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1344	1	The SED suffers from a number of defects including a lack of scientific basis, a lack of clearly-defined goals and objectives, a lack of a plan of implementation that is capable of implementation, false assumptions, unsupported conclusions, and inappropriate use of citations, to name a few. Overall, the plan is a solution looking for a problem. Rather than laying out clear goals and objectives, the SED presumes there is a problem -- a lack of flow has caused the decline of SJR salmon -- without fully understanding what is causing the decline of salmon, not just in the SJR, but in the entire Central Valley and West Coast. For example, dams are cited as one of the culprits even though Don Pedro Dam has been existence for more than 50 years and dams have been on the Tuolumne River and the other San Joaquin tributaries for more than 100 years. The SWB then adopts a “more is better approach” as the solution. This leads the SWB to conclude that more flow is needed, which in turn leads to the conclusion that “colder is better” for temperature and “more flooded area is better” for floodplains. Unfortunately, when the SWB actually measures the results of its “more is better” approach using SalSIM, the result is 1,100 fish at a cost of more than 300,000 acre-feet of water and billions of dollars in economic costs. The human costs cannot even be calculated.	Please refer to the Executive Summary for a description of the purpose of the plan amendments, and lists of clearly defined goals and critical reasons for the plan amendments. Please see Master Response 3.1, Fish Protection, regarding current fish decline and the need for increased flow, the use of best available science in the SED, adequacy of modeling to support the analyses, and justification and description of the plan amendments for protecting fish, including the unimpaired flow approach, and benefits thereof. Also refer to Master Response 3.1, regarding the limitations of SalSim modelling and how the Board did not rely on it. Please refer to Chapter 7, Aquatic Biological Resources, Section 7.2.2, Reservoirs, Tributaries, and LSJR, for a description of the environmental setting on the Tuolumne River, which includes recognition of habitat alteration, water quality, introduced species and predation, hatchery operations, and disease, as environmental stressors that have affected salmonid habitat on the Tuolumne River. The purpose of the environmental review process is to disclose environmental impacts to inform the public and decision-makers. The SED also gives consideration to potential economic effects in Chapter 20, Economic Analysis. The SED is not required to include a cost-benefit analysis as the commenter seems to suggest. Please see Master Response 1.2, Water Quality Control Planning Process, regarding consideration of beneficial uses by the State Water Board. Please see Master Response 1.1, General Comments, regarding general responses to economic-related comments, including those attempting to compare costs and benefits. Please see Master Response 8.0, Economic Analyses Framework and Assessment Tools, regarding the types of economic assessments and the tools used to consider economics in Chapter 20, Economic Analyses. Economic considerations associated with the recreation and commercial fishing industry are discussed in Chapter 20, Section 20.3.5, Effects on Fisheries and Associated Regional Economics, and Master Response 8.4, Non-Agricultural Economic Considerations, discusses the economic contribution of the plan amendments to fish and wildlife habitat and other beneficial uses. Please see Chapter 20, Section 20.3.3, Agricultural Production and Related Effects on Economic and Local Fiscal Conditions and Master Responses 8.1, 8.2, and 8.3, regarding local and regional agricultural economics.
1344	2	Many of the defects in the SED were identified by Mark Holderman, the principal engineer with the California Department of Water Resources (DWR) at the January 3, 2017, fifth and final public hearing on the SED. The conclusion of DWR was that the Bay-Delta water plan was written "without evidence, incomplete scientific information, ill-suited for real-time operations, and unverified assumptions." The [Modesto and Turlock Irrigation] Districts echo those same concerns. Among the many defects are the following: * Assigns responsibility for environmental harms without evidence * Contains out-of-date and incomplete scientific information * Uses Unimpaired Flow Standards ill-suited for real-time operations * Makes inappropriate use of a "Flow-Only" approach * Makes unverified assumptions about its effects on groundwater sustainability * Relies on dated groundwater data prior to 2010 and does not include impacts of data	Please see Master Response 1.1, General Comments, for discussions no LSJR alternatives development, State Water Board use of best available science, and the SED approach to analysis. Please see Master Response 2.1, Amendments to the Water Quality Control Plan, regarding the science and policy justification for the plan amendments, including the use of unimpaired flows and other non-flow measures. For information on the SED baseline and drought evaluation, please see Master Response 2.5, Baseline and No Project. For response to comments sustainable groundwater management, please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act.

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		collected during the 2012-2017 drought, and * Passes the buck to the Groundwater Sustainability Agencies for preventing damage to the state's aquifers.	
1344	3	The State Water Board's "unimpaired flows" approach for the San Joaquin River and its tributaries is not the path to achieve the desired ecological outcomes. It is inconsistent with established state policies, such as the California Water Action Plan, the coequal goals defined in the Delta Reform Act of 2009, the Sustainable Groundwater Management Act of 2014, and the Human Right to Water Act.	Refer to Master Response 1.1, General Responses, Relationships with Other Plans, Programs, and Agencies, for information regarding the interconnectedness between the plan amendments and other state policies. For instance, the California Water Action Plan identifies completion of the Bay-Delta Plan update as a key element to achieve the co-equal goals for the Delta as defined in the Delta Reform Act of 2009. Regarding the plan amendments, the Sustainable Groundwater Management Act, and the Human Right to Water, refer to Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, and Master Response 2.7, Disadvantaged Communities. Consistent with Water Code section 106.3 and Resolution No. 2016-0010, the State Water Board has and will continue to consider the Human Right to Water in considering past, present, and probable future beneficial uses of water, including municipal beneficial uses, when considering adoption of the proposed flow and salinity water quality objectives in accordance with Water Code section 13241.
1344	4	This proposal would undermine investments in storage, adversely impact the drinking water quality of disadvantaged communities, increase groundwater overdraft in a part of the state where groundwater basins are already out of balance, and put large acreages of agricultural land out of production.	Please refer to Master Response 1.1, General Comments regarding the relationship with other plans and programs such as storage. Please see Master Response 2.7, Disadvantaged Communities for a discussion regarding the consideration of disadvantaged communities. Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act regarding the historic use and overpumping of groundwater. Please see Master Response 3.5, Agricultural Resources regarding potential impacts on agricultural land. Please see Master Response 8.2, Local Agricultural Economic Effects and SWAP regarding the economic considerations related to water supply reliability and agriculture.
1344	5	Any strategy that would result in vast amounts of agricultural land going out of production and ultimately reduce water supply reliability for the majority of Californians is irreconcilable with the policy of coequal goals and the State Water Board's statutory obligation to protect all beneficial uses of water when establishing water quality objectives.	Please see Master Response 1.1 regarding the relationship of the Bay-Delta Plan to the Delta Reform Act, and the consideration of beneficial uses when establishing water quality objectives. Please see Master Reponses 3.5, Agricultural Resources regarding impact to agricultural lands.
1344	6	The State Water Board should set aside the percent of unimpaired flows approach and heed Gov. Jerry Brown's call for negotiated agreements. Such agreements have been demonstrably successful in achieving desired ecological outcomes while maintaining water supply reliability.	Please see Master Response 1.1, General Comments, for responses to comments regarding the State Water Board support for voluntary agreements, and for information regarding the proposed plan amendments' consistency with established state plans and policies, including the California Water Action Plan. The adoption of the plan amendments would not preclude the continuation of voluntary agreements. The State Water Board oversees and regulates water right and water quality and, as such, holds the authority to approve voluntary agreements to implement the Bay-Delta Plan. The SED evaluated the benefits and impacts of the plan amendments, including local water supply reliability. Please also see Master Response 3.1, Fish Protection, for information regarding the benefits of increased flow to fish. Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, and Master Response 2.7, Disadvantaged Communities, for clarifying information regarding the relationship between the plan amendments and impacts to water supply reliability.
1344	7	The State Water Board should embrace a collaborative process to develop water quality objectives that incorporates the best available science, utilizes comprehensive solutions that address multiple variables, aligns with established state policies, considers economic impacts, and ensures that Bay-Delta Plan decisions enable rather than obstruct implementation of the California Water Action Plan.	Please see Master Response 1.1, General Comments, for information regarding how these plan amendments relate to other plans and programs, including the California Water Action Plan, responses to comments regarding the SED's evaluation of impacts to resources, including economics, and the State Water Board's extensive public outreach and consultation with interested parties. The Board has been seeking input from the public and other agencies as early as the 2009 Notice of Preparation. Please also see Master Response 3.1, Fish Protection, for responses to comments regarding the use of best available science in the SED.

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1344	8	The SED's Program of Implementation Will Constitute a Compensable Taking Under the Fifth Amendment. The SED provides that the when the LSJR flow objectives are implemented, the SWB "will include minimum reservoir carryover storage targets or other requirements…," (SED, App. K, p. 28), including minimum end of September storage requirements, minimum diversion levels, and maximum allowable draws from storage (SED, App. F, p. F.1-31). While the SED does not establish any specific carryover storage or other requirements for any party or reservoir, it notes that such requirements will be needed because the additional streamflow requirements of the LSJR alternatives "require adjustment of parameters to ensure feasibility for the 82-year simulation so that the reservoirs are not drained entirely in the worst droughts of record." (SED, App. F, p. F.1-31). While the scope and magnitude of such requirements are yet unknown, they are expected to reduce the available water supply from the New Don Pedro reservoir for consumptive use, particularly in dry and critical years. (Jan. 3, 2017 Tr., p. 24, ln. 18-24). Additionally, the SED provides that in some cases, the volume equivalent to that which would have been released via the unimpaired flow ("UIF") percentage from February through June can be treated as a block of water and a portion released outside of the February through June period, including in the following year. (SED, App. K., p. 30-31). For such a scheme to work, MID and TID, as owners of the New Don Pedro Dam and reservoir, will be required to divert into storage a quantity of water, maintain such quantity of water in storage, and then release such water from the dam at a later date. All of these actions -- requiring MID and TID to divert water into storage, requiring MID and TID to leave water in storage and refrain from diverting it for consumptive use, and requiring MID and TID to release water from storage for the benefit of fish and wildlife located downstream -- constitute compensable takings under the Fifth Amendment to the United States Constitution. [Footnote 1: Compensation will be required even if the appropriation is based upon the SWB's alleged public trust authority. (See National Audubon Soc. v. Superior Court (1983) 33 Cal.3d 419, 440, citing Illinois Central Railroad Co. v. Illinois, 146 U.S. 387, 455 (1892), for the proposition that use of public trust to order removal of improvements on public trust lands would require compensation).] A. MID and TID Have Private Property Rights that Will Be Taken for a Public Purpose Under the SED. To constitute a compensable taking under the Fifth Amendment, the government must take private property for public use. (Klamath Irr. v. U.S., 129 Fed. Cl. 722 (2016)). The physical facilities necessary to effectuate the SWB's plan -- the dams, canals, drains and other facilities MID and TID use to divert, store and deliver water from the Tuolumne River -- are all private property facilities owned, operated, built and maintained by MID and TID. Further, the pre- and post-1914 appropriative water rights held by MID and TID are private property which cannot be taken by government action without just compensation. (See, e.g., United States v. State Water Res. Control Bd. (1986) 182 Cal.App.3d 82, 101). The commandeering of MID and TID's storage at New Don Pedro Dam and reservoir and subsequent release of stored water, water that the Districts would have provided to their customers, for the benefit of fish and wildlife downstream will be considered a public use	As described in SED Executive Summary, Section ES8.1, LSJR Alternatives, Chapter 3, Alternatives Description, and SED Appendix K, Revised Water Quality Control Plan, the Plan amendments would require the LSJR flow objectives for February through June to be implemented by requiring a certain percentage of unimpaired flow from each of the Stanislaus, Tuolumne, and Merced Rivers. A portion of the February through June unimpaired flow may be delayed until after June to prevent adverse effects to fisheries, including temperature, which would otherwise result. The State Water Board may impose minimum reservoir storage targets or other requirements to help ensure that providing flows to meet the flow objectives will not have adverse temperature impacts on fish and wildlife. Please see Master Response 3.2, Surface Water Analyses and Modeling, for responses to comments regarding carryover storage. The commenter asserts that the State Water Board's action requires compensation under the Takings Clause of the United States Constitution because it will result in a physical invasion of property. (U.S. Const. Amend. V; Lucas v. South Carolina Coastal Council (1992) 505 U.S. 1003, 1015.) The United States Supreme Court has acknowledged that the physical taking test must be reserved for the "relative rare" cases in which the physical occupation can be "easily identified," such as "[w]hen the government physically takes possession of an interest in property for some public purpose" or otherwise directly appropriates or occupies private property for its own use or use by a third party. (Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Agency (2002) 535 U.S. 302, 322, 324.) The requirement that there be an actual physical occupation, invasion, or appropriation of property by the government is the defining characteristic of a physical taking. Use restrictions, including regulatory requirements that have the effect of limiting the amount of water that can be diverted or used, do not constitute a physical invasion. (Allegretti & Co. v. County of Imperial (2006) 138 Cal.App.4th 1261, 1273.) The comment raises hypothetical issues concerning the implementation of the Plan amendments that will be addressed in a future, separate proceeding. A future potential requirement regarding as-yet-undetermined reservoir storage targets is not sufficient to demonstrate an actual impairment of a right to use water that precludes implementation of the Plan amendments. Even if the courts were to find a physical invasion or a loss of all economic value, the courts hold that there is no taking if the property right does not extend to conducting the activity or imposing harm that government prevents the property owner from carrying out, as the government is imposing limitations that inhere in the title of the property. "[I]n order for there to be a cognizable property interest sufficient to support a takings claim," the claimant must show that he or she actually possesses a right to use the property allegedly taken. (American Pelagic Fishing Co. v. United States (Fed. Cir. 2004) 379 F.3d 1363, 1377.) All water in California is the property of the people of the State and is owned in trust for them by the State. (Wat. Code, §§ 102, 1001; Kidd v Laird (1860) 15 Cal. 161, 179-180.) Water rights in California are non-possessory rights of use only; there are no rights to the corpus of the water and no water right holder has a vested right to divert a specified quantity of water without limitation. (Eddy v. Simpson (1853) 3 Cal. 249, 252; United States v. State Water Resources Control Bd. (186) 182 Cal.App.3d. 82, pp. 100, 105-106, 147.) Rather, the right is to use up to a certain quantity of water, subject to the overriding limitations and restrictions of California's reasonable use and public trust doctrines, which inhere in the water right itself. (National Audubon Society v. Superior Court (1983) 33 Cal.3d 419, 437, 440, 445, 447; Joslin v. Marin Municipal Water Dist., (1967) 67 Cal.2d 132, 144-145.) Pursuant to the reasonable use and public trust doctrines, a water right holder may be prevented from diverting the maximum quantity of water under its water rights in order to prevent harm to fishery resources and other beneficial uses of the source of water from which the water is diverted. This includes preventing deterioration of water quality that impairs beneficial uses. (United States v. State Water Resources Control Bd., supra, 182 Cal.App.3d at p. 130; see State Water Resources Control Bd. Cases (2006) 138 Cal.App.4th 674, 778-779 [State Water Board's

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		for purposes of the Fifth Amendment. (Casitas Mun. Water Dist. v. U.S., 543 F.3d 1276, 1292-1293 (2008) ("Casitas III")). B. The SED's Program of Implementation Constitutes a Physical Taking. Regulatory action by a governmental entity is considered a per se, physical taking if it (1) requires the owner to suffer a permanent physical invasion of property, no matter how small (Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419, 434-435 (1982), or (2) completely deprives the owner of all economically beneficial use of the property. (Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1019 (1992)). The carryover storage and withdrawal limitations of the SED constitute permanent physical invasions of MID's and TID's New Don Pedro reservoir. Instructing MID and TID how much water they must store in New Don Pedro for future release to satisfy non-consumptive uses, and limiting the amount of stored water that they can release from storage for consumptive uses, are clear physical invasions of New Don Pedro Dam and reservoir by the SWB. For all intents and purposes, the SWB will have taken for itself some of the available storage space in New Don Pedro reservoir which currently belongs to MID and TID. The SED thus constitutes a "classic taking" via physical appropriation of available storage space in New Don Pedro Reservoir by the SWB. (See, e.g., United States v. Security Industrial Bank, 459 U.S. 70, 78 (1982)). The requirement to release water stored in New Don Pedro Reservoir for purposes of fish and wildlife enhancement likewise constitutes a per se, physical taking of water rights owned by MID and TID. Once the stored water is taken and released for benefit of fish and wildlife, it is forever gone from the Districts, no different than if the SWB piped the water from New Don Pedro reservoir to a different location. (Casitas III, 543 F.3d at 1294). The government-caused storage and release of water away from MID and TID will be analyzed under the physical takings rubric. (Casitas III, 543 F.3d at 1298; see also Washoe Cty., Nev. V. U.S., 319 F.3d 1320, 1326 (Fed.Cir.2003) [physical taking where government has "decreased the amount of water accessible by the owner of the water rights."]). Once the SED is adopted and allocates responsibility for implementing the SED's requirements, MID and TID will seek compensation for both the value of the storage space in New Don Pedro reservoir taken by the SWB, as well as the value of the water rights taken.	development and implementation of water quality control plan largely fulfills its obligations under the public trust doctrine].) Such limitation does not infringe on any vested right. Thus, the regulation of activities that have the potential to affect public trust resources or to contravene the reasonable use doctrine cannot result in a taking because no one has a property right in the unlimited and unregulated use of surface water in California. Further, the Plan amendments do not require a water right holder to divert water to storage, as the comment inaccurately suggests. Nor would the State Water Board take available storage space for itself. Rather, the purpose of the Plan amendments is to protect the beneficial uses of the waters of the State, which belong to the people of the State, by imposing requirements on the diversion and use of water through water right or water quality actions. (Wat. Code, §§ 102, 13241.) Under the proposed Plan amendments, a water right holder who is responsible for meeting the unimpaired flow requirement could do so by reducing surface water diversions through bypassing flows, releasing stored water, or by reoperating reservoirs. There is no requirement to divert to storage in the first instance; rather conditions may be imposed that address the availability of water for diversion or the water proposed to be diverted for beneficial use. Because water rights are non-possessory rights of use subject to the overriding limitations and restrictions of California's reasonable use and public trust doctrines, and implementation of the Plan amendments do not result in a physical taking requiring compensation.
1344	9	Fish and Game Code Section 5937 Does Not Require the Release of Stored Water. The SED provides that in some cases, the volume equivalent to that which would have been released via the unimpaired flow percentage from February through June can be treated as a block of water and a portion released outside of the February through June period, including in the following year. (SED, App. K., p. 30-31). In either case, although the STM Working Group will be consulted, the SWB's Executive Director can approve such a scheme upon the recommendation of a single member of the STM Working Group. (SED, App. K, p. 29-30, items (b) and (c)). Obviously, for such a scheme to work, the dam owner would be required to divert into storage a quantity of water, maintain such quantity of water in storage, and then release such water from the dam at a later date. During the public hearings regarding the SED, several parties raised concerns about the SWB's ability to require the release of stored water for the benefit of fish and wildlife beneficial uses located downstream. In response, Chairwoman Marcus identified Fish and Game Code Section 5937 as a source of the SWB's authority to require the release of stored water. (See, e.g., Dec. 16,	Contrary to the commenter's assertions, Fish and Game Code section 5937 may be used to require releases of stored water and the section is not merely a limitation on the amount of water that can be appropriated by diversion from a dam. Section 5937 provides in pertinent part: "The owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around or through the dam, to keep in good condition any fish that may be planted or exist below the dam." (Fish and G. Code, § 5937.) Section 5937 is a legislative expression of the public trust doctrine. (California Trout, Inc. v. State Water Resources Control Board (1989) 207 Cal.App. 585.) Under the public trust doctrine and the reasonableness doctrine, the State Water Board retains continuing authority over the manner in which water is diverted and used. (National Audubon Society v. Superior Court (1983) 33 Cal.3d 419; California Constitution, art. X, § 2; Wat. Code, § 275.) California Trout, Inc. "can be read as indicating that Section 5937 legislatively establishes that it is reasonable to release enough water below any dam to keep any fish that exist below the dam in

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		2016 Tr., p. 216, ln. 3-11; Dec. 19, 2016 Tr., p. 152-153). Chairwoman Marcus is incorrect, and Fish and Game Code Section 5937 does not authorize the SWB to require the release of stored water. [Footnote 2: Fish and Game Code Section 5937 does not authorize the SWB to take any action nor provide a source of authority for any of the actions proposed in the SED. Section 5937 is part of the Fish and Game Code, whose provisions are to be administered and enforced by the Department of Fish and Wildlife. (Fish and Game Code § 702; see also § 37, defining "department."). Further, violations of the Fish and Game Code are specifically designated as misdemeanors (§ 12000(a)), for which there is no remedy via civil action. (Babu v. Petersen (1935) 4 Cal.2d 276, 288 ["No civil right can be predicated upon the violation of a criminal statute."]; compare language of Penal Code § 308, making the seller of tobacco in certain instances subject to prosecution for a misdemeanor or subject to a civil suit, with the language of Fish and Game Code §§ 5937 and 12000(a)). Moreover, the SWB has not made any findings as to what "good condition" means, has no evidence to support a conclusion that fish are or are not in "good condition," has not made any findings as to how far "below the dam" fish must be maintained in "good condition," and has not explained why natural production should trump protection for "any fish that may be planted" below a dam as called for in § 5937.] Fish and Game Code Section 5937 requires dam owners to allow water to pass through a fishway, or in the absence of a fishway, pass over, around or through a dam to keep fish below the dam in good condition. Section 5937 does not mention stored water at all. As explained by the courts that have construed Section 5937, it is a limitation on the amount of water that can be appropriated from a stream. For example, in Natural Resources Defense Council v. Patterson, 791 F.Supp.1425, 1435 (E.D. Cal. 1992), the court explained that "[w]ithout deciding whether section 5937 is a water appropriation statute, vel non, the statute's plain language demonstrates that it was intended to limit the amount of water a dam owner desiring to collect for eventual irrigation may properly impound from an otherwise naturally flowing stream. Thus, it is a prohibition on what water the … owner of the dam, may otherwise appropriate … Put another way, …, 5937 preserves from appropriation … an amount of water necessary for instream uses …" A similar finding was made in California Trout, Inc. v. State Water Resources Control Bd. (1989) 307 Cal.App.3d 585, 599: "[t]hese provisions straightforwardly limit the amount of water that may be appropriated by diversion from a dam … by requiring that sufficient water first be released to sustain the fish below the dam." Both of these cases correctly determined that Section 5937 is a limit on the appropriation of the natural flow of water in a stream or river. It does not require the release of stored water from a reservoir. This interpretation is supported by the SWB's own regulation designed to implement Section 5937, which states: "In the case of a reservoir, this provision shall not require the passage or release of water at	good condition." (State Water Board Order WR 95-2, p. 6.) The State Water Board has already determined that section 782 of the State Water Board's regulation (Cal. Code Regs., tit. 23, § 782) cannot be understood as adopting an interpretation of Section 5937 that prevents the release of stored water. (State Water Board Order WR 90-16, p. 8.) As the State Water Board held: "We cannot accept an interpretation of Section 5937 which in no case would allow compliance through releases which may exceed concurrent inflows to the reservoir at certain times of the year, because such an interpretation would be inconsistent with the rule favoring a physical solution to promote maximum beneficial use of water. (See City of Lodi v. East Bay Municipal Util. Dist., 7 Cal.2d 316, 60 P.2d 439 (1936).) For example, in a particular case, there may be two ways of maintaining fish in good condition. One flow regime may require very high winter and spring flows but allow for very low summer flows, with flows never exceeding natural levels. Another flow regime may allow storage of large volumes, and moderate stream flows, in the winter and spring, with higher than natural flows in summer. Under the District's interpretation, the Board would have to adopt the former flow regime, even if the latter provided equal protection for fish and allowed more water to be diverted and used for other purposes. Such an interpretation would be inconsistent with Article X, Section 2, of the Constitution."(Id. at pp. 8-9.)

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		a greater rate than the unimpaired natural flow into the reservoir." (Cal. Admin. Code, tit. 23, § 782). The plain language, implementing regulation, and controlling authorities clearly indicate that Section 5937 does not mandate the release of stored water to keep fish below a dam in good condition. In addition, Fish and Game Code Section 5937 cannot be used by the SWB to require the release of stored water from New Don Pedro reservoir because it is a component of a hydroelectric project licensed by the Federal Energy Regulatory Commission ("FERC"), and the Federal Power Act ("FPA") preempts the independent applicability of Section 5937 to the New Don Pedro Dam and reservoir. (California v. FERC, 495 U.S. 490, 497-5000 (1990) [holding that the FPA preempts regulations under state laws because the federal government occupies the field of hydropower licensing]).	
1344	10	The carryover storage provisions contained in the SED are unconstitutional impairments of the contractual obligations of the 4th Agreement between MID, TID and the City and County of San Francisco. In 1966, MID, TID and the City and County of San Francisco ("CCSF") entered into the 4th Agreement, by which CCSF participated financially in the costs of construction of New Don Pedro Dam and reservoir in exchange for water banking privileges in New Don Pedro reservoir. (SED, App. L, p. L-3). . The water banking privileges enable CCSF to release water to MID and TID (1) in advance of the time when releases are required under the Raker Act, (2) when such releases can be stored in New Don Pedro Reservoir, and (3) to subsequently intercept or divert equivalent amounts of water which it would otherwise be required to pass to MID and TID to satisfy their superior water rights. (4th Agreement, Art. 7, p. 7; SED, App. L, p. L-3). As recognized by the SWB, CCSF does not hold water rights to, nor physically divert from, New Don Pedro reservoir. The rights to all water in New Don Pedro reservoir are owned by MID and TID. (SED, App. L, p. L-3). In addition to dividing the costs of the construction of New Don Pedro Dam and reservoir, the 4th Agreement also provides for the sharing of certain additional future costs and flow obligations, with CCSF agreeing to be responsible for 51.7121% and the Districts 49.2879%. These percentages were derived by comparing the size of CCSF's water banking privileges to the size of the additional storage obtained by MID and TID as a result of the construction of New Don Pedro Dam and reservoir. (4th Agreement, Appendix A, page 4). The carryover storage requirements established in the SED, including end of September storage targets, maximum allowable withdrawal from storage, and end of drought refill criteria (see, e.g., SED, App. F, p. F.1-31-32) will result in storage levels in New Don Pedro reservoir being higher than under current conditions. As a result, there will be fewer times that there is room in New Don Pedro reservoir for MID and TID to store water that is released by CCSF in advance of when it is required to make releases under the Raker Act. In essence, this may result in the change in size of CCSF's water banking privileges and/or the size of MID's and TID's additional storage, and thus affect the negotiated percentages of responsibility for future costs and flow obligations as currently defined in the 4th Agreement. Such changes will frustrate the purpose of the 4th Agreement and potentially lead to its dissolution.	Please see Master Response 1.2, Water Quality Control Planning Process, regarding State Water Board implementation of the LSJR flow requirements through independent water rights proceedings. Please see Master Response 2.1, Amendments to the Water Quality Control Planning Process, regarding the LSJR Flow Program of Implementation, including reservoir carryover storage. It is premature to object to the proposed plan amendments on the basis that the carryover storage provision impairs the obligations of an existing contract. As discussed in Master Response 2.1, the proposed plan amendments have not yet been implemented by a water right decision amending specific water right permits and licenses, or by regulation. Furthermore, the program of implementation does not establish specific carryover storage requirements to avoid constraining future implementation. Reservoir operations can be modified to achieve the numeric and narrative objective within the program of implementation framework. The State Water Board modeled potential reservoir operations for the purpose of 1) analyzing impacts of the plan amendments and 2) showing the range of potential impacts in such a way that the public and the State Water Board can compare the relative effects. The commenter's suggestion that implementation of the plan amendments will "significantly impair" the City and County of San Francisco's (CCSF's) benefits under the 4th Agreement with MID and TID, and thus violates the contract clause of Article I, Section 9 of the California Constitution, is wholly unsupported. The contract clause of the California Constitution prohibits a state from passing laws that impair the obligation of contracts. However, this prohibition is not absolute, because "not only is the existing law read into contracts in order to fix their obligations, but the reservation of the essential attributes of continuing governmental power is also read into contracts as a postulate of the legal order. [Citations omitted.]" (Teachers' Retirement Bd. v. Genest (2007) 154 Cal.App.4th 1012, 1027). "[T]he proscription of 'any' impairment contained in the contract clauses must be interpreted to accommodate the inherent police power of the state to safeguard the vital interests of its residents." (Hermosa Beach Stop Oil Coalition v. City of Hermosa Beach (2001) 86 Cal.App.4th 534, 554). As discussed in response to comment 1344-8 water rights are non-possessory rights of use subject to the overriding limitations and restrictions of California's reasonable use and public trust doctrines. A water right holder may be prevented from diverting the maximum quantity of water under its water right in order to prevent harm to fishery resources and other beneficial uses of the source of water from which the water is diverted. Such limitation does not infringe on any vested right. The plan amendments are a legitimate exercise of the State's police power and potential reductions in diversions to storage by MID and TID do not operate as a substantial impairment of CCSF's contract rights.

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		Article I, Section 9 of the California Constitution prohibits legislative or judicial actions which significantly impair the obligations of an existing contract. (Bradley v. Superior Court (1957) 48 Cal.2d 509, 519). Since the SWB's SED is a quasi-legislative act, its significant impairment of the obligations and benefits of the 4th Agreement will violate Article I, Section 9 of the California Constitution.	Please see Master Response 8.5, Assessment of Potential Effects on the San Francisco Bay Area Regional Water System, for discussion of the "4th Agreement."
1344	11	The SED Cannot Be Made Applicable to MID and TID Via the Section 401 Process. The SED states in several places that its flow and carryover storage requirements may be implemented against MID and TID via the CWA Section 401 process. (See, e.g., App. K, p. K-26). The SWB has the authority and duty to certify that any discharge from MID's and TID's operation of the New Don Pedro Project under a new FERC license will comply with the CWA and any appropriate water quality requirement of State law. (33 U.S.C. 1341 (a), (d)). As explained below, much of the SED does not fall within this authority granted to the SWB by Congress and thus cannot be applied to MID and TID via the Section 401 process. A. The Alleged Harms to Native Fish Caused By the Existence of the New Don Pedro Dam To Be Rectified by the SED Are Not a Point-Source Issue that Can Be Addressed Via the 401 Process. The CWA regulates point-source pollution, and "[n]onpoint source pollution is not regulated directly by the [CWA] …" (ONDA v. Dombeck, 172 F.3d 1092, 1096 (9th Cir. 1998)). Section 401 certification thus does not apply to nonpoint source pollution. (ONDA, supra, 172 F.3d at 1097-1099). Traditionally, harms to fish allegedly caused by the existence of dams have been considered nonpoint source pollution. (see United States ex rel. TVA v. Tenn. Water Quality Control Bd., 717 F.2d 992, 999 (6th Cir. 1983); see also Nat'l Wildlife Fed'n v. Gorsuch, 693 F.2d 156, 177 (D.C.Cir. 1982)). Significantly, the SWB has relied upon this very distinction to argue that EPA cannot promulgate water quality objectives based upon streamflow under the CWA. According to the SWB, "These cases demonstrate … that changes in water quality caused by dams are the result of nonpoint sources of pollution…Where the predominant or sole cause of pollution in a water body is operation of water diversions, as is the case with the proposed salmon smolt survival criteria …, adoption of water quality standards under the Clean Water Act is not an appropriate method of regulation." March 11, 1994 letter of the SWB to EPA, p. 28, cited by the SWB in its 2006 WQCP, p. 4, fn. 3; SED, App. K, p. K-5, fn. 4, 5)(emphasis added). Controlling caselaw and SWB policy [Footnote 3: The holding of S.D. Warren Co. v. Maine Bd. Of Environmental Prot., 547 U.S. 370 (2006) is not controlling here. In that case, the parties conceded that the pollution at issue was from a point-source. (see Oregon Natural Desert Ass'n v. United States Forest Serv., 550 F.3d 778, 783-784 (9th Cir. 2008)). In this case, no such concession has been made, and in fact, the SWB has made the opposite assertion.] both demonstrate that alleged impacts to fish from the existence of dams is considered a nonpoint source of pollution. Since the Section 401 process does not apply to nonpoint source pollution, the flow and carryover storage requirements of the SED which are designed to provide floodplain, temperature and other benefits for native anadromous fish species cannot be applied to MID and TID via the Section 401 process.	Please see Master Response 1.2, Water Quality Control Planning Process regarding the State Water Board's authority to issue water quality certifications and how it is premature to object to the water quality certification process as a means of setting conditions for the protection of beneficial uses and attainment of water quality objectives. The comment selectively quotes from the 1994 comments the State Water Board made to U.S. EPA on U.S. EPA's draft water quality standards for the Bay-Delta to argue that the comments are the Board's "policy" that dam-induced water quality changes are a non-point source problem and are, therefore, by the Board's own assertion not subject to Clean Water Act § 401, which only applies to point sources. The State Water Board adopts water quality control policies in accordance with the Porter-Cologne Water Quality Control Act, not through public comments to another agency. Moreover, the issue raised by the commenter has since been settled by the U.S. Supreme Court's in S.D. Warren v. Maine Bd. of Environmental Protection (2006) 547 U.S. 270, under which the Court held water releases from dams and the river changes they can cause to affect fish and other aquatic organisms are appropriately within the ambit of Clean Water Act § 401. The commenter relies on the Board's purported policy to argue this case does not apply; however, for the reasons given above, the comment is incorrect. Regardless of the position the State Water Board took in March of 1994 against U.S. EPA's water quality standards for the Bay-Delta, the U.S. Supreme Court two months later in May 1994 concluded that water quantities can be regulated under the Clean Water Act. (PUD No. 1 of Jefferson County v. Washington Dept. of Ecology (1994) 511 U.S. 700, 719-720 [the Clean Water Act provisions governing water quality certification requirements for hydroelectric projects allows regulation by states of water "quantity" as well as water "quality"].) Thereafter, the state and federal governments reached agreement in December 1994 that minimum instream flow requirements and other actions to protect fish and wildlife were a necessary component of the Bay-Delta Water Quality Control Plan. (http://www.calwater.ca.gov/content/Documents/library/SFBayDeltaAgreement.pdf .) Thus, the commenter's assertions are incorrect and the Board is not precluded from implementing the plan amendments in 401 certifications. Comments regarding the need to obtain a 401 certification are premature, as explained in Master Response 1.2, Water Quality Control Plan Amendment Process. The State Water Board will consider all appropriate actions within its authority to require implementation of the objectives and it is not making individualized implementation decisions in this proceeding.

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		B. Section 401 Does Not Apply to Streamflow, Operations or Water Rights. As noted above, the Section 401 process applies to ensure a federal permittee complies with the CWA and any appropriate water quality requirement of State law. (33 U.S.C. (a), (d)). In this case, the UIF and carryover storage requirements proposed to be applied against MID and TID are not related to water quality and thus cannot be implemented via the Section 401 process. For purposes of the CWA, "water quality" does not include impacts associated with reductions in freshwater flows caused by dams and diversions. (33 U.S.C. 1252(b); 33 U.S.C. 1313(c)). Thus, SWB cannot rely on the authority of Section 401(a) for authority to apply the SED against MID and TID. Nor can the SWB rely upon the authority of Section 401(d), which enables a state to provide water quality certification to assure that the permitted activity complies with "any other appropriate requirement of State law…" This provision is limited in scope, and only authorizes a state to impose conditions "affecting water quality in one manner or another." (American Rivers v. FERC, 129 F.3d 99, 107 (2d Cir 1997); Arnold Irr. Dist. v. Department of Environmental Quality, 717 P.2d 1274, 1279 (1986); Matter of Eastern Niagara Project Power Alliance v. New York State Department of Environmental Conservation, 42 A.D.3d 857, 859-860 (2007)). In this case, it is clear that the flow and carryover storage requirements are not related to water quality, but rather are matters of streamflow, water rights, and operations of dams and diversions. In 1994, EPA published a proposed rule to protect fish migration and protect cold water habitat pursuant to CWA Section 303(c), 33 USC 1313 (c)). In the proposed rule, EPA suggested that the SWB should implement such criteria by amending water rights permits. These "salmon smolt survival" standards included both export limitations and minimum streamflow requirements. (59 Fed Reg. 810, 825-826 (January 6, 1994)) [Footnote 4: SWB Chairwoman Marcus was the regional administrator for EPA Region IX at the time.]. In comments filed on March 11, 1994, the SWB objected to the proposed rule, arguing strenuously that because the "salmon smolt survival criteria" were flow and export standards, they were not properly considered "water quality" issues for purposes of the CWA. The SWB argued, for example: * "the salmon smolt survival standards … take direct control of the heart of the State's water rights and water distribution system." (p. 9) * "Streamflow Matters Are Not To Be Regulated By EPA" (section heading, page 10). * "For purposes of the Clean Water Act the proposed criteria for … salmon smolt survival are streamflow requirements, not water quality criteria." (p. 10). * The only means of meeting EPA's … salmon smolt criteria would be for the State to regulate water project operations and allocate water storage and streamflow … for instream flows." (p. 11). * "It is beyond dispute that outflow and water project operations are not water quality	

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		matters." (p. 11-12). * That the EPA had written that impacts caused by reductions in streamflow were a "stream flow/water allocation issue, not a water quality issue under Section 303." (p. 15). * "Here, EPA apparently wants the State to 'work back' and cut diversions to attain the water quality standards. This method is inappropriate…" (p. 26). Each of the above statements apply equally to the UIF and carryover storage requirements of the SED. Although described as being promulgated as part of a water quality control plan amendment, clearly such requirements have nothing to do with "water quality" as described and understood in the CWA. As a result, the SWB will not be able to implement the provisions of the SED against MID and TID using Section 401(d). [Footnote 5: PUD No. 1 v. Wash. Dep't of Ecology, 511 U.S. 700 (1994) will not be of any assistance to the SWB. While the Supreme Court did conclude that Section 401(d) could be used to impose minimum instream flow requirements, in that case such requirements were adopted pursuant to CWA Section 303, 33 U.S.C. 1313. (Id. at 712-713). However, the SWB takes the position that Section 303 "is not intended to regulate pollution caused by reduction of fresh water flow." (March 11, 1994 letter, p. 10; cited as current view at 2006 WQCP, p. 4, fn. 3 and SED, App. K, p. K-5, fn. 4 and fn. 5).] Because the UIF and carryover storage requirements are not related to water quality, they exceed the authority delegated by Congress in Section 401 of the CWA. This is significant since Section 401 is the only opportunity for states to include mandatory conditions in federal power licenses; all other authority is vested in FERC. (See, e.g., Karuk Tribe of Northern Calif. V. California Regional Water Quality Control Bd. (2010) 183 Cal.App.4th 330, 359-360 [CWA gives the states a significant role in federal hydropower licensing, but this is the only area Congress has allowed]; American Rivers, supra, 129 F.3d at 111 [noting the preemptive reach of the Federal Power Act had been diminished by Section 401]; First Iowa Hydro-Elec Coop v. FPC, 328 U.S. 152, 180 (1946) [detailed provisions of federal plan for regulation of power leave no room for conflicting state regulation]). This means that while the SWB can participate in the relicensing process of New Don Pedro, and provide FERC with recommendations and comments as to the appropriate streamflow downstream of New Don Pedro Dam, FERC retains sole and exclusive jurisdiction to establish minimum streamflow and other conditions of the license in the absence of the 401 conditions. As explained by the U.S. Supreme Court when California made a prior effort to require flow requirements on a FERC-licensed project via conditions in a water rights permit, "we conclude that the California requirements for minimum in-stream flows cannot be given effect and allowed to supplement the federal flow requirements. … As Congress directed in FPA 10(a), FERC set the conditions of the license, including the minimum stream flow, after considering which requirements would best protect wildlife and ensure that the project would be economically feasible, and thus further power development. Allowing California to impose significantly higher minimum stream flow requirements would disturb and conflict with the balance embodied in that considered federal agency determination. … we agree that allowing California to impose the challenged requirements would be contrary to Congressional intent regarding [FERC's] licensing authority and would 'constitute a veto of the project that was approved and licensed by the FERC.'" (California, supra, 495 U.S. at	

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		506-507)(citations omitted). Even if adopted, the UIF and carryover storage requirements cannot unilaterally be applied against MID and TID because they are preempted by FERC's determination on appropriate streamflows. Absent agreement by FERC, and inclusion of such requirements by FERC in any new license issued, the UIF and carryover storage requirements set forth in the SED will simply not apply to MID and TID. C. Section 401 Certification is Likely Unnecessary for New Don Pedro Generally, an applicant for a FERC license for the operation of a hydroelectric facility that may result in a discharge into navigable waters must obtain certification from the state that the project will comply with state water quality standards. (33 U.S.C. 1341). However, not every circumstance requires a 401 certification from the state, particularly those that will either reduce the amount of discharge, or for which an increase may occur that will not have an adverse impact on the water quality of the discharge. Either of these exceptions will likely apply to New Don Pedro. 1. MID and TID May Apply for a New License that Will Reduce the Amount of Amount of Water Discharged By New Don Pedro Dam and Reservoir, Thus Nullifying the Need for Certification Under Section 401. As part of their effort to relicense the Don Pedro hydroelectric project, MID and TID may request a new license that results in less water being passed through the turbines than currently passes under the existing license. Such effort would eliminate the existence of a "discharge" as defined under the Clean Water Act. (North Carolina v. FERC, 112 F.3d 1175, 1188 (1997)["A decrease in the volume of water passing through the dam turbines cannot be considered a 'discharge' as that term is defined in the CWA."])(citation omitted). Since a "discharge" is a prerequisite for Section 401 to apply, FERC will be able to issue a new license without MID and TID obtaining a water quality certification from California. (Id., p. 1189; see also San Diego Elec. & Gas Co.,105 FERC ¶ 61,226 (2003) ["new certification would be required only if extending the license term would result in a new or greater discharge from the project."]). 2. Even if MID and TID Seek a New License that Would Keep the Flows through the Dam Substantially the Same or Even Result in a Slight Increase, Section 401 Certification May Not Be Needed. Not all increases in flows from hydroelectric projects will trigger the need for Section 401 certification. For example, a licensee sought permission to replace its turbine generators, which would increase the project's hydraulic capacity and enable water to be discharged more quickly. Parties argued that a new Section 401 certification was necessary, but FERC disagreed. FERC found that while increased discharges could occur, the "nature of the discharge would not change." FERC also found that the environmental analysis accompanying the proposal revealed that the changes would have no adverse impact to the water quality. (Alabama Power Co., 106 FERC ¶ 62,014 (2004)). For the New Don Pedro hydroelectric project, MID and TID are confident that the studies they have performed at FERC's direction, the proposed new terms and conditions, and the	

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		supporting environmental analysis under NEPA and CEQA will demonstrate that the nature of the discharge will not materially change from what it is now. Even if there is a slight increase in certain circumstances in terms of rate or volume, such increase will not result in a material adverse impact. As such, certification under Section 401 will not be required, and thus the SED will not be applied to MID and TID via Section 401.	
1344	12	The State Water Board proposal and its singular focus on unimpaired flows is the wrong choice for the state's future. The Districts urge the State Water Board to set aside the unimpaired flows approach and recognize that the best outcome can be achieved through comprehensive, collaborative approaches that include "functional flows" as well as non-flow solutions that contribute real benefits.	Refer to Master Response 1.1, General Comments for information on the State Water Board Support for voluntary agreements. Refer to Master Responses 2.1 Amendments to the Water Quality Control Plan for responses to comments regarding unimpaired flows and functional flows. Please see Master Responses 2.1 Amendments to the Water Quality Control Plan and Master Response 5.2, Incorporation of Non-Flow Measures, regarding non-flow measures. Refer to Master Response 2.4 Alternatives to the Water Quality Control Plan Amendments regarding functional flows.
1344	13	The Turlock Irrigation District and the Modesto Irrigation District (collectively the "Districts") requested that HDR conduct a review and provide comments on certain technical areas of the SED, including hydrology, project operations, fisheries and aquatic resources, floodplains, water temperatures, economic impacts, and related analyses and modeling. Assisting HDR in this review were a number of experienced scientists, engineers, and economists from the firms of Stillwater Sciences, FishBio, Cardno Entrix, and LGL, as well as Mr. Daniel Steiner, P.E., one of the developers of the CALSIM II model for the San Joaquin basin. This team of scientists, engineers, and economists ("Review Team") has been working with the Districts for the past eight years performing studies and preparing operations modeling and engineering, environmental, recreational, cultural, and socioeconomic assessments for the relicensing of the Don Pedro Project with the Federal Energy Regulatory Commission ("FERC"). Members of the Districts' Review Team have also been involved throughout the last 20-plus years in field investigations and analytical studies on not only the Tuolumne River, but also on the Stanislaus and Merced rivers. Specifically related to the Tuolumne River, the Review Team has intensively investigated the river's hydrology, geomorphology, fisheries and aquatic resources, floodplains, riparian and terrestrial resources, macroinvertebrate populations, cultural resources, socioeconomic conditions, and the associated Tuolumne River landscape. Therefore, the majority of the comments and findings provided herein deal with the SED's treatment of the Tuolumne River. The Review Team was asked to analyze the key benefits and impacts of the Amended Plan as described in the SED. Our assessment, presented herein, discusses the following topics: hydrology, floodplains, water temperatures, fish populations, economic impacts, and related subjects. It is important to acknowledge at the outset that deciphering and understanding the 3,500 pages of text, tables, plots, and complex computer models which were five years in the making at the SWB is a challenging task, and more time would have afforded a more detailed review. According to the SED, its proposal would decrease flow available to water users for beneficial purposes by approximately 300,000 acre-feet per year on average compared to existing conditions. In turn, by its own analysis, the SED's proposal will increase the Central Valley fall-run Chinook salmon population by 1% and decrease average temperatures as measured at Vernalis by 1°C in May and June. Overall, the Districts' Review Team concludes that the SED has overstated the potential temperature, floodplain, and fishery benefits to	Please see Master Response 1.1, General Comments, regarding how the State Water Board has attempted to present the information in plain language and in a clear format with an emphasis on information that is useful to the public and for decision-making. The basis for the commenter statement that the SED is five-years in the making is unclear. The SED was recirculated in 2016 after public comments on the 2012 Draft SED. In between those times, the State Water Board staff had to also work on other priorities, most notably, the recent drought. The State Water Board used the best available science throughout the impacts analysis and used its best efforts to find out and disclose what it reasonably can. A variety of data were obtained for the water quality planning process, including quantitative data from peer-reviewed published literature on topics specific to the plan area; peer-reviewed published literature outside the plan area but on topics relevant to the proposed project; unpublished quantitative data from within the plan area and from outside of the plan area; qualitative data or personal communication with topical experts; and expert opinion if no other sources were available. The State Water Board considered studies that have been conducted on the Tuolumne River. Many of these studies are related to the FERC relicensing process which State Water Board staff are heavily involved in because of our role in the Clean Water Act section 401 water quality certification process. For example, the floodplain and weighted usable area (WUA) evaluations in SED Chapter 7, Aquatic Biological Resources, uses information prepared during the FERC relicensing process. Please refer to Master Response 3.1, Fish Protection and Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, regarding temperature, floodplain, and other fishery benefits.

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		be expected to occur in the lower Tuolumne River and understated the adverse impacts of the SWB's Amended Plan.	
1344	14	The SED has failed to demonstrate an understanding of the current physical conditions and resources of the lower Tuolumne River. Summary: The Tuolumne River has undergone a tremendous transformation in the past 150 years from being a natural riverscape to being a highly modified river. [Footnote 1: Yarnell et al (2015) defines highly modified rivers "to be those that (1) have a high proportion of their total length converted to reservoirs, (2) have a high proportion of their total annual stream flow diverted and/or managed for societal uses, (3) have a high proportion of their total annual stream flow stored in reservoirs, and/or (4) have a large proportion of their total length channelized or lined by levees. These four characteristics rarely occur in the same river, but even one of these characteristics can greatly affect the riverscape, particularly in terms of sediment transport, and floodplain extent and constrain e[nvironmental]-flow implementation and ecosystem restoration potential."] The SED acknowledges the degree of the transformation in Chapter 7, but then neglects to consider how this major transformation of the river environment affects the anadromous fish populations that are at the core of the Amended Plan. Providing a "natural flow regime" to what is otherwise a completely modified, far from natural river-floodplain system is unlikely to lead to improvements to the anadromous fish populations of the Tuolumne River or LSJR.	Please refer to Master Response 3.1, Fish Protection, regarding how the hydrologic and landscape alterations were considered and the effects of higher flows on both juvenile salmonid survival and reduced habitat suitability for non-native predators. Also refer to the discussion in Master Response 3.1 regarding the need for, and proposed implementation of, a more natural flow regime, as well as the representation of natural conditions in the plan amendments, and incorporation of both flow and non-flow measures in the overall effort to comprehensively address ecosystem needs in the Delta and tributaries. See Master Response 5.2, Incorporation of Non-Flow Measures, for more information on non-flow actions.
1344	15	"Unimpaired flows", as defined by the SED, do not "mimic the natural hydrograph" of the Tuolumne River. Summary: At the core of the SED's preferred alternative is the assumption that requiring water supply reservoirs on the eastside tributaries to seasonally release a percent of unimpaired flows will increase the abundance of fall-run Chinook salmon simply because such flows will mimic the natural hydrograph to which these fish are adapted. Unimpaired flows, as defined in the SED, are a human invention, have never actually occurred in the lower Tuolumne River or LSJR, and are not the flow regime which anadromous fish experienced before pre-European development. Sparks (1995) and Walker et al. (1995), two references cited by the SWB, provide precise descriptions of why "unimpaired flows" as defined in the SED are not representative of the natural flow regime of the lower Tuolumne River.	Please see Master Response 3.2, Surface Water Analyses and Modeling, for a discussion of the difference between unimpaired flow and natural flow. Master Response 3.2 describes the difference between the two and discusses why unimpaired flow is an appropriate metric to use in the SED and the plan amendments, and addresses the misconception that the use of unimpaired flow is somehow intended to restore pre-development conditions. Please see Master Response 2.1, Amendments to the Water Quality Control Plan, for a description of the plan amendments and unimpaired flow as it relates to the plan amendments. Please see Master Response 3.1, Fish Protection, for a discussion of how the unimpaired flow approach is to capture the natural pattern of variability and retain the attributes of the natural flow regime to which native fish and wildlife adapted and that are important to support key ecosystem processes.
1344	16	The SED fails to analyze its own proposal. Summary: The SED reports that the LSJR fall-run Chinook salmon population, as well as other fish species not specifically analyzed, will increase as a result of greater floodplain access and cooler water temperatures. The proposed Amended Plan as defined in Appendix K of the SED and the alternatives described in Chapter 3 of the SED call for increased instream flows below La Grange Diversion Dam from February through June equal to a percent of the unimpaired flow of the Tuolumne River computed as a 7-day running average. That is, the SED's preferred alternative would provide instream flows that fluctuate every day based on a running 7-day average of the unimpaired flow. Without explanation or any demonstration of equivalency, the SED analyzes the potential for floodplain inundation and river temperature benefits using average monthly flows, which are flat, constant flows across an entire month, and therefore do not represent the instream flows as proposed in	Please refer to Master Response 3.1, Fish Protection, regarding adequacy of modeling to support the analyses, including discussions regarding the use of average monthly flow in modeling. Please also refer to Master Response 3.2, Surface Water Analyses and Modeling, and Master Response 2.1, Amendments to the Water Quality Control Plan, regarding the calculation of unimpaired flow. Please see to Master Response 3.2, Surface Water Analyses and Modeling, regarding the use of averages.

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		the Amended Plan. It is impossible to draw reasoned, scientific conclusions on potential floodplain and temperature benefits to fall-run Chinook salmon attributable to the SED's preferred alternative based on an analysis of a flow regime that would never occur under that alternative. Therefore, because the SED lacks the scientific analysis of the proposed action, the SED should be withdrawn and re-analyzed using methods appropriate to the resource questions raised.	
1344	17	The SED largely ignores the vast body of scientific data and technical information that has been compiled on the Tuolumne River and its associated resources over the last 20-plus years. Summary: The Tuolumne River is one of the most studied rivers in California. Over the last 25 years, more than 200 individual scientific investigations of the river's resources have been completed. Neglecting to seriously assess this wealth of empirical data and analysis leaves the SWB to rely on "qualitative" assessments of the potential benefits and impacts of the alternatives considered in the SED. The end result of the lack of evaluation of the extensive site-specific data available, as discussed further in the sections below, is that the various "AQUA" impacts described in Chapter 18 of the SED are largely unsupported, incomplete, or incorrect and lead to erroneous conclusions about the effects of the SED's alternatives on fall-run Chinook salmon and O. mykiss on the Tuolumne River.	The analysis that is specific to impacts on aquatic biological resources (see Chapter 7, Aquatic Biological Resources) considers multiple studies that have been conducted on the Tuolumne River. Please also refer to Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, and Appendix C, Scientific Basis Report, for references to studies conducted on the Tuolumne River. As described in Appendix K, Revised Water Quality Control Plan, implementation of the flow requirements will be conducted in a coordinated and adaptive manner that ensure current information, including studies for FERC relicensing proceedings (e.g. Tuolumne River), is taken into account. Please see Master Response 3.1, Fish Protection, for responses to comments regarding SED use of best available science, State Water Board consideration of the recent Tuolumne River predation study, Tuolumne River predation rates, and consideration of the flow-floodplain relationships on the Tuolumne River. Please refer to Master Response 1.1, General Comments, regarding program-level document and program-level analysis.
1344	18	Effects to fish and wildlife at the population level are not evaluated in the SED. Summary: As repeated many times in the SED, the goal of the Amended Plan is to "support and maintain native fish populations" (pg ES-18) and eventually improve "productivity as measured by population growth rate" (ES-19). The SED over and over again properly declares its purpose to be to improve fisheries at the population level. Predicting or measuring the effects of environmental actions at the population level is considered an essential element of environmental restoration actions (Bennett et al. 2016). The only quantitative assessment of the direct impact of the Amended Plan, and its alternatives, to fish and wildlife populations is a prediction of the effects to fall-run Chinook salmon abundance using the California Department of Fish and Wildlife ("CDFW") SalSim model. This peer-reviewed model predicts an increase in the adult fall-run Chinook population of roughly 1,000 fish, or 10%, under the SWB's alternative of increasing instream flows in the three eastside tributaries to 40% of the unimpaired flow (UF) for the February through June period. [Footnote 2: The SED's preferred alternative also includes adaptive implementation, the limits of which are not expressly defined in the SED. The SED includes SalSim model results for two alternative reallocation scenarios, neither of which is specifically identified as part of the preferred alternative. Detailed comments on the SalSim model are provided in these technical comments.] The SED does not report what level of uncertainty is associated with the SalSim estimates. [Footnote 3: At the January 3, 2017, Public Hearing the SWB staff declared that SalSim was not relied upon in the development of the SED's preferred alternative, despite the SED containing almost 100 individual references in the SED about the role SalSim played in the SWB's decision-making process.] The SJR fall-run Chinook population makes up approximately 6.7% [Footnote 4: Based on GrandTab dated April 11, 2016, pages 10-11 using CDFW run estimates from 1975-2015.] of the total Central Valley fall-run Chinook population. Therefore, according to the SED, the additional 300,000 acre-feet of water per year that will no longer be available for other beneficial uses of water is	The State Water Board has the responsibility of establishing water quality objectives to reasonably protect beneficial uses. The proposed flow objectives are based on sound scientific rationale and reasonably protect fish and wildlife beneficial uses, as shown in the SED. Contrary to the commenter's position; there is no legal obligation that the State Water Board must provide a numeric quantification of fish and wildlife population improvements from the plan amendments. Nor is the State Water Board required to undertake a cost-benefit analysis. Please see Master Response 1.2, Water Quality Control Plan Amendment Process. Refer to Master Response 3.1, Fish Protection, regarding the adequacy of the floodplain analysis, and the consideration of other stressors in the SED, including predation. As described in Appendix K, the State Water Board will establish a STM Working Group to assist with the implementation, monitoring and effectiveness assessment of the February through June LSJR flow requirements. The plan amendments do not mandate extended floodplain inundation: the STM working group may determine that fluctuating flows to disrupt spawning events of non-native predatory fish is beneficial to native fish species. It is envisioned that real-time information will inform these types of decisions. Please refer to Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, Adaptive Implementation for clarifying descriptions regarding the STM working group. Regarding the benefits analysis using SalSim, as described in Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, SalSim was developed by the CDFW, AD Consultants, and a variety of other modeling and fisheries experts. The SalSim documentation (CDFW 2013a; CDFW 2014, as cited in Chapter 19) should be consulted for a complete description of model development and calibration. Chapter 19, Sections 19.4, SalSim, provides a use advisory for SalSim and specifically describes the limitations of SalSim. Please also see Master Response 3.1, regarding State Water Board's use of SalSim, acknowledgement of model limitations, and discussion of the fish production results from model runs.

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		predicted to increase the total Central Valley fall-run Chinook population by less than 1% over the long term. Furthermore, according to the SED, increasing the instream flow to 60% UF is predicted to produce fewer fish than the 40% unimpaired flow. [Footnote 5: The results of the peer-reviewed SalSim fall-run Chinook population model refute the conclusions of the Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem" (2010 Flow Criteria Report) which is the basis for the SED's assumption that 60 percent of unimpaired SJR inflow from February-June is the preferred alternative when only considering fishery needs.] There is no other quantitative population assessment of Chinook salmon or other fish and wildlife species provided in the entire 3,500 pages of the SED. The SED does not make a scientifically defensible case that any percent of the unimpaired flow from February through June will materially and measurably increase the population abundance of the selected "indicator species" -- fall-run Chinook salmon. Furthermore, the SED lacks an assessment of the preferred alternative's effects on non-native predator species in the LSJR or Bay-Delta. By example, the proposed change in May and June flows is likely to benefit striped bass spawning. [Footnote 6: Striped bass begin spawning in the spring when the water temperature reaches 60 degrees. Most spawning occurs between 61 and 69 degrees and the spawning period usually extends from April to mid-June. Stripers spawn in open fresh water where the current is moderate to swift. The Delta, especially the San Joaquin River between the Antioch Bridge and the mouth of Middle River, and other channels in this area, is an important spawning ground. https://www.wildlife.ca.gov/fishing/inland/striped-bass#35540374-history. Lac] It is conceivable that increased flows at certain times of year and in certain reaches would benefit non-native predators to a greater extent than the SED's targeted native species. Analysis of this possibility is a significant omission in the SED.	
1344	19	The SED's 40% UF from February through June alternative is projected to result in certain adverse resource effects. The need to mitigate the adverse effects of the SED's preferred alternative may eliminate the minimal fish population benefits that were hoped to be achieved through implementation of that alternative. Summary: The SED acknowledges that the Amended Plan as proposed in Appendix K and the preferred alternative identified in Chapter 3 ("LSJR Alt3") is likely to result in certain adverse impacts to water temperatures in the Tuolumne River in the summer and fall periods. The greater instream flows called for in the SED, when combined with historical levels of water use for irrigation and M&I purposes, result in lower Don Pedro Reservoir levels, which in turn are presumed to affect the thermal stratification in the reservoir and result in the release of water from the reservoir that is warmer than historical releases. The SWB proposes to mitigate this adverse impact of its proposal by imposing a limit on reservoir drawdowns, which further limits the amount of water able to be used for water supply purposes. To mitigate the impact of the SED's preferred alternative, SWB shifts a portion of the instream flows to be delivered in the February through June timeframe to other parts of the year. The maximum "flow shifting" alternative ("40%MAXFS") reduces the planned February to June flows from 40% to 30% of the unimpaired flow. However, under the 30% unimpaired flow from February through June alternative, the SalSim model indicates there is no benefit to the target species of fall-run Chinook salmon from the February to June flows compared to the baseline (see Table 19-32 of the SED). Under the 40%MAXFS scenario, it appears that the predicted fish population benefit is derived from providing flows in the fall, thereby call into question any need above baseline flows from February	See Master Response 3.2, Surface Water Analyses and Modeling, regarding the waters supply effect modeling, water temperature modeling, and modeling of adaptive implementation, including discussion of flow shifting. Refer to Appendix F, Hydrologic and Water Quality Modeling, Section F.1.2.7, Calculation of River and Reservoir Water Balance, for a detailed discussion of flow shifting as it relates to the modeling. It is unclear how the commenter reached the conclusion regarding adverse resource effects of LSJR alternative 3. As described in Chapter 7, Aquatic Resources, the impact determinations for LSJR Alternative 3 with or without adaptive implementation are less than significant. An impact analysis specific to changes is exposure of fish to suboptimal water temperatures resulting from changes in reservoir storage and releases (i.e. AQUA-4) from LSJR alternative 3 concludes that impacts are less than significant. The commenter's characterization of flow shifting as mitigation for temperature impacts of the proposed flow objectives is incorrect. Flow shifting is part of the plan amendments' program of implementation in order to allow optimization of benefits to fish and wildlife. See Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, for details on flow shifting scenarios utilized in the SalSim modeling (referred to as "SB40%MaxFS" and "SB40%OPP"). As described in the chapter, three different 40 percent unimpaired flow scenarios are run through the SalSim model to show that under flow shifting scenarios, increases in total adult production can be further improved with refined flow, reservoir storage, and temperature management. Flow shifting of water to the fall allows a portion of the February through June unimpaired flow to be delayed until after June when assessment of real time water availability and fish conditions indicates that the benefits of achieving temperature or other goals outside of the February through June time period exceeds the benefit of using the flows entirely during the February through June period.

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		through June. The alternative of increased fall flows combined with February through June baseline flows is not reported in the SED.	However, it is important to understand the limitations of SalSim and the limitations of making optimized temperature and flow modeling runs and then inputting those results into SalSim. SalSim has temperature equations that are under-sensitive to improvements during spring and are over-sensitive to warmer conditions during the fall, making it difficult to evaluate the temperature tradeoffs between the spring and fall. Chapter 19 provides a use advisory for SalSim and specifically describes the limitations of SalSim and the limitations of optimized modeling runs. Master Response 3.1, also discusses the limitations of SalSim. Also refer to Master Response 3.1 regarding the expected fish to be produced from the various SalSim runs, the need for year round flows and a discussion of adaptive implementation to reasonably protect fish. Refer to Master Response 2.2, Adaptive Implementation, for a more detailed description of adaptive implementation and for descriptions and examples of implementing adaptive implementation.
1344	20	The SED's failure to define a specific proposal prevents substantive analysis of the Amended Plan. More specifically, there are at least two distinct "amended plans" in the SED, each of which is based on a mutually exclusive scientific hypothesis. Summary: By the time one finishes reading the SED, it is difficult to discern what "plan" is actually being proposed as the revised Bay-Delta Plan. The SED begins by presenting a case for the essential need of providing a more natural flow regime for the LSJR and the three eastside tributaries during the February through June time period to support critical life stages of salmonids, including spawning, rearing, and outmigration. The specific goal of the SED is to "support and maintain the natural production of viable native San Joaquin River Watershed fish populations migrating through the Delta" and the SED provides several citations to support its case for the need for mimicking natural flows during the fry and juvenile fish rearing period. But by Chapter 7, this necessity tends to be abandoned when the goal statement is modified to the following: "support and maintain the natural production of viable native San Joaquin River Watershed fish populations migrating through the Delta and meet any biological goals". This represents a fundamental change in goals. One is left to guess what "any biological goals" might entail. Furthermore, establishing the "biological goals" is delayed to a future date to coincide with the development of an "adaptive implementation plan" ("AIP"). One can only interpret that the phrase "and meet any biological goals" was added to show support for the notion of treating the unimpaired flow volume as just a "block of water" to be "managed" within the AIP framework. Flows originally presented as being necessary to mimic the natural hydrograph in each month of the February through June period are now considered to be capable of being reallocated as necessary to meet "any biological goals". In summary, the SED presents not one "Amended Plan", but many, proceeding from the "necessary" 40% percent of unimpaired flow for each month of February through June to having the percent of unimpaired flow in February through June be allowed to be managed as a total volume of water and released on an adaptive schedule within that period to allowing flows to be shifted out of the February through June timeframe to other unspecified times of the year and, finally, to allowing flows to be shifted in frequency, timing, magnitude, and duration to "meet any biological goals". This last version of the "Amended Plan" leads the SWB to state "[t]he LSJR alternatives entail a virtually unlimited number of possible functional flow regimes, limited only by the upper and lower bounds of the analyzed range of flows" (ES-17). While many generalized flow regimes are qualitatively considered, none are ruled out and all appear possible within the scope of the adaptive implementation plan, completely abandoning the original "necessity" of a more natural flow	Please see Master Response 2.1, Amendments to the Water Quality Control Plan for responses to comments regarding the project description, unimpaired flows, functional flows, and biological goals. The phrase "any biological goals" was used in the SED to refer to biological goals that are approved by the State Water Board to inform the adaptive methods, evaluate the effectiveness of this program of implementation, the San Joaquin River Monitoring and Evaluation Plan, and future changes to the Bay-Delta Plan. See the plan amendments at Appendix K. The text in Chapter 7 will be modified to be precisely consistent with the program of implementation which uses the phrase "any existing biological goals approved by the State Water Board." Please see Master Response 2.2, Adaptive Implementation, regarding how adaptive implementation can be implemented such as by shaping flows.

