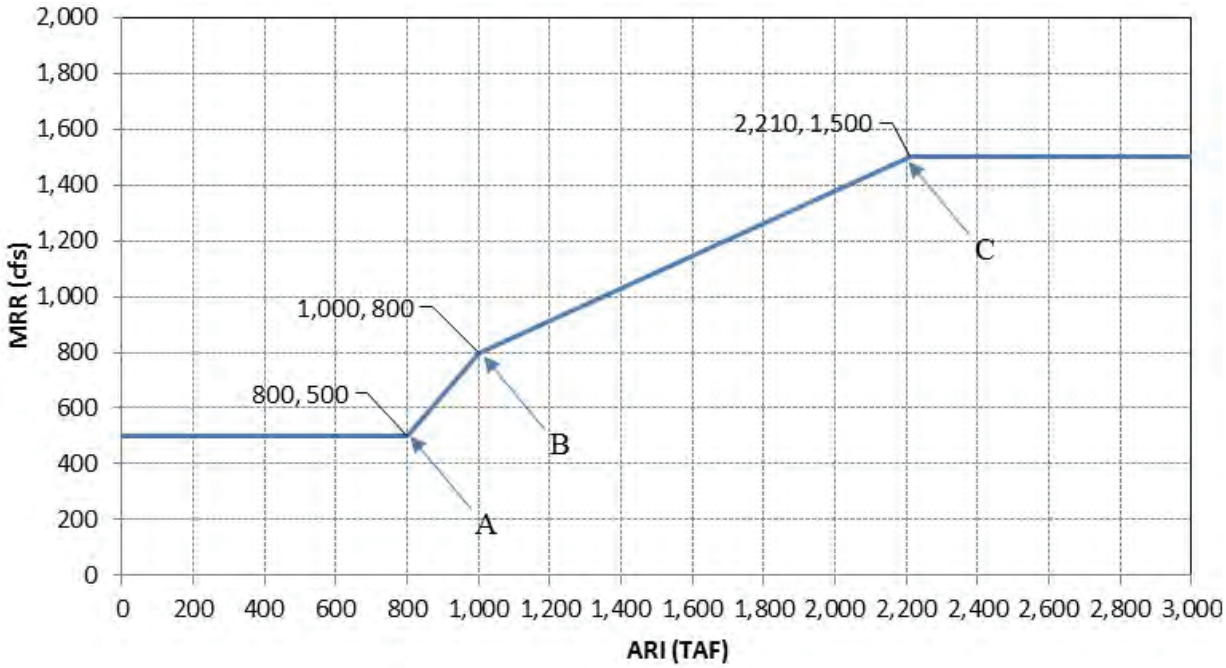


Figure 6. Relationship between the American River Index and monthly Minimum Release Requirements for April through June.

For April through June, the following equations can be used to determine the MRR for a given ARI:

- If ARI <= 800 TAF, then MRR = 500 cfs
- If 800 TAF < ARI <= 1,000 TAF, then MRR = 1.500 * ARI -700 cfs
- If 1,000 TAF < ARI <= 2,210 TAF, then MRR = 0.579 * ARI + 221 cfs
- If ARI > 2,210 TAF, then MRR = 1,500 cfs

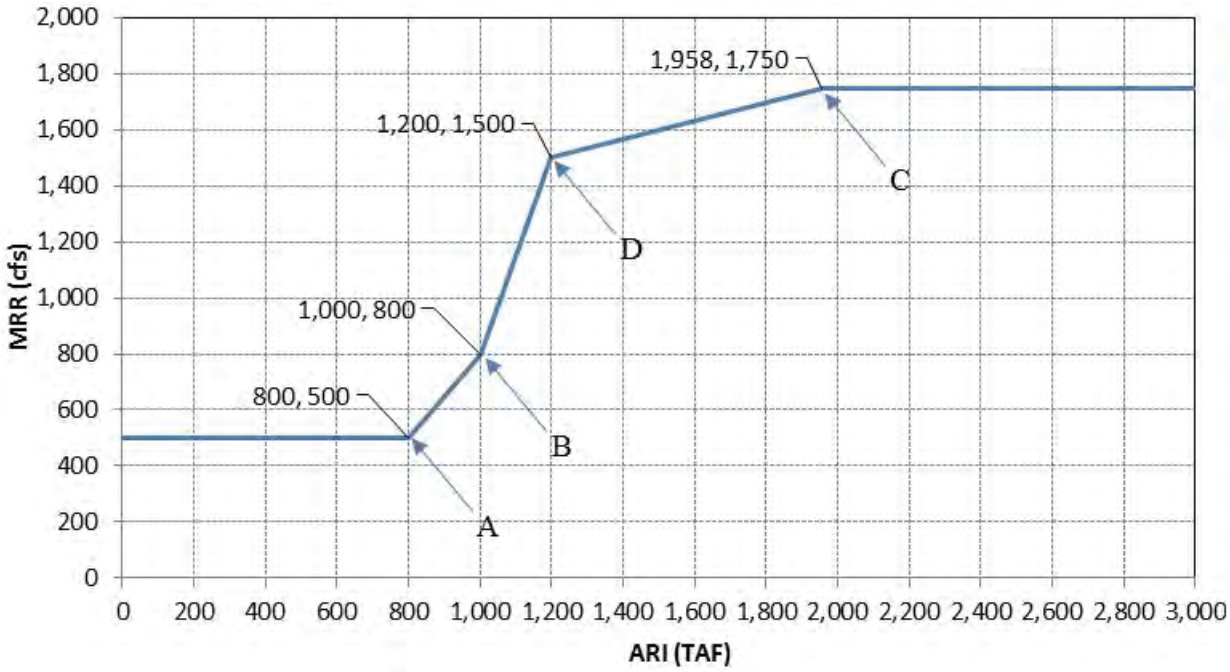


Figure 7. Relationship between the American River Index and monthly Minimum Release Requirements for July through September.

For July through September, the following equations can be used to determine the MRR for a given ARI:

- If ARI <= 800 TAF, then MRR = 500 cfs
- If 800 TAF < ARI <= 1,000 TAF, then MRR = 1.500 * ARI -700 cfs
- If 1,000 TAF < ARI <= 1,200 TAF, then MRR = 3.500 * ARI -2,700 cfs
- If 1,200 TAF < ARI <= 1,958 TAF, then MRR = 0.330 * ARI + 1,104 cfs
- If ARI > 1,958 TAF, then MRR = 1,750 cfs

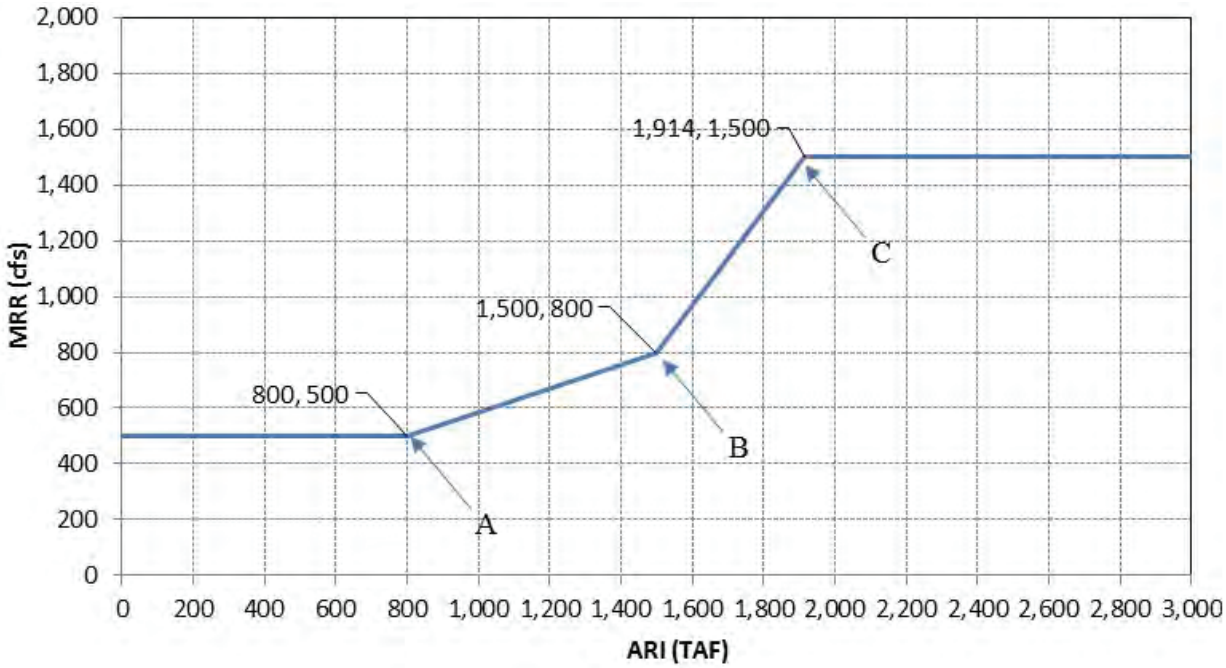


Figure 8. Relationship between the American River Index and monthly Minimum Release Requirements for October.

For October, the following equations can be used to determine the MRR for a given ARI:

- If ARI <= 800 TAF, then MRR = 500 cfs
- If 800 TAF < ARI <= 1,500 TAF, then MRR = 0.429 * ARI +157 cfs
- If 1,500 TAF < ARI <= 1,914 TAF, then MRR = 1.690 * ARI - 1,736cfs
- If ARI > 1,706 TAF, then MRR = 1,500 cfs

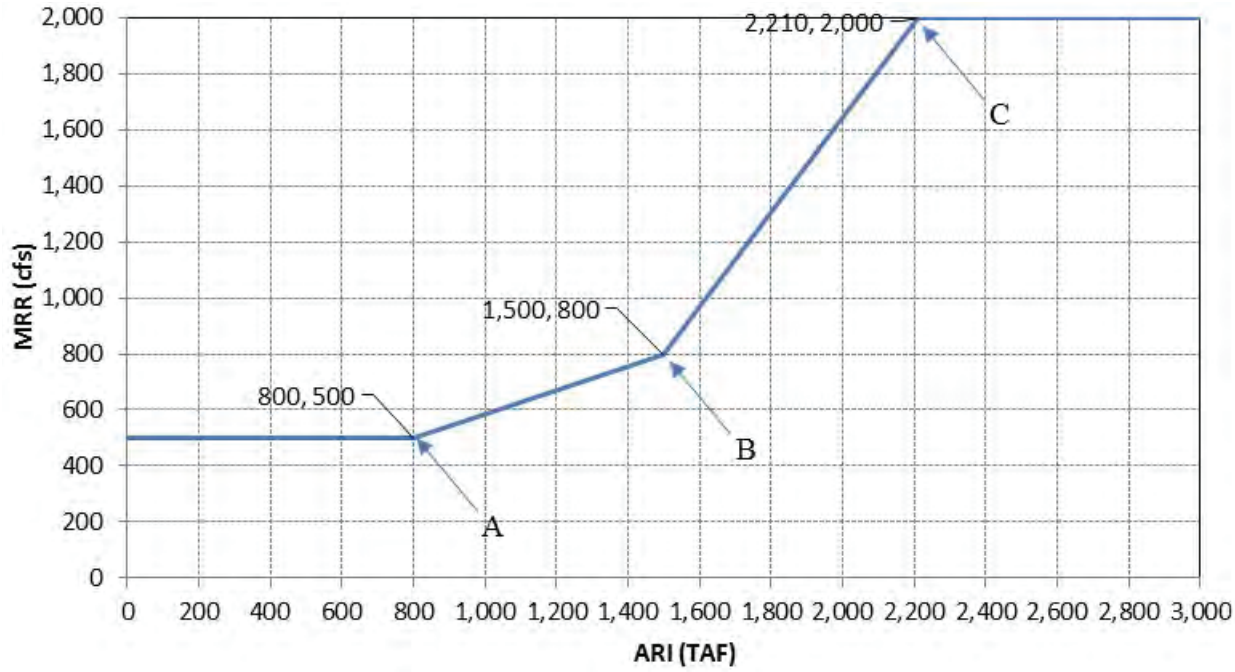


Figure 9. Relationship between the American River Index and monthly Minimum Release Requirements for November and December.

For November and December, the following equations can be used to determine the MRR for a given ARI:

- If ARI <= 800 TAF, then MRR = 500 cfs
- If 800 TAF < ARI <= 1,500 TAF, then MRR = 0.429 * ARI + 157 cfs
- If 1,500 TAF < ARI <= 2,210 TAF, then MRR = 1.690 * ARI -1,736 cfs
- If ARI > 2,210 TAF, then MRR = 2,000 cfs

Addendum F
Tuolumne Proposal

Terms

- Proposed FERC relicensing flows as submitted on November 14, 2018 constitute the base flows.
- FERC flows modified from 75 cfs to 125 cfs in critical and dry water years and reduce FERC flows from 350 cfs to 300 cfs in wet , above normal and below normal years fro June 1 to October 15.
- Flood plain pulse flows as follows:
    - 2,750 cfs for 20 days in W and AN WYs with decision on WY type in March using SJR Index 60-20-20 at 90% exceedance for floodplain pulse.
    - 2,750 cfs for 18 days in BN WYs with decision on WY type in March using SJR Index 60-20-20 at 90% exceedance for floodplain pulse.
    - 2,750 cfs for 14 days in D WYs with decision on WY type in March using SJR Index 60-20-20 at 90% exceedance for floodplain pulse.
    - 2,750 cfs for 9 days in C WYs with decision on WY type in March using the SJR Index 60-20-20 at 90% exceedance for floodplain pulse.
    - Dry and critical year off ramps.
- Predation barrier and counting weir to be designed in consultation with DFW and may be constructed with permanent concrete abutments and necessary appurtenances and will be a part of annual predator suppression activities.
- Develop initial feasibility studies within 2 years to develop additional supplies for river flows. Implementation is subject to mutual agreement of the parties.

Addendum G
Friant Proposal

As part of a comprehensive approach to coordinated operations and implementing updates to the State Water Resources Control Board's Water Quality Control Plan objectives, for 15 years from the date of this agreement, the Secretary of Interior, pursuant to section 10004(a)(4)(C) of the San Joaquin River Settlement Act (P.L. 111-11), proposes to manage San Joaquin River Restoration Flows (Restoration Flows) that are otherwise capable of being recaptured and recirculated for the benefit of Friant Division Contractors under the San Joaquin River Restoration Settlement (SJRRS) and San Joaquin River permits 11885, 11886, 11887 and License 1986.

In all years, except for those determined to be Critical-High or Critical-Low under the SJRRS, Reclamation proposes to reduce the recapture of Restoration Flows to the extent necessary to achieve a goal of total Delta outflows derived from any San Joaquin River flows released below Friant Dam of 50,000 acre-feet during the period of February and May (Delta Outflow Goal), subject to the following:

1. Reclamation proposes to recapture, protect and manage Restoration Flows for the purpose of reducing or avoiding impacts to water deliveries to Friant Division long-term contractors caused by Restoration Flows except when, during the months of February through May, reducing recapture diversions as part of this agreement is necessary to satisfy the Delta Outflow Goal above.
2. The maximum amount of reduced recapture in any month during the period of February through May would be up to 50% of the total recapturable Restoration Flows for such month.
3. It is understood and allowed that in some years there would not be sufficient Restoration Flows to meet the Delta Outflow Goal. In such years, Reclamation would still reduce recapture of San Joaquin Restoration flows by 50% of the existing flows, but the Delta Outflow Goal would not be satisfied, and Reclamation would not be required to take other actions or make other releases of water.
4. Consistent with law, Reclamation would not reduce water supply to other CVP contractors in order to achieve the Delta Outflow Goal.
5. All flows released below Friant Dam, including those flows released and/or bypassed at Friant Dam necessary to address flood conditions, would contribute towards satisfying the 50,000 acre-foot Delta Outflow Goal.

The State Water Resources Control Board would agree that implementation of this agreement, in conjunction with continued implementation of the San Joaquin River Restoration Program, would be deemed sufficient to satisfy the Friant Division Contractors' contribution to implementation of the Water Quality Control Plan updates, as long as this provision remains in effect.

Addendum H
Delta Proposal

Purpose:

The flow provided through D-1641, combined with the additional flow, structural habitat, and funds included herein, would be used to create substantial benefits to ecosystem functions and to create conditions necessary to improve the viability of native fish. The augmented outflow would be applied based on the governance described below and would be integrated with landscape and other changes to achieve ecological outcomes favorable to native fish and wildlife.

Proposed Commitments:

1. **Flow**

Reclamation and DWR, with the support of SWP Contractors and South of Delta CVP Contractors, commit 300 TAF of water from SWP Contractors and South of Delta CVP Contractors to annual outflow after April 1 of Above Normal, Below Normal, and Dry water year types.

In addition to the 300 TAF and the 440 TAF from the Agreement Framework, 300 TAF of additional water will be made available, subject to conditions below, through Prop 1 storage projects that generate environmental water; purchases of additional water through the Agreement Framework, other willing seller/buyer arrangements; future bond funding; and, if required, from SWP Contractors and South of Delta CVP Contractors. Environmental water provided through Prop 1 storage projects would be made available as these projects are constructed. If the science demonstrates a need, additional water to generate a total of 300 TAF will be made available in year 8 or beyond. This water would be used to test specific hypotheses for identified species or ecosystem needs, as agreed to through the new governance structure by a stakeholder group. The availability of this water is contingent upon the restructuring of the Delta science and monitoring program.

2. **Habitat**

The application of the 740-1,040TAF of water across seasons and water years would vary and would be based on direction from the stakeholder group, although would be primarily focused on above Normal, Below Normal, and Dry water year types. This flexibility would allow for real-time adjustments to hydrologic conditions (for example, to take advantage of pulse flows from storms), experimental flows to test ecological responses to landscape changes, and strategic use of flows to improve water quality. This also involves narrowly targeting flows to improve ecological conditions in specific areas, which increases the efficiency of the use of this water. Additionally, several projects are proposed to increase the land-water interaction in the Delta (described below). Freshwater flows, tidal flows, and landscapes would be managed together to stimulate ecosystem processes and functions to improve habitat conditions for fish. This increased flexibility in the timing and magnitude of freshwater flows and linkages to landscape modifications would increase habitat benefits and take advantage of tidal energy. For example,

flows in combination with structural habitat projects would be used to reverse declines in food resources for the Delta ecosystem, maximize high-quality habitat that favors native plants and animals, and manage nutrient pollution to reduce harmful algal blooms. Flow and non-flow habitat actions can also be influenced by existing and planned gates and barriers to further maximize the benefits of these resources. Clear hypotheses would be used to monitor, report and adjust both flow and non-flow actions to maximize the benefits of the water and funding made available to the Delta habitats. This approach has the best chance of improving our understanding of how to manage the Delta in the future.

Additionally, there are opportunities to provide substantial benefits in Cache Slough and some augmented Delta outflow through the use of water from the Solano project or other water available in Putah Creek. This can provide foodweb benefits in Cache Slough and the North Delta as well as provide a modest contribution to outflow for other ecological functions.

Delta habitat projects that may contribute to the above are included in Table 1.

Table 1. In Delta Habitat Actions

- North Delta Arc
- Complete CWF tidal and channel margin restoration on Sacramento River, Steamboat Slough and Sutter Slough
- Chipps Island restoration
- Increased aquatic weed removal
- Predator hot spot removal
- North Delta food subsidies
- Suisun Marsh food subsidies
- Construct RVRS facility
- Consolidate and screen intakes in Cache Slough
- Funding for game wardens for enforcement/boats in Delta

3. Governance/Decision Making:

An organized, deliberate approach to integrating science into decision-making, and continually adjusting actions in response, is needed to reduce uncertainty and more effectively use the resources made available as part of this agreement (Figure 1).

This approach would define a set of initial projects throughout the Sacramento and San Joaquin River basins and the Delta that have high probability to provide benefits to improve Delta ecosystem functions and to create conditions necessary to improve the viability of native fish. (See Appendix 2 to Agreement Framework, Proposed Actions for Species Objectives: The Delta and American & Mokelumne Rivers).

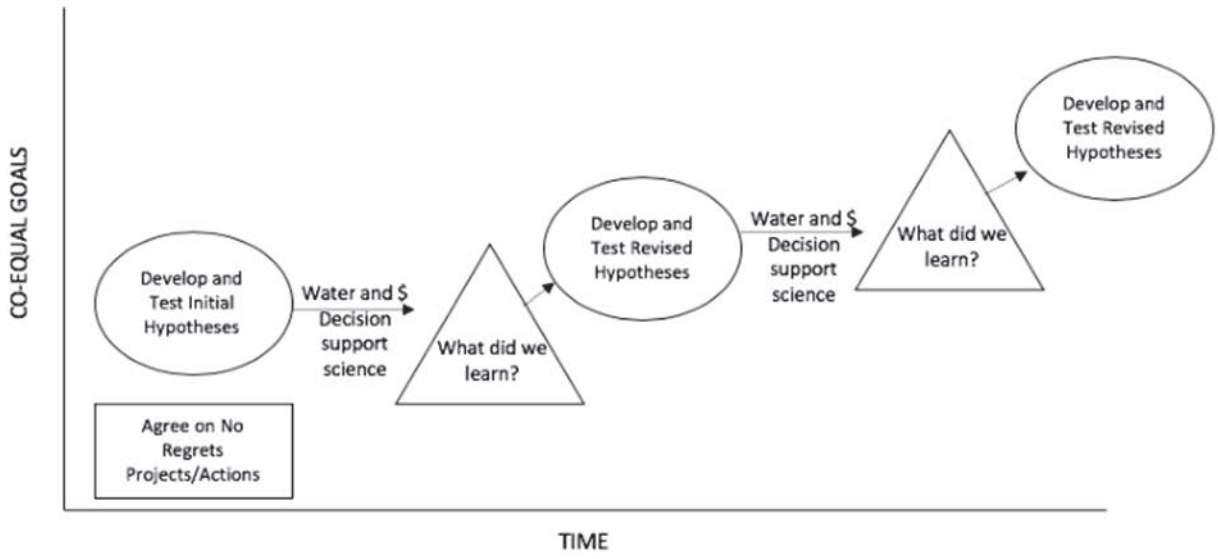
This approach would define a set of initial testable hypotheses that are used to test the integration of flow and habitat actions to provide identified, measurable benefits. It would also facilitate coordination among parties throughout the Delta ecosystem to better integrate habitat and species management activities.

This approach would define a program to answer management questions and support the investigation of the testable hypotheses. This would be accomplished by using existing funding that has been used for compliance monitoring and science program implementation and redirecting it; funding generated through this agreement, and other sources. The purpose of the program would be to accomplish the following:

- Implementing specific experiments – The Science Program would adopt a "safe to fail" experimental approach to maximize learning.
- Testing hypotheses – the program should identify and test key hypotheses, especially/even if conflicting, about how the system functions and what measures are most effective at achieving desired outcomes.
- Learning from the experiments – ensure each action undertaken is designed to gain as much knowledge as possible.
- Designing the experiments to be outcomes based – The VA Science Program would identify a manageable set of SMART objectives that describe desired environmental and biological outcomes.
- Facilitating a collaborative process – all stakeholders are engaged in the development and implementation of the science program.
- Facilitating a transparent process – through collaboration, reporting, and working towards open data.

This approach would establish a collaborative structured decision-making process to determine flow and structural habitat actions, direct science needs, and incorporate outcomes of the testable hypotheses to continue to inform decision-making.

Figure 1. Summary of proposed science and decision-making process



4. Funding Commitments:

Sacramento River Flow and Delta Outflow Augmentation Effort, With Fund: A fund will be developed to compensate farmers in the Sacramento River basin, Sacramento River, and Feather River who fallow land to contribute water for Delta outflow and tributary flows. The fund would be initially established with Prop 1 funds and subsequently funded through the collection of a surcharge on water diverted, as described below. Collection of the surcharge would begin immediately and would be collected for each of the 15 years of this agreement.

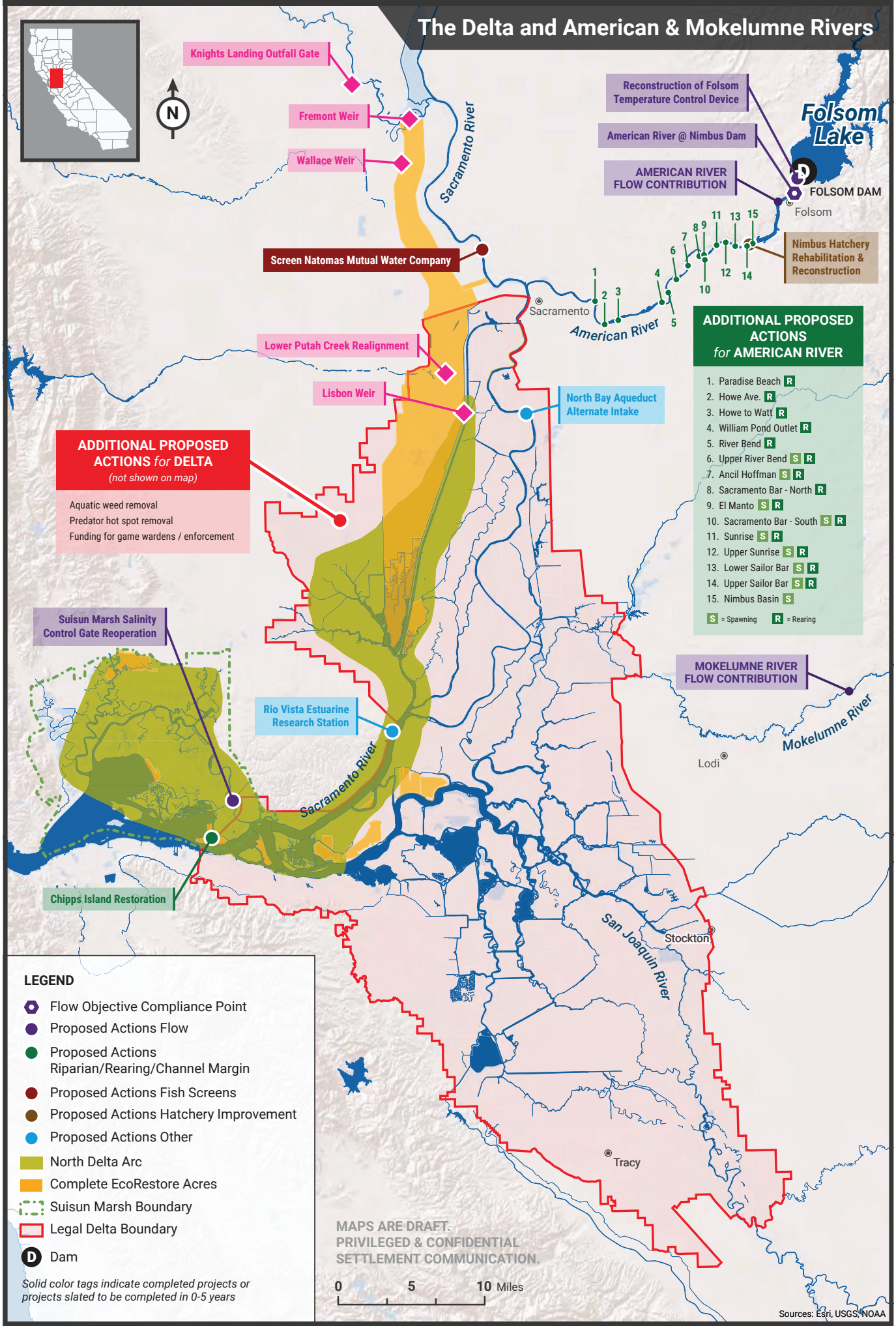
CVP and SWP contract water: Each acre-foot of CVP and SWP water diverted would be assessed a charge. Based on the last 10 years of diversions, this per acre foot charge could generate in excess of $370M over the 15-year term. After the 5th call for water using this revenue, the Reclamation, DWR, SWP Contractors and South of Delta CVP Contractors would reconvene to determine if the surcharge needs to be adjusted to ensure the fund can support future calls for water.

Non-CVP and SWP contract water: Agencies who contribute water would not pay a charge on their non-CVP/SWP water diversions, but agencies who do not contribute water would pay $10/acre-foot towards the revolving fund for water acquisition.

State and Federal contributions: The State and Federal governments commit to pursuing State bond money and seeking any necessary legislation to provide additional monetary funds. This includes potential directed and competitive funding opportunities from various State sources. Up to approximately $1.3 billion in bond funding is available for instream flows, restoration, multi-benefit flood projects, and other activities.

Appendix 2: Locations and Scale of Habitat Measures

PROPOSED ACTIONS FOR SPECIES OBJECTIVES



ATTACHMENT 4

U.S. Fish & Wildlife Service

Recovery Plan for the Giant Garter Snake

(*Thamnophis gigas*)

Photo by David Kelly, U.S. Fish and Wildlife Service

Recovery Plan for the Giant Garter Snake

(*Thamnophis gigas*)

(2017)

Region 8
U.S. Fish and Wildlife Service
Sacramento, California

Approved: _____
Regional Director, U.S. Fish and Wildlife Service
Pacific Southwest Region, Region 8.

Date: 9-28-17

Disclaimer

Recovery plans delineate reasonable actions that are believed to be required to recover and protect listed species. We, the USFWS, publish recovery plans, sometimes preparing them with the assistance of recovery teams, contractors, State agencies, Tribal agencies, and other affected and interested parties. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Costs indicated for action implementation and time of recovery are estimates and subject to change. Recovery Plans do not obligate other parties to undertake specific actions, and may not represent the views nor the official positions or approval of any individuals or agencies involved in recovery plan formulation, other than the U.S. Fish and Wildlife Service. Recovery Plans represent our official position *only* after they have been signed by the Director or Regional Director as *approved*. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery actions.

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Literature Citation should read as follows:

U.S. Fish and Wildlife Service. 2017. Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*). U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. vii + 71 pp.

An electronic copy of this recovery plan will be made available at:
http://www.fws.gov/endangered/species/recovery-plans.html

Acknowledgements

In memory of George E. Hansen, an extraordinarily talented herpetologist who was dedicated to the conservation of giant garter snakes.

In memory of Robert E. Herkert, a tireless advocate of wildlife-friendly agriculture who enlisted California's rice industry to work cooperatively on conservation efforts for the giant garter snake and other wildlife.

We wish to sincerely thank and gratefully acknowledge the advice and assistance from the following individuals:

Biological Experts: Peter Balfour (ECORP Consulting), Tag Engstrom (California State University at Chico), Matt Gause (Westervelt Ecological Services), Eric Hansen, George Hansen, Robert Hansen (Editor, Herpetological Review), Jim Roper (Heron Pacific), Eric Stitt (ECORP Consulting), Greg Sutter (Westervelt Ecological Services), and Karen Swaim (Swaim Biological Consultants).

California Department of Fish and Wildlife: John Beam, Betsy Bolster, John Brode, Laura Patterson, Christina Souza, Laura Sparks, and David Zezulak.

California Rice Industry: Bob Herkert.

City of Sacramento: Terence Moore.

Grassland Water District: David Widell.

National Oceanic and Atmospheric Administration: Melanie Paquin.

Northern California Water Association: Jeff Jaraczeski and Daniel Keppen.

Sacramento-Yolo Mosquito and Vector Control District: David Brown.

The Natomas Basin Conservancy: John Roberts.

The Nature Conservancy: Olen Zirkel.

U.S. Bureau of Land Management: Harry McQuillan and Michael Westfall.

U. S. Bureau of Reclamation: John Thompson.

U. S. Fish and Wildlife Service: Jana Affonso, Craig Aubrey, Mike Carpenter, Brian Cordone, Dan Cox, Diane Elam, Lisa Ellis, Kevin Foerster, Kim Forrest, Dale Garrison, Cay Goude, Dave Hardt, Cheryl Hickam, Kelly Hornaday, Josh Hull, Craig Isola, David Kelly, Sarah Markegard, Maryann Owens, Larry Rabin, Dan Russell, Ken Sanchez, Joe Silveira, Justin Sloan, Heather Swinney, Eric Tattersall, Betty Warne, Alison Willy, Joy Winckel, Michael Wolder, and Dennis Woolington.

U.S. Geological Survey: Mike Cassazza, Peter Coates, Brian Halstead, Mark Jennings, Michael Miller, Norm Scott, and Glenn Wylie.

EXECUTIVE SUMMARY

The giant garter snake (*Thamnophis gigas*) was federally listed as a threatened species on October 20, 1993. Historical records suggest that the giant garter snake inhabited fresh water marshes, streams, and wetlands throughout the length of the Sacramento and San Joaquin Valleys in Central California. Today only about 5 percent of its historical wetland habitat acreage remains. The 13 populations identified at listing were isolated from one another with no protected dispersal corridors. Nine populations are recognized in this recovery plan following an update of the thirteen populations described in the original listing. This change is based on recent surveys, which indicate that two populations were extirpated, and on genetic research, which lead to the grouping together of some of the populations.

The giant garter snake has specific habitat needs that include summer aquatic habitat for foraging, bankside basking areas with nearby emergent vegetation for cover and thermal regulation, and upland refugia for extended periods of inactivity. Perennial wetlands provide the highest quality habitat for the giant garter snake, and ricelands, with the interconnected water conveyance structures, serve as an alternative habitat in the absence of higher-quality wetlands. The loss and subsequent fragmentation of habitat is the primary threat to the giant garter snake throughout the Central Valley of California. Habitat loss has occurred from urban expansion, agricultural conversion, and flood control. Habitat fragmentation restricts dispersal and isolates populations of the giant garter snake increasing the likelihood of inbreeding, decreasing fitness, and reducing genetic diversity. These factors have ultimately resulted in the snake being extirpated from the southern one-third of its range in former wetlands associated with the historical Buena Vista, Tulare, and Kern lakebeds. In addition to habitat loss, the remaining Central Valley populations of the giant garter snake are subject to the cumulative effects of a number of other existing and potential threats, including: roads and vehicular traffic, climate change, and predation by non-native species.

Recovery Strategy: The strategy used to recover the giant garter snake is focused on protecting existing, occupied habitat and identifying and protecting areas for habitat restoration, enhancement, or creation including areas that are needed to provide connectivity between populations. Appropriate management is needed for all giant garter snake conservation lands to ensure that stable and viable populations can be maintained in occupied areas, and that colonization will be promoted in restored and enhanced unoccupied habitat. We defined nine recovery units that correspond directly to the nine geographically and genetically distinct populations, to aid in our recovery planning: Butte Basin, Colusa Basin, Sutter Basin, American Basin, Yolo Basin, Delta Basin, Cosumnes-Mokelumne Basin, San Joaquin Basin, and Tulare Basin.

Recovery Goal and Objective: The objective of this recovery plan is to reduce threats to and improve the population status of the giant garter snake sufficiently to warrant delisting. To achieve this goal we have defined the following objectives:

1. Establish and protect self-sustaining populations of the giant garter snake throughout the full ecological, geographical, and genetic range of the species.
2. Restore and conserve healthy Central Valley wetland ecosystems that function to support the giant garter snake and associated species and communities of conservation concern such as Central Valley waterfowl and shorebird populations.
3. Ameliorate or eliminate, to the extent possible, the threats that caused the species to be listed or are otherwise of concern, and any foreseeable future threats.

Recovery Criteria:

Factor A Criteria:

- Sufficient habitat is protected to support populations of giant garter snakes.
- Populations are connected with corridors of suitable habitat.
- Management plans and best management practices oriented to giant garter snake conservation are developed and implemented (and adaptively updated based on current research).
- Protected habitat is supplied with a reliable source of clean water during the critical active summer months.

Factor C Criteria:

- Threats due to disease are reduced or removed.

Factor E Criteria:

- Monitoring in recovery units demonstrates stable or increasing populations and evidence that the identified populations and their habitats are viable over a 20-year period including at least one 3-year drought.

Actions Needed:

1. Protect existing habitat, areas identified for restoration or creation, and areas that will provide connectivity between preserved areas of habitat.
2. Develop and implement appropriate management of habitat on public and private wetlands and conservation lands.
3. Improve water quality in areas occupied by the giant garter snake and affected by poor water quality conditions.
4. Ensure summer water is available for wetland habitats used by the snake.
5. Establish an incentive or easement program(s) to encourage private landowners and local agencies to provide or maintain giant garter snake habitat.
6. Monitor populations and habitat to assess the success or failure of management activities and habitat protection efforts.
7. Conduct surveys and research to identify areas requiring protection and management.
8. Conduct research focused on the management needs of the species, and on identifying and removing threats.
9. Establish and implement outreach and education, which includes the participation of landowners; interested public and stakeholders; and other Federal, State, and local agencies.
10. Reestablish populations within the giant garter snake's historical range.

Total Estimated Cost of Recovery: The estimated cost to implement all measures described in this recovery plan is between $17,313,138 and $116,470,200 plus additional costs to be determined. Those recovery actions for which no cost estimate is included consist primarily of habitat protection including purchase of land or easements in core areas and corridors linking such habitat, restoration, and for development and implementation of deliberately experimental adaptive management plans that include mathematical modeling to pinpoint uncertainties and generate alternative hypotheses, statistical analysis to determine how uncertainties are likely to propagate over time in relation to policy choices, and formal optimization to seek better choices (Walters, 1986). These recovery actions place an emphasis on multiple species protection and management by developing and implementing conservation measures to restore and protect the processes that maintain healthy ecosystems. Such actions contribute not only to conservation of giant garter snakes, but also to the conservation of wetland ecosystems which support the giant garter snake and associated species and communities of conservation concern such as Central Valley waterfowl and shorebird populations,

along with important ecosystem functions such as groundwater recharge. Therefore, actions to protect and manage wetland ecosystems are likely to be implemented through other authorities for these multiple species or other conservation goals, yet are included in the recovery actions here because they are compatible with and contribute to recovery efforts for the giant garter snake. Although we include the actions, it is not practicable to determine the proportion of the costs of these actions that would be attributable solely to giant garter snake recovery. In addition, widely fluctuating land cost in the recovery area, and flexibility in the specific locations and methods of habitat protection, restoration and management make estimates of such costs unreliable. As such, the cost of these actions will be determined as implementation progresses.

In order to best provide for the conservation and recovery of the species and minimize realized costs, we will maximize partnerships with federal, State, and non-governmental partners. The Service will monitor the success of early implementation efforts and, depending on the giant garter snake's progress toward recovery, determine if all of the measures outlined in this plan are necessary. Therefore, we believe that the recovery measures outlined is this plan are a comprehensive approach for recovery of the giant garter snake; however, recovery may be achieved without all measures in this plan being implemented, resulting in a decrease in cost.

Date of Recovery: Delisting could be initiated by 2047 if recovery criteria have been met including: protection of habitat and creation of population corridors. These criteria are likely to take at least 10 years to achieve. Additionally, recovery requires that giant garter snake populations be self-sustaining over the long-term. Therefore, a 20-year monitoring period is recommended to cover multiple generations (four to five generations) to provide a reliable estimate of population change. This monitoring period must also include one 3-year drought to ensure that giant garter snakes are no longer threatened by an insufficient water supply.

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I. BACKGROUND

A. OVERVIEW

The U.S. Fish and Wildlife Service listed the giant garter snake (*Thamnophis gigas)* as a threatened species on October 20, 1993 (Service 1993) under the Endangered Species Act of 1973 (Act), as amended. Critical habitat has not been designated for the giant garter snake. Since the 1993 listing rule, a threats assessment and review of the biological status were conducted in 5-year status reviews for the species in 2006 and 2012 (Service 2006a, 2012).

Recovery plans focus on restoring the ecosystems on which a species is dependent, reducing threats to the species, or both. A recovery plan constitutes an important Service document that presents a logical path to recovery of the species based on what we know about the species' biology and life history, and how threats impact the species. Recovery plans help to provide guidance to the Service, States, and other partners on ways to eliminate or reduce threats to listed species and measurable objectives against which to measure progress towards recovery. Recovery plans are advisory documents, not regulatory documents, and do not substitute for the determinations and promulgation of regulations required under section 4(a)(1) of the Act. A decision to revise the listing status of a species or to remove it from the Federal List of Endangered and Threatened Wildlife (50 CFR 17.11) or Plants (50 CFR 17.12) is ultimately based on an analysis of the best scientific and commercial data available to determine whether a species is no longer an endangered species or a threatened species.

The following discussion summarizes characteristics of giant garter snake biology, demography, distribution, population status, and threats that are relevant to recovery. Additional information is available in the 2012 5-year status review (http://ecos.fws.gov/speciesProfile/profile/speciesProfile?spcode=C057) and associated literature.

B. TAXONOMY AND DESCRIPTION

The giant garter snake was first described and named by Henry S. Fitch (1940) as *Thamnophis ordinoides gigas*. A study based on biochemical data (Lawson and Dessauer 1979) pointed toward the species-level distinctness of *T. gigas*. Rossman and Stewart (1987) used morphological characters to further examine and reevaluate the taxon and formally recognized the giant garter snake, *T. gigas*, as a full species. This recognition remains today.

The giant garter snake can be distinguished from the common garter snake (*T. sirtalis*) and the western terrestrial garter snake (*T. elegans*) by color pattern, scale numbers and/or size, and head shape. Dorsal (back or topside) background color of giant garter snakes varies from brown to olive with a cream, yellow, or orange dorsal stripe and two light-colored lateral stripes. Some individuals have a checkered pattern of black spots between the dorsal and lateral stripes. Background coloration, prominence of the checkered pattern, and the three yellow stripes are individually and geographically variable (R. Hansen 1980). The average body length for a male giant garter snake is 60 to 70 centimeters (23.6 to 27.5 inches) and 70 to 80 centimeters (27.5 to 31.5 inches) for a female (Wylie *et al.* 2010). A complete discussion of the taxonomy and appearance for this species can be found in the most recent 5-Year Status Review (Service 2012).

C. HABITAT DESCRIPTION

The giant garter snake is endemic to the wetlands of the Sacramento and San Joaquin Valleys of California, inhabiting the tule marshes and seasonal wetlands created by overbank flooding of the rivers and streams of the Central Valley (Fitch 1940; Central Valley Joint Venture 2006). Currently, less than 5 percent of the historical 1.8 million hectares (4.5 million acres) of wetlands, or approximately 90,000 hectares (222,394 acres) remain (Central Valley Joint Venture 2006). The giant garter snake now inhabits the remaining high-quality fragmented wetlands that include marshes, ponds, small lakes, low-gradient streams with silt substrates, and managed waterways. The loss of wetland ecosystems and suitable habitat has also resulted in the giant garter snake using highly modified and degraded habitats. Located among cultivated farm lands, these areas include irrigation ditches, drainage canals, rice fields, and their adjacent uplands. Since giant garter snake surveys were first conducted in the 1970s, results have demonstrated that active rice fields and the supporting water conveyance infrastructure consisting of a matrix of canals, levees, and ditches have served as alternative habitat that is commonly used by the giant garter snakes in the absence of suitable natural marsh habitat (G. Hansen 1988; G. Hansen and Brode 1980, 1993; Brode and G. Hansen 1992; Wylie 1998a; Wylie *et al.* 1997a; Wylie and Cassaza 2000; Halstead *et al.* 2010). The giant garter snake is primarily an aquatic species, but it also occupies upland terrestrial habitat, particularly during the winter inactive season. Although usually found in or adjacent to aquatic habitats, giant garter snakes have been observed in associated uplands up to hundreds of meters (hundreds of yards) distant from any water body (Wylie *et al.* 1997a; P. Coates, U.S. Geological Survey [USGS], pers. comm. 2011).

1. Habitat Components

There are three habitat components that appear to be most important to the giant garter snake (G. Hansen 1982, 1986, 1988, 1996a; Wylie *et al.* 1995, 1997a; Halstead *et al.* 2010):

1. A fresh-water aquatic component with protective emergent vegetative cover that will allow foraging (Figure 1),
2. An upland component near the aquatic habitat that can be used for thermoregulation and for summer shelter in burrows, and,
3. An upland refugia component that will serve as winter hibernacula.

Figure 1. Typical giant garter snake habitat in the Sacramento Valley. (Photo: USGS**)**

Aquatic Component. The giant garter snake has been recognized as requiring aquatic habitat since it was first described, and has been consistently observed and captured in association with aquatic habitats since accounts of the snake were first published (Fitch 1940; G. Hansen and Brode 1980). The aquatic component of the giant garter snake habitat has been regarded as a steadfast requirement for the survival of the snake, and researchers acknowledge the following qualitative requirements of ideal aquatic habitat for the giant garter snake (G. Hansen 1986; G. Hansen and Brode 1980; Wylie *et al.* 1995; Dickert 2002; E. Hansen 2002):

1. Water present from March through November.
2. Slow moving or static water flow with mud substrate.
3. Presence of emergent and bankside vegetation that provides cover from predators and may serve in thermoregulation.
4. The absence of a continuous canopy of riparian vegetation.
5. Available prey in the form of small amphibians and small fish.
6. Thermoregulation (basking) sites with supportive vegetation such as folded tule clumps immediately adjacent to escape cover.
7. The absence of large predatory fish.
8. Absence of recurrent flooding, or where flooding is probable the presence of upland refugia.

Upland Component. Although the giant garter snake is predominately an aquatic species, incidental observations and radio telemetry studies have shown that the snake can be found in upland areas near the aquatic habitat component during the active spring and summer seasons (G. Hansen 1986, 1988; Brode and G. Hansen 1992; E. Hansen 2002; Dickert 2003; Wylie and Cassaza 2000, 2001; Wylie *et al.* 1995, 1997a, 2002a, 2003a, 2004, 2005). Upland habitat (land that is not typically inundated during the active season and is adjacent to the aquatic habitat of the giant garter snake) is used for basking to regulate body temperature, for cover, and as a retreat into mammal burrows and crevices in the soil during ecdysis (shedding of skin) or to avoid predation (G. Hansen and Brode 1993; Wylie *et al.* 2003a). Giant garter snakes have been observed using burrows for refuge in the summer as much as 50 meters (164 feet) away from the marsh edge (Wylie *et al.* 1997a). Important qualities of upland habitat have been found by researchers (E. Hansen 2003a; Wylie *et al.* 2003a) to include:

1. Availability of bankside vegetative cover, typically tule (*Scirpus* sp.) or cattail (*Typha* sp.), for screening from predators.
2. Availability of more permanent shelter, such as bankside cracks or crevices, holes, or small mammal burrows.
3. Free of poor grazing management practices (i.e., grazing to the point at which giant garter snake refugia has been reduced or eliminated).

Upland Winter Refugia Component. During the colder winter months, giant garter snakes spend their time in a lethargic state. During this period, giant garter snakes over-winter in locations such as mammal burrows along canal banks and marsh locations, or riprap along a railroad grade near a marsh or roads (Wylie *et al.* 1997a; Wylie *et al.* 2002a). Giant garter snakes typically do not over-winter where flooding occurs in channels with rapidly moving water, such as the Sutter Bypass (B. Halstead, USGS, pers. comm. 2011). Over-wintering snakes use burrows as far as 200 to 250 meters (656 to 820 feet) from the edge of summer aquatic habitat (G. Hansen 1988; Wylie *et al.* 1997a; P. Coates, pers. comm. 2010).

2. Habitat types and quality

Table 1 shows four locations representing three different levels of habitat quality where trapping surveys were conducted and population estimates were completed. The habitat quality was rated as marginal for the seasonal wetland habitat at Colusa National Wildlife Refuge (NWR) (which was being managed for wintering waterfowl at the time), moderate for both the Natomas Basin and Gilsizer Slough (both have predominate rice agriculture), and high quality for Badger Creek (natural, perennial marsh). Of all known populated sites, the 240-hectare (593 acre) Badger Creek area is believed to best represent historical giant garter snake habitat, and was found to have the highest density of snakes of the four sites (Wylie *et al.* 2010). Wylie *et al.* (2010) found from their data analysis that giant garter snakes will persist in areas dominated by rice, by foraging in flooded rice fields after the rice plants have grown sufficiently to provide cover from predators. It appears that giant garter snakes do not tolerate seasonal wetlands managed for waterfowl if there is no aquatic habitat available during the active summer season. The Body Condition Index of snakes, a measure of the energy reserves of a snake (measured as a ratio of length to mass) was analyzed for the same four sites (Wylie *et al.* 2010). It was found that the snakes at Badger Creek had the highest Body Condition Index, indicating the best health, and that the snakes at the Colusa NWR had the lowest Body Condition Index.

Table 1. Comparative studies giving population estimates and densities for sites with varying giant garter snake habitat quality. (Wylie *et al.* 2010)

Location / Year	Trap-Days[A]	Captures Hand/trap	Captures Trap only	Abundance[B] N (95% CI)	Density[C] Snakes/Ha (95% CI)
Badger Creek 1997	18,376	103	103	118 (111-132)	8.0 (7.6 – 9.0)
Colusa NWR 1997	12,198	53	22	29 (22-53)	0.83 (0.63-1.5)
Gilsizer Slough 1996	17,136	88	67	177 (124-280)	3.1 (2.2 – 4.9)
Natomas Basin 1999	19,170	164	141	229 (199-276)	1.7 (1.5 – 2.1)

[A] Trap-Days = number of traps used at a site X the days they were used for trapping
[B] For abundance N = number of individual snakes, CI = Confidence Interval
[C] Snakes/Ha = Snakes per Hectare

Wylie *et al.* (2000a) reported that in wetlands managed specifically to benefit giant garter snakes, home range estimates were smaller than for those areas lacking comparable management, while Wylie (1998b) found that giant garter snakes may concentrate in the best available habitat when all other surrounding habitat has been eliminated or highly degraded.

D. ECOLOGY AND DEMOGRAPHY

1. Ecology

Reproduction. Male giant garter snakes are believed to reach sexual maturity in an average of 3 years and females in an average of 5 years (USFWS 1993); therefore, we estimate that a generation is 5 years for the giant garter snake. The mating season is believed to extend from March, soon after emergence, into May (Coates *et al.* 2009). The giant garter snake usually gives birth in summer to early fall after a gestation period of 2 -3 months. R. Hansen and G. Hansen (1990) found that parturition (giving birth) for female giant garter snakes taken into captivity occurred from late July through early September, and neonates (newly born young) emerge from the female fully developed. Litter size is variable with the giant garter snake, and averages between 17 and 23 young (R. Hansen and G. Hansen 1990; Halstead et al. 2011).

Thermal Ecology. Snakes are ectothermic animals, relying on external sources of heat to warm their bodies. Ectothermic animals regulate their body temperatures by daily behavioral activities such as basking in the sun or resting on a warm rock to heat their bodies, or by resting under vegetation or in the water to cool their bodies (Lincoln *et al.* 2001; Pough *et al.* 2001). A snake's ability to thermoregulate its body within narrow limits using external sources of heating and cooling are believed to play an important role in feeding and digestion, growth, reproduction, and in their vulnerability to predation, such as when basking without cover (Pough *et al.* 2001). Wylie *et al.* (2009a) found that giant garter snakes remain cool during hot days by remaining in underground burrows and warm themselves in cool weather by basking on canal banks.

Chemical Ecology. Chemical cues are detected by olfactory organs and the vomeronasal system in snakes, which involves oral and nasal sensory inputs from the flicking action of the forked tongue (Pough *et al.* 2001). The ability of garter snakes to detect chemicals is important in reproduction, orientation and navigation, locating prey, and predator avoidance (Costanzo 1989a).

Daily Activity. The daily activity of giant garter snakes was described by G. Hansen and Brode (1993) as follows: (1) emergence from burrows after sunrise; (2) basking in order to warm bodies to activity temperatures, particularly during cool weather; and (3) foraging or courting activity for the remainder of the day. During radio-telemetry studies, giant garter snakes typically traveled little from day to day; however, total activity varied widely among individuals (Wylie *et al.* 1997a). Giant garter snakes usually remain in close proximity to wetland habitats but G. Hansen and Brode (1993) documented movements within the Natomas Basin, observing that giant garter snakes moved at least 400 meters (1,312 feet) between small lateral ditches and larger canals, and some giant garter snakes moved distances of greater than 800 meters (2,625 feet). Wylie *et al.* (2008) found that giant garter snakes at the Colusa Drain site in Yolo County traveled on average 100 meters (328 feet) per day during the 2006 active season and 45 meters (148 feet) per day during the 2007 active season, but decreased activity significantly during the fall and winter when daily travel was about 7 meters (23 feet).

Although Fitch (1940) and Van Denburgh and Slevin (1918) both described a strictly diurnal behavior (active during daylight only) for the giant garter snake, R. Hansen (1980) recorded a more flexible daily activity period in which he observed nocturnal activity of the giant garter snake.

Seasonal Activity. Depending on annual weather conditions, snakes move underground into mammal burrows, crevices, or other voids in the earth around October 1 to avoid potentially lethal

cool autumn and winter temperatures (G. Hansen 1988). Foraging, basking, and other activities are sporadic at this time and dependent upon weather conditions (G. Hansen and Brode 1993; Wylie *et al.* 1995). Giant garter snakes begin emerging from winter retreats around April 1 and are most active from early spring through mid-fall. Seasonal activity may begin earlier than April 1 (as early as March 1) in some years and in some locations (R. Hansen 1980; G. Hansen and Brode 1993; Wylie *et al.* 1997a). Giant garter snakes are typically active by April 15, having emerged from hibernacula, and are actively foraging (G. Hansen and Brode 1993). Giant garter snake activity peaks during April and May, and then activity is reduced during the mid- to late summer months (G. Hansen and Brode 1993).

Prey. Adult giant garter snakes feed primarily on a wide variety of native and non-native aquatic prey such as fish and amphibians, capturing all their food in the water (R. Hansen 1980). Research on several species of garter snakes suggests that diet varies with age and size, and prey availability varies seasonally and geographically (Rossman *et al.* 1996). Brode (1988) and G. Hansen (1988) suggest the giant garter snake specializes in ambushing small fish underwater and giant garter snakes have been observed actively hunting for and capturing small fish in the wild (Fitch 1941; R. Hansen 1980; B. Halstead, pers. comm. 2011). They appear to take advantage of conditions that trap and concentrate prey items in small pools or near road culverts (Rossman *et al.* 1996) and have been observed on multiple occasions feeding on mosquito fish (*Gambusia affinis*) confined to small pools of water (R. Hansen 1980; G. Hansen and Brode 1993; G. Wylie, *in litt.* 2009).

Predators. A number of native mammals and birds are known, or are likely, predators of giant garter snakes, including raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), otters (*Lontra canadensis*), hawks and harriers (*Buteo* species, *Accipiter* species, *Circus cyaneus*), and great blue herons (*Ardea herodias*). Many areas supporting giant garter snakes have been documented to have abundant predators (R. Hansen 1980; G. Hansen and Brode 1993; Wylie *et al.* 1997a). However, predation is not believed to be a limiting factor in areas that provide abundant cover, high concentrations of prey items, and connectivity to a permanent water source (Wylie *et al.* 1997a).

2. Demographics

Demography, the quantitative description of a population (Krohne 2001), includes such parameters as population size, density, distribution, age structure, home range, and sex ratios. Demography provides insight into a population's age structure, growth rates and overall health, and is therefore important to wildlife management (Klemens 2000) and in measuring success in restoration of habitat and reintroductions of rare species. As a conservation tool, demographic parameters can be used to gauge the recovery of a species.

Population Size Estimates. The most fundamental of parameters used to define the demography of a population is the number of individuals in the population; these estimates are useful to wildlife managers in providing a means to determine the density of individuals in a population and to estimate the size of a self-sustaining population. Unfortunately, population counts for many animals cannot adequately estimate a population size because of the imperfect detectability of the animals (Mazerolle *et al.* 2007), such as individuals being inconspicuous, having extended periods of inactivity, having low densities, or exhibiting extensive and irregular movement (Parker and Plummer 1987; Wylie *et al.* 2010).

Table 2 displays some of the population estimates that have been published for the giant garter snake. Estimates are notably lacking for the San Joaquin Valley, and this is primarily due to low capture numbers that are insufficient for mark-recapture derived estimates (E. Hansen 2008b). Although estimates exist for some populations, inconsistent methods across years do not allow us to estimate a range-wide population size for the species. USGS is working to develop a range-wide population size estimate.

Population Density. Density is a measure of the number of individuals occupying a specific area. The measure of "ecological density" is important to species managers because it is the measure of the number of individuals per unit of appropriate habitat (Krohne 2001). Surveys from 16 different sites, trapped with varying frequency from 1999 to 2005, have shown a range of linear densities of giant garter snakes from 8 snakes per kilometer at Natomas Basin (Wylie and Cassazza 2000) to 126 snakes per kilometer at the Colusa NWR site T24 (Wylie *et al.* 2005).

Table 2. Some population estimates of giant garter snakes.

Location	Year	Trap-Days	Captures (Hand & trap)	Captures (Trap only)	Abundance N (95% CI)[A]	Author
Badger Creek	1997	18,376	103	103	**118** (111-132)	Wylie *et al.* 2010
Badger Creek	2002	14,973	63	63	**216** (137–383)	E. Hansen 2003a
Colusa NWR	1997	12,198	53	22	**29** (22-53)	Wylie *et al.* 2010
Colusa NWR	2002	Not Listed	128	128	**163** (42-186)	Wylie *et al.* 2002c
Gilsizer Slough	1996	17,136	88	67	**177** (124-280)	Wylie *et al.* 2010
Natomas Basin	1999	19,170	164	141	**229** (199-276)	Wylie *et al.* 2010
Volta WA	2003	15,900	28	28	**45** (31-59)	Dickert 2003
Volta WA	2006	5,131	7	7	Insufficient numbers caught for estimate	Sousa and Sloan 2007
Yolo WA	2005	13,700	41	41	**57** (45-84)	E. Hansen 2008a

[A] CI = Confidence Interval

In a later study, Wylie *et al.* (2010) used data acquired from previous studies to determine snake densities in four separate areas that represent a range of habitat from rice agriculture (Natomas Basin) to managed seasonal marsh (Colusa NWR and Gilsizer Slough) to managed natural perennial marsh (Badger Creek). The density estimates in this study were presented as number of snakes per unit area, such as a wetland or rice field instead of a linear value. Wylie *et al.* (2010) found that the highest densities of giant garter snakes were located in the natural marsh at Badger Creek (see Table 1), which is believed to represent the historical giant garter snake perennial marsh habitat (Wylie *et al.* 2010).

Home Range. Many animals confine their routine daily activities, such as foraging and mating, to a limited area which biologists call the home range (Pough *et al.* 2001; Lincoln *et al.* 2001). Researchers who have conducted years of surveys for the giant garter snake, including monitoring snakes by implanting Passive Integrated Transponder (PIT) tags (small electronic devices the size of a rice kernel that produce a unique number for each implanted snake when scanned by a hand-held

device) have found that giant garter snakes demonstrate site fidelity, especially the females (E. Hansen, pers. comm. 2011; B. Halstead, pers. comm. 2011; P. Valcarcel, USGS, *in litt.* 2010).

Researchers with the USGS estimated the home range size of giant garter snakes at several study sites using telemetry data (Worten 1989; Seaman and Powell 1996). Table 3 shows the home range figures from those studies. Home range estimates from the studies averaged from 17 to 44 hectares (42 to 109 acres) for a sample of 105 individual snakes (Wylie and Casazza 2000; Wylie *et al.* 2002a, 2008). In localities where surrounding land use provides or complements the necessary components of giant garter snake habitat, for example in areas of rice cultivation, the home ranges for snakes were shown to be smaller than for localities where the snakes must travel some distance to find those same components (E. Hansen 2008a).

Table 3. Home range estimates from various surveys of giant garter snakes

Location and Date	N[A]	Median home range Ha (min-max)[B]	Author
Colusa NWR 1997	27	42 (1.3 – 1130)	Wylie *et al.* 2002a
Colusa NWR 2000	9	17 (1 – 33)	Wylie *et al.* 2002a
Colusa NWR 2001	13	24 (3 – 173)	Wylie *et al.* 2002a
Colusa Drain Mar – Sep 2006	22	41.2 (3 – 239)	Wylie *et al.* 2008
Colusa Drain Mar – July 2007	22	22.78 (5.3 – 59.9)	Wylie *et al.* 2008
Natomas Basin 1999 (Elverta)	7	44 (13 – 80)	Wylie and Casazza 2000
Natomas Basin 1999 (Fisherman's Lake)	5	37.2 (13 – 87)	Wylie and Casazza 2000

[A] N = number of snakes in study [B] Ha = hectares

At Badger Creek, an area considered to exemplify high quality giant garter snake habitat, one telemetry study of the movements (not including a calculation of home ranges) of 12 individual snakes revealed that the giant garter snakes did not move more than 300 meters (984 feet) from their point of capture along the marsh emergent vegetation, and that males traveled further than females (E. Hansen 2003a).

E. DISTRIBUTION AND POPULATIONS

1. Distribution

Giant garter snakes are endemic to California's Central Valley (Fitch 1940; G. Hansen and Brode 1980; Rossman and Stewart 1987). Historically, giant garter snakes inhabited the Sacramento and San Joaquin Valleys from the vicinity of Chico, in Butte County southward to Buena Vista Lake, near Bakersfield in Kern County, California. The eastern and western boundaries of the giant garter snake range from the foothills occurring along each side of the Central Valley - the Coast Range to the west and the Sierra Nevada to the east. Observations of individual giant garter snakes range in elevation from 3 to 12 meters (10 to 40 feet) in the southern Sacramento Valley. Although the boundaries of the giant garter snake's original distribution are undetermined, occurrence records coincide with the historical distribution of the large flood-basins, freshwater wetlands, and tributary streams of the Central Valley's Sacramento and San Joaquin watersheds (Figure 2; G. Hansen and Brode 1980).

Though the abundance of giant garter snakes in the Sacramento Valley has declined, the distribution of giant garter snakes in its northern range may still reflect its historical distribution (Service 2012; Wylie *et al.* 2010). Giant garter snakes in the San Joaquin Valley, however, have suffered an extensive reduction in their abundance and distribution compared to historical times (R. Hansen 1980; Paquin *et al.* 2006; Wylie and Amarello 2007; E. Hansen 2008a). Giant garter snakes historically inhabited the extensive wetlands of the Tulare and Buena Vista lakes in the southern San Joaquin Valley and appear to have once been fairly abundant in this part of the San Joaquin Valley (G. Hansen and Brode 1980). Conversely, giant garter snakes have not been found in the northern reach of the San Joaquin Valley up to the Delta area. Here, the floodplain of the San Joaquin River and its associated wetland habitat constricts to a geologically narrow trough. The length of this 100-kilometer (62-mile) constriction is presumed to have historically separated the giant garter snake populations in Merced County from those of the eastern Sacramento/San Joaquin River Delta (Delta) in San Joaquin County (G. Hansen and Brode 1980). It is believed that the extensive historical wetlands of the Delta were suitable for giant garter snakes and that they historically occupied this area (G. Hansen 1986, 1988).

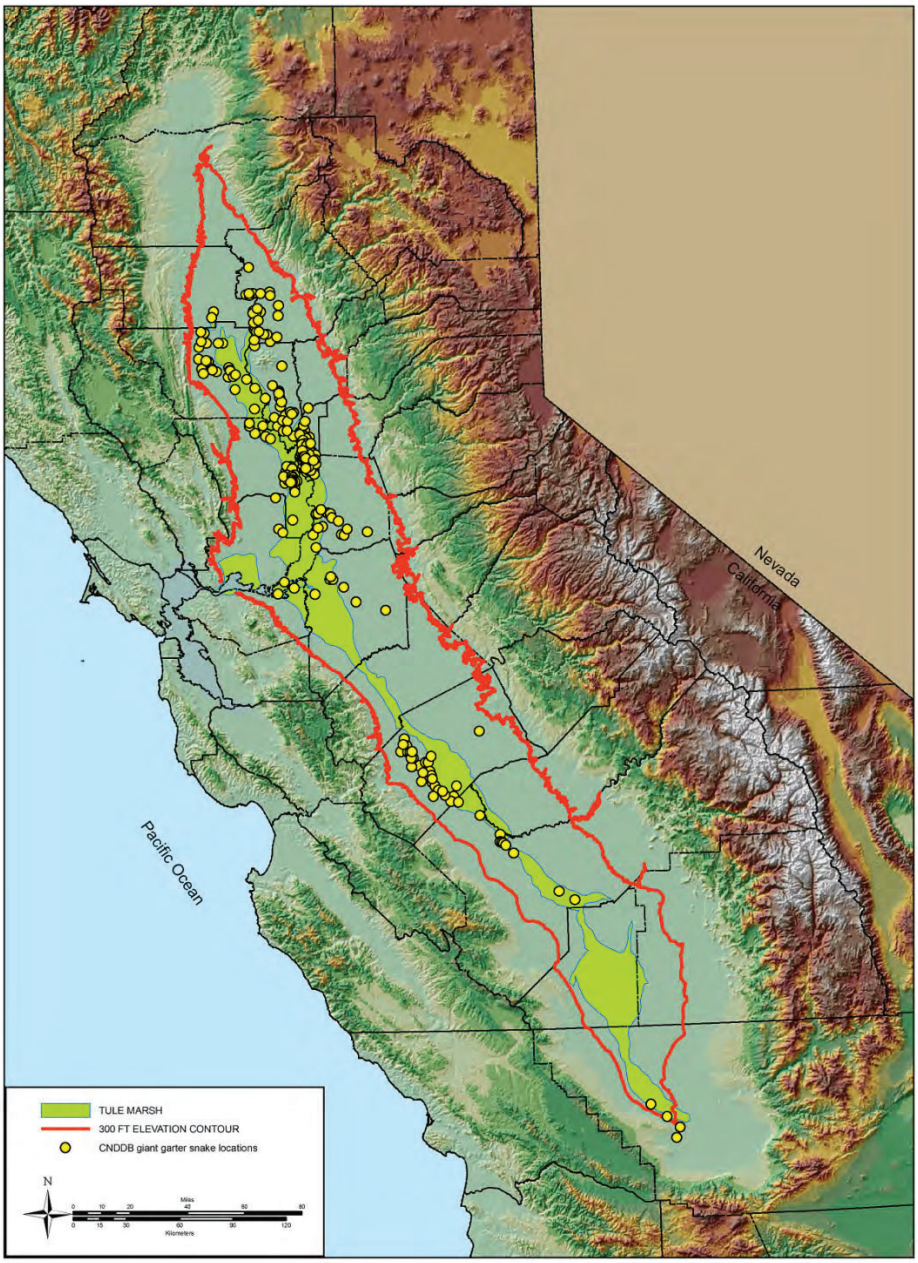

Figure 2. Distribution of historic tule marsh (lime green) and giant garter snake captures. (CNDDB, Kuchler)

2. Populations as Defined for this Recovery Plan

In this revised draft recovery plan we will continue to use, as closely as possible, the population definition from the listing rule (USFWS 1993), "a cluster of locality records in a contiguous habitat area." Locality records are distinct locations where surveys were conducted and giant garter snakes were found (USFWS 1993). These populations were associated with the major watershed basins in the Central Valley because these basins were exclusively defined by geographic features (Bryan 1923) and contained habitat that appeared to be historically interconnected by wetland features. Recent genetic studies of the giant garter snake have confirmed the validity of these population boundaries

by demonstrating that historically there was restricted gene flow between groups of individuals inhabiting these major watersheds (Paquin *et al.* 2006; Engstrom 2010). The currently recognized populations and distribution of the giant garter snake as they relate to the 13 populations described in the 1993 listing are summarized in Table 4.

Table 4. Populations of giant garter snakes at time of listing in 1993 and as currently assessed in 2016.

1993 POPULATIONS (At time of listing)	2017 POPULATIONS
Butte Basin	Butte Basin
Colusa Basin	Colusa Basin
Sutter Basin	Sutter Basin
American Basin	American Basin
Yolo Basin – Liberty Farms (currently presumed extirpated)	Yolo Basin
Yolo Basin – Willow Slough	
Badger Creek – Willow Creek	Cosumnes-Mokelumne Basin
Sacramento Basin	Delta Basin
Caldoni Marsh (now called White Slough WA)	
East Stockton: Diverting Canal and Duck Creek	
North and South Grasslands	San Joaquin Basin
Mendota WA	Tulare Basin
Burrell and Lanare (currently presumed extirpated)	

Additional description and status information is available for each basin in the most recent 5-Year Status Review for the giant garter snake (Service 2012).

F. REASONS FOR DECLINE AND THREATS TO SURVIVAL

The following discussion of threats to the giant garter snake is presented in a format that follows the five listing factors used in status reviews as described in section 4(a)1 of the Endangered Species Act. These are:

A. The present or threatened destruction, modification, or curtailment of its habitat or range;
B. Overutilization for commercial, recreational, scientific, or educational purposes;
C. Disease or predation;
D. The inadequacy of existing regulatory mechanisms; and
E. Other natural or manmade factors affecting its continued existence.

Since Federal listing in October 1993, the list of threats to the giant garter snake has changed and new threats analyses were presented in 5-year reviews for the giant garter snake completed in 2006 and 2012 (USFWS 2006a, 2012). A brief summary of the current significant threats addressed in this revised draft recovery plan follows; the 2012 5-year review should be consulted for a complete analysis.

1. Factor A: The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

At the time of listing, habitat loss as a result of urbanization and conversion of wetlands was recognized as the primary Factor A threat to the giant garter snake. Today, habitat loss and fragmentation due to urbanization and changes in the levels and methods of rice production are the largest threat to the giant garter snake (Paquin *et al.* 2006; American Farmland Trust 2007; USDA 2010; California Rice Commission 2010; Farmland Information Center 2011; Service 2012). In addition, we consider the following to be current threats: changes in water availability; levee and canal maintenance, water management and water deliveries which do not account for the giant garter snake; water transfers (resulting from cropland idling/shifting, reservoir releases, conservation measures, or groundwater substitution); small populations; and invasive aquatic species.

2. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

In the final listing rule, the Factor B threats included collection of specimens for private and scientific use, and harassment and collection of giant garter snakes by recreationists engaged in angling. Collection for private and scientific use is not considered to be a threat. However, threats from human encounters, primarily engaged in recreational activities is still considered a threat, but was moved to Factor E.

3. Factor C: Disease and Predation

In the final listing rule, predation by both native and non-native predators was considered a threat, and that threat continues today; however, it is not believed to be significant. Native and non-native predators both prey upon giant garter snakes and compete with giant garter snakes for prey. Parasites found on giant garter snakes were discussed in the final listing, but their level of threat was determined to be unknown; the degree of threat from parasites remains unknown today.

4. Factor D: The Inadequacy of Existing Regulatory Mechanisms

At the time of listing (USFWS 1993), the state and federal regulatory mechanisms thought to have some potential to protect the giant garter snake included the California Endangered Species Act (CESA), the California Environmental Quality Act (CEQA), the National Environmental Protection Act (NEPA), and the Clean Water Act (CWA). In addition, this revised draft recovery plan recognizes the Endangered Species Act (ESA) as a Federal program that was designed to protect rare species of plants and animals.

5. Factor E: Other Natural or Manmade Factors Affecting its Continued Existence

At the time of listing, Factor E threats discussed included: fluctuations in the acreages of active rice fields due to changing market values and market demand (and due to changes in water availability), levee and canal maintenance, water management and water delivery during the winter for waterfowl that does not also provide summer water for the giant garter snake, water transfers, and fragmented habitat with small populations. These threats are still considered to be valid; however, these threats are now discussed in the Factor A section since they all directly relate to the loss or alteration of available habitat for the giant garter snake. Flooding and contaminants were also discussed in the listing rule and these remain valid Factor E threats; however, they are not considered significant threats. Giant garter snake mortalities from vehicular strikes on roads were discussed as a Factor A threat in the listing, but are now presented as a Factor E threat; however, it is not considered a significant threat. Encounters with humans was described as a Factor B threat in the listing, but is

now considered more relevant as a Factor E threat since threatening encounters may include those not related to recreation; however, it is not considered a significant threat. Since the final listing rule, drought and climate change, netting used in erosion control, and competition from non-native water snakes were identified as threats; however, the significance of these threats is unknown.

II. RECOVERY PROGRAM

A. RECOVERY STRATEGY

The strategy used to recover the giant garter snake is focused on protecting existing occupied habitat and identifying and protecting areas for habitat restoration, enhancement, or creation including areas that are needed to provide connectivity between populations. This approach is vital to reduce or eliminate the primary threat to the giant garter snake, which is the loss of habitat throughout the historical range of the species.

Appropriate management is needed for all giant garter snake conservation lands to ensure that stable and viable populations can be maintained in occupied areas, and that colonization will be promoted in restored and enhanced unoccupied habitat. An essential part of the management of habitat for giant garter snakes is to ensure that sufficient clean water is available to provide adequate aquatic habitat during the summer active season. Management plans must also incorporate sufficient monitoring to determine outcomes of specific actions and responses of the species to protection and management efforts. Such monitoring programs should be designed specifically to determine the success or failure of various actions, and provide for feedback such that protection and management actions can be modified in response to new data, research, and monitoring information.

Research on the ecology, behavior and life history of the giant garter snake will be needed to further define specific recovery tasks, management needs and goals, help assess threats and determine best methods to eliminate or ameliorate the threats, and to analyze aspects of population viability.

Repatriation, the introduction and augmentation of giant garter snakes into historically occupied areas, is needed in appropriate habitat in the San Joaquin Valley where recent surveys show dwindling population numbers. This will involve captive propagation hand in hand with a genetics management plan.