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		regime. If there is no definitive "biological goal", how can it be determined by the SWB that the preferred alternative will achieve a set of yet-to-be defined "biological goals"?	
1344	21	The adaptive implementation plan suggested in the SED is critically flawed because it lacks the most basic elements of an implementable plan. Summary: Bennett et al. (2016) identifies key ingredients for an effective adaptive management plan, these being having "[c]learly defined objectives, understanding of the ecological concerns (i.e., what is not working), conceptual models of the system function, testable hypotheses, the development of a sound experimental design, and long-term funding". Having no defined biological goals, or worse, having the goal of meeting "any biological goals" and having a "virtually unlimited number" of alternatives does not define a proper AIP. Even with a well-formulated AIP, Bennett et al. (2016) cautions that "it will likely take years to decades for such [environmental] responses to unfold". The AIP does not attempt to place a limit on the scope of measures to be tested, nor is there any metrics identified for what constitutes success. All the essential ingredients of an effective AIP are undefined; even the "biological goals" are to be established in the future. Furthermore, it appears the AIP has completely supplanted the Amended Plan, or, in effect, has become the Amended Plan. Endorsing an AIP with a "virtually unlimited number of possible functional flow regimes" is a recipe for failure because of the very long timeframes needed for environmental benefits to be confirmed even under a well-defined experimental analysis with carefully defined testable hypothesis and experimental methods. There is no rational basis for concluding that handing a volume of water and a virtually unlimited number of possible trial and error experiments to a Working Group will provide fish and wildlife benefits. To fulfill its regulatory responsibility, the SWB appears to want to rely on an AIP that lacks goals, metrics, decision thresholds, or even a clear statement of what constitutes success or the expected fish and wildlife benefits. The SED's AIP is an example of adopting "adaptive management" in order to avoid making an informed decision on the record because the SWB has not done the necessary serious study to arrive at a well-supported conclusion regarding potential benefits to fish and wildlife resulting from its proposal.	Please refer to Master Response 2.2, Adaptive Implementation, for responses to comments and additional discussion regarding the distinction between adaptive implementation and adaptive management. Adaptive management is not the same as the adaptive implementation provisions of the program of implementation. SED Appendix K has all the necessary elements of a program of implementation, including an adaptive implementation framework under which adaptive management may be developed. Adaptive implementation allows the frequency, timing, magnitude, and duration of flows to shift in order to enhance the biological benefits. It does not supplant or eliminate the benefits of the unimpaired flow in terms of mimicking the natural hydrograph, but enhances many aspects of the natural hydrograph that are most functionally useful. Adaptive implementation is bounded by rules under which adaptive methods may be used and the adaptive flow range of 30 to 50 percent of February through June unimpaired flow. Master Response 2.2, Adaptive Implementation, provides additional description and examples of how adaptive management may proceed, and the bounds under which it may do so. Please refer to Master Response 2.1, Amendments to the Water Quality control Plan, for additional information regarding biological goals and the San Joaquin Monitoring and Evaluation Program. Master Response 3.1, Fish Protection, has additional information regarding biological goals.
1344	22	According to the SED's own analysis, the SWB's preferred alternative will have an adverse effect on the fry life stage of Tuolumne River fall-run Chinook salmon, while having no measurable beneficial effect on Tuolumne River juvenile fall-run Chinook salmon. Summary: The SWB makes it abundantly clear that the primary species of interest and evaluation in the SED is the fall-run Chinook salmon populations of the LSJR and the three eastside tributaries. The SED's preferred alternative would adversely impact the fry life stage of fall-run Chinook salmon on the Tuolumne River when compared to the baseline. The SWB's own analysis demonstrates such adverse effects when one reviews and integrates the information on usable juvenile rearing habitat contained in Tables 7-13b, 7-15b, 7-15d, and total floodplain habitat in Table 19-21 of the SED.	Chapter 7, Aquatic Biological Resources, presents an evaluation of environmental impacts to aquatic biological resources that could result from the LSJR alternatives. According to that evaluation, none of the impacts are identified as significant for LSJR Alternative 3. Regarding AQUA -3, fry and juvenile rearing conditions for Chinook salmon (and other fish species) are improved in all the tributaries, including the Tuolumne River, when compared to baseline conditions. Even though WUA values and floodplain inundation events are shown to decrease in select months and years of the analysis, higher spring flows and associated reductions in water temperatures are expected to increase the downstream extent and duration of suitable rearing temperatures throughout the river in many years (see Impact AQUA-4, LSJR Alternative 3). Overall, improvements in water temperatures and floodplain habitat availability later in the season (April and May) would likely enhance juvenile growth and survival, potentially increasing the number of juveniles that successfully emigrate from the river as smolts. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides further evidence of measurable benefits from the plan amendments. In general, floodplain inundation will have the greatest increases compared to baseline during the months of April, May, and June under the evaluated unimpaired scenarios (see the summarized results in tables 19-28, 19-29, and 19-30). Please also refer to Master Response 3.1, Fish Protection, specifically regarding the benefits of the plan

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			amendments; and the use of the floodplain, WUA, and temperature analyses to show those benefits. The primary species of interest was not fall-run Chinook salmon as the commenter states. As described in Chapter 7, Aquatic Biological Resources, the indicator species, or key evaluation species, used to determine impacts of the LSJR alternatives on aquatic resources include anadromous fish (fall-run Chinook salmon and steelhead), coldwater reservoir fish (e.g., rainbow trout), and warmwater reservoir fish (e.g., largemouth bass). Indicator species were selected based on their sensitivity to expected changes in environmental conditions in the plan area and their utility in evaluating broader ecosystem and community-level responses to environmental change.
1344	23	The economic assessment of the SWB's proposal (1) fails to account for any adverse effects on several of the agricultural sectors that are important to the region's economy thereby vastly underestimating economic loss, (2) lacks a rigorous evaluation of the reasonably foreseeable impacts of the state's recent groundwater regulations, and (3) neglects to consider the disproportionate effects of its proposal on disadvantaged and minority populations. Summary: The SWB fails to include the SED's economic and employment impact on the production of animal commodities, including dairy, cattle and calf operations or impacts to the food and beverage processing industries. During critical water years under the SED's proposal, the Review Team estimates the economic impact would exceed $1 billion, including direct, indirect, and induced impacts. Impacts under sequential critical water years are not evaluated in the SED. The SWB's use of average economic values over multiple water years reveals a fundamental lack of understanding of the nature of the industry it is affecting. This is also depicted by the failure to quantitatively assess the adverse economic impact of the SED's proposal in conjunction with the recently enacted statewide groundwater regulations, even while acknowledging the significance of the state's 2014 Sustainable Groundwater Management Act ("SGMA"). Lastly, the SED's proposal will have a disproportionate impact on the region's disadvantaged and minority populations, an impact the SED neglects to recognize or analyze.	Please see Master Response 1.1, General Comments, for general information regarding the economic analysis. Please see Master Response 3.5, Agricultural Resources, for discussion of the potential effects on dairies and livestock operations. Please see Master Response 8.2, Regional Agricultural Economic Effects, for discussion of the potential economic effects on dairies and food processors. Please see Chapter 21, Drought Evaluation, for analysis of potential impacts in extended dry periods. Please see Master Response 2.3, Presentation of Data and Results in SED and Responses to Comments, for discussion of why average results were presented. Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, for discussion of SGMA compliance. Please see Master Response 2.7, Disadvantaged Communities, regarding potential impacts to disadvantaged communities.
1344	24	The SED is lacking a thorough description of the current physical characteristics of the areas within the geographic scope of the Amended Plan, especially each of the three eastside tributaries. This would help the public understand the existing environmental conditions of the region, the rivers, and their floodplains. Related specifically to the lower Tuolumne River, this is one of the most studied rivers in California. Well over 200 studies and investigations have been conducted covering virtually every aspect of the lower Tuolumne River. Available data are not limited to studies of fall-run Chinook salmon, but include, for example, investigations of river substrate composition, geomorphology, riparian habitats, floodplain habitat models and assessments, hydrologic studies, predation studies, O. mykiss population studies, fall-run Chinook and O. mykiss redd surveys, adult fish counting weirs, RST monitoring, instream flow studies, studies of non-native species populations, state-of-the-art thermal capability studies of wild O. mykiss juveniles, reservoir temperature profiles, river temperatures based on a network of a dozen in-situ monitors, and multiple computer models depicting the resources of the lower river and the Don Pedro Reservoir, including a state-of-the-art three dimensional ("3-D") reservoir temperature model. While a very small portion of this data is referenced in the SED, there is no evidence that this substantial body	Please see Master Response 3.1, Fish Protection, for information about comments presenting information that do not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the analysis. Please also note that there may be differing opinions as to how to approach an analysis for a given resource, or which data sets should be used, but these differing opinions do not equate to inadequacy.

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		of work, representing the best available science for the lower Tuolumne River, was seriously evaluated or considered in any of the various quantitative or qualitative assessments reported to have been performed as part of the development of the SED. This omission has resulted in the SWB reaching misinformed and erroneous conclusions related to factors affecting the fall-run Chinook salmon and O. mykiss populations of the Tuolumne River. One of the fundamental errors of the SED is the underlying assumption that the three eastside tributaries can be lumped together and treated essentially as a single river presumed to be contributing to the decline of fisheries in the Bay-Delta region. For example, the three tributaries are subjected to the same method of analysis when considering the complex issue of whether greater spring flows will provide "floodplain benefits" for salmon, as if an acre of inundated floodplain in the Tuolumne River would have the same population level effect as an acre of inundated floodplain in the Stanislaus or Merced rivers, or that reducing river temperatures 1°C in each river would produce a "benefit" to that river's fish populations, or that fall-run Chinook salmon population benefits are somehow directly proportional to the size of the river's drainage area. Over the past two decades, a large body of research has consistently demonstrated that every river system is unique. It is only for the sake of convenience that the SWB has treated the three eastside rivers as if they would each deliver their proportionate share of benefits from the same flow prescription. There is little to no evidence presented in the SED that providing 40% of the unimpaired flow from February to June in the Tuolumne River would have similar population-level effects as 40% of the unimpaired flow on either the Merced or the Stanislaus rivers. There is even less evidence for relying on an adaptive implementation plan to produce proportional results. Adopting a one-size-fits-all approach to the analysis of the eastside tributaries runs counter to the current scientific understanding of each river's uniqueness. Ignoring the large amount of information and data available to the SWB leads, at best, to an incomplete understanding of the Tuolumne River ecosystem, and at worse, to ill-conceived and poorly informed decisions. The SED's analytical approach of relying on general qualitative assessments about the rivers instead of considering and evaluating the hundreds of available site-specific reports can only lead to poorly informed decision making. For example, of the 3,500 pages in the SED, four pages, one plot, and two tables are dedicated to describing the current complex aquatic and associated floodplain environment of the lower Tuolumne River. To compound the problem, much of what is reported in those four pages [7-35 -- 7-39] is either misleading or inaccurate.	
1344	25	On page 7-35, the SED reports that the Tuolumne River "now supports smaller populations of steelhead". This is inaccurate and misleading, and needs to be corrected. Although a rearing population of adult-sized O. mykiss was quantified during three years of intensive snorkel surveys (2008-2011), other than the occurrence of one steelhead and several resident fish exhibiting maternal anadromy demonstrated in otolith analyses by Zimmerman et al. (2009), there is no indication of a steelhead population on the Tuolumne River. Between 2009 and 2016, a total of five O. mykiss presumed to be "steelhead" (that is, greater than 16-inches in size) have been identified in the adult migrant counting weir located at River Mile 24.5. The statement quoted above misleads the public, and perhaps the SWB staff, and can lead to unfounded conclusions related to, for example, temperature requirements for Tuolumne River "steelhead".	The California Central Valley (CCV) steelhead DPS includes all naturally- spawned populations of anadromous O. mykiss below natural and manmade impassable barriers in the Sacramento and San Joaquin rivers and their tributaries (63 FR 13347); however, NMFS considers all O. mykiss that have physical access to the ocean (including resident rainbow trout) to potentially be CCV steelhead and treats these fish as CCV steelhead. The lower Tuolumne River from LaGrange Dam to its confluence with the San Joaquin River was included in the designation of critical habitat for the DPS (70 FR 52488). The State Water Board acknowledges that resident rainbow trout dominate the phenotypic life history strategy in the Tuolumne River; however, we disagree that there is no evidence of an anadromous life history based on the otolith microchemistry evidence presented by Zimmerman et al. (2009), indicating the presence of trout with anadromous mothers that spawned in the Lower Tuolumne River. Rainbow trout have anadromous and resident forms that are sympatric and capable of producing offspring with a life

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			history that is different from their own (Seamons et al. 2004; Christie et al. 2011; Zimmerman and Reeves 2000). The mechanisms for the expression of these two forms are driven by differences in selective pressures that favor certain phenotypes over others and differ between the sexes (Quinn et al. 2011; Schill et al. 2010; Gross 1991; Fleming and Reynolds 2004). The commenter presented the history of anthropogenic and environmental changes in the Tuolumne River basin that, when coupled with low migratory survival rates within the lower San Joaquin River, has driven the trajectory of phenotypic life history toward the resident life history form. The genetics of CCV steelhead below rim dams lack a geographically distinct population structure, which reflects extensive habitat modification and hatchery stocking practices (Pearce and Garza 2015). Recent genetic evidence indicates that the resident form of trout in the lower Tuolumne River is most closely aligned with Lower American River and Nimbus Hatchery rainbow trout, which are from mixed Central Valley, Eel River and Mad River Hatchery origin (Pearce and Garza 2015). This makes the genetic effects largely irreversible, making restoration of the historical population genome largely unattainable. However, genetic effects are not static and with science based recovery planning, the adaptive potential of CV steelhead may be restored to some level (Meek et al. 2014). Such plans will likely be most effective through a combination of actions that restore the viability of natural populations though improved hatchery management and improvements in flow and habitat conditions supporting the anadromous life history form of O. mykiss (NMFS 2014).
1344	26	On page 7-35, the SED goes on to say "Central Valley steelhead were thought to have been extirpated from the Tuolumne River, but fisheries monitoring for the New Don Pedro Federal Energy Regulatory Commission (FERC) relicensing project have documented the presence of O. mykiss in the Lower Tuolumne River (TID and MID 2012)." It should be noted that although NMFS considers that resident and anadromous O. mykiss to be Central Valley steelhead under the ESA, there is no evidence of a self-sustaining steelhead population on the Tuolumne River. If every O. mykiss were a "steelhead", Central Valley steelhead would not be listed under the ESA because there are many thriving populations of O. mykiss in Central Valley streams.	Please see response to comment 1344-25.
1344	27	On page 7-36, the SED, in describing the fish species found in the Tuolumne River, states "Nonnative fish species important for sport fisheries include American shad, catfish species, largemouth, smallmouth and striped bass, and sunfish species." To the best knowledge of the Districts, there are no data available, nor are there any referenced by the SWB, which would support the claim that American shad, catfish, sunfish, or any other non-native fish species are "important for sport fisheries" on the Tuolumne River. However, there are data supporting the finding that non-native species are a major cause of mortality to Tuolumne River juvenile fall-run Chinook [Footnote 7: The TID/MID final Predation Study on the Tuolumne River was filed with FERC as part of the April 2014 Final License Application on the Don Pedro Hydroelectric Project (see Appendix G [ATT20] of these comments).]. It is difficult to understand why the SWB would include an unsupported statement about recreational use of non-native fish in the Tuolumne River but not include a supportable statement about their role in predation, which would seem to be of greater relevance to the purposes of the SED.	These species of fish are recognized as sport fish by the California Department of Fish and Wildlife and are known to inhabit the Lower Tuolumne River, so it is reasonable to describe these fish as important for sport fisheries. Nonetheless, while this statement is descriptive of conditions in the Lower Tuolumne River, it does not have bearing on any of the conclusions reached in the SED. Please refer to Master Response 3.1, Fish Protection, specifically regarding a discussion of predation, recent predation studies considered in the plan amendments, and effects of higher flows on both juvenile salmonid survival and reduced habitat suitability for non-native predators.
1344	28	On page 7-36, it is reported that data collected "in recent years indicates that returns to the Tuolumne River are dominated by hatchery-origin fish." In 2011, hatchery-origin fish represented over 70% of the adult fall-run Chinook escapement. The dominance of hatchery-reared fall-run Chinook in the eastside tributaries is a very significant issue. The potential impact on the SED's proposal of such a high percentage of hatchery-origin fish in	Please refer to Master Response 3.1, Fish Protection, specifically regarding a discussion on the role of hatcheries and their influence on anadromous fish species within the plan area.

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		the Tuolumne River and the other eastside tributaries is never fully explored or evaluated in the SED. Hatchery dominance has the potential to significantly affect the Amended Plan's goal of supporting "natural production" of fall-run Chinook. Appendix A [ATT14] of these comments discusses the potential effects of hatchery-origin salmon on the genetics, ecology, and population viability of naturally-spawning fall-run Chinook salmon in the Tuolumne River and the San Joaquin River basin.	
1344	29	On page 7-37, the SED properly discloses that the "historical distribution of steelhead in the SJR Basin, including the Tuolumne River, is poorly known". However, this is a bit of an understatement given there is no evidence of a self-sustaining steelhead population on the Tuolumne River, as we have previously commented. Steelhead populations are known to potentially exhibit unique life stage characteristics; therefore, trying to accurately predict the behavior of steelhead on the Tuolumne River is problematic. However, in Chapter 18, the SWB feels sufficiently confident in its knowledge of "steelhead populations" that it asserts that the SED's preferred alternative "would substantially improve rearing habitat conditions for ... steelhead in the three eastside streams and LSJR. Considering the overall beneficial effects of higher flows on rearing habitat availability, no significant adverse impacts on … steelhead populations would occur." There is no scientific data or evidence provided in the SED examining variations in current O. mykiss population levels nor any site-specific sampling results that could be used to determine variations in resident and anadromous O. mykiss life history in response to flow and temperature conditions.	Please see response to comment 1344-25.
1344	30	On page 7-37, the SED finally begins to reveal an accurate assessment of the existing conditions on the Tuolumne River. Here, the SED acknowledges the history of anthropogenic disruption to the lower river and its effects on the current riverscape: "During the early twentieth century, the Tuolumne River channel and floodplain were dredged for gold. The gold dredges excavated channel and floodplain deposits to the depth of bedrock (approximately 25 ft [7.6 m]) and often realigned the river channel. Due to gravel mining activities, the channel has become constrained by dredge tailings, which restricts channel meander and reduces delivery of gravel to the river. Riparian vegetation is also scarce due to dredge tailings. By the end of the gold mining era, the floodplain adjacent to 12.5 miles (20 km) of the river (RM 50.5-38) had been converted to tailings deposits. Tailings remain in the reach from RM 45.4-40.3 (Stillwater Sciences n.d.). Additionally, pits were made in the channel that provide habitat for largemouth bass and other predatory fish species. Land clearing for gold dredging, aggregate mining, and agricultural and urban development has resulted in the loss of 85 percent of the Tuolumne River's historical riparian forest. Vegetation that once extended from bluff to bluff prior to the Gold Rush is now confined to a narrow band along the active channel margins in many areas, or is nonexistent. Nearly all of the areas in the gravel-bedded zone that historically supported riparian forests have been mined, grazed, or farmed (Stillwater Sciences n.d.)." Given the vast scale and scope of these significant historical environmental impacts to the lower Tuolumne River, there is no scientific basis to assume that flow alone could be some "master variable" that will solve the legacy and lingering impacts to the river. This description of the condition of the Tuolumne River is reason enough for the SWB to question the assumption that the highly modified and disrupted floodplains along the river would provide suitable habitat for fry or juvenile fall-run Chinook salmon. Yet the SED	Please see Master Response 3.1, Fish Protection, for discussion of how the flow objectives are intended to reasonably protect fish and wildlife by restoring more natural habitat conditions for native fish. The flow objectives are not intended to restore the rivers to pre-development conditions. As the commenter points out, the SED recognizes the highly modified nature of the Tuolumne River. This fact does not obviate the need for more flows, as discussed in Master Response 3.1.

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		assumes, without citing a single source of site-specific evidence, that every acre of this highly disrupted floodplain, once inundated, would be suitable fish habitat and would provide an abundant supply of food for these fish. By the same token, there is no scientific evidence provided in the SED which suggests that non-native predators inhabiting the large and deep pools formed by the in-channel mining would be displaced downstream by higher flows. The SED offers general, qualitative assessments of effects of flows to an imagined river environment, not reflective of the real site-specific conditions existing on the river.	
1344	31	On page 7-38, the SED posits that a lack of site-specific data and analysis is no reason to qualify or limit what conclusions can reasonably be drawn on the Tuolumne River: "Although specific food web studies have not been conducted in the Tuolumne River, current research indicates that regulated flows downstream of dams and losses of overbank flooding have likely contributed to historical declines and current limitations on native fish populations through reductions in primary and secondary production (phytoplankton and invertebrate production) associated with seasonal floodplain inundation (Sommer et al. 2004; Ahearn et al. 2006)." In this example, the SWB states that, to its knowledge, there are no "food web studies" available on the Tuolumne River. So the SWB cites the work of Sommer et al. (2004) conducted on the Yolo Bypass in the northwest Delta to draw its conclusions about food availability on the Tuolumne River floodplains. Further below in these comments, we explain the lack of any similarity between the 60,000 acre Yolo Bypass floodplain and the 600 acre, heavily-disturbed Tuolumne River floodplain. Suffice it to say here, especially given the SED's own description of the Tuolumne floodplain on the immediate prior page, the two floodplains are not comparable in any respect. However, the larger problem here is that the reference to "current research" relating to "historical declines and current limitations on native fish" is implied to be a finding of Sommer et al. (2004). This is not the case, and misrepresents the Sommer et al. (2004) work. One can find no such direct conclusion in the Sommer et al. (2004) report. The SWB is also incorrect in reporting the findings of Sommer et al. (2004) related to invertebrate production. The published report on the Yolo Bypass actually indicates that "no major differences were observed in zooplankton densities between the river and its floodplain", which were reported by Sommer et al. (2004) to be similar to the findings of Speas (2000). Zooplankton are invertebrates, so the SWB's attribution to Sommer et al. (2004) of a finding related to invertebrate production in general should be appropriately qualified. More importantly, but not helpful to the SED, the purpose of the Sommer et al. (2004) study "was to examine how variation in hydrology affected several food-web organisms of a large temperate river-floodplain." These food-web organisms are the food source for fish which are needed to promote the growth of juvenile salmon. Instead of using a floodplain's inundated acreage as indicative of suitable habitat, as is done in the SED, Sommer et al. (2004) analyzed a number of factors known to affect the amount of suitable fish habitat on a floodplain, including water depth, velocity, and hydraulic residence time, not simply inundated surface area. Sommer et al. (2004) recognizes that wetted surface area alone is not an acceptable measure of usable habitat. Therefore, the SWB's own citation used to support its case would in fact suggest strongly that such a simplified view of "floodplain habitat" is unfounded.	Please refer to Master Response 3.1, Fish Protection, regarding the adequacy of the floodplain habitat analysis, the use of supporting evidence from other rivers, and expected benefits from increase floodplain inundation, and the relationship between floodplain and temperatures. Refer to response to comment 1344-73 regarding the importance of floodplain habitat in the Tuolumne River as identified by 2014 NMFS Final Recovery Plan. Refer to responses to comments 1344-179 regarding the findings by Sommer et al. (2004) and Ahearn et al. (2006) Please see Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, regarding how implementation of a more natural flow regime is anticipated to have positive effects on aquatic habitat (see Section 3.7.3), and the food web (see Section 3.7.2). The SED uses site-specific information where available. For example, information from studies completed as part of the FERC relicensing process on the Tuolumne River are used to support the floodplain and Weighted Useable Area evaluations in Chapter 7. The analysis in the SED, including Appendix C, supports that the proposed flow objectives will protect fish and wildlife beneficial uses. In addition, the effectiveness of the flow objectives will be continually assessed under the program of implementation. For example, as described in Appendix K, Water Quality Control Plan Update, and further described and clarified in Master Response 2.1, Amendments to the Water Quality Control Plan, elements of the program of implementation include the establishment of a STM Working Group and the development of biological goals. The STM Working Group will assist with the implementation, monitoing and effectiveness assessment of the objectives, and can be tailored to population needs in each tributary. The biological goals will be developed based on information specific to the LSJR and its tributaries, and will be consistent with best available scientific information.

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		Another observation based on the work conducted on the Yolo Bypass, as reported in Sommer et al. (2001), again not helpful to the SED, was the link found between higher temperatures and the greater growth of salmon juveniles on the floodplain when compared to the adjacent Sacramento River. As reported in Sommer et al. (2001), temperatures observed on the floodplain were up to 5°C higher than the adjacent river. Sommer et al. (2001) reports "[a]pparent growth differences between the two areas [Sacramento River channel and floodplain] are consistent with water temperatures and stomach-content results. We found that the Yolo Bypass floodplain had significantly higher water temperatures and that young salmon from the floodplain ate significantly more prey than those from the Sacramento River". Further, Sommer et al. (2001) reported the prey availability in Yolo Bypass was sufficient to offset increased metabolic requirements from higher water temperatures. The various studies of the Yolo Bypass suggest that greater growth of juvenile salmon resulting from floodplain access is due to both increased temperatures on the floodplain compared to the adjacent river and substantial food availability. Temperature data collected on the Tuolumne River floodplain has shown no difference between river temperatures and floodplain temperatures during rearing periods of fry and juveniles (Stillwater Sciences 2012). Furthermore, the SWB presents no information or data on food availability on the Tuolumne River floodplain, or any other floodplain in the geographic area covered in the SED. Ahearn et al. (2006) is also unsupportive of the SWB's assumptions about the floodplains of the eastside tributaries. Ahearn et al. (2006) investigated floodplain food sources on the Cosumnes River. One of the key findings reported by Ahearn et al. (2006) was: "The degree of [floodplain] complexity revealed in this analysis makes clear the need for high resolution spatial and temporal studies such as this to begin to understand the functioning of dynamic and heterogeneous floodplain ecosystems." The SED's analysis of the Tuolumne River floodplain, or any of the floodplains in the project area, falls far short of the type of scientific analysis the SWB's own citations suggest would be needed in order to conclude that the SED's preferred alternative would benefit fall-run Chinook salmon as a result of floodplain inundation. Instead of supporting the analysis performed by the SWB, both Sommer et al. (2004) and Ahearn et al. (2006) can only be interpreted as indicating the significant shortcomings of the SWB's methods. Section 5.0 below and Appendix A [ATT14] of these comments provide a detailed critique of the SWB's assessment of the Tuolumne River floodplains.	
1344	32	On page 7-39, on the topic of "Disease", the SED states the following: "Fish species on the Tuolumne River are susceptible to similar diseases as those discussed for fish in the Stanislaus River. The causative agent of BKD was detected in naturally produced juveniles caught in rotary screw traps from Tuolumne River (Nichols and Foott 2002)." Contrary to what the SED implies related to disease, Nichols and Foott (2002) report that no "gross clinical signs of Bacterial Kidney Disease (BKD) were seen in any of the fish examined", including those in the Tuolumne River. Further, but not reported in the SED, of 18 Tuolumne River fish also sampled as part of the referenced study, Nichols and Foott (2002) reported only a single incidence of T. bryosalmonae, the causative agent of	The comment is noted, but we would submit that even one fish with early infection of Tetracapsula bryosalmonae indicates that there is some susceptibility to at least carry the early stages of BKD. The statement is true, thus no changes are needed to Chapter 7, Aquatic Biological Resources. Please see Master Response 3.2, Surface Water Analyses and Modeling, on the need for increased flows. Please also note that there may be differing opinions as to how to approach an analysis for a given resource, or which data sets should be used, but these differing opinions do not equate to inadequacy. Please note that the State Water Board is not required to, and did not conduct, a site-specific, project-level analysis, but made reasonable assumptions where possible to disclose a full range of potential environmental impacts. For more information, please see Master Response 1.1 for information about the program-level document

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		Proliferative Kidney Disease (PKD) and this one was at the "Early" stage, meaning few parasites and no sign of significant inflammatory response. No incidence of PKD was found. For some reason, the SED did not cite the most recent study of disease on the Tuolumne River reported in December 2013 by the US Fish and Wildlife ("USFWS"). In summary, the 2013 study found no pathogens or infections in any of the Tuolumne River fish. Overall, the SED fails to provide a thorough description of the actual physical environment and ecology of the lower Tuolumne River using the site-specific data that is readily available. Where such site-specific data is not used, the SED needs to appropriately qualify its conclusions. If the SWB had considered even a portion of the extensive site-specific data available on the Tuolumne River, including studies of invertebrate food supply (e.g., TID/MID 1997, Report 96-4; TID/MID 2003, Report 2002-8) as well as food ration studies (TID/MID 1992, Appendix 16; TID/MID 1997, Report 96-9), floodplain studies (HDR and Stillwater 2017 [Footnote 8: A final draft of this report was issued to resource agencies for review and comment in September 2014. Comments were received from USFWS and responded to in the final report (2017). There were no substantive changes to the findings or conclusions of the draft report.]), annual seine results since 2001 (e.g., TID/MID 2016, Report 2015-3), annual rotary screw trapping results since 2006 (e.g., TID/MID 2016, Report 2015-4), intensive O. mykiss population estimate (Stillwater Sciences. 2008, 2009, 2011) and annual snorkeling studies since 2001 (e.g. TID/MID 2016, Report 2015-5), predation studies (TID/MID 1992, Appendix 22; FishBio 2013), as well as spawning gravel availability studies (McBain and Trush 2004; Stillwater Sciences 2013b), to name but a few, the SWB would find that in-channel spawning and rearing habitat, and high quality food resources, are abundant in the Tuolumne River, and that floodplain access is already provided at an annual recurrence interval supportive of viable salmon populations (Matella and Merenlender 2014). In fact, the SED does not present any evidence that the current baseline conditions on the Tuolumne River do not fully support the life stages of fall-run Chinook salmon. The SWB adopts the presumption of conditions needing to be improved without demonstrating with scientific, site-specific data that this is the case.	and program-level analysis.
1344	33	Chapter 19 of the SED is entitled Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30. On page 19-2, the SWB summarizes its key findings contained in Chapter 19: "The results of the temperature, floodplain, and SalSim analysis presented in this chapter indicate that as the percentage of unimpaired flow is increased during the February through June time period, the flow related benefits to salmon and steelhead also increase. Improving flows that mimic the natural hydrographic conditions including related temperature and floodplain regimes to which native fish species are adapted, are expected to provide many juvenile salmonids with additional space, time, and food resources which are necessary for required growth, development, and survival." Chapter 19 is intended to be the technical and scientific core of the SED. Its purpose is to describe the work performed which led the SWB to select the preferred alternative for future instream flows in the eastside tributaries to be 30% to 50% of the unimpaired flow from February through June. [Footnote 9: The preferred alternative also includes adaptive implementation, as do all the alternatives considered in the SED, except the baseline alternative.] In the beginning section, 19.1, it is asserted that Chapter 19 will present the	Some of the comments include inaccuracies. The State Water Board did not solely rely on Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, for selecting the preferred alternative. While setting flow objectives with regulatory effect (i.e. in a Water Quality Control Plan), the State Water Board reviews and considers all the effects of the flow objectives through a broad evaluation into all public trust and public interest concerns including, but not limited to, aquatic resources, economics, reservoir storage, power production, and groundwater. The SED provides such an evaluation. Please refer to the SED, Chapter 20, Economic Analyses, regarding the multiple economic analyses that were performed. The evidence that provides justification for the unimpaired flow approach can be found in the SED Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, and Chapter 19. As explained in Appendix C, higher and more variable flows are anticipated to improve conditions for fish, and other ecosystem attributes including, but not limited to, 1) native fish communities; 2) food web; 3) habitat; 4) geomorphic processes; 5) temperature; and 6) water quality. Chapter 19 supplements the information contained in Appendix C by quantitatively evaluating the benefits of the plan amendments for the LSJR flow objectives in terms of potentially available cold water and floodplain habitats, and associated population implications to native salmonids.

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		"measurable benefits of providing higher and more variable flow during the February 1 through June 30 time period." These "measurable benefits" are said to be quantitatively demonstrated by analysis of "temperature and floodplain habitat" and the fish "population level changes that could be expected under a variety of unimpaired flow scenarios." The initial section goes on to state without qualification "[t]he results of the temperature, floodplain, and SalSim (fish population) analysis presented in this chapter indicate that as the percentage of unimpaired flow is increased during the February through June time period, the flow related benefits to salmon and steelhead also increase." And, further still, that these "measurable benefits" will be the result of "improving flows that mimic the natural hydrographic conditions including related temperature and floodplain regimes to which native fish species are adapted". To address a serious shortcoming of its earlier 2012 draft of the SED, Chapter 19 is intended to supplement the prior work by "quantitatively evaluating the benefits of this project in terms of potentially available cold water and floodplain habitats, and associated population implications to native salmonids" (page 19-2). Not a single one of the stated purposes of Chapter 19 is fulfilled in the SED. In fact, the SWB has not only failed to demonstrate any scientifically valid population-level benefits resulting from the preferred alternative, its own analysis can be shown to support the opposite finding. As will be shown throughout the comments provided in this review document, and based on the over 200 site-specific studies performed on the Tuolumne River since the early 1990s, which have been largely ignored in the SED, the SWB's preferred alternative is as likely, if not more likely, to have an adverse effect than a beneficial effect on fall-run Chinook salmon and O. mykiss populations in the Tuolumne River. Section 19.1 of the SED closes with this assertion: "Analyses of historical abundance (of fall-run Chinook salmon) indicate that late winter and spring flows (February through June) in the tributaries and mainstem SJR have had a strong influence on survival and abundance of SJR Basin salmon since records began in the 1940s or 1950s (Figure 19-2; and CDFG 2005a; Mesick and Marston 2007; Mesick et al. 2007; Mesick 2009; Sturrock et al. 2015)." SWB's reliance on these figures and citations for its conclusion is misplaced.	As discussed in Appendix C, numerous studies have reported that the primary limiting factor for tributary abundances of Chinook salmon are reduced spring flow, and that populations on the tributaries are highly correlated with tributary, Vernalis, and Delta flows (Kjelson et al. 1981; Kjelson and Brandes 1989; USFWS 1995; Baker and Mohardt 2001; Brandes and McLain 2001; Mesick 2001b; Mesick and Marston 2007; Mesick 2009; Mesick 2010 a-d). In addition, more recent studies (e.g. Sturrock et al. 2015; State Water Board 2017; TID and MID 2013, USFWS 2014; Zueg et al. 2014) continue to provide evidence of the importance of suitable flow and related habitat conditions during the spring time period for native fish. On the Stanislaus River for example, USFWS (2014) found a significant relationship between juvenile salmon survival and floodplain acre-days, with floodplain acre-days explaining 77% of the year to year variation in juvenile salmon survival. Refer to Master Response 3.1, Fish Protection, for more information regarding the benefits of the unimpaired flow approach, the use of best available science, current fish decline and the need for increased flow, and the adequacy of the temperature, floodplain, and SalSim modeling used to analyze anticipated benefits from implementation of the plan amendments. Despite all of the studies performed on the Tuolumne River, salmon, steelhead, and other native fish populations have continued to decline to extremely low numbers. Salmon populations on the Tuolumne river have gone through the biggest decline compared to other rivers in the Central Valley between the 1967-1991 and 1992-2011 time periods (see Chapter 19). The plan amendments are designed to reverse the current trend of native fish declines and reasonably protect beneficial uses. The State Water Board did consider studies that have been conducted on the Tuolumne River. Many of these studies are related to the FERC relicensing process which State Water Board staff are heavily involved in because of our role in the Clean Water Act section 401 water quality certification process. For example, the floodplain and weighted usable area (WUA) evaluations in SED Chapter 7, Aquatic Biological Resources, uses information prepared during the FERC relicensing process. Please see Master Response 3.1, Fish Protection, regarding predation studies conducted on the Tuolumne River. Additionally, as described in Appendix K, Water Quality Control Plan Update, adjustments to the February through June unimpaired flow requirements should be implemented in a coordinated and adaptive manner, taking into account current information, including but not limited to, those developed from FERC licensing proceedings on the Tuolumne River. Please refer to Master Response 2.1, Amendments to the Water Quality Control Plan, for clarification regarding the methods used during the February through June period for making adaptive adjustments to the LSJR flow objective. Please refer to Master Response 2.2, Adaptive Implementation, for further clarification regarding the process of adaptive implementation.
1344	34	On page 19-3, the SWB presents Figure 19-1 which purports to show that the Tuolumne River has had significant "reductions in the natural production of adult fall-run Chinook salmon" when compared to other Central Valley tributaries. As a first matter, the plot should be extended to 2015. But more importantly, the SED is deficient because it lacks any analysis of the past and present adverse effects of hatchery practices and releases on "natural production". The SED should describe the very significant statistical uncertainties associated with estimates of "natural production" dating back to 1967, a time period lacking consistent and reliable data on the large numbers of unmarked hatchery releases to Central Valley rivers (Newman and Hankin 2004). A thorough discussion of the various hatchery practices over the subject time period and the challenges this introduces for interpreting this figure is necessary to properly understand the limited significance of Figure 19-1. To the extent that Figure 19-1 means anything at all due to the large statistical uncertainties, the	Refer to response to comment 1344-18 regarding comparing costs and benefits of the plan amendments. Refer to response to comment 1344-33 regarding the scientific justification of the plan amendments. The issue of the State Water Board analyzing hatchery effects is beyond the scope of the plan amendments because the adverse effects of hatchery operations are under the authority of other agencies. Please refer to Master Response 3.1, Fish Protection, for more information regarding the role of hatcheries, and recommendations from the California Hatchery Scientific Review Group including improving marking/tagging programs to distinguish between natural and hatchery-origin fish; and improving program size and release strategies for local adaptations to reemerge and genetic differentiation to be reestablished in natural populations.

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		figure may be more indicative of the displacement of natural production that has occurred on the Tuolumne River due to hatchery fish. In fact, the SED lacks a comprehensive discussion and analysis of the adverse effects hatchery practices and releases have had on the native Tuolumne River fall-run Chinook population, effects which are likely to continue with or without adoption of the SED preferred alternative. [Footnote 10: "Appendix A [ATT14] to these comments provide a thorough discussion of the effects of historical and current hatchery practices and releases and their potential impact on the SWB's proposal."] The distinct possibility that hatchery practices and influences could negate the assumed benefits to be provided by the SED is never seriously considered or discussed in the SED. There is no analysis provided in the SED to support the SWB's conclusion that additional instream flows will have a positive effect on fall-run Chinook natural production given the current levels of hatchery fish in the three eastside tributaries. To justify the need for 300,000 acre-feet of additional instream flows to the LSJR, the SWB must provide the scientific basis for its supposition that hatchery dominance of the adult escapement would not continue indefinitely.	The estimates provided in figure 19-1 are based on the best science available for computing estimates of yearly natural production. It is acknowledged that all measurements have imprecisions, and that fisheries counts and estimates have imprecisions. However, the commenter has not suggested or provided a better source of data or a better way to consistently interpret historic abundance data. Figure 19-1 has been updated based on the numbers for the Tuolumne River as cited in USFWS 2013a.
1344	35	Appendix C of the SED (page 3-42) acknowledges that "fall-run Chinook salmon and other salmon hatcheries have unintentionally caused a reduction of genetic variability within the species by altering the genetic makeup of native salmon due to interbreeding with stocked strains of salmon. In addition, the greater quantity of hatchery fish within the river system has caused declines in native salmon, and further reduced the genetic viability of naturally produced strains due to predation and competition for spawning grounds, food, and space." The adverse effects of hatchery fish on native salmon is also acknowledged in Chapter 7 when the SED states that the "federal status of fall-run Chinook salmon is due in part to concerns regarding hatchery influence." In Chapter 7 of the SED, hatcheries are discussed more in the context of how the SED's proposal might affect hatchery reared fish. But this entirely misses the real issue, which is the effects of hatchery practices on the SED's proposal. Hatchery-reared fish are reported in the SED to make up approximately 80%, 75%, and 90% of the fall-run Chinook populations in the Stanislaus, Tuolumne and Merced rivers, respectfully, as measured in the 2011 escapement, the latest figures available. There is not any scientific analysis or evidence in the SED to demonstrate that the SWB's preferred alternative would overcome, eliminate, or even reduce these adverse effects on natural production. The fall-run Chinook salmon adult populations of all three of the eastside tributaries are dominated by hatchery fish. The SED lacks the necessary showing that the preferred alternative would reduce the dominance of hatchery fish in the LSJR. Since the goal of the SED is to improve "natural production", a critical analysis of how the SED would achieve this goal in light of the current dominance of hatchery fish is essential. Failure to provide this critical analysis and thereby ignoring the ongoing and future role of hatchery practices is a serious omission in the SED.	Refer to response to comment 1344-34 regarding the role of hatcheries, and abundance estimates.
1344	36	Immediately following Figure 19-1, the SED includes Figure 19-2 which is purported to show for the years 1952 to 2014 a relationship between the historical "adult abundance" of SJR fall-run Chinook salmon and SJR flows during February to June occurring 2.5 years prior when these adult fish were juveniles. While there does appear to be a relationship between historical LSJR tributary escapement estimates and time-lagged spring outflow, this relationship has grown weak in recent years due in part to hatchery releases, predation effects in the Delta, as well as changes in ocean conditions, to name a few. For example, on the Tuolumne River, 48% of the variation in escapement is explained by annual discharge	Refer to response to comment 1344-34 regarding the role of hatcheries, and abundance estimates. In addition to proposing amendments to the LSJR flow objectives, the State Water Board recognizes that non-flow measures have a complementary role to flow-based restoration. As described in Appendix K, Water Quality Control Plan Update, and Chapter 16, Evaluation of Other Indirect and Additional Actions, non-flow measures may include floodplain and riparian habitat restoration, reduction of vegetation-disturbing activities in floodplains and floodways, gravel augmentation, enhancement of in-channel complexity, improvement of temperature conditions, fish passage improvements, predatory fish controls, and invasive

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		three years earlier on the Tuolumne River from 1971-2013 (see Figure TR-1 [ATT1]). Interestingly, however, since implementation of increased outmigration flows on the Tuolumne River since 1996 (see Figure TR-2 [ATT2]), the escapement vs "lagged flow" relationship from 1997-2013 explains only 26% of annual escapement. This suggests that recent increases in spring pulse flows under the FERC process as well as the Vernalis Adaptive Management Program (VAMP) have coincided with a declining and weakening relationship between tributary spring flows and subsequent escapement. Similar data exploration for the Stanislaus River shows the relationship between lagged discharge since the completion of New Melones Dam (ca 1978) explains only 33% of the long term escapement since 1980 (see Figure TR-3 [ATT3]). More recently, however, even with the large flow increases coinciding with the implementation of the Vernalis Adaptive Management Plan (VAMP) in 2000 as well as more recent flow increases as a result of the Central Valley Project/State Water Project Biological Opinions (BiOps) in 2010, lagged discharge now has no relationship ($p=0.68$, $R^2=0.015$) with recent escapement on the Stanislaus River (i.e., does not explain any of the variation). As seen in Figure TR-4 [ATT4], the relationship between Stanislaus River annual discharge and subsequent Chinook salmon escapement (t+3 yrs) is no longer apparent since adoption of increased spring pulse flows under VAMP (2000) and further increases with implementation of the CVP/SWP BiOps (2010). It must be acknowledged that the effect of high flows is not consistently observed in the LSJR tributaries and that a number of confounding influences other than spring outflow have diminished or even eliminated the purported benefits of the SED flow proposals. As one example, and as briefly mentioned above, the hatchery practices, number of released hatchery fish, and locations of releases varied widely throughout this period. The potential effect of these highly varied hatchery practices on "historical abundance" is not accounted for in Figure 19-2 of the SED. Another example is the effect of changing ocean conditions on adult salmon survival. Only relatively recently has it been recognized that varying ocean conditions can be a major factor affecting adult salmon returns. The SED's Appendix C itself contains numerous references to the potential effects of changing ocean conditions on adult returns, yet these effects are not discussed when the SWB interprets Figure 19-2 as supporting its hypothesis of the relationship between unimpaired flows and adult returns. The expert peer review of the SWB's 2010 draft Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives conducted by the University of Washington's Thomas Quinn, properly captures the role of ocean conditions: "This text [in the SWB's draft Technical Report] (which would benefit from basic references such as Hilborn et al. 2003 for sockeye salmon, and the more recent papers by Moore and by Carlson on salmon in areas more extensively affected by humans) is fine but the reference to variable ocean conditions and marine survival seems to contradict the earlier statements that only smolt number going to sea really matter. Overall, I think this holistic view is more tenable than one only emphasizing the link between flow and smolt production." (see page 12 of Quinn's review in the SED). Therefore, while Figure 19-2 does provide a plot of flows and adult returns to the SJR, it must be acknowledged that a significant and variable portion of the adult returns over time have consisted of hatchery releases. Since hatchery releases are predominantly smolts	aquatic vegetation control. Please see Master Response 5.2, Incorporation on Non-Flow Measures, for more information. Please also refer to Master Response 3.1, Fish Protection, for more information specific to predation as another stressor. Changing ocean conditions is outside of the control of the State Water Board, and beyond the scope of the plan amendments. The State Water Board recognizes that while ocean conditions affect salmonid populations, a limiting factor in the freshwater environment (which is under the purview of the State Water Board) of salmonid life history is flow during the spring time period of February through June. As described in the Executive Summary a goal of the plan amendments is to "Maintain inflow conditions from the SJR Watershed sufficient to support and maintain the natural production of viable native fish populations migrating through the Delta." In the SED, Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides an analysis of biologically important and measurable benefits of providing higher and more variable flow during the February 1 through June 30 time period. Also, see Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, for the scientific basis of the plan amendments, and specifically, Section 3.6, Analyses of Flow Effects on Fish Survival and Abundance, which reviews flow effects on fish survival and abundance. Please also refer to Master Response 3.1, regarding the use of best available science, and the current trend of fish decline and the need for increased flow. As described in Master Response 3.1, current research that has been conducted (e.g. Sturrock et al. 2015; State Water Board 2017; TID and MID 2013; USFWS 2014; Zueg et al. 2014) continues to provide evidence of the importance of suitable flow and related habitat conditions during the spring time period.

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		which are normally released from the hatcheries in mid-to-late April or May, flows that occurred in February through mid-April would have no effect on these fish. Furthermore, the SWB does not appear to account for the number of hatchery strays into the three eastside tributaries which can be significant and likely vary from year to year. For the Tuolumne River where a salmon counting weir has been in place since 2009, as much as 80% of the adult escapement has consisted of hatchery strays from the Merced, Mokelumne, and Coleman hatcheries. These numbers are readily available to the SWB.	
1344	37	[ATT1:] Figure TR-1. Plot of Tuolumne River escapement vs Water Year flow for the Period 1971 to 2013.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	38	[ATT2:] Figure TR-2. Plot of Tuolumne River escapement vs Water Year flow for the Period 1997 to 2013.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	39	[ATT3:] Figure TR-3. Plot of Stanislaus River escapement vs Water Year flow from 1980 to 2013.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	40	[ATT4:] Figure TR-4. Plot of Stanislaus River escapement vs Water Year flow from 2000 to 2013.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	41	Of the five individual papers cited in Section 19-1 of the SED to support the SWB's hypothesis of a relationship between February through June flows and adult abundance (CDFG 2005a; Mesick and Marston 2007; Mesick et al. 2007; Mesick 2009; Sturrock et al. 2015), not one of these papers concludes that 40% of the unimpaired flow from February to June would lead to improved salmon populations in the LSJR.	The cited references were cited for the proposition that February to June flows in the Stanislaus, Tuolumne, Merced and San Joaquin Rivers have a strong influence on the survival and abundance on salmon. Please see Master Response 3.1, Fish Protection, for information regarding the substantial reductions in harmful and lethal temperature for migratory fish in the Stanislaus, Merced, and Tuolumne Rivers from at 40 percent of unimpaired flow. Moreover, with respect to determining the precise percentage of unimpaired flow, Appendix C correctly states: "Given the dynamic and variable environment to which SJR basin fish and wildlife adapted, and imperfect human understanding of these factors, developing precise flow objectives that will provide certainty with regard to protection of fish and wildlife beneficial uses is likely not possible. Nevertheless, the weight of the scientific evidence indicates that increased and more variable flows are needed to protect fish and wildlife beneficial uses. While there is uncertainty regarding specific numeric criteria and how the SJR ecosystem will respond to an alternative flow regime, scientific certainty is not the standard for agency decision making." Rather, a court's review is limited to an examination of the proceeding to determine whether the action of an administrative body has been arbitrary, capricious, or entirely lacking in evidentiary support, or whether it has failed to give the notices and follow the procedures required by law: "In performing its regulatory function of ensuring quality by establishing water quality objectives, the Board acts in a legislative capacity. The Water Quality Control Plan itself is thus a quasi-legislative document. Accordingly, great deference must be given to the Board's determination, and appellate review thereof is narrowly limited: 'A reviewing court will ask three questions: first, did the agency act within the scope of its delegated authority; second, did the agency employ fair procedures; and third, was the agency action reasonable. Under the third inquiry, a reviewing court will not substitute its independent policy judgment for that of the agency on the basis of an independent trial de novo. A court will uphold the agency action unless the action is arbitrary, capricious, or lacking in evidentiary support. A court must ensure that an agency has adequately considered all relevant factors, and has demonstrated a rational connection between those factors, the choice made, and the purposes of the enabling statute.' [citation] Moreover, absent any

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			indication of arbitrariness or evidentiary or procedural defect, '... in these technical matters requiring the assistance of experts and the collection and study of statistical data, courts let administrative boards and officers work out their problems with as little judicial interference as possible.' [citation]" (United State v. State Water Resources Control Board (1986) 182 Cal.App.3d 82, 112-113.)
1344	42	One additional aspect of Figures 19-1 and 19-2 is worthy of note. Later in Chapter 19, on page 19-85, when explaining the apparent limits of the SalSim model to predict the low "adult production" during years 2005-2009 (more on this further below), the SWB makes specific mention of "ocean crash" being the cause of low returns in these years. However, there is no similar cautionary mention of this phenomena when describing Figure 19-1, and only adult returns in 2007 are mentioned as being affected in Figure 19-2. It is worth noting NMFS, the agency responsible for monitoring relevant ocean conditions, did not regularly assess ocean productivity until very recently and it is very possible, even likely, that ocean conditions affected "adult production" to an unknown degree in many of the years covered by this plot. The SWB's interpretation of Figures 19-1 and 19-2 is misinformed due to the lack of consideration of the many confounding factors and uncertainties in the underlying data. Beginning with the SED's basic "Problem Statement" provided in Section 19.1.1, the overall structure of Chapter 19 reveals the thought process used by the SWB in the formulation and development of its preferred alternative. The chapter first asserts as a statement of accepted fact, instead of a scientific hypothesis to be rigorously examined, that "a more natural flow regime from the salmon bearing tributaries (Stanislaus, Tuolumne, and Merced Rivers) is needed during the February through June time frame" (see page 19-4). Subsequent sections of Chapter 19 are then intended to describe and display the quantitative analyses that provide the technical support for the prior assertion. This method of resource planning where a hypothesis is accepted as a matter of settled fact, then attempted to be justified by subsequent analysis often fails to achieve the hoped-for benefits when implemented. Having the "solution" precede any rigorous scientific, technical, or biological evaluation often results in the subsequent evaluations being analyzed and presented in a manner that supports the "solution" and, to the extent that data or analyses are not supportive, the non-conforming data or analyses are discarded, discredited, unreported, or rationalized away. This does seem to be the case with the SED, where only data that provide support for the SWB's "solution" are considered as valid and data not helpful are disregarded, discredited, or not mentioned at all.	Please see Master Response 3.1, Fish Protection, regarding current fish decline and the need for increased flow, the use of best available science, adequacy of modeling to support the analyses, and justification and description of the plan amendments for protecting fish, including the unimpaired flow approach and benefits thereof. Refer to response to comment 1344-18 regarding addressing uncertainty. Refer to response to comment 1344-33 regarding justification of the unimpaired flow approach. Refer to response to comment 1344-34 regarding abundance estimates. Refer to response to comment 1344-36 regarding ocean conditions. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides a use advisory for SalSim, and specifically describes the limitations of SalSim. Please also see Master Response 3.1, Fish Protection, regarding State Water Board use of SalSim and acknowledgement of model limitations.
1344	43	The first technical section of Chapter 19 presents the SWB's most basic underlying scientific rationale for the preferred alternative. Section 19.1 is entitled "Importance of a Natural Flow Regime". The SWB's entire supposition as to the need for a percent of unimpaired from February to June and why this flow will deliver significant benefits to fish and wildlife is summed up succinctly when the SED states the following: "Using a river's unaltered hydrographic conditions as a foundation for determining ecosystem flow requirements is well supported by scientific literature (Poff et al. 1997; Tennant 1976; Orth and Maughan 1981; Marchetti and Moyle 2001; Mazvimavi et al. 2007; Moyle et al. 2011). In addition, major regulatory programs in Texas, Florida, Australia and South Africa have developed flow prescriptions based on unimpaired hydrographic conditions in order to enhance or protect aquatic ecosystems (Arthington et al. 1992;	Portions of the comments include inaccuracies. The cited estimates of drainage areas for the Upper San Joaquin River (USJR) represent different subsets of area and are correct as shown in the SED. Also, the unimpaired flow estimates in Table 2-24 of Chapter 2, Water Resources, are not used in any impact analysis; they are used simply to demonstrate the effects of human use and modification on the natural flow regime. Refer to response to comment 1344-33 regarding justification of the unimpaired flow approach. Please see Master Response 3.1, Fish Protection, regarding current fish decline and the need for increased flow, the use of best available science, and justification and description of the plan amendments for protecting fish, including the unimpaired flow approach and the benefits thereof, and the mischaracterization of unimpaired flow representing natural conditions. Please refer to Master Response 3.2, Surface Water Analyses and Modeling, for clarification regarding the

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		Arthington et al. 2004; NRDC 2005; Florida Administrative Code 2010), and the World Bank now uses a framework for ecosystem flows based on the unaltered quality, quantity, and timing of water flows (Hirji and Davis 2009)." Returning the LSJR, and the eastside tributaries, to a flow condition that mimics their "natural flow regime" is, in essence, the underlying basis for the Amended Plan's alternatives. As stated herein previously, the "settled fact" of the need for a "natural flow regime" is taken as a given based on reference to various literature sources which speak to the importance of restoring a river's unaltered hydrographic conditions. Subsequent sections of the SED's Chapter 19 attempt to support this assertion. Relying on this list of citations, many of which are either theoretical or involve river systems not remotely like the three eastside tributaries, the SED goes on to conclude that its preferred alternative of requiring each tributary to release 30% to 50% of the unimpaired flow from February 1 to June 30 will benefit fish and wildlife: "The current updates to the Bay-Delta Plan include improving flow conditions during the February through June time period so that they more closely mimic the natural hydrographic conditions to which native fish species are adapted, including the relative magnitude, duration, timing, and spatial extent of flows as they would naturally occur." The SED's supposition that the preferred alternative will result in significant improvements to fish and wildlife suffers from a fundamental flaw: * While the citations do generally refer to the potential value of having flows mimic unaltered "natural hydrographic conditions", "unimpaired flows" as defined in and by the SED do not depict the natural, unaltered flow regime of the eastside tributaries or the LSJR. The "unimpaired flows" developed and relied upon by the SWB in the SED are a human invention and have never actually occurred in the LSJR or its contributing tributaries at their confluence with the LSJR; therefore, migrating salmon and steelhead could never have become "adapted" to the SED's "unimpaired flow regime". * None of the referenced citations endorse adoption of the "unimpaired flow" regime as defined in the SED and some could as readily be read to argue against it. Table TR-1 [Footnote 11: Tables and figures not embedded in the text are provided at the end of these comments. For Table TR-1, see Attachment 1 [ATT12].] contains a summary of the citations relied upon by the SWB to support its conclusion that simply providing a percentage of "unimpaired flow" from the three eastside tributaries will result in significant improvements to the fish and wildlife of the Bay-Delta. [Footnote 12: The tributaries to the LSJR as referenced in the SED are the Stanislaus, Tuolumne, and Merced rivers (the three eastside tributaries) and the upper San Joaquin River (USJR). According to Table 2-1 of Chapter 2, the drainage area of the USJR is given as 1,675 mi², while Table 2-1 of Appendix C lists the drainage area size of the USJR as 5,813 mi². The drainage area of the LSJR above the Vernalis gage is listed by the USGS as 13,539 mi² (https://pubs.usgs.gov/of/2004/1015). Therefore, the SED's unimpaired flow estimates of the LSJR at Vernalis given in Table 2-24 appear to be missing estimates of unimpaired flow from over 7,000 mi², or 50%, of the contributing drainage area to the LSJR at Vernalis.] The primary cited reference is Poff et al. (1997), which is also liberally cited in the other referenced literature. Poff et al. (1997) contends that successful river basin ecological restoration must begin with understanding	modeling and calculations involved in simulating unimpaired flow. Please refer to Master Response 1.1, General Comments, for responses to comments that either make a general comment regarding the plan amendments or do not raise significant environmental issues.

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		and mimicking a river's natural flow regime. Poff et al. (1997), as do most of the citations to the extent they discuss a natural flow regime at all (see Table TR-1 [ATT12]), defines a natural flow regime as one that is "unaltered by human intervention". The SWB itself makes it abundantly clear throughout the SED that the "unimpaired" flow regime concept it employs is specifically not one that is unaltered by human intervention. The SED frequently acknowledges that unimpaired flows are not equal to, nor do they represent the natural, unaltered hydrology of the LSJR or its tributaries. On the first page of Chapter 19, the SED states via footnote: "Unimpaired flow represents the water production of a river basin, unaltered by upstream diversions, storage, or by export or import of water to or from other watersheds. It differs from natural flow because unimpaired flow is the flow that occurs at a specific location under the current configuration of channels, levees, floodplain, wetlands, deforestation and urbanization."	
1344	44	On page 4 of the Executive Summary, the SED states with great clarity: "The State Water Board does not propose to revert to natural flows. Though unimpaired flow is not the same as natural flow, it is nevertheless reflective of the frequency, timing, magnitude, and duration of the natural flows to which fish and wildlife have adapted and have become dependent upon." The SED acknowledges that the "unimpaired" flows it proposes do not represent the pre-development, unaltered, natural flow regime of the LSJR. It is the unaltered, natural flow regime to which native fish of the LSJR and tributaries over the centuries would have become adapted. Native fish could not possibly be adapted to "unimpaired flows" because the SED's unimpaired flows are a human invention and have never actually occurred, so it is impossible that these species would be somehow "adapted" to a flow regime that never existed in the LSJR or lower reaches of the three eastside tributaries. This basic fact undermines the SED's most fundamental underlying principle. As an indication of the degree of significance of this issue to the scientific underpinnings of the SED, the SWB, recognizing the problem presented by this logical and technical flaw, finds it necessary to declare in Appendix C of the SED the following: "For the purposes of this report, a more natural flow regime is defined as a flow regime that more closely mimics the shape of the unimpaired hydrograph." With this single sentence, the SWB now declares that it is no longer the unimpaired flow regime that supposedly mimics the natural flow regime, but it is the natural flow regime, by definition of the SWB, that mimics the unimpaired flow regime. That the SWB has to depend on such distortion only serves to reveal the weakness of the SED's fundamental assertions. The SWB finds this necessary because it is evident that the SED's unimpaired flows are not the natural flow regime to which the native fish are adapted. Even if we overlook this fundamental flaw (that is, "unimpaired flows" do not represent the natural, unaltered flow regimes to which LSJR fisheries are adapted), the stated goal of the SED is to provide an unimpaired flow regime in the lower San Joaquin River to benefit the Bay-Delta fisheries and ecology. One does not need to be an expert in hydrology, biology or engineering to readily understand that if you eliminate from consideration a large portion of	Please see Master Response 3.1, Fish Protection, regarding current fish decline and the need for increased flow, the use of best available science, and the justification of the plan amendments for protecting fish, including the unimpaired flow approach and benefits thereof, and the mischaracterization of unimpaired flow representing natural conditions. Please also refer to Master Response 2.1, Amendments to the Water Quality Control Plan, regarding the appropriateness of the plan area and extended plan area. Please also refer to Master Response 3.2, Surface Water Analyses and Modeling, for clarification regarding the modeling and calculations involved in simulating unimpaired flow.

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		the watershed that contributes to the lower San Joaquin River flows, as the SWB has done, river flows from the remaining portion cannot possibly represent either the natural or even the unimpaired flow regime of the LSJR. The SED only requires flows from the three eastside tributaries, but the largest of all the tributaries to the LSJR -- the upper San Joaquin River -- is not required to contribute essentially any water to the river as measured at the Vernalis USGS gage. The SED's goal is to improve the fish and wildlife of the San Francisco Bay-Delta. The lower San Joaquin River enters the Delta from the south and Vernalis is identified in the SED as the measuring point for flow to the Delta from the LSJR. The total watershed of the San Joaquin River above the USGS gage at Vernalis is approximately 13,500 square miles (mi^2). The three eastside tributaries combined have a watershed of 4,335 mi^2. The three tributaries thereby account for only 32% of the watershed. It is therefore physically impossible for the three tributaries to provide or mimic the "unaltered, natural flow regime" or the "unimpaired flow" of the SJR at Vernalis. Furthermore, for some reason unexplained by the SWB, the SED omits from consideration in this SED two other significant eastside tributaries to the LSJR's inflow to the Delta -- the Mokelumne and Calaveras rivers -- with a total combined watershed of 2,200 mi^2, a drainage area only slightly smaller than the combined area of the Merced and Stanislaus watersheds (2,465 mi^2). [Footnote 13: The SED reports that these two watershed contributing flows to the LSJR will be considered in a future proceeding. However, the scientific basis for excluding these prominent tributaries to the lower San Joaquin River from the current SED scope is not explained.]	
1344	45	The SWB misrepresents the size of the watershed upstream of the confluence of the Merced and San Joaquin rivers. In Chapter 2-1 of the SED, a chapter entitled "Water Resources", the SWB reports that the size of the upper San Joaquin River as 1,675 mi^2. Including the three eastside tributaries which are the subject of the SED, these four "tributaries" to the LSJR at Vernalis only account for 6,010 mi^2 of watershed. It therefore appears that the SED's analysis of the LSJR's unimpaired flows do not include the contribution of 7,490 mi^2 (55%) of the watershed above the LSJR at Vernalis (13,500 mi^2 -- 6,010 mi^2). Suffice it to say that omitting 55% of the contributing drainage area to the LSJR may result in significantly underestimating the unimpaired flows as provided in Table 2-24, much less the "natural flows" to which the fish are adapted. This results in the reporting of misleading, and erroneous "unimpaired" flows to the Delta from the LSJR. Other portions of the SED readily cite that the natural hydrology of the lower-lying LSJR drainage areas would contribute significant flow to the San Joaquin River in the December through April periods, periods that are in the core of the February through June flow period underlying the Amended Plan's preferred alternative. It is evident that the SWB acknowledges its "unimpaired flows" do not represent unaltered, natural flows and, further, the SWB acknowledges that natural flows, not unimpaired flows, are the flows to which native fish species would be adapted. In addition, the unimpaired flow values, as presented in the SED, do not represent the historical, unaltered, natural flow regime of the LSJR because the SWB estimates of unimpaired flow exclude a large portion of the watershed above the Vernalis measuring point. The SWB's unimpaired flow values do not include or account for the effects of alterations to the natural flow regime caused by human modifications to the river's floodplains, agricultural development, filling of wetlands, construction of levees for flood protection, stream channel modification, in-river and floodplain mining of gravels, deforestation, urbanization, or the loss of the native riparian and overbank vegetation. Basic textbooks on hydrology make it clear that each of these	The commenter is assuming that characterization of drainage area was a part of unimpaired flow estimation. To the contrary, unimpaired flow at Vernalis in Table 2-24 was obtained from DWR data. In addition, please see Master Response 3.2, Surface Water Analyses and Modeling, regarding the calculation and intended use of unimpaired flow. Furthermore, please see Master Response 2.1, Amendments to the Water Quality Control Plan, for a description of the plan amendments, including the LSJR flow requirement, and a discussion of Upper San Joaquin River Watershed and the San Joaquin Valley Unimpaired Total Outflow.

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		development factors may modify the natural flow regime.	
1344	46	None of the many citations that are referenced by the SWB in Chapter 19, Section 19.2 "Importance of a Natural Flow Regime" define the natural flow regime in a manner consistent with the "unimpaired flow" regime defined by the SWB. The overwhelming majority of the citations in Chapter 19 as well as in Appendix C, Section 3.7, including the much cited Poff et al. (1997), define the natural flow regime, the regime native fish are ecologically adapted to, as being that which is "unaltered by human activity". Historically, the lower valley segments of the eastside tributaries, each being some 50-miles long and more than a mile wide at their confluence, significantly affected the flow regime of the tributary as it entered the San Joaquin River and then contributed to Delta inflow. Another of the prominent references cited by the SWB was the Florida everglades restoration. As referenced in the South Florida Water Management District report of 2007 (SFWMD 2007), the Comprehensive Everglades Restoration Plan ("CERP") relied upon developing an understanding of flow regime of the south Florida region which existed prior to human development, disturbance, and drainage activities. The SWB's "unimpaired flows" do not exclude the effects of development, disturbance, and floodplain modifications, and therefore, cannot represent the natural flow regime. The SWB also references Sparks (1995) to support the contention of the need for "unimpaired" flows to aid LSJR fish and wildlife. However, Sparks (1995) specifically notes that "small, weirs, barrages, causeways, levees, and river training structures may be no less influential than dams, by virtue of their numbers and ubiquity. Their effects (on the natural flow regime) are compounded by offstream storages, selective manipulation of tributary flows, and interbasin transfers, such that the cumulative effects may represent a far more extensive level of regulation than that suggested by dams alone." The many referenced citations do more to refute than support the SWB's claims that "unimpaired" flows, as defined by the SED, mimic a natural flow regime.	Please see Master Response 3.2, Surface Water Analyses and Modeling, for a discussion of the difference between unimpaired flow and natural flow. Master Response 3.2 describes the difference between the two, discusses why unimpaired flow is an appropriate metric to use in the SED and the plan amendments, and addresses the misconception that the use of unimpaired flow is somehow intended to restore pre-development conditions. Please also refer to Master Response 3.2 for clarification regarding the modeling and calculations involved in simulating unimpaired flow. Please see Master Response 2.1, Amendments to the Water Quality Control Plan, for a description of the plan amendments and unimpaired flow as it relates to the plan amendments. Please see Master Response 3.1, Fish Protection, for a discussion of how the unimpaired flow approach is to capture the natural pattern of variability and retain the attributes of the natural flow regime to which native fish and wildlife adapted and that are important to support key ecosystem processes.
1344	47	The SWB does not explain why it failed to estimate the natural flow regime of the San Joaquin River after repeatedly citing its importance. Fortunately for the SWB just such a study was completed for the entire Sacramento-San Joaquin basin and published in a well-respected scientific journal in October 2015. The professional international journal Hydrology and Earth Systems Sciences published a study entitled "Reconstructing the Natural Hydrology of the San Francisco Bay-Delta Watershed" (Fox et al. 2015). This study evaluated the effects of landscape changes on the inflows to the Bay-Delta region from the Sacramento and San Joaquin rivers. The study estimated tributary flows by reconstructing the natural, undisturbed landscape of the Central Valley and, using the standard hydrologic methodology of computing water balances, estimated the natural flow regime of the Bay-Delta watershed which would have occurred for the period 1922 to 2009. These estimates of the natural flow regimes were then compared to "unimpaired flows", using the same definition of unimpaired flows as used in the SED. The Fox et al. (2015) analysis shows that the amount of water currently used by farms, cities, and other water users is about equal to the amount of water formerly used by native vegetation on the undisturbed Central Valley landscape. According to this published study, the development of water resources in California's Central Valley transferred water formerly used by native vegetation to new beneficial uses without substantially reducing the long-	Please see Master Response 3.1, Fish Protection, regarding current fish decline and the need for increased flow, and the use of best available science. Also, refer to Master Response 3.1 regarding the justification of the plan amendments for protecting fish, including the unimpaired flow approach and benefits thereof, a description of how unimpaired flow with adaptive implementation will essentially provide functional flows, and the mischaracterization of unimpaired flow as natural conditions. See Master Response 2.2, Adaptive Implementation, for more details of adaptive implementation of the plan amendments. Please refer to Master Response 3.2, Surface Water Analyses and Modeling, for clarification regarding the modeling and calculations involved in simulating unimpaired flow. Please also refer to Master Response 2.1, Amendments to the Water Quality Control Plan, regarding the calculation of unimpaired flow. Please refer to Master Response 1.1, General Comments, for responses to comments that either make a general comment regarding the plan amendments or do not raise significant environmental issues.