Implementation of recovery measures will place an emphasis on multiple species protection and management by developing and implementing conservation measures to restore and protect the processes that maintain healthy ecosystems. Species that may benefit from an ecosystem focus include the western pond turtle and Pacific flyway waterfowl and shorebirds. These species will benefit from implementation of the giant garter snake recovery plan through improvements in wetland and riparian habitats.

To assist in the achievement of the recovery of the giant garter snake, it is necessary to develop and implement incentive programs for private landowners and local agencies to conserve giant garter snake habitat. Additionally, development and distribution of informational material to interested landowners and public lands managers will enlist and encourage the participation and cooperation of private citizens and public land managers in the recovery of the giant garter snake.

Definitions

Recovery Unit: We defined nine recovery units that correspond directly to the nine geographically and genetically distinct populations to aid in our recovery planning. A recovery unit is a special unit of the listed species' range that is geographically or otherwise identifiable and is essential to the

recovery of the entire listed species. Recovery Units are individually necessary to conserve genetic distinctiveness, demographic robustness, important life history stages, or other features necessary for the long-term sustainability of the entire listed species.

Management Unit: These subdivisions of recovery units are areas that might require different management, that might be managed by different entities, or that might encompass different populations. In this revised draft recovery plan, the management units are primarily administrative in that they serve to organize the recovery units into separate and approximately equal areas that will assist in managing the implementation of the recovery actions.

Locality Record: A small geographic area of giant garter snake habitat where occupancy by giant garter snakes was documented by positive trapping survey results or by confirmed visual encounters. The size of the area can range from less than an acre to hundreds of acres.

Population: A cluster of locality records in a contiguous habitat area. In this plan individual populations are defined by the watershed basins in which they reside, which are contiguous habitat areas.

Corridor: A canal, waterway, slough, channel, or creek that connects two or more areas known to support giant garter snakes. A corridor must have the necessary habitat components to provide suitable giant garter snake habitat (see section I.C.1 and I.C.2) in order to function as a viable dispersal and movement corridor.

Giant Garter Snake Recovery Units

The giant garter snake's historical range encompasses the majority of the Central Valley of California, with habitat characteristics, species status, degree of threats, and needed recovery actions varying across this large geographic area. We have approached recovery planning by dividing the giant garter snake's broad geographic range into nine recovery units corresponding directly to the nine genetically and geographically defined populations previously discussed in chapter 1E (Figure 3). This grouping of recovery units is appropriate also because of the limited movement of giant garter snakes from one watershed to another, which genetically and demographically isolates the giant garter snakes within the various watershed basins. These recovery unit assignments will assist in establishing recovery criteria and guiding recovery tasks.

In defining recovery units for the giant garter snake, we have followed the usage of watershed basins that were also used to define population boundaries, and we have additionally restructured the populations from 13 (from listing rule) to 9 based on recent surveys and giant garter snake genetic data (Paquin *et al.* 2006; Engstrom 2010). The boundaries of the recovery units were defined using the giant garter snake habitat suitability model developed by Halstead *et al.* (2010). This model was derived from several raster maps that used data from Ducks Unlimited, the location and type of waterways from the National Hydrography Dataset (http://nhd.usgs.gov), and data on canopy and impervious cover from the National LandCover Dataset (http://landcover.usgs.gov). The combined recovery units, therefore, represent the potential extent of giant garter snake habitat in the Central Valley as known at the time of listing and updated with recent surveys. Each unit has a distinctive genetic composition that is essential to the recovery of the giant garter snake as a species.

The descriptions and maps of each of the recovery units below will provide greater detail on the locality and the amount of public and private conservation lands. There are no known unique threats in any of the recovery units, and all of the threats mentioned in section F can be found in all of the recovery units; however, the level that a single threat may pose to the giant garter snake differs between the recovery units.

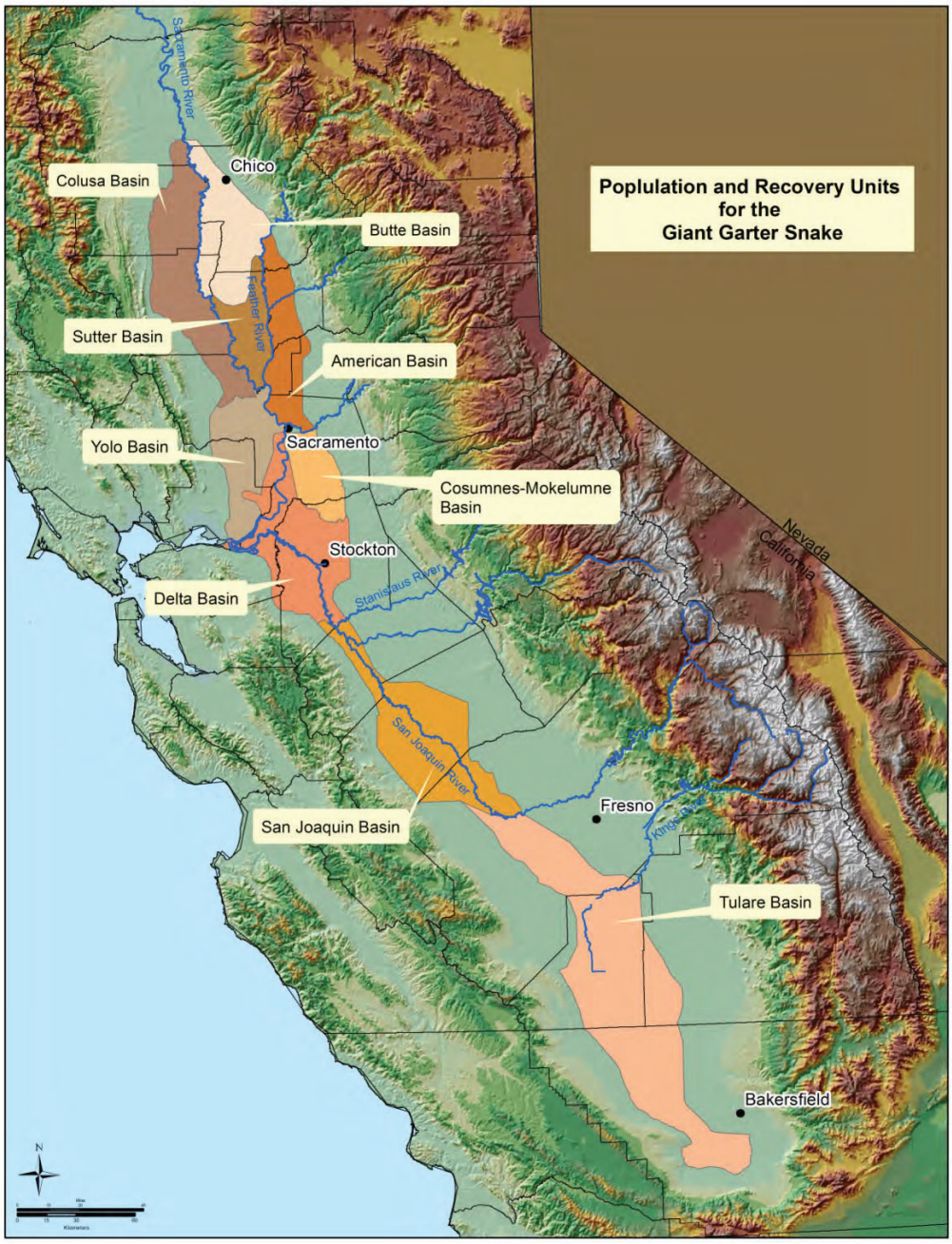

Figure 3. Populations and Recovery Units for the giant garter snake.

B. RECOVERY UNITS

1. Butte Basin Recovery Unit

The Butte Basin Recovery Unit encompasses the entire Butte Basin, extending from Red Bluff in the north to the Sutter Buttes in the south (Figure 4). The basin's watershed is dominated by the Sacramento River and includes those creeks that flow westward toward the Sacramento River. The Butte Basin consists of 193,892 hectares (479,118 acres), including portions of Tehama, Butte, Sutter, and Colusa counties. Three management units have been defined for the Butte Basin Recovery Unit: Llano Seco, Upper Butte Basin, and Gray Lodge/Butte Sink.

Within the Butte Basin, State and Federal conservation areas include: Gray Lodge Wildlife Area (WA), Upper Butte Basin WA, Butte Sink Wildlife Management Area, and several units of the Sacramento River NWR. In addition, approximately 4,047 hectares (10,000 acres) of privately owned lands are enrolled in the USFWS wetland easement program in the Butte Sink Wildlife Management Area. Currently there are no conservation banks in the Butte Basin designed for the giant garter snake.

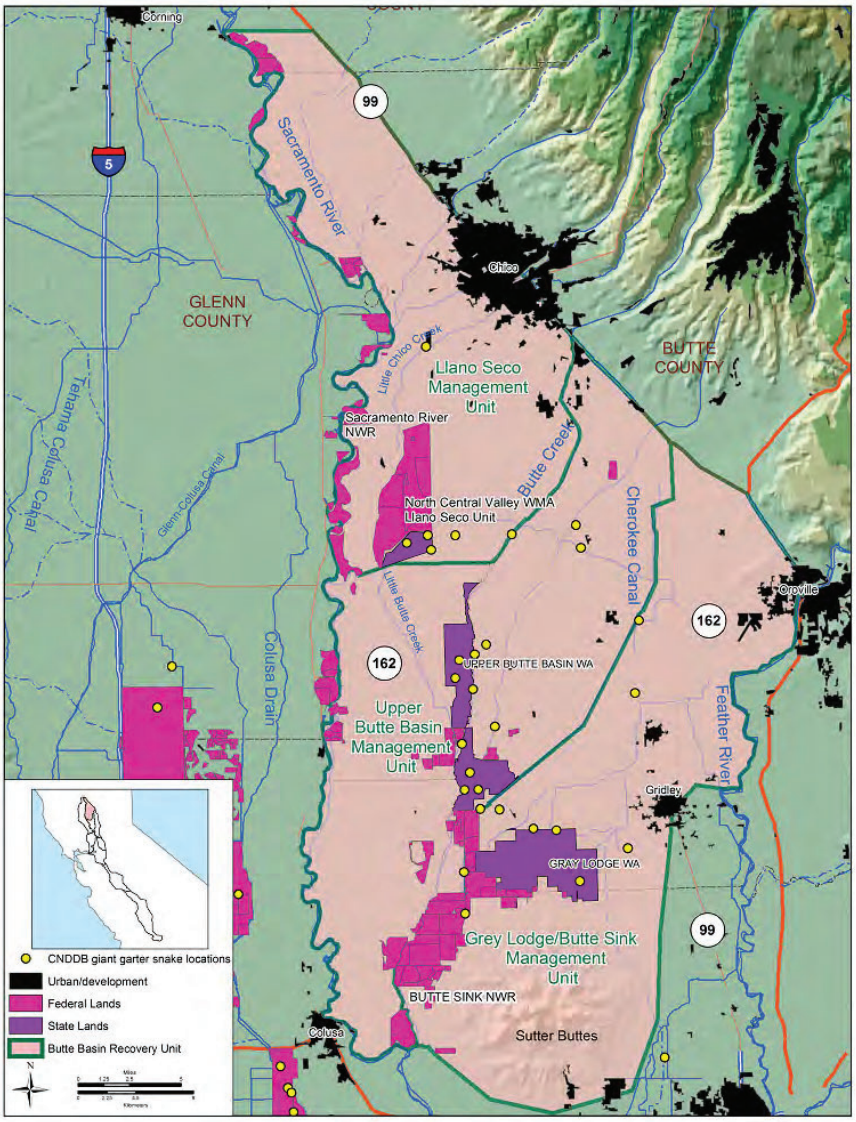

Figure 4. Butte Basin Recovery Unit

2. Colusa Basin Recovery Unit

The Colusa Basin extends from Red Bluff in the north to Cache Creek in the south (Figure 5). Its watershed is dominated by the Sacramento River. The Colusa Basin consists of 277,653 hectares (686,096 acres), including portions of the counties of Tehama, Glenn, Colusa, and Yolo. Three management units have been defined for the Colusa Basin Recovery Unit: Willows, Delevan and Colusa.

Within the Colusa Basin, Federal conservation areas include the Sacramento, Delevan and Colusa NWRs. In addition, about 2,226 hectares (5,500 acres) of private lands are enrolled in our wetland easement program in the area north and south of Delevan NWR. The Colusa Basin includes Dolan Ranch Conservation Bank (102-hectare, 252-acre) and the Ridge Cut Conservation Bank (75 hectare, 186 acre).

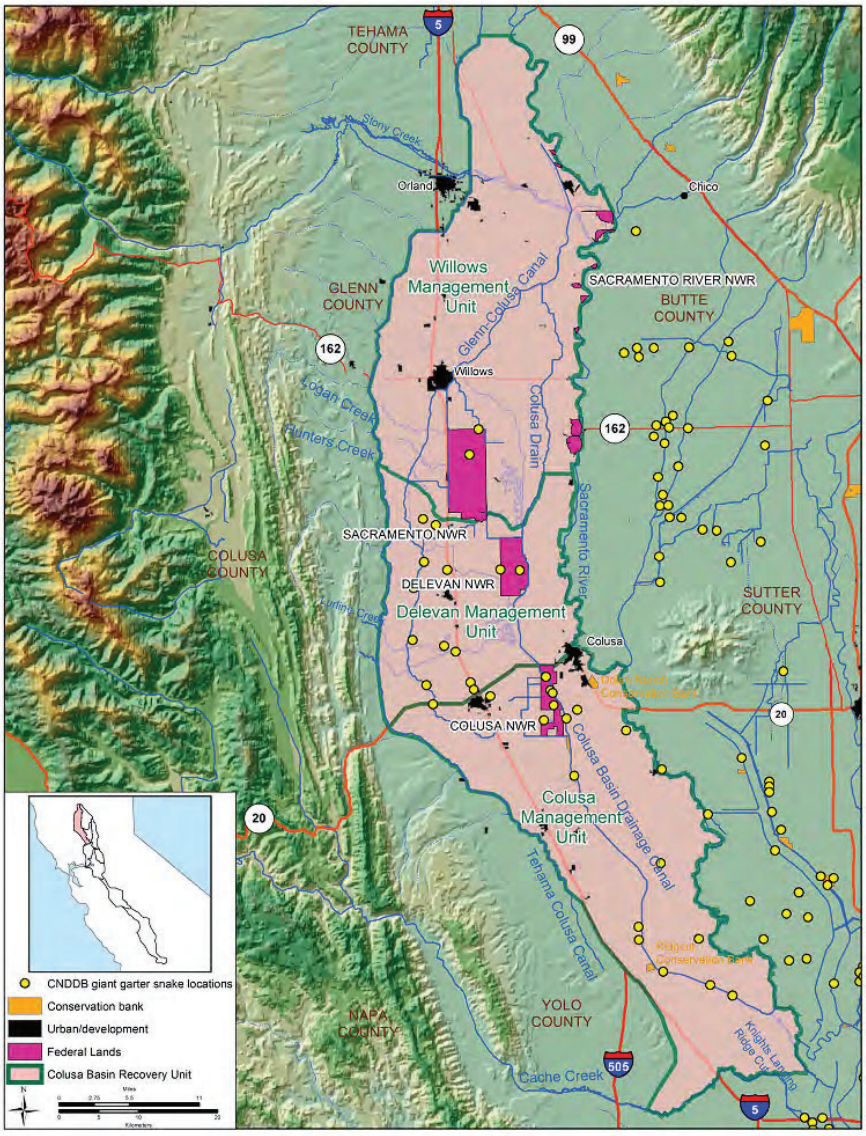

Figure 5. Colusa Basin Recovery Unit

3. Sutter Basin Recovery Unit

The Sutter Basin extends south from the Sutter Buttes to the confluence of the Feather and Sacramento rivers (Figure 6). The Sutter Basin consists of 97,048 hectares (239,810 acres), including portions of Butte and Sutter counties. Three management units have been defined for the Sutter Basin Recovery Unit: Sutter, Gilsizer Slough, and Robbins.

Within the Sutter Basin, Federal and State conservation areas include the Sutter NWR and the Sutter Bypass WA (east and west borrow channels of the Sutter Bypass, Tisdale Bypass, and Wadsworth Canal), and Feather River WAs. Also included are the Sutter Basin Conservation Bank (174-hectare, 429-acre), the Gilsizer Slough South Conservation Bank (153 hectares, 379 acres), and the Tule Basin Giant Garter Snake Preserve (60.7 hectares, 150 acres).

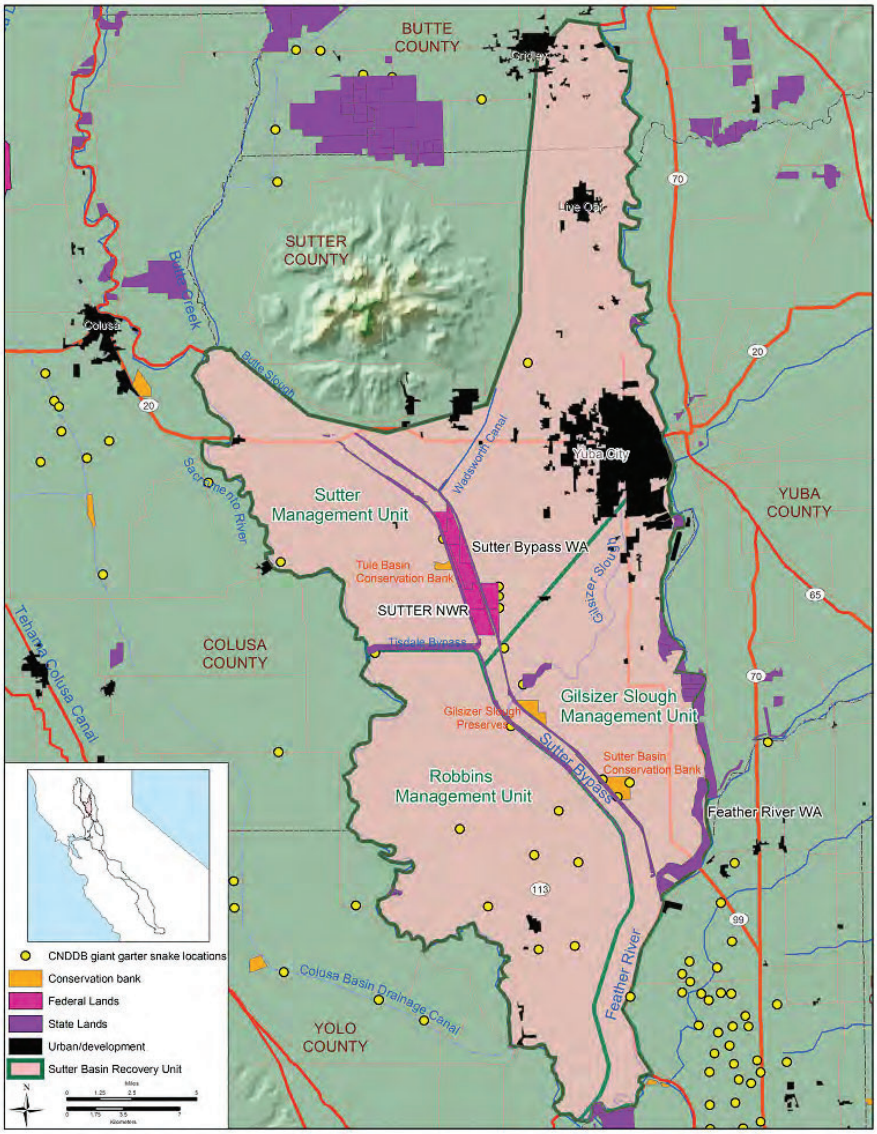

Figure 6. Sutter Basin Recovery Unit

4. American Basin Recovery Unit

The American Basin extends south from Oroville to the confluence of the Sacramento and American rivers (Figure 7). The Basin is about 152,204 hectares (376,104 acres), including portions of Butte, Yuba, Sutter, Placer, and Sacramento counties. Four management units have been defined for the American Basin Recovery Unit: District 10, Olivehurst, Nicolaus, and Natomas Basin.

Within the American Basin, the only public conservation lands are several units of the State Feather River WA along the Feather and Bear rivers. However, these conservation areas primarily provide riparian habitats that may not be suitable for the giant garter snake. There are no Federal wildlife refuges or State management areas within the American Basin. There are no conservation banks specifically for the giant garter snake in the American Basin; however, several preserves have been

established in the Natomas Basin as part of two Habitat Conservation Plans (HCPs) and currently amount to 1,677 hectares (4,145 acres).

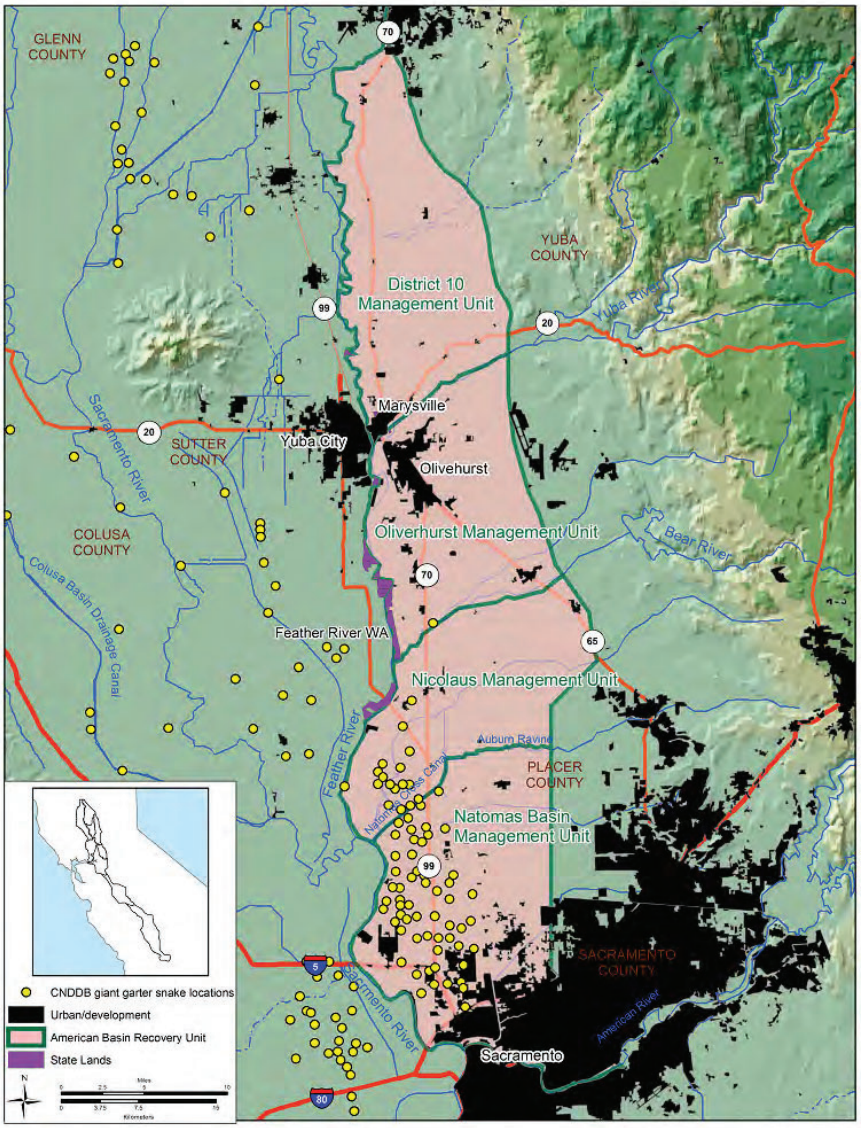

Figure 7. American Basin Recovery Unit

5. Yolo Basin Recovery Unit

The Yolo Basin extends from Cache Creek in the north to the Sacramento-San Joaquin River Delta in the south (Figure 8). The Yolo Basin includes portions of Yolo and Solano counties and is approximately 166,291 hectares (410,914 acres). Three management units have been defined for the Yolo Basin Recovery Unit: Ridgecut Slough, Willow Slough, and Yolo Bypass.

Within the Yolo Basin, conservation lands include the State Yolo Bypass WA, wetland easement areas within the Yolo Bypass, and the Jepson Prairie Preserve in Solano County. It also includes the Pope Ranch Conservation Bank (158 hectares, 390 acres).

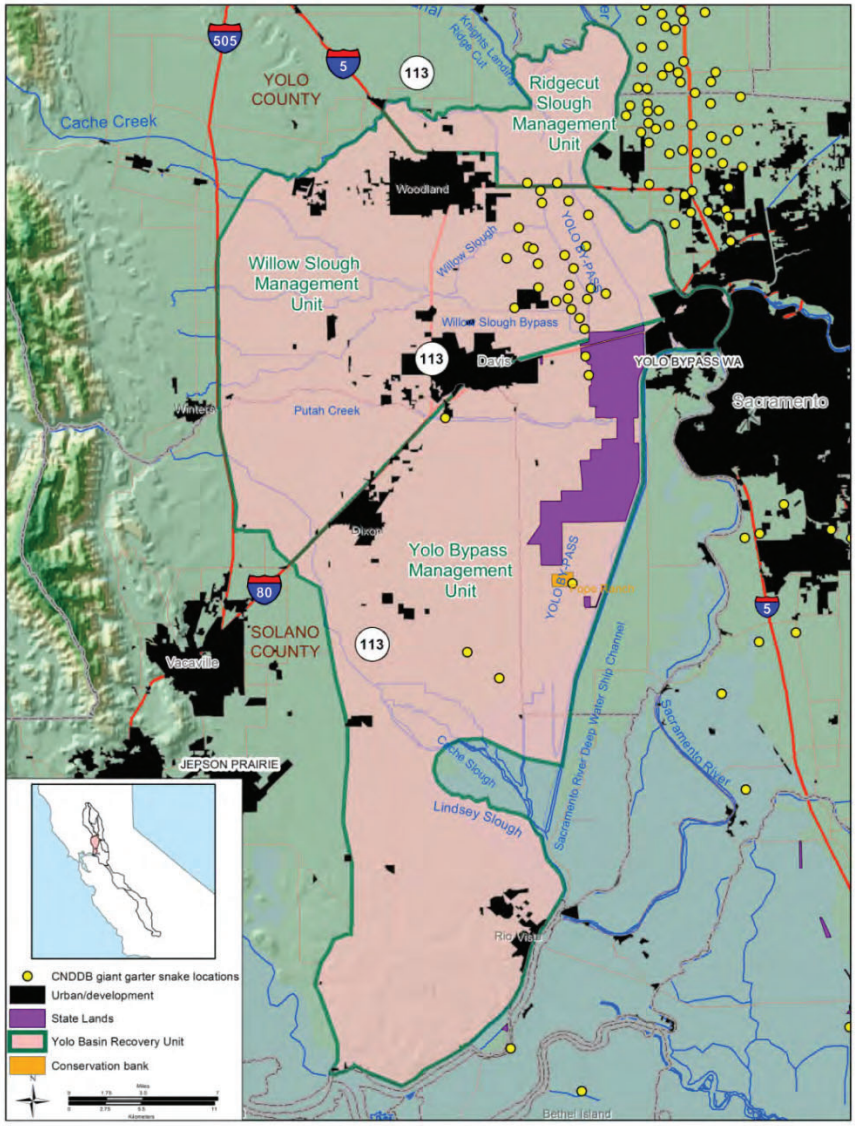

Figure 8. Yolo Basin Recovery Unit

6. Cosumnes-Mokelumne Basin Recovery Unit

The Cosumnes-Mokelumne Basin is bordered by the City of Sacramento and the Cosumnes River to the north, the foothills of the Sierra Nevada Mountains to the east, Interstate 5 to the west, and the Mokelumne River to the south (Figure 9). The Cosumnes-Mokelumne Basin consists of 95,085 hectares (234,960 acres). Noteworthy is that the locality record from Badger Creek (Snake Marsh), described as the best representative of undisturbed, historical wetlands which were once common throughout the Central Valley, is found in this watershed basin. There are no management units defined within this recovery unit because it encompasses a relatively small area and requires no geographic subdivision to assist in management.

Conservation land in the Cosumnes-Mokelumne Basin is mostly within the Cosumnes River Preserve, which is managed jointly by the California Department of Fish and Wildlife (CDFW), The Nature Conservancy, the Bureau of Land Management (BLM), and Ducks Unlimited. There are no conservation banks set up at this time in this recovery unit for the giant garter snake.

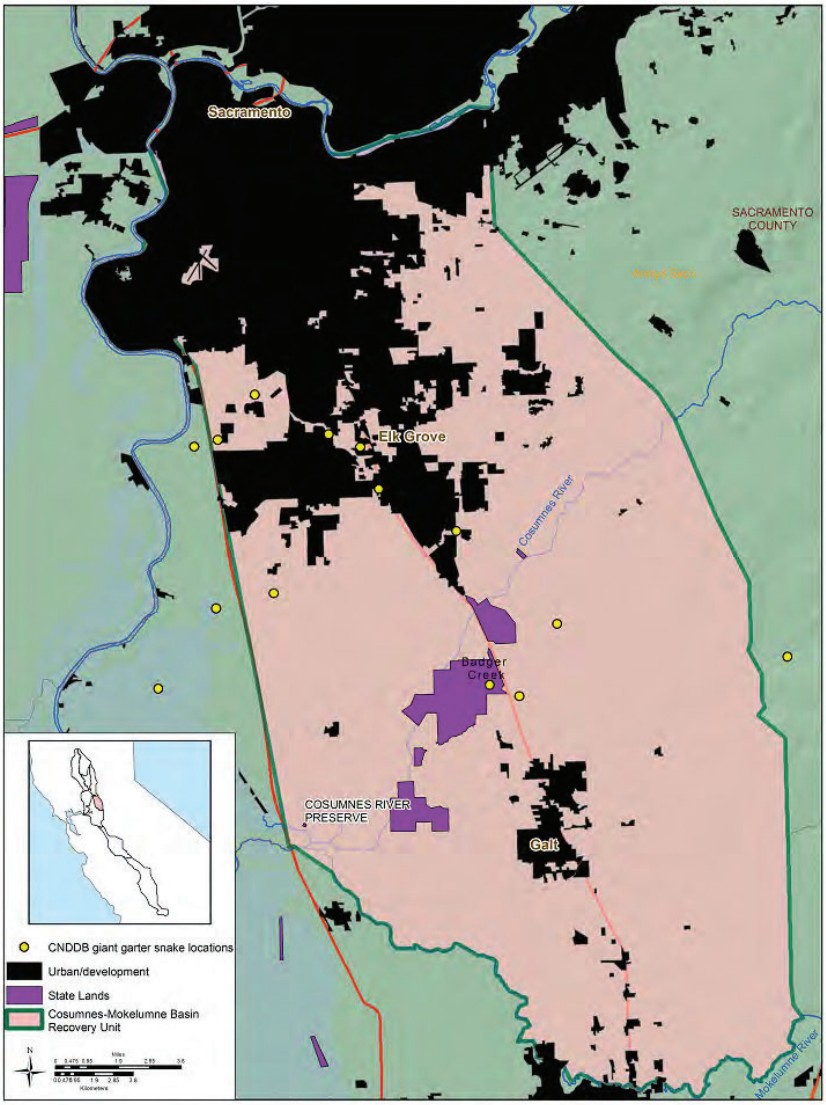

Figure 9. Cosumnes-Mokelumne Basin Recovery Unit

7. Delta Basin Recovery Unit

The Sacramento-San Joaquin River Delta (Delta Basin) extends from just south of the confluence of the Sacramento and American Rivers south to the Stanislaus River (Figure 10). The Delta Basin contains about 283,078 hectares (699,502 acres) and includes portions of Sacramento, Yolo, Solano, San Joaquin, and Contra Costa counties. Four management units have been defined for the Delta Basin Recovery Unit: Stone Lakes, White Slough, Stockton, and Tracy.

Within the Delta, Federal and State conservation areas include the Federal Stone Lakes NWR, and the State's Sherman Island WA and White Slough WA. There are no conservation banks set up at this time in this recovery unit for the giant garter snake.

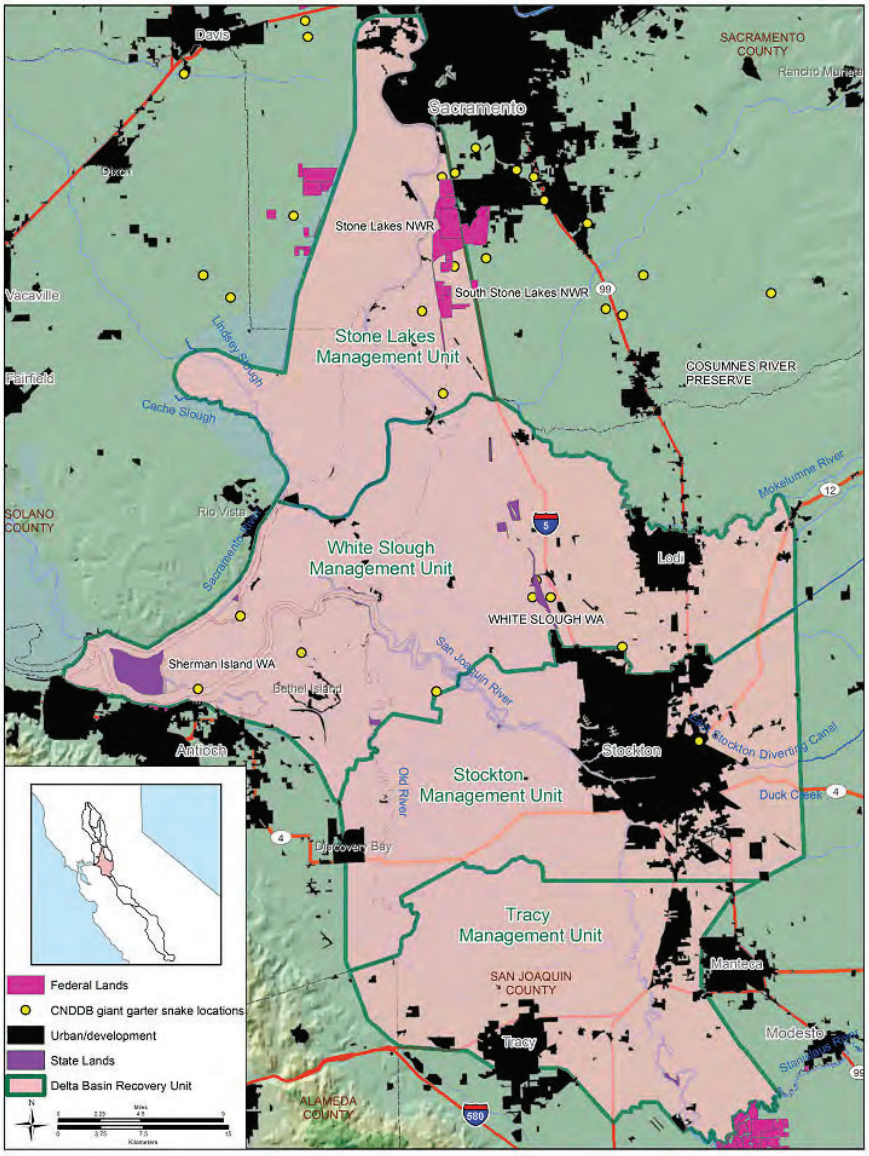

Figure 10. Delta Basin Recovery Unit

8. San Joaquin Basin Recovery Unit

The San Joaquin Basin extends from the Stanislaus River in the north to the San Joaquin River in the south and is bordered by the Coast Ranges on the west and the Sierra Nevada to the east (Figure 11). The San Joaquin Basin is 323,881 hectares (800,327 acres) and includes portions of Stanislaus, Merced, Fresno, and Madera counties. Four management units have been defined for the San Joaquin Basin Recovery Unit: San Joaquin River, San Luis/Volta, Brito, and Merced.

Within the San Joaquin Basin, Federal and State conservation areas include the San Joaquin River NWR, the San Luis NWR Complex, Merced NWR, and the North Grasslands WA, the Los Banos WA, and the Volta WA. Additional wetlands on private lands within the Grasslands Ecological Area are protected by conservation easements. The Grasslands Mitigation Bank (114 hectares, 281 acres)is located within the San Joaquin Basin Recovery Unit.