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		term annual average flows to the San Francisco Bay-Delta estuary. Another key finding of this study is that "unimpaired" flows, as computed by the SWB, significantly overestimate natural flows because unimpaired flows fail to include consumptive use by natural vegetation in the valley floor. This study concludes that "unimpaired delta outflow calculations should not be used as a surrogate measure of natural conditions or to set flow standards to restore ecosystem health", and further "by definition, unimpaired delta outflow calculations provide a high estimate when used as a surrogate for natural delta outflow." This study demonstrated that unimpaired flows do not reflect, nor should they be used to represent, the natural flow regime to which anadromous fish are adapted. The SWB did not consider this study, which cannot be found in the citations of the SED. In March 2016, the California Department of Water Resources ("DWR"), issued a report entitled "Estimates of Natural and Unimpaired Flows for the Central Valley of California: Water Years 1922-2014". DWR is the California state agency responsible for the management and regulation of the state's water usage and is widely recognized for its expertise in compiling the quantitative estimates and records of the water resources of the state. DWR's March 2016 report on page 1 of the Executive Summary states unequivocally: "Unimpaired flow estimates are theoretical in that such conditions have not occurred historically", and on the same page 1 provides this conclusion: "In sum, the findings of this report show that unimpaired flow estimates are poor surrogates for natural flow conditions." The DWR (2016) report and the published Fox et al .(2015) study reached the same conclusion that "unimpaired flow" estimates, as those used by the SWB, do not represent the natural flow conditions of the Central Valley's rivers. Both of these studies were available to the SWB in a manner that was timely, and neither were cited or appeared to be used to inform the SED. SWB chose to disregard this available information. This exclusion of relevant, but conflicting, technical information is contrary to accepted practice. As we shall continue to point out below, the SWB appears to have systematically elected to only consider data, information, and reports which do not conflict with its underlying justification for the pre-ordained conclusions about the SED's preferred alternative, an alternative which imposes significant restrictions on the water users of the three eastside tributaries to the LSJR. In summary, as discussed above, the overwhelming majority of the citations relied upon by the SWB [Footnote 14: See Table TR-1 in Attachment 1 [ATT12] to these comments.] for justifying the need for a "more natural flow regime" in the LSJR define a natural flow regime as the pre-development hydrologic regime as referenced in the south Florida CERP, or as a flow regime unaltered by human intervention as in Poff et al. (1997). A number of the citations, while not specifically suggesting adoption of an unaltered, natural flow regime to restore natural ecosystems, endorse the use of functional biological flows (see Richter et al. 1996, Yarnell et al. 2015, Kiernan et al. 2012 and others in Table TR-1 [ATT12]) to promote stream restoration by "manipulating stream flows at key times of the year". [Footnote 15: As concluded in Kiernan et al 2012 study of the Putah Creek fisheries.] Functional biological flows provide more precisely timed flows matched to preferred species' specific biological needs, in lieu of natural, unaltered flows or "unimpaired" flows. The SED has neglected to consider or scientifically evaluate the use of functional biological flows, in lieu of unimpaired flow volume to improve the fish and wildlife of the Bay-Delta and the eastside tributaries.	

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1344	48	The SWB use of the concept of "unimpaired flows" as defined in the SED to represent a natural flow regime is unique to the SED. It appears to have been used by the SWB for the reason that estimates of the "unimpaired flow" were readily available, and not as a result of a rigorous scientific assessment to verify that "unimpaired flows" actually mimicked natural flows. The SWB does not appear to have consulted with DWR on the limits of application of "unimpaired" flows. DWR originally developed these estimates for use in large scale water supply assessments, and not to inform fishery or floodplain management which, as in the case of the SED, require more detail than monthly estimates of flows. The DWR has indicated very clearly to the SWB that the "unimpaired flow" would not be suitable for use in the manner being employed by the SWB. To try to bolster its presumption of the need to require flows that mimic a natural flow regime to improve Bay-Delta fish and wildlife, and not considering that unimpaired flows do not actually mimic natural flows, the SWB tries to rely upon citing three "real-world examples" of the beneficial effects of restoring a "natural flow regime" to a river. The first of these is a discussion of Putah Creek, a tributary to the Sacramento River. As the SED states on page 19-13, the "effectiveness of restoring the natural flow regime was demonstrated by Kiernan et al. (2012) in lower Putah Creek". The SED asserts that the reestablishment of a natural flow regime in Putah Creek below the Putah Diversion Dam ("PDD") resulted in the displacement of the non-native species dominating the reach to locations approximately 20 km downstream, and thereby restoring the upper 20 km to native species. The SED further implies the Putah Creek experiment demonstrates by "real example" that returning to a natural flow regime on the LSJR would control non-native species infestations. Even aside from the fact that Putah Creek has little similarity to any of the three eastside tributaries that are the subject of the SED, the SWB's explanation of the Putah Creek "example", and the lessons one might derive from it, differs substantially from the contents and conclusions of the Kiernan et al. (2012) study. According to Kiernan et al. (2012), the non-native species originally dominating the entire 35 km reach below PDD were displaced downstream by a series of uncontrolled, high flow events occurring from 1997 to 1999, not from any action on part of the owners of the PDD. The new controlled flow release regime at PDD wasn't initiated until 2001. The original downstream displacement of non-native fish was not the result of the new flow regime, as implied by the SWB. As Kiernan et al. (2012) reports: "[b]eginning in 1997, a series of water years with high winter and spring flows displaced or suppressed alien species while creating advantageous spawning and rearing conditions for native fishes. By 1999, the proportion of native fish had greatly increased at the four upstream sites, driven by increases in abundance of Sacramento sucker and Sacramento pikeminnow. Marchetti and Moyle (2001) cited these changes as evidence that native fishes in lower Putah Creek could be enhanced by restoring a more natural flow regime." The change in the flow regime cited in the SED was the result of a settlement agreement reached in 2000 and then initiated following the agreement. The flow regime changes following the settlement agreement consisted of a combination of seasonal pulse and spawning flows (that is, functional biological flows) and summer constant releases to maintain a wetted stream. Contrary to the impression the SED attempts to portray, the new flow regime was not based on a percent of unimpaired flow. Furthermore, the species involved were not anadromous salmonids. Kiernan et al. (2012) concludes with the following statement: "This favorable outcome was achieved by manipulating stream flows at key times of the year and only required a small increase in the	The intent of using the unimpaired flow approach was to allow increased instream flows for the protection of fish and wildlife beneficial uses, and to capture the natural pattern of variability and retain the attributes of the natural flow regime to which native LSJR basin fish and wildlife adapted, and that is important to support key ecosystem processes (see Yarnell et al. 2015; Beechie et al. 2010). The results from Kiernan et al. (2012) "validate that natural flow regimes can be used to effectively manipulate and manage fish assemblages in regulated rivers." Refer to Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, and Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, for more information regarding how higher and more variable flows indicative of the natural flow regime is anticipated to positively affect native fish communities. Please also refer to Master Response 3.1, Fish Protection, regarding the composition of organisms in rivers with different flows and temperatures. Please also see Master Response 3.1 regarding the current fish decline and the need for increased flow, the use of best available science, justification and description of the plan amendments for protecting fish, including the unimpaired flow approach, benefits thereof, and a description of how unimpaired flow with adaptive implementation will essentially provide functional flows. Also, refer to Master Response 3.1 regarding the adequacy of the floodplain analysis, including the appropriateness of using monthly flow modeling. Refer to Master Response 2.2, Adaptive Implementation, for more information on adaptive implementation of the plan amendments. As described in Master Response 2.5, Baseline and No Project, and Master Response 3.2, Surface Water Analyses and Modeling, the State Water Board used the best available information in the SED analysis to realistically measure existing physical conditions and assess potential impacts. The CALSIM II water balance, including accretion estimates used in the WSE model, was the best available information for the entire plan area at the time of the analysis, and is sufficiently credible to make reasonable determinations of potential impacts. Please refer to Master Response 3.2, Surface Water Analyses and Modeling, for more information regarding the assumptions, inputs, calculations involved in simulating unimpaired flow, and accretions and depletions. As described in the SED, LSJR Alternative 3 evaluates a range between 30 and 50 percent of unimpaired flow, with 40 percent as the starting percentage of unimpaired flow. Accretion flows to the lower Tuolumne River can comprise a significant fraction of compliance with the LSJR flow objective. The accretion flows in the WSE model are considered reliable for the study period 1922-2003 as used for comparative purposes. Further, the analysis of LSJR Alternative 3 encompasses the trend suggested by the commenter; even if accretions have decreased since 2003, potentially requiring proportionally increased releases from New Don Pedro Reservoir, the effects are captured within the SED's analysis and would not alter the significance determinations related to LSJR Alternative 3 and within the SED. See also Master Response 1.2, Water Quality Control Planning Process, regarding the consideration of beneficial uses of water and regarding the State Water Board's authorities. Refer to response to comment 1344-36 and Master Response 5.2, Incorporation of Non-flow Measures, regarding non-flow measures.

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		total volume of water delivered downstream (i.e., not diverted) during most water years". The ultimate conclusion of the Kiernan et al. (2012) tends to refute the SED's preferred alternative and agrees with ideas previously put forward by the Districts that functional biological flows, consisting of properly timed, seasonal flow pulses, when combined with site-specific non-flow measures, can result in substantial improvements to in-river production of fall-run Chinook on the Tuolumne River without the large adverse impacts to water users that will occur under the SED's preferred alternative. Such a concept provides a better balanced outcome, but was not analyzed or considered by the SWB. The only other two "real-world examples" cited in the SED to support the contention of flow regime changes leading to measured improvements in fish populations are Butte Creek and Clear Creek, both tributary to the Sacramento River. While citing improvements in salmonid populations, the SED is careful to report that these improvements were the result of "fish responding substantially well to flow and non-flow restoration actions". Here the SWB at least does not contend that the favorable response by salmon populations was the result of a change to a percent of unimpaired flow. Again, the Butte and Clear creek examples do more to support ideas previously put forward by the Districts than the alternatives evaluated by the SWB. In summary, the overwhelming majority of the SED's own citations reference the potential benefit of carefully timed, functional biological flows, and not "unimpaired flows. For the reasons discussed above, with respect to the need for a percent of "unimpaired" flow from February through June to improve fall-run Chinook or steelhead populations, the information presented by the SWB in the SED does not support adoption of the preferred alternative's flow schedule, and, in fact, tends to refute the SED's proposal of a percent of "unimpaired" flow in the manner that the SED defines such flows. With respect specifically to the Tuolumne River, the SWB presents unimpaired flow estimates at the confluence of the Tuolumne River and the SJR. Since there are no records of flows entering the SJR from the Tuolumne River, the SWB presented an estimate of unimpaired flow at the USGS Modesto gage located below Dry Creek at river mile ("RM") 16. The flow at the Modesto gage includes an amount of flow entering the river between the USGS gages at La Grange and Modesto (accretion flows). According to the WSE model, described in Appendix F of the SED, accretion flows make up approximately 20% of the 40% unimpaired flow requirement at the river's confluence of the SJR under the SED's 40% UF alternative. An accretion flow of this magnitude significantly overestimates actual accretion flows between the two gages, and in so doing allows the SWB to significantly underestimate the flows that would be required to be released at the Don Pedro Reservoir to meet the 40% unimpaired flow requirement, which in turn significantly underestimates impacts to the Districts' customers and the regional economic impact of the SED's preferred alternative. The SWB provides no analysis or evidence to independently verify these high estimates of accretion flows.	
1344	49	Fall-run Chinook salmon are used as the "indicator species" for the SWB's analysis of the effects of the SED's preferred alternative on the fish and wildlife of the Bay-Delta area and three affected eastside tributaries. By its own analysis, the SED's preferred alternative ("LSJR Alt3" in Chapter 7) will adversely impact the critical life stages of fry and juvenile rearing of fall-run Chinook salmon on the Tuolumne River. As the SED points out, the February through	None of the impact determinations identified for LSJR Alternative 3 in Chapter 7, Aquatic Biological Resources, are considered significant. Table 19-1 presents composite temperature evaluation considerations and primary life stage months for fall-run Chinook salmon and steelhead of all three eastside tributaries combined.

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		April time periods are important rearing periods for fall-run Chinook in the Tuolumne River. While the SED reports in Table 19-1 that the core rearing period for fall-run Chinook is March 1 through May 31, data obtained from monitoring fall-run Chinook outmigration at rotary screw traps on the Tuolumne River indicate that over 95% of Tuolumne River juvenile fall-run Chinook salmon have left the river by May 6. Outmigrants exiting the river from late April through May are predominantly smolts, so rearing activity has largely ceased by early May. [Footnote 17: The failure to consider data obtained at the Districts' two RSTs on the Tuolumne River leads the SED to the erroneous conclusion of May being a core rearing period as it reports in Table 19-1 of the SED.] The core rearing time for Tuolumne River fall-run Chinook is February through April, except in wet years, and the occurrence of wet year spills such as those in 2011 or 2017 would be little affected by the SED's proposal.	Please also see Master Response 3.1, Fish Protection, regarding the use of best available science, and seasonal flows from February through June, including the timing of salmon and steelhead in the San Joaquin Basin.
1344	50	The SWB neglects to provide a specific section in the SED analyzing the impacts to each fall-run Chinook life stage on each river, but the relevant information can be mined from the document. Fall-run Chinook fry may rear in both the river channel and the floodplain. Table 7-13b of the SED provides estimates of available in-channel fry rearing habitat under baseline conditions and for each of the SED's alternatives given in terms of Weighted Usable Area (WUA). [Footnote 19: WUA is normally provided in units of ft2 per 1,000 linear feet of stream, but no specific units are provide in the SED's Table 7-13b.] By comparing the in-channel rearing habitat for the baseline and alternative LSJR Alt3, on average, the SED's alternative reduces the available rearing habitat by 17% in February and 25% in March. However, fry may also rear on the Tuolumne River floodplains. While there are a number of methodological problems with the SWB's assessment of suitable floodplain habitat on the Tuolumne River, as discussed below in Section 5.0, the SWB's assessment of Tuolumne River floodplain inundation in February and March is provided in Table 7-15b. Comparing the baseline and LSJRAlt3 alternative, the table shows that the SED's preferred alternative reduces inundated floodplain by 35% in February and 26% in March. Therefore, by the SWB's own analysis, the SED's preferred alternative has a significant adverse impact on floodplain rearing opportunities for this critical life stage of fall-run Chinook salmon on the Tuolumne River. While fry have been documented to be displaced downstream from the Tuolumne River to the LSJR in wet years, Table 7-15d also shows the LSJR Alt3 alternative results in a reduction in LSJR floodplain inundation as well. [Footnote 20: As discussed below, the SWB provide no estimates of floodplain habitat in the SED.] Additionally, Table 19-21 shows that there is very little floodplain available on the LSJR below the confluence with the Tuolumne River, especially at the estimated median February and March flows at Vernalis under LSJT Alt3.	Please see Master Response 3.1, Fish Protection, for information about comments presenting information that do not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the plan amendments. Please refer to the discussion on in-channel habitat, including discussion of the benefits of improved physical parameters of habitat created by higher flows, such as food production and lower temperatures. Less WUA of habitat does not have an adverse effect if the remaining habitat is improved over the baseline conditions.
1344	51	By the SED's own assessment, the SWB is predicting the SED's preferred alternative will adversely affect Tuolumne River fall-run Chinook fry rearing. Juvenile rearing is also adversely impacted. Contrary to Table 19-1 of the SED, there is little juvenile rearing occurring in May on the Tuolumne River according to RST data. By May 1, except during wetter water years, most of the fall-run Chinook juveniles have smolted and are actively emigrating and no longer rearing. Juvenile rearing primarily occurs in March and April. In any event, Table 7-14d shows that in-channel rearing habitat is reduced by 14% in April (and May) when comparing LSJRAlt3 to the baseline conditions. Again, floodplain inundation is less on average by 26% in April. [Footnote 21: Table 7-15b shows May floodplain inundation increases by 21%, but May is not a core rearing time on the Tuolumne River for fall-run	Please see Master Response 3.1, Fish Protection, for information about comments presenting information that do not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the plan amendments. Please refer to Master Response 3.1 for a discussion on in-channel habitat, including the benefits of improved physical parameters of habitat created by higher flows, such as food production and lower temperatures. Less WUA of habitat does not have an adverse effect if the remaining habitat is improved over the baseline conditions.

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		Chinook juveniles.] The SWB's analysis demonstrates that the SED's preferred alternative would have an adverse effect on rearing of the critical fry and juvenile life stage of fall-run Chinook on the Tuolumne River. While the SED acknowledges an impact to fall-run Chinook spawning habitat, the significant reduction in fry and juvenile rearing habitat is not discussed or acknowledged in the SED. In fact, Chapter 7 of the SED describes the effects of LSJRAlt3 on fry and juvenile rearing habitat as "less than significant" justifying this finding with the following (see page 18-37): "Reductions in WUA for Chinook salmon spawning would occur in the three eastside tributaries, but higher flows and lower temperatures are expected to improve attraction and migration and the longitudinal extent of suitable spawning habitat. This alternative would substantially improve rearing habitat conditions for Chinook salmon and steelhead in the three eastside streams and LSJR. Considering the overall beneficial effects of higher flows on rearing habitat availability, no significant adverse impacts on Chinook salmon and steelhead populations would occur. Higher spring flows under this alternative would also benefit other native fish species improve rearing habitat conditions for Chinook salmon and steelhead in the three eastside streams and LSJR. Considering the overall beneficial effects of higher flows on rearing habitat availability, no significant adverse impacts on Chinook salmon and steelhead populations would occur. Higher spring flows under this alternative would also benefit other native fish species." There are a number of problems with this description of impacts. First, the explanation indicates that "higher flows and lower temperatures are expected to improve attraction and migration and the longitudinal extent of suitable spawning habitat." One can only interpret this to mean that the LSJRAlt3 includes "higher flows" than baseline during the adult upmigration and spawning periods. However, nowhere in the description of LSJR Alt3 is there included a mention that it includes spawning flows different than the baseline spawning flows. At this point, it is not even clear what flow schedule has been included in LSJR Alt3. What does LSJRAlt3 actually consist of? Where do these extra spawning flows come from? This lack of transparency about what alternative is actually being evaluated is troubling and erodes the credibility of the SED. Even more difficult to understand, is how the SWB can conclude that LSJR Alt3 would "substantially improve rearing habitat conditions for Chinook salmon and steelhead in the three eastside streams and LSJR". On the face of it, this appears to contradict the various analyses shown in the tables in Chapter 7 which are discussed above. Without further detailed explanation in the SED, one can only conclude the directly opposite finding related to impacts to Tuolumne River fall-run Chinook salmon; that is, the SED's preferred alternative will have significant adverse effects on fall-run Chinook salmon on the Tuolumne River.	
1344	52	Of the four factors [Footnote 22: The four factors intended to improve fish and wildlife are (1) more natural flow regime from February through June, (2) temperature "improvements", (3) greater floodplain inundation, and (4) adaptive implementation.] encompassed within the SED's preferred alternative which are intended to show scientific support for the SED's contention that the Amended Plan will benefit the fish and wildlife of the Bay-Delta, the SED states "[o]f all of the habitat attributes for native fishes, water temperature is likely the most important one...because without adequate water temperature all of the other habitat	The quotation cited by the commenter, "[o]f all of the habitat attributes leaves out information….," is missing information, and as such, mischaracterizes the SED. Staff does not acknowledge that temperature is more important than flow. The quotation from Chapter 19 is as follows: "Of all of the habitat attributes for native fishes, water temperature is likely the most important one (besides having water itself), because without adequate water temperature all of the other habitat attributes (including floodplain inundation) become unusable." Please see Master Response 3.1, Fish Protection, regarding current fish decline and the need for increased

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		attributes become unusable." [Footnote 23: On page 19-5 at the beginning of the section on the importance of flow, the SED indicates that flow is the "master variable"; and at the conclusions of the section on water temperature on page 19-47, water temperature seems to have become the most critical element, displacing flow as the master variable.] The SED explains on page 19-8 why the preferred alternative will result in benefits related to water temperature: "The current updates to the Bay-Delta Plan include improving flow conditions during the February through June time period so that they more closely mimic the natural hydrographic conditions to which native fish species are adapted, including the relative magnitude, duration, timing, and spatial extent of flows as they would naturally occur. This document describes the benefits of the project to native salmon and steelhead in terms of improvements to temperature and floodplain habitat in response to the proposed changes in flow conditions which will more closely mimic the natural hydrographic conditions during February through June." The SED preferred alternative, by both SWB's own admission and that of the DWR, will not deliver flows that "mimic the natural hydrographic conditions" of the LSJR or the eastside tributaries. The SED also fails to demonstrate that its estimated temperature benefits could reasonably be expected to result in measurable increases to salmon or steelhead populations. Beyond the fact that the flow regime of the preferred alternative does not mimic the natural unaltered flow regime of the LSJR, the SWB analysis of temperature benefits falls short for the following reasons: * The temperature model employed has not been independently verified by the SWB. * SWB's analysis does not evaluate the flow regime actually proposed by the SED's preferred alternative; therefore, the results of its analysis cannot represent water temperatures expected under the preferred alternative. * SWB's assessment of the potential beneficial effects of future water temperatures on Tuolumne River fish are overstated because the temperatures under the current baseline conditions are not unfavorable to fall-run Chinook salmon. * SWB presents no scientific data or analysis that links the small changes in water temperatures under the SED's preferred alternative to increases in salmon or steelhead populations. * SWB's oversimplified hypothesis related to temperature -- that simply "colder is better" -- is unsupported in the record and in much of the scientific literature the SED itself cites.	flow, the use of best available science, and the adequacy of modeling to support the analyses, which includes discussions on temperature and floodplain modeling. Please also refer to Master Response 3.1 regarding the justification and description of the plan amendments for protecting fish, which discusses the unimpaired flow approach and benefits thereof, including water temperature benefits such as reduction in harmful and lethal temperatures.
1344	53	Temperature Model Employed by SWB. There is a fundamental issue related to the SWB's analysis of potential temperature benefits that should be brought to the public's attention. In Section 19.2.2 of Chapter 19, entitled "Methods of Temperature Evaluation", the SWB describes the methods and tools used to estimate the temperature changes it expects to occur under the SED's preferred alternative. The SWB is clear that it has relied heavily on a water temperature computer model named "SJR HEC-5Q", a model developed by a "group of consultants between 2003 and 2008". The	Refer to the response to comment 1344-52 regarding mischaracterization of the quoted text from the SED. Parts of the comments include inaccuracies. The water temperature model has been peer reviewed by the U.S. Army Corps of Engineers. Please see Master Response 3.2, Surface Water Analyses and Modeling, regarding the HEC-5Q model, its peer-review, and the modifications made for use in the SED. Also refer to Master Response 3.1, Fish Protection, regarding adequacy of the modeling to support the analyses, and regarding benefits anticipated with implementation of the plan amendments, including reduction of harmful and lethal water temperatures.

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		SWB gives no indication that it independently verified the reliability or accuracy of the model. Placing such high reliance on a computer model developed by others, the code of which is not in the public domain, is a substantial risk assumed by the SWB, especially when the model is used to evaluate what the SED asserts is likely the most important habitat attribute (see page 19-47). The SWB likely considered its confidence in the model to be well-placed because the SED cites in several locations that the SJR HEC-5Q model development "included peer review and refinement". As recognized throughout the scientific and engineering community, having a document, analysis, report, or computer model go through an independent peer review process represents a stamp of assurance in the reliability and usefulness of the information contained therein. Unfortunately, the SWB's confidence is misplaced. The SJR HEC-5Q model relied upon by the SWB has not gone through a peer review process. Falsely claiming that a model has been through a peer review process raises significant concerns. By itself, this mischaracterization of the SJR HEC-5Q model disqualifies all subsequent findings based on the model, until such time as the model undergoes the full and formal peer review process it was professed to have gone through, including review of the non-public code. Intentionally misrepresenting that a model has been "peer reviewed" undermines the public trust and the credibility of the SED, and not only related to the temperature analysis and results. Relatedly, we are also concerned that almost as an aside the SWB reports that the "temperature model" was "updated by the CDFW and released in June of 2013". Having a model "updated" by persons other than the original model developers is fraught with risk, and this alone should have raised questions among SWB staff. Further, in response to an October 31, 2016 email from HDR staff member Robert Sherrick concerning the SWB's model results, SWB staff member William Anderson responded on November 4, 2016 that "[i]t has come to our attention that some of the HEC-5Q temperature model files that we provided were altered by CDFW, working as a cooperative agency, in the production of SalSim results for the SED report based on the 'SB40%OPP' scenario only." Based on this response, it is apparent that CDFW has continued to "modify" the SJR HEC-5Q model within the SED development process, and apparently without the knowledge or oversight of the SWB. This is unacceptable practice and reduces the public's trust in the SED development process. The false claim of peer review, when added to the disclosure of a third party modifying a key modeling tool without the knowledge of the SWB, is sufficient to discount all subsequent temperature assessment results and "findings".	
1344	54	SWB's Temperature Analysis of the SED's Alternatives. Beyond the core issues of claims of peer review and undocumented model modifications, there are methodological and fact-related errors in the SWB's analysis which deserve discussion. [Footnote 24: The temperature model employed by the SWB uses a one-dimensional (1-D) reservoir temperature model to estimate the thermal regime of the Don Pedro Reservoir. A 1-D model is ill-suited for the task of accurately modeling the thermal dynamics of a reservoir as complex as Don Pedro.] Perhaps the most basic and serious of these methodological shortcomings is the fact that SWB's analysis of the effects on water temperature of the preferred alternative does not evaluate the actual preferred alternative, or for that matter, any of the alternatives indicated to be considered in the SED. For the	Please see Master Response 3.1, Fish Protection, regarding SED use of best available science, adequacy of the temperature analysis, including discussions of USEPA recommended temperature criteria, use of a monthly flow model with a sub-daily temperature model. The SED temperature model is appropriate for comparing alternative management scenarios on a basin-wide and long-term scale. Please also see Master Response 3.1, regarding current fish decline and the need for increased and more variable flows, benefits of the unimpaired flow approach, and the scientific basis for the LSJR alternatives. The commenter is correct that increased variability with respect to the hydrologic regime is emphasized as an important component of fish protection in the SED. Current research (e.g. Sturrock et al. 2015; State Water Board 2017; TID and MID 2013; USFWS 2014; Zueg et al. 2014) continues to provide evidence of the

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		sake of brevity, we will discuss the SWB's 40% unimpaired flow ("UF") alternative for the Tuolumne River, which is the SED's recommended starting point for its preferred alternative of 30%-50% UF from February through June. Although the SED never clearly states how in actual practice such a flow requirement would be implemented [Footnote 25: For example, according to the SED's adaptive implementation plan, discussed later, the UF flow volume expected for the upcoming February through June timeframe would have to be estimated in early January. This seems problematic and unworkable because no reliable information exists in January as to what the volume of the unimpaired flow would be from February through June.], the SWB states in Chapter 3 [Footnote 26: See page 3-9. Also see Appendix 9, page 29.] that the SED's preferred alternative requires flow to be released from the three rim reservoirs based on a rolling seven-day average of the unimpaired flow at the rivers' confluence with the LSJR. The SWB repeatedly emphasizes in the SED that it is not only the amount of flow (magnitude) which is critical to improving fish and wildlife, but as critical is that releases to the river reflect the "duration, timing, and spatial extent of flows as they would naturally occur" [Footnote 27: See pages ES-11, 1-8, 3-8, 4-12, 19-8, 23-4 and others.]; that is, the variability of flows that would occur in a natural flow regime is as important to capture as the magnitude. Unlike the summer months in the Central Valley tributaries when runoff can be relatively unchanging, the natural runoff in the months of February through June would experience high and frequent variability. In Figures 19-3 and 19-4, the SED depicts the significant daily variability that can occur in the February through June period. SWB places considerable importance in this variability and the associated temperature and floodplain benefits to fish and wildlife associated with this variability. Accurately evaluating the occurrence of this variability under the SED's preferred alternative is therefore a prerequisite to being able to demonstrate the benefits of the preferred alternative to fish and wildlife. The SWB purports to do this in section 19.2. Based on the analysis presented in section 19.2, including innumerable tables, even going so far as to show the future expected "% of maximum compliance achieved" under the alternative unimpaired flow percentages, the SED goes on to conclude the following: "Significant temperature improvements in the Tuolumne River occur under all alternative unimpaired flows with the least benefit occurring under 20% unimpaired flow and the most benefit occurring under 60% unimpaired flow." An underlying presumption in the SED related to "temperature benefits" for the Tuolumne River is that there is a need for changes to the current temperature regime. Without any analysis of the large body of empirical data on the condition or health of Tuolumne River fall-run Chinook and O. mykiss populations, the SWB simply presumes temperature improvements are necessary and would be "beneficial". The basis for this presumption is a comparison to a set of temperature values provided in Table 19-1, the relevancy of which to the Tuolumne River is also presumed. Even disregarding the lack of a scientific finding of any need for temperature improvements, the SWB's analysis does not support a conclusion of "significant temperature improvements" occurring for the simple reason that the analysis performed and presented in the SED does not analyze the instream flows expected to occur under any of the alternatives. For the Tuolumne River, the SWB's analysis of temperature benefits is based on monthly average instream flows below La Grange Diversion Dam converted to daily flows by assuming the same flow occurs every day of the month. This "flat flow" across an entire	importance of suitable flow and related habitat conditions during the spring time period. Chapter 7, Aquatic Biological Resources, Section 7.2.2, Reservoirs, Tributaries, and LSJR, provides a description of the environmental setting on the Tuolumne River, which includes recognition of elevated temperatures as a stressor in the lower reaches of the Tuolumne River. Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, recognizes that dams and reservoirs, and associated operations, alter the temperature regime of rivers, often to the detriment of cold water species such as salmonids and other aquatic plants and animals that have adapted to colder waters and the variability associated with a more natural flow regime. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides additional discussion regarding temperature, including reference to Mesick (2012) and Figure 19.9, which provides insight into Tuolumne River temperature conditions that salmon and steelhead would have had access to without current dam configurations and operations. Table 19-1 discusses a composite of fall-run Chinook salmon and steelhead and the primary life stage months of all three eastside tributaries combined, and shows the temperature evaluation thresholds (i.e. USEPA recommended temperature criteria) for primary life-stages of fall-run Chinook salmon and steelhead. Please see Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, Adaptive Implementation, regarding the biological goals that will specifically be developed for LSJR salmonids to determine the effectiveness of the program of implementation. Please see Master Response 3.2, Surface Water Analyses and Modeling, regarding the purpose of the modeling and the appropriate use of models and model results in the SED.

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		month is a flow regime that would not occur under the SED's alternatives, and is certainly not one that reflects the "duration, timing, and spatial extent of flows as they would naturally occur". Having the same flow occur every day of the month does not mimic the variability of natural flows, especially in the months of February through June. Nor does using a flat monthly flow represent the instream flows the SWB purports to evaluate under each alternative (see Chapter 3, Section 3.3.2). In fact, by assuming a flat flow across each month, the SWB has essentially modeled the one flow regime that cannot occur. As mentioned above, the SED itself calls for the eastside tributaries to use a seven-day average of the unimpaired flow so as to capture the temperature, floodplain and other benefits the SWB expects to occur through the combination of flow magnitude and flow variability. The significance of the SWB's inappropriate use of flat monthly flows can be seen in the Districts' Figures TR-5 to TR-11 (see Attachment 2 of these comments [ATT13]), which compare the SWB's flat monthly unimpaired flow to the seven-day rolling average unimpaired flow which would occur in the lower Tuolumne River under the Amended Plan's preferred alternative. By example, in many of the months the flat flow used in the SWB's analysis which is assumed to occur for 30 straight days would only actually occur for one or two days when compared to the required 7-day rolling average flow. It is apparent by inspection that SWB's assessment using its flat flow assumption does not represent the instream flows projected to occur under the SED's preferred alternative; therefore, the analysis is not relevant and must be discarded. The numerous tables presented in section 19.2 of the SED (from Table 19-3 to 19-14) all suffer from the same flawed analysis and cannot be relied upon to draw any conclusions about the effects on water temperature of any of the SED's alternatives. This error is compounded by then comparing the temperature analysis that uses monthly flat flows to the temperature "criteria" of Table 19-1. The "criteria" adopted by the SWB for its analysis is, reportedly, the EPA's "recommended temperature criteria for protection of salmonids" (pg 19-18), which is based on the seven-day average of the daily maximum temperature ("7DADM"). Comparing the results of modeled water temperatures derived using a constant daily flow for every day of a month to a criteria that is based on the metric of the seven-day average of the daily maximum temperature provides an erroneous view of the expected water temperature improvements for the river. For example, water temperatures in the lower Tuolumne River are a function primarily of river flow and local meteorological conditions, with flow being the dominant variable. A flow of 300 cfs will result in much different water temperature conditions than a flow of 200 cfs or 400 cfs. A daily flow that is constant over a month-long period is not able to capture the changes in daily water temperature (and resulting daily maxima) that occur when flows vary every day, as they would under the SED's various alternatives. By assuming flat flows for every hour of every day and every day of every month, there is no ability to capture the variations in daily maximum temperature that occur under the 7-day rolling average flow, especially under below normal and critical water years. River temperature data is normally collected at 15-minute intervals for the specific purpose of understanding diurnal temperature fluctuations and daily maximum temperatures. Using average monthly flow values masks potentially significant day-to-day, let alone hour-to-hour, temperature fluctuations. As an example, Myrick and Cech (2001), a reference cited by the SWB, reports "Central Valley salmon can apparently grow at temperatures approaching 24°C", but then acknowledge that the "chronic upper lethal limit for Central	

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		Valley Chinook salmon is approximately 25°C". Therefore, using a monthly flat flow could mask potentially harmful temperatures, especially when flows may be falling and ambient temperatures rising in the mid- to end-of-May period. This is problematic for the SWB's analysis of temperature benefits which applies the temperature thresholds shown in Table 19-1, where, for example, the 7DADM "temperature threshold" is 16°C from March 1 through May 31. Use of monthly flat flows prevents any reasoned opinion to be formed about "temperature benefits" resulting from each of the SED's alternatives. Evaluating the effects of temperature on fish living in a dynamic hour-to-hour temperature environment by using constant flow for every day of a month is unrealistic at best. The SWB's analysis using monthly flat flows does not capture the important fluctuations in daily temperatures maxima; therefore, it should not be used to draw conclusions about potential "temperature improvements in the Tuolumne River [to] occur under all alternative unimpaired flows".	
1344	55	The SWB's assessment of the need for, and potential beneficial effects of, reducing water temperatures on Tuolumne River below the baseline are lacking the necessary scientific support. There is no evidence provided in the SED that the river's temperature regime under the current baseline conditions is unfavorable to fall-run Chinook salmon or O. mykiss populations. Nowhere in the SED is there to be found a sound argument based on scientific data or information that the current temperatures experienced in the Tuolumne River have an adverse impact on the river's fall-run Chinook or O. mykiss populations. Lacking a valid scientific analysis, the SWB presumes baseline conditions are unacceptable, without any explanation as to the scientific merit of this assumption. For discussion purposes only, even if we assume the SWB's analysis is appropriate and accurate, we assess below the "temperature improvements" anticipated to occur under the SED's preferred alternative, focused on the 40% UF alternative on the Tuolumne River. Table 19-7 from the SED is reprinted below [see ATT5] (the portions applicable for RM 0, RM 13.2, RM 28.1, and RM 38.3). It is immediately apparent that there is no significant "temperature improvement" in February at any location under any alternative. There is no "temperature improvement" in March for the simple reason that the baseline conditions already meet the SWB's assigned temperature threshold of 60.8°F (16°C) for fall-run Chinook juvenile rearing. [Footnote 28: The baseline temperature in March also meets the SWB's March threshold of 13°C for the areas used by O. mykiss (that is, above RM 38). The 13°C is assumed to be O. mykiss spawning and incubation because there is no documented fall-run Chinook spawning or incubation in March.] This is also the case in April in areas where juvenile fall-run Chinook primarily rear given the SWB's assigned temperature threshold of 60.8°F. [Footnote 29: Smoltification in April can occur, but normally occurs in the mid-to-late April and May timeframe and areas above RM 28 already meet the SWB threshold. It is uncertain as to what basis was used for the SWB's smoltification threshold.] Although the SWB threshold is exceeded in April at the mouth of the river, it is exceeded by only 0.9°F (0.5°C), not a significant amount, and as indicated by the years of data collected by the Districts, this is not an in-river core juvenile rearing area. In May, once again, the baseline conditions already meet the SWB's threshold temperatures above RM 28, where the bulk of the juvenile rearing occurs. The 40% UF flow is predicted by	Please refer to Master Response 3.1, Fish Protection, regarding use of best available science, benefits and use of the unimpaired flow approach, and adequacy of the temperature analysis, including reductions in harmful and lethal water temperatures. Please refer to Chapter 7, Aquatic Biological Resources, Section 7.2.2, Reservoirs, Tributaries, and LSJR, for a description of the environmental setting on the Tuolumne River, which includes recognition of elevated temperatures as a stressor in the lower reaches of the Tuolumne River. Appendix C, Scientific Basis for Developing Alternate San Joaquin River Flow Objectives provides a discussion of factors affecting native fish in the plan area including the Tuolumne River (see Section 3, Scientific Basis for Developing Alternate San Joaquin River Flow Objectives). The report titled "The High Risk of Extinction for the Natural Fall-Run Chinook Salmon Population in the Lower Tuolumne River due to Insufficient Instream Flow Releases," cited as Mesick (2009) in Appendix C, contains additional information on the importance of flow and temperature in the Tuolumne River (see the section titled "Importance of spring water temperatures" starting on page 24 of Mesick (2009)). Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, includes temperature discussions that reference Mesick (2012). Water temperature is identified as a key stressor in the Tuolumne River and temperature management is identified as a Tuolumne River Recovery Action in the Endangered Species Act (ESA) Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead (National Marine Fisheries Service 2014). Please also see responses to comments 1344-54, 1344-59, and 1344-62, for further discussion of water temperature in the Tuolumne River. Salmon and steelhead can be found rearing and migrating throughout all anadromous parts of the Stanislaus, Tuolumne, Merced and Lower San Joaquin Rivers during the February through June time periods. The commenter's focus on the upper parts of the Lower Tuolumne River during February through June is not justified. Please see Master Response 3.1, Fish Protection, regarding the timing of salmon and steelhead in the San Joaquin basin.

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		SWB's modeling to reduce river temperatures in the most downstream parts of the lower river, a reach used as a migration corridor by Tuolumne River smolts. However, temperatures under baseline conditions are only 1.7°C higher than the SWB's threshold of 16°C. Again, there is no evidence provided by the SWB that the model's estimate of temperature difference is statistically significant for model predictions, or that this temperature is biologically significant to fall-run Chinook outmigrants. June temperatures show significant improvement under the 40% UF, but by the end of May, except in wet water years, 99% of the fall-run Chinook juveniles have left the Tuolumne River (Figures TR-12 and TR-13 below). In wet water years, spill events would be keeping river temperatures lower. Furthermore, June temperatures above RM 38 (65.3°F; 18.5°C) already reasonably meet the SWB threshold temperature of 18°C. Applying the SED's own temperature thresholds and analysis, the SED's Table 19-7 demonstrates that areas known to be used by fall-run Chinook salmon and O. mykiss on the Tuolumne River under baseline conditions already meet the SWB's February, March, and April temperature "thresholds". In general, May temperatures are also adequate above RM 28, which corresponds to the fall-run Chinook core juvenile rearing area.	
1344	56	[ATT5:] Table 19-7 from the SED.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	57	[ATT6:] Figure TR-12. Long-term migration pattern of observed juvenile Chinook salmon captured at the Waterford RST (2006-2016).	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	58	[ATT7:] Figure TR-13. Long-term migration pattern of observed juvenile Chinook salmon captured at Grayson RST (1999-2014, 2016).	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	59	The SED does not define what the "temperature threshold" values provided in Table 19-1 are intended to represent. The temperature tolerance of Central Valley salmonids is a complex matter. Simply referring to outdated, undefined temperature "benchmarks" intended for salmonid species of the Pacific Northwest is not adequate to support scientific analysis of impacts to Central Valley salmon and O. mykiss. The SED lacks a comprehensive discussion on the thermal tolerance of Central Valley salmonids based on the latest studies and scientific literature available on this topic (e.g., Myrick and Cech 2001, Verhille et al. 2016, Poletto et al. 2016). It is unclear if the various temperature thresholds in the table are intended to be temperatures that are "optimal", "upper optimal", "upper tolerable", "suboptimal", "upper incipient lethal", "acute", or some other defined parameter of salmonid's thermal tolerance. Absent a thorough discussion of the biological significance of the temperature "thresholds" provided in Table 19-1, there is no valid, scientific basis for the SWB to evaluate the effects of the existing or proposed flow regimes on the thermal tolerance of fall-run Chinook salmon or O. mykiss. If the Table 19-1 values are meant to designate temperatures for "optimal growth", then exceeding these temperatures by 2 to 3°C may have no discernable effect on fish growth or behavior (Jeffres et al. 2008, Sommer et al. 2001). However, if the values in Table 19-1 are intended to represent "upper tolerable" temperatures, then the effect of a 2 to 3°C exceedance may be significant. The SED lacks the necessary comprehensive explanation of the intended significance of the temperature values provided in Table 19-1 and the scientific basis for their selection. Absent such a discussion and analysis in the SED, there is no scientific basis upon which to	Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, Section 19.2.2, Methods of Temperature Evaluation, explains that the temperature thresholds represent the upper limits of the optimal temperature range for each evaluated life stage. Please see Master Response 3.1, Fish Protection, regarding the scientific basis for the analyses, the use of best available science, the adequacy of modeling to support the analyses, and justification and description of the plan amendments for protecting fish. Specifically see discussions of the temperature analyses regarding use of USEPA recommended temperature criteria and reductions in harmful and lethal temperatures. It is clear that Central Valley fall-run Chinook salmon can grow and survive at temperatures above 20°C. However, as demonstrated by Marine and Cech (2004), juvenile Sacramento River fall-run Chinook salmon reared at 21–24°C experienced significantly decreased growth rates, impaired smoltification indices, and increased predation vulnerability compared with juveniles reared at 13–16°C; fish reared at 17–20°C experienced similar growth, variable smoltification impairment, and higher predation vulnerability compared with fish reared at 13–16°C. Regarding the citation to and comments about the Verhille et al. (2016) study, the commenter funded and participated in the study. The Verhille et al. (2016) study is presented and discussed in a report titled, "Thermal Performance of Wild Juvenile Oncorhynchus Mykiss in the Lower Tuolumne River: A Case for Local Adjustment to High River Temperatures, Final Report, Don Pedro Project", which is included in the attachments to comment letter 1344. As indicated in a footnote on the report's title page, the same study was also published in the peer reviewed literature as Verhille et al. (2016). For clarity in this response to

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		decide if a 3°F temperature reduction from say 64°F (18°C) to 61°F (16°C) would have any effect on or make any difference in survival or growth of O. mykiss or fall-run Chinook salmon juveniles. In fact, several of the references cited by the SWB demonstrate significant growth by juvenile fall-run salmon at temperatures above 20°C (Jeffres et al. 2008; Myrick and Cech 2001). Related specifically to O. mykiss juveniles, researchers from the University of California at Davis and University of British Columbia conducted a state-of-the-art study on Tuolumne River wild O. mykiss juveniles in 2013/2014. This study determined that wild Tuolumne River juvenile O. mykiss appear to be acclimated to the relatively higher temperature regime of the lower Tuolumne River and have near optimal metabolic performance across a wide temperature range from approximately 17°C to 24°C. This study has been published in the journal Conservation Physiology (Verhille et al. 2016). The SWB is well aware of this study and had the study results since 2014 but has chosen not to consider the findings of this well-regarded work. Another similar study was recently performed by UC Davis under contract with EPA Region 9, the federal agency being referenced as providing temperature "criteria" for fall-run Chinook salmon in the SED's Table 19-6. This study examined the thermal performance of hatchery-reared juvenile fall-run Chinook salmon and the findings were recently published in the journal Conservation Physiology (Poletto et al. 2016). UC Davis researchers found that the tested juvenile fall-run Chinook "aerobic capacity was unaffected by test temperatures up to 23°C" and that the tested hatchery fish demonstrated "an impressive aerobic capacity when acutely warmed to temperatures close to their upper thermal tolerance limit, regardless of their acclimation temperature."	comment 1344-59, this study will be referred to as the Thermal Performance Study. Resources agencies and non-governmental organizations expressed concerns with the Thermal Performance Study. These concerns, including comments from the State Water Board (from March 15, 2015), are documented in the attachments to the Thermal Performance Study. Some of these concerns are discussed below. The response to comments on the draft version of the Thermal Performance Study are included in the attachments of comment letter 1344. In the response to comments on the draft version of the study, the commenter specifically stated, "[w]hat our data should NOT be used for is to pick a new thermal criterion based solely on our aerobic scope curve. In fact, we do not suggest revising the 7DADM based solely on our AAS curve. We simply state that we believe our data are suggestive of local thermal adaptation in Central Valley fish and inconsistent with a blanket criterion for the population under consideration" (see section titled "Overarching Reply Comments To CDFW's Review of the Current Study"). Aerobic scope curves should not be the sole basis for determining appropriate temperature criteria. Instead, multiple lines of evidence from multiple studies should be considered—as was previously done by USEPA (2003). For example, temperature effects on factors such as growth, disease vulnerability, predation vulnerability, smoltification, and swimming performance should be considered for juvenile life stages. Furthermore, it appears that aerobic scope can be maintained or increase throughout meaningful temperature ranges in salmonids, which suggests that aerobic scope is not always the limiting factor in thermal stress (see Raby et. al 2016 and Hvas et al. 2017). The Thermal Performance Study also reported wild O. mykiss from the lower Tuolumne River maintained 95 percent of their peak aerobic scope across a temperature range of 17.8–24.6°C. The assertion that 17.8°C and 24.6°C have the same effect on O. mykiss should raise questions about the usefulness of aerobic scope studies for understanding and determining temperature stress or criteria (see Myrick and Cech [2001] for a review of temperature effects on O. mykiss). As discussed below, aerobic scope studies may be useful for comparative purposes, but beyond that there appears to be little usefulness for understanding the temperature conditions needed to produce successful salmonids. A recent study on the San Joaquin River found that juvenile Chinook Salmon were unable to swim as fast at elevated temperatures, particularly above around 19°C (Lehman et. al 2017). The commenter and the authors of the Thermal Performance Study collected data on the time and velocity needed to swim test fish (exposed to different temperatures) to fatigue (page 4 of Thermal Performance Study, within the attachments of letter 1344). State Water Board staff recommend the commenter report the data collected on the time and velocity needed to fatigue each test fish, as this would provide additional information on how temperature affects swimming performance of Tuolumne River O. mykiss. This would also help to understand how aerobic scope relates to other measures of performance for these test fish. Aerobic scope may be useful to compare oxygen use across different strains of salmonids; however, it is unclear how study design, acclimation history, fish age or size, diet, and physical fitness affect comparative results. For future comparative studies aimed at understanding genetic differences, State Water Board staff recommend raising multiple strains of fish from egg in the same laboratory to get a truly comparative result. There are many differences in experimental protocol between the study performed by the commenter and comparison studies the commenter used to draw conclusions (Fry, 1948; Scarabello et al., 1992; Alsop and Wood, 1997; McGeer et al., 2000 [as cited in the Thermal Performance Study]). For example, it is unclear why the Thermal Performance Study used wild captured fish to compare results to hatchery and lab raised fish if the goal was to understand how genetic differences influence aerobic scope. Comparing lab fish to lab

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			fish, or hatchery fish to hatchery fish, that were raised under the same conditions would have provided a more comparative result. It is also unclear why test fish from the Thermal Performance Study, which had an average mass of approximately 22 grams (see the Experimental Data Table included as an attachment to the Thermal Performance Study, within the attachments of comment letter 1344), were compared to test fish from Scarabello et al. (1992), and Alsop and Wood (1997), which both used test fish with an average mass of approximately six grams. The commenter has not provided sufficient information to warrant changing the temperature criteria or evaluations used in the SED.
1344	60	SWB presents no scientific data or analysis that relates the changes in water temperatures projected to occur to increased salmon or steelhead populations. For this discussion, we again focus on the Tuolumne River. The relevant results of the SWB's analysis are provided in Table 19-7 which is reported to show the presumed "improvement" in temperature provided by each of the SED's alternatives compared to baseline conditions. This is the most relevant table of any because it at least provides results in terms of changes in temperature (the variable being examined) and provides a comparison to the baseline temperatures. It is unclear what the intended purposes of Tables 19-6 and 19-8 are, as they both present information the scientific significance of which is not explained or substantiated by the SWB. [Footnote 30: For example, Table 19-6 purports to show "temperature habitat" benefits if higher flows provided by an alternative reduce modeled temperatures to a value lower than the EPA "criteria". As a first matter, there are no "EPA temperature criteria" for the Tuolumne River. More importantly, as discussed in detail in this section, the SWB has not modeled or analyzed the SED's alternatives by virtue of its use of flat monthly flows; therefore, any comparisons are based on an alternative that has not been proposed in the SED. Lastly, the SWB indicates a change of greater than 10% in the table would "represent significant changes to salmon and steelhead temperature habitat". The SWB provides no scientific basis or reasoning for arriving at this newly defined parameter of "biological significance". The unsupported selection of 10% is biologically meaningless and arbitrarily chosen.] By the SWB's own analyses, there is no difference between the current temperatures (baseline) and any of the SED's unimpaired flow alternatives from essentially August through January, and it is goes unexplained by the SWB how alternatives which do not affect flows in July can result in a reduction in July temperatures compared to the baseline. In any event, we'll focus our discussion on the remaining months of the year (February through June), which are indeed the primary months intended to be dealt with in the SED. However, two additional items deserve further mention. * Nowhere in the Chapter on temperature modeling and benefits, or anywhere in the SED that we could find, is there a discussion of the degree of accuracy of the temperature model used by the SWB. Without an adequate description of the statistical uncertainty associated with the model results, there is no basis for interpreting whether modeled temperature differences between baseline and the alternatives of 1°, 3°, or 5°F are meaningful. * Contrary to the SED's statement that the "temperature thresholds used in this evaluation are based on the U.S. Environmental Protection Agency (USEPA) recommended temperature criteria for protection of salmonids" (page 19-18), Table 19-1 does not reflect	Please refer to responses to comments 1344-54, 1344-55, 1344-59, and 1344-62, regarding temperature on the Tuolumne River. In Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, temperature results are evaluated for unimpaired flows during the 34-year temperature model period and presented in three ways compared to modeled baseline conditions: 1) magnitude of expected percent change in the amount of time that USEPA recommended criteria are met (Table 19.6 for the Tuolumne River); 2) expected difference in average daily 7DADM values for each month (Table 19.7 for the Tuolumne River); and 3) expected difference in 90th percentile daily 7DADM values for each month (Table 19.8 for the Tuolumne River). Consideration of all results are important for evaluating temperature effects on salmonids. As described in Chapter 19, the USEPA recommended temperature criteria are used for the purposes of evaluating the differences among the alternatives relative to measureable benefits and potential impacts of changes in water temperature as a result of implementation of the plan amendments, and are not being proposed to be applied as regulatory benchmarks. The change in the amount of time that USEPA recommended temperature criteria are met, in combination with professional judgment, is used to determine a significant benefit or impact. Ten percent was selected because it accounts for a reasonable range of potential error associated with the assumptions used in the various analytical and modeling techniques. In addition, lacking quantitative relationships between a given change in environmental conditions and relevant population metrics (e.g., survival or abundance), a 10% change was considered sufficient to potentially result in beneficial or adverse effects to sensitive species at the population level. Please refer to Master Response 3.1, Fish protection, regarding the adequacy of the temperature analysis, including use of the USEPA recommended temperature criteria, using a sub-daily time step with a monthly flow model, and addressing uncertainty. The State Water Board acknowledges that uncertainty is inherent in any programmatic planning effort of this geographic and temporal scale. Moreover, foreseeing the unforeseeable is not possible. The State Water Board, however, has strived to use the best available science throughout the impacts analysis, consistent with the requirements of the certified regulatory planning process, and, in accordance with CEQA, used its best efforts to find out and disclose what it reasonably can. Additionally, the official public review process for the plan amendments provides an opportunity for formal public comment on the plan amendments. Public and agency comments on the 2012 draft SED led to further refinement of the plan amendments, as evidenced in the current document. Furthermore, the State Water Board analyzed effects at different percentages of unimpaired flow in the SED to provide a wide ranging and conservative approach to the analysis. Evaluating and showing effects at low and high percentages of unimpaired flow, allows full disclosure of the possible types of impacts that could

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		the EPA's benchmark temperatures or relevant river reaches for the Tuolumne River, nor is it appropriate to label EPA's suggested temperatures as "criteria". On November 12, 2010, EPA approved the SWB's 2008-2010 Section 303(d) List of Impaired Waters and disapproved the omission of several water bodies and associated pollutants that were judged to meet federal listing requirements. On October 11, 2011, EPA issued its final decision regarding the waters EPA added to the State's 303(d) list. Included in Enclosure 2 to that decision, EPA determined that the Tuolumne River from Don Pedro Reservoir to the San Joaquin River has "water quality-limited segments" requiring TMDLs for temperature pursuant to the Clean Water Act (CWA), sec. 303(d) and 40 CFR 130.7(b). EPA's Enclosure 2 identified four temperature "benchmarks" for the Tuolumne River. Relevant to EPA's determination, the temperatures and segments identified as being "impaired" were: * 18°C for salmon adult migration from September 1 to October 31 for the entire lower Tuolumne River, * 13°C for salmon spawning for RM 26 to 52 from October 1 to December 15, * 16°C for salmon smoltification and juvenile rearing from March 15 to June 15 for the entire lower Tuolumne River, and * 18°C for O. mykiss rearing from June 15 to September 15 upstream of RM 42.6. The Districts do not agree with the EPA's TMDL temperature "benchmarks" [Footnote 31: Table 19-6, 19-7, and 19-8 purport to demonstrate the "temperature benefits" of greater instream flow compared to either the base case or EPA (2003) temperature benchmarks. In many places in the text and tables of Chapter 19, the SWB labels the EPA 2003 temperature benchmarks as "criteria". As the SWB knows, the temperature benchmarks used in EPA (2003) have not been adopted by the SWB as water quality "criteria" and have no regulatory standing until such time they are formally adopted by the SWB. As such, suggesting the EPA (2003) temperatures are "criteria" is misleading. This should be clarified in the SED.]; however, for the purposes of the SED, the temperatures and segments associated with EPA's List of Impaired Waters should be the ones used for comparison. It is unclear how the "temperature evaluation thresholds" and "primary evaluation locations" were selected by the SWB. The SED lacks a discussion of the SWB's rationale for the selected temperatures and locations. We note there are many years of data collection related to habitat use on the Tuolumne River which show the juvenile core rearing for both O. mykiss and fall-run Chinook salmon occurs above RM 30 (Final FERC License Application for the Don Pedro Project 2014). Lacking (1) a robust discussion on the degree of accuracy of the temperature model results, (2) model runs which actually model the SWB's alternatives as proposed in the SED, (3) a thorough discussion of the scientific basis for the temperature thresholds and reaches selected in Table 19-1, and (4) an analysis based on valid scientific studies of the effects on Tuolumne River salmonid populations when river temperatures exceed the SWB's temperature thresholds by 1°, 3°, or 5°F, the information provided in Table 19-7 (or Tables 19-6 and 19-8) are simply numbers without any scientific meaning. The only basis the SWB puts forward for claiming its estimated reductions in river temperature are "beneficial" to the subject salmonids is the unsound, unscientific, and unsupported claim that "colder is	occur.

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		better". The SWB provides no basis to conclude that the temperature changes presented in the SED are necessary or would lead to increased fall-run Chinook or O. mykiss at the population level.	
1344	61	SWB's oversimplified hypothesis related to temperature -- that "colder is better" -- is unsupported in the record and in the scientific literature cited by the SED. The SED devotes considerable attention to the subject of water temperature suitability in the LSJR and the three eastside tributaries. The formulation of the importance of water temperature in the text, tables, and figures of the SED has the consistent theme of "colder is better". Temperature "benefits" to fall-run Chinook salmon and "steelhead" are presented in the SED in terms of the extent and degree to which the alternatives would produce lower temperatures compared to the baseline, without ever providing a scientific basis or analysis supporting the assertion that baseline temperatures are detrimental to fall-run Chinook or O. mykiss populations in the eastside tributaries. It is important to keep in mind that lower temperatures are not a goal in and of themselves. The SED presents no scientific evidence that a reduction in river temperatures in the eastside tributaries are biologically necessary or will increase the target fish populations. The goal of the SED Amended Plan is to improve fish and wildlife populations of the Bay-Delta, one of the corollary aspects of which is to improve fry and juvenile survival on the three eastside tributaries and the LSJR. The need for improved survival is, ultimately, the basis of the SWB's hypothesis of the need for increased instream flows in the February through June timeframe. Therefore, the need to reduce water temperatures must be judged on whether such reductions can reasonably be expected to contribute to the goal of increasing the in-river populations of the target fish species of fall-run Chinook and O. mykiss.	Chapter 7, Aquatic Biological Resources, Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, and Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, provide the scientific evidence of an altered temperature regime on the LSJR and tributaries, and that a more natural flow regime, including greater flows in the spring (specifically February through June), and cooler instream water temperatures, is anticipated to benefit salmonids and multiple levels of the aquatic ecosystem. Please refer to the overview of Master Response 3.1, Fish Protection, regarding the composition of organisms in rivers with more natural and variable flow regimes and temperatures. Also, refer to Master Response 3.1 regarding the adequacy of the temperature analysis, including use of the USEPA recommended temperature criteria, and reductions in harmful and lethal temperatures expected from implementation of the plan amendments.
1344	62	The SED cites numerous studies which are reported to show a relationship between water temperatures and the health and survival of juvenile salmonids (e.g. Myrick and Cech 2001; Nichols and Foott 2002; Marine and Cech 2004; Boles et al., 1988; Kiernan et al 2012; Mesick 2012). The Mesick 2010 study primarily deals with assessing the influence of hatchery releases on natural production in the Merced River and attempts to relate temperature in the lower Merced River with smoltification. The Boles et al., (1988) work is somewhat outdated as considerable research on fall-run Chinook and O. mykiss has been conducted since the publication of that study. The SED's iteration of the events on Putah Creek reported in Kiernan et al. (2012) are misleading and incorrect, as discussed previously in this report. Myrick and Cech (2001) and Marine and Cech (2004) are widely reported in the literature and frequently cited by the SWB in the SED's discussions about temperature. As Myrick and Cech (2001) points out "[g]rowth is perhaps the most powerful and complete integrator of environmental, behavioral, and physiological influences on a fish's fitness". Juvenile fish growth rates are a function of numerous factors, an important one of which is temperature. Another factor, perhaps as important as temperature, is available food quantity and quality. It is the combination of food availability and temperature, not temperature alone, which affects growth rates (Sommer et al. 2001; Jeffres et al. 2008). Based upon field studies of floodplain use by juvenile fall-run Chinook salmon, Jeffres et al. (2008) found the "optimum temperature for growth of juvenile salmon is dependent on food availability." Jeffres et al. (2008) observed that "[t]emperature on the [Cosumnes] floodplain for a 1-week period had a daily average of 21°C and reached a daily maximum of	Please see Master Response 3.1, Fish Protection, regarding use of best available science, adequacy of the temperature analysis, use of USEPA recommended temperature criteria, and changes to temperatures in harmful and lethal ranges. The USEPA recommended temperature criteria are used for evaluating the measureable benefits and potential impacts of changes in water temperature as a result of different flow management scenarios, and are not being proposed as regulatory benchmarks. The SED did not solely rely on changes to compliance with USEPA recommended temperature criteria. It appears the commenter mistakenly quoted Myrick and Cech (2001) as reporting "studies of IULT are the most biologically relevant form of thermal tolerance study"—this quote cannot be found in Myrick and Cech (2001). The commenter is not providing the full context of the Marine and Cech (2004) quote. Marine and Cech (2004) stated, "Chinook salmon can readily survive and grow at temperatures up to 24°C. However, juveniles reared at 21–24°C experienced significantly decreased growth rates, impaired smoltification indices, and increased predation vulnerability compared with juveniles reared at 13–16°C. Fish reared at 17–20°C experienced similar growth, variable smoltification impairment, and higher predation vulnerability compared with fish reared at 13–16°C". The commenter mischaracterized the purpose of the USEPA recommended temperature criteria. The USEPA criteria are intended to be protective under a wide range of environmental conditions. USEPA (2003) acknowledged that the criteria may be more protective in some situations (e.g. high food abundance) and less protective in others (e.g. low food abundance). Water quality criteria are often designed to be protective in less than ideal scenarios. For example, if water quality is occasionally poor, then designing

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		25°C and fish continued to grow." Another factor regularly identified in the scientific literature as affecting thermal tolerance of juvenile salmon and O. mykiss is acclimation temperature. As referenced in Myrick and Cech (2001), work by Hanson (1991) reported an incipient upper lethal temperature ("IULT") of 25°C for Feather River salmon acclimated to 13°C. Myrick and Cech (2001) reports that "studies of IULT are the most biologically relevant form of thermal tolerance study." Marine and Cech (2004) conducted studies of the effects of temperature regimes typical of the range experienced by Central Valley fall-run Chinook salmon during juvenile rearing and smoltification. Their studies demonstrated that "Chinook salmon can readily survive and grow at temperatures up to 24°C." For the SWB to suggest that the temperatures provided in Table 19-1 can be considered as the single functional parameter used to judge thermal suitability and "temperature improvements" is unsupported and arbitrary. The SWB's own citations would generally instruct against using such a single temperature parameter for each life stage, especially a temperature metric that is not clearly defined. Employing a number of references, Myrick and Cech (2001) states: "Fish growth rates are influenced by a number of factors including temperature (Myrick and Cech 2000b), race (Cheng et al.,1987), ration size (Shelbourn et al., 1995), ration quality (Fynn-Aikins et al. 1992), disease (Jensen, 1988), fish size (Wurtsbaugh and Davis, 1977a), habitat (Ewing et al., 1998), social interactions (McDonald et al., 1998), photoperiod (Clarke et al., 1981), and water quality (Ross et al., 1995)." Research studies conducted on the thermal tolerance of salmonids [Footnote 32: For a thorough reference to relevant scientific literature, see references cited in Poletto et al (2016) "Unusual aerobic performance at high temperatures in juvenile Chinook salmon, Oncorhynchus tshawytscha".] have consistently shown chinook salmon and steelhead thermal tolerances can also be a function of acclimation temperature and exposure time, with fish exposed to higher acclimation temperatures generally having greater tolerance, within limits, to warmer river temperatures than those acclimated to cooler temperatures. [Footnote 33: For specific reference to temperatures tested, limits of acclimation temperatures, and results, see page 18 of Myrick and Cech (2001).] According to Myrick and Cech (2001) [Footnote 34; See Myrick and Cech (2001), Figure G.1, Figure g.3 and pages 28, 29, and 31.], several studies reported maximum growth rates for Central Valley juvenile salmon at 17°C to 20°C, including the Marine (1997) study of juvenile fall-run Chinook from the Coleman National Fish Hatchery. Myrick and Cech (2001) also reported the highest growth rate for Central Valley steelhead occurred at 19°C. [Footnote 35: See Figure G.5 in Myrick and Cech (2001).] Verhille et al. (2016) reported optimum thermal metabolic performance of wild Tuolumne River O. mykiss between 21°C to 22°C. In Chapter 19, Table 19-7, the SED presents the results of the analysis of changes in average water temperature on the Tuolumne River under the SED's alternatives. [Footnote 36: The Review Team has previously reported that the SWB has not actually analyzed any of the SED's alternatives because it uses flat monthly flows and not 7-day rolling average flows.] Inspecting the results of the analysis of the preferred alternative of 40% UF from February through June, the SED predicts that the average monthly water temperatures in April would be reduced from 13.9°C to 12.8°C at RM 28.1 and from 12.9°C to 11.9°C at RM 38.3. In May, at RM 28.1, temperatures are predicted to be reduced from 15.3°C to 13.3°C and at RM 38.3 from 14°C to 12.3°C. The month of April, and to a much lesser extent May, is an important	temperature criteria that is protective under these conditions is important. The commenter seems to be suggesting that temperature criteria should be based on situations where all other environmental variables are ideal (e.g. unlimited food availability and good water quality). Many of the studies referenced by the commenter consisted of feeding test fish to satiation in laboratory tanks where test fish do not have to expend much energy to acquire food. The USEPA (2003) temperature criteria identified in Chapter 7, Aquatic Biological Resources, and Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, align with current knowledge of optimal temperature conditions for Central Valley fall-run Chinook salmon and steelhead. The commenter has not provided sufficient information to justify using different temperature criteria in the SED analyses. The commenter focused on temperature results in the upper half (upstream of RM 28.1) of the Lower Tuolumne River. State Water Board staff recommends that the commenter consider the entire 53.5 miles of Lower Tuolumne River and the LSJR (another approximately 12 miles to Vernalis). Juvenile salmonids are found throughout the entire plan area during February through June. Chapter 19 shows that during April, the 90th percentile temperatures are reduced from 69.0°F to 62.9°F at the confluence with the San Joaquin River (Table 19-8). During May, the 90th percentile temperatures are reduced from 73.2°F to 65.2°F at the confluence with the San Joaquin River (Table 19-8). Water flowing out of the Tuolumne River then flows into the LSJR where Table 19-14 shows a reduction of 90th percentile temperatures during May from 72.7°F to 67.8°F above the Stanislaus River confluence (at RM 72.501). As discussed in master Response 3.1, it is important to consider reductions of harmful and lethal temperatures. The additional time (more months in late spring) and space (more river miles) that suitable temperatures are available, in combination with additional floodplain acreage, under the plan amendments will be a benefit to native fish. The SED identifies improvements to temperature conditions and access to inundated floodplain areas that can provide additional food resources as some of the benefits of the plan amendments (see Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, Section 3.7.2, Effects on Food Web, Chapter 19, and Chapter 7, Aquatic Biological Resources). Please see Master Response 3.1 regarding the adequacy of the floodplain analysis, including anticipated benefits from increased floodplain inundation and the relationship between floodplain and temperature. Food resources available for salmonids are relative to the abundance of salmonids; currently, there is very low abundance of salmonids in the Tuolumne River. The commenter is making assumptions about food resources from studies that were primarily conducted during the summer time period (see Tables 5.3.2-24 through 5.3.2-27 of commenter's Pre-Application Document (PAD), Volume II of II, (February 2011) for Don Pedro Project FERC NO. 2299) when there were hundreds, or thousands, of salmonids present (see Figure 7 of TID and MID, 2012, Tuolumne River 2011 Oncorhynchus mykiss Monitoring Summary Report) in the Lower Tuolumne River; the commenter is transferring those assumptions to the February through June time period when there are hundreds of thousands, or millions, of salmonids present (see Table 1 of TID and MID, 2016, Outmigrant Trapping of Juvenile Chinook Salmon in the Lower Tuolumne River, 2015). This transfer of assumptions by the commenter is misleading. Furthermore, the commenter is focusing on food resources in the reaches of the Lower Tuolumne River directly below La Grange Dam (see the commenters PAD document as cited above) and not considering the 53.5 miles of Lower Tuolumne River, approximately 12 miles of the Lower San Joaquin River (from the Tuolumne River confluence to Vernalis), and additional San Joaquin River and Delta habitat downstream of Vernalis that salmonids originating from the Tuolumne River use for growth and migration. The commenter has previously reported that food ration estimates at locations downstream of Modesto (RM 16.2) were generally lower than those samples collected nearer to La Grange Dam (RM 52.2) (see MID/TID [2007] page 4-12, TID and MID, 2013, Oncorhynchus Mykiss Population Study Report, Don Pedro Project FERC NO.2299)

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		time period for juvenile rearing. Aside from the numerous methodological problems related to the SWB's analyses previously identified in this review, and that nowhere in the SED does the SWB demonstrate with scientific analysis that such temperature reductions materially would affect fish growth, fish size, or fish populations, let's assume for discussion purposes these estimated reductions in temperature would actually occur. Based on the results of a number of the studies cited by the SWB in its SED as referenced just above, it is not only likely that the asserted "temperature benefits" associated with reduced river temperatures would not occur, it is equally plausible the reduced temperatures would slow the growth of juvenile salmonids, which according to the SWB, would make them less able to avoid predation in their outmigration. Under conditions where food rations are plentiful, as in the Tuolumne River (TID/MID 1992, Appendix 16; TID/MID 1997, Report 96-9), the optimum growth rate for fall-run Chinook juveniles may occur at temperatures ranging from 17°C to 20°C, or higher. As shown in Table 19-7, even base case temperatures are slightly below this optimum range in April and May. Studies conducted for the Districts on the Tuolumne River, and in the possession of the SWB, have shown that the availability of drift as well as benthic macroinvertebrates (BMI) in the Tuolumne River are robust (TID/MID 1997, Report 96-4; TID/MID 2003, Report 2002-8), and should be adequate to support the ration needed for optimum growth. By the SED's own analysis and its own citations, the reductions in river temperature resulting from the preferred alternative may actually have the unintended consequence of producing fish with smaller size at outmigration, potentially making Tuolumne River parr and smolts more vulnerable to predation. The SED must consider and analyze the potential for adverse effects to occur due to the potential effects of lower temperatures on the growth of juvenile salmonids. The hypothesis of colder being automatically better is not supported by the best available science and is logically inconsistent with many of the SED's own references.	and that benthic macroinvertebrate habitat quality decreases from upstream to downstream in the Tuolumne River (see page 3-167 of TID and MID, 2017, Amendment of Application, Exhibit E - Environmental Report, Don Pedro Hydroelectric Project FERC NO. 2299). The commenter has also previously reported that "sampling data gathered from 1988 to 2009 at Riffle 4A (RM 48.8) support the observations that increased summer flows released since the 1995 Settlement Agreement have resulted in beneficial shifts in food supply for fishes" (page 3-167 of TID and MID, 2017, Amendment of Application, Exhibit E – Environmental Report, Don Pedro Hydroelectric Project FERC NO. 2299). In this same document, the commenter reported that "Based on documentation of reduced Chinook salmon growth rates in the Delta, as well as declines in pelagic prey species, including insect drift and zooplankton, food resources may also be limiting for actively feeding steelhead smolts outside of flood conditions" and that "A number of factors affect aquatic food sources available to rearing juvenile Chinook salmon in the Delta" including "changes in flow magnitudes and timing". As described throughout the SED, the plan amendments will improve functional flow timing and magnitude, which is expected to provide additional food resources to native fish. The commenter has not provided information that supports their assertion that additional food resources will not benefit native fish during the February through June time period. Information presented throughout the SED is clear that higher flows during the February through June time period have resulted in higher rates of juvenile salmon survival and higher adult salmon returns approximately 2.5 years later in the San Joaquin Basin (see Appendix C, Chapter 19, and Master Response 3.1). The commenter has not provided information that supports that higher flow and colder water temperatures will produce less successful juvenile salmonids in the Tuolumne River. The commenter's own predation study (see Table 5.4-2 of TID and MID, 2013, Predation Study Report, Don Pedro Project FERC NO. 2299) showed that higher flows can reduce predation vulnerability of tagged Chinook salmon. Through adaptive implementation (see Master Response 2.2, Adaptive Implementation), flow and temperature conditions can be managed to disrupt non-native predatory fish, which are generally warm-water species that are not as successful in cold water or fast water (see Kiernan et al. 2012; refer to response to comment 1344-48 regarding the study by Kiernan et al. (2012)). Furthermore, the commenter should consider that the anadromous part of the Tuolumne River system is 53.5 miles long and that salmonids originating from the Tuolumne River must also migrate through the Lower San Joaquin River and Delta. The plan amendments provide more area and duration of suitable temperature habitat during the February through June period. This will provide salmonids and other native fish with additional opportunities to select habitats that maximize their success. Please see response to comment 1344-59 regarding Poletto et al. 2017, Verhille et al 2016, and MID/TID 2017. It is unclear why the commenter used aerobic scope (Verhille et al. [2016] and MID/TID [2017]) to study the effects of temperature on Tuolumne River O. mykiss if the commenter recognizes the importance of growth as the most powerful and complete integrator of environmental, behavioral, and physiological influences on a fish's fitness (see response to comment 1344-59 for discussion of Verhille et al. [2016] and MID/TID [2017]). A temperature study that considered effects on growth would have been more informative than the aerobic scope study performed by the commenter.
1344	63	It is informative to examine Tables 19-12 and 19-13 of the SED in light of the fact that the goal of the Amended Plan is to improve fish and wildlife, specifically those of the Bay-Delta area. The SED uses the USGS gage at Vernalis as a measuring point for informing the effects of the SED's preferred plan on the fisheries of the Bay-Delta. Vernalis is located several miles upstream from the confluence of the LSJR with the Delta. According to the SED's Table 19-	The comment mischaracterizes the goal of the plan amendments. Please see Master Response 1.1, General Comments, and Master Response 2.1, Amendments to the Water Quality Control Plan, regarding a description of the plan amendments. Tables 19-12 and 19-13 only discuss temperature changes on the San Joaquin River. Tables 19-3 through 19-

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		13, the Amended Plan's preferred alternative, which will remove an average of almost 300,000 acre-feet of water each year from its current beneficial uses in the Stanislaus, Tuolumne, and Merced river valleys, will have no measurable effect on water temperatures in the LSJR at Vernalis in the months of February, March, or April, and will lower LSJR water temperatures in May and June by a mere 1°C on average. Based on its own analysis, the SWB must conclude that the Amended Plan's preferred alternative will have no measurable effect on the Bay-Delta ecology due to its projected temperature "improvements". Table 19-12 can be referenced to further bolster this conclusion because it shows that the preferred alternative will have no positive effect on meeting the SED's assigned temperature "criteria" in the months of April, May, and June. The SWB should provide an explanation of how this meets its responsibilities to balance impacts to the region's water users with the "benefits" to fish and wildlife when there are no predicted benefits to temperature, the parameter for which the SED claims on page 19-47 "of all of the habitat attributes for native fishes, water temperature is likely the most important one...because without adequate water temperature all of the other habitat attributes become unusable".	11 discuss the changes on each tributary (Stanislaus, Tuolumne, and Merced) where salmonids will be spawning, incubating and rearing. Please see Master Response 3.1, Fish protection, regarding the adequacy of the temperature analysis, including reductions in sublethal and lethal temperatures; refer to the longitudinal profiles of the San Joaquin River in the justification and description of the plan amendments section. The purpose of the environmental review process is to disclose potential environmental impacts to the public and decision-makers. Please see Master Response 1.2, regarding State Water Board consideration of beneficial uses and Master Response 1.1, for general responses to economic-related comments, including comments attempting to compare costs and benefits.
1344	64	There are a number of statements in the Temperature Section of Chapter 19 where the record needs to be corrected and/or clarified. The more prominent of these are discussed below. While much of the discussion in section 19.2 is very general in nature and does not serve to inform the public about conditions on the Tuolumne River, or any of the eastside tributaries for that matter (e.g., citing the importance of water temperature for salmonids in the Pacific Northwest on page 19-11), the SED does contain a discussion on "Influence of Temperature On Disease Risk in Salmonids", wherein there is specific reference to the occurrence of disease in Chinook salmon juveniles in the eastside tributaries as follows (page 19-12): "Diseased fish are present and have been caught in the Stanislaus, Tuolumne, Merced and San Joaquin Rivers. Naturally produced Chinook salmon juveniles caught in these rivers were infected with the causative agents of bacterial kidney disease (BKD) and proliferative kidney disease (PDK). These diseases and others can rapidly increase in the population as water temperature rises above the optimal temperature range of salmonids (Nichols and Foott 2002)." This statement, the only site-specific reference in the SED about Tuolumne River fish and disease, is misinformed at best, and intentionally misleading at worst. It is noteworthy that the sole citation provided to support the statements related to disease is Nichols and Foott (2002). With respect to the Tuolumne River, the Nichols and Foott (2002) study found a single fish (from a sample of 18) with the myxozoan parasite Tetracapsula bryosalmonae. This parasite can be a causative agent for Proliferative Kidney Disease (PKD), but is neither a disease itself nor even evidence of the disease. The single Tuolumne River fish inflicted with Tetracapsula bryosalmonae was diagnosed with "relatively few parasites and no associated lesions" (see Figure 2, page 6 of the report). Of 20 other Tuolumne River fish sampled for the incidence of Renibacterium salmoninarum (causative agent for Bacterial Kidney Disease [BKD]), two fish were found to have the parasite present; however, as reported in Nichols and Foott (2002), "[n]o gross clinical signs of BKD were seen in any of the fish examined" (see page 7 of Nichols and Foott 2002). The SWB seriously misrepresents its information source when it claims "diseased fish are present" in the Tuolumne River and implies the use of Nicholas and Foott (2002) as the reference. The sentence the SED specifically attributes	Please see Master Response 3.1, Fish Protection, regarding SED use of best available science, adequacy of the temperature analysis, and reduction in sublethal and lethal temperatures. The additional information provided with regard to diseased fish on the Tuolumne River does not affect the overall conclusion that a more natural flow regime from the salmon bearing tributaries (Stanislaus, Tuolumne, and Merced Rivers) is needed. However, in the study by Nichols and Foott, "[t]he myxozoan parasite Tetracapsula bryosalmonae, which causes PKD, was detected in 25 of 90 (28%) histological sections of posterior kidney from individual fish." For the Tuolumne River, the incidence of Tetracapsula bryosalmonae infection was 10 percent. Please see responses to comments 1344-54, 1344-55, 1344-59, and 1344-62, regarding water temperature in the Tuolumne River.