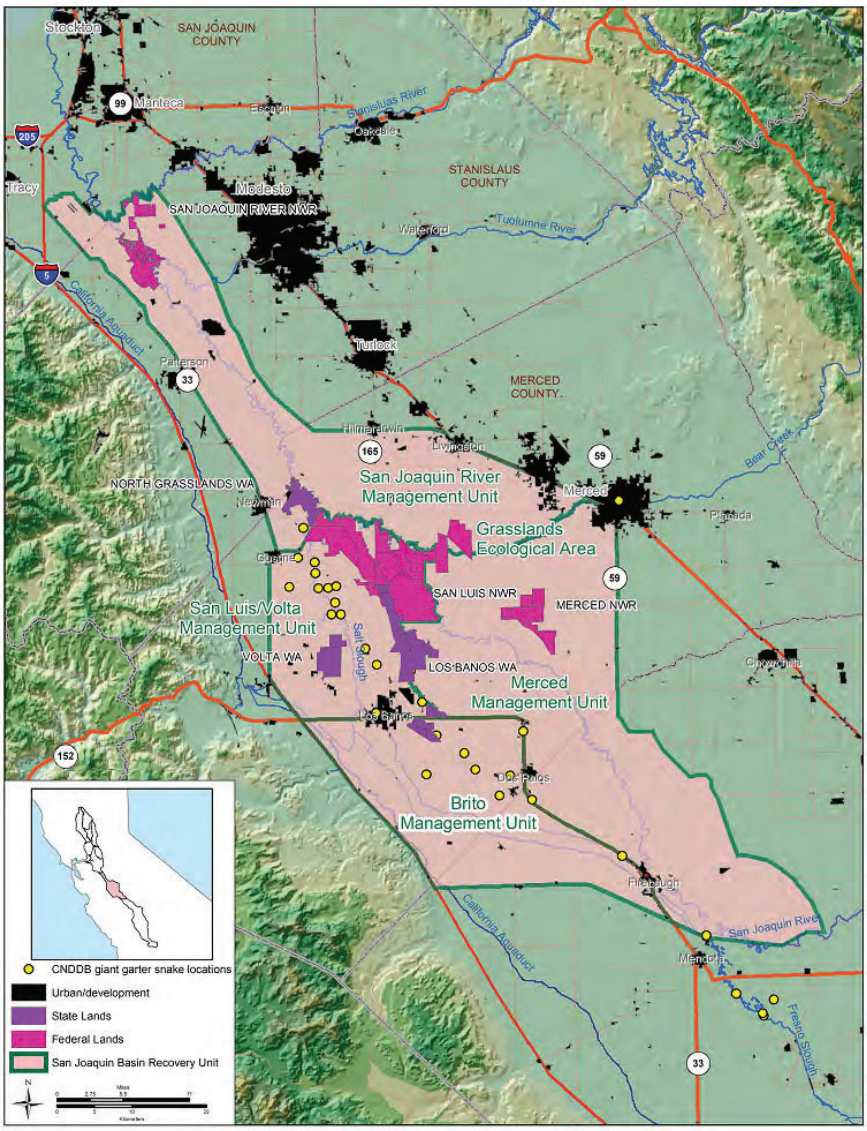

Figure 11. San Joaquin Basin Recovery Unit

9. Tulare Basin Recovery Unit

The Tulare Basin is the southern-most portion of the Central Valley and extends from the southern San Joaquin River south to the Buena Vista and Kern lakebeds (Figure 12). The Tulare Basin contains about 688,710 hectares (1,701,841 acres), and includes portions of Fresno, Kings, Tulare, and Kern counties. Four management units have been defined for the Tulare Basin Recovery Unit: Mendota, Burrell Lanare, Kern, and Buena Vista Lake.

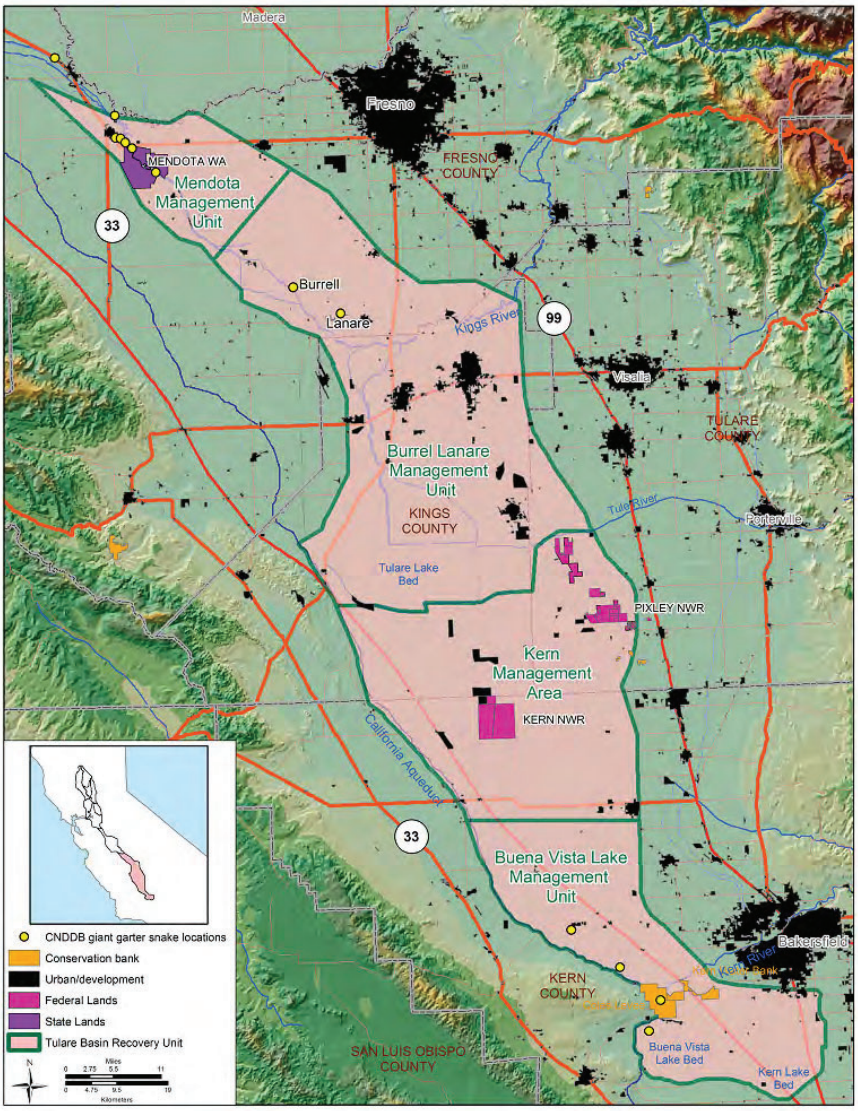

Figure 12. Tulare Basin Recovery Unit

Within the Tulare Basin, Federal and State conservation areas include the Kern and Pixley NWRs, and the Mendota WA. The Coles Levee Ecosystem Preserve and the Kern Water Bank are properties that will be preserved in perpetuity; however, these properties would require a great deal of restoration and reconfiguration to become appropriate habitat for giant garter snake populations. The 2,452-hectare (6,059-acre) Coles Levee Ecosystem Preserve was created by Aera Energy LLC and is managed by the CDFW. The Kern Water Bank HCP provided for a 1,322-hectare (3,267-acre) conservation bank. Additional wetlands on private lands occur within the Tulare Basin but will require habitat assessments and surveys to determine whether they provide potential habitat for the giant garter snake.

C. RECOVERY GOALS AND OBJECTIVES

The ultimate goal of this revised draft recovery plan is to recover the giant garter snake so that it no longer needs the protection of the Endangered Species Act and can be delisted (removed from the

list of Threatened and Endangered Species.). To achieve this goal the following objectives have been developed:

1. Protect existing and establish (and protect) self-sustaining populations of the giant garter snake throughout the full ecological, geographical, and genetic range of the species.

2. Restore and conserve healthy Central Valley wetland ecosystems that function to support the giant garter snake.

3. Ameliorate or eliminate, to the extent possible, the threats that caused the species to be listed or of concern and any foreseeable future threats.

D. RECOVERY CRITERIA

An endangered species is defined in the Endangered Species Act as a species that is in danger of extinction throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. When we evaluate whether or not a species warrants downlisting or delisting, we consider whether the species meets either of these definitions. A recovered species is one that no longer meets the Act's definitions of threatened or endangered. Determining whether a species should be downlisted or delisted requires consideration of the same five categories of threats which were considered when the species was listed and which are specified in section 4(a)(1) of the Endangered Species Act.

Recovery criteria are conditions that, when met, are likely to indicate that a species may warrant downlisting or delisting. Thus, recovery criteria are mileposts that measure progress toward recovery. Because the appropriateness of downlisting or delisting is assessed by evaluating the five threat factors identified in the Endangered Species Act, the recovery criteria below pertain to and are organized by these factors. These recovery criteria are our best assessment at this time of conditions that may indicate that the giant garter snake is ready to be delisted and removed from the list entirely. Because we cannot envision the exact course that recovery may take and because our understanding of the vulnerability of a species to threats is very likely to change as more is learned about the species and its threats, it is possible that a status review may indicate that delisting is warranted although not all recovery criteria are met. Conversely, it is possible that the recovery criteria could be met and a status review may indicate that delisting is not warranted; for example, a new threat may emerge that is not addressed by the recovery criteria below and that causes the species to remain threatened.

1. Recovery Criteria for Factor A: The present or threatened destruction, modification, or curtailment of its habitat or range.

In order to ensure the long term recovery of the giant garter snake, threats to the species habitat must be reduced or removed in order to provide sufficient high-quality habitat and connections between populations. This will have been accomplished if: a) sufficient habitat of suitable quality is protected in each recovery unit, and b) blocks of habitat within each recovery unit are connected. The following provides specific descriptions as to how habitats would be sized and connected to reduce threats associated with habitat loss:

Specified areas in all recovery units with known populations of the giant garter snake are protected in perpetuity as suitable giant garter snake habitat and supplied with sufficient clean water during the

spring and summer to maintain necessary aquatic habitat. The protected areas are buffered from all activities that preclude recovery of the species and are connected by corridors of suitable habitat.

Habitat for the giant garter snake will be preserved in multiples of two block pairings of habitat. Each block pair will consist of one 240-hectare (539-acre) block of contiguous buffered perennial wetland habitat (existing, restored or enhanced) and one 639-hectare (1,578-acre) block of contiguous active ricelands separated by no more than 5 miles (8 kilometers)[1]. Alternatively, a pair of blocks may also consist of two 240-hectare (539-acre) blocks of buffered perennial wetlands. Between five and ten habitat block pairs may be prescribed for each of the recovery units depending on the size of the recovery unit and the available suitable habitat within the recovery unit. These block pairs should be evenly distributed among the management units. In addition, the habitat pairs must not be separated by more than 5 miles. Paired habitat blocks were selected because perennial wetlands are known to support core populations of the giant garter snake throughout a wide range of hydrologic conditions, while rice fields and the supporting infrastructure can provide habitat for robust populations of the giant garter snake while the rice fields are active. During periods of crop rotation the inactive or dry crop fields may provide some level of connectivity between perennial wetlands by keeping key irrigation canals full.

These pairs of contiguous perennial wetlands and ricelands must be buffered by 0.5 kilometer (.32 mile) of compatible habitat and the two blocks must be connected by a corridor of aquatic and upland habitat with a 0.8-kilometer (0.5-mile) minimum width. Corridor width is based on the distance a giant garter snake is known to travel in one day, which is 0.8 kilometer (0.5 mile) (G. Hansen and Brode 1993). All pairs of habitat blocks must be connected with the other pairs of habitat blocks within and between the management units by corridors of suitable habitat, and recovery units should be connected to one another by similar corridors.

A1 **Butte Basin Recovery Unit**: Minimum of six habitat block pairs with no less than two block pairs per management unit in the Butte Basin Recovery Unit. Additional protection along the following watercourses in the Butte Basin will provide for connectivity between existing populations of giant garter snakes and will protect habitat immediately on either side of the main watercourse at a minimum of 0.25 miles from each bank:

a. Little Chico Creek – 1,036 hectares (2,560 acres) abutting the Llano Seco Unit of the Sacramento NWR and continuing northeastward.
b. Butte Creek – 1,295 hectares (6,400 acres) abutting the Upper Butte Basin management unit and continuing northeastward.
c. Cherokee Canal – 3,108 hectares (7,680 acres) abutting Gray Lodge/Butte Sink management unit and continuing northeastward.

A2 **Colusa Basin Recovery Unit**: Minimum of six habitat block pairs with no less than two block pairs per management unit in the Colusa Basin Recovery Unit. Additional protection along the watercourses in the Colusa Basin will provide for connectivity between existing populations of giant garter snakes and will protect habitat immediately on either side of the

[1] The 240 hectare blocks of perennial wetlands is derived from Wylie *et al.* (2010), who reported that a self-sustaining Badger Creek population of giant garter snakes is supported by 240 hectares of perennial wetlands. This acreage of perennial wetlands is also close to acreages preserved in several giant garter snake conservation banks. The 639 hectare blocks of active ricelands are also derived from Wylie *et al.* (2010) by calculating the acreage of ricelands needed to support a giant garter snake population of equivalent size to the self-sustaining population at Badger Creek. This was done by dividing the target population density from Badger Creek (Wylie *et al.* 2010) by the giant garter snake density observed in rice fields (Wylie *et al.* 2010) and using this ratio to determine the target acreage of ricelands, which is 639 hectares. These values do not represent a minimum or maximum acreage for either perennial wetlands or ricelands, but represent target values.

main watercourse at a minimum of 0.25 miles from each bank – 8,417 hectares (20,800 acres). Final protected watercourse length should extend at a minimum from the Glenn Colusa Canal in the north to the proximity of Ridge Cut Slough in the south.

A3 **Sutter Basin Recovery Unit**: Minimum of four habitat block pairs with no less than one block pair per management unit in the Sutter Basin Recovery Unit (areas with high flooding flows within the Sutter Bypass should be considered as unsuitable habitat). In order to provide connectivity between northern and southern populations additional protection should focus on the Sutter Bypass: 3,885 hectares (9,600 acres) comprising a continuous corridor along and outside of the western bank (levee) of the Sutter Bypass out to a width of 0.8 kilometers (0.5 miles) from the bank, and including the Tisdale Bypass 389 hectares (960 acres).

A4 **American Basin Recovery Unit:** Minimum of eight habitat block pairs with no less than one block pair per management unit in the American Basin Recovery Unit.

A5 **Yolo Basin Recovery Unit**: Minimum of five habitat block pairs with no less than one block pair per management unit in the Yolo Basin Recovery Unit (areas with high flooding flows within the Yolo Bypass should be considered as unsuitable habitat).

A6 **Cosumnes-Mokelumne Basin Recovery Unit**: Minimum of two pairs of habitat blocks in the Cosumnes-Mokelumne Basin Recovery Unit.

A7 **Delta Basin Recovery Unit**: Minimum of ten habitat block pairs with no less than two block pairs per management unit in the Delta Basin Recovery Unit.

A8 **San Joaquin Basin Recovery Unit**: Minimum of ten habitat block pairs with no less than two block pairs per management unit in the San Joaquin Basin Recovery Unit.

A9 **Tulare Basin Recovery Unit**: Minimum of two habitat block pairs in the Mendota management unit in the Tulare Basin Recovery Unit.

All Recovery Units

A10 Corridors of aquatic habitat with a 0.8-kilometer (0.5-mile) width hydrologically connect adjacent habitat block pairs within Recovery Units.

A11 Corridors hydrologically connect adjacent Recovery Units.

A12 Management plans are developed, implemented, and updated as needed for 20 years for all habitat blocks and corridors preserved for the giant garter snake listed in Criteria A1 through A9. Management plans will address as a minimum the following: water management to provide summer aquatic habitat, use of pesticides, best grazing regimes, fallowing of rice fields, eradication of invasive plants, operations and maintenance of canals and flood control structures, control of non-native predators, monitoring of native predators, location and use of roads within the conservation areas)

A13 Water supplied for use on all giant garter snake preserves will have annual water delivery requirements identified. Garter snake preserves are supplied with water of sufficient quantity to support the aquatic habitat component of the giant garter snake on that property in perpetuity and will be free of contaminants or will contain contaminants at levels that have been demonstrated to be harmless to giant garter snakes. Monitoring of annual water supplies and water quality standards reveals that water used to provide aquatic habitat is provided each year, and meets or exceeds quality standards over a 20-year monitoring program.

2. Recovery Criteria Factor B: Overutilization for commercial, recreational, scientific or educational purposes.

Overutilization for any purpose is not known to threaten the giant garter snake at this time. Therefore, no recovery criteria have been developed for this factor.

3. Recovery Factor C: Disease or Predation.

In order to ensure the long term recovery of the giant garter snake, threats to the species from disease or predation must be reduced or removed. This will have been accomplished if the following have occurred:

C1 Introduced snakes (*Nerodia* sp.) are either eradicated or reduced in numbers throughout the historical range of the giant garter snake to the point where the transmission of disease by these non-native snakes is no longer a threat (and competitive interactions are eliminated between introduced snakes and the giant garter snake).

C2 A management plan is developed and implemented to monitor for the effects of parasites, viruses, and fungi on the giant garter snake and any discovered threats to the giant garter snake from parasites, viruses, or fungi are controlled or ameliorated to an extent they are not a threat to the populations.

C3 Introduced game fish (e.g., largemouth bass and catfish), crayfish (e.g., signal and Louisiana crayfish), and bullfrogs that eat giant garter snakes and compete with giant garter snakes for smaller forage fish and amphibians are either eradicated or reduced in numbers throughout the historical range of the giant garter snake to the point where garter snakes are no longer threatened by predation or competition by introduced fish, crayfish and bullfrogs.

4. Recovery Factor D: Inadequacy of existing regulatory mechanisms.

If the threats under factors A, B, C and E are ameliorated or eliminated then additional regulatory mechanisms (beyond the existing ones) are not necessary.

5. Recovery Factor E: Other natural or manmade factors affecting its continued existence.

In order to ensure the long term recovery of the giant garter snake, the species must be protected from other natural or manmade factors known to affect its continued existence. This protection will have been accomplished if all of the preserved perennial marshes and ricelands host a stable population (i.e. the age-specific fertility and mortality rates remain constant) as determined from monitoring over a 20-year period that includes at least one consecutive 3-year period of dry or critically dry weather[2], and the following have occurred:

E1 These populations are protected from predicted alterations of habitat components due to climate change through the development of contingency plans that will provide resources to ensure habitat components are maintained at all preserves during adverse climatic

[2] There are multiple determinants of population dynamics of the giant garter snake. Populations of any species typically fluctuate over time depending on density dependent factors like births, deaths, emigrations, and immigration; and also may fluctuate as determined by a number of abiotic environmental factors, the level of resources, the life cycle of the species, and the influence of predators and parasites (Townsend *et al.* 2000). Thus a single year of population surveys is not an accurate portrayal of the stability of a population. Giant garter snake populations will similarly vary among years depending on annual weather patterns, local agricultural practices, degree of predation and recruitment, and other demographic factors. In order to determine whether giant garter snake populations are stable we use 20 years of monitoring as a period of time that will include multiple generations (4 or 5 generations based on the average of 5 years for females to reach sexual maturity) and reflect long-term trends in both demographics and local habitat suitability in response to weather and land use patterns (B. Halstead pers. comm. 2015, E. Hansen pers. comm. 2015).

conditions, such as extended periods of drought, or extended periods of above average temperatures.

E2 The density found during trapping is at least an average 8 snakes per hectare for buffered perennial wetlands and 3 snakes per hectare for active ricelands.

E3 The population estimate and density are used for a trend analysis over a 20-year period that demonstrates a 90 percent probability that the population is stable or increasing.

E4 The habitat requirements described in delisting criteria A/1 – A/9 are available during all surveys.

E5 The sex ratio is not significantly different than 1:1.

E6 Age structure analysis reveals that recruitment is occurring at a level that will prevent a senescent population.

E7 Road mortalities of giant garter snakes are reduced to a level that does not cause declines to populations.

III. RECOVERY ACTION NARRATIVE AND IMPLEMENTATION SCHEDULE

A. Recovery Action Narrative

This chapter lays out the elements of the recovery strategy, then tiers them down to individual recovery actions for implementation. Each most-detailed or stepped-down action has been assigned a priority according to our determination of what is most important for the recovery of giant garter snake. The priority numbers are defined as follows:

Priority 1: An action that must be taken to prevent extinction or to prevent a species from declining irreversibly.

Priority 2: An action that must be taken to prevent a significant decline in the species population/habitat quality or some other significant negative impact short of extinction.

Priority 3: All other actions necessary to provide for full recovery of the species.

Because situations change over time, priority numbers must be considered in the context of past and potential future actions at all sites. Therefore, the priority numbers assigned are intended to guide, not to constrain, the allocation of limited conservation resources.

1. Protect existing habitat, areas identified for habitat restoration or creation, and areas needed to provide connectivity between populations.

Protection of giant garter snake populations includes preserving and restoring the habitat necessary to maintain existing populations, providing for population increase, and ensuring that numbers and populations of giant garter snakes are self-sustaining and sufficient to maintain genetic diversity and adaptive potential of the species.

1.1 Protect, secure, and restore habitat distributed across the historical range of the giant garter snake. All habitat with known giant garter snake populations, based on locality record data, that is currently unprotected should be protected and secured. Habitat for the giant garter snake will be preserved in pairs of contiguous blocks of land as described in the recovery criteria above. (Priority 1)

1.2 Protect and secure corridors linking habitat blocks (within and between management units) and recovery units. Corridors for the giant garter snake need to be protected with an emphasis on accommodating movement that allows genetic exchange between giant garter snakes occupying habitat blocks and between management units and recovery units. (Priority 2)

1.3 Work with city and county governments to buffer areas identified for protection as habitat for the giant garter snake to minimize the effects of urban development on giant garter snakes and their habitat. Buffers may be secured and protected through acquisition,

conservation or agricultural easements, through land use planning, or development of regional conservation plans. (Priority 2)

1.4 Establish an incentive or easement program(s) to encourage private landowners and local agencies to provide or maintain agricultural practices (e.g. rice cultivation) and wetland habitats that benefit the giant garter snake. Work with nonprofit organizations (such as land trusts) to assist private landowners in conserving and recovering the giant garter snake through economic and other incentive programs. Agricultural incentives should be developed and made available to landowners and water districts and users who conserve giant garter snakes on their property or who may provide suitable habitat. (Priority 1)

2. Develop and implement appropriate management of habitat on public and private wetlands and conservation lands, including specific practices for agricultural operations, water conveyance systems, and flood control systems that maintain either summer seasonal wetlands, perennial wetlands, or ricelands.

2.1 Service-approved management plans that incorporate adaptive management should be developed, approved, and implemented for habitat blocks and corridors. Management plans should include specific resource and habitat objectives and monitoring that ensure suitable habitat is restored and maintained, and include measures to minimize the impacts of habitat management activities on giant garter snakes and their habitat. Management plans should be developed in coordination with local landowners and water managers to ensure that they are workable and effective. (Priority 1)

2.2 Develop and periodically update best management guidelines for giant garter snake habitat occurring outside of conservation lands that: (1) minimize the risk of physical injury to giant garter snakes from ground disturbing activities, use of heavy equipment, and vehicle use; (2) minimize the amount and frequency of habitat disturbance; and (3) allow establishment and/or maintenance of habitat for giant garter snakes. Guidelines should be developed for ricelands, canals and ditches, flood control structures, water transfers, and private wetlands in coordination with local landowners and water managers to ensure that they are workable and effective. (Priority 1)

2.3 Work with California Department of Transportation and the Federal Highway Administration to minimize effects of roadway expansion and increased use associated with urbanization by incorporating protective measures into project planning to minimize the effects of roads to giant garter snakes and giant garter snake habitat. (Priority 2)

3. Improve water quality in areas occupied by the giant garter snake and affected by poor water quality conditions.

3.1 Work with appropriate agencies to ensure the improvement of water quality within known-contaminated water bodies occupied by the giant garter snake. Review the Clean Water Act (303(d)) list of impaired water bodies in California produced by the USEPA to determine which impaired water bodies supply water to any known giant garter snake habitat and work with appropriate federal and state authorities to promote improvement of water quality in those waters. (Priority 2)

3.2 Study the effects of selenium, mercury, and other contaminants on giant garter snakes and their prey. (Priority 3)

3.3 Investigate, develop and implement a means to supply uncontaminated water to State and Federal wildlife refuges (such as Grasslands Ecological Area, Volta WA). (Priority 1)

4. When feasible, ensure summer water is available for wetland habitats used by the snake.

Explore, develop and implement methods to assure quantity and timing of water deliveries to meet habitat objectives for all conservation lands developed and protected for the giant garter snake. The USFWS, CDFW, and other species experts will work with the USBR, the Army Corps of Engineers, and local municipal water agencies to assure adequate water will be available to support the giant garter snake habitat and management needs at those locations where populations exist, acknowledging that fluctuating environmental conditions (e.g. drought) and other conflicting water uses may preclude the availability of adequate water for the giant garter snake during certain years.

4.1 Identify total water requirements to maintain and/or restore habitats according to management plans developed under recovery action 2 on all conservation lands identified in recovery action 1. (Priority 1)

4.2 Evaluate the current, existing water supply and determine whether additional water is necessary to meet habitat needs and management goals determined and identified in recovery action 4.1 for each of the conservation lands identified in recovery action 1. For areas where additional water needs have been identified, secure sufficient water to fully develop or manage habitat for the giant garter snake. (Priority 1)

5. Monitor populations and habitat to assess success or failure of management activities and habitat protection efforts.

Monitoring is needed to establish population trends, to determine if and when additional management actions should be performed, and to determine the efficacy of management actions. A standardized protocol developed under recovery action 6.1 is needed to ensure consistency of monitoring performed by different entities and at different times.

Monitoring must be based on multiple biological and physical factors, not just on number of individuals captured. Monitoring should document changes in habitat quantity and quality over time. During development of monitoring plans, the development and implementation of population viability analyses should be considered and incorporated where possible using data collected during monitoring programs (see recovery actions 7.4.1 through 7.4.4).

5.1 Develop and incorporate into management plans, monitoring programs for giant garter snake habitat and presence and abundance on all lands preserved for the giant garter snake. (Priority 1)

6. Conduct surveys and research to identify areas requiring protection and management.

6.1 Develop habitat assessment protocols to measure the suitability of giant garter snake habitat and conduct habitat assessments, habitat suitability analysis and mapping, and conduct surveys using the most recent protocols within the recovery units to assess giant garter snake populations and where the best habitat exists for potential conservation. (Priority 1)

7. Conduct research focused on the management needs of the species, and on identifying and removing threats.

7.1 Conduct research on the habitat requirements of the giant garter snake.

7.1.1 Determine habitat use and prey requirements of neonatal, juvenile, and adult giant garter snakes and examine the use of upland habitats by the giant garter snake to determine the amounts and types of upland habitats required to support giant garter snakes. (Priority 1)

7.1.2 Examine occurrence in and use of riparian habitats by the giant garter snake to determine if additional areas require management for the giant garter snake. (Priority 2)

7.1.3 Determine buffer requirements for protecting giant garter snakes and their habitat from incompatible uses, such as urban development and roadways. (Priority 2)

7.1.4 Examine use of corridors between conservation lands to determine use and effectiveness of protecting corridors. (Priority 1)

7.1.5 Examine response of giant garter snakes to managed marsh restoration to determine effectiveness of restoration efforts and to modify restoration techniques as necessary to benefit the giant garter snake. (Priority 1)

7.2 Conduct research on life history and population characteristics of giant garter snakes.

7.2.1 Determine the movement patterns of giant garter snakes, including home ranges, daily and annual movements, and dispersal abilities over a broad range of size classes, among different habitat types, across the giant garter snake's range. (Priority 2)

7.2.2 Determine demographic information on reproductive and mortality rates, clutch sizes, fecundity, age and size at sexual maturity, and population sizes and densities among different habitat types and across the giant garter snake's range. (Priority 1)

7.2.3 Determine movement of giant garter snakes in response to changes to various external conditions (such as changes in habitat conditions or management). (Priority 2)

7.3 Determine genetic relatedness among populations of giant garter snakes within and between recovery units and identify landscape features that serve as barriers to dispersal. (Priority 2)

7.4 Conduct population viability analyses.

Population viability analysis (PVA) is the use of quantitative methods to analyze the environmental and demographic factors that affect the survival of populations. Population viability analyses may be used to refine recovery criteria and tasks in a number of ways. (Priority 2)

7.5 Conduct research on threats and propose actions to ameliorate those threats. Research is needed to determine extent of threats and to develop methods to ameliorate those threats.

7.5.1 Study the effects of parasites, viruses, fungi, and introduced predators and plants (e.g. *Ludwigia hexapetala* (water primrose)) on giant garter snake populations, and develop and implement a management program to monitor affected populations. (Priority 2)

7.5.2 Determine the effects of flooding on the survival of the giant garter snake. Although giant garter snakes evolved in the Central Valley and likely are adapted to withstand some flooding of habitats, reclamation and flood control activities have altered the timing, duration, and severity of floods. (Priority 2)

7.5.3 Determine how to minimize the effects of water transfers to the giant garter snake and its habitat and develop and implement guidelines for water transfers that minimize the effects of transfers to the giant garter snake and its habitat. (Priority 1)

7.5.4 Determine the effects of erosion control netting products on snake movement, and recommend ways to ameliorate negative effects if found. Determine which products have the least chance of negatively affecting the giant garter snake and provide a list of these products for consideration during section 7 consultations. (Priority 2)

7.5.5 Collaborate with the California Climate Change Center to investigate the effects of climate change on the giant garter snake and its habitat. Information developed will, in part, inform development of adaptive management guidelines that should be implemented throughout the range of the giant garter snake. (Priority 2)

8. Establish and implement outreach and education, which includes the participation of landowners, interested public and stakeholders, and other Federal, State, and local agencies.

8.1 Distribute guidelines for land use practices compatible with giant garter snake conservation to landowners and agencies and distribute to appropriate land managers and partners (farmers, ranchers). (Priority 1)

8.2 Develop and distribute informational material on the habitat and management needs of the giant garter snake to interested and affected private landowners. (Priority 2)

8.3 Develop and distribute outreach and education materials for public and conservation land managers. (Priority 2)

8.4 Form a Recovery Implementation Team that cooperatively implements specific recovery actions necessary to recover the giant garter snake. (Priority 1)

9. Re-establish populations within the giant garter snake's historical range.

Since giant garter snakes have been extirpated over a portion of their range and several populations are now at risk of extirpation, repatriation may be necessary for recovery of the giant garter snake. Specific sites for repatriation are not currently identified; however the first sites will be in the San Joaquin Basin Recovery Unit or Tulare Basin Recovery Unit since these populations are more at risk than in the Sacramento Valley.

The first step is to research the possibility of conducting translocations to either augment populations with low numbers of individuals or to reintroduce individuals into historically occupied areas. If translocation is deemed unfeasible or undesirable, then a controlled propagation program must be conducted in a manner that will, to the maximum extent possible, preserve the genetic and ecological distinctness of the listed species, and minimize risks to existing wild populations.

9.1 Identify suitable repatriation sites based on results of surveys and habitat assessments including analysis of the habitat and management requirements necessary to successfully

reintroduce giant garter snakes and current threats at potential reintroduction sites. The historical range of the giant garter snake in the San Joaquin Basin and the Tulare Basin Recovery Units should be assessed and surveyed for suitable repatriation sites or areas and to verify that no giant garter snakes already inhabit potential repatriation sites. (Priority 2)

9.2 Develop and implement a captive propagation and repatriation plan (including genetics management plan) for specific sites if repatriation is determined to be necessary to prevent local extirpations and feasible. (Priority 2)

The purpose of a genetics management plan is to provide a framework for evaluating giant garter snake conservation options from a genetics perspective. The genetics management plan would include a review and synthesis of the most recent genetic studies, along with an examination of the implications for management and recovery. The ultimate goal of the plan would be to aid in management and decision-making for the species, specifically for repatriation, captive propagation, and determination of genetically important populations.

B. Implementation Schedule

The implementation schedule that follows outlines actions for this revised draft recovery plan. It is a guide for meeting the objectives discussed in Chapter III of this revised draft recovery plan. This schedule describes and prioritizes recovery actions, provides an estimated time table for performance of recovery actions, and indicates the responsible agencies. **Because recovery plans are guidance and planning documents, they do not obligate partners to carry out actions, nor do they provide funds to carry out actions.** These actions, when accomplished, should further the recovery and conservation of the covered species.

Total Estimated Cost of Recovery and Date of Recovery: To best provide for the conservation and recovery of giant garter snake, we will maximize partnerships with federal, State, and non-governmental partners. The estimated cost of recovery actions is detailed in the Implementation Schedule below. In developing an estimate of the cost of recovery, however, there were certain recovery actions for which we were unable to develop reliable cost estimates. These actions consisted primarily of habitat protection, restoration, and management. Such actions include the purchase of easements or land in core areas and corridors linking such habitat, and the development and implementation of adaptive management plans. These recovery actions place an emphasis on multiple species protection and management by developing and implementing conservation measures to restore and protect the processes that maintain healthy ecosystems. Such actions contribute not only to conservation of giant garter snakes, but also to the conservation of wetland ecosystems which support the giant garter snake and associated species and communities of conservation concern such as Central Valley waterfowl and shorebird populations, along with important ecosystem functions such as groundwater recharge. Therefore, actions to protect and manage wetland ecosystems are likely to be implemented through other authorities for these multiple species or other conservation goals, yet are included in the recovery actions here because they are compatible with and contribute to recovery efforts for the giant garter snake. Although we include the actions, it is not practicable to determine the proportion of the costs of these actions that would be attributable solely to giant garter snake recovery. In addition, widely fluctuating land cost in the recovery area, and flexibility in the specific locations and methods of habitat protection, restoration and management make estimates of such costs unreliable. As such, the cost of these actions will be determined as implementation progresses.

Delisting could be initiated by 2047 if recovery criteria have been achieved in the next 30 years. The core of the recovery strategy, protection of habitat and corridors, is likely to take a minimum 10 years to achieve, but may take significantly longer. Following the protection of habitat, an additional 20-year monitoring period is recommended to cover multiple generations (four to five generations) to ensure that giant garter snake populations are self-sustaining.

We believe that considerable positive conservation can occur by working with agencies and landowners to conduct recovery actions and working toward acquisition of the highest priority areas. The Service will establish a Recovery Implementation Team (RIT) upon completion of a final recovery plan. The RIT will be a broad-based group of stakeholders and will help to identify the highest priority tasks for early implementation. The RIT will monitor the success of early implementation efforts and, depending on the giant garter snake's progress toward recovery, determine if all of the measures outlined in the plan are necessary. Therefore, we believe that the recovery measures outlined in this plan are a comprehensive approach for recovery of the giant garter snake; however, recovery may be achieved without all measures in this plan being implemented, resulting in a decrease in cost and time to recovery.

Key to Terms and Acronyms used in the Implementation Schedule

Definitions:
Continual - A recovery action that will be implemented on a routine basis once begun.
Ongoing - A recovery action that is currently being implemented and will continue until action is no longer necessary.
Unknown - Either recovery action duration or associated costs are not known at this time.
TBD - To be determined

Responsible parties:
BLM - U.S. Bureau of Land Management
BRD - Biological Resources Division (USGS)
CITY – Local City
CDFW - California Department of Fish and Wildlife
CDOT - California Department of Transportation
COE - U.S. Army Corps of Engineers
COUN – Local County
CDPR - California Department of Parks and Recreation
CPP - Conservation program participant (easements, incentives)
CRIA - California Rice Industry Association
DPR - California Department of Pesticide Regulations
DWR - California Department of Water Resources
FCD – Local Flood Control District
FHWA - Federal Highways Administration
MVCD - Mosquito and Vector Control District
NCWA - Northern California Water Association
NGO - Non-government Organization
NRCS - Natural Resources Conservation Service
PLO - Private landowner or party
RB/DWR - Reclamation Board/California Department of Water Resources

(includes levee and reclamation districts)
RCD - Resource Conservation District
SJCOG – San Joaquin Council of Governments
SWRCB - State Water Resources Control Board
USBR - U.S. Bureau of Reclamation
USEPA - Environmental Protection Agency
USFWS - U.S. Fish and Wildlife Service
WD – Local Water District

The most likely lead responsible party is listed in bold in the following Implementation Schedule.

Implementation Schedule for the Giant Garter Snake											
Recovery Action Information					Cost estimate in $1,000 units						
Priority	Action Number	Description	Duration	Responsible Parties	Total Costs	2016	2017	2018	2019	2020	Comments/Notes
1	1.1	Protect, secure, and restore habitat distributed across the historical range of the giant garter snake.	Ongoing	**USFWS**, CDFW NGO, PLO, CPP, RCD, SJCOG, USBR, CDPR, RB/DWR	TBD						
2	1.2	Protect and secure corridors linking habitat blocks (within and between management units) and recovery units. Corridors for the giant garter snake need to be protected with an emphasis on accommodating movement that allows genetic exchange between giant garter snakes occupying habitat blocks and between management units and recovery units.	Ongoing	USFWS, CPP, **NGO,** CDFW	TBD						
2	1.3	Work with city and county governments to buffer areas identified for protection as habitat for the giant garter snake to minimize the effects of urban development on giant garter snakes and their habitat.	Continual	USFWS, CIT, **COUN**	0	0	0	0	0	0	
1	1.4	Establish an incentive or easement program(s) to encourage private landowners and local agencies to provide or maintain agricultural practices and wetland habitats that benefit the giant garter snake. Work with nonprofit organizations to assist private landowners in conserving and recovering the giant garter snake through economic and other incentive programs. Agricultural incentives should be developed and made available to landowners and water districts and users who conserve giant garter snakes on their property or who may provide suitable habitat.	Ongoing	USFWS, CDFW, **NRCS**, USBR, DWR, CRIA, NCWA	13,630	1,300	1,300	1,300	1,300	1,300	
2	2.1	Service-approved management plans that incorporate adaptive management should be developed, approved, and implemented for habitat blocks and corridors.	Continual	**USFWS**, **CDFW**, **NGO**, PLO, CPP. **BLM**	TBD						

Implementation Schedule for the Giant Garter Snake											
Recovery Action Information					Cost estimate in $1,000 units						
Priority	Action Number	Description	Duration	Responsible Parties	Total Costs	2016	2017	2018	2019	2020	Comments/Notes
1	2.2	Develop and periodically update best management guidelines for giant garter snake habitat occurring outside of conservation lands that: (1) minimize the risk of physical injury to giant garter snakes from ground disturbing activities, use of heavy equipment, and vehicle use; (2) minimize the amount and frequency of habitat disturbance; and (3) allow establishment and/or maintenance of habitat for giant garter snakes. Guidelines should be developed for ricelands, canals and ditches, flood control structures, water transfers, and private wetlands.	Continual	**USFWS**, CDFW, BRD**, CRIA**, NCWA	232	60	144	0	0	0	
2	2.3	Work with California Department of Transportation and the Federal Highway Administration to minimize effects of roadway expansion and increased use associated with urbanization by incorporating protective measures into project planning to minimize the effects of roads to giant garter snakes and giant garter snake habitat.	Ongoing, Continual	USFWS, CDFW, **CDOT**, FHWA	5	0.5	0.5	0.5	0.5	0.5	
2	3.1	Work with appropriate agencies to ensure the improvement of water quality within known-contaminated water bodies occupied by the giant garter snake.	2 years	**USFWS**, USEPA, CDFW	9.4	4	5.4	0	0	0	
3	3.2	Study the effects of selenium, mercury, and other contaminants on giant garter snakes and their prey.	4 years	USFWS, CDFW, **BRD**, USBR, NGO	1,200	300	300	300	300	0	
1	3.3	Investigate, develop and implement a means to supply uncontaminated water to State and Federal wildlife refuges (such as Grasslands Ecological Area, Volta WA).	5 years	USFWS, CDFW, BRD, USBR, USEPA, **DWR**, **FCD**	79,000	0	1,300	16,300	16,400	15,000	
1	4.1	Identify total water requirements to maintain and/or restore habitats according to management plans developed under recovery action 2 on all conservation lands identified in recovery action 1.	Ongoing	**USFWS**, CDFW, CPP	62.3	6	6	6	6	6	
1	4.2	Evaluate the current, existing water supply and determine whether additional water is necessary to meet habitat needs and management goals.	Ongoing	**USFWS**, CDFW, CPP, USBR, WD, SWRCB	124.5	12.4	12.4	12.4	12.4	12.4	

Implementation Schedule for the Giant Garter Snake											
Recovery Action Information					Cost estimate in $1,000 units						
Priority	Action Number	Description	Duration	Responsible Parties	Total Costs	2016	2017	2018	2019	2020	Comments/Notes
1	5.1	Develop and incorporate into management plans, monitoring programs for giant garter snake habitat and presence and abundance on all lands preserved for the giant garter snake.	Ongoing, Continual	**USFWS**, **CDFW**, USBR, CPP, BRD, **NGO**	11,890	0	575	479	714	384	
1	6.1	Develop habitat assessment protocols to measure the suitability of giant garter snake habitat and conduct habitat assessments, habitat suitability analysis and mapping, and conduct surveys using the most recent protocols within the recovery units to assess giant garter snake populations and where the best habitat exists for potential conservation.	Ongoing	**USFWS**, CDFW, BRD	TBD						
1	7.1.1	Determine habitat use and prey requirements of neonatal, juvenile, and adult giant garter snakes and examine the use of upland habitats by the giant garter snake to determine the amounts and types of upland habitats required to support giant garter snakes.	3 years	USFWS, CDFW, **BRD**, USBR, NGO	452	1	1	150	150	150	
2	7.1.2	Examine occurrence in and use of riparian habitats by the giant garter snake to determine if additional areas require management for the giant garter snake.	5 years	USFWS, CDFW, **BRD**, USBR, NGO	200	40	40	40	40	40	
2	7.1.3	Determine buffer requirements for protecting giant garter snakes and their habitat from incompatible uses, such as urban development and roadways.	2 years	USFWS, CDFW, **BRD**, USBR, NGO	260	0	0	130	130	0	
1	7.1.4	Examine use of corridors between conservation lands to determine use and effectiveness of protecting corridors.	2 years	USFWS, CDFW, **BRD**, USBR, NGO	5	2.5	2.5	0	0	0	
1	7.1.5	Examine response of giant garter snakes to managed marsh restoration to determine effectiveness of restoration efforts and to modify restoration techniques as necessary to benefit the giant garter snake.	10 years	USFWS, CDFW, **BRD**, USBR, NGO	20	0	0	20	0	0	
2	7.2.1	Determine the movement patterns of giant garter snakes, including home ranges, daily and annual movements, and dispersal abilities over a broad range of size classes, among different habitat types, across the giant garter	Ongoing	USFWS, CDFW, **BRD**, USBR, NGO	500	20	20	20	20	20	

Implementation Schedule for the Giant Garter Snake											
Recovery Action Information					Cost estimate in $1,000 units						
Priority	Action Number	Description	Duration	Responsible Parties	Total Costs	2016	2017	2018	2019	2020	Comments/Notes
		snake's range									
1	7.2.2	Determine demographic information on reproductive and mortality rates, clutch sizes, fecundity, age and size at sexual maturity, and population sizes and densities among different habitat types and across the giant garter snake's range.	Ongoing	USFWS, CDFW, **BRD**, USBR, NGO	500	20	20	20	20	20	
2	7.2.3	Determine movement of giant garter snake in response to changes to various external conditions	2 years	USFWS, CDFW, **BRD**, USBR, NGO	10	5	5	0	0	0	
2	7.3	Determine genetic relatedness among populations of giant garter snakes within and between recovery units and identify landscape features that serve as barriers to dispersal.	Ongoing	USFWS, CDFW, **BRD**, USBR, NGO	310	27.5	37.5	37.5	37.5	37.5	
2	7.4	Conduct population viability analyses. Population viability analysis (PVA) is the use of quantitative methods to analyze the environmental and demographic factors that affect the survival of populations. Population viability analyses may be used to refine recovery criteria and tasks in a number of ways.	Ongoing	USFWS, CDFW, **BRD**, USBR, NGO	540	0	100	100	105	102.5	
2	7.5.1	Study the effects of parasites, viruses, fungi, and introduced predators and plants (e.g. *Ludwigia hexapetala* (water primrose)) on giant garter snake populations, and develop and implement a management program to monitor affected populations.	5 years	USFWS, CDFW, **BRD**, USBR, NGO	500	0	100	100	100	100	
2	7.5.2	Determine the effects of flooding on the survival of the giant garter snake. Although giant garter snakes evolved in the Central Valley and likely are adapted to withstand some flooding of habitats, reclamation and flood control activities have altered the timing, duration, and severity of floods.	5 years	USFWS, CDFW, **BRD**, USBR, COE, NGO	50	5	5	5	5	5	
1	7.5.3	Develop guidelines for water transfers that minimize the effects of transfers to the giant garter snake and its habitat and develop and implement guidelines for water transfers that minimize the effects of transfers to the giant	5 years	USFWS, CDFW, **BRD**, USBR, NGO, RB/DWR.	6,000	700	700	700	700	700	.

Implementation Schedule for the Giant Garter Snake											
Recovery Action Information					Cost estimate in $1,000 units						
Priority	Action Number	Description	Duration	Responsible Parties	Total Costs	2016	2017	2018	2019	2020	Comments/Notes
		garter snake and its habitat.									
2	75.4	Determine the effects of erosion control netting products on snake movement, and recommend ways to ameliorate negative effects if found. Determine which products have the least chance of negatively affecting the giant garter snake and provide a list of these products for consideration during section 7 consultations.	2 years	USFWS, CDFW, **BRD**, USBR, NGO, COE, CDOT	5	2.5	2.5	0	0	0	
2	7.5.5	Collaborate with the California Climate Change Center to investigate the effects of climate change on the giant garter snake and its habitat. Information developed will, in part, inform development of adaptive management guidelines that should be implemented throughout the range of the giant garter snake.	Ongoing	USFWS, CDFW, **BRD**, USBR, NGO	20	10	5	5	0	0	
1	8.1	Distribute guidelines for land use practices compatible with giant garter snake conservation to landowners and agencies and distribute to appropriate land managers and partners (farmers, ranchers)	Continual	**USFWS**, CDFW, BRD, USBR, COE, NRCS, RB/DWR, CRIA, NCWA	15	5	5	1	1	0.5	
2	8.2	Develop and distribute informational material on the habitat and management needs of the giant garter snake to interested and affected private landowners.	Continual	**USFWS**, CDFW	5	0	0.5	0.5	0.5	0.5	
2	8.3	Develop and distribute outreach and education materials for public and conservation land managers.	Continual	**USFWS**, CDFW	400	20	20	20	20	20	
1	8.4	Form a Recovery Implementation Team that cooperatively implements specific recovery actions necessary to recover the giant garter snake.	Continual	**USFWS**, BRD, NGO, CDFW	5	5	0	0	0	0	
2	9.1	Identify suitable repatriation sites based on results of surveys and habitat assessments including analysis of the habitat and management requirements necessary to successfully reintroduce giant garter snakes and current threats at potential reintroduction sites. The historical range of the giant garter	unknown	USFWS, **BRD**, NGO, CDFW	190	0	0	0	0	10	

Implementation Schedule for the Giant Garter Snake											
Recovery Action Information					Cost estimate in $1,000 units						
Priority	Action Number	Description	Duration	Responsible Parties	Total Costs	2016	2017	2018	2019	2020	Comments/Notes
		snake in the San Joaquin Basin and the Tulare Basin Recovery Units should be assessed and surveyed for suitable repatriation sites or areas and to verify that no giant garter snakes already inhabit potential repatriation sites.									
2	9.2	Develop and implement a captive propagation and repatriation plan (including genetics management plan) for specific sites if repatriation is determined to be necessary to prevent local extirpations and feasible.	unknown	**USFWS**, BRD, CDFW, NGO	330	0	5	10	10	10	
Total Estimated Cost[3]: $17,313,138 – $116,470,200											

[3] Because we cannot envision the exact course that recovery may take and because our understanding of the vulnerability of a species to threats is very likely to change as more is learned about the species and its threats, it is possible that a status review may indicate that delisting is warranted without the necessity of implementing all of the actions described in the implementation schedule. A review of the recovery plans for domestic vertebrate species that have been delisted due to recovery indicates that between 15% and 100%, with an average of 60%, of recovery actions are initiated in the process of accomplishing species recovery. Applying this range to the actions described in this recovery plan suggests that the potential cost range for achieving recovery is between $17,313,318 and $116,470,200 plus additional cost that cannot be determined at this time (see page III-6).

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V. APPENDIX

Public Comment and Peer Review on the Revised Draft Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*)

Responses to Public Comments:

Comment: *One commenter objected to the western boundary for the Yolo Basin Recovery Unit (YBRU) in Solano and Yolo Counties for the following reasons: 1) The YBRU boundaries cover a much broader area of Solano County than the Conservation Area boundaries that were developed for the Solano County Habitat Conservation Plan (HCP) in cooperation with the Service, CDFW, local stakeholders, and other agencies over the last 16 years; 2) the YBRU doesn't conform to any boundaries of an identified watershed basin as identified by the cited sources in the Recovery Plan, and it actually splits across multiple official watershed designations that are regularly employed by the Service and other agencies to define watersheds. Historically, the drainages in the western portion of the YBRU likely contained flowing water only during the rainy season (Kuchler, 1977) and were likely dry most of the March through November time frame identified in the Recovery Plan as a "steadfast" requirement for giant garter snake habitat; 3) based on the habitat conditions in Solano County within the proposed YBRU and trapping studies conducted by USGS in 2004 and 2005 (Wylie), it appears that the waterways within the majority of the YBRU do not currently support giant garter snakes. The commenter expressed concern that inconsistencies between the YBRU and the Solano County HCP Conservation Area for the giant garter snake will increase regulatory compliance costs for the public and fail to provide movement corridors or any other benefit for giant garter snake recovery. The commenter recommends close coordination with the Solano County Water Agency and the Yolo Habitat Conservancy to make the YBRU more consistent with the giant garter snake Conservation Area in the Solano County HCP, which is smaller and corresponds to the perennial waterways and lower tributaries of the western Delta, Yolo Bypass, and lower portions of Putah Creek.*

Response: The Recovery Unit boundaries are not intended to match perfectly with Conservation Area boundaries for the Solano County HCP because the goals of the Recovery Plan and the HCP are different. The goal of the Recovery Plan is to "establish and protect self-sustaining populations of the giant garter snake throughout the full ecological, geographical, and genetic range of the species," whereas the goals of the Solano County HCP are "to promote the conservation of biological diversity and the preservation of endangered species and their habitats consistent with the recognition of private property rights; provide for a healthy economic environment for the citizens, agriculture, and industries; and allow for ongoing maintenance and operation of public and private facilities in Solano County". Incorrect citations were listed in the description of giant garter snake recovery units in the Recovery Plan (page II-2). The Recovery Unit boundaries were developed primarily using the habitat suitability model discussed in Halstead et al. (2010). We have updated the language in this section of the recovery plan accordingly. Although the western boundary of the YBRU is considered to be of "low suitability" for the giant garter snake according to the model, it is still considered suitable habitat which may be useful for connectivity and ultimately, recovery. The absence of recent giant garter snake occurrences from a specific area a) does not mean that giant garter snakes do not exist in that area or use it as a corridor and b) does not preclude future habitat restoration and repatriation of giant garter snakes at that location. Regardless of the existence of a Recovery Plan, Federal and non-Federal actions that may affect or take giant garter snakes and their habitat will be reviewed by the USFWS under ESA Section 7 and Section 10 processes, including the measures outlined in the HCP. We believe that the currently designated YBRU encompasses an area of land that is appropriate for recovery actions for giant garter snake. The Service intends to work

closely with all agencies and individuals involved in the development of HCPs when establishing a Recovery Implementation Team for the giant garter snake.

Comment: *One commenter stated that the Service's view toward flood infrastructure maintenance activities in the 2015 Revised Recovery Plan has changed significantly since the publication of the 1993 Federal Register Final Rule (58 FR 54064) listing of the giant garter snake, the 1999 Draft Recovery Plan, and the 2006 and 2012 5-Year Reviews for this species. Clarification is sought as to the rationale used to reach the conclusion that flood maintenance activities are now considered by the Service to be current threats to the giant garter snake.*

Response: The Service's standpoint on the impact of flood maintenance activities on the giant garter snake and its habitat have not changed significantly since the listing of the snake. The 1993 Listing Rule states, "… intensive control of vegetation along water delivery and drainage facilities eliminates remaining habitat and prevents reestablishment of former habitat (Hansen 1983; Brode and Hansen 1992; G. Hansen, pers. comm., 1902; Brode, pers. comm., 1992). Such activities can kill or injure snakes, remove critical escape cover, eliminate prey populations, and destroy small mammal burrows and other soil fissures needed as winter retreat habitat." Both the 2006 and the 2012 Giant Garter Snake 5-Year Reviews echo these sentiments, adding that, "Much of the remaining giant garter snake habitat is subject to flood control and canal maintenance activities, subjecting the snake to on-going risks of mortality and injury and the effects of habitat degradation. Since the last status review it appears that flood control and canal maintenance remain potential threats to the giant garter snake." Both 5-Year Reviews discuss the various flood control maintenance activities, including weed and rodent eradication, de-silting, excavation and re-sloping of ditches and channels, deposition of ditch and canal spoils materials on adjacent property, placement of fill material within the canal, and control of vegetation in and around canals, ditches, and drains by mowing and other measures. All of these activities are noted to have deleterious impacts to giant garter snakes and their habitat. The stance set forth by the Service regarding levee and canal maintenance activities in the Revised Recovery Plan closely aligns with that of the 1993 Listing Rule and the 5-Year Reviews published in 2006 and 2012.

Comment: *A similar comment was made regarding the apparent use of contradictory statements in the Recovery Plan about the effects of levee and canal maintenance on giant garter snake. Specifically, the commenter addressed one of the qualitative requirements for ideal aquatic habitat in the Recovery Plan: "absence of recurrent flooding, or where flooding is probable, the presence of upland refugia". The commenter indicates that this statement is contrary to the Service's designation of levee and canal maintenance as significant threats and flooding as a non-significant threat. The commenter also noted that many levee and canal maintenance activities can be beneficial to the giant garter snake and its habitat, including invasive species removal, vegetation trimming and limbing up, gravelling roadways, and sediment removal from canals.*

Response: It is important to note that although the Service did not find flooding to be a significant threat, it is still identified as a threat to giant garter snakes. As the Recovery Plan discusses, the giant garter snake evolved in the Central Valley, and therefore probably adapted to withstand some natural flooding events. However, the timing, duration, and severity of floods have changed over time as a result of anthropogenic activities, and it is these human-caused activities (reclamation and flood control) that the Service has deemed a threat to the giant garter snake. The Service agrees that not all levee and canal maintenance activities are detrimental to giant garter snakes and their habitat, and in fact, some maintenance activities likely provide some benefit to the giant garter snake. Recovery Criterion A12 discusses the development/implementation of management plans for the

designated giant garter snake habitat blocks and corridors to ensure that canals and flood control structures are operated and maintained with the giant garter snake in mind.

Comment: *One commenter expressed concerns that flood control and maintenance activities will be restricted or significantly modified in the designated Recovery Units because of language in the Recovery Criteria and Actions sections of the Draft Recovery Plan. They believe this language conflicts with statutory obligations of certain agencies to provide for flood protection.*

Response: The intent of the recovery plan is not to restrict flood control and water delivery agencies from carrying out their missions. As a guidance document, the recovery plan does not place restrictions on flood control, reclamation, or water districts. The recovery plan recommends several recovery actions to minimize the effects of canal and water conveyance management activities on giant garter snakes. These include developing and updating guidelines for canal maintenance, incentive programs to assist water agencies and users in developing and implementing conservation measures, and outreach and education programs. Regardless of the existence of a Recovery Plan, Federal and non-Federal actions that may affect or take giant garter snakes and their habitat will be reviewed by the USFWS under ESA Section 7 and Section 10 processes, including maintenance and improvements of water conveyance facilities.

Comment: *One commenter also stated that the 2015 Revised Recovery Plan does not explain the Service's change in its view regarding the threat of flooding to the species since the 1993 Listing Rule, 1999 Draft Recovery Plan, and 2006 and 2012 5-Year Reviews. This commenter also recommended that additional research efforts on the impact of flooding to the survival of the giant garter snake be incorporated into the Recovery Plan.*

Response: The Service's opinion on flooding impacts to giant garter snakes has not changed significantly since the 1993 Listing Rule. The Listing Rule and the 2006 and 2012 5-Year Reviews all acknowledge that flooding is a threat to the giant garter snake, but none of them made the claim that flooding is a "significant" threat to the snake. All of these documents, including the Recovery Plan, express the need for hydrologic links to suitable habitat and preserved upland refugia so that giant garter snakes have a mode of escape during flooding events. The Recovery Plan includes the following Recovery Action (8.5.2 (p. III-4)): "Determine the effects of flooding on the survival of the giant garter snake. Although giant garter snakes evolved in the Central Valley and likely are adapted to withstand some flooding of habitats, reclamation and flood control activities have altered the timing, duration, and severity of floods. (Priority 2)"

Comment: *One commenter mentioned that additional research on the impacts and benefits of water primrose removal should be included in the Recovery Plan.*

Response: The Service agrees. We have updated Recovery Action 7.5.1 on page III-5 and in the Implementation Table to address this suggestion.

Comment: *One commenter requested detailed descriptions of the current status and threats for 3 Recovery Units (Butte, Colusa, and Sutter Basins). They state that the Recovery Plan directs readers to the most recent 5-year review for the giant garter snake for additional description and status info. However, they claim that the 2012 review offers no synthesis of the information or assessment of the species status in specific areas.*

Response: The requested information (description and status assessment) is provided for each Recovery Unit, including Butte, Colusa, and Sutter Basins in the 2012 5-Year Review (see pages 3-12).

Comment: *Multiple commenters requested citations and substantiation for the following statement on page I-8 of the Draft Recovery Plan: "Though the abundance of giant garter snakes in the Sacramento Valley has declined, the distribution of the giant garter snake in its northern range may still reflect its historical distribution."*

Response: Citations for this statement have been added to the Recovery Plan. This statement does not imply that the numbers and distribution of giant garter snakes have been reduced at uniform rates across its historical range, as one commenter asserted. We are simply saying that although the distribution of the giant garter snake in its northern range has not changed significantly over time, the abundance of giant garter snakes in the Sacramento Valley has declined from historical levels.

Comment: *One commenter requested a citation for the following statement on page II-1 in the Draft Recovery Plan: "…changes in the levels of rice production are the largest threat to the giant garter snake."*

Response: This statement is made on page I-11 of the Draft Recovery Plan, not on page II-1. We have updated this statement in the Draft Recovery Plan to read: "Today, habitat loss and fragmentation due to urbanization and changes in the levels and methods of rice production are the largest threat to the giant garter snake." We have also provided supporting citations, as requested.

Comment: *One commenter referred to Page 1-5 of the Draft Recovery Plan (Upland Winter Refugia Component), which states that over-wintering snakes use burrows as far as 200 to 250 meters from the edge of summer aquatic habitat. The commenter asked if the frequently recommended 200 foot buffer from aquatic habitat would be based on studies referenced in the Recovery Plan or information that may come from future recovery actions.*

Response: This statement is made on page I-3 (not 1-5) of the Draft Recovery Plan. Recovery Plans are used as guidance documents and may be used to inform other regulatory documents under the Endangered Species Act such as Section 7 Biological Opinions and Section 10 Habitat Conservation Plans.

Comment: *One commenter asked what is meant by "clean water" on p. II-1 of the Draft Recovery Plan and throughout.*

Response: "Clean water" is defined in Recovery Criteria A13 on page II-16 as water that is "…free of contaminants or will contain contaminants at levels that have been demonstrated to be harmless to giant garter snakes."

Comment: *Multiple commenters mentioned that only California Natural Diversity Database data are included in the Recovery Unit Figures (Figures 4-12) on pages II-5 - II-13, but that there is more recent occurrence data that should be included. Specifically, commenters mentioned that Figure 10 (Delta Basin Recovery Unit; p. II-11) is missing information about Jersey Island occurrences, and Figure 4 (Butte Basin Recovery Unit; p. II-5) is missing data from the Biggs-West Gridley Water District and Gray Lodge Canal projects. One commenter also mentioned that Table 2 on page I-7 fails to disclose more recent population estimates for the giant garter snake.*

Response: Only CNDDB occurrence data were included in the Recovery Unit maps on pages II-5 – II-13 in the Recovery Plan because all data collected during giant garter snake occupancy surveys

in the state of California should be submitted to CNDDB. The population estimates included in Table 2 on page 1-7 are the most recent published estimates that were available to the Service at the time the draft was released. There may be more recent published data that we have not yet received. The Recovery Plan is a living document, and therefore, as new information comes to light, the Recovery Plan may be revised accordingly.

Comment: *One commenter requested that Factor C on page II-17 address predation by introduced species.*

Response: We agree that predation by introduced species should be addressed as a Factor C threat. We have added this threat to Factor C on page II-17.

Comment: *One commenter mentioned that Grasslands Mitigation Bank overlaps a portion of the Delta Basin Recovery Unit but is not included in the description of the Delta Basin RU. They also requested that the Recovery Plan mention that mitigation credits are approved and available at the Grasslands Mitigation Bank in the San Joaquin Basin Recovery Unit.*

Response: The Grasslands Mitigation Bank does not overlap the Delta Basin Recovery Unit. It occurs entirely within the boundaries of the San Joaquin Basin Recovery Unit (SJBRU). We have updated the description of the SJBRU to include the Grasslands Mitigation Bank as an approved Bank.

Comment: *One commenter asked when the clock starts for Recovery Factor E: "all preserved perennial marshes and ricelands host a stable population as determined from monitoring over a 20-year period that includes at least one consecutive 3-year period of dry or critically dry weather…". They also asked how minimum density is measured under Recovery Factor E, E2.*

Response: The 20-year monitoring period will begin at different times for different populations. We consider 'year 1' to equal the first year each population reaches the desired density as described in Recovery Factor E2: "at least an average of 8 snakes per hectare for buffered perennial wetlands and 3 snakes per hectare for active ricelands." Under Recovery Factor E2, the density is measured per giant garter snake population following the cited methodology under Factor A1. As results of new research become available alternate survey methods may be recommended by the Recovery Implementation Team.

Comment: *One commenter asked where to find best management guidelines for giant garter snake habitat outside of conservation lands, as referenced in Recovery Action 2.2 on page III-2.*

Response: As stated in 2.2 of the Recovery Action Narrative on page III-2, best management guidelines for recovery actions still need to be developed. Best management guidelines will likely vary among populations and regions depending on local circumstances.

Comment: *Multiple commenters addressed Recovery Action 4 on pages III-2 and III-3, which provides the following guidance: "Ensure summer water is available for wetland habitats used by the snake". One commenter requested that the Service address potentially conflicting water uses (agriculture in particular) and the effects of drought on achieving this action. Similarly, another commenter requested that the plan recognize the challenges in ensuring that summer water is available during drought years.*

Response: The Service agrees that it is important to recognize that summer water availability for the giant garter snake is highly dependent on other potentially conflicting water uses as well as fluctuating environmental conditions. We have updated Recovery Action 4 on page III-2 to acknowledge these uncertainties.

Comment: *One commenter mentioned that Recovery Action 5.1 on page III-3 should also recommend the provision of regulatory assurances for neighboring landowners which provide incidental take coverage for ongoing maintenance activities.*

Response: Recovery Plans are not regulatory documents, and therefore, it is not appropriate to recommend the provision of regulatory assurances for neighboring landowners in the form of incidental take coverage. The Service will work with neighboring landowners to ensure compatible land uses for any recovery actions we undertake.

Comment: *One commenter requested a statement which clarifies the obligations (or lack thereof) of partners to carry out actions at the beginning of the Implementation Schedule.*

Response: The following sentence was previously included in the Total Estimated Cost of Recovery and Date of Recovery section, and has been bolded and moved to the introductory paragraph of the Implementation Schedule section for greater emphasis: *"Because recovery plans are guidance and planning documents, they do not obligate partners to carry out actions, nor do they provide funds to carry out actions."*

Comment: *Multiple commenters stated that the Recovery Plan overstates the negative impact of water transfers on giant garter snakes, and that this claim requires substantiation. One commenter also requested clarification on the "effects" of water transfers on giant garter snakes that need to be minimized (as discussed on p. III-4), as well as what measures need to be taken beyond the conservation measures that are already included in the most recent consultation with the Bureau of Reclamation (BOR) on water transfers. Finally, it has been requested that the Service define the word "transfer" in the Recovery plan. Specifically, does it include groundwater substitution transfers, land fallowing transfers, and transfers being made to another Region?*

Response: In the Draft Recovery Plan, "water transfers" refer to any transfer of water from one location to another as a result of cropland idling/shifting, reservoir releases, conservation measures, or groundwater substitution. We have included this definition in the Recovery Plan as requested. Depending on the type of water transfer that occurs, if transfers are away from giant garter snake habitat, the following effects to giant garter snakes and their habitat can reasonably be anticipated: increased stress on snakes that must disperse further to find suitable habitat (including summer water) and prey items, increased predation on snakes due to the loss of refugia, increased competition for food and shelter resources between displaced and resident snakes, and ultimately, reduced reproduction and recruitment as females are displaced from familiar retreats and basking sites and neonates and juveniles are deprived of essential nutrients to facilitate growth and sexual maturation. These detrimental impacts to individuals have the potential to become population-level effects as the quality of habitat and food resources is reduced persistently, over time, or undergoes annual fluctuations of high magnitude. Because the Recovery Plan is not a regulatory document, it is not the appropriate document to describe conservation measures for specific projects.

Comment: *One commenter asked that the Recovery Plan acknowledge conflicting intra-agency guidance regarding the use of water for imperiled species, and present the trade-offs of the various water uses. Specifically, the Recovery*

Plan should mention the tendency of USFWS/NMFS fisheries divisions to pressure water management agencies to provide additional water in-stream instead of diverting it for use by ricelands and wildlife refuges, which can harm species like the giant garter snake.

Response: This Recovery Plan was developed specifically to facilitate the recovery of the giant garter snake, and therefore, the Recovery Criteria and Actions were focused only on the giant garter snake. The Service and NMFS will continue to coordinate closely regarding the best possible uses for available water for all protected species.

Comment: *One commenter asked that "stable population" be defined in the Recovery Plan.*

Response: We have included language in Recovery Factor E on page II-17, which further defines a "stable population."

Comment: *One commenter asked that a cost estimate be developed and anticipated funding sources be identified in the Recovery Plan.*

Response: Cost estimates and responsible parties have been added to the Recovery Implementation Schedule as requested. Once finalized, the Service will work with all interested partners to identify appropriate sources of funding for implementation of recovery actions.

Comment: *One commenter wanted to know the anticipated means of acquiring additional giant garter snake habitat (purchase, easement, etc.) and the length of time the habitat blocks are expected to provide the benefit (in the Recovery Criteria for Factor A on pages II-14-II-16).*

Response: The anticipated means of acquiring additional giant garter snake habitat is described in Recovery Actions 1.1-1.3 on page III-1 and in the Implementation Schedule on page III-8. The habitat blocks are expected to protect giant garter snakes in perpetuity.

Comment: *One commenter requested that the Service define "the following watercourses" and "main watercourses" on page II-15 (A2. Colusa Basin Recovery Unit). Also, regarding the "final protected canal length" in this section, the commenter asked what canal this refers to.*

Response: No specific canal is the focus of this section. Therefore, we have removed the word "following" and changed "final protected canal" to "final protected watercourse" in Recovery Criteria A2: Colusa Basin Recovery Unit.

Comment: *One commenter asked how the lands described in Recovery Action 1 on page III-1 will be protected and secured.*

Response: The Service has not determined the mechanism by which these particular lands will be protected and secured. This will depend greatly on the interests of existing landowners and the location and current ownership/management of the land. These lands could be secured through a number of means such as purchase, easement, mitigation or conservation bank, etc. The Service will work with interested parties, on a voluntary basis, to determine the method of protection most appropriate for each location.

Comment: *One commenter recommended that the Service collaborate with local landowners and water managers to develop management plans and best management guidelines (as discussed in Recovery Actions 2.1 and 2.2 on page III-2) that are practical, best for the local areas, and able to be implemented.*

Response: The Service agrees and has added language to Recovery Actions 2.1 and 2.2 on page III-2 that reflects this suggestion.

Comment: *One commenter asked what areas within the Sacramento Valley have been identified as having harmful water quality, and another commenter asked where to find guidance regarding harmless contaminants for giant garter snakes.*

Response: The 2012 5-Year Review (p. 37-40) discusses the threat of impaired water quality and references recent studies that analyze specific contaminants and their impacts to giant garter snakes. Please refer to the 2012 5-Year-Review for the most up-to-date information on the impacts of water quality and contaminants on giant garter snakes.

Comment: *One commenter asked how Recovery Action 5 on page III-3 differs from Recovery Action 1 on page III-1.*

Response: While Recovery Action (RA) 1 differs from Recovery Action (RA) 5, it would make sense to include RA 5 under the umbrella of RA 1, since the establishment of incentive/easement programs is one method that can be used to protect, restore, or create habitat and habitat corridors. We have updated the Recovery Action Narrative and Implementation Schedule in the Recovery Plan to reflect this suggestion.

Comment: *One commenter expressed the concern that, as a result of the Recovery Plan, airports could be required to ensure that their managed waterways contain sufficient water throughout the summer to provide aquatic habitat for the giant garter snake. This would directly conflict with FAA requirements to minimize the amount of open water within 10,000 feet of airports to reduce attractants to hazardous wildlife. They requested that the Service acknowledge the priority of the airports to protect the safety of the travelling public and to discourage the restoration or creation of aquatic habitat near any Sacramento County Airport in accordance with FAA regulations, especially when reviewing locations to protect or preserve block pairs in the Natomas Basin Management Unit.*

Response: The Recovery Plan is not a regulatory document, but rather, a guidance document to facilitate the recovery and conservation of the giant garter snake. The Recovery Plan is not obligatory in nature, and therefore the Recovery Actions laid out in the plan are not requirements, but recommendations for our partners to assist in recovery efforts. The Service does not yet have a specific plan for where the habitat block pairs will be located, and we will work closely with the appropriate land managers and/or landowners during the designation of habitat block pairs. The Service recognizes that health and human safety are of the utmost importance and support the airport achieving that mission. Any restoration or creation of aquatic habitat near Sacramento County Airports will comply with FAA requirements to minimize open water and reduce wildlife attractants.

Comment: *One commenter requested that the Recovery Plan include explanations regarding the history of the development of the Recovery Plan, including delays, failure to designate critical habitat, and why a condensed Recovery Plan was released by the Regional Office instead of the more comprehensive plan developed by the Sacramento Field Office.*

Response: The purpose of a Recovery Plan is to facilitate the recovery of Federally-listed species through a) development of objective, measurable criteria, which, when met, would result in delisting, b) a description of site-specific management actions which will move the species toward recovery, and c) estimates of the time and cost required to carry out the management actions. Although we do not typically describe the history of a plan's development, the Service as a whole, including Region 8, is currently working to make recovery plans more streamlined and flexible, while still accomplishing the purpose listed above thoroughly and effectively.

***Comment**: One commenter asked that we address how the Service facilitates threats to the giant garter snake through multiple water transfer Biological Opinions that don't require mitigation.*

Response: The Recovery Plan addresses water transfers as a threat to the giant garter snake and includes two Priority 1 Recovery Actions specifically stating that guidelines should be developed and implemented for water transfers (Recovery Action 2.2) and that more research needs to be conducted to determine how to minimize the effects of water transfers to the giant garter snake and its habitat (Recovery Action 8.5.3)..

***Comment**: One commenter requested a discussion about the impact of a long drought on the 20-year timeline to recover the species.*

Response: The date of recovery listed in the 2015 Draft Recovery Plan is 2045 (30 years from the release of the Draft Plan). This 30-year period includes a 10-year period in which the Recovery Criteria are achieved and a 20-year monitoring period to provide a reliable estimate of population change. The plan also states that the 20-year monitoring period must also include one 3-year drought to ensure that giant garter snakes are no longer threatened by an insufficient water supply.

***Comment:** One commenter asked that the Service explain how the significance of certain threats, especially climate change and drought, which are well-known and studied, is still unknown.*

Response: Although some research has addressed climate change and drought-related impacts to imperiled species, focused research on the impacts of climate change and drought on the giant garter snake is still lacking. Recovery Action 8.5. addresses the need for additional research on threats to the giant garter snake to determine their extent and to develop methods to ameliorate them. Recovery Action 8.5.5. specifically addresses the need for climate-change research as it relates to the giant garter snake and its habitat.

***Comment:** One commenter stated that the Recovery Plan failed to mention the development of management plans with other agencies.*

Response: Achieving recovery of the giant garter snake will be an inherently collaborative process and the Service will coordinate with agencies and other partners in implementation of the recovery actions. The Recovery Implementation Table includes a column which specifies the potential parties responsible (and other likely partners) for each Recovery Action, including development of management plans. Management plans are mentioned in four separate Recovery Actions: 1) Recovery Action 2.1, which will involve the California Department of Fish and Wildlife (CDFW), non-government organizations (NGOs), private landowners, conservation program participants (CPPs), and the Bureau of Land Management, 2) Recovery Action 4.1, which will involve the

CDFW and CPPs, 3) Recovery Action 6.1, which will involve the CDFW, the U.S. Bureau of Reclamation, CPPs, the Biological Resources Division of the U.S. Geological Survey (BRD), and NGOs, and 4) Recovery Action 10.2, which will involve the BRD, CDFW, and NGOs. The Service will work with each of these agencies, as appropriate, in development of management plans for the giant garter snake.