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		to Nichols and Foott (2002) that reads "These diseases and others can rapidly increase in the population as water temperature rises above the optimal temperature range of salmonids (Nichols and Foott 2002)" is nowhere to be found in the Nichols and Foott report. There is no sentence in the report specifically relating disease levels to "water temperature rises above the optimal temperature range". In summary, there were no "diseased fish" found to be present in the Tuolumne River by Nichols and Foott (2002), and such statements must be removed from the SED and the citations to Nichols and Foott (2002) should be corrected.	
1344	65	The SED gives the impression of being highly selective about the information it cites. For example, in the case of concerns the SED raises related to disease, the USFWS also produced a report in 2001 (Nichols and Foott 2001) describing disease presence in fall-run Chinook salmon sampled from the LSJR at Mossdale, the Merced River and the Merced River Hatchery. In summary, the findings of the 2001 report were "[n]o clinical signs of disease, viral or obligate bacterial pathogens were detected in any of the juvenile fall-run chinook salmon examined." (see page 1 of the report). One of the other reasons the SWB may have found it inconvenient to cite Nichols and Foott (2001) is that it contains this finding on page 12: "We expected to see changes in the health and physiology of the juvenile salmon during the decreasing flows and increasing water temperatures typical of late spring. River temperatures reached 23°C, the temperature shown statistically to reduce survival of migrating smolts by 50% (Baker et al 1995). Normal physiological changes associated with smolting and migration were observed, and no decline in health was detected in our sample groups." This finding by the USFWS in Nichols and Foott (2001) does not fit the picture attempted to be drawn in the SED, and so better to ignore information that does not fit the desired end. The SWB also chooses to ignore a much more recent river-specific study on the incidence of disease. This study was undertaken by the USFWS and was issued in December 2013 (USFWS 2013). In 2013, the USFWS' California-Nevada Fish Health Center "performed health and physiological condition screening of Chinook salmon smolts in the San Joaquin River basin." Samples of fall run Chinook smolts (FL> 70mm) were collected from each of the three eastside tributaries. A host of lab assays were performed. With regard to all of the smolts collected and assayed, the USFWS reported "[n]o obligate bacterial or viral fish pathogens were detected in any of the fish sampled". And further, the USFWS reported the only "abnormality observed was minor kidney inflammation in one fish in the March Stanislaus River sample and one fish from the April Merced River sample." While some increase in KFL and gill ATPase levels were noted between April and May in fish from the Merced and Stanislaus rivers, no such increase was reported for Tuolumne River fish. The USFWS went on to report that the "lower KFL and gill ATPase observed in March smolts were not biologically significant or likely to impact outmigration performance." And finally, the USFWS reported that the "only significant pathogen detected was Tetracapsuloides bryosalmonae, the causative agent of proliferative kidney disease. This pathogen was detected during April in smolts from the Stanislaus, San Joaquin and Merced Rivers." There was no detection of "the causative agents" of BKD or PDK in Tuolumne River fish, as suggested by the SWB in the SED. This recent study which involved fish directly from the Tuolumne River isn't even listed in the "References Cited". The study is widely available, and	Please see response to Comment 1344-64 regarding the relationship between temperature and disease, and benefits of the plan amendments. The 2002 Nicholas and Foot study cited in the SED was an expansion of the 2001 Nichols and Foott study (which was conducted during the spring of 2000) cited by the commenter. The USFWS 2013 study cited by the commenter does not appear to be in the references cited section of the commenter's letter. Therefore, a review of the results and their applicability to the SED could not be performed.

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		its lack of reference gives the appearance of "selective science" being used in the SED.	
1344	66	On page 19-13 of the SED in the section entitled "Influence of Temperature on Predation Risk to Salmonids", several generalized, non-specific statements are made in an apparent attempt to link "high" water temperatures to increased vulnerability to predation. However, the only citation provided that relates directly to Central Valley juvenile fall-run Chinook salmon is Marine and Cech (2004). In this study, the researchers took fish from the Coleman National Fish Hatchery and reared them in three tanks with the water in each tank being held at a different temperature for a protracted period (2.5 months). The SED reports the study results as follows: "When water temperatures increase above preferred ranges, juvenile salmonids become stressed and potentially disoriented and erratic, which consequently causes them to become more vulnerable to increased predation rates (CDFG 2010a). Marine and Cech (2004) found that juvenile salmon that were reared in 21-24°C (69.8°F-75.2°F) were significantly more vulnerable to predation by striped bass than juvenile salmon reared at lower temperatures." The Districts have long maintained that predation by black bass, striped bass, and other non-native species is a major cause of low juvenile survival, and subsequently low escapement, on the Tuolumne River. The Districts have performed several site-specific studies of predator abundance and predation on the Tuolumne River going as far back as 20 years (FishBio 2013; TID/MID 1992, Appendix 22). While all of these studies are publicly available, they all have apparently been ignored in the development of the SED alternatives. It is well-known by resource agencies that predation by non-native species is a major problem affecting fry and juvenile salmon survival, yet the only solution put forward by the SWB and other agencies is more flow will fix the predation problem. One of the prominent studies that SWB cites to bolster its case is the Marine and Cech (2004) study. Yet while the SWB cites this study to support the argument that higher flows will lower temperatures, which in turn should substantially reduce predation, once again the SWB's own information serves to prove it wrong. Marine and Cech (2004) indicates that juvenile salmon reared at temperatures exceeding 70°F (21°C) are "significantly more vulnerable" to predation by striped bass. The SWB reports that the core rearing period for juvenile fall-run Chinook on the Tuolumne River is March 1 to May 31 (see Table 19-1). Table 19-7 of the SED reports that under the current baseline conditions, depending on the river reach, the average March temperature on the Tuolumne River ranges from 49.7°F to 58.5°F, the average April temperature ranges from 49.7°F to 61.0°F, and the average May temperature ranges from 50°F to 65.9°F. Therefore, by its own analysis, the SWB shows that increasing flows to reduce temperatures is not necessary on the Tuolumne River because Tuolumne River fish already rear at temperatures lower than, and in fact much lower than, 70°F.	Please see Master Response 3.1, Fish Protection, for discussions regarding temperature criteria and modeling, predation (including State Water Board consideration of the recent Tuolumne River predation study), and current fish decline and the need for increased and more variable flows. The additional information provided with regard to predation risk on the Tuolumne River does not affect the overall conclusion that a more natural flow regime from the salmon bearing tributaries (Stanislaus, Tuolumne, and Merced Rivers) is needed. Please see responses to comments 1344-59 and 1344-62 regarding the study by Marine and Cech (2004).
1344	67	The Marine and Cech (2004) study cited by SWB is another example of selectively citing research deemed to be favorable to the SED's preferred alternative. However, the findings of the Marine and Cech study go well beyond the single paraphrase provided in the SED and repeated above. To cite just a few: * Marine and Cech (2004) found there to be no difference in growth rates between groups	Refer to responses to comments 1344-59 and 1344-62 regarding the study by Marine and Cech (2004). Refer to the SED Chapter 7, Aquatic Biological Resources, regarding changes in predation risk resulting from changes in flow and water temperature (see Impact AQUA-10). Please see Master Response 3.1, Fish Protection, regarding the adequacy of the temperature analysis, including use of USEPA recommended temperature criteria, and reductions in sublethal and lethal

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		of salmon juveniles reared at 17°C to 20°C and 13°C to 16°C. * Although the juveniles reared as part of the 21-24°C group were smaller, the report concludes that "no predator size selection was detected within rearing temperature test groups". * The study also notes "that applicability of our results to fish in the wild is limited by the lack of refugial habitat for prey fish in the open tank experiments." The point needs to be emphasized -- the sentence contained in the SED that reads "Marine and Cech (2004) found that juvenile salmon that were reared in 21-24°C (69.8°F-75.2°F) were significantly more vulnerable to predation by striped bass than juvenile salmon reared at lower temperatures" misapplies the findings of the study. The study must be considered within the limitations of the experiment. For example, the fish reared at 21-24°C were reared at those temperatures for a protracted period of 2.5 months. A comparable juvenile rearing period for Tuolumne River fall-Chinook would be the 2.5 month period from March 1 to mid-May. Even a quick glance at the SWB's own analysis (see Table 19-7) indicates these temperature conditions do not exist on the Tuolumne River. The Review Team is unaware of any studies examining O. mykiss or Chinook vulnerability in relation to temperature conditions in the three eastside tributaries, and the SED does not present any relevant site-specific studies. And, finally, it is instructive that the Marine and Cech (2004) study states the following: "Most of the prior investigations have focused on more northerly salmon stocks. Applications of these results to southerly distributed salmon stocks is probably not appropriate because differences among anadromous fish stocks in their physiological responses to temperature have been reported (Myrick and Cech 2000, 2002)." The temperature "criteria" used by the SWB to conclude that temperature benefits may result from the SED's preferred alternative are based on temperature guidelines developed for salmon stocks in the Pacific Northwest. Marine and Cech (2004) would apparently not support the use of such "criteria", but evidently the SWB does not consider this aspect of the Marine and Cech study useful to the purposes of the SED.	temperatures.
1344	68	As another example of the "improvements" the SWB expects from "more natural temperature and flow regimes", the SWB cites Kiernan et al. (2012) and lower Putah Creek where the SWB reports a new flow regime was implemented that mimics the natural seasonal streamflow. The SED on page 19-13 states: "Following implementation of the new flow regime, native fish populations expanded and regained dominance across more than 20 km of lower Putah Creek." Once again, this summary statement of the conditions and changes in Putah Creek is misleading. As previously discussed, the original downstream displacement of non-native fish in Putah Creek was not the result of "the new flow regime", as implied in the SED. As Kiernan reports: "[b]eginning in 1997, a series of water years with high winter and spring flows displaced or suppressed alien species while creating advantageous spawning and rearing conditions for native fishes. By 1999, the proportion of native fish had greatly	The additional information provided with regard to Putah Creek does not affect the overall conclusion that a more natural flow regime from the salmon bearing tributaries (Stanislaus, Tuolumne, and Merced Rivers) is needed. Please see Master Response 3.1, Fish Protection, regarding temperature and SED use of best available science; the need for higher and more variable flows; the composition of organisms in rivers with different flows, and temperatures a description of how the unimpaired flow approach with adaptive implementation will provide functional flows. Please see response to comment 1344-48 for discussion of the study by Kiernan et al. (2012).

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		increased at the four upstream sites, driven by increases in abundance of Sacramento sucker and Sacramento pikeminnow. Marchetti and Moyle (2001) cited these changes as evidence that native fishes in lower Putah Creek could be enhanced by restoring a more natural flow regime." The initial displacement of non-native species came before the implementation of the new flow regime. We do not dispute the success experienced in Putah Creek, but as Kiernan reports "[t]his favorable outcome was achieved by manipulating stream flows at key times of the year and only required a small increase in the total volume of water delivered downstream (i.e., not diverted) during most water years". Improvements in Putah Creek are maintained through relatively small amounts of well-timed functional flows, not a percent of unimpaired flow.	
1344	69	The SED provides a lengthy discussion of the potential effects of temperature on salmonids using a number of citations, many of which describe hypothetical scenarios, but not actual conditions on the eastside tributaries. For example, following a discussion of the effects of water temperature on incubating eggs on page 19-14 and 19-15, the SED summarizes the section with: "Under existing conditions, elevated water temperatures appear to be impairing reproductive life-stages of salmonids in the SJR Basin, including its tributaries (CDFG 2010a). The magnitude in which poor temperatures effect the survival of incubating eggs, and ultimately population abundance, is currently unknown." This concluding sentence in this section is an example of the relatively frequent occurrence in the SED of two sentences on the same subject matter stating logically conflicting conclusions. If the "magnitude" of a problem is unknown, then one cannot reasonably conclude it is a real problem, even if it is heavily qualified with the phrase "appear to be impairing". In this specific case, once again, the SWB chooses to ignore a study performed on this very subject on one of the eastside tributaries -- the Merced River. In March 2013, the Merced Irrigation District ("Merced ID") completed an in-river, site-specific fall-run Chinook salmon egg viability study on the Merced River. The study concluded that although river temperatures exceeded EPA guidelines, egg survival was comparable or better when compared to other Central Valley rivers. Also, test group egg survival was higher in the river than the test group at the nearby Merced River Hatchery. This study was provided to the SWB in 2013.	Please see Master Response 3.1, Fish Protection, regarding the adequacy of the temperature analysis, including the use of USEPA recommended temperature criteria, reductions in harmful and lethal temperatures, and benefits from the unimpaired flow approach. The information provided by the commenter does not change impact determinations in Chapter 7, Aquatic Biological Resources, or affect the benefits analyses in Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30.
1344	70	On page 19-43, the SED presents a section entitled "Summarized Temperature Benefits". The SED states: "When considering temperature results at different river locations and different times of the year, it becomes difficult to provide an overall picture of potential temperature benefits. One way to summarize the temperature benefits of different unimpaired flows is to consider a data output we refer to as "mile-days". This result is a measure of temperature criteria compliance in both space and time." Using a compliance "criteria" termed "mile-days" would be a new and novel method of compliance management by the SWB. To the best knowledge of the Review Team, there is no project or river currently monitored or required by the SWB to report temperature compliance in "mile-days". The table providing the results of the SWB's temperature analysis contains a column heading entitled "% of maximum compliance achieved". Since	Please see Master Response 3.1, Fish Protection, regarding the adequacy of the temperature analysis, including the use of USEPA recommended temperature criteria, reductions in harmful and lethal temperatures, and benefits from the unimpaired flow approach. The commenter incorrectly cited the section on page 19-43, which is correctly titled "Summarized Temperature Results." The commenter mischaracterizes the benefits assessment regarding temperature. The SED does not purport to establish a method of compliance management. The mile-days evaluation is a useful approach for summarizing spatial and temporal changes while considering both frequency and magnitude. The benchmark for evaluating temperature-related impacts or benefits of the LSJR alternatives is the USEPA water temperature criteria for each life history stage. As shown in Table 19-15, the biggest temperature improvements occur for the core rearing (CR) life stage in April and May, which increases from 69 and 54

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		there is no specific numeric temperature standard promulgated for the eastside tributaries, referring to a degree of "compliance" would be premature, at best. Despite the numerous methodological and analytical concerns raised above by the Districts, the table may be instructive. It shows under the SWB's preferred alternative two items worth pointing out: * Even with the substantial increase in water required to be released to the river, in none of the months analyzed is "compliance" achieved, except when it is already achieved under baseline conditions (December January, February, March). * In most months, there is little overall change in the percent "compliance", especially when considering, as enumerated above, the SWB does not analyze the actual preferred alternative contained in the SED.	percent under baseline to 83 and 73 percent with 40 percent unimpaired flow.
1344	71	One additional aspect of the temperature model used by SWB is worth noting. On page 19-78, the SED states: "The model simulates the reservoir stratification, release temperatures, and downstream river temperatures as a function of the inflow temperatures, reservoir geometry and outlets, flow, meteorology, and river geometry. Calibration data was used to accurately simulate temperatures for a range of reservoir operations, river flows, and meteorology." The HEC-5Q model is a one-dimensional ("1-D") temperature model. By definition, a 1-D model cannot simulate full reservoir or river geometry. By inspection of a map of the Don Pedro Reservoir, one can readily see the unusual shape of the impoundment. The shape is highly dendritic with numerous arms and large changes in configuration in both the longitudinal and transverse directions. To further complicate modeling, the original Don Pedro Dam ("old Don Pedro") built in the 1930s remains in place with its discharge gates in the open position. A 1-D temperature model does not physically capture these elements of this complex reservoir. The Districts, on the other hand, developed a fully three-dimensional ("3-D") temperature model to study and understand the thermal regime and thermal structure of the Don Pedro Reservoir. This fully 3-D model is available for use, but requests for its use have not been forthcoming from the SWB. The 3-D model of the reservoir provides the best available science regarding the thermal structure of the Don Pedro Reservoir as well as a more accurate assessment of release temperatures to the lower Tuolumne River under a range of annual outflow assumptions. According to the SED, the HEC-5Q model was run on a daily time step using monthly flows from WSE/CalSim, which are then assumed to be the same, constant, flat flow for each day of the month. For purposes of the temperature analysis presented in the SED, the HEC-5Q model was run for the period 1970 to 2003 using the monthly flows converted to daily flows by assuming a constant flow for each day. However, to support SalSim model runs extended to 2010, HEC-5Q was also run for the period 1994 through 2010. There is no discussion in the SED of whether the version of the HEC-5Q model supporting the SalSim runs was put through a model verification procedure. If this was not done, and there is no evidence that it was, then the version of the model extended to 2010 is not a calibrated and verified model, and should not be relied upon. The process by which the model was extended to 2010 by the SWB should be discussed and described in the SED. Furthermore, by email dated November 4, 2016, a SWB staff member alerted the Districts' consultant, HDR, to the fact that CDFW had recently altered HEC-5Q files without the knowledge of the SWB. It	The SED analyses are appropriate for a program-level evaluation and adequate to disclose potential impacts and measureable benefits from the plan amendments. Furthermore, 1-D models are commonly used to simulate river temperatures and need not necessarily represent the complex structures of individual reservoirs: 1-D models generally provide sufficiently accurate representation of reservoir outflow and river thermal conditions. For example, in support of the San Joaquin River Restoration Program's PEIS/R, a Technical Model Selection Technical Memorandum documented the selection of a water temperature model to be used in a CEQA and NEPA analysis to determine potential impacts; 1-D and 2-D temperature models simulating outflow conditions from Friant Reservoir were compared (HEC-5Q and USJRBSI) and differences between calibration statistics were negligible. The memorandum states, "[t]he outflow temperatures are a function of the water temperature profile and the operation/elevation of the outlets. This information can be supplied by a 1-D model or a 2-D model. The accuracy of the water temperature profile at the outlets is more a function of calibration than the dimensionality of the model." (USBR 2008, Temperature Model Selection, Technical Memorandum, page 3-4, temperaturemodelselection-tm_061708.pdf, accessed 2/14/2018 from http://52.53.144.83/?wpfb_dl=525.) Please see Master Response 3.1, Fish Protection, regarding the adequacy of temperature modeling using a sub-daily time step with a monthly flow model. To better understand the effects for the more recent time period of 2004-2015, the Water Supply Effects model is extended using historical reservoir inflows and estimated monthly data for downstream local inflows, return flows, and water supply diversions, using CALSIM inputs from years with similar hydrology. The historical data is used to generate flows for HEC-5Q, but is not relied upon in the impacts analysis for the SED (see Chapter 21, Drought Evaluation). Furthermore, the SED does not rely on SalSim for its impact conclusions or determinations of fish benefits. Please see Master Response 3.1, Fish Protection, regarding, State Water Board use of SalSim and acknowledgement of model limitations. The SJR HEC-5Q model was developed by a group of consultants between 2003 and 2008 through a series of CALFED contracts that included peer review and refinement (CALFED 2009 as cited in Chapter 19). This model was most recently updated by the CDFW and released in June of 2013 (CDFW 2013). Please see Master Response 3.2, Surface Water Analyses and Modeling, for information regarding use of the HEC-5Q temperature model and appropriate modifications made to the model.

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		would not be a usual or preferred practice for a third-party to make changes to a critical analytical tool without the prior approval of and subsequent verification by the party using that analytical tool.	
1344	72	The SWB predicts that the SED's preferred alternative will provide "floodplain inundation benefits to juvenile salmonids and other native fishes from increased flows during the February through June time period." According to the SWB, increased floodplain inundation would benefit the juvenile life stage of fall-run Chinook salmon by providing access to better sources of food than what is available from in-river rearing, which would result in greater juvenile growth which, in turn, may lead to higher juvenile and smolt survival, which might lead to greater escapement. The SED acknowledges that for juvenile fish to achieve greater growth due to floodplain access, there must be plentiful food sources on the floodplain, at least equal to, if not greater than, in-river food availability. The SED contains no data related to the quantity or quality of food on any of the eastside tributaries' floodplains. Therefore, there is no empirical site-specific data that would lead one to reasonably conclude that floodplain access will provide greater growth than in-channel rearing. Lacking any river-specific data about food availability on the floodplains of the three eastside tributaries, the SWB provides a number of citations to try to support its presumption of greater food availability. The SED asserts "prey items can be orders of magnitude greater in floodplains than in adjacent rivers" which will lead to larger growth because "floodplain habitats in the Central Valley have been found to have a positive effect on growth" which in turn, presumably, leads to greater fish survival to adulthood. This bootstrapping of one presumption onto another to arrive at a favorable conclusion is the "scientific" basis of the SED's "floodplain benefits" assessment. The conclusion related to "floodplain benefits" provided by the preferred alternative compared to baseline conditions is arrived at by evaluating the increase in a metric the SWB labels as "floodplain acre-days". This evaluation leads the SWB to conclude on page 19-72: "Implementation of the proposed project will produce substantial increases in floodplain habitat which is available to native fish and wildlife populations, and it is expected that there will be significant positive population responses by native salmonids, and other native fishes." There is not a single piece of direct scientific evidence or river-specific data presented in the SED to support this conclusion as it might specifically apply to the three eastside tributaries. As explained below, the SWB's analysis fails to provide any quantitative evidence that the expected increases in floodplain inundation area would result in access to greater food sources, larger growth, greater emigration survival through the LSJR, or measurable increases in long-term salmon or steelhead populations. Because there are no data comparing floodplain vs in-channel rearing of fish in the LSJR or tracking emigration of fish substantially using one or the other rearing area, there is most certainly no evidence provided of "positive population responses by native salmonids" as claimed in the SED. As detailed in the sections below, the SWB analysis of floodplain benefits suffers from the following problems: * Most of the citations relied upon by the SWB are either not relevant to the LSJR and the	Please see Master Response 3.1, Fish Protection, regarding SED use of best available science, adequacy of the floodplain analysis (including use of evidence from other rivers), expected benefits of increased floodplain inundation, and the appropriateness of the wetted-area approach. Please see Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, regarding how implementation of a more natural flow regime is anticipated to have positive effects on aquatic habitat (see Section 3.7.3), and the food web (see Section 3.7.2) Please see Chapter 7, Aquatic Biological Resources, regarding changes in quantity/quality of physical habitat for spawning and rearing resulting from changes in flow (see Impact AQUA-3).

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		eastside tributaries or conflict with the SWB's assertions related to floodplain benefits. * SWB fails to analyze the SED's preferred alternative, or any of the SED's alternatives for that matter; therefore, the results of its analysis cannot reasonably be interpreted to conclude any floodplain benefits would occur. * SWB presents no evidence of "substantial increases in floodplain habitat" as it purports to do. * SWB provides no quantitative evidence of any benefit to fall-run Chinook or steelhead at the population level due to "floodplain benefits".	
1344	73	Citations relied upon are either not relevant to the LSJR and the eastside tributaries or directly conflict with the SWB's assertions related to floodplain benefits. As a first matter, for the floodplain benefits predicted by the SWB to occur, there must be greater food availability on the eastside tributaries' floodplains than what is available in their respective river channels. The SED presents no evidence that this is the case for any of the eastside tributaries or the LSJR. Lacking any river-specific data, the SWB relies heavily on a report by Sommer et al. (2001), a two-year study of juvenile fall-run Chinook use of the Yolo Bypass floodplain. The Yolo Bypass floodplain is located along the lower Sacramento River. The Yolo Bypass is a unique floodplain because of its large size, engineered flow control structures, degree of separation from the adjacent Sacramento River by levees, land uses, surface gradient, and vegetation communities. Flow to the Yolo Bypass area is controlled by the Fremont and Sacramento weirs and other structures. The Yolo Bypass floodplain is large, encompassing approximately 60,000 acres which floods seasonally in about 60% of the years (Sommer et al. 2004) and is characterized as uniformly wide, shallow, and with a low gradient that results in weeks or months of inundation following high flow events. Notwithstanding recent extremes in spring runoff such as 2010 and 2016, inundation of the Tuolumne River floodplain over the period of 1971-2012 occurs at a 2- to 4-year recurrence interval on the lower Tuolumne River (HDR and Stillwater Sciences 2017), consistent with the typical return periods of fall-run Chinook suggested to be supportive of salmon by Matella and Merenlender (2014). According to the SWB, at a river flow of 5,000 cfs, approximately 750 acres of Tuolumne River floodplain would be inundated (see Figure 19-12 of the SED), a tiny fraction of the inundated area of the Yolo Bypass floodplain. Further, because of the relatively higher gradient and higher velocities within Tuolumne River floodplain habitats, water temperatures are generally similar at in-channel and floodplain areas on the Tuolumne River (Stillwater Sciences 2012). The Yolo Bypass floodway bears no similarities to the Tuolumne, Merced or Stanislaus river floodplains, and the SWB does not attempt to make the case that it does. However, that does not prevent the SED from citing Sommer et al. (2001) as saying "prey items can be orders of magnitude greater in floodplains than in adjacent rivers" (page 19-53 of the SED). However, this is not what the Sommer (2001) report actually states. The actual quote is: "…the density of Diptera was much higher in the Yolo Bypass than in the Sacramento River	The additional information provided from the studies referenced in the comment does not affect the overall conclusion that a more natural flow regime from the salmon bearing tributaries (Stanislaus, Tuolumne, and Merced Rivers) is needed. Please see Master Response 1.1, General Comments, for responses to comments that do not raise significant environmental issues or make a general comment regarding the plan amendments. The SED identifies numerous studies that have demonstrated both aquatic and riparian ecosystems benefit from dynamic connectivity between rivers and their floodplains. The commenter has focused on one citation of dozens in the SED that describe the importance of floodplain habitat (see Appendix C, Chapter 19, and Chapter 7). Sommer et al. (2001) reported that "the diet of young salmon in the Yolo Bypass was dominated by dipterans." Figure 4 of Sommer et al. (2001) clearly shows that food availability of the dominant food item can be orders of magnitude greater on a floodplain compared to the river channel. Grosholz and Gallo (2006) reported that in "all three years (2000-2002) we measured zooplankton biomass 10-100 times greater at floodplain sites than at river sites." Regarding the Tuolumne River, the availability of in-river invertebrate food sources is relative to the number of juvenile salmon and steelhead in the river, which under current conditions are few. The importance of floodplain habitat on the Tuolumne River is supported by the fact that the final recovery plan for winter-run Chinook salmon, spring-run Chinook salmon and steelhead in the Central Valley (see NMFS 2014) identifies numerous Tuolumne River Recovery Actions (see Table 5-27) related to floodplain habitat in the Tuolumne River. The Recovery Plan supports the contention that increasing the frequency, magnitude, duration, and quality of floodplain habitat in the Tuolumne River is important component to steelhead recovery. Please see Master Response 3.1, Fish Protection, regarding use of best available science, adequacy of the floodplain analysis, including use of evidence from other rivers, and expected benefits of increased floodplain inundation.

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		(Fig 4), particularly in 1998, when densities were consistently an order of magnitude higher." Diptera is just one of the many "prey items" which juvenile salmonids can feed upon. There are many other "prey items" that serve as food sources for juvenile salmonids. The Sommer et al. (2001) report also examined zooplankton in the Yolo Bypass. In fact, in the same paragraph cited in the SED, the Sommer et al. (2001) report goes on to say: "There was little difference in zooplankton density in the Yolo Bypass between 1998 and 1999 or between Yolo Bypass and the Sacramento River in 1999" [note also the study reports that "1998 zooplankton data were not available for the Sacramento River"]. Contrary to what is stated in the SED, there was no finding in Sommer et al. (2001) that supports the SED's statement "prey items can be orders of magnitude greater in floodplains than in adjacent rivers". In the end, the Sommer et al. (2001) report concludes: "The Yolo Bypass floodplain may be seasonally more productive than the Sacramento River for some fish and vertebrates, but we have no data regarding its contribution during dry months or years." The SED contains no data on the abundance of Diptera, zooplankton, or any other "prey items" on the Tuolumne, Merced, or Stanislaus river floodplains. There is no evidence presented, nor to the Review Team's knowledge does any exist, that one could use to predict or expect greater prey items being available on the eastside tributaries' floodplains compared to the in-river food sources. However, studies have been conducted on in-river invertebrate food sources on the Tuolumne River, and these studies show that these in-river sources are plentiful (TID/MID 1997, Report 96-4; TID/MID 2003, Report 2002-8). No parties in the Don Pedro relicensing process, or at any other time, have claimed that Tuolumne River channel lacks adequate food sources.	
1344	74	Regarding the second of the floodplain benefits the SWB predicts to occur under the preferred alternative -- greater juvenile fall-run Chinook growth rates and "increased survivorship in river" (see page 19-53) -- the SED cites Sommer et al. (2001) and Jeffres et al. (2008), among others. Sommer et al. (2001) does report greater growth rates for juveniles that reared on the Yolo Bypass floodplain. Sommer et al. (2001) attributes the greater growth rate to food availability, but also notes that in both 1998 and 1999 "temperature levels in Yolo Bypass were up to 5°C higher than those in the adjacent Sacramento River during the primary period of inundation, February-March". Figure 2 of the Sommer et al. (2001) report shows that juvenile fish grew to large size at temperatures up to and exceeding 20°C, well above the SED's temperature criteria presented in Table 19-1 of 16°C. Other sources cited by the SWB in the SED (e.g., Myrick and Cech 2001; Marine and Cech 2004) indicate that juvenile fall-run Chinook with adequate food sources, while not differentiating between floodplain or in-river rearing, grow well at temperatures up to 20°C, and can continue to grow at temperatures approaching 24°C. It should be noted that these temperatures far exceed the "temperature threshold" of 16°C applied in the SED's assessment of temperature benefits. By relying on Sommer et al. (2001), Myrick and Cech (2001), and Marine and Cech (2004), it appears the SED is promoting floodplain rearing at	Please see response to comments 1344-72 and 1344-73 regarding floodplain benefits. Please also see Master Response 3.1, Fish Protection, regarding the appropriateness of the acre-days approach, floodplain relationship to temperature, use of evidence from other rivers, and use of USEPA recommended temperature criteria. The references mentioned by the commenter were cited in Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, as examples supporting the contention that floodplain habitats in the Central Valley have been found to have a positive effect on growth of juvenile Central Valley salmonids.

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		these higher temperatures. Having adequate food sources is consistently reported in references cited by the SWB to be an important determinant of growth, and "positive" fall-run Chinook growth rates are not simply a function of floodplain rearing, but are a function of food availability and river temperature, among other factors. Regarding increased survival, Sommer et al. (2001) reported that although juvenile fall-run Chinook reared on the Yolo Bypass floodplain had greater size and the survival indices were somewhat higher for fish released in the Yolo Bypass than for those released in the Sacramento River for both 1998 and 1999, statistical analysis of the two groups -- floodplain vs in-river reared -- indicated that the differences in the survival indices were not statistically significant. It is worth mentioning that flooding of the Yolo Bypass to improve juvenile salmonid growth is an example of the use of engineered structures and controlled pulse flows, and not an example of the implementation of a percent of unimpaired flow. The Yolo Bypass is not comparable to the floodplains of the eastside tributaries and cannot be relied upon by the SWB to draw conclusions on supposed "floodplain benefits" under the SED's preferred alternative, or any other alternative. The Yolo Bypass has been the subject of years of investigation of the structure, geometry, food sources, and food web. No such comparable study, indeed no study at all, has been carried out or referenced by the SWB related to the floodplains of the eastside tributaries or the LSJR. Estimates of floodplain area inundated, or "floodplain acre-days" are not adequate substitutions for the detailed scientific information needed to conclude what the effect might be of a greater frequency of floodplain inundation on the eastside tributaries. In Appendix A [ATT14] to this report, the SED's claims of floodplain rearing of juvenile fish are more thoroughly examined.	
1344	75	Another study carried out on the Yolo Bypass and reported in Sommer et al (2005) received little attention in the SED. The title of this report is "Habitat Use and Stranding Risk of Juvenile Chinook Salmon on a Seasonal Floodplain". Based on Brown (2002), the Sommer et al. (2005) report acknowledges it is "still unknown whether seasonally dewatered habitats are a net 'source' or a 'sink' for salmonid production relative to production in permanent stream channels." Stranding of juvenile fish is cited in Sommer et al. (2005) as a potential concern. There is no assessment of stranding risk on the floodplains of the eastside tributaries undertaken by the SWB, it is simply presumed not to be a factor without further analysis. In contrast, the Sommer et al. (2005) study carefully evaluated data collected over three years, 1998, 1999, and 2000, to draw its conclusions related to stranding risk. The SED, on the other hand, evaluated no site-specific data, in spite of the fact that the USFWS in March 2013 [Footnote 37: See USFWS letter to FERC dated March 2013 as part of the Don Pedro Relicensing proceeding.] when commenting to FERC on the need for a floodplain habitat assessment for the Tuolumne River as part of the Don Pedro Project relicensing stated the following: "Furthermore, a comprehensive evaluation of stranding survey was conducted on the lower Tuolumne River which indicated direct Project effects on juvenile salmonids when flows inundate the floodplain (TID and MID 2005). The tradeoffs between Project-related stranding of salmonid fry and juveniles and their expected increased growth and survival in off-channel habitats have yet to be evaluated."	Appendix K, Revised Water Quality Control Plan, and Chapter 16, Evaluation of Other Indirect and Additional Actions, describe recommended non-flow actions that are complementary to the LSJR flow objectives; the non-flow actions include, but are not limited to, enhancing riparian and floodplain habitat, and reducing salmon stranding events in ponds, pits, and other unnatural features by physically modifying problem areas within river corridors. Please see Master Response 5.2, Incorporation of Non-Flow Measures, for further discussion of non-flow actions. The adaptive implementation process discussed in Appendix K, will also allow for fine tuning of flows to achieve desired floodplain timing, magnitude, and duration; and prevent the flow fluctuations that could cause the stranding discussed in the comment. Please see Master Response 2.2, Adaptive Implementation, for clarification and examples of adaptive implementation. To date, large restoration projects have been completed in the tributaries that have restored riparian and floodplain habitat, including modifying habitat to reduce stranding risk (e.g. Merced River Salmon Habitat Enhancement Project, Robinson Reach). These types of restoration projects will continue to be implemented by other entities in the tributaries, as funding permits. Please see also see Master response 3.1, Fish Protection, regarding the adequacy of the floodplain analysis, making adjustments, and addressing uncertainty.
1344	76	One of the studies cited frequently in the SED, as well as in several other cited scientific literature, as supposedly demonstrating the benefits of floodplain rearing compared to in-	Refer to responses to comments 1344-72 and 1344-73

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		river rearing is Jeffres et al. (2008). The SED, and others, cites Jeffres et al. (2008) as demonstrating that juvenile fall-run Chinook salmon reared on floodplains grow larger and faster, and have greater access to prey, than juvenile fall-run Chinook reared in the river. According to the SED (page 19-53): "The higher growth rates of juvenile Chinook salmon using Central Valley floodplains, relative to other river habitat types, have largely been attributed to the greater availability of prey within floodplain habitats (Sommer et al. 2001; Jeffres et al. 2008)." We have discussed the lack of applicability of the Sommer et al. (2001) study of the Yolo Bypass to the eastside tributaries of the SJR, and have also pointed out the role of higher floodplain temperatures (up to 5°C higher) in contributing to greater growth for fish on the Yolo Bypass. Jeffres et al. (2008) reared juvenile Chinook for two consecutive flood seasons within various habitats of the Cosumnes River, a tributary to the Mokelumne River which empties into the LSJR. In the winter/early spring flood seasons of 2004 and 2005, six enclosures containing fall-run Chinook juveniles were placed in each of three different habitat types in the floodplain and two different locations in the river channel. Noteworthy for this discussion, the two river locations were the river channel upstream of the floodplain and the river channel downstream of the floodplain. The upstream river location was a riverine, non-tidal reach with a sandy substrate and the downstream location was in a freshwater tidal area. While there are a number of interesting findings from the Jeffres et al. (2008) study conducted on the Cosumnes River, the conclusion most relevant to the SWB's supposition of higher juvenile growth rates from floodplain is the following: "Our study indicates that off-channel floodplain habitats provide significantly better rearing habitat, supporting higher growth rates, than the intertidal river channel" There are no intertidal river reaches in any of the LSJR's three eastside tributaries. If anything, a close and accurate reading of the Jeffres study actually disproves the hypothesis of the need for floodplain access to increase juvenile growth. In the 2004 study year, the size of the juvenile fish located in the non-tidal river channel location upstream of the floodplain "increased rapidly" and by the end of the season "fish in the river site upstream of the floodplain were statistically grouped with the fish in the ephemeral floodplain sites, with greater lengths than fish placed in both the lower pond and river below the floodplain habitats". In study year 2005, after the first 20 days of being in the river, "fish in the flooded vegetation (site), upper pond, and above the floodplain (in-river site) had increased in length significantly more than fish in the lower pond and below the floodplain (other in-river site)". A large flow then occurred during the 2005 study which buried in sand most of the enclosures containing the pens at the upstream in-river site, apparently killing the in-river fish. Jeffres et al. (2008) cannot be used to show greater growth on floodplains compared to a non-tidal riverine channel; that is, the channel-types encountered in the three eastside tributaries. The SWB should more properly cite Jeffres et al. (2008) as showing that food supply is a major determinant of juvenile growth, whether fish are rearing on the floodplain or in the river channel proper. However, doing this would only highlight the fact that the SWB has no data comparing in-river to floodplain food supply for any of the LSJR eastside tributaries, and therefore lacks the scientific basis to conclude that providing floodplain flows would result in greater growth of juvenile anadromous fish. Furthermore, Jeffres et al. (2008) reports the maximum daily temperatures at the floodplain	

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		study site supporting the higher growth was in excess of 22°C for ten consecutive days and the juveniles continued to grow. The SED did not cite or mention this finding in Jeffres et al. (2008). Therefore, both citations relied upon by SWB--Jeffres et al. (2008) and Sommer et al. (2001) -- attribute improved growth of juvenile salmon on floodplains to higher temperatures in combination with adequate food supplies as physically observed on the floodplains investigated. In both cases, the temperatures contributing to higher growth significantly exceeded the "compliance" temperatures used by SWB in Table 19-1, but, once again, the SWB chooses to ignore this part of the studies, possibly because this does not support the SED's "colder-is-better" paradigm.	
1344	77	The SED presents no evidence that large temperature differentials exist between floodplain and in-channel habits (up to 5°C observed on the Yolo Bypass) on any of the eastside tributaries or the LSJR. On the Tuolumne River, temperature data were collected during spring runoff in 2011 in the river and the adjacent floodplain. There were no significant temperature differentials observed (Stillwater Sciences 2012). The SWB has this data in its possession. Lacking site-specific data on floodplain food supplies or floodplain temperatures, the SWB is forced to try to rely on the scientific literature on Central Valley juvenile salmon growth to make its case. The key citations relied upon by the SWB as evidence of "floodplain benefits" do not support the SWB's conclusions that juvenile fish inhabiting the eastside tributaries would benefit from increased floodplain inundation, and, in fact, only demonstrate the need for site-specific empirical data to draw a reasoned conclusion. The SWB has presented no evidence that either the Yolo Bypass or the Cosumnes River floodplains have any similarity to the floodplains of the eastside tributaries or the LSJR. The citied studies might be useful in demonstrating higher growth potentially associated with higher temperatures than the "criteria" adopted in the SED; unfortunately, these results are not presented or discussed in the SED.	This comment is a summary of previous comments. Please see responses to comments 1344-72, 1344-73, 1344-74, 1344-75, and 1344-76.
1344	78	SWB fails to analyze the SED's preferred alternative; therefore, the results of its analysis cannot conclude there would be floodplain inundation benefits. Beyond relying on citations, the SWB states that it has conducted a quantitative study of floodplain inundation evaluating the SED's baseline conditions and alternatives using its WSE computer models. As stated on page 19-56: "The frequency during the 82-year modeling period (1922 to 2003) that different monthly average flows, and the related floodplain acreages, are achieved was compared between baseline and unimpaired flows of 20%, 30%, 40%, 50%, and 60%. A 10% change in the frequency of floodplain flows, in combination with professional judgment, is used to determine a significant benefit or impact. Ten percent was selected because it accounts for a reasonable range of potential error associated with the assumptions used in the various analytical and modeling techniques. In addition, lacking quantitative relationships between a given change in environmental conditions and relevant population metrics (e.g., survival or abundance), a 10% change was considered sufficient to potentially result in beneficial or adverse effects to sensitive species at the population level." As stated numerous times in the SED, the core purpose of the SWB's proposed flow	Please see Master Response 3.1, Fish Protection, regarding the adequacy of the floodplain analysis, appropriate use of modeled monthly flow as a basis for analysis, and elements of the plan amendments that inform/enhance biological benefits (including adaptive implementation and non-flow actions). Please see Master Response 3.2, Surface Water Analyses and Modeling, regarding calculation of the instream flow objective as a percent of unimpaired flow.

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		objectives is to provide: "Flow conditions that reasonably contribute toward maintaining viable native migratory SJR fish populations include, but may not be limited to, flows that more closely mimic the hydrographic conditions to which native fish species are adapted, including the relative magnitude, duration, timing, and spatial extent of flows as they would naturally occur. Indicators of viability include abundance, spatial extent or distribution, genetic and life history diversity, migratory pathways, and productivity." [Appendix C, page 3-56] These two statements, the first describing the floodplain benefits assessment undertaken by the SWB and the second defining the core purpose of the flow objectives, are in direct conflict with one another. The SWB's goal in adopting an unimpaired flow regime as the instream flow requirement is to capture the variability that occurs in natural flows, including the variability in magnitude, duration, timing, and spatial extent of flows "as they would naturally occur". However, as the SWB states in the first quotation above, floodplain acreages were determined using "monthly average flows". Monthly average flows cannot possibly capture the variability of natural flows or even a percent of unimpaired flows. In fact, the monthly constant flow modeled by the SWB (that were then turned into constant daily flows) is probably the only flow regime that would never occur under any of the unimpaired flow regimes being considered in the SED. What sense would it make to repeatedly site the benefits of natural flow variability, and then model constant monthly flows? The SED indicates the preferred alternative includes using a 7-day running average of the unimpaired flow as the instream flow to capture the benefits of flow variability. Therefore, the SWB cannot claim any floodplain benefits based on the "quantitative analysis" it undertakes because its quantitative analysis never analyzes either the baseline conditions, the SED's preferred alternative, or any other of the SED's alternatives. The analysis only considered an alternative that would never occur.	
1344	79	Contrary to SWB's conclusions, the SED presents no evidence of "substantial increases in floodplain habitat". On page 19-72, the SED claims that the preferred alternative contained in the SED will result in "substantial increases in floodplain habitat". Even beside the fact that the SWB cannot make this claim because the SED's preferred alternative was never analyzed, the SWB analysis makes no attempt to actually determine amounts of "floodplain habitat". The SWB analysis evaluates floodplain inundated acreage. As the SWB well knows, every inundated acre cannot possibly qualify as suitable habitat. Just as every square foot of a wetted river channel does not constitute usable fish habitat, every wetted square foot of inundated floodplain does not constitute suitable fish habitat. In Chapter 7, the SWB goes into substantial detail explaining how wetted channel habitat is evaluated to determine the portion of that habitat that is suitable fish habitat. The SWB appropriately explains that considerations must include such factors as suitable water velocities, water depths, substrate, and cover. This explanation in Chapter 7 is thorough and well done. Directly following the discussion of what constitutes suitable in-river fish habitat versus just wetted in-channel area, the SWB then goes on to explain that for floodplains, none of those factors were considered, only wetted area. While the criteria of what may constitute suitable floodplain habitat may differ from that for stream channel habitat, there are still suitability criteria that apply. [Footnote 38: The Districts performed a detailed 2-D	Please see response to comment 1344-116.

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		floodplain hydraulic and juvenile fish habitat assessment for the entire 52 miles of the lower Tuolumne River and released the report to Don Pedro Project relicensing participants for comment, including the SWB, in September 2015. In comments on the Districts' study plan, the USFWS provided lengthy comments about floodplain Habitat Suitability Criteria. The USFWS rejected the use of inundated area as a measure of juvenile habitat. See USFWS comments dated March 11, 2013.] The SED provides no analysis of the percent of inundated floodplain area that could qualify as suitable floodplain habitat. The Districts understand that estimating the amount of suitable habitat, and how it varies with flow, for an area as large as that being considered in the SED is not an easy task. We understand this because the Districts, at the request of the SWB, CDFW, and the USFWS actually undertook and completed just such a study of the lower Tuolumne River floodplain in 2014/2015 from river mile 52 to the confluence with the San Joaquin River (HDR and Stillwater Sciences 2017). [Footnote 39: Comments on the September 2015 report were provided by the USFWS; these comments have been addressed, and the final report is being submitted to the SWB as part of these comments on the draft SED (see Appendix F [ATT19]). There were no changes to the conclusions and findings of the September 2015 report based on the USFWS comments.] For this study, LiDAR aerial imagery of the entire valley was acquired in 2011. The resource agencies, including SWB, CDFW, and USFWS, were consulted in the development of the study, including criteria for what would constitute suitable floodplain habitat, recognizing that estimating inundated area is not sufficient as a measure of suitable floodplain habitat. [Footnote 40: See USFWS March 2013 study plan comments filed with FERC and the Workshop Meeting notes in the September 2013 report and the report filed with these comments on the Draft SED (Appendix F [ATT19]).] The study's 2-D modeling and related assessment of the entire Tuolumne River floodplain is the best available science on the floodplain habitat of the Tuolumne River. The SED provides no indication that the SWB considered the findings of this state-of-the-art study. Instead, the SWB has chosen to rely on a study issued in 2008 by the USFWS which only considered inundated area and only at certain flows. The USFWS in its March 2013 comments on the Districts' proposed 2-D floodplain modeling of the Tuolumne River floodplains states the following: "The Service (USFWS 2008) conducted an empirical analysis of flow-inundated floodplain area for the reach between La Grange Dam (RM 52.2) and just upstream of the Santa Fe Bridge, at RM 21.5, near the town of Empire...While this study indicated that floodplain inundation began at flows between 1,100 and 3,100 cfs, it could not be used to determine how much floodplain area was inundated at flows between 1,100 and 3,100; 3,100 and 5,300; and from 5,300 to 8,400 cfs; because there were no data between these points...Further study of Project-related effects on fry and juvenile rearing habitat in the lower Tuolumne River, with a focus on off-channel rearing habitat, is warranted for several reasons." The USFWS letter went on to say that the "work of the Service (2008) that did address off-channel habitat focused on only a narrow range of flows; quantification still needs to be done under a wider range of flows to sufficiently evaluate Project-related effects (i.e., at both pre-and post-Project flows.)" While the USFWS letter mentions both the Sommer et al. (2001) and Jeffres et al. (2008) studies, the USFWS goes on to remark "however, it is unknown if off-channel habitats function similarly in the lower Tuolumne River".	

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1344	80	The importance of applying habitat suitability criteria to inform judgments about the potential benefit of floodplain flows is depicted in Figures TR-14 [ATT8] and TR-15 [ATT9] below. These figures demonstrate the significant difference that exists between inundated floodplain acreage and inundated floodplain habitat. Serving to only further compound the shortcomings of its floodplain analysis, the SWB adopts a term called "acre-days" for assessing "floodplain benefits", citing a study from the USFWS (2014) on the Stanislaus River that used this term. The term "acre-days" is the "number of acres inundated each day summed over an identified time period". If simply using the number of inundated acres as a measure of suitable habitat is unjustified, then multiplying the inundated acres by the number of days that the acreage is inundated only compounds the misapplication. An even more important element of this misapplication of "inundated acres" again relates to the methodology the SWB used to estimate the inundated acreage. Using constant monthly flows as discussed above only exacerbates the lack of relevancy of the "floodplain benefits" predicted to occur by the SWB.	Please see Master Response 3.1, Fish Protection, regarding the adequacy of the floodplain analysis.
1344	81	[ATT8:] Figure TR-14. Plot of wetted area vs flow on the Tuolumne River. Total wetted area includes the in-river channel area. Wetted floodplain includes only floodplain wetted area. Floodplain inundation begins at a flow of approximately 1,100 cfs.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	82	[ATT9:] Figure TR-15. Plot of floodplain wetted area and floodplain fall-run Chinook fry and juvenile habitat on the Tuolumne River.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	83	The SWB did not evaluate the "floodplain benefits" of the preferred alternative because the model it employed used monthly average flows and not the variable flows proposed in the SED alternatives. Figures TR-5 through TR-11 (see Attachment 2 of these comments [ATT13]) illustrate the difference in daily flows between the SWB use of flat flows and using a 7-day rolling average of flow. By example, the degree of error embodied in the SWB's analytical method based on constant daily flows can be understood when one examines the month of April in Figure TR-5 [see ATT13:ATT1], especially in light of Figure 15. Instead of there being a constant daily flow for the month of about 1,500 cfs as modeled by the SWB, which would yield 30 days of about 50 acres of constantly usable habitat (see Figure TR-15 [ATT9]), the 7-day rolling average flow provides no usable floodplain habitat for the first 10 days, then about 70 acres for 15 days and roughly 170 acres for 5 days. Also observable by combining Figure TR-5 [ATT13:ATT1] with the figures shown above is the degree and frequency of changes in the floodplain habitat. This changing physical environment is demanding on the energy reserves of rearing juvenile fish. As the suitability of habitat keeps changing, energy reserves used to continually search for suitable habitat that must be made up by greater food availability.	Please see Master Response 3.1, Fish Protection, regarding the adequacy of the floodplain analysis, including the appropriateness of using modeled monthly flows as a basis for the SED's floodplain habitat analysis, as well as expected benefits from increased floodplain inundation frequency and duration. Please see Master Response 3.2, Surface Water Analyses and Modeling, regarding the calculation of the instream flow objective as a percent of unimpaired flow. Please see Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, Adaptive Implementation, regarding using a 7-day averaging period for complying with the unimpaired flow requirement.
1344	84	Use of monthly flat flows introduces another methodological error in the analysis conducted for the SED. There is little discussion in the SED about the importance of the duration of floodplain habitat inundation necessary to yield a growth benefit for rearing juvenile salmonids. When the primary goal of providing access to such floodplain habitat is to promote the growth of fry and juveniles, then the length of time that habitat is available becomes a key variable. Fish growth takes time. Several of the citations referred to in other sections of the SED indicate that the duration of inundation is an important factor (Sommer et al. 2001, Sommer et al. 2005, Jeffres et al. 2008, Matella and Merenlender 2014). While	Please see Master Response 3.1, Fish Protection, regarding the adequacy of the floodplain analysis, appropriateness of using modeled monthly flows as a basis for the floodplain analysis, and expected benefits from increased floodplain inundation frequency and duration. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, indicates that monthly average flows will be higher more often in the range that is meaningful for floodplain inundation. Chapter 19 presents results for approximately 30-day duration events (depending on the month). The adaptive implementation process will allow the fine tuning of flows to achieve desired floodplain timing, magnitude, and duration. See Master Response 2.2, Adaptive Implementation, for more

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		the work of Sommer et al. (2005) on the Yolo Bypass reported a minimum, continuous residence time of 32 days on the floodplain, Matella and Merenlender (2014) suggest a minimum continuous period for fall-run Chinook juveniles of at least 14 days. Except for the acknowledgement of the importance of the duration of floodplain rearing, there is not general scientific agreement on the number of days needed in order to confer growth or survival advantages. For purposes of discussion, if we assume a minimum duration of 21 continuous days is beneficial for growth, then by inspection of Figures TR-5 to TR-11 [see ATT13] the effect of the SED's flat flows on estimates of "floodplain benefits" is apparent. There is hardly any period where flows would be constant for 21 days in the February through June period. Juvenile fish would have to be constantly moving on and off the floodplains in order to find suitable habitat under the SED alternatives. In addition to potential losses due to stranding and avian predation, fry and juvenile fish would have to expend considerable energy to continually move to locate suitable habitat in such a dynamic floodplain environment, the intrinsic dynamics of which are not captured by the assumption of constant daily flows. The SWB's use of constant, or flat, flows over an entire month to represent flows occurring under an unimpaired flow objective is unrealistic, and the use of flat flows gives misleading results when considering the expected duration of inundation.	information. Please also see response to comment 1344-75 regarding stranding.
1344	85	On page 19-71, the SED provides a narrative overview of the results of the SWB's floodplain inundation study: "A critically important time period for floodplain inundation, and also the time period that achieves the greatest benefit from the flow proposal, is the April through June period. Floodplain inundation does not change much during February and March because flows are relatively high during those months already under baseline." This statement is deserving of close inspection, even given the numerous errors and methodological shortcomings of the SWB's floodplain analysis. As can be seen in Figures TR-12 [ATT6] and TR-13 [ATT7] in Section 4.0 of these comments, based on site-specific Tuolumne River data from the Grayson rotary screw trap ("RST"), 99.6% of the outmigrating fall-run Chinook salmon have left the Tuolumne River by the end of May. Therefore, there are few, if any, potential "floodplain benefits" to parr-sized fish potentially rearing on the Tuolumne River in June. In fact, by May 1, over 90% of the fall-run Chinook have left the system. The most significant time periods for fry and juvenile rearing on the Tuolumne River are February and March, and as acknowledged in the SED, flows are "relatively high" under baseline conditions in those months. Just as with the SED's temperature benefits assessment, the results of the SED's own analysis show few to no incremental "floodplain benefits" in February or March, nor would there be significant floodplain benefits in most of May or June because fall-run Chinook have largely left the river. Therefore, the SWB's own analyses show that there are no measurable incremental benefits to be expected from the preferred alternative in February, March, or June.	Please see Master Response 3.1, Fish Protection, regarding floodplain habitat and the importance of seasonal flows from February through June, including the presence of salmon and steelhead in June.
1344	86	SWB provides no quantitative evidence of any benefit to fall-run Chinook or steelhead at the population level. Lastly, in its conclusory statement on page 19-72 related to floodplain benefits, the SWB states "it is expected that there will be significant positive population responses by native salmonids, and other native fishes." On page 19-56, the SED explains the basis for this expectation when it states "lacking quantitative relationships between a given change in	Please see Master Response 3.1, Fish Protection, regarding benefits of the unimpaired flow approach, use of best available science, current pattern of fish decline and need for increased flow, adequacy of the floodplain analysis, clarification regarding SalSim model runs, elements of the plan amendments that inform biological benefits, and the biological goals included in the program of implementation. Contrary to the commenter's position, there is no legal obligation that the State Water Board must provide a numeric quantification of fish and wildlife population improvements from the plan amendments.

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		environmental conditions and relevant population metrics (e.g., survival or abundance), a 10% change was considered sufficient to potentially result in beneficial or adverse effects to sensitive species at the population level." This is the sum total of the scientific basis used by the SWB to predict "significant positive population responses". It is left unexplained why a 10% change is considered sufficient to represent significance. It's worth noting there is no citation provided for this "judgment". There is no statistical analysis, or sensitivity analysis, to test this opinion. Even a professional opinion by an expert in the field is only an opinion when it is not supported by evidence. Without a reasoned basis for the 10% opinion, it is not a rational basis for requiring 300,000 acre-feet of additional water be dedicated to instream flows. The only tool available to the SWB which provides an estimate of fish population response to the SED's alternative of 40% UF from February to June is SalSim, and SalSim estimates that for an additional instream flow of 300,000 acre-feet of water, the SWB can expect about 1,000 additional fall-run Chinook adults under this alternative, or approximately a 10% increase in the LSJR population, which equates to about a 1% increase in the Central Valley fall-run Chinook population.	Please see Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, Adaptive Implementation, regarding the biological goals that will specifically be developed for LSJR salmonids to determine the effectiveness of the program of implementation. Please see Master Response 1.2, Water Quality Control Planning Process, regarding State Water Board consideration of beneficial uses in the context of the water quality control planning process. Please see Master Response 1.1, General Comments, regarding the purpose of the environmental review process and general responses to economic-related comments, including those attempting to compare costs and benefits. The State Water Board is not required to include a cost-benefit analysis, as the commenter seems to suggest. The State Water Board appropriately considers potential economic effects in Chapter 20, Economic Analysis.
1344	87	At the conclusion of the SalSim section of the SED (Section 19.4), under the heading "Final SalSim Summary", the SED states: "With the projected temperature and floodplain benefits during the spring time period (as indicated by modeling results in the previous sections of this chapter), and with adaptive implementation, it is expected that there will be substantial increases in fall-run Chinook salmon abundance on these tributaries from unimpaired flows at or greater than 40%. The SalSim results support this expectation, and because of the apparent conservative nature of SalSim, the results are likely a lower bound of potential salmon production increases that could have occurred during the SalSim evaluation time period. Finally, it is important to consider that many other native fish and wildlife species are expected to benefit from improved flow conditions during the February through June time period including other imperiled Bay-Delta species such as steelhead, sturgeon, and splittail." There is no valid scientific evidence presented in the SED that supports any of these several conclusions, and no factual or valid scientific basis for the SWB to expect "substantial increases in fall-run Chinook salmon abundance on these tributaries". Claims of temperature and floodplain benefits are addressed in prior sections of these comments. The various contentions of the SED related to SalSim are discussed herein. Contrary to the SED's assertion of increased abundance "on these tributaries", nowhere in the SED does the SWB provide any information about changes in salmon abundance in each tributary compared to the baseline. Only the predicted change in the "combined tributaries" is provided. Therefore, the SWB does not present any information about the contribution to "salmon abundance" from each tributary. Relying on an undefined, unexplained adaptive management plan to increase salmon abundance is also not supported by reasoned scientific analysis and is arbitrary. There is no sound scientific basis for such an expectation. By the SWB's own quantitative population analysis, there is no valid basis for concluding that flows released as 40% of the February 1 to June 30 unimpaired flow will deliver substantially increased salmon abundance. By its own analysis, flows from February through June higher than the 40% UF (i.e., 50% or 60%) actually produce lower average adult fall-run Chinook salmon production (see SED Figure	Please see Master Response 3.1, Fish Protection, regarding State Water Board use of SalSim to inform the plan amendments, the scientific basis for the plan amendments, expected benefits of increased and more variable flows, biological goals, and adaptive management. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, presents SalSim results for the unimpaired flow scenarios and 40 percent flow shifting scenarios as combined results for the three eastside tributaries. Results of the floodplain and temperature evaluations are provided for each individual tributary. SalSim has limitations (temperature equations that are under sensitive to improvements during the spring time period and over sensitive to warmer conditions during the fall), that make it difficult to evaluate the tradeoffs between spring and fall. Additional optimization to the 60 percent unimpaired flow scenario would likely produce more fish than any of the other scenarios considered. The flow shifting scenarios are not alternatives, but are used to demonstrate the benefits that could be realized under adaptive implementation in the program of implementation. Please see Master Response 2.2, Adaptive Implementation, for clarification and examples of the adaptive implementation process.