Comment: *One commenter asked how an easement program will encourage local agencies to provide/maintain habitat, and what constitutes an easement program (p. iv.)? Additionally, they mentioned that the incentive program addressed on page iv includes local agencies, but when it is addressed again on page II-1, local agencies are not included.*

Response: Action 5 on page iv. of the Recovery Plan states, "Establish an incentive or easement program(s) to encourage private landowners and local agencies to provide or maintain giant garter snake habitat." In this statement, the easement program does not apply to local agencies. Only the incentive program(s) are intended to encourage local agencies to provide/maintain habitat for the giant garter snake. The easement programs are intended specifically for private landowners. This is discussed in further detail in Recovery Action 5.1. An easement program is a voluntary program where willing landowners are paid a percentage of their wetland or agricultural property's fair market value for purchase of the farming and development rights in perpetuity. When purchasing easements on agricultural land the Service works directly with landowners to develop, fund and implement a wetland restoration plan. Landowners are not required to follow a management plan, but technical assistance is provided by the Service and landowners are encouraged to participate in various programs for habitat restoration, enhancement and management. Local agencies have been included in the discussion about incentive programs on page II-1 as requested.

Comment: *One commenter mentioned that the Draft Recovery Plan fails to provide the most recent description and status for the giant garter snake and punts to the 2012 5-year review.*

Response: The species description has not changed since the 2012 5-Year Review was released, and therefore, we determined that an in-depth discussion of the description was not necessary in the Recovery Plan. The 2012 5-Year Review provides the most up-to-date, comprehensive status information that we currently have for the giant garter snake. It is important to note that the state of the science is constantly changing, and as we receive new information, it will be incorporated into subsequent 5-Year Reviews and Species Status Assessments for the giant garter snake, which will be released to the public upon completion.

Comment: *One commenter mentioned that the Recovery Plan does not include a discussion on page I-11 about how serious the threat from contaminants is to giant garter snake recovery.*

Response: Under the Factor E threats on page I-11 of the Recovery Plan, contaminants are listed as a threat to the giant garter snake, but not considered significant. At the top of page I-11, the Recovery Plan also mentions that the 2012 5-Year Review should be consulted for a complete analysis of each threat. The 2012 5-Year Review provides the most recent, comprehensive information about the impacts of contaminants on giant garter snakes that is currently available (p. 37-40).

Comment: *One commenter asked that "incompatible uses" be defined on page II-15 of the Draft Recovery Plan.*

Response: "Incompatible uses" refers to all activities that preclude the local recovery of the species. We have updated the text on page II-15 to include this definition.

Comment: *One commenter asked if the following Recovery Action on page II-16 is included in the Implementation Schedule: "Management plans are developed, implemented, and updated as needed for 20 years for all habitat blocks and corridors preserved for the giant garter snake listed in Criteria A1 through A9". Multiple commenters also mentioned that the development of a management plan for giant garter snake parasites and viruses (p. II-17) is not included in the Recovery Action Narrative or the Implementation Schedule.*

Response: The statement from page II-16 of the Recovery Plan (*"Management plans are developed, implemented, and updated as needed for 20 years for all habitat blocks and corridors preserved for the giant garter snake listed in Criteria A1 through A9"*) is not a Recovery Action, but a Recovery Criterion; therefore it does not need to be included in the Implementation Schedule. However, Recovery Action 2.1 addresses this Recovery Criterion, and is included in the Implementation Schedule on page III-8. Regarding Recovery Criterion C2 (development/implementation of a parasite, virus, and fungi management plan) on page II-17, we have noted that a corresponding Recovery Action is missing from the Recovery Action Narrative and Implementation Schedule. We have updated the Narrative and Implementation Schedule to include an analogous action.

Comment: *One commenter pointed out that the Implementation Schedule mentions developing a genetics plan, but doesn't provide details on the purpose, goals, or contents of this plan.*

Response: The purpose of a genetics management plan is to provide a framework for evaluating giant garter snake conservation options from a genetics perspective. The genetics management plan would include a review and synthesis of the most recent genetic studies, along with an examination of the implications for management and recovery. The ultimate goal of the plan would be to aid in management and decision-making for the species, specifically for repatriation, captive propagation, and determination of genetically important populations. This explanation has been added to page III-6 of the Recovery Plan.

Comment: *One commenter requested that the Recovery Plan disclose how the Service has allowed impacts to giant garter snake that are not consistent with recovery of the species. Specifically, the commenter mentioned the allowance of twice as many fallowed acres during water transfers, despite the failure to complete the Conservation Strategy required by the 2004 Biological Opinion on Central Valley water transfers and the deletion of the Environmental Water Account mitigation measure excluding Yolo County east of Hwy 113 from the areas where rice fields may be left fallow rather than flooded.*

Response: The purpose of a Recovery Plan is to facilitate the recovery of Federally-listed species through a) development of objective, measurable criteria, which, when met, would result in delisting, b) a description of site-specific management actions which will move the species toward recovery, and c) estimates of the time and cost required to carry out the management actions. Biological opinions are provided to federal agencies that conduct activities that may affect listed species. Although they do relate, regulatory processes such as Section 7 consultations are separate from recovery planning, and are generally not included in Recovery Plans.

Comment: *One commenter stated that the scientific foundation for the ecology and conservation of the giant garter snake presented in the Draft Recovery Plan is weak and lacks transparency. Specifically, it was noted that most of the source documents cited in the Draft Recovery Plan are unpublished and therefore, not readily available to the public. In*

addition, multiple conclusions appear to be based on speculation (e.g. the plan dismisses predation and disease as threats to giant garter snake persistence). However, these threats may actually be significant when the giant garter snake is constrained to small habitat areas (which it is).

Response: We acknowledge that many of the citations used in the Draft Recovery Plan are unpublished. This is primarily due to the fact that rigorous, peer-reviewed studies on many aspects of giant garter snake ecology are currently lacking. As a result, reports from partner agencies and expert judgement represented the best available science and were used to develop portions of the Draft Recovery Plan as appropriate. Although some of the source documents are not readily available to the public via internet searches, all source documents are available to the public as part of the Service's file record. Regarding the assertion that many conclusions in the plan appear to be based on speculation, we contend that the Plan openly addresses uncertainty and that conclusions were drawn using the best available science. Additionally, predation and disease were not dismissed as threats to the persistence of giant garter snakes. We simply concluded that they were not as significant as other threats to giant garter snakes, such as habitat loss and fragmentation. We include Recovery Actions which address the threat of predation and disease at the end of the Recovery Plan (Recovery Actions 7.5.1 and 7.5.6). It is also important to note that Recovery Plans are living documents, and therefore, as new information comes to light, certain portions of the Recovery Plan may be revised accordingly.

Comment: *One commenter requested that certain terms in the Recovery Plan be more clearly defined or eliminated altogether:*

1. *Overgrazed (p. I-3): unclear what qualifies*
2. *Habitat: this is a vague term in ecology and should be used cautiously*
3. *Habitat quality: the Recovery Plan doesn't base any of its habitat assessments on "habitat quality" metrics, and therefore, this term should be clearly defined or eliminated*
4. *Habitat fragmentation: poses a greater threat to the giant garter snake than habitat loss, so it should be given greater consideration in the assessment of current conditions and in formulating a recovery strategy.*
5. *Corridor (p. II-2): definition is missing the upland habitat elements necessary for giant garter snake survival*
6. *Habitat restoration and habitat enhancement: should only be pursued if we know a) the requirements of the giant garter snake, b) the conditions prior to habitat degradation/destruction, and c) consequences to the giant garter snake and other species*
7. *Adaptive management: define what this means*

Response: We have addressed each term in the order in which it was listed:

1. Overgrazed: we have updated this language on page I-3 to read, "3. Free of poor grazing management practices (i.e., grazing to the point at which giant garter snake refugia has been reduced or eliminated)."
2. Habitat: we acknowledge that the term "habitat" remains fairly vague in ecological studies and should be used cautiously. For the purposes of this Recovery Plan, "habitat" refers to any location that supports giant garter snakes.
3. Habitat quality: Although habitat quality is not specifically defined in the Recovery Plan, Section C.2*: "Habitat types and quality*" provides a general overview of what comprises high quality versus low-quality habitat by referencing Wylie *et al.* (2010). This publication delves

more deeply into the definition of "habitat quality", and provides evidence to support the hypothesis that natural emergent wetlands are high quality giant garter snake habitat. In this paper, the authors state that although population vital rates, such as survival and recruitment, are required to definitively assess habitat quality for a species (Van Horne, 1983), observing both greater densities and greater body condition in giant garter snakes at the same sites suggests that these sites are of greater quality.

4. Habitat fragmentation: Habitat fragmentation and habitat loss are not mutually exclusive processes. Habitat fragmentation is the direct result of habitat loss, and therefore, it is incorrect to say that habitat fragmentation poses a greater threat to the giant garter snake than does habitat loss. Page III of the Recovery Plan states, "The loss and subsequent fragmentation of habitat is the primary threat to the giant garter snake throughout the Central Valley of California". Both processes are given due consideration in the assessment of current conditions and the recovery strategy.
8. Corridor: As is noted in the comment, the definition of corridor on page II-2 refers to sections I.C.1. and I.C.2. of the Recovery Plan. Section I.C.1. provides a detailed definition of upland habitat, including vegetation cover, mammal burrows and protection from flooding, and therefore, it is redundant to include the upland habitat elements in the definition of corridor.
9. Habitat restoration and habitat enhancement: The Service agrees with this comment, which is why additional research on restoration techniques has been included as a Priority 1 Recovery Action (8.1.5, p. III-4).
10. Adaptive management: Adaptive management is a systematic, iterative process with very clear targets that must be met along the way. Therefore, we have included a brief description of the adaptive management process as explained in Walters (1986) on page iv of the Recovery Plan.

Comment: *One commenter objected to the definition of a giant garter snake population in the Recovery Plan as "a cluster of locality records in a contiguous habitat area". The commenter argues that this definition can't be used for establishing thresholds of success, nor can it be used as a monitoring metric. In addition, the commenter states that Tables 1 and 2 on pages I-4 and I-7 summarize population and population density estimates, but do not provide interpretations of the estimates relative to the spatial scales over which they were made. This is important for establishing recovery criteria, minimum habitat areas, and suitable monitoring protocols. The commenter asks that an estimate be provided for the number of giant garter snakes that represents a population and an explanation be provided for the determination of the habitat blocks, so that the area needed to support this number can be targeted as part of the Recovery Strategy.*

Response: The definition of "populations" in the Recovery Plan is not intended to be used to establish thresholds of success. The Recovery Criteria establish these thresholds. Recovery Criteria for Factor E (p. II-17 – II-18) elaborates on the requirements that must be met to ensure the long term recovery of the giant garter snake. Specifically, Recovery Criteria E2 states that "The density found during trapping is at least an average of 8 snakes per hectare for buffered perennial wetlands and 3 snakes per hectare for active ricelands". Therefore, we are not monitoring "locality records", but rather, we are monitoring densities. The population and density estimates in Tables 1 and 2 are taken from numerous publically available studies (cited directly in the tables), and these densities are

associated with specific spatial limits. Please also refer to the footnote located on page II-15 for the derivation of the acreage for habitat block pairs in the Recovery Criteria for Factor A. This footnote clarifies not only the determination of habitat block pair acreage, but also the minimum densities required by Recovery Criteria E2. Our uncertainty about population size estimates is made clear on Page I-7 (Population Size Estimates), where we state, "Although estimates exist for some populations, inconsistent methods across years do not allow us to estimate a range-wide population size for the species. USGS is working to develop a range-wide population size estimate."

Comment: *One commenter expressed concerns with targeting rice cultivation as a primary means of recovering the giant garter snake. The commenter argued that just because animals are seen in a particular environment does not mean that that environment qualifies as suitable habitat. Further, they claim that the majority of giant garter snake occurrences are not located in rice fields, and in the Natomas Basin, rice cultivation has likely adversely affected the giant garter snake by destroying or degrading habitat. The Recovery Plan refers to the importance of tules, cattails and/or tule "mats" for basking, yet these do not occur in rice fields nor do they often occur in ditches and drains associated with rice fields. The fact that giant garter snakes have been found in relatively large numbers on habitat patches within landscapes dominated by rice cultivation likely reflects remnant clusters of snakes more than it does an attraction to rice cultivation. Snakes entering rice field are exposed to pesticides, machinery, predators due to lack of cover and refuge, and vehicle traffic. The Recovery Plan dismisses these threats, but provides no data to support the dismissal. In addition, the commenter argues that rice cultivation does not achieve the ponding schedule needed by giant garter snakes as described on page I-3 of the Recovery Plan, and is overall unsuitable for preservation because it is subject to market forces, diseases, and fluctuating soil conditions and water availability.*

Response: In the Recovery Plan, rice cultivation is not called out as a primary means of recovering the giant garter snake. Preservation of contiguous perennial wetland blocks is the primary means of recovering the snake. Page III of the Recovery Plan states, "Perennial wetlands provide the highest quality habitat for the giant garter snake, and rice lands, with the interconnected water conveyance structures, serve as an alternative habitat in the absence of higher-quality wetlands." Rice lands are only utilized in cases where the protection of sufficient perennial wetlands is not possible. In order to conform to the guidance in the Recovery Criteria, habitat block pairs must contain at least one 240-hectare block of buffered perennial wetlands. Peer-reviewed research has guided the development of Recovery Criteria for Factor A, including the protection of rice lands for giant garter snake habitat. We know that giant garter snakes persist in rice fields because of published research that addresses this question (e.g., Wylie et al., 2010). The commenter brings up the correlation that as rice cultivation proliferated in the Natomas Basin from 1929 until its peak acreage in 1995, giant garter snakes declined in distribution and abundance, and states that the most likely cause is that rice cultivation adversely affected giant garter snakes by degrading their habitat. It is important not to equate correlation to causation, and we are not aware of any studies that provide evidence to support this claim. The Recovery Plan does not dismiss threats to giant garter snakes associated with rice fields, and in fact, Recovery Criteria A1 directly addresses these threats by recommending the development and implementation of management plans for each habitat block which addresses water management to provide summer aquatic habitat, pesticides, best grazing regimes, fallowing of rice fields, eradication of invasive plants, operations and maintenance of canals and flood control structures, control of non-native predators, monitoring of native predators, and location and use of roads. Tules, cattails, and/or tule "mats" are important components of natural giant garter snake habitat, but they are not the only feature needed by giant garter snakes. Regarding the ponding schedule needed by giant garter snakes, according to Wylie et al. (2010), rice fields in California are flooded in late April or May and maintain water for most of the giant garter snake active season (until September). When rice becomes emergent in June, the rice fields become

shallow marsh habitat suitable for the giant garter snake, and canals associated with rice agriculture typically provide a reliable source of aquatic habitat throughout the year.

Comment: *One commenter mentioned that the Recovery Criteria for Factor A is missing the protection of adjoining upland habitat needed for hibernacula and daily refuge.*

Response: Under the Recovery Criteria for Factor A, we state, "These pairs of contiguous perennial wetlands and ricelands must be buffered by 0.5 kilometer (0.32 mile) of compatible habitat and the two blocks *must be connected by a corridor of aquatic and upland habitat* with a 0.8 kilometer (0.5 mile) minimum width.

Comment: *One commenter expressed concerns about using reintroduction as a recovery strategy until more is learned about the ecology and conservation needs of the species. Reintroductions should wait until they can be performed confidently.*

Response: We agree that reintroductions should only be used as a recovery tool once we have a better understanding of giant garter snake ecology and we have conducted pilot studies to evaluate its effectiveness in various field settings. This is addressed in Recovery Action 9.

Comment: *One commenter stated that Safe Harbor Agreements (SHAs) are unnecessary, since the Service has discretion over enforcement of take and can exercise discretion as it does routinely. Additionally, the Recovery Plan shouldn't include SHAs or any other assurances that would impinge on future regulatory actions, since Recovery Plans are guidance, not regulatory, documents. Finally, the commenter asserted that SHAs are probably only intended for incentivizing rice cultivation in perpetuity, and therefore shouldn't be included in the Recovery Plan at all.*

Response: Safe Harbor Agreements are not mentioned in the body of the Recovery Plan.

Comment: *One commenter recommended implementing limited test-case habitat restoration and habitat enhancement using experimental designs at meaningful spatial and temporal scales and measuring success using well-accepted biological metrics.*

Response: We agree. This falls under Recovery Action 8.1.5., which provides the directive to examine the response of giant garter snakes to managed marsh restoration to determine the effectiveness of restoration efforts and to modify restoration techniques as necessary to benefit the giant garter snake.

Comment: *One commenter recommended broadening the expertise of ecologists, conservation biologists, and agricultural experts contributing to the Recovery Plan.*

Response: The Recovery Plan was developed with input from a variety of experts, and an Implementation Team composed of scientists, land managers, and regulatory professionals will be appointed to guide implementation of the Recovery Actions listed in the Plan.

Comment: *One commenter requested that the Recovery Plan summarize the impacts and (net) benefits of the proposed mitigation measures in the Natomas Basin Habitat Conservation Plan (HCP) on the giant garter snake, and whether and to what degree the numbers and distribution of giant garter snakes changed in the Natomas Basin since the HCP was certified.*

Response: Pages 7 and 11 of the 2012 5-Year Review provides a status update for the giant garter snake in the Natomas Basin. At this time we cannot conclusively state that the current status of the giant garter snake in the Natomas Basin has been significantly impacted by the implementation of the Natomas Basin HCP. Although such HCPs may be identified and referenced, the Recovery Plan is not the appropriate forum for critical analysis of HCPs.

Comment: *One commenter expressed concerns that by relying on minnow traps as the exclusive or near-exclusive means of giant garter snake capture and counting, there may be a bias favoring smaller snakes. They requested that the Service examine this uncertainty by comparing results from studies that utilize hand-capture techniques.*

Response: We will take this suggestion into consideration when implementing Recovery Actions 5 and 6.1 in the Recovery Plan.

Comment: *Multiple commenters expressed concerns with Recovery Criterion A4 on page II-16, which recommends the preservation of a "minimum of eight habitat block pairs with no less than one block pair per management unit in the American Basin Recovery Unit (ABRU)". As the footnote explains at the bottom of page II-16, "This is in addition to the existing 3,541 hectares (8,750 acres) preserved in minimum blocks of 162 hectares (400 acres) with one 1,012 hectare (2,500 acre) reserve provided as compensation through the Natomas Basin HCP and the Metro Park HCP." The Natomas Basin HCP and the Metro Park HCP both operate within the Natomas Basin Management Unit (NBMU) in the ABRU. Specifically, commenters were concerned about the current lack of adequate mitigation land necessary to carry out and fully implement the HCPs and the burden of preserving an additional block pair in the NBMU, as recommended by the Recovery Plan. The commenters requested that the Service make a detailed calculation as to whether or not there is sufficient acreage remaining in the Natomas Basin to add this habitat block without further challenging the implementation of the HCPs. One commenter also called out the lack of support in the Recovery Plan for the notion that acquisitions in the NBMU should be doubled down while acquisitions in the other management units consist of only a single block pair. One commenter requested that the Service consider shifting the acquisition target to "Area B" outside the Natomas Basin.*

Response: We have removed footnote 2 at the bottom of page II-16. We believe that Recovery Criterion A4 provides sufficient recovery benefits to the giant garter snake in the American Basin Recovery Unit without specifically targeting the preservation of lands in addition to the 8,750 acres that are already provided as compensation through the Natomas Basin HCP and the Metro Park HCP. Lands preserved pursuant to the Natomas Basin and Metro Park HCPs may or may not count toward Recovery Criterion A4 depending on whether or not they also meet the criteria for preserved habitat blocks as outlined on page II-15 of the Recovery Plan.

Comment: *One commenter objected to the development of a Recovery Plan for the giant garter snake, stating that taxpayer money should have gone directly toward protecting the snake rather than writing a Recovery Plan.*

Response: The development of the giant garter snake Recovery Plan is a necessary step to bring all of the species experts and stakeholders to the table and create a workable plan to protect the giant garter snake and its habitat in perpetuity. Protections for the snake have not ceased during the development of the plan.

Responses to Peer Review Comments:

Comment: One reviewer suggested that in addition to potential for inbreeding depression and loss of genetic diversity associated with small populations that the Recovery Plan should also address demographic stochasticity which is a more insidious threat.

Response: We have addressed the need for demographically stable populations in the recovery criteria and recovery actions. Additional discussion of the effects of demographic stochasticity can be found in the 2012 5-Year Review (Service 2012).

Comment: One reviewer suggested that additional research is warranted to determine how winter flooding affects the behavior of giant garter snakes.

Response: The Recovery Plan calls for additional research into the effects of flooding on giant garter snake survival in action 7.5.2 on page III-5.

Comment: One reviewer suggested that because rice is already providing habitat for giant garter snakes that restoration to perennial marsh focus on crops other than rice in order to provide greater benefit to giant garter snake.

Response: The actions in the Recovery Plan recovery do not specify or prioritize particular types of land for restoration to permanent wetlands to support recovery of the giant garter snake. Working with interested partners and landowners, restoration of agricultural land planted in any crop type within the historical range of the giant garter snake will equally be considered during the implementation phase of the recovery plan in the context of potential benefit to the giant garter snake.

Comment: One reviewer stated that in addition to vomeronasal organs snakes also use olfactory organs that are commonly used by other tetrapod animals to detect airborne chemical cues.

Response: The Recovery Plan was updated to include the use of olfactory organs by snakes to detect airborne chemical cues (page I-5).

Comment: One reviewer stated that under certain circumstances snakes will show fidelity to hibernacula, parturition, and ecdysis sites.

Response: We have incorporated additional findings from movement research and revised the section discussing giant garter snake home range on page I-7 to reflect that giant garter snakes exhibit site fidelity.

Comment: One reviewer confirmed that they have also observed giant garter snakes feeding on mosquito fish confined to small pools of water.

Response: We acknowledge the comment and have not altered the text on page I-6 that discusses this foraging behavior.

Comment: One reviewer noted that they have never observed giant garter snakes feeding on crayfish, even in areas where crayfish are extremely abundant.

Response: The Recovery Plan does not include crayfish as a potential prey item for giant garter snakes. However, the potential threat of introduced species is addressed by recovery criterion C3 and includes signal and Louisiana crayfish as potential threats to the giant garter snake.

Comment: *One reviewer commented that the initiation of the winter inactive season for giant garter snakes is dependent on the prevailing weather conditions and may not always be October 1.*

Response: We updated the discussion of seasonal activity of page I-5 to reflect that the inactive season for the giant garter snake begins around October 1, but the timing is dependent on prevailing weather conditions.

Comment: *One reviewer noted that in 15 years of working with the giant garter snake they have not acquired any evidence that fall mating occurs with this species.*

Response: The Recovery Plan's discussion of giant garter snake reproduction on page I-5 states that the mating season extends from March into May.

Comment: *One reviewer indicated that in addition to the list of possible giant garter snake predators listed in the draft recovery plan that otters have been observed eating giant garter snakes.*

Response: We have revised the discussion of predators on page I-6 of the Recovery Plan to indicate that otters are one of the possible predators of giant garter snakes.

Comment: *One reviewer confirmed that their giant garter snake surveys in Kings, Tulare, and Kern Counties in 2006 indicated that the giant garter snakes were no longer present in that area.*

Response: The distribution section of the Recovery Plan beginning on page I-8 reflects this finding.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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MAR 14 2019

Mr. Dan Cordova
Bureau of Reclamation
2800 Cottage Way
Sacramento, California 95825

Subject: Supplemental Draft Environmental Impact Statement for the Long-Term Water Transfers Project, Various Counties, California (CEQ# 20180326)

Dear Mr. Cordova:

The U.S. Environmental Protection Agency (EPA) has reviewed the Supplemental Draft Environmental Impact Statement (SDEIS) for the Long-Term Water Transfers Project. Our review is provided pursuant to the National Environmental Policy Act, Council on Environmental Quality Regulations (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act.

EPA reviewed the Draft and Final Environmental Impact Statements for the Long-Term Water Transfers Project and provided comments to the Bureau of Reclamation (Reclamation) on December 15, 2014 and April 27, 2015, respectively. In our DEIS letter, we provided comments regarding the potential for groundwater overdraft, land subsidence, air quality impairments, impacts to fisheries, migratory birds, and terrestrial wildlife, as well as the effectiveness of mitigation measures to offset impacts related to these issues. Our FEIS comments identified concerns with groundwater level impacts on stream flows and wildlife resources, and the effectiveness of mitigation measures to offset such impacts. We recommended the establishment of significance thresholds/mitigation triggers for all water transfers. 3.1

As the SDEIS states, the FEIS was challenged in the case of *AquAlliance, et al., v. U.S. Bureau of Reclamation, et al.* On July 5, 2018, the District Court entered judgement, vacating the 2015 FEIS. As a result, Reclamation has revised the FEIS to address specific issues identified in the ruling: Project Description, Groundwater, Vegetation and Wildlife, Water Quality, Fisheries Resources, Climate Change, and Appendices. Of note, the SDEIS limits water transfers from multiple sellers in a year so as not to exceed 250,000 acre-feet between 2019-2024, a six-year period; whereas the 2014 Draft EIS analyzed transfers of up to 511,094 acre-feet between 2015-2024, a 10-year period.

The SDEIS provides more extensive information on water quality impacts, specifically how changes in Delta inflows, outflows or exports could affect Delta water quality and/or salinity. The SDEIS also assesses the effects of potential future climatic conditions on the Action Alternatives. EPA appreciates that the SDEIS presents more detailed information about Mitigation Measure GW-1, the implementation of a monitoring program with the following components: 1) monitoring well network (participating wells and monitoring wells), 2) groundwater level monitoring (before, during, and after transfer-related pumping at pre-determined frequencies), and 3) identification of groundwater level triggers. In addition, sellers will be required to monitor groundwater levels to ensure that significant adverse effects to deep- 3.2

rooted vegetation are avoided. Mitigation Measures VEG and WILD-1 include measures to maintain water levels in major irrigation canals that support emergent wetland and riparian vegetation, which can provide added habitat for migratory birds and other species. EPA understands that by utilizing adaptive management, Reclamation intends to identify any unexpected effects of the water transfer program in a timely manner so that corrective actions, if necessary, can be identified. EPA recommends that the adaptive management strategy, along with responsible parties and criteria for action (what thresholds require corrective action, etc.), be as fully described as possible in the Supplemental Final EIS and Record of Decision (ROD).

With respect to the updated Water Quality analysis, the SDEIS acknowledges that the Central Valley Salinity Alternatives for Long-Term Sustainability initiative (CV-SALTS) could affect water quality in the Central Valley. The SDEIS concludes that these standards have not yet met the criteria to be considered reasonably foreseeable; hence, they are not included in the Water Quality Cumulative Effects analysis. In May 2018, the California Regional Water Quality Control Board Central Valley Region adopted Resolution R5-2018-0034,[1] which includes amendments to the Water Quality Control Plans for the Sacramento River and San Joaquin River Basins and the Tulare Lake Basin to incorporate a Central Valley-Wide Salt and Nitrate Control Program. It is anticipated that these amendments will be considered for adoption by the State Water Resources Control Board in the near future. Therefore, these criteria are reasonably foreseeable and should be considered for inclusion in the Water Quality Cumulative Effects analysis. 3.3

Effective October 22, 2018, EPA no longer includes ratings in our comment letters. Information about this change and EPA's continued roles and responsibilities in the review of federal actions can be found on our website at: https://www.epa.gov/nepa/epa-review-process-under-section-309-clean-air-act. 3.4

EPA appreciates the opportunity to review this SDEIS and we have no further comments at this time. When the Supplemental Final EIS is released for public review, please send one hard copy and one CD to the address above (mail code: ENF-4-2). If you have any questions, please contact me at 415-947-4161, or contact Ann McPherson, the lead reviewer for this project. Ms. McPherson can be reached at 415-972-3545 or mcpherson.ann@epa.gov.

Sincerely,

Connell Dunning

Connell Dunning, Team Supervisor
Environmental Review Section

[1] See Internet website: https://www.waterboards.ca.gov/centralvalley/water_issues/salinity/#cvwbaction

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March 22, 2019

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842 6th Street
Los Banos, CA 93635

Via email: frances.mizuno@sldmwa.org

RE: Comments on Long-Term Water Transfers RDEIR/SDEIS, SCH#2011011010

Dear Ms. Mizuno:

Thank you for the opportunity to comment on the Long-Term Water Transfers Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (Draft RDEIR/SDEIS). The Delta Stewardship Council (Council) recognizes the San Luis & Delta-Mendota Water Authority (SLDMWA) objective to make water transfers more implementable in years when participating member agencies could experience shortages, in order to serve existing demands.

The Council submitted comment letters on both the Draft Long-Term Water Transfers EIS/EIR (2014 Draft EIS/EIR) and the Final Long-Term Water Transfers EIS/EIR (2015 Final EIS/EIR). In both letters, the Council identified: (1) omission of the Delta Plan from the regulatory setting; (2) the need for SLDMWA to determine whether the project is a covered action and, if so, file a Certification of Consistency with the Council; and (3) Delta Plan regulatory policies potentially implicated by the proposed project. Ultimately, none of these concerns were addressed in the 2015 Final EIS/EIR. 4.1

Council staff recognizes that the scope of the RDEIR/SDEIS is limited to addressing specific issues identified in a 2018 District Court ruling. We also note that the District Court's decision vacated the 2015 Final EIS/EIR and SLDMWA's decision to approve the project. Therefore, this letter provides comments on the findings of the RDEIR/SDEIS, and reiterates the Council's comments and concerns on elements of the 2015 Final EIS/EIR described above.

Delta Stewardship Council Authority; Delta Plan Regulatory Policies

The Council is an independent State of California agency established by the Sacramento-San Joaquin Delta Reform Act of 2009 (SBX7 1; Delta Reform Act). As stated in the Delta Reform Act, the State has coequal goals for the Delta: providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place (Water Code §85054). The Council is charged with furthering the coequal goals through the adoption and implementation of the Delta Plan, regulatory portions of which became effective on September 1, 2013.

Through the Delta Reform Act, the Council was granted specific regulatory and appellate authority over certain actions that take place in whole or in part in the Delta and Suisun Marsh, which are referred to as "covered actions". The Council exercises that authority through development and implementation of the Delta Plan. State and local agencies are required to demonstrate consistency with 14 regulatory policies identified in the Delta Plan when carrying out, approving, or funding a covered action. 4.2

In our comment letters on the 2014 Draft EIS/EIR and the 2015 Final EIS/EIR, Council staff requested acknowledgement of the Council's regulatory authority, the Delta Plan, and its regulatory policies. The Council's 2015 comment letter noted that the Regulatory Setting in the 2015 Final EIS/EIR identifies federal and state regulations, but does not describe the regulatory authority of the Council and the Delta Plan over covered actions. The RDEIR/SDEIS does not address this deficiency. The final environmental document for this project should identify the Delta Plan and its applicable regulatory policies in the Regulatory Setting, and Council staff strongly recommends that SLDMWA revise the final environmental document to incorporate this information.

Covered Action Determination and Certification of Consistency with the Delta Plan

As explained in the Council's comment letter on the 2014 Draft EIS/EIR, it appears that this project meets the definition of a covered action. Water Code section 85057.5(a) provides a four-part test to define activities that would be considered covered actions. The project appears to meet the definition of a covered action considering that it:

1. Would occur in whole or in part within the boundaries of the Legal Delta (Water Code §12220) or Suisun Marsh (Public Resources Code §29101).

   The project would occur, at least in part, within the Delta. Water would be conveyed through the Delta using Central Valley Project (CVP), State Water Project (SWP), and/or local facilities. In addition, at least four of the potential sellers covered by the project are located within the Delta. 4.4

2. Would be carried out, approved, or funded by the State or a local public agency.

   The project would be undertaken by SLDMWA, a public agency. Transfers utilizing SWP infrastructure (Harvey O. Bank Pumping plant) would require approval by the California Department of Water Resources.

3. Would have a significant impact on the achievement of one or both of the coequal goals or the implementation of a government-sponsored flood control program to reduce risks to people, property, and State interests in the Delta.

   The project would have a significant impact on the achievement of the coequal goal of water supply reliability. The Council notes that this effect can either be an increase or decrease in water supply reliability.

4. Would be covered by one or more of the regulatory policies contained in the Delta Plan 23 CCR section 5003-5015).

   *Delta Plan Policies **WR P1** and **WR P2** address water transfers through the Delta. These, along with other Delta Plan regulatory policies that may be implicated by the project, are described below.*

4.3

According to the Delta Reform Act, it is the State or local agency approving, funding, or carrying out the project that ultimately must determine if that project is a covered action and, if so, file a certification of consistency with the Delta Plan (Water Code §85225) prior to project implementation. Council staff recommends that SLDMWA file a certification of consistency with the Delta Plan on behalf of its participating member agencies. More information on covered actions and the certification process can be found on the Council website at http://deltacouncil.ca.gov/covered-actions.

In addition to the program-level analysis of Long-term Water Transfers analyzed in the 2015 Final EIS/EIR and RDEIR/SDEIS, each individual multi-year water transfer agreement that is made possible by this proposed project would need to be considered and evaluated to determine if it meets the definition of a covered action, and if so file a certification of consistency with the Delta Plan.

4.4

Delta Plan Regulatory Policies

The following section describes regulatory Delta Plan policies that may apply to the proposed project based on the available information in the RDEIR/SDEIS. This information is offered to assist SLDMWA to prepare certified environmental documents that can be used to support the project's eventual certification of consistency.

4.5

Regulatory Policies Pertaining to Transfers

In our comment letters on the 2014 Draft EIS/EIR and the 2015 Final EIS/EIR, Council staff explained two of the Delta Plan regulatory policies pertaining to water transfers implicated by this project. We summarize these policies below for reference.

Water Resources Policy 1: Reduce Reliance on the Delta through Improved Regional Water Self-Reliance
Delta Plan Policy **WR P1** (23 CCR §5003) requires proposed actions that export water from, transfer water through, or use water in the Delta shall contribute to reduced reliance on the Delta and improve regional self-reliance.

The Long-Term Water Transfers project proposes to facilitate through-Delta water transfers between willing sellers and buyers. A number of potential sellers are located within the Delta. SLDMWA should describe how all water suppliers that would receive water as a result of the project adequately contribute to reduced reliance on the Delta and improve regional self-reliance. This includes completion of a current Urban or Agricultural Water Management Plan; identification, evaluation, and commencement of implementation activities identified in a plan to reduce reliance on the Delta; and the expected outcome for measurable reduction in Delta reliance and improvement in regional self-reliance. 4.5

Water Resources Policy 2: Transparency in Water Contracting
Delta Plan Policy **WR P2** (23 CCR §5004) requires the contracting process for water from the State Water Project and/or the Central Valley Project be done in a publicly transparent manner consistent with applicable policies of the California Department of Water Resources and the Bureau of Reclamation.

Please update the final environmental document or materials prepared as part of a certification of consistency to include information regarding the contracting process and to describe how sellers and buyers will negotiate transfers and use SWP and CVP pumping facilities in a transparent, public manner.

Additional Delta Plan Regulatory Policies

Council staff has identified additional Delta Plan regulatory policies that may be implicated by this project. The following information is offered to assist SLDMWA in describing the relationship between the proposed project and the Delta Plan in the environmental document, as well as to support the project's eventual certification of consistency.

General Policy 1: Detailed Findings to Establish Consistency with the Delta Plan
Delta Plan Policy **G P1** (23 CCR §5002) specifies what must be addressed in a certification of consistency by a proponent of a project that is a covered action. The following is a subset of these requirements which a project must fulfill to demonstrate consistency with the Delta Plan:

Mitigation Measures
Delta Plan Policy **G P1** (23 CCR §5002(b)(2)) requires that actions not exempt from CEQA and subject to Delta Plan regulations must include applicable feasible mitigation measures consistent with those identified in the Delta Plan Program EIR or substitute mitigation measures that are equally or more effective. Mitigation measures in the Delta Plan's Mitigation Monitoring and Reporting Program (Delta Plan MMRP) are available at:
http://deltacouncil.ca.gov/sites/default/files/documents/files/Agenda%20Item%206a_attach%202.pdf

The RDEIR/SDEIS identifies the following significant impacts that require mitigation: reduction in groundwater levels, land subsidence, groundwater quality changes, impacts to special-status plant species, and impacts to special-status wildlife species and their habitats (including but not limited to the *giant garter snake* and *greater sandhill crane* . Council staff recommends that SLDMWA review the mitigation measures in the Delta Plan MMRP addressing each of these significant impacts. In particular, Council staff recommend that SLDMWA closely review the proposed Long-Term Water Transfers project mitigation measures in relation to Delta Plan MMRP measures **4-2** and **4-3** as they pertain to selection of seller/source areas for transfers.