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		19-13 and Table 19-32). [Footnote 41: The SED also presents the results of two SalSim alternative flow scenarios that evaluated reallocating a portion of the February through June flows to other times of the year ("flow shifting"). The potential population benefits depicted in the model results from such flow shifting scenarios provides evidence that the essential concept presented in the SED that greater flows are needed in the February through June period is itself flawed.] Contrary to the SED's stated conclusion, SalSim does not support the SWB's expectation of unimpaired flows at or greater than 40% substantially increasing salmon abundance. The text of the SED is in direct conflict with the results of its analysis.	
1344	88	Of all the computer models employed by the SWB, SalSim is the only one which attempts to provide a quantitative assessment of the population-level benefits estimated to occur for fall-run Chinook salmon resulting from the proposed revisions contained in the Amended Plan. The SED presents mixed-messages about the usefulness and reliability of the SalSim model. On the one hand, the SWB relies completely on the SalSim model to conclude that taking a portion of the February through June unimpaired flow requirement and applying it to other parts of the year will result in greater salmon production than applying the 40% unimpaired flow to each of the February to June months alone. Indeed, the results of the SalSim model for the SB40%MaxFS and SB40%OPP model runs are the only evidence provided in the entire SED that the SWB could cite to conclude that an "adaptive management" approach would improve results over the direct 40% UF proposal. But then on the other hand, when the SalSim model predicts that the preferred alternative's 300,000 acre-feet of additional water released as 40% of the UF from February through June will only increase the fall-run Chinook population by about 1,000 fish (from 11,373 to 12,436), the SWB indicates the SalSim model has serious scientific limitations and it lacks confidence in the SalSim model's results.	Please see response to comments 1344-86 and 1344-87.
1344	89	SWB used results from the SalSim model to evaluate the potential benefits of alternative flow shifting scenarios and to support its recommendations regarding "adaptive implementation". SWB's conclusions are largely based on SalSim model results which suggest higher average total adult production when some of the spring flow is reallocated to the fall. However, SWB did not identify what fall life history components were affected, nor the relationship to flow that resulted in this predicted higher level of total adult production. Lacking a detailed analysis of the model's accuracy of simulating individual life stages, it is not clear in the SED how the SWB can have confidence in only the SalSim model results which produce greater salmon abundance, while being dismissive of results which produce little to no population benefit. Selectively choosing which model results are useful and which ones are not reveals that, once again, the SWB is using only those results which meet the SWB's ends, versus trying to make an informed decision considering all of the information available to the SWB. The SWB has stated that it has relied significantly in the development of the preferred alternative on input from CDFW, a cooperating state agency and the state agency responsible for managing California's fishery resources. Yet when it comes to SalSim, a model described by CDFW as "state-of-the-art", "best available science", and "no better tool available to perform th[e] task" of predicting the average change in salmon production from river system modifications, the SWB substitutes its own judgment for CDFW's [Footnote 42: At the January 3, 2017 Public Hearing sponsored by the SWB, both the SWB staff and the staff of CDFW provided explanatory remarks on the SalSim model and	The SED cites numerous studies that have demonstrated the benefit from dynamic connectivity between rivers and their floodplains on both aquatic and riparian ecosystems 90 see Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, Chapter 7, Aquatic Biological Resources, and Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30. The commenter has focused on one citation of dozens in the SED that describe the importance of floodplain habitat. The additional information provided with regard to Jeffres et al. (2008) does not affect the overall conclusion that a more natural flow regime from the salmon bearing tributaries (Stanislaus, Tuolumne, and Merced Rivers) is needed. The commenter misunderstood the quoted statement regarding SalSim and floodplain benefits. The statement discusses how SalSim slows fish down that are modeled to be on the floodplain, but does not increase their growth rate during that period in the model; thus, the model results underrepresent the benefit of habitat improvements related to floodplain conditions. The statement does not indicate that when downstream movement is slowed (e.g., when river flow velocities are lower) juvenile salmon will reach larger size and have improved survival irrespective of floodplain access. Furthermore, Chapter 19, indicates that monthly average flows will be higher more often in the range that is meaningful for floodplain inundation. Chapter 19 presents results for approximately 30-day duration events (depending on the month). The adaptive implementation process will allow the fine tuning of flows to achieve desired floodplain timing, magnitude, and duration. See Master Response 2.2, Adaptive Implementation, for more information.

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		its apparent shortcomings. Appendix D [ATT17] of these comments provide a critique of the various resource agency presentations made by SWB staff, CDFW staff, and NMFS-UC Davis at the January 3 Hearing.] in the following statement: "SalSim appears to underrepresent the benefit of habitat improvements related to floodplain and water temperature conditions during the spring time period that result from different flow scenarios which were evaluated for this project. Specifically, in SalSim, the downstream movement of juvenile salmon is slowed down when they pass inundated floodplains, which results in a later date and larger size of entry into the SJR and Delta, where a larger size improves survival. However, SalSim does not increase the growth rate of these fish when they are "on a floodplain". Recent literature (see Jeffres et al. 2008) indicates that growth rates of juvenile salmon on a floodplain can be significantly greater than juvenile salmon rearing in the adjacent river channel." This sentence is very interesting and needs to be read carefully. In this sentence, the SWB, without limitation, indicates that when downstream salmon movement is slowed down; that is, when river flow velocities are lower, juvenile salmon will reach larger size and have improved survival, irrespective of whether the fish have floodplain access. This conclusion by the SWB is consistent with the findings of Chinook salmon in-river habitat studies conducted on the Tuolumne River where PHABSIM modeling shows optimum fry in-channel habitat suitability occurs at flows less than 75 cfs and the optimum juvenile in-channel habitat suitability occurs at 150 cfs (Stillwater Sciences 2013), well below the flows resulting from the 40% unimpaired flow alternative. The SWB then explains that it rejects SalSim because SalSim does not provide the extra growth rate which should occur if the fish can be "on a floodplain" instead of merely in the river channel adjacent to the floodplain. As we have stated above, the SED presents no scientific evidence to support an expectation that Tuolumne River juvenile fish would grow to greater size with floodplain access. To arrive at this expectation of "extra growth", the SWB feels it is able to substitute its judgment over that of CDFW based on the single reference to Jeffres et al. (2008). We have discussed the Jeffres et al. (2008) study in our comments previously, but here it is worth repeating the actual findings of Jeffres et al. (2008) again: "However, lengths of fish in the river site above the floodplain increased rapidly and were intermediate between the ephemeral floodplain habitats and the lower pond and river location below the floodplain (Fig. 4). The final time that the fish were sampled, 32 days after deployment, fish in the river site upstream of the floodplain [site] were statistically grouped with the fish in ephemeral floodplain sites, with greater lengths than fish placed in both the lower pond and river below the floodplain habitats." Jeffres et al. (2008) also concluded the following: "Our study indicates that off-channel floodplain habitats provide significantly better rearing habitat , supporting higher growth rates, than the intertidal river channel" And Jeffres et al (2008) provides this cautionary note about juvenile salmon on floodplains: "...fish risk stranding and periods of stagnation, which can also create conditions lethal to juvenile salmon. However, natural floodplains tend to be heterogeneous in terms of water quality (Ahearn et al. 2006) and fish can avoid stressful conditions and seek more favorable	Please see response to comment 1344-87 regarding the SalSim model. Please see response to comments 1344-72 and 1344-73 regarding the floodplain analysis and benefits. Please see response to comment 1344-75 regarding stranding. Please see response to comment 1344-86 regarding the scientific basis for the plan amendments and expected benefits. Please see Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, Adaptive Implementation, regarding using a 7-day averaging period for complying with the unimpaired flow requirement. For the full context of the comments from other entities and a complete response to those remarks, please refer to the index of commenters in Volume 3 to locate the material from the November 2016 public hearing, which will be identified by the person’s name and is assigned a letter number.

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		habitats (Matthews and Burg 1997). The risk of stranding merits further study in this and other systems.." Therefore, not only does Jeffres et al. (2008) not support SWB's basis for rejecting SalSim, Jeffres et al. (2008) can just as readily be cited to suggest that higher flows may have an adverse effect on fall-run Chinook fry and juveniles when it states: "When juvenile salmon are migrating down from upstream spawning grounds during high flow events, migration is more passive than active (Healey 1980; Kjelson et al. 1981) and they are essentially entrained in the water column until they find slower water velocities where active swimming becomes possible. The Cosumnes River is similar to most rivers in the Central Valley in that it is incised and lacks channel complexity. Because other Central Valley rivers also lack access to floodplains -- with the notable exception of the Yolo Bypass for the Sacramento River (Sommer et al. 2001) -- juvenile salmon in these systems are frequently displaced to the intertidal delta during high flows." Jeffres et al. (2008) found slow growth when fish are displaced by high flows, like the flows proposed in the SED, to downstream "intertidal" river reaches on the east side of the Delta. But most significantly, the Jeffres et al. (2008) study argues persuasively for the need for site-specific data when examining the potential benefit and risks to fish on floodplains compared to in-river habitats. For the Tuolumne River, the SWB has presented no site-specific information that serves as evidence that floodplain access has any greater growth advantage than in-river habitats. The SED contains no information on Tuolumne River floodplain food availability, yet a number of studies show the Tuolumne River has ample in-channel food sources for fish (TID/MID 1992, Appendix 16; MID/TID 1997, Report 96-9). RST data collected on the Tuolumne River show that smolts leaving the river are large and in good condition. USFWS studies show Tuolumne River fish have no disease (Nichols and Foott 2002; USFWS 2013). The high flows that will occur under the SWB alternatives in February and March may result in the displacement of fry and smaller juvenile fish to the LSJR where there is little floodplain access, possibly inadequate food supply, and potential relocation of the fish to the intertidal portion of the LSJR, the very river habitat locations where Jeffres et al. (2008) did actually show lower growth on the Cosumnes River. The potential for fish being stranded on the floodplain under the SED's fluctuating unimpaired flows was not adequately considered by the SWB, even though USFWS identified the possibility of stranding on the Tuolumne River based on a site-specific study. Using constant, flat flows as a basis to assess stranding is unacceptable because the constant daily flows would minimize the chance of stranding compared to 7-day rolling average instream flows. Fluctuating flows both exacerbate the risk of fish stranding and require the exertion of energy reserves to continue moving in the search to find suitable habitat under changing flows.	
1344	90	One of the other problems with SalSim cited by the SWB is that it is structured as a "backcasting" model. However, the SWB does not cite this as a problem with the HEC-5Q model which is also a "backcasting" model (pg19-77), another example of selectively choosing what to consider and what not to consider in its evaluations. The Districts would generally agree that SalSim has limitations, and perhaps even serious limitations, but not necessarily the ones identified by the SWB. The Districts have equally serious concerns as raised above with both the SWB's temperature model and floodplain analysis. SalSim was	The use of the term "backcasting" is to appropriately describe types of models, including SalSim, that run historical data through simulations to determine what would be expected to happen on average if the physical environment were changed from that which existed historically. This type of modeling is consistent with other widely used simulation models, such as CALSIM II, HEC-5Q, and DSM2. The SED analyzes effects at different percentages of unimpaired flow under various alternatives to provide a wide ranging and conservative approach to the analysis. Evaluating and showing effects at low and high percentages of unimpaired flow, allows full disclosure of the possible types of impacts and benefits that

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		developed by the CDFW as a tool to evaluate different river management options. SWB used it for that express purpose. On page 19-81 of the SED in Section 19.4.1 entitled "Results of the SalSim Evaluation", the SWB states: "The SalSim results for the unimpaired flow cases (as used in the SED analysis) and the two 40% flow shifting cases indicate that as percent of unimpaired flow is increased, annual average total adult salmon production would have also increased during the 1994 to 2010 time period (Figure 19-13, Figure 19-14, and Table 19-32)." Based on this statement, it appears that the SWB decided to accept the SalSim model results. However, even this final conclusion is either just wrong or intentionally misleading, because the SalSim results portrayed in the referenced table and figures directly conflict with this statement. Both the 50% and 60% unimpaired flow alternatives have lower adult salmon production than the 40% unimpaired flow, indicating that as the percent of unimpaired flow is increased, salmon production is estimated to decline. [Footnote 43: It is worth noting that the SED only presents "flow shifting" model results for the 40% UF preferred alternative. The SED does not explain the mechanism for the benefit to salmon abundance under either flow shifting scenario.] Adult production actually goes down as unimpaired flows are increased above 40%. This is significant because SalSim itself contradicts statements in the SED that prior studies demonstrated that a 60% unimpaired flow from February through June was necessary to protect fish and wildlife. The SWB stated that it chose the preferred alternative as a balance between the needs of fish and the impacts to agriculture, but according to SalSim results, 40% appears to be the optimum unimpaired flow alternative for fish and not one that strikes a balance between benefits to fish and losses to water users. In fact, a closer inspection of the SED's Table 19-32 undermines the need for a percent of unimpaired flow from February through June altogether. The 30% UF alternative results in essentially the same salmon production as the base case, according to SalSim. By looking closely at the SalSim results of the SB40%MaxFS option, all the benefits to salmon production appear to occur due to reallocating flow from the spring to a window in the fall. Reallocating a small amount of water in the same fashion in the base case might produce nearly the same increase in production, but the SWB evidently did not test this alternative, but should. SalSim simply reallocating a relatively small portion of the baseline flows may produce significantly greater salmon production than the SWB's preferred alternative. SalSim is the only model which estimates the effects of the SED's Amended Plan at the population level. Without fall flow redistribution, SalSim estimates an increase in fall-run Chinook salmon adult escapement to be approximately 1,000 fish, or 10% of the current estimated run size. If the SWB disregards SalSim, as it appears ready to do based on comments made at the January 3, 2017, Public Hearing, the entire 3,500 page SED has no basis for predicting a positive population response when implementing the preferred alternative of the SED.	could occur. The flow shifting scenarios are not alternatives; the scenarios demonstrate the benefits that could be realized with flow shifting and optimization of flows allowed under adaptive implementation in the program of implementation. Please see Master Response 3.1, Fish Protection, regarding how and why the State Water Board used SalSim, acknowledged limitations of SalSim. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, explains that under the flow shifting scenarios, total adult production can be further improved with refined flow, reservoir storage, and temperature management. However, it is important to understand the limitations of SalSim and the limitations of inputting the results of optimized temperature and flow modeling runs into SalSim. Please see Master Response 3.2 Surface Water Analyses and Modeling, for discussion of the HEC-5Q model.
1344	91	It is apparent that the SED places a substantial reliance on the concept of "adaptive implementation" to deliver the fish and wildlife benefits the SWB expects to occur from the preferred alternative. Related to the goal of the Amended Plan to improve conditions for fish and wildlife, the SED states the following (see page 3-2):	Please see Master Response 2.2, Adaptive Implementation, for clarification and examples of the adaptive implementation process. Please refer to Master Response 3.1, Fish Protection, regarding year-round flows, benefits of the unimpaired flow approach, and elements of the plan amendments, including adaptive implementation, that

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		"The underlying fundamental purpose and goal of the plan amendments is … [t]o establish flow water quality objectives during the February-June period and a program of implementation for the reasonable protection of fish and wildlife beneficial uses in the LSJR Watershed, including the three eastside, salmon-bearing tributaries." This fundamental "program of implementation" is referred throughout the SED as "adaptive implementation". The phrase is used no fewer than 400 times in the first 700 pages of the SED. The importance placed on this aspect of the plan objectives is further emphasized by having it embedded as an objective itself in each alternative considered, except the baseline which is never evaluated as an option with an adaptive implementation plan. On page 3-7, the SED states that each alternative considered in the SED that includes adaptive implementation achieves "goal 4" of the plan objectives, which is: "[Goal] 4. Allow adaptive implementation of flows that will afford maximum flexibility in establishing beneficial habitat conditions for native fishes, addressing scientific uncertainty and changing conditions, developing scientific information that will inform future management of flows, and meeting biological goals, while still reasonably protecting the fish and wildlife beneficial uses." Of course, it would be odd for the SWB to establish adaptive implementation as a fundamental goal, but then not to include it as a part of each of the alternatives, so specifically calling out that each alternative meets the goal of adaptive implementation seems a bit unnecessary. In any event, the SWB relies to a very large extent on the benefits to be derived from adaptive implementation to justify its conclusion that the SED's preferred alternative will substantially improve "fish and wildlife beneficial uses" in the LSJR and the three eastside tributaries. A few statements from the SED indicate the level of reliance the SWB is placing on adaptive implementation: "With the projected temperature and floodplain benefits during the spring time period (as indicated by modeling results in the previous sections of this chapter), and with adaptive implementation, it is expected that there will be substantial increases in fall-run Chinook salmon abundance on these tributaries from unimpaired flows at or greater than 40%." (page 19-87) "This adaptive implementation element allows for flows under each alternative to be "shaped" or shifted in time to provide more functionally useful flows and to respond to changing information and conditions. Functionally useful flows achieve a specific function such as increased habitat, more optimal temperatures, or a migration cue." (page 3-10) "Adaptive implementation achieves one of the principal goals for flow objectives." (page 3-10) "Adaptive implementation of the blocks of water represented by the various percentages of unimpaired flow can result in even larger [temperature] benefits". (page 19-47) But the anticipated benefits accruing to adaptive implementation go even further to include being able to mitigate the adverse effects on fish caused by the SED's February through June unimpaired flow requirements:	inform/enhance biological benefits.

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		"Adaptive implementation allows for flows to be reduced to the low end of the range as long as these reductions do not reduce benefits to fish and wildlife and, thus, could have the effect of lessening the environmental impacts associated with higher flow alternatives." (page 3-10) "As described in the SED, the proposed project allows for adaptive implementation actions that could shift a portion of the required February through June unimpaired flows to other times of the year to prevent adverse effects to fisheries, including temperature." (page 19-80) As if that isn't enough, adaptive implementation apparently has the flexibility to completely modify and reallocate the original flow objectives of the revised Plan: "Although framed as February-June flow objectives, the range of alternatives captures the entire feasible quantity of water that could be used to reasonably protect fish and wildlife in the LSJR year round." (page 3-12) So what exactly is the SWB's plan for adaptive implementation? And what is the rational basis for the SWB's confidence in and reliance on adaptive implementation to produce the expected benefits to fish and wildlife "year round"? In fact, what exactly are the expected benefits, and how does one know when they have been achieved?	
1344	92	By adopting a highly flexible adaptive implementation plan, in one wave of the baton, the SWB discards the critical importance that it had placed on "mimicking natural flows" in favor of providing flows "'shaped' or shifted in time to provide more functionally useful flows." Adaptive implementation now becomes the means to use "blocks of water" to "protect fish and wildlife in the LSJR year round." The SWB goes so far as to assert the following in the Executive Summary on page ES-19: "Adaptive implementation allows the frequency, timing, magnitude, and duration of flows to shift in order to enhance the biological benefits. The LSJR alternatives entail a virtually unlimited number of possible functional flow regimes, limited only by the upper and lower bounds of the analyzed range of flows." Although the two words "adaptive implementation" are used with great frequency in the 3,500 pages of the SED, exactly three pages are devoted to describing and defining the content and requirements of what has now become the most essential and critical element of the SWB's revised WQCP -- the adaptive implementation plan ("AIP"). Having proposed to extract on average 300,000 acre-feet of additional surface water from the water supply users of the three eastside tributaries based on the apparent need to provide higher instream flows mimicking the natural hydrograph, the pretense of the need for "natural hydrograph" is now abandoned and in its place is substituted a completely undefined plan for conducting annual experiments with a "block of water" calculated as 30% to 50% of the UF expected to be available from February through June. Basically, the AIP as defined in the SED consists of the SWB authorizing the establishment of a working group (the "STM Working Group", or "STMWG") operating under the auspices of the SWB which can experiment with a "virtually unlimited number" of flow regimes in real time over a region that covers the entire LSJR and the three eastside tributaries. According	Please see Master Response 2.2, Adaptive Implementation, for responses to comments regarding the unimpaired flow objective, mimicking natural flows (tracking the hydrograph), and flow shaping and shifting in the program of implementation. Master Response 2.2, Adaptive Implementation, also provides additional explanation and examples of how adaptive management may proceed, and the bounds under which it may do so.

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		to the SWB's description of its AIP, the flow regimes can be changed annually as long as the SWB approves of the change. A request for a changed flow regime can be made "by one or more" of the members of the STMWG. Apparently, the so-named "Annual Operations Plan" containing a proposed change to an existing flow regime must be submitted to the SWB by January 10 of the year of the proposed change, and while the deadline for the SWB to approve the change is not mentioned, it is presumed to be by January 31 because the flow change would likely affect the required February to June flows. The SWB indicates it will approve a change so long as "scientific information supports that such changes would continue to support and maintain the natural production of the viable native fish LSJR fish populations migrating through the Delta"(page 3-10) and if the change would "better protect fish and wildlife beneficial uses" (see also Appendix K). The SED provides no guidance as to what is meant by "natural production" and how it will be measured, "viable native LSJR fish populations", and which of those are considered to be "migrating through the Delta", nor is there any guidance on what type of scientific information would be needed to prove that a proposed flow change would meet these "criteria". Further, there is no guidance for what would constitute "better protection of fish and wildlife beneficial uses" or what metric or metrics the SWB intends to use to make that decision. Indeed, the experimental flow regime would only be required to "support and maintain" existing fisheries, instead of being expected to increase fish population abundance, productivity, and spatial extent.	
1344	93	The only information, data, or analysis presented in the entire SED that could possibly, and mistakenly, lead the SWB to conclude adaptive implementation might lead to increased fish populations, or any other fish and wildlife benefit, is the results from the two "flow shifting" ideas examined by the SalSim model (SB40%MaxFS and SB40%OPP). Yet, the SWB asserts that the SalSim model is not reliable and, according to statements by the SWB staff at the January 3, 2017 Public Hearing, was not considered in the SWB's decision making. We have previously described in detail why the SWB's analysis of potential "temperature" and "floodplain" benefits is flawed and unreliable, not the least of which is the fact that the SWB has never actually analyzed its own preferred alternative. Therefore, the SWB is forced to make a finding that the AIP [Adaptive Implementation Plan], in and of itself, will somehow deliver the expected benefits to fish and wildlife. There are numerous reasons why the SWB can make no such finding. Most basically, the SED never actually describes exactly what benefits to fish and wildlife the SWB is expecting to achieve by adopting the Amended Plan other than in very general, qualitative terms. Much of the SED is devoted to trying to make the case that the preferred alternative will result in improved abundance of the "indicator species" -- fall-run Chinook salmon. But there is no evidence provided that "more flow will equal more fish". It is simply presumed to occur, according to the SWB, because the flow regime will mimic natural flow (which it is no longer required to do), juvenile fish grow larger on floodplains (which there is not a single piece of site-specific evidence put forward to support this contention for the LSJR or eastside tributaries), and river temperatures will be cooler (there is no evidence presented that juvenile fall-run Chinook for example in the Tuolumne River are adversely effected by the current river temperature regime, and the sum total change in temperatures at Vernalis near the entry to the Delta is 1°C in May and June).	Please see responses to comments 1344-86, 1344-87, and 1344-90. Chapter 7, Aquatic Biological Resources, Section 7.2, Environmental Setting, provides a description of factors that affect the abundance of aquatic biological resources, and reviews environmental stressors in the LSJR, three eastside tributaries (including the Tuolumne River), and the southern Delta, including temperature. Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, Section 3.7.5, Effects on Temperature, summarizes the effects of altered temperature regimes due to modified habitats, and the anticipated benefits of increased flows and cooler temperatures.

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1344	94	The SED's lack of clarity in defining the needed or expected benefits to the target fish populations greatly diminishes the possibility of the AIP [Adaptive Implementation Plan] achieving the goals hoped for by the SWB, precisely because there are no well-defined goals. The most basic element of a well-conceived AIP is to describe and establish clear, well defined goals and objectives so testable hypotheses can be put forward to try to achieve these goals (Bennett et al. 2016; Fischman and Ruhl 2015). Further, without a well-defined goal, how do participants know when the goal is achieved, what constitutes success or even progress, or when to stop the flow experiments? The AIP proposed in the SED leaves the development of the "biological goals" to be achieved by the SED's AIP to a future date, and these goals are to be developed by the STMWG. How can the SWB reasonably conclude that the instream flows of the preferred alternative, or any alternative for that matter, are adequate to meet biological goals which have not yet been established? The SED asserts that "[a]daptive implementation achieves one of the principal goals for flow objectives", that being to "[a]llow adaptive implementation of flows…that will inform future management of flows, and meeting biological goals..." (page 3-10). So, adaptive implementation achieves the goal of adaptive implementation. Adaptive implementation cannot be a goal in and of itself; there has to be a purpose to be fulfilled. This sort of self-fulfilling goal only sets the stage for failure of the AIP. Adaptive management, the common term for the SED's AIP, is an often-used and often-abused term. More formally, it generally refers to a decision-making process of taking actions and adopting measures through an explicit, structured process the essential ingredients of which start with having clearly stated goals and management objectives, an established baseline from which to compare and measure results, framing hypothesis about cause and effect that can be realistically tested over an appropriate time period, and setting the benchmark for when success is achieved (Bennett et al. 2016, Zimmerman et al. 2012, Delta Independent Science Board 2016).	Please refer to Master Response 2.1, Amendments to the Water Quality Control Plan, for responses to comments and additional information regarding the STM Working Group, biological goals, and the San Joaquin Monitoring and Evaluation Program. Master Response 3.1, Fish Protection, has additional information regarding biological goals and benefits to fish from the plan amendments. Please refer to Master Response 2.2, Adaptive Implementation, for responses to comments and additional discussion regarding adaptive implementation and the distinction between it and adaptive management. .
1344	95	The geographic scope of the AIP [Adaptive Implementation Plan] being proposed in the SED is vast covering the entire LSJR and three substantial tributaries each with its own unique characteristics, while also dealing with anadromous fish that spend the great majority their life outside the study area. It must be acknowledged that an AIP of this magnitude and importance is an enormously difficult undertaking with the potential to be hugely expensive with high risk of failure. Most of the AIPs of such scale and dealing with salmon and steelhead have been undertaken in the Pacific Northwest. Adaptively managing resources on the scale and of the type proposed by the SWB have come to be known as "intensively managed watersheds", or IMWs. According to Bennett et al. (2016), an underlying assumption of much of the river restoration projects in the Pacific Northwest has been that improvements in freshwater habitat will automatically lead to increased population viability and ultimately delisting of threatened or endangered species (National Marine Fisheries Service 2014). However, Bennett et al. (2016) reports there being a lack of evidence that past stream restoration projects have actually benefited salmon and steelhead populations (as cited in Roni et al. 2008). The need for reliable information about whether stream restoration is increasing salmon and steelhead viability led to the establishment of several "intensively monitored watershed" experiments in the Pacific Northwest (Bilby et al. 2005). According to Bennett et	Please refer to Master Response 2.1, Amendments to the Water Quality control Plan, for responses to comments and additional information regarding the STM Working Group, biological goals, and the San Joaquin Monitoring and Evaluation Program. Please refer to Master Response 3.1, Fish Protection, for responses to comments regarding biological goals and benefits to fish from the plan amendments. Please see Master Response 2.2, Adaptive Implementation, for responses to comments regarding non-flow measures and voluntary agreements with respect to adaptive implementation. The scientific evaluations in the SED show that flow alone will have positive effects on habitat and temperatures, and therefore overall fish and wildlife protection. Expected improvements in temperature and habitat are shown in Chapter 19. Master Response 2.2, Adaptive Implementation, provides additional description and examples of how adaptive management may proceed, and the bounds under which it may do so.

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		al. (2016), the IMW approach is defined as an experiment in one or more catchments with a well-developed, long-term adaptive management program to determine watershed-scale fish and habitat responses to restoration actions (e.g., Zimmerman et al. 2012). The goals of the IMW approach are to determine the effectiveness of restoration actions at increasing salmon and steelhead productivity, determine the causal mechanisms of fish responses to restoration, and possibly extrapolate the results to other watersheds where intensive monitoring is not possible (Bilby et al. 2005; McDonald et al. 2007). One of the common problems cited in Bennett et al. (2016) is that restoration actions and studies often assess the effects of multiple restoration actions implemented at the same time (e.g., in the Keogh River where road deactivation, nutrient enhancement, wood and boulder additions were undertaken at the same time), which confounds an assessment of the effectiveness of an individual restoration action type. The Keogh River study also demonstrated the difficulty in definitively determining whether restoration has increased freshwater production of salmon and steelhead because changing climatic conditions in both the ocean and freshwater confounds the fish response (Ward 2000). This describes only part of the problem with the AIP as defined in the SED. By the SWB's own acknowledgement, there are a "virtually unlimited number" of flow regimes for testing in real time on three separate watersheds. To add to the potential for inconclusive and confounding results, on page 3-19 in Chapter 3, the SED lists another 10 separate non-flow measures which "are recommended for evaluation and subsequent implementation" to occur over an undisclosed timeframe.	
1344	96	Simply declaring that an AIP [Adaptive Implementation Plan] will be established does not constitute evidence that an AIP [Adaptive Implementation Plan] will be successful or will lead to greater fish populations. The SWB does not demonstrate an understanding of the enormity of the AIP it would unleash under the SED. While providing a degree of flexibility in flow regimes and being open to considering both flow and non-flow measures seems like a good idea, it virtually ensures failure as a prescription for an AIP. The SED is not even clear about the overall goal of the experimental program. Is it to increase the adult fall-run Chinook population? If it is, what specifically in measurable terms constitutes success? Is it to increase steelhead abundance? What is the baseline population of "steelhead" in each tributary? While the SWB considers that these two species will respond in the same way to specific actions, this is not true. Steelhead have a unique life history very different from fall-run Chinook, including different responses to temperatures, flows, and use of floodplains. As just one example, the higher flows proposed by the SED in April and May to increase juvenile fall-run Chinook parr and smolt survival is very likely to have an adverse impact on the ESA-listed O. mykiss fry that will be in the river at that time of year by displacing them downstream where predator species are abundant, causing the displaced O. mykiss to be more vulnerable to predation or exposed to the higher temperatures that occur in the LSJR. This displacement process is described in the SED's oft cited Jeffres et al. (2008) study: "When juvenile salmon are migrating down from upstream spawning grounds during high flow events, migration is more passive than active (Healey 1980; Kjelson et al. 1981) and they are essentially entrained in the water column until they find slower water velocities where active swimming becomes possible." Jeffres' description applies to both fry and smaller juvenile salmon and O. mykiss. Fish on	Please see Master Response 2.1, Amendments to the Water Quality Control Plan, Master Response 2.2, Adaptive Implementation, and Master Response 3.1, Fish Protection for responses to comments regarding the LSJR plan amendments, biological goals, adaptive implementation, and benefits to fish that result from the plan amendments. Master Response 3.1, Fish Protection, and SED Chapters 7 and 19 show that the plan amendments result in higher flows than under baseline and will improve conditions for fish and wildlife. The adaptive implementation framework must be sufficiently flexible to address multiple species, ecological performance metrics, and combined flow and non-flow actions. Master Response 2.2 provides additional description and examples of how adaptive management may proceed, and the bounds under which it may do so.

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		the eastside tributaries at early life stages can be entrained in the water column and non-volitionally transported downriver to what is, or what will become, less suitable physical, food and temperature habitats. Fry and juvenile salmon and O. mykiss are unlikely to swim back to upstream areas because of the energy that must be expended to do so. This potential downstream drift and the potential conflicts among species the SED is attempting to benefit are not issues considered by the SWB. These factors add to the complexity and difficulty of developing an effective AIP. Bennett et al (2016) also cites another problem experienced in some AIPs; that is, identifying the wrong primary ecological concern. Bennett et al. (2016) found this can happen "when the primary ecological concerns are misidentified (e.g., relying on expert opinion alone)." This is likely to be a problem encountered in the SWB's proposed AIP because this issue is closely linked to the lack of a well-defined, structured process with clearly defined and measurable goals. It is not at all clear what goals the AIP proposes to achieve. The biological goals are unspecified and evidently come later during the STMWG process. The SED sometimes references temperature goals to be met in the summer and fall (see ES-16) as a goal. The only "metric" put forward in the SED is a general reference to the idea that the SWB will require the later development of "biological goals for abundance, productivity, and population spatial extent, distribution and structure." (ES-72) None of these terms are quantitatively defined. The other "metrics" to be employed by the SWB for assessing whether specific measures would meet AIP goals are that such measures must "support and maintain the natural production of the viable native fish LSJR fish populations migrating through the Delta" (Chapter 3) and/or must "reasonably protect fish and wildlife beneficial uses" (page 3-11). How this would be determined in left unsaid.	
1344	97	Zimmerman et al. (2012) explains the fundamental elements necessary to be established from the outset for an AIP [Adaptive Implementation Plan] which is intended to improve ecosystem function and produce more fish. The fundamental elements to be considered are (1) the study approach, which should be designed to demonstrate cause and effect, (2) the baseline fish population, which any improvement would be measured against, (3) the magnitude of change required to detect an actual effect, and (4) the expected magnitude of the effect, which needs to be shown to be reasonably feasible. Zimmerman et al. (2012) provides an example of the application of these elements which involved the identification of statistical parameters, including natural variability, measurement error, and predicted increases. In the case described in Zimmerman et al. (2012), eight years of baseline fish populations were available prior to the implementation of improvements. As a minimum, the SWB's AIP should establish these most basic elements. For example, is the baseline fall-run Chinook adult escapement abundance to be 11,300 fish over the three tributaries? Since even the historical abundance from Mills and Fisher (1994) used to establish the AFRP doubling goal (USFWS 1995) have unaccounted biases from unmarked hatchery releases that cannot be estimated from available data (Newman and Hankin 2004), how is the baseline to be established for implementation of an AIP? What is the expected magnitude of effect to be tested? Is that magnitude reasonably able to be achieved? For the three LSJR tributaries, what is the baseline "steelhead" population? What is the expected magnitude of the change based on the preferred alternative? None of these most basic elements are provided in the AIP as proposed in the SED. But where the AIP proposed in the SED displays a complete lack of realism, and therein lays	Please see Master Response 2.1, Amendments to the Water Quality Control Plan, Master Response 2.2, Adaptive Implementation, and Master Response 3.1, Fish Protection for responses to comments regarding the LSJR plan amendments, biological goals, adaptive implementation, and benefits to fish that result from the plan amendments. Master Response 3.1, Fish Protection, and SED Chapters 7 and 19 show that the plan amendments result in higher flows than under baseline and will improve conditions for fish and wildlife. Master Response 2.2, Adaptive Implementation explains that the framework for the adaptive implementation of LSJR flow objectives provides the foundation for successful adaptive management. As stated in Master Response 2.2, the science in the SED demonstrates that fish and wildlife will be reasonably protected with the proposed flows even with little or no adaptive management. To the extent there are any complexities and uncertainties associated with adaptive management, it will not reduce the benefits of the LSJR flow objectives and program of implementation. Master Response 2.2, Adaptive Implementation, provides additional description and examples of how adaptive management may proceed, and the bounds under which it may do so.

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		the groundwork for it being unsuccessful, is in the absence of any realistic sense of the experimental time scales necessary to conduct studies for the species being "restored". SWB's lack of appreciation for the undertaking proposed to be accomplished by the AIP can be demonstrated by considering even the simplest of experimental designs for the plan area covered by the SED. Let's assume for discussion purposes that the SWB would want statistically valid results. Let's consider the time required to just explore the 30% to 50% range in unimpaired flows contained in the preferred alternative by employing a "smolts per spawner at the confluence" metric. Assuming 5% increments in the unimpaired flow were to be evaluated (30%, 35%, 40%, etc.), this would be a 5-year experiment if each of the five years happened to end up being the same water year type. Assuming that different water year types are to be evaluated and that at least one replicate would be required to improve the precision of the metric, by applying the historical frequency of occurrence of water year types, it would take 50 years to examine this one question. If other flow scenarios (i.e., "flow shifting") were to be examined, it would be quite easy to identify at least five alternative flow regimes under the flow shifting paradigm. This would require another 50-year experiment. This simplistic approach also assumes there is no error in RST data and extrapolations, and the metric of "smolts per spawner" is not itself dependent on number of spawners (density dependencies). However, conducting an experiment over this long a period of time introduces other factors to be considered, like those already mentioned in the SED, including natural variability (boom and bust periods occurring on the order of 14 years, see SED Appendix C; varying ocean conditions). Considering these factor, it would take at least two and probably three cycles to be able to discern biological changes above natural variability of the system. We would now be looking at 150 years to obtain statistically reliable results to determine the best flow regime, even if the climate remained relatively stable over this timeframe. This timeframe also assumes system stability with respect to other major factors, such as ocean conditions as well as the changing influences of hatcheries and predation. This simplified experimental design shows the importance, at a bare minimum, of precisely defining the goal of the AIP, the metric or metrics to be used, and when success is achieved. Having as the metric "protection of fish and wildlife beneficial uses" or, even worse, "better protection of fish and wildlife beneficial uses" or "support and maintain the natural production of the viable native fish LSJR fish populations migrating through the Delta" are not sufficient direction from the overarching regulatory authority. Further, endorsing flexibility through having a "virtually unlimited number" of flow options is leading the STWWG in the wrong direction. Bennett et al. (2016) points out this challenge when it cautions that when dealing with salmon or steelhead, the "populations being studied have variable life histories that require monitoring for 2-5 or more years to assess a single cohort." Bennett et al. (2016) provides guidelines for designing IMWs, giving high priority to "explicit adaptive management plans"; "explicit criteria to minimize confounding response", including ensuring a minimum influence from hatcheries and exotic species; identifying "ecological concerns derived from prior data"; and having a "clearly defined experimental design". To have a reasonable chance at success, the party that established the overall goal must establish the bounds of the parameters for the AIP. Just providing a "block of water" to experiment with resembles, at best, a "trial-and-error" approach, which is the least preferred type of adaptive management. But the AIP approach is one step worse than trial-	

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		and-error because there is not a success metric established in advance.	
1344	98	In the Executive Summary, section 11.6, the SED indicates that the SWB's prior 2012 draft Plan was criticized for not containing adequate "bounds and rigor" and having "no goals" in the then-proposed adaptive implementation plan. The SWB's response to this criticism in the current Amended Plan is to modify the 2012 Plan such that "[t]he program of implementation now includes a requirement to develop tributary-specific numeric biological goals for abundance, productivity, and population spatial extent, distribution, and structure." In four years' time, the SED has gone from having no goal to requiring that a goal be developed later. It is difficult to discern any meaningful difference between these two positions. For the simple reason that the SWB's expectation is that the additional 300,000 acre-feet (or more) of water it is removing from a known and acknowledged beneficial use will produce significant incremental benefits to fish and wildlife populations, the SWB needs to take the time necessary to work with interested parties to develop a real AIP [Adaptive Implementation Plan] before it adopts the revised WQCP. If the goals are quantitatively defined, it may be possible to meet them with much less water and through other measures and actions. On the other hand, if the goals are set at a level where they are unlikely to be achieved, substantial beneficial uses of food production and M&I water supply would be sacrificed. Just as providing flows on the Tuolumne River floodplain cannot be a goal in and of itself, having a block of water to ostensibly benefit fish does not assure increased fish production. The SED provides no valid scientific evidence that the block of water the SED is acquiring for fish and wildlife will actually benefit fish and wildlife populations, especially when this water is allowed to be used without reasonable bounds, rigor, metrics, or quantitative indicators of success.	Please see Master Response 2.1, Amendments to the Water Quality Control Plan, Master Response 2.2, Adaptive Implementation, and Master Response 3.1, Fish Protection for responses to comments regarding the LSJR plan amendments, biological goals, adaptive implementation, and benefits to fish that result from the plan amendments. Master Response 3.1, Fish Protection, and SED Chapters 7 and 19 show that the plan amendments result in higher flows than under baseline and will improve conditions for fish and wildlife. The plan amendments now have a robust adaptive implementation framework. Master Response 2.2, Adaptive Implementation, Chapter 19 and Master Response 3.1, Fish Benefits, describe the program of implementation and fish benefits of the proposed LSJR flow objectives. These benefits will occur even with little or no adaptive management of flows. As stated in the Executive Summary: "These improvements are low estimates of the temperature improvements that can be achieved with increased flow because flow patterns were not optimized to achieve temperature benefits. Adaptive implementation of the blocks of water represented by the various percentages of unimpaired flow can result in even larger benefits." The additional benefits are demonstrated in Chapter 19, where it can be seen that shaping flows at critical periods would result in achieve greater temperature and habitat improvements.
1344	99	The SED estimates the economic impact to the water users of the Stanislaus, Tuolumne and Merced rivers from the SED's proposed Amended Plan to be $64 million per year on average. This grossly underestimates the economic loss to the region that would occur under the Amended Plan. The depth of the mischaracterization of the economic loss points to a fundamental misunderstanding on the part of the SWB of the nature of the local economies and the overriding importance of water to the irrigation, industrial, municipal, and commercial water users of the areas served by the three eastside tributaries. This fundamental lack of understanding portrayed in the SED is exemplified by five methodological errors in the analysis: * Use of and reference to an average economic impact. * Exclusion of major components of the economic base from the economic analysis. * Lack of quantitative analysis of the reasonably foreseeable restrictions on the future use of groundwater sources. * Failure to consider the social and community impacts that result from loss of key portions of the tax base. * Failure to evaluate and understand the disproportionate impact the SED's proposal will	Please see Master Response 1.1, General Comments, regarding the programmatic scope of the SED. Please see Master Response 2.3, Presentation of Data and Results in SED and Response to Comments, regarding the use of averages. Please see Master Response 8.0, Economic Analyses Framework and Assessment Tools, regarding the regulatory context of the economic analysis, reasonable assumptions, and spatial and temporal considerations. Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, regarding the groundwater impact analysis and SGMA as it relates to the plan amendments. Please also see Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, regarding groundwater as it relates to agricultural economic effects. Please see Chapter 20, Economic Analyses, Section 20.3.2, Agricultural Production and Related Effects on Economic and Local Fiscal Considerations, Baseline Local Fiscal Conditions and Potential Fiscal Effects, for information regarding the tax base in the plan area. Please see Master Response 2.7, Disadvantaged Communities, for response to comments related to disadvantaged communities

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		have on disadvantaged and minority populations of the affected region.	
1344	100	Use of and reference to an average economic impact. The most basic tenet of water supply planning is to maintain a sufficient available supply to withstand drought conditions. No entity in the water supply business plans for average water conditions. All water planners and the associated regulatory bodies understand that drought conditions, especially consecutive years of drought, pose the greatest threat and will have the greatest economic impact. This is especially applicable to the Tuolumne River study area affected by this SED because of the prominence of fruit and nut trees and dairy, cattle and calf operations in the agricultural economy of the TID and MID service territories. In contrast to annual crops, large initial capital outlays are required for tree crops and dairy and cattle operations and a reliable water supply is needed in all years to protect that investment. By evaluating and reporting the economic impact based on average conditions, the SWB reveals a fundamental misunderstanding of the nature of the local economies its actions are affecting and the true water supply impacts. The SED's use of averages masks the real economic effects of the SED's proposal. An effective way to understand the lack of relevancy of estimating average economic impact is to consider it on a personal level. Let's say over a twenty-year period, a person is required to shoulder the burden of a reduction in salary. That reduction will now result in the employee receiving on average 87% of their former salary. That sounds palatable, until it is further described as receiving the full salary for 17 years and 10% of their salary for three of those years, and the three years of 10% will be consecutive. Of course, no average person, and their family, would survive economically with 10% of their salary for three consecutive years. By using average water supply numbers over a longer time frame, the SED is seriously mischaracterizing the economic impact of the SED's proposal. By not considering the economic impact during the drought years, the SED underestimates the economic loss just for the TID and MID service areas by over $1.5 billion during critical water years, including direct, indirect, and induced economic losses.	Please see Master Response 2.3, Presentation of Data and Results in SED and Responses to Comments, for discussion of why average results were presented. In addition, please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, and Master Response 8.2, Regional Agricultural Economic Effects, for presentation of the results of the revised SWAP model run averaged by water year type. Also, please see Master Response 8.2 for discussion of economic analysis performed by Turlock and Modesto Irrigation Districts.
1344	101	Exclusion of major components of the economic base from economic analysis. The Districts conducted a detailed assessment of baseline economic conditions as part of the Don Pedro Project Final License Application filed with FERC in April 2014, and this baseline assessment was made available to the SWB at that time. The SWB did not use or rely upon this extensive study of the Districts' service area. If the SWB had considered this work, it would have been aware that animal commodities comprise over half the annual commodity revenues resulting from the Districts' water supply (TID/MID FLA 2014). Food and beverage processing is also a substantial economic driver in the area and provides between one-quarter and one-third of the jobs in the study area analyzed in the Districts' study area (TID/MID FLA 2014). The SED fails to include in its assessment the economic impacts of the SED's preferred alternative on either the dairy, cattle and calf industries, or the food and beverage processing industries that benefit from the Districts' water supply. The lack of consideration of the full economic base of the region misleads the public about the degree of economic impact.	Please see Master Response 3.5, Agricultural Resources, for discussion of the potential effects on dairies and livestock operations. Please see Master Response 8.2, Regional Agricultural Economic Effects, for discussion of the potential economic effects on dairies and food processors.
1344	102	Lack of quantitative analysis of the reasonably foreseeable restrictions on the future use of	Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act for discussion on the approach to the groundwater impact analysis, groundwater recharge, groundwater

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		groundwater sources. In 2014, the state legislature passed the Sustainable Groundwater Management Act (SGMA). Under SGMA, groundwater districts will be established and regulatory controls will be established that will place limits on groundwater extraction. Groundwater is a significant component of the Districts' and their customers' water supplies, especially during drought years. Comments provided on the SWB's 2012 draft SED directed the SWB to improve its assessment of groundwater/surface water interactions in order to develop a quantitative evaluation of the effects of future restrictions on groundwater supplies and the resulting increased reliance this will place on surface water supplies. On page ES-24 of this 2016 draft SED, the SWB acknowledges the issue when it states that the "sustainability of increased reliance on groundwater pumping is an important issue" and the "reduced availability of surface water diversions in the plan area could also affect groundwater recharge". Reduced groundwater recharge is likely to affect the SED's current assumptions about accretion flows to the Tuolumne River. The importance of accounting for the interaction of surface water and groundwater was emphasized in the peer review comments on the Review Panel Report for the San Joaquin River Valley CalSim II Model: [Footnote 44: http://science.calwater.ca.gov/pdf/calsim/calsim_II_final_report_011206.pdf] Groundwater is the most important process not included in the newer [CalSim] model, and was absent from previous models. It is clear from the documentation and the oral presentations that adding groundwater to the model was not part of the scope of work for this project. Thus our comments on groundwater are not intended as a criticism of the work done to improve the model. They are intended to point out an important missing element in modeling water management in the San Joaquin valley. Groundwater interaction with various components of the model is critical for several reasons: * Groundwater is an important basin water supply, especially during droughts. * Groundwater is an important source of tributary inflows, mainstem inflows, and is a potentially important source of salinity from the Westside. * Groundwater is an important subject of management within the basin, with important interactions with the surface water demands and processes involved in the CalSim model of this region. …Without explicit groundwater representation, the [CalSim] model's applicability to planning, policy, and operational problems under future water management and hydrologic conditions could be severely limited. This problem will become increasingly limiting for planning applications involving activities that affect the availability of groundwater (including any ongoing overdraft), groundwater return flows, and groundwater management. Given the difficulties and expense of groundwater modeling and data for such a large region, it is understandable why this was not included in the effort being reviewed. However, explicit groundwater representation is likely to be important for future applications.	models and SED consideration of SGMA. The level of detail in the SED is reasonable and appropriate for a program-level analysis and is not meant to be, nor required to be, a site-specific analysis of, for example, each cone of depression or potential cone of depression in each basin. Therefore, estimating variables like sustainable yield, declines in groundwater levels, and groundwater-surface water interactions is beyond the scope of the SED, because those variables require site-specific information and groundwater modeling. Moreover, it is speculative to assume how pumpers in each area will respond to implementation of the flow objectives, because it will depend on many individual and collective decisions including, but not limited to, the discrete actions of local water users in response to reductions in surface water, crop choices in response to markets and other factors, and implementation of SGMA and conservation measures. Please see Master Response 1.1, General Comments, for discussions of the programmatic scope of the SED, CEQA requirements for program-level analysis, and State Water Board use of best available science. Detailed discussions regarding groundwater balance assumptions and groundwater impact analysis methodology are provided in Appendix G, Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives: Methodology and Modeling Result. Potential impacts of the plan amendments on groundwater resources are discussed in Chapter 9, Groundwater Resources, Section 9.4.3, Impacts and Mitigation Measures. SGMA was not included in the baseline, because as noted above, GSPs are not yet written and groundwater sustainability could be implemented through projects and programs in a number of ways. Therefore, any future-condition baseline "with SGMA" is purely speculative. However, SGMA was properly included in the analyses as an existing legal requirement to prevent further degradation of the groundwater basins and as a potential cumulative limit on future irrigation supplies (Chapter 9, Section 9.4.3, Impacts and Mitigation Measures; Chapter 22, Section 22.4.1, Potential Impacts of LSJR Alternatives). The Review Panel Report (report) referenced in the comment predates the release of the SED by ten years and is a peer review report exclusively for the San Joaquin River Valley CalSim II Model. The comments on the report were made for the CalSim II Model in 2006, not for the SED analysis. The groundwater analysis was not conducted in CalSim II or the WSE model. The groundwater impact analysis is a spreadsheet analysis using outputs from the WSE model, information extracted from various agricultural water management plans, and information provided by the irrigation districts. This spreadsheet model has been made available and can still be downloaded at https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/2016_sed/index.shtml. For information on the relationship between CalSim II and the WSE model, please see Master Response 3.2, Surface Water Analyses and Modeling. Please also see, Chapter 4, Introduction to Analysis, and Master Response 1.1, for descriptions of the general approach to the SED analyses and use of modeling results.

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		The SWB's modeling has not accounted for this critical interaction, and the peer review comments on the SWB's base model flows from CalSim still apply. Without addressing the peer review comments regarding the specific inclusion of groundwater, the SWB is unable to address the economic impact of reductions in surface water supplies resulting from the SED's preferred alternative.	
1344	103	Failure to consider the social and community impacts that result from loss of key portions of the tax base. Economic impacts during drought periods are vastly underestimated in the SED. These impacts are projected to be severe under the SED (see Appendix C [ATT16] of these comments), especially when the effects of SGMA are considered. The economic impact to the communities' business interests will directly affect the tax revenues of the local communities, revenues which support schools, law enforcement, social services, public health and community programs. [Footnote 45: See, e.g. comments provided by the San Joaquin County District Attorney Tori Verber Salazar (December 16, 2016 Tr., page 89-93), Merced County Supervisor Deidre Kelsey (November 29, 2016 Tr., page 84, In 15-21), Merced County Assessor Barbara Levey (December 19, 2016 Tr., page 72-74), Stanislaus County Supervisor Terry Withrow (December 20, 2016 Tr., page 97), and MID Board Member Jack Wenger (December 20, 2016 Tr., page 400).] Quantifying these impacts must be undertaken by the SWB and shown in the SED. The potential impacts of the reduced tax base must also be discussed. Without a substantial assessment of these impacts, the SED fails to demonstrate a recognition of the effects of its proposed action. Lack of acknowledgement of the impact provides the SWB with the ability to avoid the need to mitigate for the impact of its actions.	Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, for discussion of SGMA compliance. Please see Appendix G, Agricultural Economic Effects of the Lower San Joaquin River Flow Alternatives: Methodology and Modeling Results, section G.5.4 for discussion of potential fiscal impacts to local governments.
1344	104	Failure to evaluate the disproportionate impact the SED's proposal will have on disadvantaged and minority populations of the affected region. The communities affected by the SED's proposal are already some of the most disadvantaged in the state, having significantly higher unemployment and lower incomes than the state average. Nowhere in the SED is the issue of environmental justice discussed or addressed. Environmental justice refers to considering the potential impact on the environmental and public health issues and challenges confronting the nation's minority, low income, and disadvantaged communities. Environmental justice also refers to the "fair treatment of people of all races and cultures". [Footnote 46: California Government Code §65040.12.12] It is apparent that the SWB has not considered its proposed action within the context of environmental justice because the term cannot be found in the SED. [Footnote 47: This issue was raised in the public hearings. See, e.g., the comments of Kathy Miller, member of the San Joaquin County Board of Supervisors, who noted that the SED will create "an environmental justice nightmare for our region." (December 16, 2016 Tr., p. 88, ln. 8-11).]	As described in Chapter 9, Groundwater Resources, and further clarified in Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, Master Response 2.7, Disadvantaged Communities, Master Response 3.5, Agricultural Resources, and Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, agriculture uses within the plan area have increased over the years, resulting in the need for a larger water supply. As described in Master Response 2.7, the concerns of disadvantaged communities and environmental justice issues are important to the State Water Board. The plan amendments in no way discriminate against people on the basis of race, culture or income. Agricultural expansion, especially the recent expansion of permanent crops, in the areas near disadvantaged communities has exacerbated water supply problems for disadvantaged and environmental communities in the plan area. The State Water Board is sensitive to this problem and has disclosed the significant impacts to groundwater levels in Chapter 9 and proposed mitigation measures that call for the sustainable management of the groundwater basins in compliance with SGMA, among other measures. Whether water supply for disadvantaged communities remains a problem depends on local choices made to sustainably manage groundwater and on making other adaptations in response to reduced surface water supplies from the plan amendments. The State Water Board will exercise its enforcement authority to ensure compliance with SGMA. The State Water Board also has been and will continue to be at the forefront of assisting disadvantaged communities and considering the human right to water, as explained in Master Response 2.7.
1344	105	Certainly in terms of quantity, at 3,500 pages the SED is a tremendous accomplishment. However, within these 3,500 pages, there is a lack of any evidence that the SWB seriously considered the resource studies that have been carried out by Turlock Irrigation District (TID), Modesto Irrigation District (MID), and the City and County of San Francisco (CCSF) on	The content provided by the commenter is acknowledged. The commenter points out a concern about resource studies by local irrigation districts that were not incorporated in Chapter 7, Aquatic Biological Resources. Incorporating the citations would not change the impact determinations for Chinook salmon juveniles in Chapter 7; therefore the content identified by the commenter has not been included in the

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		the Tuolumne River since 1995. Over the last 20-plus years, the Districts and CCSF have undertaken well over 200 separate investigations of the aquatic and terrestrial resources of the 52 mile reach of the lower Tuolumne River, the river reach which the SED asserts is in need of substantial modification, such modification to be accomplished by establishing a new, though yet undefined, flow regime. It is important to note that all of these 200-plus studies are publicly available, and the overwhelming majority have been filed with the SWB previously. Many of the studies involved SWB in the scoping and reviewing process. But even with the studies cited with some frequency in the SED, Stillwater Sciences (2006) and Stillwater Sciences (2013), the study results were evidently not considered by the SWB because they would have dissuaded the SWB from recommending an instream flow of 40% of the unimpaired flow in February and March, at a minimum because of the potential adverse impacts to fall-run Chinook fry and juveniles. The Tuolumne River has been referred to as one of the most studied rivers in California. Nearly every aspect of the lower 52 miles of river have been investigated over the last 25 years. Most recently, as part of the FERC relicensing of the Don Pedro Project, a process in which the SWB was actively involved, an additional 20-plus studies of the water resources and aquatic resources were conducted and submitted to all interested parties, including the SWB. Each of these studies underwent detailed public scrutiny as required by FERC from the study planning phase to collaboration with relicensing participants during study execution and public review of draft reports and issuance of the final reports. These 200-plus studies constitute the most recent and best available science on the resources of the lower Tuolumne River. The SWB appears to have systematically ignored this entire body of work.	chapter.
1344	106	Don Pedro Reservoir Inflow Hydrology Extends Through 2012: The SWB's WSE model is based on monthly data for the period 1922 to 2003. For the purpose of evaluating "temperature benefits", the SWB used the period 1970 to 2003. Aside from the numerous and serious concerns raised previously in these comments about the SWB's temperature assessment, our understanding is the SJR HEC-5Q temperature model was originally calibrated to daily flow and temperature data. There is no evidence the SWB recalibrated the model before using just monthly data; if not, then the SWB's "temperature benefits" were estimated by the SWB using an uncalibrated model. As part of the relicensing of the Don Pedro Project, the Districts, at the urging of the SWB and CDFW, developed a daily flow hydrology record for the inflow to the Don Pedro Project for the period 1971 to 2012. This daily flow record was calibrated to meet mass balance criteria over the monthly time steps for that entire period. This full data set was provided to, reviewed, and accepted by the SWB and CDFW in March 2013 (Final License Application [FLA], Don Pedro Project, 2014). The Districts' hydrology database represents the best available science on the Tuolumne River. The SWB's WSE model and subsequent temperature and floodplain assessments should have relied upon this daily hydrology developed as part of the Don Pedro Project relicensing for the 1971 to 2012 period.	Please see Master Response 3.1, Fish Protection, regarding the adequacy of the temperature and floodplain analyses, including using a sub-daily time step with a monthly flow model. Staff recognized that data is available for the Don Pedro Relicensing Project; however, a model was needed that would simulate water supply conditions for the entire geographic area of the plan amendments, not just a single tributary. Please see Master Response 3.2, Surface Water Analyses and Modeling, regarding modeling assumptions, the WSE model, and the water temperature model.
1344	107	Don Pedro Reservoir Inflow Hydrology: Another and more significant aspect of the Don Pedro Reservoir inflow hydrology is that since it is a daily record, the SWB could have employed this data set to properly investigate the alternatives actually proposed in the SED. According to the SED (see Appendix K), the February through June releases to instream	Please see Master Response 1.1, General Comments, for responses to comments that do not raise significant environmental issues or make a general comment regarding the plan amendments. Please also see Master Response 3.1, Fish Protection, for information about comments presenting information that do not conflict with or contradict the key scientific information used to support the impact

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		flows on all three eastside tributaries would be the 7-day rolling average of the unimpaired inflow. Since the WSE model only had monthly inflow data, the SWB analysis was only able to examine monthly variations in flow (that is, constant or flat flows) in the lower Tuolumne River. Monthly average flows do not adequately represent the daily variations in flow that occur in the river, which are especially variable in the February through June time period. In fact, since monthly flat flows are not the preferred alternative, the SWB never actually evaluated the preferred alternative, and therefore, is not able to draw any reasoned conclusions about floodplain inundation or river temperature benefits under the preferred alternative since these were not properly evaluated. The SWB neglected to use the best available hydrologic record in its possession for developing the 7-day rolling average flow record and the associated percents of unimpaired flow which would have represented the instream flow variability of the preferred alternative.	determinations or benefit assessments in the plan amendments. Please also refer to the discussion of the use of a monthly model and temperature, and note that there may be differing opinions as to how to approach an analysis for a given resource, or which data sets should be used, but these differing opinions do not equate to inadequacy.
1344	108	The Tuolumne River Operations Model: As part of the Don Pedro Project's FERC relicensing process, the Districts developed a daily operations model for the entire Tuolumne River system, consisting of both the Districts' Don Pedro project and water operations of the upstream Hetch Hetchy Project owned and operated by CCSF, including the protocols for CCSF's use of the "water bank" privileges it has in Don Pedro Reservoir. The WSE model does not consider the Hetch Hetchy operations and its potential effects on Don Pedro inflows. Omitting the role of CCSF's Hetch Hetchy System in the flow regime of the Tuolumne River is a shortcoming of the WSE model when representing Tuolumne River flows and effects of the SED alternatives. The Tuolumne River Operations Model is fully available to the SWB; and SWB staff were trained in its use in 2013 (FLA, Don Pedro Project 2014).	Please also see Master Response 3.1, Fish Protection, for information about comments presenting information that do not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the plan amendments. Please also refer to the discussion of the use of a monthly model and temperature, and note that there may be differing opinions as to how to approach an analysis for a given resource, or which data sets should be used, but these differing opinions do not equate to inadequacy.
1344	109	Don Pedro Reservoir 3-D Temperature Model: On page 5-60 of the SED in a section discussing the HEC-5Q temperature model employed by the SWB, the SWB states: "The model simulates the reservoir stratification, release temperatures, and downstream river temperatures as a function of the inflow temperatures, reservoir geometry, and outlets, flow, meteorology, and river geometry." Here the SWB misrepresents the capability of a model it used in the development of the SED, in this case, the SJR HEC-5Q model. HEC-5Q is a one-dimensional model, meaning that each of the three dimensional locations along the length of the reservoir is represented in one dimension only, therefore, reservoir geometry is not simulated as the SWB represents. This is important for several reasons. First, the shape and physical structure of the Don Pedro Reservoir is highly dendritic with complex plan and profile divergences and convergences. Its geometry can't possibly be accurately represented by a one-dimensional model. The complex three-dimensional configuration has implications for reservoir temperature stratification. A 1-D model is not adequate to accurately depict the thermal regimes of this complex reservoir. This is particularly true when it is recognized that the old Don Pedro Dam still remains in the reservoir and introduces even greater complexity to the reservoir thermal regime. In addition, a 1-D reservoir model cannot depict the 2-D dimensions of outlets, and, therefore, cannot reliably predict reservoir release temperatures. Recognizing these complexities, and the importance of reliably depicting the full reservoir thermal regime, old Don Pedro Dam, and reservoir outlets, the Districts developed a state-of-the-art 3-D reservoir temperature model. The Districts' 3-D reservoir	Please refer to Master Response 3.2, Surface Water Analyses and Modeling, regarding hydrologic and water temperature modeling including reservoir operations, modeling assumptions, and use of best available information. Also see Appendix F1, Hydrologic and Water Quality Modeling, for details on the water supply effects modeling and temperature modeling. As described in Appendix F1, reservoir geometry considered in the WSE model included elevation, surface area, and volume.

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		temperature model is the best available science, the SWB is aware of this model, and it is available for use.	
1344	110	Fall-run Chinook Population Model: As part of relicensing, the Districts developed, in consultation with the relicensing participants, a detailed fall-run Chinook population model that simulates the in-river life stages of that species in the Tuolumne River. This model incorporates data collected over the past 20-plus years on fall-run Chinook in the Tuolumne River, including data on adult spawning, redd location and superimposition, egg incubation, emergence, fry dispersal and development, parr growth, and smolt outmigration. The model includes and considered data on habitat availability by life stage and how it varies with flow, food availability, temperature response, size-at-age, size-at-river-exit, and survival by life stage. The SWB staff participated in the collaborative model development process, all of which is documented in the Don Pedro Project Final License Application filed with FERC in April 2014, and which is appended to these comments on the SED (see Appendix G [ATT20]). This model predicts changes in-river survival under different Don Pedro Project operation scenarios and can be used to evaluate alternative flow and non-flow measures and their effects on Tuolumne River fall-run Chinook in-river survival. This is the best available science and should have been used by the SWB when considering changes to the Tuolumne River.	Please see Master Response 3.1, Fish Protection, regarding the use of best available science, including discussion of the use of surrogates, and predation studies conducted on the Tuolumne River. The State Water Board considered studies conducted on the Tuolumne River. Many of these studies are related to the FERC relicensing process, in which State Water Board staff are heavily involved as part of the Clean Water Act section 401 water quality certification process. For example, the floodplain and weighted usable area (WUA) evaluations in Chapter 7, Aquatic Biological Resources, use information prepared during the FERC relicensing process. The model cited by the commenter is limited to the geographic area of the Tuolumne River. The State Water Board needed a model that would provide insight into the demographics of the salmon population from the SJR and three eastside salmon bearing tributaries (Stanislaus, Tuolumne, and Merced Rivers). Furthermore, according to public comments on the District's draft license application, NMFS disagrees with several aspects of the Chinook Salmon Population Model, O. mykiss Population Model, and the studies and literature that pertain to model development, application and preliminary conclusions.
1344	111	O. mykiss Population Model: A population model for in-river life cycle stages of O. mykiss was also developed as part of the Don Pedro Project relicensing based on in-river data collected on O. mykiss in the Tuolumne River. Since the SED did not even attempt to undertake a valid scientific investigation to assess the effects of the SED alternatives on in-river O. mykiss populations in any of the eastside tributaries, this population model would have been especially beneficial to the SWB. Instead, the SWB simply presumes that flows that benefit fall-run Chinook will also benefit O. mykiss because both are salmonids. This oversimplification is not reasonable on the face of it, for it is recognized that O. mykiss life-stage periodicities in the Tuolumne River, determined using river-specific data, are substantially different than that of fall-run Chinook, and even more broadly, O. mykiss are acknowledged throughout the literature to have one of the most complex life histories of any fish species. The SWB's presumptions about the effects of the SED's alternatives on O. mykiss lack the careful scrutiny that could have been achieved by using this model.	Please see response to comment 1344-110.
1344	112	Fall-run Chinook and O. mykiss Spawning and Population Studies: The Districts have collected accurate river counts of adult escapement in the Tuolumne River since 2009. The Districts have also undertook spawning and redds assessments over many years. The Districts have also conducted O. mykiss population relative abundance studies. These studies would have informed the SWB's decision-making process through the use of the best available science on Tuolumne River anadromous species.	Please see response to comment 1344-110.
1344	113	Predation Studies: The SED barely acknowledges the large populations of non-native predator species in the eastside tributaries and the LSJR, and the significant role they play in the high mortality rates of fall-run Chinook fry and juveniles. In fact, the SED seems to ignore this important, and potentially limiting, factor to fall-run Chinook populations. The Districts conducted a Predation Study on the Tuolumne River in 2012, and reported the results in 2013. The findings were highly informative. Virtually all of the mortality measured by the two Tuolumne River RSTs could be accounted for by predation by just three species: largemouth bass, smallmouth bass, and striped bass. Considering this study would have	Please see Master Response 3.1, Fish Protection, regarding use of best available science, benefits of the unimpaired flow approach, and consideration of predation, including the study cited by the commenter.

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		greatly informed the SWB's decision-making process. The Districts' analyses using the best available science concerning predation in the Tuolumne River demonstrate that a small change in the current flows, discharged at biologically functional times, combined with specific predator reduction and control measures improves fall-run Chinook smolt survival to a much greater extent than the 40%, 50%, or 60% unimpaired flow. Instead, the SWB has chosen to rely on inferences that high flow by itself will substantially reduce the current high mortality rates on fry and juvenile salmon. While RST data do show higher survival of smolts on the Tuolumne River under certain flows, this is only in the high flow years ("wet years") and this increase is not observed in all high flow years. Furthermore, studies of predation on the LSJR have shown high predation rates during all water year types. The SWB chose to ignore this important information about the role of predation related to fall-run Chinook in-river survival on the Tuolumne River.	
1344	114	Otolith Study: [Footnote 48: See Appendix H [ATT21] of these comments for the Otolith Final Study Report, e-filed with FERC post-FLA filing.] The Districts, with the cooperation of the CDFW and UC Santa Cruz, conducted a study of fall-run Chinook otoliths from five different year classes representing a range of year types. This study consisted of deconstructing the otoliths of fall-run Chinook adults from the Tuolumne River to determine, among other things, rearing location and growth rates. There are a number of interesting findings from this study. One of the findings of the study is that fall-run Chinook adult escapement in the Tuolumne River is chiefly made up of fish that leave the Tuolumne as parr or smolts. In the years represented in the study, it was shown that fish which leave the Tuolumne River as fry are poorly represented (less than 5%) in subsequent escapements (FLA, Don Pedro Project 2014). This points to the possibility of high predation losses in the San Joaquin River and Delta or overall poor rearing conditions in the LSJR. Considering this study would be of significant value to the SWB because as cited in Jeffres et al. (2008), high early flows can displace fry and young juvenile fish well downriver where rearing conditions appear to be poorer. The SWB chose to ignore the findings of this study.	The additional information provided with regard to the otolith study on the Tuolumne River does not affect the overall conclusion that a more natural flow regime from the salmon bearing tributaries (Stanislaus, Tuolumne, and Merced Rivers) is needed. Please see response to Comment 1344-110 regarding consideration of FERC studies. Please also see response to Comment 1344-86 regarding use of best available science, importance of higher and more variable flows during the February through June time period, and SED consideration of predation.
1344	115	Thermal Capability of Wild Juvenile O. mykiss: The Districts supported a study planned and conducted by fishery researchers at UC Davis and University of British Columbia (UBC) to investigate the thermal performance of wild juvenile O. mykiss that inhabit the Tuolumne River. This state-of-the-art study employed the use of swim tunnels and highly accurate measuring devices to evaluate the thermal tolerance of wild fish. Over the last ten or more years, a large amount of research and studies have consistently shown that fish in general, and O. mykiss in particular, express population-specific performance in many traits -- growth, swimming performance, lethal thermal limits-each of which can be shaped by the temperature characteristics of their environment. The Districts' funded study evaluated the absolute aerobic scope (AAS) of wild Tuolumne River juvenile fish and how AAS changed with changes in temperature. While the SED does not present any direct relationships between reductions in temperature from current conditions and improvements in fish growth, health, or survival, the SED generally assumes a "colder-is-better" paradigm for all salmonid species in the eastside tributaries, including the Tuolumne River. However, the study performed by the UC Davis and UBC researchers found this not to be the case. Wild juvenile O. mykiss on the Tuolumne River performed optimally at approximately 21°C to 22°C, and within 5% of the maximum performance from 18°C to 24°C. Summer flows recommended by the SWB are intended to reduce temperatures below 18°C to benefit O. mykiss. However, this study, representing the best available science on Tuolumne River O.	Please see response to comment 1344-59 regarding the wild juvenile O. mykiss study cited by the commenter. Please see Master Response 1.1, General Comments, regarding the scientific basis of the plan amendments and Master Response 3.1, Fish Protection, regarding the adequacy of the temperature analysis, including the use of USEPA recommended temperature criteria, and reductions in harmful and lethal temperatures.

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		mykiss, was arbitrarily ignored by the SWB. This study was recently published in the respected journal Conservation Physiology and is now part of the peer-reviewed scientific literature on O. mykiss thermal tolerance (Verhille et al. 2016). The Districts are submitting this study in full with these comments on the Draft SED (see Appendix E [ATT18]).	
1344	116	Tuolumne River Floodplain Hydraulics Study: The Districts, at the request of the CDFW, USFWS, and SWB conducted an assessment of the relationship between flow and floodplain habitat for the entire 52-mile lower Tuolumne River. This is the most recent, best scientific information available on the floodplain system of the Tuolumne River. Unlike the USFWS (2008) study used by the SWB to estimate floodplain area-flow relationship for the Tuolumne River, the Districts study, developed in consultation with the resource agencies, recognized that not all wetted floodplain area is suitable fish habitat, The Districts study, evaluated using 2-D hydraulic modeling, developed floodplain habitat versus flow relationships. This recent study used LiDAR imagery from 2011 (versus early 1990s imagery used in the USFWS 2008 study) and supplemented existing river cross-section data with dozens of additional river transects to capture all potential hydraulic controls in order to accurately evaluate when floodplain inundation occurs. This study was released to the SWB in 2015. It is being filed with these comments in its final form which incorporate the Districts' response to comments provides by the USFWS (see Appendix F [ATT19]).	Please see response to comment 1344-72. The final report of the study cited in the comment was released publically in February 2017, several months after the SED was released. As such, the report was unavailable to staff during preparation of the SED. The report concludes that, overall, flows above bankfull discharge are associated with increases in habitat area for juvenile life stages of lower Tuolumne River salmonids. These findings are not inconsistent with the SED and are acknowledged in Master Response 3.1, Fish Protection (see the adequacy of the floodplain analysis discussion). Furthermore, expanding the floodplain analysis in the SED to incorporate the entire Tuolumne River would likely increase the floodplain inundation benefits associated with the plan amendments.
1344	117	Presentation of Results: The SWB's representation of "floodplain benefits" as "acre-days" gives the reader the impression that the SWB's analysis was conducted using daily flows (when, in fact, the flows were average monthly flows assumed to be the same for each day of the month). This implies a level of detail to the analysis of the relationship between flow and floodplain inundation for each day of the period of record of 1922 to 2003 which did not occur. This is misleading and gives a false impression to the public. Only by examining the computer model itself does it become apparent that the SWB's floodplain benefits analysis was conducted using monthly average flows, not daily average flows, and that the "acre-days" was simply computed by multiplying by the number of days in the month. These values should be properly presented as "acre-months" and avoid giving the reader the impression that the SWB used "acre-days" to simply make the numbers larger.	Please see Master Response 3.1, Fish Protection, regarding adequacy of floodplain modeling, including use of modeled monthly flow in the floodplain analysis and use of acre-days to evaluate benefits of increased floodplain inundation. Please see Master Response 2.3, Presentation of Data and Results in the SED and Responses to Comments, regarding the types of data used and presented in the SED.
1344	118	Inundation Duration: The SED does not adequately discuss the importance of inundation duration when assessing use of floodplains by juvenile salmon. The importance of this parameter is brought up in several of the citations referenced in the floodplain benefits assessment section of the SED. It is a matter of debate in the scientific literature regarding the amount of time, in consecutive days, suitable floodplain habitat needs to be inundated to have a measurable benefit on juvenile salmon growth (even assuming the floodplain has more plentiful food than the river channel). There are trade-offs for fish selecting floodplain habitats over in-river habitats, including energy use, food supply, overall habitat suitability, stranding risk, and other factors. Certainly providing say one day or two consecutive days of floodplain access would not be sufficient to produce some measurable benefit in growth. The SED cited two studies (Sommer et al. 2001; Jeffres et al. 2008) related to the growth of juveniles residing on floodplains. Both of these studies measured juvenile salmon growth of fish residing continuously on the floodplain over relatively long periods. On page 19-53 of the SED, SWB cites Jeffres et al. (2008) as saying "[t]he benefits of floodplain inundation generally increase with increasing duration, with even relatively short periods of 2 weeks providing potential benefits to salmon (Jeffres et al. 2008)." While there does appear to be	Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, presents results for approximately 30-day (depending on the month) duration events. Tables 19-22 to 19-27 indicate that monthly average flows will be higher more often under the plan amendments in the range that is meaningful for floodplain habitat. The adaptive implementation process will allow the fine tuning of flows to achieve desired floodplain timing, magnitude, and duration. Please refer to Master Response 3.1, Fish Protection, regarding the adequacy of the floodplain analysis, benefits of floodplain inundation, the appropriateness of the acre-days approach, and the relationship between floodplain and temperature. Please see Master Response 2.2, Adaptive Implementation, for clarifying descriptions and examples of adaptive implementation. Jeffres et al. (2008) reported that after 17 days, the average length of juvenile Chinook salmon in the flooded vegetation site and upper floodplain pond were significantly greater than salmon in the river channels sites (see pages 453 and 454, and Figure 4 of Jeffres et al. 2008). The word "approximately" has been added to Chapter 19 (page 19-61) to more accurately characterize the statement regarding "2 weeks". The quotation by the commenter regarding Jeffres et al. (2008) is out of context. According to Jeffres et al.

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		some general scientific consensus that a period of at least two weeks of continuous residence time may be needed for juvenile salmon to derive a growth benefit (Matella and Merenlender 2014),the reference to two weeks cannot be found in Jeffres et al. (2008). In fact, we cannot find the statement the SWB attributes to Jeffres et al. (2008) anywhere in the Jeffres report. What Jeffres et al. (2008) actually states is quite informative, but is seemingly ignored by the SWB. Contrary to the temperature of 16°C the SED puts forward as necessary for juvenile core rearing in Table 19-1, Jeffres et al. (2008) found "[h]igher water temperature is one of the factors that distinguished floodplain habitat from the river habitat. Temperatures on the floodplain for a 1-week period had a daily average of 21°C and reached a daily maximum of 25°C and fish continued to grow rapidly." Jeffres et al. (2008) also specifically states "[r]earing on a floodplain is a balance of risk and reward for juvenile salmon. Growth rates can be very high on the floodplain, but fish risk stranding and periods of stagnation, which can also create conditions lethal to juvenile salmon." These two findings by Jeffres et al. (2008) may have been ignored because they do not support the SWB's temperature "criteria" provided in Table 19-1. The fact that the SWB has no data on food availability on any of the floodplains of the eastside tributaries, and therefore could not make any reasoned about the value of providing flows sufficient to provide access to the floodplains, is a serious shortcoming and should be acknowledged and discussed in the SED. For discussion purposes, and by example, the Tuolumne River floodplain has undergone substantial modification since the late 1800s. Modifications by urban development, gravel mining, agricultural development, and levee construction have restructured and disrupted the natural floodplain ecosystems. Furthermore, non-native vegetative species are prominent in the limited amount of remaining vegetated floodplains. To simply presume that the Tuolumne River floodplain has greater food availability than the river channel is unsupportable, especially when site-specific data exist that show the in-river food sources to be plentiful.	(2008), "[h]igher water temperature is one of the factors that distinguished floodplain habitat from the river habitat (Fig. 3). The optimum temperature for growth of juvenile salmon is dependent on food availability. Temperatures from 14°C to 19°C provide optimal growing conditions for juvenile Chinook salmon fed at 60% to 80% of satiation (Marine and Cech 2004; Richter and Kolmes 2005). In habitats where food is abundant and fish are satiated, temperatures for optimum growth may be higher than those observed in studies where food is limited (Myrick and Cech 2004). Temperatures on the floodplain for a 1-week period had a daily average of 21°C and reached a daily maximum of 25°C and fish continued to grow rapidly. Continued growth at high temperatures implies that food is not limiting during warm water conditions… Our study indicates that off-channel floodplain habitats provide significantly better rearing habitat, supporting higher growth rates, than the intertidal river channel. Variable responses in both growth and mortality in the habitats investigated, however, indicate the importance of providing habitat complexity for juvenile salmon in floodplain reaches of streams, so fish can find optimal places for rearing under varying flow conditions. When juvenile Chinook salmon leave fresh water at a larger size, as seen in fish reared on floodplains, overall survivorship to adulthood is increased (Unwin 1997; Galat and Zweimuller 2001). Restoration of river-floodplain connectivity should thus prove to be an effective part of any salmon conservation strategy. This study and that of Sommer et al. (2001) show that restoring floodplain habitats in Central California should have major benefits to Chinook salmon populations." The commenter seems to be suggesting that water temperatures over 21°C are more beneficial to salmonids compared to lower water temperatures based on the study and remarks of Jeffres et al. (2008). It is unclear how the commenter is reaching this apparent conclusion based on several days of high temperatures at the tail end of the Jeffres et al. (2018) study. It is also possible that the lower temperatures in previous weeks (see Figure 3-a in Jeffres et al. 2018), in combination with abundant food created fish that were in good condition and had energy reserves to carry them through several days of hot temperature conditions. Additionally, when comparing Figure 3 and Figure 4 in Jeffres et al. (2018), it appears that growth rates slowed down dramatically after March 19, 2004 (see Figure 4), when temperatures were much higher (Figure 3). The longer term and more controlled temperature study on Central Valley Chinook salmon by Marine and Cech (2004; as cited in SED Chapter 19) found that "juveniles reared at 21–24°C experienced significantly decreased growth rates, impaired smoltification indices, and increased predation vulnerability compared with juveniles reared at 13–16°C. Fish reared at 17–20°C experienced similar growth, variable smoltification impairment, and higher predation vulnerability compared with fish reared at 13–16°C". Please see Master Response 3.1, Fish Protection, regarding the adequacy of the temperature analysis, the use of USEPA recommended temperature criteria, and reductions in sublethal and lethal temperatures. Furthermore, on the Stanislaus River, USFWS (2014; as cited in Chapter 19) found a significant relationship between juvenile survival and floodplain acre-days, with floodplain acre-days explaining 77 percent of the year to year variation in juvenile survival on the Stanislaus River. The vast amount of floodplain literature is supportive of floodplain habitats as being an overall positive benefit to native fish, which are adapted to use seasonal floodplain habitat (see Moyle, Peter B., Patrick K. Crain, and Keith Whitener. 2007. Patterns in the Use of a Restored California Floodplain by Native and Alien Fishes. San Francisco and Estuary Watershed Science. Volume 5, Issue 3. Article 1). Please see response to comment 1344-62 regarding food availability on the Tuolumne River. Please see response to comment 1344-75 regarding stranding.
1344	119	The Role of Hatcheries: [Footnote 49: The potential effects of hatcheries on the SED's Amended Plan is discussed extensively in Appendix A [ATT14] attached to these comments.]	Please see Master Response 3.1, Fish Protection, regarding the role of hatcheries, recommended actions for other agencies (e.g., improving hatchery programs for species of concern), current fish decline and the need

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		It has long been recognized that anadromous fish hatcheries play an important, often critical, role in sustaining and protecting salmon populations. It is also widely recognized that hatchery bred and reared salmon can have adverse effects on natural salmon production. The SED acknowledges this and lists hatcheries (see Chapter 7) as one of the anthropogenic factors affecting salmon populations on the three eastside tributaries. The SED also makes it clear that the goal of the revised Plan is more than just increasing fall-run Chinook populations, the flow objective is to "support and maintain the natural production of viable native SJR Watershed fish populations migrating through the Delta", although this goal seems to abruptly change in Chapter 13 and further on in the SED when the phrase "and meet any biological goals" appears. Fall-run Chinook salmon is considered a "species of concern" by NMFS under ESA, indicating its sensitive status. On page 7-13, the SED duly notes "[t]he federal status of fall-run Chinook salmon is due in part to concerns regarding hatchery influence". Although the potential adverse effects of hatchery operations on natural production are acknowledged, there is no discussion of how, or if, increased instream flows in the three eastside tributaries would reduce hatchery influences or benefit naturally produced salmon over hatchery salmon. The SWB is obligated to show through scientific analysis that the increased flows proposed by the Amended Plan would increase natural production of fall-run Chinook salmon in light of the dominance of hatchery fish in the adult escapement. The mechanism by which the SED's proposed flow increases would decrease the hatchery influence and increase natural production is not discussed or addressed in the SED. On page ES-20, the SWB calls for "[i]mprove(d) management and operation of fish hatcheries" as a recommendation of the revised Plan. However, the SED also reports CDFW's response to this comment in Appendix M when it states "CDFW also takes issue with the assertion that it should "develop and implement improvements to its anadromous fish hatcheries." In Chapter 7, the SWB provides brief descriptions of each of the three eastside tributaries. Specifically related to the influence of hatcheries, the SED indicates that fall-run Chinook salmon populations on each of the three tributaries are "maintained by natural production and hatchery strays". This description seriously misrepresents the influence of hatchery fish on natural production in the eastside tributaries. On the Stanislaus River, recent escapements have been essentially 100% hatchery fish. The Tuolumne River hatchery influence is reported to be nearly 80%, as is the Merced fall-run Chinook run. How increased flows will reduce hatchery influence and its attendant adverse effects and benefit natural production is never explained in the SED. There is no evidence provided in the SED that could lead the SWB to conclude that simply increasing instream flows will somehow reduce the influence of hatchery releases. However, the opposite is true, at least on the Tuolumne River. The Otolith Study undertaken on the Tuolumne River show that fish leaving the Tuolumne River as fry make up a very small percent (<5%) of the later adult escapement. On the other hand, hatchery fish are released as smolts, and these fish, comparatively, may be aided in their outmigration through the Delta by higher spring flows, continuing the trend to less natural production and greater influence of hatchery fish. The SED does not consider or discuss this possibility, nor provide a rationale for why it is unlikely to occur. The SED states in Chapter 19 that the "Stanislaus, Tuolumne, and Merced Rivers (individually or combined) have had larger reductions in the natural production and returns from the ocean of adult fall-run Chinook salmon than any of the other tributaries (or combination of tributaries) to the Sacramento	for increased flow, benefits of the unimpaired flow approach, and adaptive adjustments and uncertainty. Please also see response to Comment 1344-110 regarding consideration of FERC studies (e.g., otolith study cited in the comment). The State Water Board recognizes that non-flow measures have a complementary role to flow-based restoration. Please see Master Response 5.2, Incorporation on Non-Flow Measures, regarding the role of non-flow measures in the overall health of the tributaries and how non-flow measures relate to the plan amendments.

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		River". The SED appears to then immediately jump to the conclusion that the cause is too little flow. The SED would benefit from a more complete discussion of the many potential causes of this reduction. The first issue to discuss would be the lack of data on hatchery operations before 2007 when CDFW initiated a program of constant fractional marking of hatchery releases. The impact of hatchery fish on the native Tuolumne River fall-fun Chinook population deserves additional discussion. Reliable estimates of natural production are highly uncertain, and this uncertainty should be acknowledged in the SED. The SWB suggests the distinct possibility the adverse effects of hatchery releases on the Tuolumne River native Chinook run in Chapter 7 (page 7-39): "In recent years, up to 200,000 hatchery-origin salmon from the Merced River Hatchery have been released annually in the Tuolumne River. As a result, a significant number of hatchery-origin Merced River salmon return to the Tuolumne River each year. Fish produced by the hatcheries have the potential to negatively affect natural fall-run Chinook salmon by displacing wild salmonid juveniles through competition and predation, competing with natural adults for limited resources, and hybridizing Central Valley Chinook salmon with fish from outside the SJR Basin (CDFG 2011a)." [Footnote 50: This quote from Chapter 7 identifies the potential adverse effects of hatchery releases on natural production of fall-run Chinook salmon. The number of releases to the Tuolumne provided in the quote is far larger than the annual CWT releases prior to 2005, which were on the order of 100,000. Since 2008, there have been only three releases of hatchery salmon to the Tuolumne, none of which totaled more than about 7,000 fish.]	
1344	120	Stranding: The SED acknowledges the potential for floodplain inundation to result in adverse effects on juvenile salmon if stranding of juvenile fish occurs when water levels drop or due to exposure to avian predation in shallow areas. In Chapter 19, page 55, the SED states "[i]n addition, areas with engineered and managed water control structures can have comparatively higher rates of stranding fish (Sommer et al. 2005). Further, floodplains that are too shallow or that lack vegetative cover may also make salmon more susceptible to avian predation (Gawlik 2002)." The amended Plan in Appendix K goes so far as to recommend that interested parties should take steps to "reduce salmon stranding events in ponds, pits, and other unnatural features by physically modifying problem areas within river corridors." As mentioned above, virtually the entire Tuolumne River floodplain could be considered to have "unnatural features". The SWB received a number of comments on its 2012 draft Plan related to the potential for stranding of juvenile fall-run Chinook on floodplains emphasizing that "evaluating the effects of redd dewatering and fish stranding losses base on average monthly flow does not accurately capture the effects on aquatic species." (See Appendix M, pg. 24 of the SED). The SWB has made no attempt to examine this potential adverse effect in the current draft Plan on any one of the three rivers' floodplains. This is especially the case on the Tuolumne River floodplain where, as pointed out above, the USFWS acknowledged this possibility. This would not have been difficult to do given that the Tuolumne River Floodplain Hydraulics Study, undertaken as part of the relicensing of the Don Pedro Project, contained information enabling the performance of such an investigation, and was in the possession of the SWB since September 2015.	The quotations from Chapter 19 were made to emphasize that the quality of floodplain habitat is important, not to acknowledge the potential for floodplain inundation to result in adverse effects on juvenile salmon. Refer to response to comment 1344-75 regarding stranding. Refer to response to comment 1344-110 regarding consideration of FERC studies. Refer to response to comment 1344-116 regarding the Tuolumne River Floodplain Hydraulics Study.
1344	121	Accretion Flows: According to SWB's analysis, accretion flows in the lower Tuolumne River make up a significant portion of the preferred alternative's February through June 40% unimpaired flow requirement. Each alternative in the SED is defined such that the flow	The CALSIM II water balance, including accretion estimates used in the WSE model, is the most appropriate and long-standing information that was available at the time of the analysis, and is sufficiently credible to make reasonable impact assessments in the SED. Furthermore, specific to the Tuolumne, the CASLIM

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		requirement applies at the confluence of the tributary with the San Joaquin River (see pg. 3-14). However, since there are no streamflow gages at these locations, the "compliance" point was moved to the streamflow gage that is closest to the confluence. It's worth mentioning that this location for computing unimpaired flow is problematic, given for example, the 24 hour travel time on the Tuolumne River between the point of release to the downstream gage under normal flows. But there's a larger problem related to water accounting in the SED's analysis when is using the Modesto USGS gage as the location for estimating unimpaired flow. This problem involves the method used to estimate accretion flows between the La Grange and Modesto gages. The accretion flow estimates, which play a large role in meeting the flow targets, were pulled directly from CalSim II into the WSE model. As shown in Table TR-2 [ATT10], the assumed accretions account for about 20% of the 40% unimpaired flow requirement in the Tuolumne River. The accretion/depletion assumptions from CalSim II are calculated using the difference in monthly volume between the downstream and upstream gages, as well as some assumptions about return flows and riparian diversions as reported in USBR (2005). A significant problem with assuming such a high percent of the SED's required flows are made up of accretion flows is that it requires perfect foresight for this method of counting accretion flows to be part of the 40% UF. This is impossible in real time, and lacks practical application. However, the most significant problem with assuming such high accretion flows lies with their lack of reliability in the future. Even now, the values in CalSim II are outdated and overestimate the accretion flows. Figure TR-16 [ATT11] shows recent data on accretion flows in the Tuolumne River and depicts the systematic overestimation of accretion flows built into the SWB's WSE model. The SED fails to recognize this significant change in accretion flows. The result of the erroneous assumptions regarding the volume of accretion flows is that it leads the SWB to underestimate the flow contribution required to be released from Don Pedro Reservoir to meet the 40%UF at the Modesto gage, which in turn leads the SED to underestimate the economic impact to the Districts of the SED's alternatives. More importantly, as groundwater levels drop as predicted by the SWB due to reduced recharge as a result of the Amended Plan's flow prescription, accretion flows will be further reduced, even to the extend where the Tuolumne River between La Grange and Modesto may become a depleting reach and not an accreting reach. Furthermore, the SED has not accurately accounted for the riparian diversions that occur in the Tuolumne River between La Grange and the confluence.	monthly accretions are based on a gage comparison, where data is available, and represent the actual accretions in the river. The accretion flows in the WSE model are considered reliable for the study period 1922-2003 as used for comparative purposes. Please refer to Master Response 3.2, Surface Water Analyses and Modeling, for a fuller discussion of the accretion/depletion assumptions of the WSE model, calculation of percent of unimpaired flow, and the measurement and compliance locations.
1344	122	[ATT10:] Table TR-2. Portion of 40% unimpaired flow met by SWB's assumed accretions (1923-2015).	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	123	[ATT11:] Figure TR-16. Plot of actual accretion flows between the Tuolumne River La Grange and Modesto USGS gages since WY 2007 and assumed values in the SWB's analyses.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	124	Predation: The SED acknowledges the detrimental effect of predation of fry and juvenile salmon by non-native species. In Appendix C, Technical Report on the Scientific Basis for	Please refer to Master Response 3.1, Fish Protection, regarding predation and non-flow measures, the 2013 FishBio study, adequacy of the temperature analysis, USEPA recommended temperature criteria, reductions

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		Alternatives San Joaquin River Flow and Southern Delta Salinity Objectives, predation is identified as not only a limiting factor, but a significant limiting factor, for fall-run Chinook salmon outmigrant survival in the SJR Basin and southern Delta and a major impediment to Central Valley salmon recovery efforts. On page 16-188, the SED reports that "[j]uvenile salmon are clearly consumed by fish predators and several studies indicate that the population of predators is large enough to effectively consume all juvenile salmon production." As for the Tuolumne River specifically, in the most recent study of predation (FishBio 2013) it was shown that predation by just three species -- striped bass, largemouth bass, and smallmouth bass -- was sufficient to account for all the losses of juveniles estimated to occur between the two RSTs. Large juvenile mortalities occur in the Tuolumne River at all river flows except the very wettest years. It's not possible to have every year be a wet year, therefore, without addressing the effects of predation, none of the alternatives evaluated in the SED should be expected to materially increase outmigrant survival. This result is essentially predicted by the SalSim model, which may be a reason why the SWB is now discrediting the SalSim model results. The SWB makes no effort to quantitatively evaluate the effect of predation in the three eastside tributaries, nor quantitatively assess what benefits would occur with even a small-to-modest reduction in predation rates. The SWB is in possession of, and has been trained to use, a model that can be used to perform such an assessment, at least for the Tuolumne River. The SWB has chosen not to perform this assessment. Instead of using site-specific information of the Tuolumne River, the SWB relies on Marine and Cech (2004) where, according to the SED, it was found that juvenile salmon that were reared in 21-24°C (69.8°F-75.2°F) were significantly more vulnerable to predation by striped bass than juvenile salmon reared at lower temperatures. To be clear, the results of the experiment reported in Marine and Cech (2004) were that "[j]uvenile Chinook salmon reared at 21-24°C for 2.5 months exhibited an increased vulnerability to predation compared with fish reared at 13-16°C or 17-20°C". Since juvenile fish on the Tuolumne River do not rear at anywhere near these experimental temperatures for the period tested (21-24°C for 2.5 months), that part of the findings of Marine and Cech (2004) would not be applicable. On the other hand, Marine and Cech (2004) did find that "growth performance of juvenile Sacramento River Chinook salmon remained similar among the temperature regimes that included daily maximum temperatures up to 20°C, ,when fed rations similar to those reported for wild fish" and further that that their "laboratory experiments demonstrated that Chinook salmon can readily survive and grow at temperatures up to 24°C" and "we did not observe significant reductions in growth rates for juvenile salmon reared with adequate food to promote growth until daily temperatures (daily means or daily maxima) exceeded 20°C."	in harmful and lethal temperature conditions, use of SalSim, modeling limitations. The State Water Board is not required to undertake a quantitative assessment of every stressor of fish and wildlife, especially ones that have been dismissed as insufficient by themselves to restore native fish populations. The plan amendments are about providing more flow to reasonably protect fish and wildlife, and the State Water Board has provided the required analyses and justification for the flow objectives. Please see comments 1344-59 and 1344-62 regarding the study by Marine and Cech (2004).
1344	125	O. mykiss Impacts: In several sections of the SED, the SWB refers to "steelhead" and "steelhead populations" on the eastside tributary rivers or the LSJR. The first reference appears at ES-78 where the SED reports LSJR Alternative 3 "would substantially improve rearing habitat conditions for Chinook salmon and steelhead in the three eastside streams and LSJR." Aside from there being no empirical data provided in the SED to support "steelhead" rearing on floodplains [Footnote 51: In fact, a number of sources can be cited to show that steelhead/rainbow trout do not use floodplains for rearing. See Bustard and	Please see Master Response 3.1, Fish Protection, for information concerning floodplain benefits, in-channel habitat, and information on weighted usable area. Please also see the following discussion addressing whether steelhead populations exist on the East Side San Joaquin Tributaries. The California Central Valley (CCV) steelhead DPS includes all naturally spawned populations of anadromous O. mykiss below natural and manmade impassable barriers in the Sacramento and San Joaquin rivers and their tributaries (63 FR 13347). However, NMFS considers all O. mykiss that have

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		Narver (1975), Feyrer et al. (2006), Swales and Levings (1989), Keeley et al. (1996), Moyle et al. (2007).] in any of the three eastside tributaries, the SED is implying there exist steelhead populations on the three eastside tributaries. Although NMFS considers that resident and anadromous O. mykiss to be Central Valley steelhead under the ESA, there is little to no evidence of self-sustaining steelhead populations on any of the LSJR tributaries south of the Stanislaus River and the influence of strays from Mokelumne River hatchery releases on any natural origin steelhead on the Stanislaus River have not been evaluated. While an occasional large O. mykiss (presumed to be a "steelhead") has been captured in the Tuolumne River adult fish counting weir, there have been a total of five O. mykiss larger than 16 inches that ascended the counting weir between 2009 and 2014, inclusive. Therefore, there are no data to support "steelhead use" of habitats or predict increase use by steelhead. This is arbitrary speculation on the part of the SWB. In Chapter 7, and other places in the SED, the SWB refers to its use of WUA habitat curves, and for the Tuolumne River cites IFIM studies by Stillwater Sciences (2013). Contrary to recommending higher flows for the fry and juvenile rearing life stages of O. mykiss, this study demonstrates that lower flows produce greater habitat for these two life stages. In fact, maximum fry rearing WUA occurs at flows of 50 cfs to 75 cfs, and maximum juvenile rearing WUA occurs at flows of about 175 cfs. Based upon generalized life history timing from NMFS (2009) and corroborated by seine and snorkel data collected by the Districts' timing of O. mykiss fry rearing in the Tuolumne River occurs from about April through June and juvenile rearing occurs from July through September. There is little to no data to suggest that O. mykiss use floodplain habitat, but instead prefer to use in-channel physical structure and stream margins during early life stages. In fact, a strong case can be made that high flows in the spring months could adversely affect young-of-the-year O. mykiss fry by displacing them into downstream habitats where they will encounter unsuitable and lethal water temperatures even under the UF flow scenarios proposed in the SED. The SED has not recognized or discussed this potential adverse impact on this ESA-listed species, and this is a significant omission in the SED.	physical access to the ocean (including resident rainbow trout) to potentially be CCV steelhead and treats these fish as CCV steelhead. The lower Tuolumne River from LaGrange Dam to its confluence with the San Joaquin River was included in the designation of critical habitat for the DPS (70 FR 52488). The State Water Board acknowledges that resident rainbow trout dominate the phenotypic life history strategy in the Tuolumne River; however, the State Water Board disagrees that there is no evidence of an anadromous life history, based on the otolith microchemistry evidence presented by Zimmerman et al. (2009) indicating the presence of trout with anadromous mothers that spawned in the Lower Tuolumne River. Rainbow trout have anadromous and resident forms that are sympatric and capable of producing offspring with a life history that is different from their own (Seamons et al. 2004; Christie et al. 2011; Zimmerman and Reeves 2000). The mechanisms for the expression of these two forms are driven by differences in selective pressures that favor certain phenotypes over others and differ between the sexes (Quinn et al. 2011; Schill et al. 2010; Gross 1991; Fleming and Reynolds 2004). The commenter presented the history of anthropogenic and environmental changes in the Tuolumne River basin that when coupled with low migratory survival rates within the lower San Joaquin River has driven the trajectory of phenotypic life history toward the resident life history form. The genetics of CCV steelhead below rim dams lack a geographically distinct population structure, which reflects extensive habitat modification and hatchery stocking practices (Pearce and Garza 2015). Recent genetic evidence indicates that the resident form of trout in the lower Tuolumne River is most closely aligned with Lower American River and Nimbus Hatchery rainbow trout, which are from mixed Central Valley, Eel River and Mad River Hatchery origin (Pearce and Garza 2015). This makes the genetic effects largely irreversible, making restoration of the historical population genome largely unattainable; however, genetic effects are not static and with science based recovery planning, the adaptive potential of CV steelhead may be restored to some level (Meek et al. 2014). Such plans will likely be most effective through a combination of actions that restore the viability of natural populations though improved hatchery management and improvements in flow and habitat conditions supporting the anadromous life history form of O. mykiss (NMFS 2014). Floodplains are considered vital to the health of salmon and steelhead populations by providing important habitat during the freshwater phase of their life history cycle (NMFS 2014). There are data to support the use of floodplain habitat by steelhead juveniles. Although juvenile steelhead may not use floodplain habitat in the same way as juvenile Chinook, steelhead do use seasonal and perennial side channels and other off-channel habitats as documented in the Yuba, Trinity, and American rivers (California Department of Water Resources and Pacific Gas and Electric Company 2010; Gallagher 1999, Jones and Stokes 1999, Sellheim et al. 2015). For example, floodplain rearing by steelhead was documented in the American River following spawning gravel augmentation, which increased floodplain inundation and provided juvenile salmonids access to habitats with preferred habitat conditions in overbank areas (i.e., lower water velocities and higher vegetative cover than found in the main channel). Similar responses to increases in the availability of low-velocity areas and cover along the channel margins and floodplains of the San Joaquin River tributaries would be expected in response to more frequent overbank flows under the plan amendments, as discussed in Master Response 3.1. In addition to providing preferred rearing conditions, such habitat also functions as important velocity refuge for juveniles, reducing the risk of downstream displacement from high velocities in the main channel (Gallagher 1999; Sellheim et al. 2015).
1344	126	[ATT12:] ATTACHMENT 1 -- Table TR-1. Review team comments on the SED's citations related to natural flow regime and "unimpaired" flow regime.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	127	[From ATT12:]	Please see Master Response 1.1, General Comments, for responses to comments that do not raise significant

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Ltr#	**Cmt#**	**Comment**	**Response**
		[Ref:] Poff et al. 1997. [Cited:] Chapter 19 and Appendix C, pages 3-40; 3-41; 3-43; 3-47. [Term Defined:] Natural flow regime is that unaltered by human intervention. Poff et al. promotes this concept as the management goal/baseline for river basin ecological restoration decisions, but acknowledges the importance of functional flows. Poff states that for "many rivers, it is land-use activities, including timber harvest, livestock grazing, agriculture, and urbanization, rather than dams, that are the primary causes of altered flow regimes." Alterations of natural flow regimes also include draining of wetlands and construction of levees.	environmental issues, or make a general comment regarding the plan amendments. Please see Master Response 3.1, Fish Protection, regarding the unimpaired flow approach, information and data used in Appendix C, and a description of how the unimpaired flow approach with adaptive implementation will essentially provide functional flows. Please see Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, for information regarding functional flows.
1344	128	[From ATT12:] [Ref:] Tennant 1976. [Cited:] 3-40. [Term Defined:] Suggests using varying percentage of the mean annual flow for seasonal minimum flow targets. Uses "undepleted" USGS hydrology data that refer to the stream in its pristine, natural conditions (e.g., before dams, levees, urbanization, diversions, pumps, etc.).	Please see Master Response 1.1, General Comments, for responses to comments that do not raise significant environmental issues, or make a general comment regarding the plan amendments. External peer review of the scientific basis for the plan amendments was performed in 2011. The peer reviewers concluded that under the current altered flow regime, fish and wildlife beneficial uses are being impaired; furthermore, a more natural flow pattern would be beneficial to fish and wildlife. Please see Master Response 3.1, Fish Protection, for more information. Please also see Master Response 3.2, Surface Water Analyses and Modeling, for information regarding the adequacy of SED hydrologic modeling and a description of unimpaired flow calculation.
1344	129	[From ATT12:] [Ref:] Orth and Maughan 1981. [Cited:] 3-40. [Term Defined:] Provides an evaluation of Tennant Method -- i.e., percentage of "undepleted" (Tennant 1976) mean annual flow (aka "Montana Method") for Oklahoma streams. Recommended that slightly different percentages of the "undepleted" mean annual flow was applicable for streams in Oklahoma.	Please see Master Response 1.1, General Comments, for responses to comments that do not raise significant environmental issues, or make a general comment regarding the plan amendments. Please refer to Master Response 3.2, Surface Water Analyses and Modeling, for information regarding the adequacy of SED hydrologic modeling and a description of the unimpaired flow calculation.
1344	130	[From ATT12:] [Ref:] Marchetti and Moyle 2001. [Cited:] 3-40. [Term Defined:] Collected empirical fisheries data during dry and wet years in Putah Creek, CA, following two wet years which resulted in the displacement of non-native species to downstream reaches. Final flow regime to support native species employed patterns of a natural flow regime, not a pure unaltered (i.e., mimicking the timing and duration of flow variation in the natural flow regime, but not necessarily the overall magnitude or volume).	Please refer to Master Response 3.1, Fish Protection, regarding the current fish decline and the need for increased flow, the use of best available science, justification and description of the plan amendments for protecting fish, including the unimpaired flow approach, benefits thereof, and a description of how unimpaired flow with adaptive implementation will essentially provide functional flows. Refer to Master Response 2.2, Adaptive Implementation, for more information on adaptive implementation of the plan amendments. See Master Response 3.2, Surface Water Analyses and Modeling, regarding additional details of the hydrologic modeling. Also refer to Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, for additional discussion of how higher and more variable flows are anticipated to improve conditions for fish and other ecosystem attributes. Refer to Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, for the quantitative evaluation of the measureable benefits of the plan amendments for the LSJR flow objectives in terms of potentially available cold water and floodplain habitats, and associated population implications to native salmonids.
1344	131	[From ATT12:]	Please see Master Response 1.1, General Comments, for responses to comments that do not raise significant

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		[Ref:] Mazvimavi et al. 2007. [Cited:] 3-40. [Term Defined:] The study hypothesized that in order to maintain slightly modified to natural habitats along the rivers of Zimbabwe, the environmental flow recommendation should be 30-60% of mean annual runoff in regions with perennial rivers. The MAR statistic attempts to mimic a natural flow regime by calculating runoff without human intervention.	environmental issues, or make a general comment regarding the plan amendments. Appendix K, Revised Water Quality Control Plan, describes a similar range (as a percent of unimpaired flow between 30 – 50 percent inclusive) to be maintained from February through June from each of the tributaries (Stanislaus, Tuolumne, and Merced Rivers). Please see Master Response 3.1, Fish Protection, regarding the unimpaired flow approach. Please see Master Response 3.2, Surface Water Analyses and Modeling, for information regarding the adequacy of SED hydrologic modeling and a description of the unimpaired flow calculation.
1344	132	[From ATT12:] [Ref:] Moyle et al. 2011. [Cited:] 3-40; 3-41. [Term Defined:] This is a large document that reviews and critiques past Environmental Flow Methodologies used in FERC licensing throughout CA. The last Section (4.0) of the report describes a follow up to the study published by Marchetti and Moyle 2001, a test of the functional flow regime concept in Putah Creek, CA, and is the apparent target for use as a reference. The minimum flow release schedule implemented in 2000 as a result of the Putah Creek Water Accord provided a test of a functional flow regime concept. The release schedule was explicitly designed to mimic the natural flow regime, principally in terms of the seasonal timing of increases and decreases in streamflow, but not the full magnitude of the natural flow regime. After eight years of fisheries monitoring under the new flows, the authors conclude that implementation of the new flow regime has allowed native species to regain dominance of more than 20 km of lower Putah Creek. This favorable outcome was achieved by manipulating stream flows at key times of the year and only required a small percentage of the available water during most water years. While the authors call the new Putah Creek flows a “natural flow regime”, it was not a pre-human perturbation “natural flow regime” (per Poff et.al. 1997) as described in the Section 3.1.1 Terminology (p 3-1) of Appendix C. Rather, the new Putah Creek flow regime seems to most closely align with the definition of functional flow regime.	Please see Master Response 1.1, General Comments, for responses to comments that do not raise significant environmental issues, or make a general comment regarding the plan amendments. Please refer to Master Response 3.1, Fish Protection, regarding the unimpaired flow approach, information and data used in Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, and a description of how the unimpaired flow approach with adaptive implementation will essentially provide functional flows. Please also refer to Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, for information regarding functional flows.
1344	133	[From ATT12:] [Ref:] Arthington et al. 1992. [Cited:] 3-40. [Term Defined:] The methodology described is to first estimate the unregulated hydrograph preferably from analysis of historical unregulated flow records if available (as a surrogate for the Poff et al. 1997 "natural flow regime") as the ecological baseline. With the unregulated hydrograph defined, elements of the hydrograph with ecological importance are identified, and a modified flow regime that incorporates the ecologically important features is defined within the site specific constraints of the river basin. The difficulty is in the identification of those certain features of the natural hydrological regime that are of value (timing, duration, and magnitude) to the ecosystem versus those that are not.	Please see Master Response 1.1, General Comments, for responses to comments that do not raise significant environmental issues, or make a general comment regarding the plan amendments. Please see Master Response 3.1, Fish Protection, regarding the benefits of higher and more variable flows, the unimpaired flow approach, information and data used in Appendix C, and a description of how the unimpaired flow approach with adaptive implementation will essentially provide functional flows. The unimpaired flow approach is intended to capture the natural pattern of variability and retain attributes of the natural flow regime to which native LSJR basin fish and wildlife adapted and important to support key ecosystem processes. Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, and Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, explain that higher and more variable flows are anticipated to provide protection for fish, and improve a number of ecosystem attributes including, but not limited to 1) native fish communities; 2) food web; 3) habitat; 4) geomorphic processes; 5) temperature; and 6) water quality.

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		This approach appears to use the Poff et al. 1997 "natural flow regime" as baseline to inform flow modifications.	Please see Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, for information on functional flows. Please see Master Response 3.2, Surface Water Analyses and Modeling, for information regarding the adequacy of SED hydrologic modeling and a description of the unimpaired flow calculation.
1344	134	[From ATT12:] [Ref:] Arthington et al. 2004. [Cited:] 3-40. [Term Defined:] This is another international scope paper that reviews some of the more that 200 environmental flow assessment (EFA) methodologies in use worldwide today. Emphasis is placed on two primary types of EFA used in Australia and southern Africa: (1) A proactive response, intended to maintain the hydrological regimes of undeveloped rivers as close as possible to the un-regulated condition, or at least to offer some level of protection of natural river flows and ecosystem characteristics, and (2) A reactive response, intended to restore certain characteristics of the pre-regulation flow regime and ecosystem in developed rivers with modified/regulated flow regimes. The paper favors an approach referred to as "Holistic Methodologies". This type of approach reasons that if certain functional ecological features of the natural hydrological regime can be identified and adequately incorporated into a modified flow regime, then, all other things being equal, the extant biota and functional integrity of the ecosystem should be maintained (Arthington et al. 1992; King and Tharme 1994). These methodologies are underpinned by the concept of the "natural flow paradigm" (Poff et al. 1997) and basic principles guiding river corridor restoration. The difficulty is in the identification of those certain features of the natural hydrological regime that are of value (timing, duration, and magnitude) to the ecosystem versus those that are not.	Please see response to comment 1344-133.
1344	135	[From ATT12:] [Ref:] NRDC 2005. [Cited:] 3-40. [Term Defined:] Information provided is not from the NRDC review cited but rather the Texas Water Development Board (TWDB 2008) Texas Instream Flow Technical Manual. The study approach adopted for the instream flow program focuses on the flow requirements of the entire riverine ecosystem. Studies will be multidisciplinary in nature, including the disciplines of hydrology and hydraulics, biology, geomorphology, and water quality. Studies will also address connectivity and linkages between each discipline. Multidisciplinary studies will be integrated to develop a flow regime composed of several flow components such as subsistence and base flows, high flow pulses, and overbank flow components. Flow components will be identified for wet, average, and dry hydrologic conditions, as appropriate. This is a comprehensive study-based approach that does not purport to mimic the Poff et al. 1997 "natural flow regime" but rather attempts to determine through study those aspects	The commenter is correct that the citation in Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, is incorrect; the citation should read NRC 2005. The correction has been made. The other content provided by the commenter does not contradict the conclusion that under the current altered flow regime, fish and wildlife beneficial uses are being impaired. Please also see response to comment 1344-133 for further discussion of the unimpaired flow approach. Please refer to Master Response 1.1, General Comments, for responses to comments that either make a general comment regarding the plan amendments or do not raise significant environmental issues.

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		of the river flow regime that are important to preserving or enhancing a broad array of ecosystem functions.	
1344	136	[From ATT12:] [Ref:] Florida Administrati ve Code 2010. [Cited:] 3-40. [Term Defined:] Information is obtained from a program summary document (SFWMD 2007). The south Florida Natural System Regional Simulation Model (NSRSM) is designed to simulate south Florida's pre-development hydrology to assist in the development of restoration strategies outlined in the Comprehensive Everglades Restoration Plan (CERP). The CERP was designed to restore the Everglades ecosystem while maintaining adequate flood protection and water supply for south Florida. The CERP requires an understanding of the south Florida regional system hydrology prior to drainage and development. Natural system modeling has been used in south Florida, in combination with other adaptive management tools, to formulate restoration plans and set targets. The model applicable to the unique hydrologic processes and geologic features in pre-drainage south Florida, such as storage and flows through a flat but microtopographically varied ridge and slough landscape.	Please see response to comment 1344-133. Please also see Master Response 5.2, Incorporation of Non-Flow Measures, for discussion of recommendations for non-flow actions that are complementary to the plan amendments for the LSJR flow objectives.
1344	137	[From ATT12:] [Ref:] Hirji and Davis 2009. [Cited:] 3-40. [Term Defined:] This is another broad based international publication of the World Bank to develop policies and practices for environmental flow assessments (EFA) to incorporate in lending decisions. Similar to Arthington et al. 2004, it covers a broad range of EFA methods but favors holistic methods. Although there are various methods for undertaking EFAs, they fall into four discrete groups, namely hydrological index methods, hydraulic rating methods, habitat simulation methods, and holistic methodologies. Holistic methodologies, which typically incorporate all components of the flow regime, are at the cutting edge of EFA methodology. Applying these methods involves a wide range of water users and sometimes includes considerations of the social and economic dependence of communities on environmental flows. Holistic methods were developed in South Africa and Australia, but are increasingly being tried in other parts of the world.	Please see response to comment 1344-133. Please also see Appendix K, Revised Water Quality Control Plan, regarding development of a Stanislaus, Tuolumne, and Merced (STM) Working Group to assist with the implementation, monitoring, and effectiveness assessment of the February through June flow requirements. The State Water Board will seek participation in the STM Working Group by the following entities who have expertise in LSJR, Stanislaus, Tuolumne, and Merced Rivers fisheries management, hydrology, operations, and monitoring and assessment needs: the DFW; NMFS; USFWS; and water users on the Stanislaus, Tuolumne, and Merced Rivers.
1344	138	[From ATT12:] [Ref:] Sparks 1995.	Please see response to comment 1344-133. Please also see Chapter 7, Aquatic Biological Resources, Section 7.2, Environmental Setting, for a description of factors that affect the abundance of aquatic biological resources, and reviews environmental stressors in the LSJR, three eastside tributaries, and the southern Delta, including flow and habitat alteration, water

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		[Cited:] 3-40; 3-41. [Term Defined:] This paper discusses the importance of large river-floodplain ecosystems and the consequences of altering their natural processes, functions, and connectivity. The focus is on the Mississippi basin floodplains and the importance of floodplain connectivity, both longitudinal and lateral, to the basin ecosystem. A major thrust of the paper describes the ecological harm caused by flood control channelization and levees because of the resulting loss of floodplain connectivity. Nutrient enrichment, plankton blooms, and deoxygenation of Gulf of Mexico in the Delta region is also aggravated by flood control projects, as floodplain inundation removes nutrients from the river. The author promotes ecosystem management with the goal of attaining biotic integrity via reestablishment of floodplain connectivity. A pre-disturbance ecosystem as a reference point is proposed using available hydrologic data from 1870 to 1893 as representative of a relatively undisturbed condition before draining and leveeing of the floodplains. The paper concludes that restoring an annual flood pulse (presumably of a manageable magnitude) would do much to restore biotic integrity in the river basin. While pre-human disturbance flow regimes are used as a reference point for timing of floods, the focus of this paper is really on the ecological damage caused by channelization and levees, loss of floodplain and wetlands, deforestation, and urbanization, which CA chooses to ignore in its use of "unimpaired flow" as the reference condition.	quality, introduced species and predation, and disease.
1344	139	[From ATT12:] [Ref:] Walker et al. 1995. [Cited:] 3-40. [Term Defined:] This paper focuses on the ecosystem functions supported by the natural flow regime in arid and semi-arid river basins. Similar to Sparks (1995), the focus is on flood pulse timing and magnitude to recover missing ecosystem functions of the floodplain. The authors note that in arid and semi-arid regions, baseline unaltered flow estimates require a longer period of recorded to establish flood frequency and magnitude because floods are less frequent and more variable in these dryer climates. Similar to Sparks (1995), the authors note that "small weirs, barrages, causeways, levees and river training structures may be no less influential than dams, by virtue of their numbers and ubiquity. Their effects are compounded by offstream storages, selective manipulation of tributary flows and interbasin transfers, so that the cumulative effects may represent a far more extensive level of regulation than that suggested by dams alone". They suggest an IHA analysis similar to Richter et al. methods (in development at the time of publication) to establish an estimated pre-human natural flow regime as the ecological baseline.	Please see response to comment 1344-138.
1344	140	[From ATT12:] [Ref:] Richter et al. 1996. [Cited:] 3-40.	Please see response to comment 1344-133.

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		[Term Defined:] This is the well-known Richter paper introducing the Indicators of Hydraulic Alteration (IHA) methodology which utilizes various metrics to determine the magnitude of deviation a present day hydraulic regime and a natural flow regime (pre-human influence).	
1344	141	[From ATT12:] [Ref:] Tharme and King 1998. [Cited:] 3-40. [Term Defined:] Information is from the updated version of the manual published in 2008 (King et al. 2008). The building block method (BBM) described in this manual does not dwell on unaltered or natural flow regimes. Instead, five major assumptions that are prevalent in riverine ecology, and are fundamental to the credibility of the BBM, are analyzed: * There is spare water in rivers. * Rivers will recover from most perturbations. * The natural disturbance regime of rivers is important for the maintenance of their biodiversity. * The maintenance of habitat will ensure the persistence of species. * Riverine communities, particularly those of semi-arid regions, are driven by abiotic rather than biotic processes. The hydrological functioning of the river is not important per se. Rather, it is the impact of different hydrological regimes on the ecological functioning of the river that is of primary concern. The hydrological information can therefore be viewed as 'service' data. It has been common practice to base flow assessments using the BBM on the natural flow regime of the river that is, with all impacts of upstream developments removed, on the assumption that this is the condition against which the future modified regime should be compared. This is a logical approach, given that the designated EMC for the river can range from totally natural (pristine) to critically modified (Chapter 11). It would not be logical to consider only the present-day regime if the EMC were to be set at a closer to natural level, as there would be no information on the natural upper limit of flows to guide discussions on how to upgrade the condition of the river. Ideally, information on both regimes (natural and present day) should be made available, so that the new recommended flow regime can be logically described in terms of both present and past flow conditions.	Please see response to comments 1144-128 and 1344-133.
1344	142	[From ATT12:] [Ref:] Bunn and Arthington 2002. [Cited:] 3-40; 3-41; 3-42; 3-44. [Term Defined:] This is a literature review on a world-wide scale prepared by two Australian	Please see response to comment 1344-133.

Ltr#	Cmt#	Comment	Response
		investigators. The purpose of the literature review was to highlight the important mechanisms that link hydrology and aquatic biodiversity and to illustrate the consequent impacts of altered flow regimes. As a literature review document, the discussions contrasting natural to altered flow regimes are often vague and undefined. However, when the concept of "natural flow regime" is mentioned on several occasions in the text it is accompanied by a citation to Poff et al. (1997), which implies a pre-human alteration hydrologic baseline perspective.	
1344	143	[From ATT12:] [Ref:] Richter et al. 2003. [Cited:] 3-40. [Term Defined:] As with earlier Richter papers, the concept of the "natural flow regime" is promoted as the baseline standard resulting in the "natural state of freshwater ecosystems" having maximum richness of native species and high complexity of biophysical habitats. However there is an evolution of sorts being promoted that recognizes human needs must also be considered and that the key in water management lies in the ability to maintain/balance aspects of the natural flow regime that drive important ecological aspects while also accommodating human needs similar to the BBM method described by Tharme and King 1998. Quotes from Richter et al. 2003: 'When natural variability in river flows is altered too much, marked changes in the physical, chemical, and biological conditions and functions of natural freshwater ecosystems can be expected. When changes to natural flow regimes are excessive, causing a river ecosystem to degrade toward an altered character, the costs are high to both biodiversity and society.' "In this paper we have sketched what we believe to be a useful roadmap for finding ecological sustainability in water management. We are inspired by growing evidence proving that water management does not need to compromise freshwater ecosystems while providing for human needs."	Please see response to comment 1344-133. Please also see Master Response 1.1, General Comments, and Master Response 1.2, Water Quality Control Planning Process, regarding State Water Board consideration of beneficial uses in the context of the water quality control planning process.
1344	144	[From ATT12:] [Ref:] Richter and Thomas 2007. [Cited:] 3-47. [Term Defined:] "Assessing the potential benefits of dam re-operation begins by characterizing the dam's effects on the river flow regime, and formulating hypotheses about the ecological and social benefits that might be restored by releasing water from the dam in a manner that more closely resembles natural flow patterns." "Of all the environmental changes wrought by dam construction and operation, the alteration of natural water flow regimes has had the most pervasive and damaging effects	Please see response to comment 1344-143.

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		on river ecosystems and species (Poff et al. 1997, Postel and Richter 2003)." "In this paper we discuss opportunities and strategies for modifying dam operations, hereafter referred to as "re-operation" for restoring natural flow regimes and associated ecosystem health and services, which are important to society. We focus on restoration of natural flow regimes as a general principle of dam re-operation because sustaining river-dependent biodiversity and ecosystem services requires maintaining some semblance of natural flow characteristics (Poff et al. 1997, Richter et al. 2003, Postel and Richter 2003). "It is important to acknowledge that given multiple and often competing objectives imposed upon any water management system, both the volume and timing of water releases from a dam will likely differ from natural flows." "We begin by describing the primary ways in which dams of various types alter the natural flow regime. We then offer a conceptual framework for assessing opportunities and constraints in restoring natural flow characteristics, and conclude by describing a variety of dam re-operation strategies that can be used to restore environmental flows and associated benefits." "When environmental flow criteria such as minimizing departures from the natural flow regime are included in the optimization scheme, the considerable flexibility in a multi-dam operation can be effectively tapped for environmental flow restoration."	
1344	145	[From ATT12:] [Ref:] Tharme 2003. [Cited:] 3-40. [Term Defined:] This paper aims to provide a global overview of the current status of development and application of methodologies for addressing the environmental flow needs of riverine ecosystems, against the background of an ever-increasing rate of hydrological alteration of such systems worldwide and the resultant environmental impacts. It outlines the main types of environmental flow methodologies available and explores the extent to which they have been utilized in different countries and world regions, with emphasis on the identification of emerging global trends.	Please see response to comment 1344-143.
1344	146	[From ATT12:] [Ref:] Poff et al. 2006. [Cited:] 3-40. [Term Defined:] This paper evaluates similarities and differences at different spatial scales and geomorphic scales in how streamflow variability relates to natural ecological integrity. Quotes from Poff et al. 2006: "The importance of hydrologic variability in sustaining natural riverine ecosystems is now	Please see response to comment 1344-143.

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		well accepted." "….however, some critical questions have arisen concerning the degree to which generalizations about flow regime characteristics are geographically dependent both within and among regions, and the degree to which flow variability alone captures critical environmental variability." "First, we examined hydrologic variability among 463 readily available daily streamflow gauges from five continents/countries around the world: Australia, New Zealand, South Africa, Europe, and the United States." "Second, within the continental United States, we examined how hydrologic variability changes along river profiles as catchment area increases for five river basins arrayed across a gradient of hydroclimatic variation." "Third, we used a modeling approach to illustrate how geomorphic setting provides a context for assessing the ecological consequences of flow variation at the local scale of stream reaches." "Among river ecologists there is now a general consensus that 'natural' or 'normative' flows are a desirable goal to sustain riverine function and native biodiversity (Poff et al., 2003). This viewpoint is supported by numerous case studies that clearly indicate the importance of natural flow variability for both ecological processes (see reviews in Poff et al., 1997; Bunn and Arthington, 2002) and evolutionary adaptations (Lytle and Poff, 2004)."	
1344	147	[From ATT12:] [Ref:] Poff et al. 2007. [Cited:] 3-40; 3-41; 3-44. [Term Defined:] This paper examines the cumulative regional pattern of the loss of natural flow regimes (or homogenization of flow regimes) across the continental US. Quotes from Poff et al. 2007: "Here, we use 186 long-term streamflow records on intermediate-sized rivers across the continental United States to show that dams have homogenized the flow regimes on third- through seventh-order rivers in 16 historically distinctive hydrologic regions over the course of the 20th century." "For 317 undammed reference rivers, no evidence for homogenization was found, despite documented changes in regional precipitation over this period." "By strongly modifying natural flow regimes, dams have the potential to reduce these natural regional differences and thus impose environmental homogeneity across broad geographic scales." (See figure below [ATT12:ATT1])	Please see response to comment 1344-138.

Table 4-1. Responses to Comments			
Ltr#	**Cmt#**	**Comment**	**Response**
1344	148	[ATT12:ATT1] Map of homogenized flow regimes across the U.S.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	149	[From ATT12:] [Ref:] Brown and Bauer 2009. [Cited:] 3-40; 3-41; 3-48. [Term Defined:] This is a publication by Larry Brown regarding California's Central Valley Rivers (including the San Joaquin River drainage) and the effect of hydrologic infrastructure on native and alien fish species. Quotes from Brown and Bauer 2009: "In this paper, we evaluate how existing hydrologic infrastructure and management affect streamflow characteristics of rivers in the Central Valley, California and discuss those characteristics in the context of habitat requirements of native and alien fishes. We evaluated the effects of water management by comparing observed discharges with estimated discharges assuming no water management ('full natural runoff')." "The reduced discharges in the San Joaquin River drainage streams are favorable for spawning of many alien species, which is consistent with observed patterns of fish distribution and abundance in the Central Valley. However, other factors, such as water temperature, are also important to the relative success of native and alien resident fishes." "We use the Indicators of Hydrologic Alteration (IHA) software (TNC, 2007) to address our rimary question: How does the existing hydrologic infrastructure and management affect the streamflow characteristics of each river compared to natural flows?" "Our basic approach was to compare estimates of 'full natural runoff' (FNR) with measured streamflow (observed; OBS) for the time period after completion of the most recent major unpassable downstream dam (Table I)." "Estimates of FNR are calculated based on a number of measurements from the upper watershed, including precipitation, gauge records and reservoir levels. Basically, inflows from precipitation are adjusted for water storage, water diversions and reservoir releases to estimate flows in the absence of such manipulation (CDEC; http://cdec.water.ca.gov/). These estimates should not be interpreted as 'true' unimpaired historical streamflows because the reconstructions do not account for changes in the historic channel configuration (e.g. loss of side channels) or changes in land use (e.g. deforestation, agriculture)." "In California and elsewhere, a major impediment to developing river management strategies is the paucity of data on the linkages between hydrologic modification and biological responses (Pringle et al., 2000; Arthington et al., 2006; Murchie et al., 2008)." "Thus, changes in water management can affect hundreds of kilometers of river habitat. The effects of such changes should be evaluated for the entire ecosystem rather than selected	Please see response to comment 1344-138.

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		species of management interest (e.g. Chinook salmon)."	
1344	150	[From ATT12:] [Ref:] Resh et al. 1988. [Cited:] 3-40. [Term Defined:] The authors define disturbance in stream ecosystems to be: any relatively discrete event in time that is characterized by a frequency, intensity, and severity outside a predictable range, and that disrupts ecosystem, community, or population structure and changes resources or the physical environment. The purpose of the publication is to provide a literature review and propose methods for comparing the responses of different streams and their biotic communities to flow disturbances.	Please see response to comment 1344-138.
1344	151	[From ATT12:] [Ref:] Power et al. 1995. [Cited:] 3-40. [Term Defined:] This paper presents a model to explore how temporal and spatial relationships of hydrology and hydraulics in floodplain rivers influence the dynamics of the food chain, including humans as top predator. This paper is similar to Sparks et al. (1995), as the focus is on floodplain connectivity and the potential harm (to the food chain) caused by flood management infrastructure (levees, dams, and agriculture on floodplains).	Please see response to comment 1344-138.
1344	152	[From ATT12:] [Ref:] Naiman et al. 2008. [Cited:] 3-41. [Term Defined:] This is another paper focusing on the importance inter- and intra-annual variability of the hydrologic regime using examples from the Sabie River in South Africa and the Queets River, Washington, USA. Emphasis is also placed on the difficult challenge of establishing appropriate environmental flows. Quotes from Naiman et al. 2008: "Our objective is to illustrate how variability in flow and water temperature shapes the biophysical attributes and functioning of river systems. We explain the ecological rationale for sustaining flow variability. We examine case studies from rivers in two contrasting climate regions -- a semi-arid savanna river in South Africa and a temperate rainforest river in North America -- that illustrate connections between flow variability, large wood, and the development of river-specific ecological characteristics. We conclude by exploring the importance of variability in establishing environmental flows for rivers -- flows needed to sustain ecological systems."	Please refer to response to comment 1344-133. Please also Master Response 5.2, Incorporation of Non-Flow Measures, regarding non-flow measures recognized and recommended by the State Water Board including, but not limited to, restoration of riparian and floodplain habitat, enhancing in-channel complexity (e.g. adding woody debris) are necessary, in conjunction with improved flows.

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		"….degradation of freshwater biodiversity and environmental quality is ongoing…. Much of this degradation is a direct result of flow homogenization of the world's rivers by dams and by water withdrawals that undermine natural flow variability [10,52,71]. Nevertheless, it is recognized that flow regulation, land fragmentation and development are a suite of tightly interacting factors, often implemented simultaneously, making it difficult to assign cause and effect to one or the other."	
1344	153	[From ATT12:] [Ref:] Lytle and Poff 2004. [Cited:] 3-41; 3-42; 3-47. [Term Defined:] This paper examines (ponders?) the relationships between extreme flow variation (floods, droughts) and short term (population ecology) long term (evolution) adaptation over both local and regional spatial scales. Quotes from Lytle and Poff 2004: "The natural flow regime paradigm (Box 2) has become a fundamental part of the management and basic biological study of running water ecosystems [2-4]. Although some of the ecological consequences of altered natural flow regimes have been reviewed [3,5], little attention has been paid to how organisms have evolved in response to floods and droughts."	Please refer to response to comment 1344-133. Please also see Chapter 5, Surface Hydrology and Water Quality, and Appendix F, Hydrologic and Water Quality Modeling, regarding the Water Supply Effects model, which simulates hydrologic conditions for an 82-year period, including cycles of both floods and droughts, to evaluate potential impacts and benefits to aquatic resources.
1344	154	[From ATT12:] [Ref:] Fleenor et al. 2010. [Cited:] 3-41. [Term Defined:] This paper discusses methods used for establishing environmental flows for the Bay-Delta. The text of Appendix C cites this source in the following context: two methods for determining flow needs: 1) flows based on the unimpaired flow, and 2) flows based on the historical flow. As indicated in the fourth quote from the source below, four methods are actually discussed. Quotes from Fleenor et al. 2010: "Any serious scientifically-based effort to establish flows for desirable fishes, including our work, is therefore exploratory and cannot be a finished product. Moreover, it is not possible to resolve scientifically the major uncertainties over flow prescriptions within current planning timeframes. Managing uncertainty during the indefinite period of implementation for flow prescriptions will pose a far greater technical and institutional challenge than setting the initial prescriptions." "The larger professional literature contains much on environmental flows for rivers and other water bodies, with little consensus on method." "For the Delta, these difficulties are compounded by major geological, biological, and	Please see response to comments 1344-128, 1344-133, and 1344-138. The State Water Board acknowledges that uncertainty is inherent in any programmatic planning effort of this geographic and temporal scale. However, the State Water Board strived to use best available science throughout the SED, consistent with State CEQA Guidelines. Please see Master Response 1.1, General Comments for further discussion.

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		engineering challenges, particularly the return of diked, subsided lands to aquatic habitat (subtidal, intertidal and floodplains), changes in water management within and upstream of the Delta, including likely peripheral diversions of much of the water currently exported through the Delta, new invasive species, and water contamination from upstream and in-Delta uses. These massive ongoing and potential changes cast doubt on the future value of empirical relationships often used to establish required Delta flows." "Additional flows are needed upstream of the Delta to support fish migration, spawning, and rearing. However, at this time riverine environmental flows seem better handled by other efforts." "Here we examine four approaches for prescribing environmental flows for the Sacramento-San Joaquin Delta: (1) unimpaired (quasi-natural) inflows, (2) historical impaired inflows that supported more desirable ecological conditions, (3) statistical relationships between flow and native species abundance, and (4) the appropriate accumulation of flows estimated to provide specific ecological functions for desirable species and ecosystem attributes based on available literature." "Engineers have developed a surrogate for upstream natural inflow called ""unimpaired" inflows that the Delta would likely have seen without interference from upstream dams or diversions, or in-Delta diversions. These flows have been estimated for the 1921-2003 period by the California Department of Water Resources for use in various models of Central Valley water projects (DWR 2006). These are only estimates of stream flows for this period, and are unlikely to capture the effects of longer attenuation of spring flows by upstream marshlands and floodplains, evapotranspiration from vast floodplains and marshlands, riparian forests and unimpaired stream-aquifer interaction of the natural system. All were prominent features of the pre-development hydrology." "Pre-development flow, habitat, and water quality variability are likely to remain somewhat uncertain since precise pre-development measurements are imperfect and estimates are questionable because it is difficult to understand the full extent of changes in climate, base flow from groundwater, floodplain areas, and modified Delta channels." "Flows needed to support desirable Delta fishes are likely to have changed from pre-European settlement conditions because of extreme landscape changes, illustrated by the 1873 map of the Central Valley in Figure 1 with vast often-connected areas of seasonal and permanent wetlands. The changes include upstream watershed changes, tidal marsh reclamation and channelization of the upstream and in-Delta landscape, impacts of biological invasions, and on-going climate change and sea level rise. Greater or lesser flows might be needed to adjust for the conversion of most of the Delta from marshland to agriculture and the severing of river channels from floodplains." "During the post landscape-development period of the 1940s-1970s, native populations were still reasonably robust, although some fishes had already gone extinct (e.g., Sacramento perch and thicktail chub). By this time most Delta marshland had been converted to agriculture, floodplains had been greatly reduced, dam development and upstream diversions reduced inflows and increased salinity intrusions, channelization of the Delta greatly reduced shallow water and intertidal habitat, and many invasive species had arrived. However, this period differed substantially from the contemporary era of rapidly	

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		declining populations, in part, because major water exports from the Delta had not yet begun. Contrasting flows from this period with unimpaired flows (when native fishes had more robust populations) and more recent flow conditions (when dam development was complete and native fishes fared worse) provides some indications for how much fresh water is needed to keep native fish populations healthy." "Table 2 contains historical flow volumes for three periods: 1949-1968, 1969-1985 and 1986-2005. The early 20-year period represents a time when fish were known to be doing better and the last 20-year time frame when fish were doing worse (Moyle and Bennett 2008). The middle 17 years represents a transitional water export period and contains extreme wet and dry periods." "Historical flows under which native fish were more successful should have greater relevance for establishing fish flows for the current highly altered Delta." "Basing environmental flows solely on historical and estimated pre-development conditions, or on past aggregate correlations between flows and fish populations might not be the best approach alone." "Thus, fish relationships to flow that are established using past data might lead us astray, if not considered in light of how they may be influenced by changing conditions".	
1344	155	[From ATT12:] [Ref:] Petts 2009. [Cited:] 3-41. [Term Defined:] This paper is a review of the instream flow policy development and offers a critical and international state-of-the-science perspective of environmental flows. It is written from environmental flow advocacy perspective. Quotes from Petts 2009: "The ecological integrity of riverine ecosystems depends on their natural dynamic character (Poff et al., 1997). The fundamental ecological principle for the sustainable management of riverine ecosystems is the need to sustain flow variability that mimics the natural, climatically-driven variability of flows at least from year to year and from season to season, if not from day to day (Naiman et al. (2002). Thus, the two fundamental general principles are: 1. the natural flow regime shapes the evolution of aquatic biota and ecological processes; 2. every river has a characteristic flow regime and an associated biotic community." "Second is the issue of 'naturalizing' the gauged flow regime. In many areas the pristine catchment has no relevance to the modern day. The hydrology of catchments characterized by long-term human interference -- such as urban conurbations and intensive agriculture -- bears little resemblance to the hydrologic character of unmodified catchments in a given ecoregion. The concept for such catchments may be to produce functionally diverse, self-regulating ecological systems that provide medium-term enhancements and allow longer-	Please see response to comment 1344-133.