4.5

Best Available Science
Delta Plan Policy **G P1** (23 CCR §5002(b)(3)) states that actions subject to Delta Plan regulations must document use of best available science as relevant to the purpose and nature of the project. The regulatory definition of "best available science" is provided in Appendix 1A of the Delta Plan
http://deltacouncil.ca.gov/sites/default/files/2015/09/Appendix%201A.pdf

Best available science is defined in the Delta Plan as the best scientific information and data for informing management and policy decisions. Six criteria are used to define best available science: relevance, inclusiveness, objectivity, transparency and openness, timeliness, and peer review. (23 CCR §5001(f)). This policy generally requires that the process used by the lead agency in analyzing project alternatives, impacts, and mitigation measures of proposed projects be clearly documented and effectively communicated to foster improved understanding and decision making.

Application of this policy would be specifically relevant to analysis of surface water depletion factors and groundwater recharge rates related to groundwater substitution transfers and their potential impact on streamflow conditions and Delta water quality requirements.

Adaptive Management
Delta Plan Policy **G P1** (23 CCR §5002(b)(4)) requires that ecosystem restoration and water management covered actions include adequate provisions for continued implementation of adaptive management, appropriate to the scope of the action. This requirement is satisfied through a) the development of an adaptive management plan that is consistent with the framework described in Appendix 1 B of the Delta Plan http://deltacouncil.ca.gov/sites/default/files/2015/09/Appendix%201B.pdf), and b) documentation of adequate resources to implement the proposed adaptive management plan. Council staff believe that a long-term transfer such as this project is a water management action, and therefore requires an adaptive management plan. However, we also acknowledge that this policy is to be applied as appropriate to the scope of a project. Given that the project has an end date of 2024, an adaptive management plan may be more limited in this case. 4.5

In the development of an adaptive management plan, the RDEIR/SDEIS describes mitigation measures such as GW-1 and WS-1 that will be used to develop information to analyze impacts to groundwater and steam flow due to long term, multi-year water transfers. These and other mitigation measures could be examples of decision triggers that inform step 7 of the Evaluate and Respond Phase of the Adaptive Management Framework.

Additional Comments on the RDEIR/SDEIS

Mitigation Measure WS-1: Streamflow Depletion Factor proposes to mitigate for lower streamflows due to groundwater recharge impacts. The mitigation measure proposes to have Reclamation apply a streamflow depletion factor to mitigate potential water supply impacts from additional groundwater pumping due to groundwater substitution transfers. This mitigation measure addresses the initial streamflow depletion, but it does not address cumulative impacts from multiple multi-year water transfers on streamflow. The measure should be updated to address conditions during various water year types and the cumulative effects of multi-year water transfers from groundwater pumping.

Additionally, the streamflow depletion factor cited in the mitigation measure is a minimum 13 percent, "…but this factor may be adjusted based on additional information on local conditions. The streamflow depletion factor may not change every year, but will be refined as new information becomes available and may become more site-specific as better data and groundwater modeling becomes available." It is not clear when and how this additional information would be collected and provided to evaluate the need to adjust the percentage. Therefore, the Council anticipates that individual water transfer covered actions certifying consistency with the Delta Plan will need to provide additional project-level information related to groundwater impacts beyond the program-level conditions described in the RDEIR/SDEIS. 4.6

Closing Comments

We encourage SLDMWA to engage with Council staff prior to developing and submitting a certification of consistency for this project. We are available to discuss issues outlined in this letter as you proceed in the next stages of your project and approval processes. Please contact Anthony Navasero at (916) 445-5471 (Anthony.Navasero@deltacouncil.ca.gov with any questions. 4.7

Sincerely,

Jeff Henderson, AICP
Deputy Executive Officer

Cc: Sheryl Looper
Bureau of Reclamation, Mid Pacific Division
2800 Cottage Way, MP-400
Sacramento, CA 95825

Via email: slooper@usbr.gov

Billiou Farming Company
P.O. Box 765
Hamilton City, Ca. 95951

Attn: Dan Cordova
U.S. Bureau of Reclamation
2800 Cottage Way, MP-410
Sacramento, CA 95825

Revised EIR and Supplemental EIS for Water Transfers

March 16, 2019

Dear Mr. Cordova,

My name is Michael Billiou. I am a farmer, just south of Hamilton City. This year our family ranch enjoys its 150th year of continuous ag operations. I am concerned for its future.

The northeastern area of Glenn County has been repeatedly proposed as a potentially large source of ground water for transfer. I see in the Revised EIR and Supplemental EIS for Water Transfers, that Glenn Colusa Irrigation District is still listed as a Seller of up to 91,000 ac/ft . of pumped ground water. I believe this number qualifies for a substantial revision downward, or elimination altogether. I suggest that this is a possible revision that has been overlooked, and ask that it be addressed before the documents are accepted. 5-1

This area from Capay to below Ord Bend, now has a 17+ year history of what happens before, during, and after, export sized groundwater pumping is conducted by GCID.

DWR/Glenn County monitoring wells 22N02W01N, 22N01W29N, 21N02W01F, and GC 36A show that GCID pumping a total of 20,000 acre feet, *er an eight year period* , has caused unacceptable impacts to the area. 5-2

Prior to 2007, the aquifers were able to fully recharge with an average rainfall year.

GCID began large scale groundwater pumping in 2007 and continued until July 2015. Although this pumping was ostensibly limited to the 950'-1200' deep (Tuscan) aquifer, the three overlying aquifer strata at ±600', 300' and 100' have all been affected, and remain compromised.

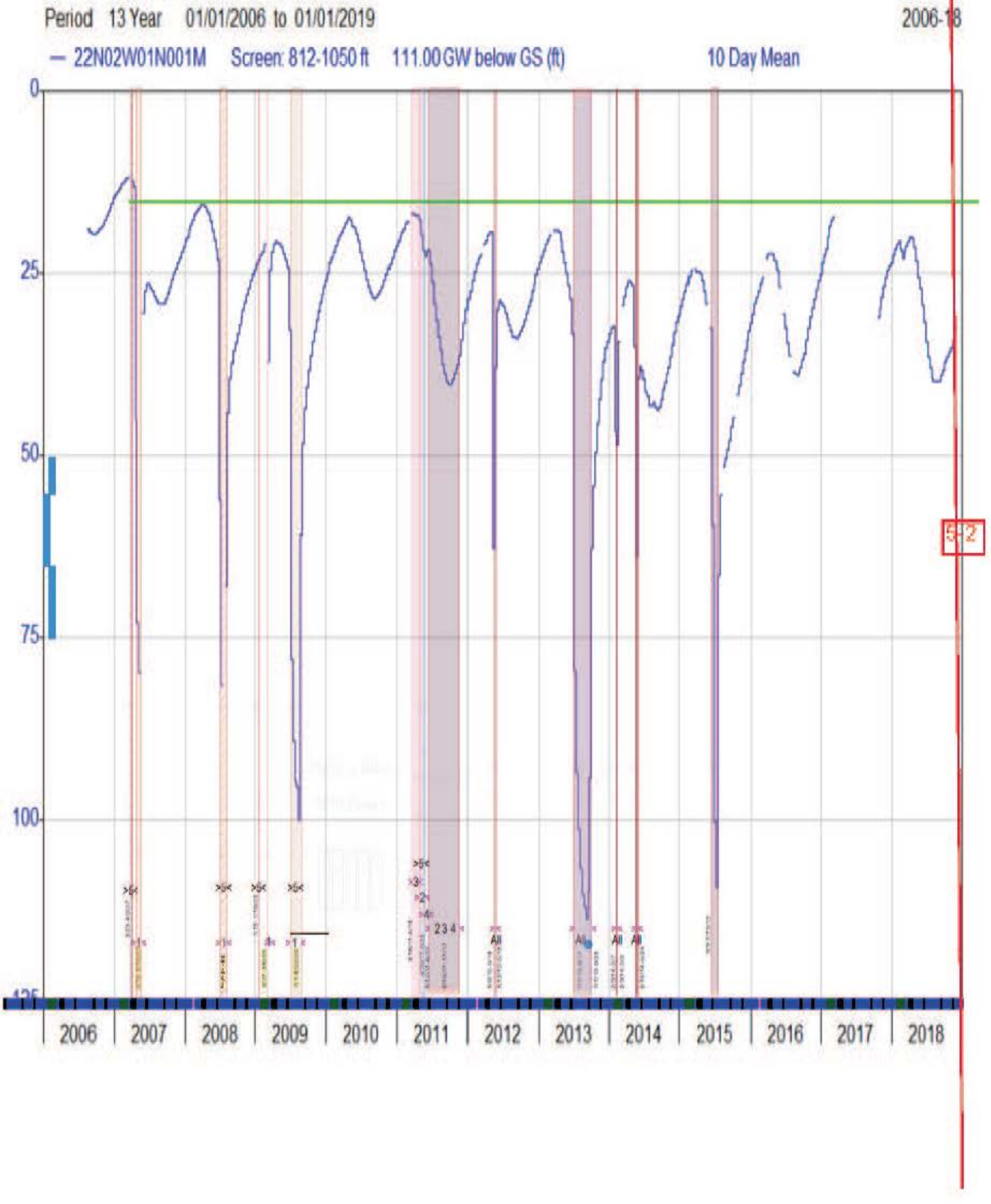
The ranches I operate for my family and friends rely on 19 groundwater wells. Since 2011- 2012 several of these wells have shown abnormal and erratic behavior. Our pump 19 went completely dry on July 19, 2014. In the years since, three important wells have become unusable for several days at a time.

Monitoring well 22N01W29N is sited on my property central to our 1,400 acres of Orchards It is also between GCID Pumps #2 & #3 at Hamilton City, and Road 24.

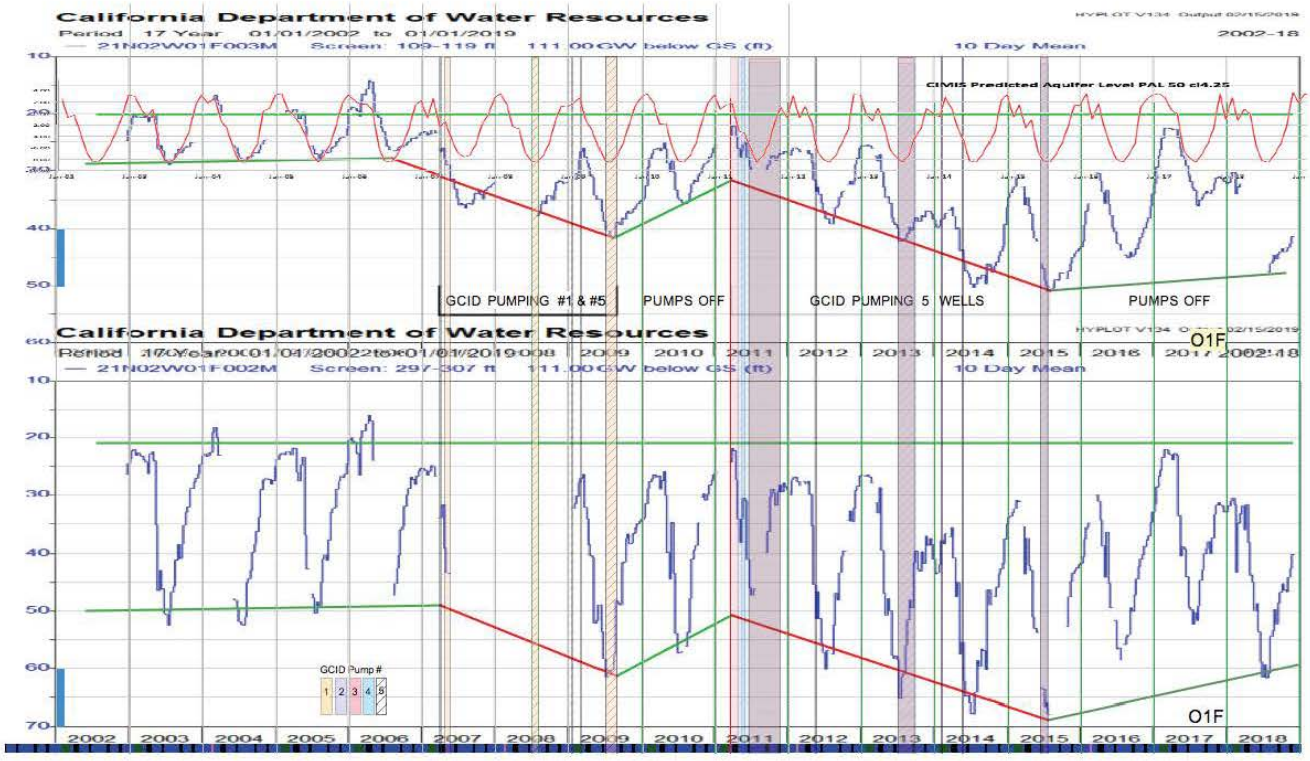
Scale from Pump 1 to 5 is approx. 10 miles.

5-2

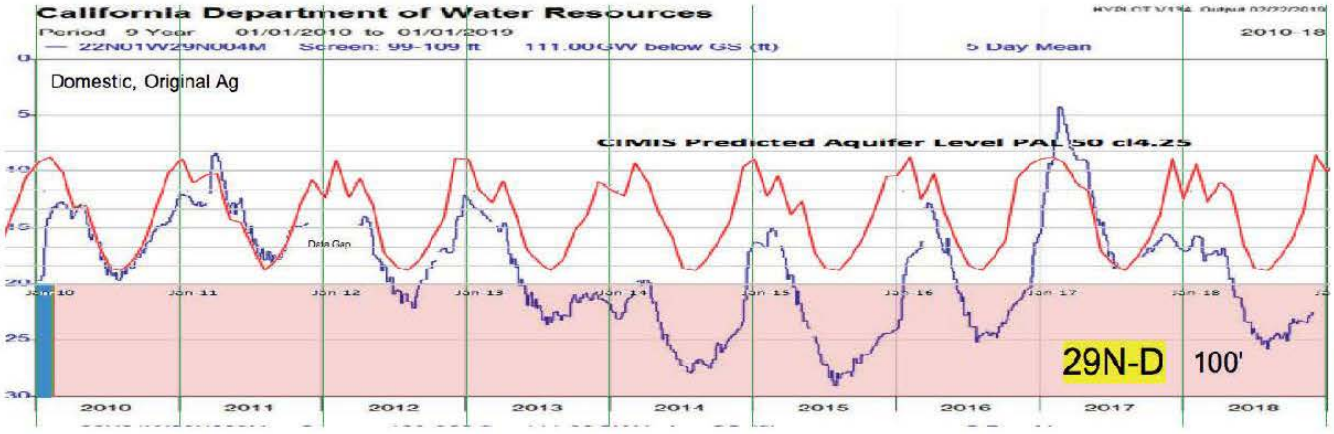
Nearly four years after the pumping ended, the 1000'-1200' aquifer still has not recovered to 95% recharge levels.



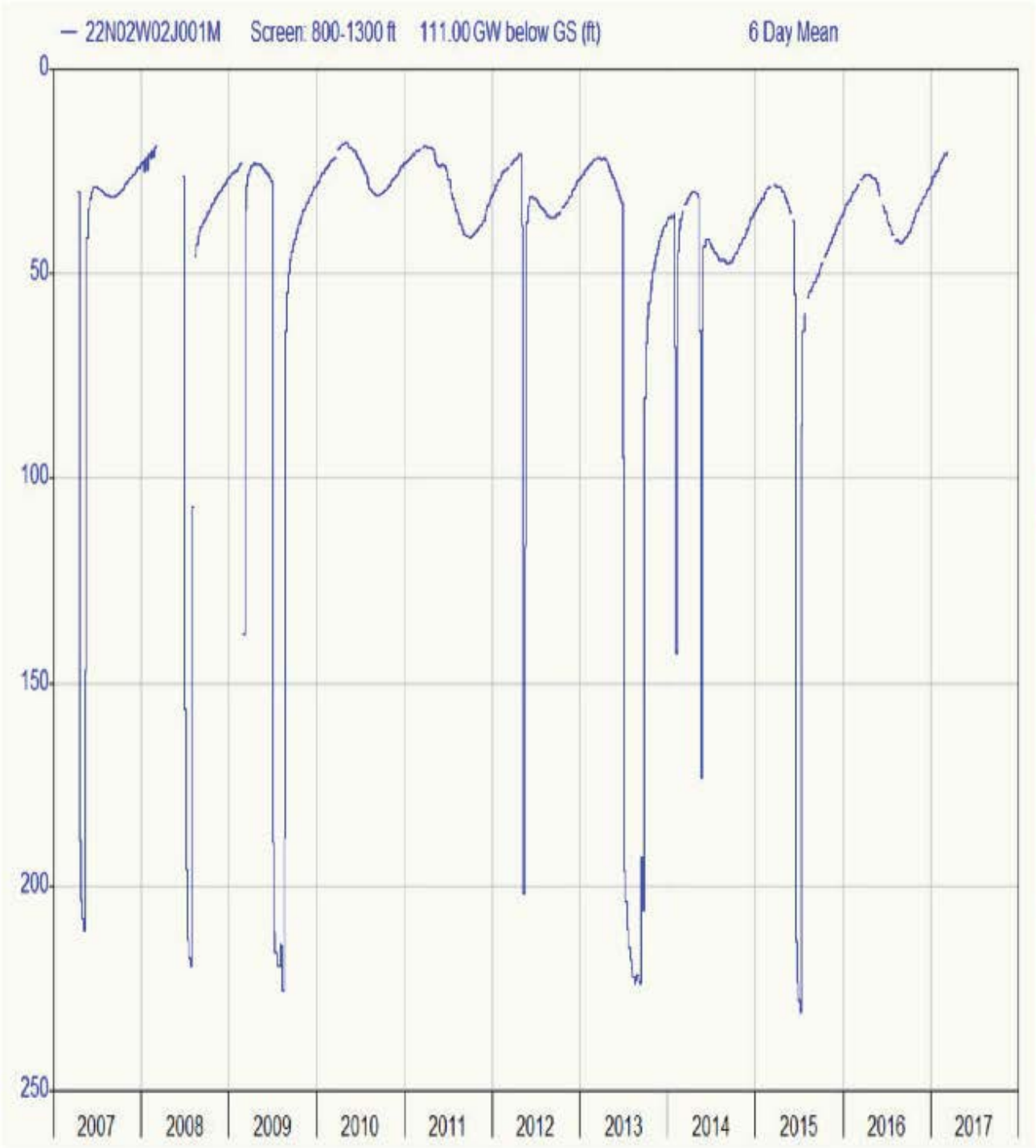
Nor have the 110' & 300' levels recovered



The Predicted Aquifer Level (PAL curve in red) uses evapotranspiration and rainfall data from CIMIS #12 in Durham to predict where the aquifer would be, without the influence of GCID transfer pumping.



When these pumps are turned on, an extremely rapid draw down occurs over a few hours. It is equivalent to a pressure drop of over 10,000 psf . The rapid loss of this pressure is a significant factor in a new situation for our area –overdraft pumping caused subsidence. New cracks in two of our brick homes began to appear after 2007. Even though both are built on heavy foundations and were previously unbroken the gaps are getting more serious with time. This alone has seriously devalued our historic brick and beam ranch house.



California Department of Water Resources

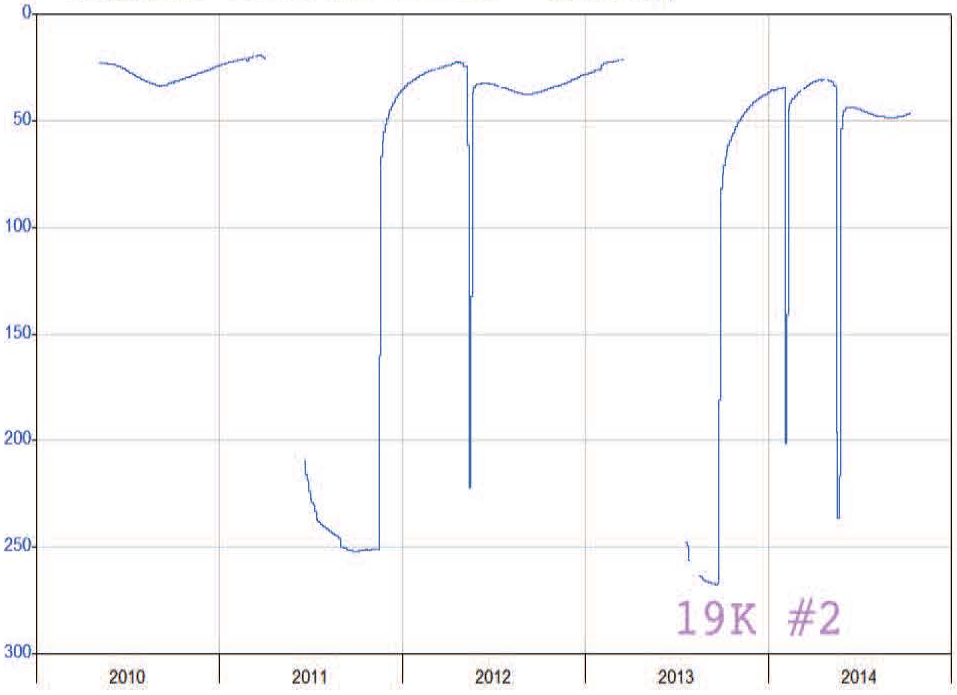
HYPLOT V133 Output 04/04/2015

Period 5 Year Plot Start 00:00_01/01/2010

2010-15

Interval 3 Day Plot End 00:00_01/01/2015

— 22N01W19K005M Screen: 920-1230 ft 111.00 Mean GW below GS (ft)



5-2

California Department of Water Resources

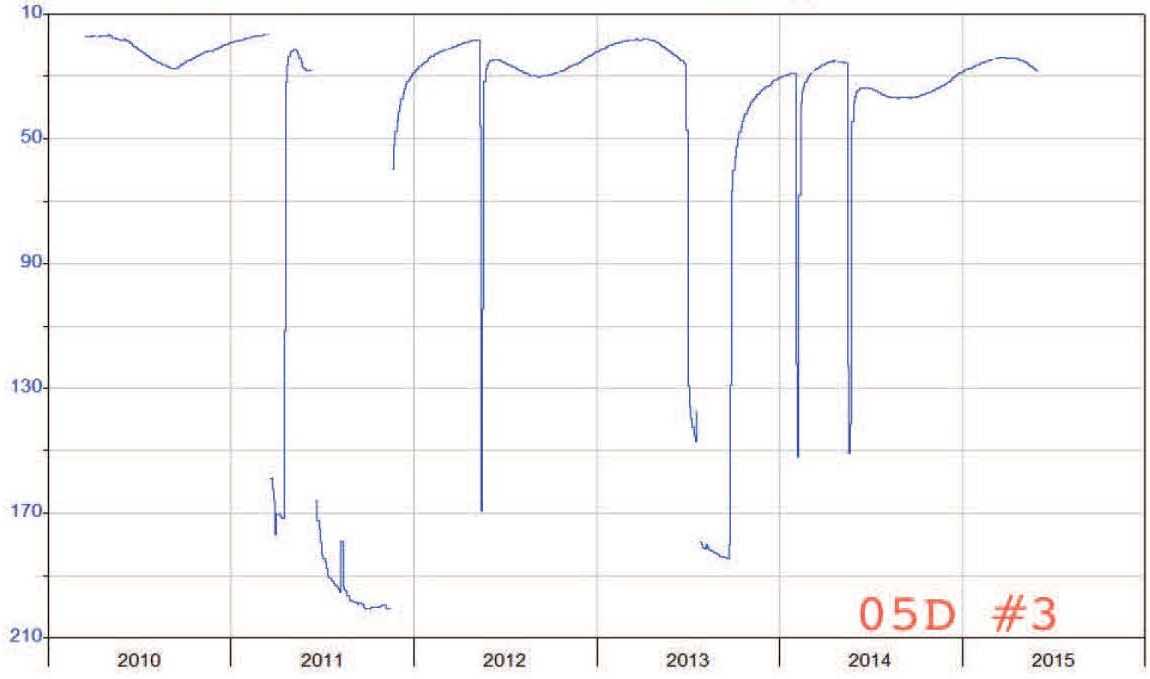
HYPLOT V133 Output 06/12/2015

Period 6 Year Plot Start 00:00_01/01/2010

2010-16

Interval 3 Day Plot End 00:00_01/01/2016

— 21N01W05D001M Screen: 783-1227 ft 111.00 Mean GW below GS (ft)



Summary

8 years of deep well pumping for money has caused local homeowners and farmers surrounding the GCID wells, all kinds of expensive problems. Since most of those affected don't know why, these incidents go largely unreported.

To date, BMOs, monitoring, and mitigation for these problems in our area, have been ineffective. The managing parties are quick to blame the aquifer declines on "the Drought". The rainfall and evapotranspiration numbers have been recorded, and they show otherwise. The declines are clearly a function of removing ±20,000 acre feet from the area, and from the local water equation.

5-2

The responsibility for proving damage under this system leaves the average landowner at a severe disadvantage, and I don't believe this is what the law intends. The unraveling of small groundwater dependent farms is a very significant issue that we want to prevent, not mitigate.

I have just replaced one of three wells that have failed since this all began..I had hoped that the cessation of GCID pumping would allow the domestic and main ag stratas to recover enough for them to be useable. Even with above average rainfall in the past 3 years, they have not. I will be out a half million dollars, just on these three replacements. And still have 15 other wells to worry about.

This area has been damaged. To allow any use of existing GCID groundwater pumps for transfer, would further deprecate the aquifers that support non-GCID landowners. The results would be a disaster to the people that live here. The $$$ that GCID sees, directly correlate to what the local humans will see: Subsidence, Salinity, and Sucking Air.

believe the water code says this cannot happen.

I urge you to review this data in detail, and disallow GCID pumps 1 through 5 from ground water pumping in any manner, if the water is to leave the originating, and recharge, area of NE Glenn County.

Sincerely,

Michael Billiou


4 Mile Radius
86,430 Acres Impacted
Capay
GCID #1
22N02W01N
Nord
GCID #2
Highway 32
Hamilton City
22N01W29N
GCID #3
21N02W01F
Plaza
Highway 45
GCID #4
Ord Bend
GCID #5
36A
N

CALIFORNIA INDIAN WATER COMMISSION

16 March 2019

Sheryl Looper
Bureau of Reclamation - MP400 Division
2800 Cottage Way, Sacramento CA 95825

Subject: Draft EIR/SDEIS Long-term Water Transfers

Dear Ms. Looper:

These comments are provided in response to the subject document, hereafter document. As an Intertribal self-determination organization pursuant to PL 93-638, these comments are submitted in reverence to the responsibility we uphold to be good stewards of lands and waters. The proposed project, actions and alternatives thereof all fail to meet the needs of the ecology, culture, and metaphysical properties of traditional Indigenous homelands and features impacted. Please see Hankins (2018)[1] to better understand specific shortcomings of analysis as pertains to the project. We have previously advised the Bureau of Reclamation (BOR) to assess ecocultural impacts from their projects and actions by using the Mauriometer (http://mauriometer.com), which assesses impacts to the environment, cultural wellbeing, social wellbeing, and economic wellbeing. The use of this tool should be done in consultation and participation with tribes, traditional cultural practitioners, and tribal organizations (hereafter beneficiaries). The consultation with beneficiaries, including the California Indian Water Commission in the development of the proposed alternatives is clearly lacking. 6-1

The document, and its precursor, fail to address how this project assists the BOR in fulfilling its tribal trust responsibilities to beneficiaries, interspecies kinship relationships, or impacts thereto. The current operations of the Central Valley Project (CVP) is counterintuitive to the laws of nature and our traditional laws, and will continue to adversely affect trust resources, for which BOR is obligated to uphold pursuant to federal laws including PL 93-638. While these projects were developed prior to existence of laws requiring consultation, the Trust responsibilities to tribes has existed, yet there has been no real effort to address direct, indirect, and cumulative impacts to tribal trust resources (e.g., water, fish, wildlife, and other transitory resources) as the intended by law. For instance, prior legal precedence identifies beneficiaries' preeminent rights to surface and ground water (see *Winters v. United States* and *Agua Caliente v. Coachella Valley Water District & Desert Water Agency*). Since time immemorial California Indians have stewarded the lands and waters for our own needs, but also to fulfill the needs of the landscape and species therein. Yet, the analysis fails to address this inclusive of all areas impacted by the CVP. In fact, the document hinges water transfers on the contributions of water from others (sellers), without addressing how those rights infringe upon tribal water rights. Furthermore, the document assumes separation between surface and ground water. 6-2

Clearly the cases cited above recognize the interconnected nature of surface and groundwater as one. In this sense, substitution of surface water from willing sellers while enabling use of groundwater by those sellers is problematic on multiple levels. Allowing a seller to access groundwater in lieu of surface water sold further reduces base flows in surface water. The reduction in base flows adversely impacts tribal 6-3

[1] Hankins, D.L. 2018. Ecocultural Equality in the Miwko? Waali?. *San Francisco Estuary and Watershed Science* 16(3): 1-11

C/O PO BOX 627
FOREST RANCH, CALIFORNIA 95942

trust resources. Utilization of groundwater in this manner may have adverse impacts on groundwater users in surrounding areas, and may be inconsistent with plans developed regionally via California's Sustainable Groundwater Management Act.

Given climate change, detailed analysis of the long-term sustainability of the CVP and water transfers should be completed to minimize reliance on water transfers for unsustainable water uses. Analysis should include limits to crop types that can be sustained via dry land farming, conversing to ranch lands, or outright land retirement.

The proposed action provides a nexus for a deeper level of analysis of the CVP and its impact on tribal trust resources. Given the lack of comprehensive analysis and consultation, we support the no project alternative.

Sincerely,

Don L. Hankins, Ph.D.

President

C/O PO BOX 627
FOREST RANCH, CALIFORNIA 95942

March 18, 2019

Daniel Cordova
Bureau of Reclamation, Mid-Pacific Region

dcordova@usbr.gov via E-Mail

Re: Comments on Revised Draft Environmental Impact Report & Supplemental Environmental Impact Statement for the Bureau of Reclamation and San Luis & Delta-Mendota Water Authority Long-Term Water Transfers

Dear Mr. Cordova,

On behalf of Friends of the River, Restore the Delta, Planning and Conservation League, Sierra Club, and Environmental Water Caucus we are writing to provide comments on the Revised Draft Environmental Impact Report and Supplemental Environmental Impact Statement ("RDEIR/SEIS") for the United States Department of the Interior, Bureau of Reclamation ("BOR") and San Luis & Delta-Mendota Water Authority ("SLDMWA") Long-Term Water Transfers ("LTWT"). The proposed project and RDEIR/SEIS fail to satisfy the requirements of the California Environmental Quality Act ("CEQA") and the National Environmental Policy Act ("NEPA") and the lead agencies obligations under state and federal law. By this comment letter our public interest organizations object to approval of the LTWT project and the LTWT project RDEIR/SEIS. Due to the RDEIR/SEIS being fundamentally and basically inadequate and conclusory in nature, any meaningful public review and comment regarding the proposed project is precluded. As such, a new RDEIR/SEIS must be recirculated to provide the public with the data and analysis needed to make an informed decision regarding the environmental impacts of the proposed project. At the core of an EIR/EIS lies a duty to provide both public agencies and the public with *detailed information* about the effect the project is likely to have on the environment; to list ways in which the significant effects of such a project might be minimized; and to indicate alternatives to such a project.[1] Here, BOR fails to provide both the public and

7-1

[1] California Public Resources Code § 21061

public agencies with sufficient information on multiple fronts through omissions, incomplete data, and unfinished analysis.

7-1

I. GROUNDWATER RESOURCES

The current RDEIR/SEIS fails to comply with both CEQA and NEPA requirements on groundwater resources by failing to provide current data, analysis of the environmental impacts of the project, and incomplete mitigation analysis.

7-2

As research and knowledge regarding the interconnectedness between all water systems in California grows, scientific data continues to emerge showing the negative impacts increased groundwater withdraw has on surface water users and ecosystems throughout the state. This knowledge and data related to California's groundwater systems has grown exponentially over the last decade. Data and analyses have continued to shed light on how groundwater pumping can lead to impacts on nearby streams fairly immediately, while impacts on streams miles from the pumping may not be fully realized for years or even decades.[2] Despite the information readily available, the RDEIR/SEIS fails to incorporate data and analyses into the RDEIR/SEIS that would provide agencies and the public with the information needed to make an informed decision regarding the project.

7-3

The RDEIR/SEIS acknowledges the proposed project would have an impact on the surrounding environment as a result of increased groundwater pumping. Under section 3.3.2.2, the RDEIR/SEIS describes that the proposed project would lead to increased groundwater pumping, thus resulting in lower groundwater levels, leading to potential subsidence. These lower

In analyzing the current state of the multiple groundwater basins impacted by the proposed project, the RDEIR/SEIS paints a stark picture of the state of each of these basins. While some of the impacted groundwater basins are faring better than others, all basins included in the RDEIR/SEIS have been adversely impacted by the excessive taking of groundwater. In describing the Redding Area Groundwater Basin, Section 3.3.1.2.1 states: "Groundwater levels in the Anderson subbasin have recovered to spring 2016 levels but *not to pre-drought levels*." In the northern Sacramento Valley Groundwater Basin, section 3.3.1.2.2 groundwater levels on average have shown decline, with an average of 10.6 feet in deep aquifer zones. This drop in groundwater levels have caused numerous wells to go dry. Of serious concern is Yolo County within Conaway Ranch, where land subsidence estimated by DWR showed a .2 foot drop from 2012 to 2013 and an additional .6 foot drop from 2013 to 2014. This subsidence is glaring considering that in the previous 22 years land subsidence was less than .1 feet. While the RDEIR/SEIS states subsidence in these zones has reverted to pre-2012 levels in recent years, the proposed project would increase the groundwater draw, thus raising the serious potential for larger subsidence in future years. While the RDEIR/SEIS states that these declines have slowed

7-4

[2] The Nature Conservancy, 2014. *Groundwater and Stream Interaction in California's Central Valley: Insights for Sustainable Groundwater Management.*

in 2017, groundwater levels have not recovered to pre-2011 levels. Section 3.3.1.2.3 states that the San Joaquin Valley Groundwater Basin has also shown decline in groundwater levels. These declining groundwater levels have also led to land subsidence, one study described in the section noting two feet of subsidence in portions of the San Joaquin Valley between May 2015 and September 2016. Section 3.3.1.2.4 describes a lowering of groundwater levels in the Santa Clara Valley Groundwater Basin, with Santa Clara County historically experiencing as much as 13 feet of subsidence due to excessive pumping of groundwater. Statewide, the impact of significant groundwater elevation change is clearly shown in Appendix E, Figure E-44. Monitoring wells throughout the state show decreases of over 25 feet from the Spring of 2011 to the Spring of 2017.

7-4

The RDEIR/SEIS is important in that it shows the severe impacts, including subsidence, that occur when groundwater pumping and withdraw is increased. These impacts would typically be greater in droughts, and mitigated in wet years as the underlying basins would be recharged. However, the proposed project would *increase* the amount of groundwater withdraw, thus impacting all basins ability to recharge cyclically in wet years following drought years.

Despite the clear environmental impacts associated with the project, in part acknowledged in the RDEIR/SEIS itself, BOR and SLDMWA fails to analyze updated data resulting in conclusory statements regarding the impacts of the proposed project. The following sections address deficiencies in the RDEIR/SEIS related to groundwater impacts of the proposed project. These wide-ranging deficiencies make the RDEIR/SEIS incomplete, and require the RDEIR/SEIS be recirculated after proper data and analysis is provided to give the public the ability to assess the environmental impacts of the project.

7-5

a. Reliance on outdated modeling to establish a baseline under both NEPA and CEQA renders the RDEIR/SEIS inadequate, as new modeling with current data is now available

Fundamental assertions in the FEIR/EIS relied on data that is now outdated. This data, among other uses, was used to provide an environmental baseline for the current project. BOR has now filed the RDEIR/SEIS and has not provided data, other than some referenced in appendices, and failed to analyze that new data, when determining the impacts of the project. This failure runs afoul of recognized procedure and law when conducting both the NEPA and CEQA process.