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		term catchment-scale planning (Petts et al., 2000). In reality this requires determination of the flow regime that would be sustained under current or future catchment conditions in the absence of existing dams, reservoirs, diversions and abstractions."	
1344	156	[From ATT12:] [Ref:] Freeman et al. 2001. [Cited:] 3-41. [Term Defined:] This is a study looking at differences in the fish communities in the tailwater of a large peaking project and an unregulated river reach upstream of the peaking project on the Tallapoosa River. Definitions of unimpaired flow or natural flow are not directly addressed.	Please see response to comment 1344-133. The study by Freeman et al. 2001 is used as supporting evidence that altered flow regimes negatively impact native fish communities, and not to provide descriptions of unimpaired flow or natural flow. Distinctions between both types of flow are described in multiple locations of the SED (see Chapter 4 Section 4.2.1, Hydrologic Modeling, Appendix C Section 3.1.1, Terminology, and Appendix F1, Section 1.1, Introduction).
1344	157	[From ATT12:] [Ref:] Moyle and Mount 2007. [Cited:] 3-41. [Term Defined:] This is an editorial type commentary in a technical journal discussing the linkage between regulated river reaches, loss of biodiversity, loss of native fish species, and establishment of invasive alien species. Quotes from Moyle and Mount 2007: "We suggest that the following measures are some of the key alternatives for recreating alluvial rivers below dams: dam removal, alteration of flow regimes, protection of tributaries below dams, recreation of floodplains, and active management of channels as habitat. Often these measures must be used in conjunction with one another for successful reestablishment of native biota." "Alteration of flow regimes is one of the most widely used options because of the perception, often wrong, that large benefits can be achieved at low cost. As a consequence, methodologies have developed worldwide to determine how much water should be left in rivers to maintain ecological function (11). Increasingly, these methodologies focus on restoring a flow regime that mimics in some respects the historic flow regime, but that requires much less water. This concept of the natural flow regime (12) is achieving wide acceptance as a useful model for bringing back native organisms adapted to local flows." "A common consequence of flow regulation is the disconnection of floodplains from river channels through a combination of incision, levee construction, and lack of sufficient flood pulses for frequent floodplain inundation. For many species, regular connection to the floodplain at the appropriate time of year is essential for persistence (17). Even partial reconnection of a river to its floodplain through increased flows and levee setbacks can favor native fishes and other organisms." "Unfortunately, even intensive management of a regulated river often cannot prevent invasions by alien species. In fact, in our experience, alien fishes are generally present in low	Please see response to comment 1344-138. Please also see Master Response 5.2, Incorporation of Non-Flow Measures, regarding use of non-flow measures including, but not limited to, restoration of riparian and floodplain habitat, enhancing in-channel complexity, and reducing invasive species are necessary, in conjunction with improved flows.

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		numbers even in ‘‘restored’’ streams with natural flow regimes. The numbers of aliens can quickly increase under favorable conditions, such as prolonged low flows created by drought."	
1344	158	[From ATT12:] [Ref:] Brown 2000. [Cited:] 3-41. [Term Defined:] "Twenty sites in the lower San Joaquin River drainage, California, were sampled from 1993 to 1995 to characterize fish communities and their associations with measures of water quality and habitat quality. The feasibility of developing an Index of Biotic Integrity was assessed by evaluating four fish community metrics, including percentages of native fish, omnivorous fish, fish intolerant of environmental degradation, and fish with external anomalies. Of the thirty-one taxa of fish captured during the study, only 10 taxa were native to the drainage."	Please see response to comment 1344-133.
1344	159	[From ATT12:] [Ref:] Freyer and Healey 2003. [Cited:] 3-41. [Term Defined:] "We sampled 11 sites in the southern Sacramento-San Joaquin Delta from 1992-1999, to characterize fish communities and their associations with environmental variables. Riparian habitats were dominated by rock-reinforced levees, and large water diversion facilities greatly influenced local hydrodynamics and water quality. We captured 33 different taxa, only eight of which were native. None of the native species represented more than 0.5% of the total number of individuals collected." "Additionally, dams associated with the water projects highly regulate river inflow to the region and compromise the natural hydrograph. The south Delta is arguably the most altered region of the system considering the influence of the water export facilities and associated river flow control structures (Nichols et al. 1986, Arthur et al. 1996), as well as degraded habitat quality in the lower San Joaquin River (SJR) drainage (Saiki 1984, Brown 2000)."	Please see response to comment 1344-157.
1344	160	[From ATT12:] [Ref:] Brown and May 2006. [Cited:] 3-41; 3-48. [Term Defined:] This paper summarizes results of a study using seining data from two monitoring programs to provide an integrated view of spring near shore resident fish species composition and life history characteristics in five regions: the San Joaquin River, the upper Sacramento River, the lower Sacramento River, the northern Sacramento-San Joaquin Delta (North Delta), and the Interior Delta.	Please see responses to comments 1344-86 and 1344-154.Please see responses to comments 1344-86 and 1344-154.

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		Quotes from Brown and May 2006: "The potential benefits of San Joaquin River native fish restoration appear high because there is so much potential for improvement; however, it is unclear how to best manipulate the system to achieve such restoration. Addressing such uncertainties is necessary if society desires the preservation and restoration of native biodiversity as human demands on water resources increase." "However, it is unclear how to manipulate the San Joaquin River system to renew the connection of the tributary populations of native fishes with the mainstem San Joaquin River, through the Interior Delta, and into the North Delta. The responses of alien fishes to restoration actions will be critical to determining success. The costs of such restoration actions, once identified, might outweigh the potential benefits, especially if similar or greater benefits for native fishes could be accomplished elsewhere in the system with less difficulty."	
1344	161	[From ATT12:] [Ref:] Brown and Michniuk 2007. [Cited:] 3-41. [Term Defined:] This study was very similar to Brown and May 2006 except that littoral zone electrofishing data were examined as opposed to the near-shore sein data used in Brown and May 2006.	Please see response to comment 1344-133.
1344	162	[From ATT12:] [Ref:] Gido and Brown 1999. [Cited:] 3-41. [Term Defined:] This paper summarizes an analysis of data from the literature that were used to document colonization patterns by introduced freshwater fishes in 125 drainages across temperate North America. The study found that drainages with a high number of impoundments, large basin area and low native species diversity had the greatest number of introduced species.	Please see response to comment 1344-133.
1344	163	[From ATT12:] [Ref:] King et al. 2003. [Cited:] 3-42. [Term Defined:] "Floodplain inundation in rivers is thought to enhance fish recruitment by providing a suitable spawning environment and abundant food and habitat for larvae." "The observed low use of the inundated floodplain for recruitment in this study contradicts previous models. We propose a model of the optimum environmental conditions required for use of the inundated floodplain for fish recruitment. The model suggests that the notion	Please see response to comment 1344-133.

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		of the flood pulse alone controlling fish recruitment is too simplistic to describe all strategies within a system. Rather, the life history adaptations in the fauna of the system and aspects of the hydrological regime such as duration and timing of inundation will control the response of a river's fish fauna to flooding."	
1344	164	[From ATT12:] [Ref:] McElhany et al. 2000. [Cited:] 3-42. [Term Defined:] This document introduces the viable salmonid population (VSP) concept, identifies VSP attributes, and provides guidance for determining the conservation status of populations and larger-scale groupings of Pacific salmonids. Quotes from McElhany et al. 2000: "Practically speaking, applying our definition of a population will involve an assumption about the degree of independence individual fish groups experienced under historical or "natural" conditions (i.e., before the recent or severe declines that have been observed in many populations). It is necessary to consider historical conditions to ensure that a population designation is not contingent on relative conservation status among groups of fish. In some cases, it may be determined that environmental conditions are so altered that either it is impossible to evaluate an ESU's pre-decline population structure or the population structure of the recovered ESU would be substantially different from what it was historically."	Please see response to comment 1344-133. Appendix K, Revised Water Quality Control Plan, describes how development of biological goals for the plan amendments for the LSJR flow objectives will inform adaptive implementation. Indicators of viability such as population abundance, spatial extent, distribution, structure, genetic life history diversity, and productivity will be used as biological goals to evaluate the effectiveness of the plan amendments, and inform potential changes to implementation based on changing conditions. Please see Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, Adaptive Implementation, for clarification regarding the biological goals component of the Program of Implementation.
1344	165	[ATT13:] ATTACHMENT 2 -- Figures TR #5 through TR #11. Plots comparing modeled Tuolumne River flow variability for various years at the La Grange and Modesto USGS gages from (1) SWB's WSE model's flat, constant monthly flows and (2) the 7-day running average flow in from the daily flow record in the Tuolumne River Operations Model developed by TID and MID as part of the Don Pedro Project FERC relicensing.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	166	[ATT13:ATT1:] Figure TR-5. Plot comparing modeled Tuolumne River flow variability for 1973 at the La Grange and Modesto USGS gages from (1) SWB's WSE model's flat, constant monthly flows and (2) the 7-day running average flow in from the daily flow record in the Tuolumne River Operations Model developed by TID and MID as part of the Don Pedro Project FERC relicensing.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	167	[ATT13:ATT2:] Figure TR-6. Plot comparing modeled Tuolumne River flow variability for 1979 at the La Grange and Modesto USGS gages from (1) SWB's WSE model's flat, constant monthly flows and (2) the 7-day running average flow in from the daily flow record in the Tuolumne River	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.

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		Operations Model developed by TID and MID as part of the Don Pedro Project FERC relicensing.	
1344	168	[ATT13:ATT3:] Figure TR-7. Plot comparing modeled Tuolumne River flow variability for 1984 at the La Grange and Modesto USGS gages from (1) SWB's WSE model's flat, constant monthly flows and (2) the 7-day running average flow in from the daily flow record in the Tuolumne River Operations Model developed by TID and MID as part of the Don Pedro Project FERC relicensing.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	169	[ATT13:ATT4:] Figure TR-8. Plot comparing modeled Tuolumne River flow variability for 1989 at the La Grange and Modesto USGS gages from (1) SWB's WSE model's flat, constant monthly flows and (2) the 7-day running average flow in from the daily flow record in the Tuolumne River Operations Model developed by TID and MID as part of the Don Pedro Project FERC relicensing.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	170	[ATT13:ATT5:] Figure TR-9. Plot comparing modeled Tuolumne River flow variability for 1996 at the La Grange and Modesto USGS gages from (1) SWB's WSE model's flat, constant monthly flows and (2) the 7-day running average flow in from the daily flow record in the Tuolumne River Operations Model developed by TID and MID as part of the Don Pedro Project FERC relicensing.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	171	[ATT13:ATT6:] Figure TR-10. Plot comparing modeled Tuolumne River flow variability for 2004 at the La Grange and Modesto USGS gages from (1) SWB's WSE model's flat, constant monthly flows and (2) the 7-day running average flow in from the daily flow record in the Tuolumne River Operations Model developed by TID and MID as part of the Don Pedro Project FERC relicensing.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	172	[ATT13:ATT7:] Figure TR-11. Plot comparing modeled Tuolumne River flow variability for 2010 at the La Grange and Modesto USGS gages from (1) SWB's WSE model's flat, constant monthly flows and (2) the 7-day running average flow in from the daily flow record in the Tuolumne River Operations Model developed by TID and MID as part of the Don Pedro Project FERC relicensing.	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	173	[ATT14:] APPENDIX A -- Evaluation of the SED's Floodplain Benefits and Hatchery Impacts by Stillwater Sciences.	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	174	[ATT14:ATT1:]	The commenter provided this attachment for reference purposes in support of their comments. Those

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		Attachment A-1. Technical Review of the SWRCB's SED -- Floodplain Analyses by Stillwater Sciences. Dated March 6, 2017.	comments are addressed in these responses to comments; therefore, no additional response is required.
1344	175	[From ATT14:ATT1:] The SED uses the generally accepted ecological importance of floodplain access as a justification that some "improvement" in the current floodplain inundation amounts and frequency in the LSJR and its tributaries are needed. However, almost none of the references presented related to current or historical use of LSJR floodplain habitats by Chinook salmon or other floodplain adapted species use of the LSJR. Other than anecdotal accounts of historical floodplain inundation in the lowland portions of the greater San Joaquin River, the SED contains no evidence of, or a basic statement of, a specific floodplain related problem in the LSJR to be solved associated with baseline conditions. The broadest assumption of the SED floodplain analysis which was not stated is that the present-day floodplain inundation amounts and frequency do not support existing aquatic and wildlife beneficial uses. However, no information is provided that demonstrates that aquatic or wildlife beneficial uses are not supported by existing amounts, frequency and timing of floodplain inundation within the San Joaquin Flood Control Project levees.	Chapter 7, Aquatic Biological Resources, explains the tributaries and LSJR have experienced habitat alterations, which have reduced the frequency of overbank flows and the availability of floodplain habitat for salmon rearing and other ecosystem functions (see Environmental Setting). Please see Master Response 3.1, Fish Protection, regarding the adequacy of the floodplain analysis and expected benefits of increased floodplain inundation.
1344	176	[From ATT14:ATT1:] The potential benefits of the UIF alternatives rely upon a more specific assumption that increasing the percentage of time that existing floodplains are inundated will result in increased growth, survival, and production for Chinook salmon and other species. However, rather than relying on any direct assessment of biological resources use of existing floodplain habitats within the in the LSJR, or attempting to examine the strength of the relationship among various biological metrics above with floodplain inundation or other explanatory variables, the presumption of a problem is used to establish a general equivalency between incremental changes in inundation area or frequency and the abundance of the selected floodplain indicator species, Chinook salmon and Sacramento splittail. One would presume that use of indicator species is warranted when information exists for these species use of floodplain habitats. However, because no such information from the LSJR is presented and purported ecological linkages are not documented to any level of local detail there is no way to confidently assess whether current floodplain inundation amounts and frequencies are not protective of beneficial uses or that specific increases and decreases relative to existing conditions are demonstrably more or less protective of these beneficial uses.	The scientific basis for concluding that modified habitat and altered flow regimes has resulted in decreased habitat connectivity and floodplain inundation is presented in Chapter 7, Aquatic Biological Resources; Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30; and Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives. Please refer specifically to Chapter 7 (see Environmental Setting) for a description of how the tributaries and LSJR have experienced habitat alterations, which have reduced the frequency of overbank flows and the availability of floodplain habitat for salmon rearing and other ecosystem functions. Please see Section 19.3 of Chapter 19, and Sections 3.7.3 and 3.7.4 of Appendix C, for information regarding floodplain benefits from a more natural flow regime. Please also see Master Response 3.1, Fish Protection, regarding the adequacy of the floodplain analysis and the expected benefits of increased floodplain inundation.
1344	177	[From ATT14:ATT1:] The "plan area" for analysis of impacts on aquatic biological resources consists of the three eastside tributaries and the lower San Joaquin River between the Merced River confluence and Vernalis. Rather than analyzing each river individually, SED floodplain effects determinations are reached for the plan area as a whole. This serious logical flaw fails to account for the variable conditions and differences in effects among the three tributaries, many of which are discussed in the impact analysis but not given proper consideration for each individual river in the overall determination of significance.	Please see Section 7.4.2, Methods and Approach, for information of how each of the three rivers are evaluated in Chapter 7, Aquatic Biological Resources. The impact analysis evaluates potential impacts on aquatic species evaluates each river individually and makes a conservative overall determination based on the individual river evaluations. For example, Impact AQUA-3, Changes in the quantity/quality of physical habitat for spawning and rearing resulting from changes in flow, evaluates potential impacts on the Stanislaus, Tuolumne, and Merced River looking at those rivers specific floodplain inundation-flow relationships. Tables 7-11a through 7-17c present results for each river and each LSJR alternative. Impact determinations are made for each river using this information. The overall impact determination for Impact AQUA-3 is then conservatively made by considering the determination of each river. In other words, for example, if one river is determined to have impacts that are potentially significant and unavoidable, then the overall determination for the impact is determined to be significant and unavoidable. The impact analysis

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			provides a sufficient degree of analysis to inform decision-makers about the environmental consequences of the plan amendments in light of what is reasonably feasible when considering the magnitude of the plan amendments and their geographic scope. Please refer to Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, for more information as to the expected benefits on each of the three rivers related to floodplain inundation.
1344	178	[From ATT14:ATT1:] As the SED itself describes in Chapter 19, there is no generally accepted, or standard relationship between wetted floodplain area and usable floodplain habitat. The use of "wetted area" to express an "improvement" for specific fish populations is unsupported in the SED and unsupportable in general. References cited by the SED speak to the need for detailed site-and river-specific data on these factors. Without any information on these and other factors from within the areas analyzed, any expectation of "improvement" over current conditions is speculative at best.	Please see Master Response 3.1, Fish Protection, regarding the adequacy of the floodplain analysis, the appropriateness of using floodplain inundation area (wetted area) as a measure of floodplain habitat, and discussion of the expected benefits of increased floodplain inundation.
1344	179	[From ATT14:ATT1:] Inappropriate use of citations. There are many examples of the SED citing a document that is not appropriate or even contrary to the SED findings. For example, in discussing the importance and ecological functions of natural flow regimes, most of the references cited were not based on information developed in the LSJR basin or other Central Valley Rivers (e.g., Bunn and Arthington 2002; Junk et al 1989; Poff and Ward 1989; Poff et al. 1997; Poff et al. 2006; Poff et al. 2007; Richter et al. 1996; Richter et al. 2003; Sparks 1995; Tharme and King 1998; Tharme 2003; Walker et al. 1995). The lack of information on ecological functioning at any specific fraction of UIF suggests that the alternatives presented are arbitrary and the expected benefits are largely hypothetical with no basis in actual data from the LSJR basin. As previously stated, the SED (pages 19-52 through 19-55) makes inappropriate reference to fish growth in studies of seasonal flooding on lowland bypass areas (Sommer et al. 2004; Ahearn et al. 2006) which have no counterpart in the higher gradient foothill settings of the LJSR tributaries to the east of the San Joaquin valley floor, and the SED makes no effort to draw the necessary comparison of similarity between the floodplains referenced in the literature and the floodplains of the three east side tributaries. Use of Sommer et al. 2004 and Ahearn et al. 2006 to support conclusions regarding food web limitations within floodplains or in-channel habitats of the LSJR and tributaries (SED Page 7-43) is inappropriate. No information is presented regarding current levels of food resources within the LSJR tributaries. Use of Matella and Merenlender (2014) to support statements regarding food limitation for Chinook salmon related to floodplain access within the LSJR and tributaries (SED page 7-45) is also inappropriate. The reference analyzes floodplain inundation frequency and no information is presented regarding current levels of food resources within the LSJR tributaries.	The comment contains inaccuracies. The study by Matella and Merenlender (2014) did evaluate food resources; specifically, it evaluated flooding conditions that are needed to produce phytoplankton and zooplankton. Although Sommer et al. (2004) and Ahearn et al. (2006) were performed in other systems outside the LSJR watershed, these studies support the concept that reductions in primary and secondary production (phytoplankton and invertebrate production) associated with seasonal floodplain inundation, as a result of regulated flows downstream of dams and losses of overbank flooding, have likely contributed to historical declines and current limitations on native fish populations. As described in Chapter 7, Aquatic Biological Resources, (see Section 7.2, Environmental Setting), the tributaries and LSJR have experienced habitat alterations, which have reduced the frequency of overbank flows and the availability of floodplain habitat for salmon rearing and other ecosystem functions. Please see Chapter 7 (Section 7.2.2, Reservoirs, Tributaries, and LSJR); Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30 (Section 19.3.1, Importance of a Natural Floodplain Inundation Regime); and Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives (Section 3.7.2), for descriptions of how current research indicates that regulated flows downstream of dams and losses of overbank flooding have likely contributed to historical declines and current limitations on native fish populations through reductions in primary and secondary production (phytoplankton and invertebrate production) associated with seasonal floodplain inundation. Please see Appendix C for information regarding the anticipated benefits of higher and more variable flows including, but not limited to, food web, aquatic habitat, and geomorphic processes. Please also see Master Response 3.1, Fish Protection, regarding the use of best available science, benefits of the unimpaired flow approach, and the adequacy of the floodplain analysis, including consideration of studies performed outside of the SJR tributaries and the LSJR.
1344	180	[From ATT14:ATT1:] No evidence of food availability or Chinook salmon rearing within floodplain or in-channel	As described in Chapter 7, Aquatic Biological Resources (see Environmental Setting), the tributaries and LSJR have experienced habitat alterations, which have reduced the frequency of overbank flows and the availability of floodplain habitat for salmon rearing and other ecosystem functions. Please see Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity

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		habitats of the LSJR and tributaries is presented. In Section 19.3, no information is presented regarding floodplain ecology within the modeled LSJR tributaries, such as data on current levels of food resources, Chinook salmon growth rates or survival rates related to floodplain access or the frequency and duration of inundation events. For example, page 7-38 states: "Although specific food web studies have not been conducted in the Tuolumne River, current research indicates that regulated flows downstream of dams and losses of overbank flooding have likely contributed to historical declines and current limitations on native fish populations through reductions in primary and secondary production (phytoplankton and invertebrate production) associated with seasonal floodplain inundation (Sommer et al. 2004; Ahearn et al. 2006)." This statement does not take into account the many years of benthic macroinvertebrate and drift sampling (e.g., TID/MID 1997, Report 96-4; TID/MID 2003, Report 2002-8), food ration studies from direct stomach sampling (TID/MID 1992, Appendix 16; TID/MID 1997, Report 96-9), as well as recent evidence showing high lipid content found in Chinook salmon smolts sampled from the Tuolumne River and other LSJR tributaries in 2001 by Nichols and Foott (2002), all of which demonstrate that food resources are not currently limiting based upon current levels of floodplain access. Lastly, because no evidence is presented showing in-channel food resources are limiting Chinook salmon rearing and emigration success from the LSJR and its tributaries to the point that increases in floodplain inundation is needed to relieve this limitation, future monitoring will be unable to statistically discriminate the relative benefits of specific UIF recommendations on the basis of floodplain inundation.	Objectives, regarding the anticipated benefits of higher and more variable flows including, but not limited to, food web, aquatic habitat, and geomorphic processes. As described in Appendix K, Revised Water Quality Control Plan, the program of implementation includes biological goals including, but not limited to, productivity as measured by population growth rate will specifically be developed for LSJR salmonids to determine the effectiveness of the program of implementation. Please see Master Response 2.1, Amendments to the Water Quality Control Plan, regarding the plan amendments and the program of implementation, including biological goals. Please also see Master Response 2.2, Adaptive Implementation, regarding the adaptive implementation process. Please see Master Response 3.1, Fish Protection, for a description of the importance of biological goals from a population monitoring perspective. Please also see Master Response 3.1, Protection of Fish and Wildlife, regarding the use of best available science, the adequacy of the floodplain analysis and expected benefits from increased floodplain inundation.
1344	181	[From ATT14:ATT1:] Study reach extent and characteristics. In Section 19.3.2, the study reach in the SED for the LSJR includes only limited floodplain extent due to the confining levees of the San Joaquin River Flood Control levees authorized by the Flood Control Act of 1944 and constructed between 1956 and 1972. Leaving aside concerns over the timing of floodplain inundation for the moment, the areas being characterized as floodplain habitats in the SED are generally limited to toe berms of the project levees in the reach downstream of the Tuolumne River with the total inundated area shown in Table 19-21 (2,773 acres in reaches 3 and 4 at a flow of 15,000 cfs) is less than 5% of the 59,000-acre Yolo bypass considered in floodplain rearing studies in the SED (Sommer et al 2001). For the Tuolumne River, the modeled study reach extent is from RM 52 to RM 21.5 (page 19-58), which omits the lower 20 miles of the river that was modeled by HDR and Stillwater Sciences (2016). The SED provides no explanation for this. While much of that lower river is urban area within the City of Modesto, there is also some agricultural land use. Based on the Districts' own study of the entire floodplain habitat on the Tuolumne River the varying topography in these confluence areas presents different inundation thresholds, flow vs inundation area relationships, and habitat suitability considerations (HDR and Stillwater Sciences 2016).	The State Water Board recognizes that non-flow measures have a complementary role to flow-based restoration. Please see Master Response 5.2, Incorporation on Non-Flow Measures, regarding the role of non-flow measures in the overall health of the tributaries and how non-flow measures relate to the plan amendments. The comments include some inaccuracies. The FERC report cited by the commenter as HDR and Stillwater Sciences (2016) was released publically in February 2017, several months after the 2016 Recirculated Draft SED was released for public review. As such, the report was unavailable to staff during preparation of the SED. The report concludes that overall, flows above bankfull discharge are associated with increases in habitat area for juvenile life stages of lower Tuolumne River salmonids. These findings are not inconsistent with the SED and are acknowledged in Master Response 3.1, Fish Protection (see the adequacy of the floodplain analysis discussion). Furthermore, expanding the floodplain analysis in the SED to incorporate the entire Tuolumne River would likely increase the floodplain inundation benefits associated with the plan amendments. Please also see Master Response 3.1 regarding the adequacy of the floodplain analysis, including the applicability of studies from other rivers, and expected benefits from increased floodplain inundation, including in areas with narrow floodplain habitat.
1344	182	[From ATT14:ATT1:] Selected assessment metrics. The most common approaches used in species recovery planning include (1) development	Please see Master Response 3.1, Fish Protection, regarding floodplain habitat and the the appropriateness of monthly modeling, habitat metrics, and significance criteria for programmatic evaluation of the LSJR alternatives with respect to their impacts and benefits on aquatic resources. Please also see Master Response 2.2, Adaptive Implementation, which describes the program of implementation and adaptive implementation approach to address uncertainty and provide flexibility to modify the frequency, timing,

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		of ecological or other performance standards based on descriptive statistics of habitat metrics, and (2) assessment of the relative importance of limiting factors that potentially constrain the production of a species of interest (ISAB 2003). For the floodplain topic addressed by the SED, the quantity of available floodplain habitat for the indicator species is evaluated using only the area of inundation and total number of days of inundation (p. 19-56), without consideration of the duration of continuous inundation as well as habitat suitability of the inundated habitat based on common criteria such as depth, velocity, cover, or water temperature on the floodplains. Similarly, in advancing a functional floodplain approach the proposed floodplain inundation frequency metric used to analyze rearing benefits for indicator species does not consider the annual recurrence period of inundation events of particular durations. Matella and Merenlender (2014), which was reviewed in the preparation of the SED, presents suggested durations and recurrence periods to benefit Chinook salmon, splittail, and other native species. While the SED recognizes there is little data available to assess specific inundation goals (SED page 19-56) or to separate the effects of floodplain inundation from other factors affecting inland and ocean life stages of Chinook salmon, the SED claims as useful and then adopts the floodplain inundation area and frequency metrics above and then adopts a 10 percent change from baseline in combination with "professional judgment" to determine a significant benefit or impact. This arbitrary assignment of significance is unsupported and will simply lead to self-fulfilling conclusions that UIF scenarios producing greater than 10 percent increases are necessary for species recovery. Courts have previously rejected the assertion that an agency conclusion is a "finding" where it was merely a prediction based on opinions. (See Bangor Hydro-Elec. Co. v. FERC, 78 F.3d 659, 663 [D.C. Cir. 1996]). Basing such "professional judgment" opinions upon limited studies from areas outside of the LJSR study area is unwarranted. Because the information presented which has been available for well over a decade, one would expect it would be used to inform monitoring studies during the multiple years of floodplain inundation that have occurred since the earliest floodplain rearing studies of Sommer et al (2001). Any conclusions on ecological functioning of in-channel and floodplain habitats should be based upon a well-designed study program that examines physical and biological monitoring data to develop a local understanding regarding inter-annual variations in life history outcomes at a range of flow magnitudes, floodplain inundation frequency and event duration within the LSJR.	duration, and magnitude of flows within the 30 to 50 percent range to meet specific ecological flow needs (e.g., floodplain inundation targets to support species life history and habitat needs).
1344	183	[From ATT14:ATT1:] Assessment Results. We fundamentally disagree with the premise of comparing floodplain inundation for baseline hydrology and various UIF proposals based on annual exceedance frequency of total acre-days of inundation across the 82-year analysis period. Because no minimum inundation amounts, minimum duration, or minimum annual recurrence frequency for floodplain is established in the SED or compared to other factors affecting the target Fall-run Chinook salmon population or other aquatic beneficial uses, there is no basis to conclude that the current inundation amounts and frequency do not adequately support existing beneficial uses or that the apparent "improvements" in the selected metrics will support future species recovery. Nevertheless, examining the LSJR and tributary-specific results shown in Tables 7-15(a-d) shows that baseline inundation areas are generally	Please see response to comment 1344-181 regarding the study cited by the commenter as HDR and Stillwater Sciences (2016). The scientific basis for concluding that modified habitat and altered flow regimes has resulted in decreased habitat connectivity and floodplain inundation is presented in Chapter 7, Aquatic Biological Resources; Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30; and Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives. Please refer specifically to Chapter 7 (see Environmental Setting) for a description of how the tributaries and LSJR have experienced habitat alterations, which have reduced the frequency of overbank flows and the availability of floodplain habitat for salmon rearing and other ecosystem functions. Please see Section 19.3 of Chapter 19, and Sections 3.7.3 and 3.7.4 of Appendix C, for information regarding floodplain benefits from a more natural flow regime. The commenter is correct that the incremental floodplain benefits during February and March are lower;

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		present at frequencies equal to, or in excess of those under the proposed UIF scenarios presented during the February and March periods when fry and juvenile Chinook salmon would be expected to benefit from floodplain inundation. Although some UIF scenarios show small increases in floodplain inundation frequency during April and greater amounts in May which could potentially support Splittail spawning no information is presented analyzing the timing or duration of flows necessary for Splittail spawning. For Chinook salmon, the vast majority of rearing juveniles would be expected to reach smolt size and emigrate by this time and not benefit from floodplain growth opportunities. Further, the April and May periods generally coincide with rapidly rising air temperatures and it is unlikely that temperatures suitable for survival let alone smoltification (USEPA 2003) occur within inundated floodplain habitats during this timeframe. Not assessed here is that the rearing habitat impact analyses do not account for total usable rearing habitat variations with flow. In Sections 19.3.2 and 19.3.3, the floodplain versus flow relationships presented for the LSJR and its tributaries (SED pages 19-58 through 19-62) do not consider habitat suitability of inundated overbank habitat for juvenile Chinook salmon or other species based on depth, velocity, or other attributes such as water temperature on floodplains. Because this method will over-represent usable habitat amounts at different flows, the reported inundation frequency results for the specific UIF scenarios evaluated (Tables 7-15, 19-24, 19-25, and 19-28) must lead to differing conclusions than if usable habitat had been considered. For example, information available from the Districts' more recent and more detailed floodplain hydraulic study of Tuolumne River floodplains (HDR and Stillwater Sciences 2016) shows that the fraction of usable to total habitat is sometimes as low as 30 percent, varying both by river sub-reach as well as with discharge. The Tuolumne River study shows that potential gains in habitat that come with increased floodplain inundation are accompanied by losses in habitat associated with increased in-channel velocities and depths, and these gains/losses are not assessed. Because there is a non-linear relationship between flow and usable habitat and because channel and floodplain morphology contributes to large spatial variations between usable habitat and flow, any conclusions regarding annual exceedance frequencies of floodplain inundation will differ if expressed based on total inundation area rather than usable habitat.	however, it is important to note the potential for overall benefits from the plan amendments (shown in Table 19-28) are between a 16% and 74% increase in annual average floodplain inundation during February through June under the 30-50 percent unimpaired flow range of the preferred alternative. As described in Chapter 7, key evaluation species that are used to determine impacts of the LSJR alternatives on aquatic resources include anadromous fish, reservoir fish, and warmwater reservoir fish (including non-natives). Indicator species were selected because of their utility in evaluating broader ecosystem and community-level responses to environmental change. In particular, the responses of Central Valley fall-run Chinook salmon to changes in flow, water temperature, and other flow-related variables have been well studied and provide a general indication of the overall response of the ecosystem to hydrologic change. Although no analysis was performed specific to splittail, the impacts from the LSJR alternatives are considered for other species including, but not limited, to splittail. Please see Master Response 3.1, Fish Protection, regarding the adequacy of the floodplain analysis, including expected benefits from increased floodplain inundation, the appropriateness of using floodplain inundation area (wetted area) as a measure of floodplain habitat, and the relationship between floodplain and temperature. Also, see the section regarding the presence of salmon and steelhead in June.
1344	184	[From ATT14:ATT1:] Inappropriate attribution of Chinook smolt survival to floodplain inundation. In Section 19.3.1 (page 19-53), reference is made to a USFWS (2014) study purporting to show a positive relationship between juvenile survival as a function of floodplain inundation expressed in acre-days. This analysis is flawed in several ways. First, the referenced study did not specifically analyze the difference in fish survival within floodplain vs in-channel habitats, which is normally accomplished using PIT-tagging or other mark-recapture techniques. Instead, the USFWS (2014) study re-analyzed in-channel rotary screw trap (RST) data from 1996-2009 based on a flow data transform to arrive at a floodplain inundation metric. No comparisons of other flow data transformations (e.g., log-flow, power law fits, flows within particular months) are presented to determine if the hypothesized linkage between floodplain inundation and in-channel RST passage is suggested. Since the RSTs are deployed at in-channel locations, floodplain benefits cannot possibly be separated from the effects of in channel flow variations on predator habitat suitability and encounter rates	Please see Master Response 3.1, Fish Protection, regarding the use of best available science in the SED, the adequacy of the floodplain analysis, and expected benefits from increased floodplain inundation. The information provided with regard to the study referenced in the comment does not affect the overall conclusion that a more natural flow regime from the salmon bearing tributaries (Stanislaus, Tuolumne, and Merced Rivers) is needed. As described in Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives; Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30; and Chapter 7, Aquatic Biological Resources, numerous studies have demonstrated that both aquatic and riparian ecosystems benefit from dynamic connectivity between rivers and their floodplains. The commenter has focused on one citation of dozens in the SED that describe the importance of floodplain habitat. Additionally, the referenced study did not collect their own population monitoring data, but used survival estimates based on rotary screw trap data from Zeug et al. (2014) in order to understand how inundated floodplain area affects juvenile survival. According to the referenced study, “The biological validation of the floodplain area-flow relationship increases confidence in the applicability of the flow-floodplain relationship to evaluate survival of juvenile

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		between predators and emigrating juvenile salmon. Because the study does not attempt to assess spatial variations in Chinook salmon mortality within either floodplain or in-channel locations, use of inundation area as an explanatory variable is inappropriate and only a traditional survival vs. flow relationship is supportable. Lastly, whether using the flow-area data transform presented or simply flow as an explanatory variable, the resulting regression presented in USFWS (2014) to explain relative RST passage as a survival index appears to be based on just three groups of clustered points. Statistically, the resulting relationship can only be considered suggestive and should only be used as the basis of data collection efforts to validate the hypothesized linkages. Such studies would include controlled mark-recapture or tracking studies to assess differential growth and mortality of fish within adjacent in-channel and floodplain habitats of the LSJR and tributaries.	anadromous salmonids in the Stanislaus River."
1344	185	[From ATT14:ATT1:] Other publicly available information not considered. As an example of publicly available information that was not reviewed for the SED includes studies of invertebrate food supply (e.g., TID/MID 1997, Report 96-4; TID/MID 2003, Report 2002-8), direct stomach content sampling of Chinook salmon (TID/MID 1992, Appendix 16; TID/MID 1997, Report 96-9) as well as physiological assessments by USFWS (Nichols and Foott 2001), data representing current levels and frequency of floodplain inundation, data that suggests existing food resources are more than adequate for rearing and smoltification of Chinook salmon. Further, because seasonal air temperatures in the lower portions of the LSJR tributaries may reach 80-90°F during late May and through June (TID/MID 2013), water temperatures within inundated floodplain habitats in the lower reaches of the Tuolumne River would be well above EPA (2003) temperature recommendations being used in other sections of the SED and there is no reason to believe that increased floodplain inundation metrics in this time period (Tables 19-22 through 19-27) would benefit the targeted Fall-run Chinook salmon population.	Please see Chapter 7, Aquatic Biological Resources (Section 7.2.2); Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30 (Section 19.3.1); and Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives (section 3.7.2), for information descriptions of how current research indicates that regulated flows downstream of dams and losses of overbank flooding have likely contributed to historical declines and current limitations on native fish populations through reductions in primary and secondary production (phytoplankton and invertebrate production) associated with seasonal floodplain inundation. Documents prepared for TID/MID as part of the FERC relicensing process were considered and referenced in Chapter 7. Additionally, an investigational report on health monitoring and natural fall-run Chinook salmon juveniles in the San Joaquin and Tributaries by Nichols and Foott was considered and referenced in both Chapters 7 and 19. Please see Master Response 3.1, Fish Protection, regarding use of best available science in the SED, the adequacy of the floodplain analysis, including expected benefits from increased floodplain inundation and the relationship between floodplain and temperature. Also see the use of USEPA recommended temperature criteria, and temperature improvements during June.
1344	186	[From ATT14:ATT1:] ALTERNATIVE FINDINGS AND CONCLUSION. Because many of California's native species have evolved and adapted to take advantage of seasonal floodplain inundation (See Moyle 2002), several studies suggest that increasing the inter-annual inundation frequency (Matella and Merenlender 2014) and duration of floodplain habitats (Matella and Jagt 2014) may provide access to significant food resources for rearing salmonids (Sommer et al. 2001, Sommer et al. 2004, Grosholz and Gallo 2006). In addition to direct biological data collection within in-channel and floodplain habitats of the LSJR study area, modeling that predicts area, depth, frequency, and duration of floodplain inundation would be a much more appropriate and valuable tool than the modeling used in the SED. Such models are available such as the expected annual habitat (EAH) method of Matella and Jagt (2014). As an example of an alternative modeling approach, floodplain inundation for the WY 1971-2012 hydrology on the lower Tuolumne River was considered by the Don Pedro Project relicensing floodplain study (HDR and Stillwater Sciences 2016). Area-duration-frequency analyses for the period above were conducted based on 2-D modeling floodplain habitat vs	Please see response to comment 1344-181 regarding the study cited by the commenter as HDR and Stillwater Sciences (2016). Staff understands that there are multiple methodologies available for assessing floodplain inundation benefits from flow scenarios. The analyses in Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, are provided to supplement the information contained in Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives. Please see Master Response 3.1, Fish Protection, regarding the use of best available science in the SED and the adequacy of modeling to support the analyses. Please see Master Response 3.1 for a description of how the unimpaired flow approach to the plan amendments, when used with adaptive implementation, will essentially provide functional flows. Please also see Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, Adaptive Implementation, for more information regarding functional flows.

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		flow relationships. The results show that floodplain inundation (e.g., 14 to 21 days) analyzed during the rearing period of Chinook salmon (February through May) currently occurs at a 2- to 4-year recurrence interval on the lower Tuolumne River consistent with the typical return periods of fall-run Chinook salmon and Sacramento River suggested to be supportive of salmon by Matella and Merenlender (2014). Only considering inundated area, for comparability to the SED, Figure 1 [ATT14:ATT1:ATT1] shows the frequency of occurrence of inundated area over several event durations under current hydrology conditions on the Tuolumne River. This analysis does not consider habitat suitability and any direct assessment of actual habitat use, but is intended to illustrate the functional flow concepts advanced by several references included in the SED.	
1344	187	[ATT14:ATT1:ATT1:] Figure 1. Total area-duration-frequency (ADF) plot showing recurrence of events exceeding various total inundation area and duration thresholds in the lower Tuolumne River (RM 52-0) from February through May under Base Case (1971-2012) hydrology (HDR and Stillwater Sciences 2016).	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	188	[ATT14:ATT2:] Attachment A-2. Technical Review of the SWRCB's SED -- Supplemental Analysis of Hatchery Impacts upon Survival and Escapement of Naturally-Produced Chinook Salmon from the Lower San Joaquin River and Tributaries by Stillwater Sciences. Dated March 6, 2017.	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	189	[From ATT14:ATT2:] Because the SED contains relatively little information regarding the impacts of hatchery salmon, Stillwater Sciences conducted a review to determine whether flow increases proposed in the SED improve survival and escapement of naturally-produced Chinook salmon. The following key points are summarized: -- Recent evidence shows that hatchery-origin fall-run Chinook salmon are replacing and now far outnumber natural fall-run Chinook in the Central Valley, with adult returns to all SJR tributaries dominated by hatchery fish in most years.	Please see Master Response 3.1, Fish Protection, regarding the role of hatcheries.
1344	190	[From ATT14:ATT2:] Because the SED contains relatively little information regarding the impacts of hatchery salmon, Stillwater Sciences conducted a review to determine whether flow increases proposed in the SED improve survival and escapement of naturally-produced Chinook salmon. The following key points are summarized: -- An observed lack of genetic distinction between hatchery and naturally spawning fall-run Chinook salmon throughout the Central Valley and the loss of early life history diversity, due to the long history of interbasin hatchery transfers and stocking, as well as the increasing practice of out-of-basin release of hatchery-reared juveniles, are reducing the population's ability to adapt and maintain stability in the face of fluctuating environmental conditions. Increasing evidence indicates that these and other hatchery influences are likely reducing reproductive fitness of Central Valley Chinook salmon on a large scale.	Please see Master Response 3.1, Fish Protection, regarding the role of hatcheries.

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1344	191	[From ATT14:ATT2:] Because the SED contains relatively little information regarding the impacts of hatchery salmon, Stillwater Sciences conducted a review to determine whether flow increases proposed in the SED improve survival and escapement of naturally-produced Chinook salmon. The following key points are summarized: -- The high proportions of hatchery-origin Chinook salmon represented in recent Tuolumne River spawning runs suggest that the influence of Project-related effects (e.g., flow) on salmon production as well as the ability to discriminate the effectiveness of potential measures intended to benefit naturally-reproducing salmon and steelhead populations may be obscured by uncertainties related to the production, survival, recruitment, and reproductive fitness of hatchery fish from the Mokelumne River hatchery, Merced River hatchery and other Central Valley hatcheries.	Please see Master Response 3.1, Fish Protection, regarding the role of hatcheries. The program of implementation (see Appendix K, Revised Water Quality Control Plan) describes biological goals (indicators of viability including abundance; productivity as measured by population growth rate; genetic and life history diversity; and population spatial extent, distribution, and structure) that will specifically be developed for LSJR salmonids to determine the effectiveness of the program of implementation. Please see Master Response 2.1, Amendments to the Water Quality Control Plan, for clarifying descriptions regarding modifications to the plan amendments, and the program of implementation, including biological goals. Please see Master Response 2.2, Adaptive Implementation, for clarification regarding the adaptive implementation process. Please also see Master Response 3.1, Fish Protection, for a description of the importance of biological goals from a population monitoring perspective.
1344	192	[From ATT14:ATT2:] Because the SED contains relatively little information regarding the impacts of hatchery salmon, Stillwater Sciences conducted a review to determine whether flow increases proposed in the SED improve survival and escapement of naturally-produced Chinook salmon. The following key points are summarized: -- If the proposed flow measures primarily benefit hatchery salmon and steelhead, substantial adverse impacts may result and should be specifically analyzed in the EIR. Johnson et al. (2012) found that the clear majority of adult Chinook salmon spawning in the Stanislaus River were hatchery-produced fish only 1 to 2 generations removed from the hatchery, and concluded that hatchery-related genetic and ecological impacts could be contributing significantly to the large-scale population decline observed for Chinook salmon throughout the Central Valley.	The State Water agrees, and recognizes in the SED, that hatchery operations have an influence on anadromous fish populations. Please see Master Response 3.1, Fish Protection, regarding the consideration of hatchery affects in the SED. The supporting reference used by the commenter does not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the SED. As described in Appendix K, Water Quality Control Plan, and further described and clarified in Master Response 2.1, Amendments to the Water to the Water Quality Control Plan, the amendments are designed to “support and maintain the natural production of viable native migratory San Joaquin River watershed fish populations migrating through the Delta”. The phrase “natural production” refers to naturally occurring fish populations as opposed to those originating in fish hatcheries. The convening of a STM Working Group and development of biological goals will facilitate the tracking of natural populations, and help determine the effectiveness of the LSJR flow objectives. Please refer to Master Response 3.1, Fish Protection, regarding the plan amendments maintaining and supporting natural-origin fish.
1344	193	[From ATT14:ATT2:] Because the SED contains relatively little information regarding the impacts of hatchery salmon, Stillwater Sciences conducted a review to determine whether flow increases proposed in the SED improve survival and escapement of naturally-produced Chinook salmon. The following key points are summarized: -- The SED includes little acknowledgment of the current and increasing prevalence of hatchery-origin Chinook salmon in SJR populations, and provides no information on the relative effects of flows on hatchery fish vs. naturally-produced fish or whether the proposed measures can be reasonably expected to improve natural production. Because the WRCB goal is "natural production," the SED needs to analyze the benefits and impacts of the proposed measures in a manner that specifically addresses whether the proposed alternatives would have any beneficial effect on natural production of Chinook salmon and steelhead or would mainly benefit hatchery fish, as well as the long-term implications of the alternatives on population viability in consideration of increasing hatchery influence.	Please see Master Response 3.1, Fish Protection, regarding the role of hatcheries. Please see response to comment 1344-191 regarding the development of biological goals to determine the effectiveness of the program of implementation.
1344	194	[From ATT14:ATT2:]	Please see Master Response 3.1, Fish Protection, for information regarding the role of hatcheries. Recommended specific standards and guidelines to reduce the influence of hatchery practices on natural-

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		Because the SED contains relatively little information regarding the impacts of hatchery salmon, Stillwater Sciences conducted a review to determine whether flow increases proposed in the SED improve survival and escapement of naturally-produced Chinook salmon. The following key points are summarized: -- The observation that estuary releases of advanced smolts compose most of the fishery catch and hatchery escapement yet exhibit high rates of straying from their natal hatcheries indicates that hatchery practices are increasingly producing salmon that survive at relatively high rates but have low rates of fidelity to their natal streams and little need or opportunity to express a diversity of life history traits. Because these fish are largely disconnected from the selective pressures present in the natural riverine environment, the effects of management actions that target freshwater habitat without also addressing hatchery practices and other influences on survival and fitness (e.g., predation and habitat quality in the estuary) may be increasingly futile for conservation and recovery of Central Valley salmon and steelhead. This position is supported by the results of Johnson et al. (2012), who found that wild-origin Chinook salmon in the Mokelumne River were 3 times as likely as hatchery-origin salmon to spawn in the river. The authors note that if wild-origin salmon preferentially spawn with other wild-origin fish, then advantageous genetic traits remaining within the natural population could become re-established if the abundance of hatchery-origin salmon is reduced and mortality (e.g., from predation in the river and estuary) is decreased.	origin salmonid populations include: altering marking\tagging strategies to identify hatchery fish; release practices to reduce straying; and other recommendations to increase the local adaptations of natural fish. The State Water Board recognizes that non-flow measures have a complementary role to flow-based restoration. Please see Master Response 5.2, Incorporation on Non-Flow Measures, regarding the role of non-flow measures in the overall health of the tributaries and how non-flow measures related to the plan amendments.
1344	195	[From ATT14:ATT2:] Because the SED contains relatively little information regarding the impacts of hatchery salmon, Stillwater Sciences conducted a review to determine whether flow increases proposed in the SED improve survival and escapement of naturally-produced Chinook salmon. The following key points are summarized: -- While abundance is one of the essential measures of salmonid population viability (McElhany et al. 2000), management measures aimed at increasing abundance without also understanding how abundance is associated with demographic processes such as survival and immigration (Johnson et al. 2012), and how these processes are affected by hatchery influence, are unlikely to improve the viability of anadromous salmonid populations. As demonstrated by Johnson et al. (2012), substantial subsidies of hatchery-origin Chinook salmon into a local population can decouple abundance from viability and obscure the dynamics of the naturally-produced population. In the sections below, we provide a more detailed review of hatchery and natural production assessments as well as whether proposed flow increases envisioned by the SED would improve survival and escapement of naturally produced Chinook salmon from the LSJR and its three tributaries (Merced, Tuolumne, and Stanislaus rivers).	Please see Master Response 3.1, Fish Protection, regarding the role of hatcheries. As described in Appendix K, Revised Water Quality Control Plan, population abundance is just one of the indicators of viability that will be developed in the program of implementation as a biological goal to determine the effectiveness of the program of implementation. See response to comment 1344-191 regarding biological goals.
1344	196	[From ATT14:ATT2:] RELATIVE AMOUNTS OF HATCHERY- AND NATURALLY-PRODUCED CHINOOK SALMON AND CHANGES OVER TIME. Populations of fall-run Chinook salmon in the Central Valley, including runs in the	Please see Master Response 3.1, Fish Protection, regarding the role of hatcheries.

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		Sacramento and San Joaquin basins, are heavily supplemented by hatchery production (Huber and Carlson 2015). Recent evidence shows that hatchery-origin fall-run Chinook salmon are replacing and now far outnumber natural fall-run Chinook in the Central Valley (Kormos et al. 2012, Palmer-Zwahlen and Kormos 2013, 2015), and Barnett-Johnson et al. (2007) determined that 90% of Chinook salmon captured in the California ocean harvest originated from Central Valley hatcheries. The proportion of hatchery fall-run Chinook salmon is particularly high in San Joaquin River tributaries and streams with hatcheries (e.g., Battle Creek, Feather River, Mokelumne River) (Kormos et al. 2012, Palmer-Zwahlen and Kormos 2013, 2015). In the Mokelumne River, Johnson et al. (2012) found that 91-99% of spawning adults in 2004 were of hatchery origin, and that without hatchery-origin salmon the Mokelumne River Chinook salmon population would not be viable (i.e., would have a negative population growth rate). Although total releases of Chinook salmon from the two dominant Central Valley hatcheries (Coleman and Nimbus) have declined over time since inception of the hatchery programs, releases from the Feather, Mokelumne, and Merced hatcheries have generally increased (Huber and Carlson 2015). Estimates based on mathematical expansions of coded-wire tag recoveries from Tuolumne River Chinook salmon in 2010, 2011, and 2012 revealed that hatchery-origin salmon composed an estimated 49%, 73% and 36% of the runs in these years, respectively (Kormos et al. 2012; Palmer-Zwahlen and Kormos 2013, 2015). Relative contributions from various hatcheries to the Tuolumne River fall-run Chinook spawning runs varied from 2010-2012. In 2010, the hatchery component of the spawning run was dominated by fish from the Merced River hatchery, the Coleman National Fish Hatchery, and the Feather River hatchery, with smaller contributions from the Mokelumne and Nimbus hatcheries (Kormos et al. 2012). In 2011, Tuolumne River spawners of hatchery origin were composed mainly of fish from the Mokelumne River, Merced River, and Feather River hatcheries, with smaller numbers of fish from the Coleman and Nimbus hatcheries (Palmer-Zwahlen and Kormos 2013). In 2012, hatchery-origin spawners in the Tuolumne River were overwhelmingly from the Mokelumne hatchery, with small proportions from the Merced River, Coleman, and Feather River hatcheries (Palmer-Zwahlen and Kormos 2015). Tuolumne River spawners from out-of-basin hatcheries are overwhelmingly strays, as the relative proportion of salmon from those hatcheries released in the San Joaquin River basin has been very low in the last 20 years and there have been no out-of-basin hatchery salmon released in the basin since 2008 (Figure 1 [see ATT14:ATT2:ATT1]). With few exceptions (e.g., 2007 and 2008), almost all hatchery Chinook salmon from the Merced River and Mokelumne River hatcheries are released at locations in the San Joaquin River basin (Figure 2 [see ATT14:ATT2:ATT2]). Otolith analysis from eight generations of Chinook salmon spawning in the Tuolumne River indicates that hatchery contributions make up a somewhat larger proportion of the annual spawning runs than indicated by the coded-wire tag analyses, and the proportions of hatchery fish have been increasing in recent years (Stillwater Sciences 2015). Using recovery data only from 3-year olds, which are expected to make up the bulk of the annual escapement, the mean proportion of Tuolumne River spawners of hatchery origin in five spawner years (2000-2002, 2005, and 2011) was 58% (range: 36-90%). Whereas Palmer-Zwahlen and Kormos (2015) estimated a 73% hatchery contribution to the 2011 Tuolumne River spawning run, the otolith study results indicate that 90% of the spawning run was of hatchery origin in the same year (Stillwater Sciences 2015). The apparent underestimate of the hatchery contribution is consistent with the findings of Mohr and Satterthwaite (2013),	

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		which revealed that misclassification of adipose fin presence/absence in Chinook salmon carcass counts can result in significant estimation bias. If these findings apply to the Tuolumne River, the actual proportion of hatchery-origin spawners in the Tuolumne River is likely higher than reported from recent coded-wire tag expansions (e.g., Kormos et al. 2012; Palmer-Zwahlen and Kormos 2013, 2015). In fall 2015, the most recent year for which data are available, 23% of adult Chinook salmon observed at the Tuolumne River counting weir were adipose-clipped, indicating hatchery origin (Becker et al. 2016). Because the constant fractional marking (CFM) program implemented at the Merced River hatchery in 2012 and elsewhere in 2007 marks only 25% (on average) of all hatchery-produced Chinook salmon, this represents a theoretical minimum, and the actual proportion of hatchery-origin fish was undoubtedly higher. Becker et al. (2016) postulate that most and perhaps all the adult salmon observed at the Tuolumne River weir in 2015 were of hatchery origin, since about 75% of hatchery salmon are not adipose-clipped and the assumption that adipose fin-clipping has no influence on the high hatchery straying rate. While the large proportion of hatchery-origin Chinook salmon spawning in the Tuolumne River in recent years may be correlated with the increasing releases from the two San Joaquin River basin hatcheries, data that would allow investigation of such longer-term trends are lacking. Because the numbers of unmarked hatchery releases have been very high and variable in the several decades prior to initiation of the CFM program in California, the accuracy of reported long term averages and directions of long term trends in natural production cannot be determined using analytical procedures (Newman and Hankin 2004).	
1344	197	[ATT14:ATT2:ATT1:] Figure 1. Hatchery releases of fall-run Chinook salmon into the San Joaquin River basin since 1991 (source: RMIS 2017).	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	198	[ATT14:ATT2:ATT2:] Figure 2. In-basin and out-of-basin releases of Chinook salmon from the Merced River and Mokelumne River hatcheries combined (source: RMIS 2017).	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	199	[From ATT14:ATT2:] HATCHERY INFLUENCE ON CENTRAL VALLEY CHINOOK SALMON. Most research has focused on genetic effects and, to a lesser degree, ecological effects of hatchery-reared salmonids. A study of the population genetic structure and diversity in Central Valley Chinook salmon by Williamson and May (2005) suggests that fall-run Chinook salmon occupying rivers and streams throughout the Central Valley belong to a genetically homogeneous population, with lower genetic diversity than other fall-run Chinook salmon populations examined at similar geographic scales and little to no differentiation between salmon reared in hatcheries and their wild counterparts. The lack of genetic distinction between hatchery and naturally spawning fall-run Chinook salmon indicates that considerable gene flow occurs between fall-run Chinook salmon throughout the Central Valley, almost certainly due to the long history of interbasin hatchery transfers and stocking	Please see Master Response 3.1, Fish Protection, regarding the role of hatcheries.

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		throughout the Central Valley and the increasing practice of off-site release of hatchery-reared juveniles (Huber and Carlson 2015, Garza et al. 2008, Williamson and May 2005). Since the early 1980s, a substantial and increasing proportion of Chinook salmon from Central Valley hatcheries has been released in the San Francisco estuary downstream of Chipps Island. From 1981-2012, estuary releases averaged 13 million fish annually (Huber and Carlson 2015). Of the Chinook salmon that survive to adulthood, those reared in Central Valley hatcheries and released off-site (outside their basin of natal origin, including the estuary) stray into non-natal basins at a frequency about eight times greater than hatchery salmon released on-site (Huber and Carlson 2015, Cramer 1991). Straying is problematic for anadromous salmonid conservation and recovery because it can reduce the ability of salmon to adapt to local environmental conditions (McElhany et al. 2000, Lindley et al. 2009) and mask the decline of wild populations (Johnson et al. 2012). The loss of genetic diversity and differentiation between Chinook salmon subpopulations in the Central Valley is a major concern because genetic diversity and its phenotypic expression in life history and behavioral traits is a crucial factor in maintaining the adaptability and resilience of the population to variable environmental conditions (Sturrock et al. 2015). Using a multi-component index to describe life history diversity, Huber and Carlson (2015) found that early life history diversity of Chinook salmon released from Central Valley hatcheries has declined by approximately 50% since the 1980s. The loss of diversity among populations of Central Valley Chinook salmon is an outbreeding effect that can be caused by unnatural changes in gene flow from high rates of straying and reproduction by out-of-basin hatchery fish (NMFS 2011). These findings suggest that hatchery practices, such as off-site release of hatchery-reared juveniles and interbasin hatchery transfers and stocking, are reducing the prevalence of diverse early life history traits that provide population stability in the face of fluctuating environmental conditions (Hilborn et al. 2003, Schindler et al. 2010, Carlson and Satterthwaite 2011) including climate change and flow regulation. In addition to outbreeding effects such as loss of within-population diversity, other genetic effects of hatchery production can include domestication selection that results in reduced fitness and survival of salmon and steelhead in the wild compared with natural-origin fish (NMFS 2011). Araki et al. (2007) demonstrated that the fitness (reproductive success) of hatchery-reared steelhead reproducing in the wild declined by 37.5% per generation due to rapid domestication effects. Chilcote et al. (2011) found that hatchery salmon had a recruitment performance (offspring per parent) that was only 13% that of naturally-produced salmon. Ecological effects of hatchery production can include reduced survival of hatchery and natural fish, increased predation risk of hatchery fish, and changes in the timing of outmigration and spawning by hatchery fish (Kostow 2009, NMFS 2011). Hatchery-reared salmonids grow faster than those rearing in the wild, and many hatcheries now produce and release larger fish than in previous decades to accelerate smolting and improve ocean survival (Kostow 2009, Huber and Carlson 2015). While it is well documented that larger size at ocean entry generally confers greater early marine survival in anadromous salmonids (Bilton et al. 1982, Ward and Slaney 1988, Ward et al. 1989, Sogard 1997, Osterback et al. 2014), hatchery salmonids may not have greater marine survival or overall reproductive success than those of wild origin. Ocean conditions appear to have a major influence on	

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		survival of juvenile salmonids regardless of natal origin. Woodson et al. (2013) found that Central Valley Chinook salmon of hatchery origin had marine survival like natural-origin Chinook during a period of low ocean productivity, even though the hatchery salmon were larger and had higher growth rates upon ocean entry. Under similar conditions of low ocean productivity, Beamish (2012) found that hatchery-origin Chinook salmon in the Strait of Georgia (B.C., Canada) survived at rates six to 24 times lower than wild-origin salmon. Fritts et al. (2007) found that hatchery-reared wild-origin Chinook salmon fry were significantly more vulnerable to predators than wild Chinook salmon fry of the same stock. Kostow (2009) cites evidence that altered spawn timing by hatchery-origin salmonids, which is due largely to intentional hatchery practices, can have ecological implications for survival and fitness of both hatchery and wild populations. Earlier spawning results in earlier emergence, and while this may confer a territorial and feeding advantage over later-spawning (and later-emerging) wild juveniles (Berejikian et al. 1996), Brannas (1995) found that early emergence may be associated with increased predation mortality. Nickleson et al. (1986) and Kostow et al. (2003) found that the offspring of early-spawning hatchery salmonids in Oregon had very poor survival to adulthood. Hatcheries frequently select for early run timing by spawning a disproportionately higher percentage of earlier returning fish (Flagg et al. 2000). Although there is currently no evidence of altered run timing in the Tuolumne River resulting from hatchery influences, the high degree of hatchery influence in the Central Valley Chinook salmon population may nonetheless be causing reduced reproductive fitness on a large scale. In their examination of historical releases of Chinook salmon from Central Valley Chinook hatcheries, Huber and Carlson (2015) revealed several trends with implications for stability and viability of the population, including a recent shift toward releases of smolts and advanced smolts and away from fry releases, more downstream releases (i.e., in the Delta or Estuary), and increased size-at release for each release month over time. Observations by Woodson et al. (2013), who found that Central Valley hatchery Chinook salmon were an average of 20 days older than wild-origin salmon collected at the Golden Gate as they exited the estuary, are indicative of the trend toward releases of hatchery salmon that are more developmentally advanced than wild salmon at the same date and location in their outmigration pathway. As noted by Huber and Carlson (2015), the trend toward spring releases of advanced smolts has created a new Chinook salmon phenotype that exhibits reduced life history diversity and extremely high rates of straying into non-natal basins, yet contributes the most to hatchery escapement throughout the Central Valley. Despite the high likelihood that these hatchery-origin fish exhibit reduced fitness due to domestication selection, this maladaptive phenotype is being propagated by hatcheries at an increasing rate.	
1344	200	[From ATT14:ATT2:] EFFECTS OF FLOW ON CHINOOK SALMON SURVIVAL AND RECRUITMENT. Despite the prevalence of hatchery Chinook salmon throughout California's Central Valley, little is known about the effects of river flow on the survival and ecology of hatchery salmon and whether hatchery and wild salmon respond differently to flow and its influence on survival and population response. Michel et al. (2015) found that survival of hatchery-origin Chinook salmon outmigrating from the Sacramento River was 2-5 times higher in an above-	Please see response to comment 1344-191 regarding biological goals. Also refer to response to comment 1344-333 regarding the findings of the study Stillwater Sciences (2016). For the full context of the comments from other entities at the public hearing on the 2016 Recirculated Draft SED, please refer to the index of commenters in Volume 3 to locate the letter number(s) of interest. Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, and Chapter 19, Analyses of Benefits to Native Fish Populations from Increased

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		normal flow year than in four below-normal flow years. The increased survival observed during the above-normal flow year (2011) primarily occurred in the riverine portions of the migration route, whereas survival was lowest in the estuary and similar there during all study years (Michel et al. 2015). In the Stanislaus River, Sturrock et al. (2015) found that Chinook salmon fry contributed more to the spawning population during a year of higher river flow, while smolts contributed more spawners during a low-flow year. However, because hatchery-origin salmon were specifically excluded from the Sturrock et al. (2015) study it is not possible to determine whether survival of the various juvenile life stages or if relationships between survival and river flow were different for wild- and hatchery-origin Chinook salmon. This information would seem particularly important to inform flow management decisions on the Stanislaus River and elsewhere, as hatchery-origin Chinook salmon have composed a large proportion of the Stanislaus River spawning population in recent years (? 50% in 2010 [Kormos et al. 2012] and ? 83% in 2011 and 2012 [Palmer-Zwahlen and Kormos 2013, 2015]). Although Sturrock et al. (2015) postulate that a regulated flow regime may reduce the prevalence of the fry life history type in Central Valley Chinook salmon by truncating migratory windows for early fry outmigration and suppressing winter pulse flows during which fry survival can be high, recent evidence from the Tuolumne River indicates that fry survive at very low rates and contribute very little to the spawning escapement (Stillwater Sciences 2016). Of the five outmigration years examined in otolith studies of Chinook salmon from the Tuolumne River (1998 [Wet], 1999 [AN], 2000 [AN], 2003 [BN], and 2009 [BN]), there were zero fry contributions to subsequent escapement in three out of the five outmigration years analyzed and a maximum fry contribution of 5% for fish emigrating in the above-normal water year (WY 2000) (Stillwater Sciences 2016). Survival through the south Delta appears to be consistently low regardless of flow. For this reason, flow management that encourages early emigration of naturally-produced fry through increased flow releases may not result in measurable increases in subsequent returns. Instead, measures to improve in-river rearing success of wild-origin Chinook salmon and reduce hatchery influence and straying will be more likely to increase river, Delta, and ocean survival and lead to increased population viability. Whereas previous investigations (e.g., Mesick et al. 2008) indicated that Chinook salmon smolt production from the Tuolumne River may have been highly correlated with winter-spring flow magnitude and duration, and that spawner recruitment was likely correlated with the number of emigrating smolts (and thus related to the Delta and ocean survival of those smolts), newer evidence of substantial contributions of hatchery strays to the annual Tuolumne River spawning population (see Section 1) indicates that these relationships are likely no longer valid. Furthermore, the recent finding that the contribution of smolts to the population of returning Chinook salmon spawners in the Stanislaus River was highest in a low-flow year (Sturrock et al. 2015) suggests that correlations between river flow and salmon recruitment and population viability are equivocal at best and are likely intertwined with the influence of hatcheries on Chinook salmon population dynamics acting across multiple life stages (fry, parr, smolt, adult) and geographical scales (river, estuary, ocean). Although Baker and Morhardt (2001) demonstrated a positive relationship between Chinook salmon escapement and flow in the San Joaquin River 2.5 years prior to escapement, as discussed in SED comments by Noah Hume for the Districts in Modesto on December 20, 2016, more recent investigations show that such lagged flow relationships in	Flow between February 1 and June 30, provide the scientific justification for providing higher and more variable flow during the February 1 through June 30 time period. See Appendix C, Section 3.6, for an analysis of flow effects on fish survival and abundance. Appendix C was peer reviewed in November 2011, and among the peer reviews were experts in aquatic ecology and fishery science specific to salmonids and steelhead. The peer reviewers assessed the report regarding the scientific knowledge (including the relationships presented in Section 3.6), methods, and practices, and indicated an overall agreement with the methodology in the report. Please see Master Response 3.1, Fish Protection, regarding the peer review of Appendix C, and the science behind the current pattern of fish decline and the need for increased flow. Studies conducted more recently also show the positive benefits of flow (e.g. Sturrock et al. 2015; SWRCB 2017; TID and MID 2013, USFWS 2014; Zueg et al. 2014). Also refer to Master Response 3.1, Fish Progection regarding the role of hatcheries, as well as discussions of the seasonal timing of flows, predation, benefits of the unimpaired flow approach, and the adequacy of the temperature and floodplain analyses. Please see Master Response 1.2, Water Quality Control Planning Process, regarding the State Water Board's protection of beneficial uses in the Bay-Delta and tributary watersheds through independent proceedings.