NEPA prohibits an EIS to substitute a mitigation measure as a proxy for measuring the environmental baseline because without data from before a project is approved, one cannot carefully consider information about significant environment impacts. *N. Plains Res. Council v. Surface Transp. Bd.*, (9th Circ. 2011) 668 F.3d 1067, 1085. With regards to CEQA, the determination of the baseline is the first step in the impact review process. *Save our Peninsula Comm. V. Monterey Cty. Bd. Of Supervisors*, (2001) 87 Cal.App.4th 99, 125. CEQA Guidelines section 15125(a) states "An EIR must include a description of the physical environmental conditions in the vicinity of the project, as they exist at the time the notice of preparation is published, or if no notice of preparation is published, at the time environmental analysis is commenced, from both a local and regional perspective." The FEIS/R relied on a variety of models to establish a baseline regarding environmental conditions related to groundwater. The

7-6

SACFEM2013 model provided a full simulation period of 1970-2010. The CalSim II provided a water year range of 1922 through 2003. Due to the data available for the various models, the FEIS/R primarily relied on a model year period from 1970-2003 for modeling in establishing an environmental baseline.

Not only was the modeling of the conditions related to groundwater based on an older data set, the water supply demand baseline was also based on an older data set. This is described in *AquAlliance v. U.S. Bureau of Reclamation*, (2018) 287 F.Supp.3d 969, 1022 stating "the Authority explains in its supplemental briefing, the 2010 land use data incorporated into SACFEM2013 was the most recent land use data available in 2011, the time of the initiation of this environmental review." Further, the Court discussed that the Authority conceded that since 2010 the groundwater demand has likely increased due to additional irrigated lands. (*Id.* At 1021.) We are now approaching a decade after the initial filing of the FEIS/R, with new data readily available to analyze data related to both groundwater modeling as well as water supply demand. The RDEIR/SEIS should include updated data in establishing both a proper baseline for groundwater basins as well as water supply demand. 7-6

Further, the current RDEIR/SEIS fails to provide updated data relating to environmental impacts to decreased streamflow related to groundwater withdrawal. This data could be obtained through the C2VSIM model provided by the Department of Water Resources.[3] This updated model was released April 27, 2018 and readily available to be used to analyze impacts decreased groundwater will have on rivers and streams. Despite the availability of the updated modeling capabilities, it is unclear from the RDEIR/SEIS if this updated model was used, and analysis appears absent. A recirculated RDEIR/SEIS should incorporate the data from the updated C2VSIM model into analysis regarding project impacts. If the most current data is not used, the RDEIR/SEIS should state why the data was not used so the public is given complete information to properly analyze environmental impacts of the project.

b. The current RDEIR/SEIS fails to provide data and analyze environmental impacts associated with decreased streamflow due to excessive groundwater withdrawal

In analyzing C2VSim model relating to Butte Creek, the Lower American River, and the Lower Merced, graphs of annual and monthly groundwater discharges to river reaches for the 1920s, 1960s, and 2000s show changes in the groundwater-river flow exchange. A 2013 article using this C2VSim modeling explains:

> Net annual groundwater discharges have declined for all three reaches, most dramatically on the American River where the flow direction has reversed. The monthly patterns of stream-aquifer flows for the three reaches have also changed over this time. The large seasonal differences on Butte Creek and the Merced River have been reduced. The large summer groundwater discharge on the American River has been replaced by a nearly 7-7

[3] https://water.ca.gov/Library/Modeling-and-Analysis/Central-Valley-models-and-tools/C2VSim

> constant flow of river water into the aquifer. These changes have impacted flow levels and water temperatures in these reaches, and may have also affected water chemistry.[4]

This is further supported in the 2014 article by the Nature Conservancy titled *Groundwater and Stream interaction in California's Central Valley: Insights for Sustainable Groundwater Management* which states:

> Because even small changes in groundwater levels can lead to potentially significant stream depletion, and given lag times that may take decades, *simply monitoring and subsequently reacting to changes* in observed water level data *is not sufficient* for proper integrated water resource management. Use of models is critical in understanding the timing and spatial extent of pumping effects on surface water systems and managing these impacts accordingly.

Despite the availability of updated modeling and data showing the enormous environmental impacts the lowering of groundwater can have on stream and river flow, the REIR/SEIS fails to fully analyze updated data on these impacts. Further data is needed to quantify what impact decreased groundwater would have on streams and rivers within an impacted basin. This is of particular importance given the significant lag time before the impacts on streams are fully realized. 7-7

Of the stream data provided, six show that there would be a greater than ten percent reduction in flow. Of concern, Table I-1 shows that eleven creeks would have a reduction in cubic feet per second ("CFS"), but it is unknown whether that reduction would be greater than ten percent. This failure makes assessing the environmental impacts associated with the project impossible. As clearly shown by the monitory results in Table I-1, gauge data can be obtained. Given the numerous streams and rivers impacted by the proposed project, and the limited number of data sets presented in Table I-1, additional gauges would make an understanding of the environmental impacts associated with the lowering of stream levels due to groundwater pumping clearer. To effectively monitor changes in groundwater systems, baseline conditions must be established. The United States Department of Agriculture published the *Technical Guide to Managing Ground Water Resources*[5] which states:

> Once the status of existing data is established, areas where additional data are needed can be identified and new data obtained. Examples of needs may include new wells and water levels, *new stream gages and stream flows*, water-quality data, and water-use data.

Further gauging would help to understand the impacts of groundwater pumping. This is of considerable importance considering mitigation measure GW-1 relies on groundwater levels as triggering mechanism to stop pumping, not on streamflow data. However, an environmental

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[4] Charles F. Brush, Emin C. Dogrul, and Tariq N. Kadir, (2013), Department of Water Resources *Development and Calibration of the California Central Valley Groundwater-Surface Water imulation Model (C2VSim), version 3.02-CG*

[5] Steve Glasser, James Gauthier-Warinner, Joseph Gurrieri, Joseph Keely, United States Department of Agriculture (2007). *Technical Guide to Managing Ground Water Resources*

impact report must contain facts and analysis, not just the bare conclusions of the agency. *Gray v. County of Madera*, (2008) 167 Cal.App.4th 1099. Due to the lag of impacts on stream flow resulting from groundwater pumping, greater mitigation and data is needed to prevent stream flow reduction that may be occurring prior to the groundwater levels reaching their triggering point. This data must be analyzed, and not simply used to state bare conclusions. 7-7

Based on the failures to provide data and analysis regarding impacts to streamflow from the proposed project, the RDEIR/SEIS does not satisfy the requirements of NEPA and CEQA.

c. The current GW 1 fails to comply with the requirements of CEQA and NEPA

The updated GW-1, as provided in the RDEIR/SEIS is incomplete in providing data, analysis, integration, and clarity regarding measures that would mitigate the environmental impacts of the proposed project.

Starting January 31, 2020 Part 2.74 of the Sustainable Groundwater Management Act ("SGMA") states in section 10720.7(a)(1):

> By January 31, 2020, all basins designated as high- or medium-priority basins by the department that have been designated in Bulletin 118, as it may be updated or revised on or before January 1, 2017, as basins that are subject to critical conditions of overdraft shall be managed *under a groundwater sustainability plan or coordinated groundwater sustainability plans pursuant to this part.*

Further, SGMA defines "Sustainable groundwater management" as the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results. The definitions for "Undesirable result" includes chronic lowering of groundwater levels, significant and unreasonable reduction of groundwater storage, significant and unreasonable seawater intrusion, significant and unreasonable degraded water quality, significant and unreasonable land subsidence that substantially interferes with surface land uses. 7-8

Substantial deference to an agency's methodology is not owed if "the agency has completely failed to address some factor consideration of which was essential to making an informed decision." *Brower v. Evans*, (9th Cir. 2001) 257 F.3d 1058, 1067. Here, the RDEIR/SEIS fails to discuss multiple factors needed for the public to make an informed decision on project impacts.

First, the RDEIR/SEIS fails in the GW-1 to fully integrate future requirements of SGMA into the proposed project. While the proposed project provides in section 3.3.4.2 that "In areas where quantitative BMOs do not exist, sellers will manage groundwater levels to maintain them above the identified historic low groundwater level (trigger) and will initiate the mitigation plan if groundwater levels reach the trigger." However, the RDEIR/SEIS fails to adopt language relating to the January 31, 2020 SGMA requirements under Water Code § 10735.2(a)(3) that would designate a critically-overdraft basin as "probationary" if DWR, in consultation with the Board, determines that the GSP is inadequate or will not achieve sustainability. This creates a potential

conflict between the standards laid out as triggering in the GW-1 with those that may be imposed under California law. Further, the alternative provided to potential sellers to use the "historic low groundwater" may also run afoul of California law requiring high and medium priority basins to be managed under a GSP by January 31, 2022.[6]

7-8

Second, the RDEIR/SEIS fails to incorporate new data that would help create a GW-1 that would meet mitigation requirements under NEPA and CEQA. NEPA's purpose is twofold: (1) to ensure that agencies carefully consider information about significant environmental impacts and (2) to guarantee relevant information is available to the public. *Roberson v. Methow Valley Citizens Council*, (1989) 490 U.S. 332, 349. Here, because the GW-1 fails to use updated data and modeling describing the interplay between groundwater and surface water, the GW-1 is inadequate. As described earlier, simply monitoring and reacting to changes in observed water data is not adequate for proper integrated water service management. However, this is exactly what the GW-1 contemplates doing. This is done by waiting until groundwater levels reach GSP levels and or historic lows before discontinuing a seller's ability to pump groundwater. Once groundwater levels raise, the GW-1 would permit pumping by sellers, only to have the groundwater level lower to the trigger point again. Thus, the effect would be to keep groundwater levels at or near the GSP level and/or historic low. These long-term impacts need be fully analyzed with current data, and a proper mitigation plan put in place that would avoid a permanently lowered ground water levels.

7-9

In analyzing the issues related to decreased water quality, Section 3.3.3.3.1 states "Inducing the movement or migration of reduced quality water into previously unaffected areas due to groundwater substitution pumping is not likely to be a concern *unless groundwater levels and/or flow patterns are substantially altered for a long period of time.*" While the RDEIR/SEIS discounts this possibility due to groundwater substitution being limited to short-term withdrawals, the RDEIR/SEIS fails to fully analyze these impacts using current known science. Importantly, the proposed project would lead to a potential altered level over a long period of time. This is based on the proposed project only limiting pumping when the GSP or historic low level is triggered. However, once the level increases, the assumption is that pumping may resume. This results in the groundwater level continually bouncing around near the historic low level, and not recharging to a typical level were the proposed project not be implemented. This is of serious concern as the continual pumping of groundwater can have wide ranging environment impacts, including: lowering of the water table, increasing costs to the user, reduction of water in streams and lakes, land subsidence, and deterioration of water quality.[7]

While the RDEIR/SEIS describes the continued decline in groundwater levels being related to consecutive drought years, the RDEIR/SEIS fails to analyze the known factors of climate change and increased groundwater draw as being of equal or greater concern to the groundwater levels. Further, the RDEIR/SEIS states that implementation of Mitigation Measure GW-1 would avoid permanent subsidence and reduce land subsidence impacts to less than significant. However, language relating to monitoring of subsidence which was included in the FEIR/EIS, appears to not be included in the RDEIR/SEIS. Importantly, land subsidence is not simply an adverse effect

7-10

[6] Water Code § 10720.7(a)(2)

[7] https://water.usgs.gov/edu/gwdepletion.html

through the lowering of the land. Land subsidence to over pumping can lead to the permanent loss of natural water storage. During a recent drought, land in the San Joaquin Valley sank nearly three feet, this translated to a permanent loss of natural water storage capacity of between 336,000 and 606,000 acre feet.[8] In *Clover Valley Foundation v. City of Rocklin*, (2011) 197 Cal.App.4th 200, 236, the Court held "Impermissible deferral of mitigation measures occurs when an EIR puts off analysis or orders a report without either setting standards or demonstrating how the impact can be mitigated in the manner described in the EIR." As discussed below, the changes made in the GW-1 regarding subsidence are unclear making a recirculated RDEIR/SEIS necessary. 7-10

II. THE STRUCTURE OF THE RDEIR/SEIS LEADS TO CONFUSION AS TO WHAT THE PROJECT SCOPE, ENVIRONMENTAL IMPACTS, AND MITIGATION MEASURES ARE BEING APPLIED TO THE PROPOSED PROJECT

The RDEIR/SEIS fails to provide clear guidance as to what portion of reports/statements apply to the project, as language is combined between the RDEIR/SEIS and FEIR/EIS. Due to the lack of clarity regarding what sections apply to the proposed project, the RDEIR/SEIS should be recirculated with language making it clear to the public what information is being used and analyzed regarding the current project.

At the core of the NEPA and CEQA process is the requirement that an agency consider environmental impacts and provide them in a format that ensures the general public has sufficient information to weigh the environmental impacts of the proposed project. This is shown in *Roberson v. Methow Valley Citizens Council*, (1989) 490 U.S. 332, 349, which articulates that NEPA's purpose is twofold: (1) to ensure that agencies carefully consider information about significant environmental impacts and (2) to guarantee relevant information is available to the public. Similarly, regarding CEQA "the purpose of an environmental impact report is to provide public agencies and the *public in general with detailed information* about the effect which a proposed project is likely to have on the environment …" Public Resource Code § 21061. 7-11

Here, the format of the RDEIR/SEIS makes it impossible to flush out both the impacts and mitigation measures that the agency is applying to the proposed project. Among other issues parsing out the applicable portions of the two reports, two crucial differences stand out.

First, the original Draft Environmental Impact Statement and Draft Environmental Impact Report ("DEIS/R") analyzed transfers of water relating to the proposed project of up to 511,094 acre-feet. However, in Section 1.2 of the RDEIR/SEIS the BOR says transfers in a year would be limited to not exceed 250,000 acre-feet. However, the potential seller totals in Table ES-2 add more than 100,000 acre feet of water than those in the FEIR/FEIS ES-2. So, while the RDEIR/SEIS is stating that water transfers would be lower, the new RDEIR/SEIS actually includes more sellers with more totals of possible transfers of water. The RDEIR/SEIS provides 7-12

[8] Ker Than, Stanford News (2017). *Groundwater over-pumping is reducing San Joaquin Valley's ability to store water*

no framework as to how or why the limit would be 250,000 acre feet, simply stating that it is "based on buyers' demand for transfers." To provide the public with the information needed to assess the current project, the RDEIR/SEIS must clarify how this trigger of a maximum transfer of 250,000 will be enforced and applied to long-term water transfers. Without this information, the conclusory statements regarding the 250,000 cap make the RDEIR/SEIS incomplete. 7-12

Second, in the FEIR/SEIS the mitigation plan included subsidence impacts, and steps to avoid it. However, the RDEIR/SEIS fails to include in the mitigation plan the language and mitigation regarding subsidence. This leaves the public guessing as to what the final mitigation plan and GW-1 would entail, and how well the GW-1 would prevent negative project related environmental impacts. 7-13

A recirculated RDEIR/SEIS should address these areas of confusion in order to provide the public and public agencies the ability understand the impacts and mitigations of the current project. 7-14

III. THE RDEIR/SEIS FAILS TO PROVIDE THE CORRECT SCOPE OF THE PROJECT AS WELL AS PROVIDE THE CORRECT SCOPE OF PROJECTS RELATED TO CUMULATIVE IMPACTS, RESULTING IN PIECEMEAL CEQA AND NEPA REVIEW

The current project fundamentally changes the flow of both surface and groundwater throughout California. The project will do this by increasing transfers from sellers generally in the north, to buyers in the south. The environmental impacts of taking water from the northern watersheds and transferring it to southern buyers is magnified by the recently amended Coordinated Operating Agreement ("COA"). The failure of the RDEIR/DEIS to include recent amendments to the COA in the scope of the current project amounts to improperly chopping up a large project into small pieces.[9]

On December 12, 2018, DWR and the Bureau of Reclamation ("BOR") reached an agreement to update the COA. Important changes include amending Article 6(c) of the COA to alter the storage withdrawal percentage from the parties. Under the original COA each party's responsibility for making storage withdrawals to meet Sacramento Valley in-basin use was fixed, with the United States percentage at 75% and California at 25%. The amended language *reduces* the United States percentage to 65% in Dry Years and 60% in Critical years. This alteration may lead to serious environmental impacts yet to be addressed in the present RDEIR/SEIS. These amendments render the underlying water use assumptions that have been discussed regarding the present project inadequate. 7-15

Significantly concerning is that at times when water is most scarce, in Dry and Critically Dry years, the SWP may have to divert up to 15% more water outside of the SWP system. This will

[9] CEQA mandates "that environmental considerations do not become submerged by chopping a large project into many little ones, each with a minimal potential impact on the environment, which cumulatively may have disastrous consequences." (*Bozung v. Local Agency Formation Com.* (1975) 13.3d 263, 283-284.)

compound environmental issues during years when environmental impacts are the most severe due to water shortage. In addition, the water year classifications are based on Sacramento Valley 40-30-30 Index. However, the likelihood of prolonged drought and unpredictable weather patterns is only expected to increase due to continued changes in our climate.[10] Thus, the clear risk is that California will repeatedly fall into water year classifications of Dry and Critically Dry years. Alarmingly, these are the exact years that SWP will have to contribute *more* water to meet Sacramento Valley in-basin use.

7-15

Thus, the COA amendments changed the frequency, amount, and timing of the taking of water from drainages in California. The current project also will change the frequency, amount, and timing of taking water from drainages in California. The COA amendments and the current project both relate specifically to the transferring of water as well as include the Central Valley Project as a primary participant. Thus, the impacts of both would need to be analyzed to fully grasp the amount of water that will be taken and transferred from the various impacted watersheds and groundwater basins.

Additionally, section 3.8.6 states "The projects considered for the vegetation and wildlife cumulative condition are the SWP water transfers, CVP Municipal and Industrial Water Shortage Policy (WSP), Lower Yuba River Accord, refuge transfers, San Joaquin River Restoration Program (SJRRP), and Exchange Contractors 25-year Water Transfers …" However, the failure of the RDEIR/SEIS to include the California WaterFix ("WaterFix"), Water Supply Contract Amendments ("WSCAs"), and the Contract Extension projects in the scope of the current projects cumulative impacts amounts to improperly chopping up a large project into small pieces.[11] Here, the proposed project would increase the taking of water from sellers, diverting water from the source watersheds, and transferring it to buyers in different water service areas. These impacts would clearly be magnified by the proposals to increase water transfers through the State Water Project WSCAs, and increase supply created by the WaterFix to be transferred and exchanged at an increased rate. This would be then guaranteed over a long-term time horizon due to the contract extension project. This in turn would lead to greater flows of water being moved from PWAs, leading to greater amounts of water being diverted from watersheds and moving to differing uses. This impact would also occur over longer term due to the contract extension. Thus, the projects in *conjunction* would increase impacts over a longer time horizon. These additional projects, not included in the RDEIR/SEIS, would magnify impacts of the proposed project because of the significant overlap of groundwater basins, watersheds, and service areas of the proposed project. This includes the cumulative impacts of the projects on the Delta. This failure creates an inability for the public and public agencies to seriously analyze the environmental impacts of the project.

7-16

[10] "The odds of California suffering droughts at the far end of the scale, like the current one that began in 2012, have roughly doubled over the past century" Justin Gillis, "*Hotter Planet Fuels Drought, Scientists Find*", New York Times, 2015, A1

[11] CEQA mandates "that environmental considerations do not become submerged by chopping a large project into many little ones, each with a minimal potential impact on the environment, which cumulatively may have disastrous consequences." (*Bozung v. Local Agency Formation Com.* (1975) 13.3d 263, 283-284.)

As the RDEIR/SEIS does not currently address environmental issues raised by the COA amendments, all Environmental Impacts have not been identified. A full analysis, along with data showing what impacts the COA amendments will have on the current project, as well as analyzing the correct scope of cumulative project impacts is needed to provide the public with a clear understanding of the environmental impacts of the current project. 7-16

IV. THE RDEIR/SEIS FAILS, UNDER BOTH NEPA AND CEQA, TO PROVIDE DATA AND ANALYZE IMPACTS ASSOCIATED WITH CLIMATE CHANGE

The Court *in AquaAlliance v. U.S. Bureau of Reclamation*, (2018) 287 F.Supp.3d 969, 1028 stated "the parties appear to be in agreement that NEPA requires an evaluation of the impact of climate change on a project, at least under certain circumstances." The Court went on to hold that "the FEIS/R fails to address or otherwise explain how this information about the potential impacts of climate change can be reconciled with the ultimate conclusion that climate change impacts to the Project will be less than significant." (*Id.* At 1032)

The FEIR/EIS relied on reports showing that the snow water equivalent in California is projected to decrease by 16 percent by 2035, 34 percent by 2070, and 57 percent by 2099. The relied on reports also projected that late spring streamflow could decline by up to 30 percent. (*Id.* at, 1028.) The Court in *AquAlliance*, in discussing whether the FEIR/EIS was sufficient regarding Climate Change initially stated "Plaintiff's point out, correctly, that the record supports a finding that climate change will have an impact on the water supply, which will in turn put pressure on California's water resources which are already fully utilized by the demands of growing economy and population. (*Id.* At 1027) However, the Court went on to state "Plaintiffs fail to point to record evidence substantiating their position that the Project may exacerbate impacts to water supply caused by climate change. (*Id.* At 1028) The evidence here clearly shows that the proposed project environmental impacts would clearly be exacerbated by climate change.

7-17

The proposed project will take water from groundwater and surface water resources and transport them from the basins and watersheds from which they flowed. Section ES.5.2 clearly states this would be in amounts of hundreds of thousands of acre feet. Table ES-4 in the FEIR/EIS acknowledges that the proposed project would have impacts on a wide range of environmental areas that are also projected to be impacted by climate change. BOR concluded that the impacts to these areas would vary in levels of significance, but nonetheless lists that the project would impact multiple areas that overlap with those impacted by climate change. Table ES-4 in the FEIR/SEIS show these include (1) Groundwater substitution transfers could decrease flows in surface water bodies (2) Water supplies on the rivers downstream of reservoirs could decrease following stored reservoir water transfers (3) Changes in Delta diversions could affect Delta water levels (4) Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff (5) water transfers could change river flow rates in Seller Service Area and could affect water quality (6) Groundwater substitution transfers could cause a reduction in groundwater levels in the Seller service area. These are but a few of the listed impacts from the FEIR/SEIS table ES-4. All these impacts would be exacerbated by the newest climate change studies.

California's driest consecutive four-year period occurred from 2012 to 2015.[12] The future California faces as result of climate change, based on recent projections, is stark. According to the Fourth Assessment's latest projections, temperatures in California could rise between 2.5 and 2.7 degrees Fahrenheit early this century.[13] According to the Fourth Assessment, by 2050, the state's average water supply from snowpack in the Sierra Nevada is projected to decline by two-thirds compared to historic levels. This is highly important, as "A snow drought, where higher temperatures under climate change reduce snowmelt and change the timing of runoff, will affect imported surface water supplies that many groundwater basin managers rely on for consumptive use and for groundwater storage."[14] These impacts clearly exacerbate the acknowledged impacts the project has on the environment. 7-17

Despite numerous articles, including the updated *California's Fourth Climate Assessment*, the RDEIR/SEIS fails to incorporate data and considerations, along with analyses of the projects' environmental impacts with current data. In *AquaAlliance v. U.S. Bureau of Reclamation*, 287 F.Supp.3d 969, 1031, the Court stated "the FEIS/R fails to address or otherwise explain how this information about the potential impacts of climate change can be reconciled with the ultimate conclusion that climate change impacts to the Project will be less than significant." Thus, the Court provided a roadmap to an analysis that was needed to determine environmental impacts associated with, and exacerbated by, climate change. Despite this, in section 3.6.2.4 the RDEIR/SEIS makes the conclusory statement "Therefore, impacts to the proposed action from climate change would be less than significant, since the annual demands, supplies and frequency of transfers do not change much under the without climate and with climate change (Central Tendency) scenarios." The public is left to scratch their head at what, "do not change much" standard is referring to. According to Table 3.6-2, the Central Tendency climate change model would increase existing condition transfer demand and supply by 22 percent. This can have enormous environmental and ecological impacts, yet this increase is discounted as "not changing much."

Due to this lack of data and analyses, the RDEIR/SEIS is fundamentally incomplete and must be recirculated with current data, analyses, and appropriate mitigation measures to address climate change.

V. THE RDEIR/SEIS FAILS TO PROVIDE DATA AND ANALYZE CUMULATIVE IMPACTS ASSOCIATED WITH THE PROJECT

In *AquaAlliance*, the Court held that "the record suggests that the present condition of the Delta is already precarious, due in part to reduced Delta outflows. (*Id.* At 1036) The Court went to hold that the cumulative impacts analysis does not pass muster "because the thresholds utilized do not

[12] Office of Environmental Health Hazard Assessment, California Environmental Protection Agency (2018). *Indicators of Climate Change in California.*

[13] Bruce Lieberman, Yale Climate Connections (2018). *California and Climate Change: Here's what to expect* 7-18

[14] Ruth Langridge, Stephan Sepaniak, Amanda Fencl, Linda Esteli Mendez Barrientos, California Natural Resource Agency (2018). *Management of Groundwater and Drought Under Climate Change*

take into account existing conditions in the Delta. (*Id.* At 1037) In an analysis of the Delta Smelt, 2019 BA states under 2.15.4:

> Recent research combining long-term monitoring data with three-dimensional hydrodynamic modeling shows that the spatial overlap of several of the key habitat attributes described above increases as Delta outflow increases (Bever et al. 2016). This means that higher outflow, which lowers salinity of Suisun Bay and Suisun Marsh, increases the suitability of habitat in the estuary by increasing the overlap of some, but not necessarily all, needed elements.

7-18

Regarding land subsidence, section 3.3.6.1.1 states that "This subsidence would not likely result in substantial risk to life or property; however, the existing subsidence along with future increases in groundwater pumping in the cumulative condition could cause potentially significant cumulative effects." However, the updated GW-1 appears to have *less* monitoring and protection for land subsidence than the FEIR/EIS. Unless clarified, it appears the entire proactive monitoring regarding land subsidence was removed from the GW-1 in the current RDEIR/SEIS. Because the GW-1 appears wholly inadequate to prevent subsidence in particular, the RDEIR/SEIS mitigation would not make the cumulative impact of subsidence insubstantial.

7-19

As to cumulative impacts to water quality, section 3.3.6.1.1 states "most of the Seller Service Area has high quality groundwater and changes in groundwater flow patterns should not cause migration of poor quality groundwater. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulatively significant impact related to groundwater quality." It should be noted that the Redding Area Groundwater Basin has, as stated in section 3.3.1.2.1 areas of high salinity (poor water quality) along with localized high concentrations of boron. The Sacramento Groundwater Basin has, from 1994-2000 data, shown 5% of public water supply wells failing to meet the maximum contaminant levels. In addition, section 3.3.6.1.1 states, that "SWP transfers and the Tuscan Aquifer Investigation Project would increase pumping within (or near) seller service area." In sum, seller service areas have areas of poor water quality throughout both basins, and there is the potential due to cumulative impacts of the movement or mobilization of poorer quality groundwater into existing wells. However, the RDEIR/SEIS states "most of the Seller Service Area has high quality groundwater and changes in groundwater flow patterns should not cause migration of poor quality groundwater." The basis for this assertion is unclear, as there is no data and analyses as to potential water movement or mobilization discussion regarding the cumulative projects or the areas with poor water quality. Groundwater moves from areas of high water-levels altitudes to areas of low water-level altitudes.[15] Given the known areas of poor water quality, along with the multiple monitoring sites and modeling of each basin, data could be presented that would show risk areas due to groundwater pumping in certain locations that would lead pockets of poor water quality to flow to pockets of higher quality water, thus leading to possible contamination.

7-20

[15] Welch, W.B., Frans, L.M., and Olsen, T.D., 2014, Hydrogeologic framework, groundwater movement, and water budget of the Kitsap Peninsula, west-central Washington: U.S. Geological Survey Scientific Investigations Report 2014-5106, 44 p., *http://dx.doi.org/10.3133/sir20145106.*

7-20

Based on the lack of analysis and data on the projects cumulative impacts on wildlife, subsidence, water quality, and water supply the RDEIR/SEIS should be recirculated with this additional data.

VI. THE RDEIR/SEIS FAILS TO PROVIDE DATA AND ANALYSE ON THE ALTERNATIVE OF WATER CONSERVATION & REUSE

Throughout the RDEIR/SEIS, BOR and SLDMWA discuss the no project alternative. However, the RDEIR/SEIS does not provide data and analysis regarding an alternative of lowering long-term water transfer amounts and supplementing demand through water conservation.

Water recycling is increasing in California, and is beneficial in that it "provides drought-resistant, cost-effective water supply for local communities, and there are huge opportunities to increase water recycling in the future."[16] Projections for recycled water say that recycled water could augment water supply by 1.8 million to 2.3 million acre-feet per year by 2030.[17] Additionally, State Water Resources Control Board adopted Resolution No. 2018-0057 on December 11, 2018. In addition, the Final Staff Report with Substitute Environmental Documentation Re: Amendments to the Water Quality Control Policy for Recycled Water put out by the State Water Resources Control Board ("SWRCB") was conducted on December 11, 2018. The report addresses goals regarding recycled water goals, mandates, storm water goals, and conservation goals. The RDEIR/SEIS should provide data and analysis, in a portfolio approach, regarding decreased long-term water transfers amounts in the project being offset by reuse and conservation.

7-21

The benefits of including updated data and regulations regarding water reuse and conservation when analyzing an alternative would be significant. Lowering total water transfers in the proposed project would lead to less water being diverted from basins and watersheds in the north to those in the south. Out of basin and watershed transfers have significant negative environmental impacts. The RDEIR/SEIS acknowledges the project would lead to a lowering of groundwater levels due to pumping, less water flowing in streams and rivers, and less water reaching the Delta.

The failure to include in the RDEIR/SEIS an alternative to the proposed project that would lower total water available through long-term water transfers, with the lower water supplemented by reuse and conservation programs, renders the RDEIR/SEIS incomplete.

[16] https://www.nrdc.org/experts/doug-obegi/california-recycled-water-survey-shows-more-work-be-done

[17] Natural Resource Defense Council & Pacific Institute, (2014) *Issue Brief: Water Reuse otential in California*

VII. THE RDEIR/SEIS FAILS TO COMPLY WITH CEQA AND NEPA PROVIDING INCOMPLETE DATA AND ANALYSES REGARDING PROJECT IMPACT TO VEGETATION AND WILDLIFE

The RDEIR/SEIS discusses a variety of impacts on the various water systems resulting from the proposed project. Each of these individual impacts has far reaching environmental impacts that need to be analyzed.

Multiple reservoirs would have significantly lower average end-of-month water storage. Section 3.8.2.3.2 states Camp Far West Reservoir would have in the range of 10.8 to 21.9 percent lower end-of-month storage from July through September during critical water years. Table 3.8-1 shows that Hell Hole, French Meadows, and Lake McClure would have significantly less water under the proposed project in a variety of year types. Despite this, the RDEIR either fails to address and analyze these impacts and/or concludes that they do not need to be addressed due to transfers occurring in the "normal range of operations." This conclusion ignores the responsibility to address a known environmental impact, and not avoid analyses by reaching conclusions without data. The significant lowering of water levels raises a variety of environmental issues. One potential impacts is temperature changes in water due to lower reservoir levels, and the ability to release cooler water downstream for aquatic species. Temperature in reservoirs impacts dissolved-oxygen concentration in water, which is important to aquatic life.[18] Additionally, reservoir temperature and cold water pools are critical for helping regulate water temperature for aquatic life. An example of this is discussed in *Shasta Temperature Management Plan – Key Components*, which stated "Last year, due to lack of ability to regulate water temperatures in the Sacramento River in September and October, water temperature rose to greater than 60 degrees F." This change reduced early lifestage survival of winter run Chinook in the Keswick to Red Bluff section of river from 27 percent in 2002-2012 to 5 percent in 2014. This is but an example of clear impacts the proposed project can have on the environment due to chronic lowering of reservoir levels. The RDEIR/SEIS fails to fully analyze the environmental impacts the project will have as a result of lower average reservoir levels.

7-22

Multiple river and stream flows will be impacted by the proposed project. Table I-1 shows that eleven of the monitored creeks would have a reduction in cubic feet per second ("CFS"), but it is unknown whether that reduction would be greater than ten percent. This failure makes assessing the environmental impacts associated with the project impossible. Further, six creeks monitored would have a greater than 10 percent reduction in flow during certain year classes. In discussing specific impacts to stream drainages, the RDEIR/SEIS states that it would be possible that Cache Creek could have up to 31 percent *lower* water in critical years during November. Stony Creek could see flows reduced by 10 percent during October in critical water years. The RDEIR/SEIS not only fails to provide data and analyze impacts related to reduced flow, but also timing of flow routings in streams and rivers. It is well accepted that flow routings have large impacts on

7-23

[18] USGS https://water.usgs.gov/edu/temperature.html

ecosystem functions.[19] Altering flow variability changes the characteristics of a river system.[20] The proposed project will undoubtedly change the flow variability on multiple rivers and streams throughout California. Further, the taking of water from sellers north of the Delta leads to a compounding of impacts as drainages downstream of the point of diversion will directly suffer due to the lower flow from the taking upstream. Based on the failures to provide data and analysis regarding impacts to streamflow from the proposed project, the REIR/SEIS does not satisfy the requirements of NEPA and CEQA. 7-23

The RDEIR/SEIS fails to provide data and analyze the cumulative impacts the project would have on wildlife and vegetation in combination with other projects. The RDEIR/SEIS states in Section 3.8.6.1.2 that the proposed project would not have a significant cumulative effect on vegetation and wildlife resources. On January 31, 2019, the BOR released the Final Biological Assessment regarding the *Reinitiation of the Consultation on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project* ("BA"). The newly filed BA addresses numerous cumulative impacts to wildlife based on the actions that include the proposed project. This report includes updated information regarding multiple species, including the Giant Garter Snake, and the status and potential threats these species face from ongoing proposed projects. Section 7.3.8 states "The proposed action may result in loss of up to 1,049 acres of giant garter snake aquatic and upland habitat. Reclamation will discuss appropriate mitigation ratios with USFWS. The proposed action may affect, is likely to adversely affect, *Giant Garter Snake*." Regarding the Delta Smelt, the BA states "while the proposed action is likely to have some beneficial effects, it is likely to adversely affect *Delta Smelt*." The ESA listed the western DPS of the Yellow-Billed Cuckoo as threatened on October 3, 2014. The 2019 BA lists the critical habitat along the Sacramento River south of Red Bluff in Tehama County to Colusa, California. Current threats include alterations to hydrology. These are but some of the many species that will be negatively impacted by the cumulative effects of the proposed project. 7-24

The current RDEIR/SEIS fails to address updated information in the BA. One concern relates to the Yellow-Billed Cuckoo which was listed as threatened in October 3, 2014. The area of critical impact appears to overlap with areas that would be impacted by the proposed project. A listed threat of the Cuckoo includes alterations to hydrology, which the current project impacts. Additionally, the RDEIR/SEIS does not fully address the updates regarding recovery and management with the Giant Gartner Snake.

The RDEIR/SEIS does not appear to have incorporated BA data and analysis into their review of environmental impacts. Data is not provided regarding impacts to multiple species created by the project. Based on the failure to provide data and analyze the data, as well as provide scientifically supported mitigation measures, the RDEIR/SEIS is inadequate.

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[19] "Flow routings have potentially large impacts on ecosystem functions, such as primary and secondary production in pelagic food webs that sustain native fish.." *San Francisco Estuary and Watershed Science*, Vol. 5, iss. 3 [July 2007] pg. 13

[20] "Flow variability is an important characteristic of river systems, with implications for river geomorphology, ecology, and human uses" *Catchment Dynamics and River Processes: Mediterranean and Other Climate Regions*, (2005) G. Mathias Kondolf and Ramon J. Batalla.

VIII. CONCLUSION

California faces ever increasing challenges regarding our water supply. As our understanding grows of the interconnectedness of the natural flow of water throughout our state, we have also increased our understanding into how water flow impacts the environment around us. While we have learned much about our water systems, much remains uncertain and poses extreme challenges. These challenges include impacts from our changing climate, how groundwater is best managed, and long-term environmental impacts from taking water and lowering surface and groundwater levels across the state. With this complex and evolving backdrop, the NEPA and CEQA process has become crucial in how best to manage our water resource. Most importantly, the EIR/EIS provides a tool to inform the public about what environmental impacts a project will have on the environment. It is only with this knowledge the public can best understand the threats a project poses to our environment. Upon providing this understanding through current data and analysis, the EIR/EIS process can than formulate rational ways to mitigate adverse impacts. Here, the RDEIR/SEIS fails provide data and analyses to inform the public so that they can understand what impacts this project poses to their environment. Without this understanding, determining proper mitigation and/or project alternatives is not possible.

7-25

Sincerely,

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