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		the Tuolumne River are becoming weaker over time, suggesting that factors other than flow need to be more thoroughly analyzed. Large releases of hatchery salmon into the estuary in recent decades appear to be increasing ocean survival but are further decoupling survival from river outflow. Hatchery production and estuary releases also eliminate many environmental influences that would otherwise select for traits such as predator avoidance and life history variability that maximize fitness in the riverine environment and adaptability to changing environmental conditions. Thus, even if we assume that increased flows from SJR tributaries will improve juvenile salmon production and river survival, benefits to the naturally-produced populations would be unlikely. This is because, as described previously, returns of adult Chinook salmon to SJR tributaries are dominated by hatchery fish, most of which are strays from out-of-basin hatcheries that were released outside their basin of natal origin (e.g., in the estuary) and thus not subject to the influence of river flows. Any flow-related benefits to juvenile salmon from SJR tributaries would overwhelmingly be conferred to the progeny of hatchery-origin individuals that would not contribute to the recruitment or viability of the natural population. The relationship between river flows and salmonid production and survival during outmigration is especially complex because flow has a direct effect on other factors that influence survival; notably water temperature, turbidity, predation, and availability of highly productive off-channel rearing habitat (i.e., floodplains). Flow-related effects, particularly water temperature, also affect the timing and reproductive success of spawning adult salmonids. Although the SED estimates the potential effects of increased SJR tributary flows on water temperature and floodplain availability, it does not address the extent to which these relationships may affect hatchery-origin and wild-origin salmonids differently. With the current and increasing prevalence of hatchery-origin Chinook salmon in the Central Valley and SJR populations, it is critically important that management decisions include consideration of effects on hatchery-origin salmonids, and whether such decisions truly benefit naturally-produced populations.	
1344	201	[ATT15:] APPENDIX B -- INTENTIONALLY OMITTED	This attachment was included with the comment letter. The attachment does not make a general comment regarding the plan amendments or raise a significant environmental issue.
1344	202	[ATT16: Appendix C -- Comments on the SWRCB's SED: Economics, Agriculture, Social and Environmental Justice.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	203	[From ATT16:] The SWRCB's estimate of the economic impact of the preferred alternative is significantly lower than the Districts' estimate of the economic impact. [Footnote 1: Regional Economic Impact to the Agricultural Economy caused by Reductions in Service Water Supplies to Turlock Irrigation District and Modesto Irrigation District, 2017, included in Appendix I of the Districts' comments.] In critical water year types the SWRCB estimates that the economic impact of reducing canal deliveries to the Districts under Alternative 3, the 40 percent unimpaired flow (UF), is an annual loss of $141.7 million. Whereas the Districts' estimate the economic loss for the same alternative as just under $1.6 billion, that's billion, with a "b," a difference of $1.4 billion. A bridge, describing the between the SWRCB's estimated annual impacts on agricultural output in critical water year types, which	Please see Master Response 8.2, Regional Agricultural Economic Effects, for discussion of economic analysis performed by Turlock and Modesto Irrigation Districts. Please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, for discussion of the SWAP model and assumptions about intra-district transfers. Please see Master Response 3.5, Agricultural Resources, for discussion of the potential effects on dairies and livestock operations. Please see Master Response 8.2 for discussion of the potential economic effects on dairies and food processors. Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, for

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		occur 20 percent of the time, and the Districts' estimate are: SWRCB's critical year impact estimate ($ millions): $141.7 Additions to the SED's annual impact estimate for critical water-year types SED's incorrect modeling assumptions: $167.5 - Re-allocating water to "highest value" crop is incorrect; 1) TID does not accommodate intra-district water transfers, 2) SWRCB's analysis did not consider the valued-added by animal feed crop into the production of animal commodities (milk and beef): $85.6 - Additional groundwater cannot be pumped due to SGMA and chronic overdraft: $10.7 - "Ripple effect," e.g. indirect and induced impacts on above ($96.2): $71.1 Omissions from SED's model: $1,285.6 - Animal commodities (e.g. milk and beef): $266.2 - Food and beverage processing of crop and animal commodities: $590.6 - "Ripple effect," e.g. indirect and induced impacts on above ($96.2): $428.7 Restate SWRCB's impact estimate to 2012 dollars: -9.3 Total estimated critical year impact: $1,585.3	discussion of implementation.
1344	204	[From ATT16:] The SED fails to include any mention of or impact of the project to the production of animal commodities, e.g. milk and cattle and calves, to the agricultural economy. Animal commodities comprise over half the annual commodity revenue produced in the study area. Not only does the SED omit any mention of dairies and cattle & calf operations, the SED assumes that reducing the production of feed crops will help maintain irrigation supplies for tree and vegetable crops. The impact of the reduction in feed crops on animal operations is inadequate. Estimated Annual Critical Water-Year Impact: $420 million; $266 million direct impact on milk and beef commodity revenue (roughly 40 percent of baseline) plus $154 million of indirect and induced impacts, representing a loss of ~1,200 jobs.	Please see Master Response 8.2, Regional Agricultural Economic Effects, for discussion of economic analysis performed by Turlock and Modesto Irrigation Districts. Please see Master Response 3.5, Agricultural Resources, for discussion of the potential effects on dairies and livestock operations. Please see Master Response 8.2 for discussion of the potential economic effects on dairies.
1344	205	[From ATT16:] The SED fails to include any mention of or impact of the SED's preferred alternative to the food and beverage processing sector of the agricultural economy. The food and beverage processing sector is estimated to support between one quarter and one third of all jobs in the study area. The sector is dependent on raw input of crop and animal commodities.	Please see Master Response 8.2, Regional Agricultural Economic Effects, for discussion of economic analysis performed by Turlock and Modesto Irrigation Districts. Please also see Master Response 8.2 for discussion of the potential economic effects on food processors.

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		Estimated Annual Critical Water-Year Impact: $865 million; $590 of direct impact and $275 million in indirect and induced impacts, representing a loss of approximately 2,500 jobs.	
1344	206	[From ATT16:] In summarizing results, the SED averages the annual impacts, obfuscating the true impact of a change in long-term water supply reliability. The SED estimates that annual average surface water deliveries to TID and MID under Alternative 3 will be 67% of baseline. However, in critical water year-types, which occur one in five years, and are known to occur sequentially, the surface water supplies are estimated to be only 31 percent of baseline. Estimated Annual Critical Water-Year Impact: Minimum impact of $1.6 billion in economic activity and upwards of 4,000 jobs.	Please see Master Response 2.3, Presentation of Data and Results in SED and Responses to Comments, for discussion of why average results were presented. In addition, please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, and Master Response 8.2, Regional Agricultural Economic Effects, for presentation of the results of the revised SWAP model run averaged by water year type.
1344	207	[From ATT16:] In summarizing results the SED neglects to discuss the impact of an increase in sequential years of irrigation shortages on agricultural operations, particularly animal operations and permanent crops. The SED estimates that not only will the magnitude of irrigation shortages increase but the number of sequential years of shortages will also increase. Sequential years of drought are particularly hard on the permanent crops and animal operations that characterize the project area's agricultural economy. Having not just a short-term effect but also a lag effect. Under the SED's preferred alternative of 40% unimpaired flow (Feb-Jun, inc.) shortages occur with greater frequency and are more likely to occur in sequential years. The SED fails to analyze this economic impact. Estimated Annual Critical Water-Year Impact: Irrigation stress on trees reduce yields in subsequent years. Herds take years to rebuild. These impacts have not been discussed, let alone quantitatively examined.	Please see Master Response 3.5, Agricultural Resources, for discussion of permanent crops, agricultural demand management during dry years, and the potential effects on dairies and livestock operations. Please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, for discussion of the SWAP model and assumptions about stress irrigation.
1344	208	[From ATT16:] Not all irrigation Districts facilitate intra-district transfers of water. A fundamental assumption in the SED is that irrigation water will be transferred within each of the Districts (TID and MID), supporting tree, fruit and vegetable crops and sacrificing animal feed crops and all other field crops. However, TID does not facilitate intra-district transfers of water. Estimated Annual Critical Water-Year Impact: The SED understates the impact of the preferred alternative on crop commodity revenue. The economic cost of the SWB's unfounded assumption is not known, but should be evaluated in the final SED.	Please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, for discussion of the SWAP model and assumptions about intra-district transfers.
1344	209	[From ATT16:] The economic analysis does not consistently consider the geographic scope of impacts.	Please see Master Response 8.0, Economic Analyses Framework and Assessment Tools, regarding the framework and spatial considerations of the economic analyses. Also, please see Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, regarding the scope of the agricultural economic

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		The SED presents what it refers to as summary of costs and benefit of its proposal over the entire affected area by category; however, not all benefits or costs are considered in all geographic plan areas. Estimated Annual Critical Water-Year Impact: Vastly understates the cost to the state-wide agricultural economy as well as the water supply benefits to the South of Delta water users.	analysis.
1344	210	[From ATT16:] Number of acres of crop land and crop distribution is incorrect. In the SED, crop acres are too low for MID and too high for TID. More importantly the crop distribution is significantly wrong. The estimate of the number of acres of trees is 40,000 acres too low. Estimated Annual Critical Water-Year Impact: The SED understates the impact of its proposal on crop commodities.	Please see response to comment 1344-222.
1344	211	[From ATT16:] The impact of stress irrigation on the acres of trees is not explained. It appears that the SWAP model estimates that tree acres come in and out of production with the availability of irrigation supplies. This is an erroneous assumptions and is unrealistic. Estimated Annual Critical Water-Year Impact: Not quantified.	Please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, for discussion of the SWAP model and assumptions about stress irrigation and permanent crops.
1344	212	[From ATT16:] The SED assumes additional groundwater can be pumped to offset reductions in surface water supply. The SED ignores the fact that there is already overdraft throughout the region and does not quantitatively evaluate the implementation of SGMA, the effects of which are reasonably foreseeable, when assuming additional groundwater can be used to offset surface water. Estimated Annual Critical Water-Year Impact: $10.7 million annually, as a minimum	Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, for discussions on potential increases in groundwater pumping, SED consideration of SGMA, and groundwater recharge.
1344	213	[From ATT16:] Missing Existing Condition section in the Economic Chapter. There is no description of the demographics or economics of the project area, an area characterized by relatively higher population growth, higher unemployment and more people living in poverty compared to the state. This is a serious flaw as it enables the SWB to ignore the disproportionate impacts of its proposal on low income and minorities. Estimated Annual Critical Water-Year Impact: N/A	Please see Master Response 1.1, General Comments, for general information regarding the economic analysis related to disadvantaged communities. Please see Master Response 8.2, Regional Agricultural Economic Effects, for an overview of the regional agricultural economic setting.

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1344	214	[From ATT16:] Missing an Environmental Justice section/chapter. There is no description of the relative high density of minority populations or poverty that characterize the affected area. Estimated Annual Critical Water-Year Impact: N/A	Please refer to Master Response 2.7, Disadvantaged Communities, regarding consideration of disadvantaged communities (DACs). Disadvantaged communities are considered in the context of public health in Chapter 22, Integrated Discussion of Potential Municipal and Domestic Water Supply Management Options.
1344	215	[From ATT16:] Impacts to Williamson Act enrollment not accurately described. The reduction in long-term water supply reliability may cause growers to have to un-enroll land that is current enrolled in the Williamson Act. The SED argues that land can be dryland, however given the capital investment made in permanent and animal operations most growers could not afford to continue to farm without irrigation water. Estimated Annual Critical Water-Year Impact: The expense to the growers has not been quantified in the SED.	Please see Chapter 11, Agricultural Resources, Section 11.5, Impacts and Mitigation Measures, Impact AG-3 for a discussion about the impacts on Williamson Act lands. Dry-land farming was included as a potential means of maintaining land in Williamson Act contracts because, among other things discussed in Impact AG-3, Williamson Act holds that a reduction in the economic character of existing agricultural land is not a sufficient reason for cancellation of a contract. Please see Master Response 3.5, Agricultural Resources, for information regarding dry-land farming and dairies. The expense to growers was included in the analysis as a component of the economic analysis presented in Appendix G; however, it was presented as an exceedance plot and not by year type. Results at the higher end of the exceedance plot represent critical dry years. Please see Appendix G Section G.4.1.2 Effects on Agricultural Revenue for a discussion on the economic impacts during years with reduced irrigation water availability. Please see Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, for information about grower economics and Master Response 8.2, Regional Agricultural Economic Effects, regarding economics associated with animal operations (e.g., dairies).
1344	216	[From ATT16:] Impact of the project's reduction in canal deliveries on the Districts' irrigation rate structure. Both TID and MID utilize a tiered rate structure tied to volume of water delivered. When there is less water to deliver, rates may need to increase and/or there is less operational revenue for the Districts. Estimated Annual Critical Water-Year Impact: Not quantified.	Please see Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, regarding irrigation district water rates. Irrigation district rates typically involve a water delivery charge per acre-foot, and a canal and facilities maintenance assessment per acre, and the combined revenue covers the cost of district service. If under the plan amendment, the volume of water delivered decreases, revenue would decline unless there is a rate adjustment. However, the cost of service should also decrease, as pumps are used less and facilities less subject to wear and tear. As noted in Master Response 8.1, the SWB acknowledges that there may be some rate adjustment necessary, but it is speculative to attempt to forecast quantitatively.
1344	217	[From ATT16:] Consideration of dairies' Waste Management Programs (WMP) is missing. The SED assumes that animal feed crops will be the first to be removed from production. Animal operations rely on those acres not only for animal feed but also as a critical component of WMP. The SED lacks an analysis of this relationship and the cost of alternative means, if any, for growers to manage waste without those crops. Estimated Annual Critical Water-Year Impact: No quantified.	Please see Master Response 3.5, Agricultural Resources and Chapter 11, Agricultural Resources, Section 11.2.2, Other Agricultural Production, for information about dairy waste management and the application of dairy waste to cropland. Please see Chapter 11, Agricultural Resources Section 11.5 for information about impacts to agricultural land, specifically Impact AG-2 for a discussion regarding dairies and feedstock. Please see Appendix G Section G.4.1.2 Effects on Agricultural Revenue for a discussion on the economic impacts during years with reduced irrigation water availability. Please see Master Response 8.2, Regional Agricultural Economic Effects, regarding economic considerations as they relate to dairies and feedstock.
1344	218	[From ATT16:] Impact on future housing needs not addressed. 14 Cal. Code Regs. § 15131(c) requires that water quality plans must consider "Economic,	CEQA requires public agencies to consider economic and social factors, along with environmental, legal, and technological factors in determining whether mitigation measures or alternatives are feasible. (Cal. Code Regs., tit. 14, §§ 15091(a)(3), 15364.) Information on economic and social factors, including housing, may be included in an EIR for this purpose, but it is not required. (Cal. Code Regs., tit. 14, § 15131. The SED contains

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		social, and particularly housing factors." Estimated Annual Critical Water-Year Impact: Not quantified.	information on economic and social factors, including housing, in, for example, Chapters 16, 17, 20 and 22 and the Executive Summary.
1344	219	[From ATT16:] Aggregation of the results obfuscates the impact on individual water resources management agencies. Burdensome and time-consuming effort to analyze the estimated impacts of the project at a geographic scale that is consistent with water management and water rights. While most of the data is available in supporting spreadsheets, this demonstrate a lack of understanding of how water management decisions are made. Estimated Annual Critical Water-Year Impact: Not applicable.	Please see Master Response 2.3, Presentation of Data and Results in SED and Responses to Comments, for discussion on the presentation of data in the SED. For information on the program-level approach to the SED, please see Master Response 1.1, General Comments.
1344	220	[From ATT16:] SED model input data not provided. Most of the data used as input to the SED model including prices, yields, costs, water rates, crop aggregation details is not provided thereby limiting the affected public's ability to understand the full set of assumptions and analytical approach. This lack of transparency is contrary to full disclosure requirements. Estimated Annual Critical Water-Year Impact: Not applicable.	Please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, for discussion of the SWAP model and its input data.
1344	221	[From ATT16:] SED states all values in 2008 dollars. This unnecessarily complicates the decision makers' review of the impact estimates. Resource managers and other readers of the document may naturally assume the impacts are in current dollars. Estimated Annual Critical Water-Year Impact: $9.3 million	Please see Master Response 8.0, Economic Analyses Framework and Assessment Tools, for the rationale for dollar values used in the SED.
1344	222	[From ATT16:] Number of Acres of Crop Land and Crop Distribution are not Correct. Issue: The SED does not use the most recent estimates of irrigated acres of crop land for each TID and MID and does not use the correct crop distribution for the acres that it did use. Impact: The SED is using incorrect acres of all crops however the most egregious error is the fact that the SED assumes nut tree acres are only 55 percent of their actual value. Discussion: The SED did not utilize the best available data about irrigated crop acres for TID or MID (the Districts). Neither the total number of irrigated acres by district nor the crop distribution of those acres within each district is correct. Each district publishes an Agricultural Water Management Plan (AWMP), most recently in 2015, however the SED	The SED relies on the best available data at the time of the analysis for both district irrigated area and crop distributions, sufficient to make reasonable determinations of effects with regard to applied water use. Baseline total acreage estimates for the Turlock and Modesto Irrigation Districts (TID and MoID, respectively) were derived from their corresponding Agricultural Water Management Plan (AWMP) published in 2012. Distributions of each crop within this total were derived from 2010 DWR Detailed Analysis Unit (DAU) data for all districts corresponding to the Baseline period for the SED. The DWR DAU data are part of a statewide, consistent database supported by DWR, the state agency responsible for providing technical and policy assistance with economic and demographic analyses to sustainably manage California's water resources. Accordingly, although the AWMP and DWR DAU data have some differences in crop distributions, as reported in the SED, it is reasonable to rely on DWR DAU data. Please see Master Response 2.5, Baseline and

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		used the 2012 AWMP version to estimate the total acres irrigated in the Districts. For no understandable reason the SED used DWR DAU data for the crop distribution, even though crop distribution is available in the AWMP (both 2012 and 2015). In addition to using old data it appears an error was made interpreting the 2012 AWMP data. The SED used TID's accessed acres as input in the SED model instead of the irrigated acres. TID's 2012 AWMP reports (page 56) "between 2007 and 2011 an average of 143,160 assessed acres received surface water from TID. This translates to an average of 134,751 irrigated acres when an estimate of field roads and other small non-irrigated acres are account for." The SED reports using 143,783 irrigated acres for TID which is essentially the assessed acres. TID's 2015 AWMP reports 135,836 total irrigated acres, which is what should be used in the SED model instead of the 143,783 used. The difference, 7,947 acres (6 percent), is the number of acres overstated in the SED (Table 2 [see ATT16:ATT1]). The SED also used the incorrect number of acres for MID, but instead of overstating acres, the number of irrigated acres was understated. The SED assumed irrigated acres in MID were 57,354. The 2012 AWMP reports irrigated acres of 59,153 PLUS double cropped acres of 8,855. So the total number of acres in production in MID is the sum of the cropped and double cropped acres (see Table 23 in MID's 2012 AWMP). Using the most recent data from the 2015 AWMP the total acres under production in MID is estimated to be 62,778 (Table 2 [see ATT16:ATT1]). So the SED understated productive acres in MID by 5,424 (9 percent). In addition to using an incorrect number of total acres in the SED model the SED also uses an incorrect crop distribution, e.g. the specific number of acres of each crop grown in the Districts. The SED reports on this error, but does not fix it. Rather than use information presented in the AWMP about the types of crops grown in the Districts the SED chooses to use, without explanation, DWR's DUA data. The SED states (Page G-44): "For all irrigation districts except SEWD and CSJWCD, the crop distribution and applied water rates based on DWR DAU data were used." Attachment 1 of Appendix G compares the differences, by crop acres, between the DWR DAU data and the Districts' AWMP. For example, the SED states (page 6 of Attachment 1 to Appendix G): "The total applied water demand resulting from the DAU distribution is about 50,000 AF lower than the AWMP distribution estimate." A difference of 50,000 AF is 20 percent of the total applied water demand, and yet our review could not find a correction to this data in the SED model. In addition to the difference in the applied water demand the crop distributions used in the SED are significantly different than those reported in either the 2012 or the 2015 AWMP. And the difference in crop distribution would change the SED's estimated impact of the project on crop commodities. Table 2 [ATT16:ATT1] compares the data used in the SED to the data available from the Districts' 2015 AWMP. The SED data shown in Table 2 [ATT16:ATT1] is summarized from information found in the spreadsheet available on the SWRCB's SED web page under Modeling Tools Information and Files entitled Agricultural Economic Analysis_09142016. In that spreadsheet the crops are aggregated into the five categories shown, namely Fruit, Grain, Other, Tree Nut, Vegetables. The SED over reports TID's fruit acres (primarily peaches, other stone fruit and apples) by 4,491 acres and MID's by 5,289 acres. The SED under reports grain acres for TID by 11,870	No Project, for additional information regarding the baseline. The commenters recommend that the analysis be updated using data from TID's and MoID's 2015 AWMPs, which were published in November 2015 (TID) and December 2015 (MoID), respectively. However, there is no requirement under CEQA that the Baseline conditions be continuously updated to account for new information. There were minor misinterpretations of the total irrigated area for both districts from the 2012 AWMPs. These values were updated in a revised SWAP model run described in Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model. MoID's total irrigated area was updated by adding double cropped acres (about 8,855 acres according to table 23 of MoID's 2012 AWMP). TID's irrigated area was reduced from 146,030 acres (TID's assessed acreage, page 13 of the 2012 AWMP) to 134,682 (TID's average annual total irrigated acreage from 2007 to 2011, Table 4.3 page 57 of TID's 2012 AWMP) acres to reflect total irrigated area rather than total assessed area. Walnuts are included in the category of "Other Deciduous" for the SWAP model. In aggregation for the regional economic analysis using IMPLAN multipliers, the "Other Deciduous" category is included under the "Fruit" IMPLAN crop category. However, this does not significantly alter the estimated effects of the LSJR alternatives. The change in gross revenue for "Other Deciduous" crops in response to implementation of the LSJR alternatives is relatively small in the SWAP output. Whatever IMPLAN crop category "Other Deciduous" crops could be included under, their incremental contribution to regional economic and employment effects would be small because the IMPLAN multipliers would be applied to a relatively small number. Please see Master Response 3.5, Agricultural Resources, for discussion of the potential effects on dairies and livestock operations. Please see Master Response 8.2, Regional Agricultural Economic Effects, for discussion of the potential economic effects on dairies.

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		acres and slightly over reports for MID by 550 acres. The SED over reports "other" acres by 26,956 for MID and 19,643 acres for MID. Nut tree acres are under reported by 18,512 acres for TID and 20,547 acres for MID. Lastly vegetable acres (primarily sweet potatoes) are over reported by 6,882 acres for TID and 2,571 acres for MID. [Footnote 2: Analyzing the crop distribution is made more difficult by the fact that the SED does not provide the aggregation of district crops to the SED model's crop categories. However, something is wrong with the aggregation which is easiest to see when comparing MID's 2012 OR 2015 AWMP to SED's Table 5 on page 6 of Attachment 1 to Appendix G. The table shows MID's crops by the SED model's crop category. The table does not include a category for walnuts, despite the fact that there are over 8,000 acres of walnuts reportedly grown in MID in both the 2012 and 2015 AWMPs. Presumably the SED includes the walnuts in the category "other deciduous" crops, which it reports as 11,624 acres. However, the SED also reports on Table F.5-1. Comparison of the SED model's Crop Categories to IMPLAN Crop Groups that "other deciduous" acres are aggregated into IMPLAN category for Fruit. So the SED is analyzing walnuts as if they were a fruit. The impact of this may not have ramifications on the analysis, it is not possible to know without re-running the model. However, it is worrisome that the crop categorizations do not accurately reflect the area being impacted.] The impact of this crop-distribution error on the SED model's estimates of a change in crop commodities acres could be significant. The assumption in the SED model is that water would be allocated to the "highest value" crop commodity. And because the SED does not account for the additional value that "grain" (primarily silage) and "other" (primarily alfalfa and pasture) contribute as feed for animals, the acres of those two crops are first to be removed from production as water supplies are reduced. By understating the number of acres of the permanent crops (e.g. fruit and nut trees) the SED model is under estimating the proposed project's impact to grain and other crops. In other words, if the SED model was re-run with the correct, and higher, acres for fruit and nut trees, there would be even less water for grain and other crops, such that the reduction in the acres of animal feed would be even larger than the current SED estimate. As it is the SED represents much more grower flexibility to adapt to a reduction in long-term supply reliability than actually exists.	
1344	223	[ATT16:ATT1: Table 2. Crop Distribution Comparison, Districts' (TID and MID) AWMP to the SED.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	224	[From ATT16:] Estimates of the Volume of Existing Groundwater Pumping. Issue: The SED assumes that groundwater will continue to be used in the same volume as is currently pumped. Given the impending implementation of SGMA this is an erroneous assumption. Impact: The SED's estimate of the economic impact to agriculture is understated. Discussion: It is not reasonable to assume that the current volume of pumping could continue under SGMA, because the current volume of groundwater pumping is supported by recharge from surface water supplies. [Footnote 3: San Joaquin River Flows and South Delta Water Quality Substitute Environmental Document -- Comments of Groundwater Impact Analysis for the Turlock Subbasin, Memorandum from Gus Yates, Senior Hydrologist Todd Groundwater, 2017.]	Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, for discussion of SGMA implementation and groundwater recharge.

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		Under the SED, surface water supplies significantly reduce the amount of surface water that will be available to recharge the groundwater system. As a result, there will likely be a corresponding reduction in groundwater pumping that will be viable. That is, unless there can be recharge projects installed to make use of the surface water supplies that might be available in the wettest of years to help bolster groundwater supplies. The SED impacts are on top of any impacts or changes to groundwater availability that might be available as a result of SGMA. There has been no determination of "sustainability" as it pertains to the subbasin, which makes it difficult to predict what the future will look like when SGMA is fully implemented.	
1344	225	[From ATT16:] Estimates of Ability to Pump Additional Groundwater is Incorrect. Issue: The SED recommends lost surface water supplies be replaced by increasing the volume of groundwater pumped in nearly every year. Impact: Including this additional groundwater in the SED impact estimates understates the economic impact of the SED to the agriculture. Discussion: Given the current overdraft of the basin and the impending implementation of the SGMA it is incorrect to assume groundwater can be used to replace lost surface supplies.	Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, for information about the groundwater resource analysis and the level of groundwater pumping used in the SED. As described in Master Response 3.4, the SED does not recommend lost surface water supplies would be replaced by increasing the volume of groundwater pumped. The plan amendments do not require or mandate an increase in groundwater pumping and nothing in the SED requires groundwater pumping to be the response. Precise actions that local public agencies would take under the plan amendments, with or without the future condition of SGMA, are in the hands of those local entities. The State Water Board's responsibility under SGMA is, within designated timeframes, to act to ensure sustainable management of groundwater basins if local public agencies fail to form groundwater sustainability agencies (GSAs), fail to adopt groundwater sustainability plans (GSPs), or submit GSPs that are inadequate or not being implemented in a way that is likely to achieve sustainable management. Please see Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, and Master Response 8.2, Regional Agricultural Economic Effects, for information on local and regional agricultural economics.
1344	226	[From ATT16:] Not All Irrigation Districts Support Intra-District Water Transfers between Growers. Issue: The SED model (page G-43) "selects those crops, water supplies, and irrigation technology that maximize profit subject to . . . constraints." An underlying assumption in the selection of those crops is that intra-district water transfers are utilized to maintain irrigation supplies to high valued crops, such as trees, and reduce irrigation supplies to lower valued crops, such as alfalfa and irrigated pasture. However TID's by-laws do not allow for intra-district transfers of water between landowners. [Footnote 4: See section 6.8 of TID's AWMP, 2015.] Impact: As modeled in the SED, the estimated reduction of acres of "high valued" crops is too low and the estimated reduction of acres of "low valued" crops is too high. Discussion: The SED model assumes that water is allocated to maximize the revenue at a district level. This assumption infers that water can be transferred from one grower/landowner to another. Under this assumption the SED model's estimates of acres to "high valued" crops (e.g. trees, fruit and vegetables) would be last to be impacted. Instead acres of "lower valued" crops (e.g. grains, other) would decline (Figure 1 [see ATT16:ATT2]). For example, tree nut acres are just over 46,000 acres in every year, with a slight decline below 46,000 in critical dry water year types. However, acres of "all other crops" (primarily alfalfa and irrigated pasture) declines from over 69,000 acres in wet years to approximately 67,000 acres in above normal and continues to decline in each water-year type until there	Please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, for discussion of the SWAP model and assumptions about intra-district transfers.

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		are just over 11,000 acres in critical water-year types. Given that TID does not support the transfer of water from one grower to another this is an extremely unlikely outcome. In addition, animal feed crops, represented in "grain" and "all other crops," are not "low value" as the SED purports.	
1344	227	[ATT16:ATT2: Figure 1. Acres by Crop Category under SED Alternative Three for TID and MID.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	228	[From ATT16:] The method of analysis uses industry standard models however the scope of the study is too narrow in places and ill-defined in other. Three concerns about the scope are: 1) the SED does not account for all agricultural sectors impacted, 2) the SED does not describe a temporal scope and is missing an analysis of the long-term impacts on all agricultural sectors and 3) the SED's geographic scope is inconsistent across impact categories.	Please see Master Response 8.0, Economic Analyses Framework and Assessment Tools, regarding the framework and spatial considerations of the economic analyses. Also, please see Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, regarding the scope of the agricultural economic analysis. Please see response to comments 1344-229 to 1344-236.
1344	229	[From ATT16:] Animal commodities are not included in the modeling. Issue: The scope of the SED's agricultural economic impact analysis does not include potential impacts to animal commodities, e.g., milk and beef, despite the SED's projection of an average annual reduction in the number of acres of animal feed crops in production. Impact: The SED's estimate of the average annual reduction in agricultural output supported by irrigation supplies from TID and MID is significantly understated. Implementing the SED will impact the dairy and cattle & calf industry. The economic impact is estimated to be an annual reduction of between $140.9 million dollars upwards to $289.7 million in more than half of all years. With a corresponding reduction of full and part-time jobs of between 620 and 1,480. Discussion: this issue was discussed at all of the public hearings and SWRCB member Dorene D'Adamo requested clarification multiple times. For example, the transcript of the November 29, 2016 meeting (page 241): "5 Ms. D'Adamo: I just think that this is a 6 really important issue. And not to take up time now, but 7 just to get whether its staff and then also your industry 8 to give us a sense of what a dairy will do with their 9 forage crops if there's an assumption that they will sell 10 the water to the highest bidder, when they're going to 11 end up with a loss of feed for their dairy. So some way 12 to make that real in terms of what's the acreage out 13 there that is owned or under control by these dairies as	Please see Master Response 8.2, Regional Agricultural Economic Effects, for discussion of economic analysis performed by Turlock and Modesto Irrigation Districts. Please see Master Response 3.5, Agricultural Resources, for discussion of the potential effects on dairies and livestock operations. Please see Master Response 8.2 for discussion of the potential economic effects on dairies and regarding the limitations of IMPLAN for estimating downstream economic effects on dairies. Please see Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, regarding the temporal scope of the agricultural economic analysis and a potential contraction in the agricultural industry.

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		opposed to purchasing it from other growers that are in the area." California leads the nation in milk and cream production, with a 19 percent share of U.S. production in 2015. [Footnote 5: California Agricultural Statistics Review, 2014-2015, California Department of Food and Agriculture.] Stanislaus and Merced Counties ranked second and fourth in the nation, respectively, in terms of the value of milk produced. [Footnote 6: Dairy Cattle and Milk Production, October 2014, USDA Census of Agriculture, National Agricultural Statistics Service.] In 2015, a year in which milk prices were down, the combined value of those two commodities was $2.2 billion, one third of the total value of agricultural commodities produced in those two counties. [Footnote 7: 2015 Report on Agriculture, Merced County Department of Agriculture and Stanislaus County Agricultural Report, 2015, Stanislaus County Agricultural Commissioner.] In 2014, when milk prices were higher, the total production value of milk was $3.1 billion. Historically, between 20 percent and 25 percent of California’s total production value of milk and cattle & calves, $9.6 billion in 2015 and $13.1 billion in 2014, is produced in these two counties, ranking second and third in animal commodity production counties in the state. [Footnote 8: California Agricultural Statistics Review, 2014-2015, California Department of Food and Agriculture.] TID and MID supply water to farmers and ranchers to irrigate approximately 20 percent to 30 percent of the animal feed crops (e.g., corn silage, hay and pasture) necessary to support approximately 20 percent to 30 percent of the two-counties’ dairy and beef herds. These feed crops support annual animal commodity production valued between $930 million and $440 million. Since the SED did not include animal commodities in its analysis the baseline estimate of the value of irrigation water supplied by TID and MID is understated. On average, the estimated baseline value of animal commodities, excluded from the SED analysis, supported by water delivered from the Don Pedro Project, is $665 million annually (2012 dollars). [Footnote 9: Socioeconomics Study Report, Don Pedro Project FERC No. 2299, 2014, Turlock Irrigation District and Modesto irrigation District.] The SED baseline also excludes the jobs created by production of these animal commodities, estimated to be 2,890 full and part time jobs, annually paying workers over $30.8 million in labor income. [Footnote 10: Ibid.] The full economic impact of a reduced water supply reliability on the dairy and cattle & calf industries is not estimated in the SED. The reduction in the acres of feed crop produced is estimated. The SED treats these animal feed crops as "lower net-revenue crops" relative to nuts and fruits without regard to the contribution these crops make to supporting animal commodities. For example (page G-48), "The lower net-revenue crops cover large portions of the study area; consequently, these crop groups are substantially reduced for the LSJR alternatives with higher unimpaired flow requirements, particularly for LSJR Alternative 4." Furthermore, because the SED states that these "lower net-revenue crops cover large portions of the study area," without explaining the value added at dairies and cattle & calf operations, it could appear to water resource managers reading this document that the region grows lower value agriculture. Nothing could be further from the reality, it’s just that the SED ignored the value added and the impact of the reduction in feed crop on animal commodities.	

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		Unlike annual crops, e.g. rice, tomatoes, truck crops, etc.--where a grower's operational response to a reduction in irrigation supplies ends with the decision not to plant--dairy and cattle & calf operators have to go one step further and either find replacement feed for acres not planted or choose to cull their herds. Both of these types of responses were seen in the recent drought. In Economic Analysis of the 2015 Drought for California Agriculture [Footnote 11: Economic Analysis of the 2015 Drought for California Agriculture, 2015. R.E. Howitt, D. MacEwan, J. Medellin-Azuara, J. Lund, D. Sumner, UC Davis Center for Watershed Sciences, ERA Economics and UC Agricultural Issues Center.], (Howitt et.al, 2015) the authors (one of whom is the lead author for the SED's Appendix G) describe both types of operators' responses (Page 8): "Losses to California's dairy and cattle and calf industries derive primarily from higher costs and lower availability of California-produced forage, including hay, silage and pasture. . . . The drought has accelerated milk cow culling rates and reduced milk output on top of depressed milk prices. Milk production in California has dropped from 2014, whereas national production outside California has remained high." The SED estimates an average annual 5 percent reduction in corn silage acres (e.g. 95 percent of baseline) under Alternative 3 (Figure 2-a [see ATT16:ATT3]). Average annual alfalfa and irrigated pasture would fall by 20 percent (e.g. 80 percent of baseline) under Alternative 3 (Figure 2-b [see ATT16:ATT4]). [Footnote 12: Agricultural Economic Analysis 09142016.xls spreadsheet found on the SWRCB's SED website under the heading Modeling Tools and Information Files.] However, when it comes to animals the average annual impact to feed crops does not accurately represent the potential impact to animal commodities. Animals eat every day in every year. What matters in this analysis is the change in the reliability of feed supplies over all water year types. For example, under the Baseline corn silage acres are 100 percent of the acres under full demand in all but critical water-year types (which occur 20 percent of the time), when acres fall by approximately 5 percent (e.g., 95 percent of full demand). Under Alternative 3, in critical water-year types corn silage is nearly 20 percent below full demand (an addition 15 percent reduction from full) and alfalfa and irrigated pasture are estimated to be 80 percent below full demand (an additional 65 percent reduction from full). It is highly unlikely that the dairy and cattle & calf industries could manage a 20 percent reduction in corn silage and an 80 percent reduction in alfalfa and irrigated pasture in one out of five years (e.g., frequency of critical water-year types) without at least an impact to the volume of milk and beef produced or more likely a structural change to the industry (e.g., a contraction in the two-county herd size representing a reduction in animal operators' income and/or the closing of operations). For example, after a two-year drought in Texas in 2012 and 2013 a beef processing plant shut down. "The drought dried up pastures and increased the costs of hay and feed, forcing some ranchers to sell off their herds to reduce expenses." As a result, a beef processing plant that employed 2,300 people was shut down. ". . .executives said they were idling the plant and not permanently closing it, and it could reopen if the drought breaks and the cattle herd rebounds, a process that would take years." [Footnote 13: F Fernandez, M. Drought Fells a Texas Town's Biggest Employer, February 27, 2013. NY Times.] As Figure 2-a and Figure 2-b show [see ATT16:ATT3 and ATT16:ATT4], under the SED	

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		estimated shortages of both silage and irrigated pasture and alfalfa are not only greater than under full demand and baseline but shortages of irrigated pasture and alfalfa occur with greater frequency. Irrigated pasture and alfalfa shortages occur under Alternative 3 and Alternative 4 in all but wet and above normal years. Under Alternative 3 shortages occur in 50 percent of all water year types (below normal, dry and critical). And the magnitude of the shortage is 20 percent to 64 percent larger than baseline, up to 80 percent of full demand under Alternative 4. The only comment in the SED about the impact of a reduction in feed crops on dairies and cattle & calf operations is found on page G-55, reproduced below in its entirety. "Livestock (beef cattle) and dairies, the two main animal operations in California, require both irrigated and non-irrigated crops as production inputs. Evaluating the effects of the LSJR alternatives on these two sectors requires a forward-linkage assessment that typically is beyond the capabilities of traditional input-output analysis, including IMPLAN. Nevertheless, it is possible to draw some inferences using economic information about the affected dairy and livestock sectors and the built-in information about the relationships in IMPLAN for the study area. "Beef cattle require pasture (including non-irrigated winter pasture) and other fodder crops, whereas dairy cattle rely heavily on alfalfa, locally grown silage corn, and a concentrate that is usually imported from out of state. Implementation of some of the LSJR alternatives may limit the economic feasibility of growing feed crops near affected water districts. Thus, these districts would experience some cost increase for inputs during water-short years. [Footnote 14: The SED's statement that the 'districts experience some cost increase for inputs' is not correct. The cost increase in inputs would be borne by the dairy and cattle & calf operators, not the irrigation districts. Likely this error is an oversight, however it is worrisome in that it misleads the reader into thinking that the irrigation districts, rather than the individual operators, would be the affected party.] "Dry forms of feed crops, such as alfalfa hay, can be imported to replace the limited supply of locally grown feed crops when regional markets for these crops are operating. However, silage corn, which has higher water content, is more costly to transport and is often not sold in the market. Because of the higher transport cost, this product is more often produced by farm operators. The ability to substitute various crops in the milk cow and the beef cattle diet with imported feed crop or concentrate is considered the determining factor for potential economic impacts of the LSJR alternatives on livestock and dairy net returns. In addition, the ability to substitute corn for fodder crops is limited by dairy dietary restrictions." The SED is correct that IMPLAN does not estimate the impact of a change in feed supplies on animal commodity production. However, that is not to say that an analysis cannot be done. TID and MID have undertaken an analysis of the impact of implementing the SED on animal commodities. [Footnote 15: Agricultural Economic Impacts of a Reduction in Water Supply to Turlock Irrigation District and Modesto Irrigation District, 2017.] The analysis used two different assumptions to estimate responses to an increase in uncertainty about feed supplies. * No structural change to the existing dairies and cattle & calf operations. Operators	

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		attempt to maintain baseline herd size, but do have to respond to annual variability in feed crops either by culling their herds or paying higher feed costs. * There is a structural change to the existing dairies and cattle & calf operations. The industry down-sizes commensurate with the reduction in feed supplies. Under the first assumption the analysis bookended a range of impacts. The maximum impact occurs when animal commodity values fall in proportion to the reduction in animal feed. Under SED Alternative 3 the maximum annual impact to direct animal commodity revenue in critical water-year types is estimated to be a $186.4 million dollars plus another $103.36 million in backward linkages for a total of $289.73 million dollars and a reduction in approximately 1,480 jobs (both direct and indirect). The minimum impact assumes that all of the feed can be replaced, albeit at a higher cost, so there is no reduction in animal commodity revenue or jobs however operator's income falls by an average 3 percent to 7 percent. Given the magnitude of annual changes in feed supplies, the cost of re-building a herd and the potential reduction in operator income it is unlikely that operators would choose to maintain baseline herd size if the SED is implemented. A more reasonable approach to estimating the long-term impact of the SED on dairy and cattle & calf operators assumes that operators choose to permanently down-size herds, or relocate out of the area, to maintain the same level of certainty in feed-supply reliability as currently exists under the baseline. Currently under baseline conditions the only reduction in feed crops occurs in critical water-year types when corn silage is reduced by 4 percent and alfalfa and irrigated pasture are reduced by 25 percent (compared to the 20 percent reduction in corn silage and the 80 percent reduction in alfalfa and irrigated pasture under the SED for the same year type). Under this assumption herd size would be permanently reduced, e.g., the dairy and cattle & calf industry would contract, by approximately 15 percent to 30 percent. A contraction in the dairy and cattle & calf sector, in addition to reducing revenue and eliminating jobs, would also strand a significant amount of capital. Diary and cattle & calf operations require a significant capital investment. In the dairy industry the cash costs of operations are estimated to be between 78 percent and 98 percent of total costs depending on factors including debt structure, age of infrastructure, type of infrastructure, etc. Depreciation and interest costs for the investments in items including the milking barn, free stall, manure pit, bulk tank, hay barn, silage pit, maternity pens, etc., represent between 22 percent and 2 percent of total costs. [Footnote 16: Market Milk Production in San Joaquin County, Cost analysis Work Sheet, 1986. University of California Cooperative Extension.] [Footnote 17: California Cost of Milk Production 2015 Annual, California Department of Food and Agriculture. https://www.cdfa.ca.gov/dairy/pdf/Annual/2015/COP_Annual2015.pdf.] In 2015 an estimated $7.3 million to $10.9 million of depreciate expense was taken by dairies and cattle & calf operations that feed their cows crops that are grown with water from TID and MID. [Footnote 18: CDFA reports that 2015 depreciation expense for the North Coast was $6.31 per cow per month and the herd size in Stanislaus and Merced County was 480,000 head. Of which approximately 20 percent to 30 percent were assumed to be fed on feed crops grown with water from Don Pedro water supplies.] Depreciation expense of that magnitude suggests capital investments between $36.5 million to $305.2	

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		million. [Footnote 19: Assuming straight-line depreciation of most assets assuming a useful life of 5 to 28 years and no salvage value.] Investments of this magnitude were made because growers depended on the historically high water supply reliability created by TID's and MID's Don Pedro Project. These capital investments would be at risk if the dairy and cattle & calf sectors contracted. Another way the dairy and cattle & calf sector can contract is through relocation of operations to area that are not threatened with a reduction in irrigation supplies. Kansas, Nebraska and other Midwest states are pitching themselves as a dairy heaven, hoping to attract dairy owners and looking for a windfall of jobs and money in rural economies. [Footnote 20: Midwest lures California dairies with lower costs, wide open spaces, The Kansas City Star, January 12, 2015. http://www.kansascity.com/news/business/article6172863.html.] "Each new dairy represents millions to the local economy. It takes an investment of $14 million to $15 million to build a 2,000-cow dairy, according to Jeff Keown, a retired dairy specialist with the University of Nebraska-Lincoln." [Footnote 21: Ibid.] At the World Ag Expo in Tulare, in 2015, more than a half dozen states--Nebraska, Iowa, Kansas, North Dakota, South Dakota, Texas, and Nevada--had booths to recruit milk producers with "promise of water, stable feed supply and abundant land." [Footnote 22: Outside states to California dairy farmers: We have water. CNBC, February 12, 2015. http://www.cnbc.com/2015/02/10/california-drought-states-tempt-california-dairy-farms--we-have-water.html.] In Iowa the executive director of the Iowa State Dairy Association has been quoted as getting "a lot of inquiries from people" interested in relocating from California to Iowa, following one dairy that already relocated. [Footnote 23: Dairy industry could see slight shift amid drought in California, Illinois Farmer Today, August 17, 2015. http://www.illinoisfarmertoday.com/news/dairy-industry-could-see-slight-shift-amid-drought-in-california/article_a0eedd80-4059-11e5-84a9-871a19198e6c.html.] The region has already seen a reduction in the number of dairy operations, and some operations have moved. Implementation of the SED, creating uncertainty about the reliability of water and feed crops, may encourage more dairies to leave California.	
1344	230	[ATT16:ATT3: Figure 2-a. Graph of Corn Silage Acres as a Percent of Baseline by Water-Year Type, all Alternatives.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	231	[ATT16:ATT4: Figure 2-b. Graph of Alfalfa and Irrigated Pasture Acres as a Percent of Baseline by Water-Year Type, all Alternatives.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	232	[From ATT16:] Processing Sector and Forward Economic Linkages. Issue: The scope of the SED's agricultural economic impact analysis does not include potential impacts to the agricultural food and beverage processing/manufacturing sector. Impact: The SED's estimate of the economic impact to output and jobs in the region is understated. Discussion: In Citizens Association for Sensible Development of Bishop Area v. Inyo (1985) 172 Cal. App. 3d 151, the court held that ". . . economic and social effects of a physical	Please see Master Response 8.2, Regional Agricultural Economic Effects, for discussion of economic analysis performed by Turlock and Modesto Irrigation Districts. Please see Master Response 8.2 for discussion of the potential economic effects on food processors and regarding the limitations of IMPLAN for estimating downstream economic effects. Please see Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, regarding the scope of the agricultural economic analysis and a potential contraction in the agricultural industry.

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		change may be used to determine that the physical change is a significant effect on the environment." In this case, the Court held that an EIR for a proposed shopping center located away from the downtown shopping area must discuss the potential economic and social consequences of the project, if the proposed center would take business away from the downtown and thereby cause business closures and eventual physical deterioration of the downtown. (14 Cal. Code Regs. § 15131). The SED incorrectly states: "For this application, direct agricultural-related revenues generated by the SED model [note: which is only estimating the crop commodity and ignores the animal commodity], and indirect and induced economic effects estimated using the IMPLAN multipliers together provide an estimate of the total economic effects on economic output and jobs." The "indirect and induced economic effects" included in the SED account for the inputs to agricultural production, e.g. the labor for pruning and harvesting, fertilizer, pesticides, etc. However, the SED does not qualify or quantify the impact that a reduction in the production of crop and animal commodities--used as inputs to food and beverage processing--would have on the processing sector. Food and beverage processing plants transform raw agricultural materials into products for intermediate or final consumption by applying labor, machinery, energy, and scientific knowledge. Given the volume of the crops grown in the two-county area processors have chosen to locate processing facilities, including warehousing and refrigeration, in the two-county area also. The California Employee Development Department (EDD) reports the top 25 major employers in California counties (measured in terms of number of employees). In Stanislaus and Merced County 25 of the two-county total of 50 major employers are directly or indirectly involved in agriculture, either growing or processing agricultural output (Table 3 [see ATT16:ATT5]). Together, these top 25 agricultural employers alone provide between 16,150 and 71,476 jobs to Stanislaus and Merced County. The SED's lead author for the agricultural impact analysis contributed to a report entitled The Economic Impact of Food and Beverage Processing in California and Its Cities and Counties in which the authors estimate that food and beverage processing is responsible for 20 percent or more of all jobs in Merced and Stanislaus Counties. [Footnote 24: Sexton, R.J., J. Medellin-Azuara and R.L. Saitone, The Economic Impact of Food and Beverage Processing in California and Its Cities and Counties, January 2015. Prepared for the California League of Food Processors.] The report states (page 5): "Here we see vividly the importance of food and beverage processing to the economies of many California counties, particularly those that are most rural and which were hit hardest by the prolonged economic downturn and have also been impacted most by California's drought." Relative to the state, the two-county area depends more on agriculture and agricultural processing (e.g. manufacturing) for employment. The agriculture and manufacturing industries in the two counties comprise a larger relative share of employment compared to the state (Table 4 [see ATT16:ATT6]). Total farm employment in the two counties was between 10 percent and 11 percent of total employment between 2010 and 2015 compared to 3 percent of state employment for the same time period. In absolute numbers, the agricultural industry in the two counties supported 29,000 jobs in 2015. Manufacturing, much of which is the processing of crops (e.g., food snacks, canned food, wine, cheese),	

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		supported another 31,000 jobs--combined, these jobs account for approximately one quarter (23 percent) of the employment in the two counties. The SED does not assess how a reduction in crop commodities would impact the food processing sector. Despite evidence that the most recent drought has impacted output and jobs in the food processing sector. In a 2015 Fortune article entitled 6 industries hurt by the California drought the author quotes a senior economist describing the drought's impact on both agriculture and agricultural processing [Footnote 25: Sherman, E. 6 industries hurt by the California drought, April 9, 2015. Fortune Magazine.]: "California not only grows food but processes it. In 2015, the state had 11% of the country's food-processing jobs. 'That segment is directly tied to agriculture,' Walters said. 'It's in the same boat. It's less input for them and reduced payroll as well.' The news will be bad for lower-income communities that depend on the jobs. 'You'll see significant reductions in household incomes in areas already severely hurting.' Higher prices for processed goods could also hurt sales." The only way that the reduction in raw inputs (e.g., crop and animal commodities) would NOT have an impact on the processing sector would be if food processors replaced raw inputs from outside the region without an increase in cost. This is an erroneous assumption. If the reduction in the availability of raw inputs, caused by a reduction in irrigation supplies, COULD be imported from outside the region at least two things would happen. First, the transportation costs would increase. Second the increased transportation costs would result in either or both a decrease in processors' profits and an increase in food costs. More likely the processors would be forced to scale back production relative to baseline, resulting in a loss of jobs. TID and MID undertook an analysis to estimate the economic impact of a reduction in irrigation water on the food and beverage processing sector. This analysis is called a "forward linkages" analysis. The Districts used IMPLAN to estimate the impacts. While IMPLAN is not specifically designed to estimate forward linkages it has been used by others (Cai and Leung [Footnote 26: Cai J. and P. Leung, "The Linkages of Agriculture to Hawaii's Economy," Cooperative Extension Service, College of Tropical Agriculture and Human Resources University of Hawaii at Manoa, Economic Issues, Aug 2002.]; Guerrero B. et.al. [Footnote 27: Guerrero, B. D. Hudson, S. Amosson, R. Dudensing, D. McCorkle and D. Hanselka, "Direct and Indirect Economic Contributions of Farm Level Production to Agribusiness Supply Chains and Local Communities," Texas A&M, AfriLife Extension Service, October 2012.]), including the USDA in its recently published article entitled A Practitioner's Guide to Conducting an Economic Impact Assessment of Regional Food Hubs using IMPLAN: a step-by-step approach. [Footnote 28: T.M. Schmit, B.B.R. Jablonski, and D. Kay. A Practitioner's Guide to Conducting an Economic Impact Assessment of Regional Food Hubs using IMPLAN: a step-by-step approach, September 2013.] The Districts estimated that the impact to the food and beverage processing sector from a change in irrigation supplies could be as high as $865.5 million in critical years and on average could be a $231.5 million dollar annual reduction in output, with a reduction of jobs ranging between 3,000 and 4,000. All related to a contraction in the food and beverage sector.	
1344	233	[ATT16:ATT5: Table 3. Top 50 Employers in Stanislaus and Merced Counties by Industry.]	The commenter is providing this attachment for reference purposes in support of their comments. Those

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			comments are addressed in these responses to comments; therefore, no additional response is required.
1344	234	[ATT16:ATT6: Table 4. Employment by Industry, Two-County Total and Statewide, 2010-2015.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	235	[From ATT16:] Geographic Scope Issue: The economic analysis does not analyze impacts consistently within the geographic scope. Impact: The full impacts of the SED are not quantified and the results are presented in a misleading manner. Discussion: The geographic scope for the SED is described in section ES3.2 and 1.2 referred to as the Plan Area. Three areas are described: * The Plan Area (page ES-5): "salmon-bearing tributaries of the LSJR below the rim dams5 on the Stanislaus, Tuolumne, and Merced Rivers, and the mainstem of the LSJR between its confluence with the Merced River and downstream to Vernalis to protect fish and wildlife beneficial uses in those reaches." * The Extended Plan Area (page ES-6): ". . . the Stanislaus, Tuolumne, and Merced Watersheds above the rim dams." * Areas not included or contiguous with either the Plan Area or the Extended Plan Area but were plan amendments have the potential to create impacts. "These areas are included in the areas of potential effects for some of the resources evaluated throughout this SED and are listed below. - City and County of San Francisco (CCSF) - Any other area served by water delivered from the plan area or extended plan area not otherwise listed above." The economic impact analysis is not consistent with regard to geography scope described above. This inconsistency does not help water resource managers consider and balance all costs and benefits from the proposed project. Specifically, the data presented in the SED summary tables (Table 20.2.-1 through Table 20.2-5) is misleading. The tables, are entitled Summary of Average Annual Cost and Beneficial Effects of the LSJR Alternatives 2, 3, and 4, Relative to Baseline Conditions for the various water use category, e.g. Agricultural Production and Related Economics (Table 20.2-1), Municipal and Industrial Water Supply and Related Economics (Table 20.2-1), Hydropower Generation and Related Economics (Table 20.2-3), Fisheries and Related Economics (Table 20.2-4 and Recreation Activity-Related Economics (Table 20.2-5). Organizing the result in this manner leads the reader to assume that the summaries are a comprehensive list of all benefits and costs for the various water use category. However, that is not the case. The geographic scope of the economic analysis adheres to the definition above, except where it does not, the SED states (Page 20-2): "The geographic locations or study areas discussed in this chapter vary by topic, depending on the resource being evaluated, the	By presenting a focus on a universal geographic scope, the commenter suggested that only a full benefit-cost analysis (BCA) (i.e., "…consider and balance all costs and benefits…") would allow the SWB to effectively evaluate the impacts of the proposed plan. However, the SWB is not required to conduct a benefit-cost analysis, but rather to consider economic effects of the plan amendments. Please see Master Response 8.0, Economic Analyses Framework and Assessment Tools, regarding the regulatory context of the economic analysis, reasonable assumptions, and spatial and temporal considerations. As described in this master response and in Chapter 20, Economic Analysis, Section 20.1, Introduction, the geographic locations or study areas discussed with respect to economic considerations vary by topic, depending on the resource being evaluated. This is necessary and appropriate given the types of resources being evaluated and where they occur and the available information and data to evaluate the resources. Furthermore, it is not inconsistent with the State Water Board's regulatory authority to assess effects, i.e., changes that result from a proposed rule or plan amendment, with consideration of the specific geographic extent of the impact category being assessed. As such, the geographic scope, as described in section ES3.2 and 1.2 and referenced (and quoted) by the commenter, is appropriate.

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		temporal and geographic distribution of that resource, and the geographic extent of potential effects on local and regional economies. As such, evaluations may extend beyond the defined plan area described in Chapter 1, Introduction. For example, the evaluation of recreation and commercial fisheries includes the Pacific Ocean marine waters and corresponding coastal areas. . . . Given the spatial variability among topics discussed in the analyses, each subsection in this chapter describes the geography in which the analysis focuses." This fractured view of the geographic scope and impact analysis does not consider all beneficial uses of water consistently across all areas. A request that was made by SWRCB Chairwoman Marcus at the December 16, 2016 hearing (page 16) when she stated: "20 . . . The Bay-Delta Plan lays out 21 water quality protections to ensure that various water 22 uses including agriculture, municipal use, fisheries, 23 hydropower, recreation and more are protected. 24 In establishing these objectives, the State 25 Water Board must consider and balance all beneficial uses (Page 17) 1 of water, not just pick one and discard the others. So 2 please help us do that." Chairwoman Marcus's request to "not just pick one and discard the others" echoes guidelines written by the Council on Environmental Quality (CEQ) to identify major actions significantly affecting the quality of the environment [Footnote 29: 40 C.F.R. § 1500.6(d)(1) (1974).]: "In many cases, broad program statements will be required in order to assess the environmental effects of a number of individual actions on a given geographical area." For example, the geographic scope for the discussion about use-benefits to fisheries is the entire California economy. Specifically, (page 20-69): "As discussed above under Recent Salmon Fishery Closures in California, the closures of the ocean commercial and sport fisheries in 2008 and 2009 cost the California economy an estimated \$255-\$275 million in industrial output (sales), \$118 million in personal income, and 1,800-2,700 jobs during each year of the closure." Additionally, the geographic scope of the non-use valuation studies (see Table 20.3.5-3) uses examples in the SED with a range of geographic scope from local areas to the nation. If the California economy and beyond is the geographic scope for a discussion about fish benefits then the California economy should also be the geographic scope for other benefits, including agriculture and municipal and industrial water supply. If not, then the statewide agricultural and municipal and industrial water supply benefits are being	

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		"discarded." The statewide agricultural benefits would include food and beverage processing of food grown within the three-county area but processed outside the three-county area. For example, the large volume of the almonds grown in the three-county area are processed at the Blue Diamond plant in Sacramento County. The statewide benefits to municipal and industrial water use would accrue from increase delta exports. Or, if the geographic scope of the economic analysis is not consistent across all water use types, then at a minimum the names of Tables 20.1-1 through 20.1-5 should be changed to (additions in bold): Summary of [b]Some[/b] of the Average Annual Cost and Beneficial Effects of the LSJR Alternatives 2,3, and 4, Relative to Baseline Conditions, or: Summary of the Average Annual Cost and Beneficial Effects [b]that the SWRCB[/b] analyzed of the LSJR Alternatives 2, 3, and 4, Relative to Baseline Conditions.	
1344	236	[From ATT16:] Temporal Scope Issue: The SED does not state the temporal scope for the analysis despite the fact that the long-term water supply reliability of the Districts will be significantly impacted under the SED. Impact: The long-term structural change to the agricultural economy in the area caused by the SED's long-term impact to water supply reliability is not addressed. Discussion: CEQA Guideline 15126(a), states: "An EIR shall identify and focus on the significant environmental effects of a proposed project. Direct and indirect significant effects of the project on the environment shall be clearly identified and described, giving due consideration to short term and long term effects." The long-term effects of the SED on agriculture are not considered. The SED assumes that permanent crops will continue at their current level of production. And by omitting any estimate about an impact to animal commodities the SED is implicitly estimating no change to animal commodities. Despite a decrease in water supply reliability, with larger and more frequent reductions in irrigation water supplies, the SED estimates that acres of trees will only decline in below normal, dry and critical water-year types and "bounce back" to current levels again in the wet and above normal water year types. This assumption is incorrect. The SED fails to take into account how an increase in the number of sequentially dry years would impact the agricultural sector. [Footnote 30: The importance of considering sequentially dry years was not lost to the SWRCB's member, Ms. D'Adamo, who stated at the November 29, 2016 SWRCB workshop when discussing impacts to fisheries (page 286 of the hearing transcript): "24 And then another area is sequential dry years. . . . (Page 287): 2 . . . But I think it's really important for 3 us to just overlay the last four years on this SED and	Please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, for discussion of the SWAP model and assumptions about stress irrigation and permanent crops. Please also see Master Response 8.1 regarding the scope of the agricultural economic analysis and a potential contraction in the agricultural industry.

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		4 see what it looks like."] The SED model's foundational economic assumption is that growers and ranchers optimize their annual use of resources in order to maximize returns. Given that foundational economic assumption it is reasonable to assume that growers and ranchers have optimized their investment in permanent crops, and capital equipment for animal operations (e.g., milking barns, etc.) based on the current water supply reliability afforded by the Don Pedro Project. Any long-term change in water supply reliability and growers and ranchers would re-optimize their investments and consequently change either/or both cropping patterns and herd size. Historically, the top eight commodities in the two-county region, measured in terms of commodity value, have been almonds, milk, cattle & calves, chickens, silage/hay/pasture, walnuts and sweet potatoes (Table 5 [see ATT16:ATT7]). [Footnote 31: Production of chickens does not rely heavily on regional irrigation water supplies. Chickens feed is primarily imported from the mid-west. Therefore, the value of chicken-based commodities is not included in subsequent impact estimates. This is consistent with the way the SED handled chicken-based commodities.] Those top eight commodities account for between 75 percent to 85 percent of the total commodity value for the two counties and are either animal-based commodities (e.g., milk, cattle & calves and chickens), animal feed crops (e.g., silage/hay/pasture) or permanent nut trees (e.g. almonds and walnuts). Only one of the top eight commodities is an annual crop, sweet potatoes, comprising only 3 percent of the 2015 total commodity value. And many of the commodities that are not in the top eight are also animal-based (sheep, bees, etc.) and/or permanent trees and vines (pistachios, peaches, citrus, etc.). These commodities are high-value and require significant capital investments, making them relatively fixed in the short run (approximately 25 years). The capital investment required to establish an almond orchard is over $5,000 per acre. The establishment cost is the sum of the costs for land, planting, trees, etc., as well as the production expenses for growing the trees until almonds are harvested and revenue is generated--approximately 3 years (UCCE 2011). For a 40-acre orchard, that equates to over a $200,000 investment before revenue is generated. These establishment costs are recovered over the remaining 22 of the 25 years the orchard is in production. In the dairy industry the cash costs of dairy operations only represent between 98 percent and 78 percent of the total annual costs (see discussion below). Depreciation and interest costs for the investments in items including the milking barn, free stall, manure pit, bulk tank, hay barn, silage pit, maternity pens, etc., represent 2 percent to 22 percent of total costs (UCCE 1986). Capital investment in these high-valued crops was made possible because of the relatively high degree of water supply reliability provided by TID and MID. Utilizing data reported in the SED's supporting models and spreadsheets the baseline water deliveries from TID and MID show the high degree of water supply reliability the Districts have afforded their growers thereby justifying the investment in permanent crops and animal operations (Figure 3 [see ATT16:ATT8]). The estimated applied water for the period 1922 through 2003 for the SED baseline shows surface water deliveries have been just over 600 TAF in most years. Shortages of any magnitude (between 100TAF and 200TAF) occurred in only nine of the 82 years (1924, 1931, 1935, 1961, 1978, 1988, 1990, 1991, and 1993).	

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		Those water-short years occur sporadically, only two were sequential, 1990 and 1991. Under SED Alternative 3 not only does the magnitude of the water shortages increase but the frequency and the pattern of water-short years changes too. Under Alternative 3 the number of water-short years increases to 31 from nine. Also the water shortages are greater than the baseline and occur in sequential years much more frequently. For example, six sequential years, between 1929 and 1934, see water shortages between 200 TAF and 300 TAF below baseline. The period from 1949 to 1986 is characterized by two to three-year water shortages followed by a five-year period, from 1988 to 1992, of water shortages ranging between just under 200 TAF and approximately 300TAF. Given the relatively fixed nature of the crops grown in the region the pattern of water shortages is as important if not more important to growers' operations than the magnitude of the shortage and would cause a re-thinking or re-optimization of investment in permanent crops and capital. This re-optimization by growers and ranchers is not addressed in the SED model. The SED model is an annual model, e.g., it estimates growers' responses to a reduction in irrigation supplies without consideration for the prior year's irrigation supplies or projections of next year's irrigation supplies. This model can work well if 1) modeling short-term impacts of droughts, as it has been used to estimated annual impacts from the most recent drought and/or 2) the crops grown are primarily annual crops (e.g. tomatoes, sweet potatoes, rice, etc.) and there is no significant demand for animal feed crops. However, in the TID and MID service area, given the fixed nature of the agricultural crops a decrease in water supply reliability as proposed under the SED, there would be a permanent contraction in the agriculture sector. Either/or the acreage planted to permanent crops would be reduced over the long-term, or the diary and cattle & calf operations would downsize, reducing the herd size. However neither of these responses are discussed in the SED. At best, using the SED model in a situation when, long-term water supply reliability is declining and the area is characterized by permanent crops and animal operations, the estimated impacts should be considered a minimum impact to agriculture. Permanent crops need water in every year and animals need feed in every year. The likely outcome is the cropping patterns will change as a consequence of this long-term change in water supply reliability and the agricultural sector will permanently contract.	
1344	237	[ATT16:ATT7: Table 5. Top Eight Commodities by Value, Stanislaus and Merced Counties, 2015.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	238	[ATT16:ATT8: Figure 3. Graph of TID and MID, Estimated Applied Water by Year, Baseline and SED Alternative 3 (40% UF).]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	239	[From ATT16:] Comments on Analysis Issue: The SED aggregates the estimated impacts over time and geography. Impact: The estimate of the SED's impact to growers dependent on water from TID and MID is both obscured by this aggregation and significantly understated. In addition to understating the impacts of the proposed project, because animal commodities and the	Please see Master Response 2.3, Presentation of Data and Results in SED and Responses to Comments, for discussion of why average results were presented. In addition, please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, and Master Response 8.2, Regional Agricultural Economic Effects, for presentation of the results of the revised SWAP model run averaged by water year type.

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		food processing sector are omitted, the impacts that are estimated, crop commodities, are reported as average annual impacts to the total project area both of which obscure the impact of implementing the SED to the entities that are impacted. The focus of the SED write-up should be on the impact of a reduction in irrigation supplies to each irrigation district and by water-year type. This disaggregated information is provided in the SED but only in the Modeling Tools Information and Files and requires significant re-formatting and review to comprehend. Disaggregated district-level data should be front and center so that water resource managers and water-rights holders can make informed decisions about implementation and potential settlements. The fact that this crucial decision-making data is not in the text of the SED and is obscured in the supporting models and tools is highly unusual for a public document and calls into question the State's understanding of the perspective of the local water resource managers, the agricultural sector and a commitment to transparency.	
1344	240	[From ATT16:] Geographic Aggregation Obfuscates Impacts and Does Not Conform with Water Resource Governance. The SED reports that the average annual project-wide loss of implementing Alternative 3 is $64 million from crop commodities and related "ripple effects." [Footnote 32: Table ES-9. Average Annual Total Economic Output Related to Agricultural Production in the irrigation Districts under Baseline Conditions and the Change for LSJR Alternatives 2, 3, and 4. Evaluation of San Joaquin River Flow and Southern Delta Water Quality Objectives and implementation, September 2016.] This loss in crop commodity revenue is caused by an 11 percent average annual project-wide reduction in irrigation supplies. Close examination of data reported in the SED's supporting models and spreadsheets reveals that TID and MID bear a larger share of both the loss in crop commodity revenue and irrigation water. The economic loss to the growers in TID and MID is $42 million, or 65 percent of the total estimated project-wide loss, despite the fact TID and MID comprise 40 percent of the irrigated acreage of the study area. [Footnote 33: Agricultural Economic Analysis (zip file) located on the SWRCB website under Modeling Tools Information and Files.] And the average annual reduction in irrigation supplies to TID and MID is 17 percent, 55 percent higher than the project-wide average of 11 percent. We recommend that not only should the state revise its damage estimate to include animal commodities and the processing sector, the revised damage estimate should be reported at the district level, which is the level of governance and water resource management.	Please see Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, for presentation of district agricultural revenue losses estimated from the revised SWAP model run and averaged by water year type.
1344	241	[From ATT16:] Aggregating Over Time Equally as important as disaggregating the impacts to the district level is to disaggregate the impacts over time, at least by water year type. Average annual changes in water supply mean very little in terms of how a change in irrigation supply will impact agriculture and should NOT be used to make informed decisions about water resource management. Under Alternative 3, the SED reports that the annual average reduction in surface water for the entire study area would only be 240 TAF (15 percent of baseline) and that 105 TAF (seven percent) of that shortage would be made-up by pumping additional ground water. So that the annual average increase in unmet demand would only be 140 TAF (seven percent of	Please see Master Response 2.3, Presentation of Data and Results in SED and Responses to Comments, for discussion of why average results were presented. In addition, please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, and Master Response 8.2, Regional Agricultural Economic Effects, for presentation of the results of the revised SWAP model run averaged by water year type. Also please see Master Response 3.2, Surface Water Analyses and Modeling, for presentation of district diversion results averaged by water year type. Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, for discussion of SGMA implementation.

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		baseline). However, when disaggregated for just TID and MID and over time, the estimated shortages are not only larger than for those of the entire study area, the significant difference in reporting annual averages become apparent. Under the baseline all but critical water year types TID and MID have provided growers with upwards of 600 TAF of surface water (Figure 4 [see ATT16:ATT9]). The SED reports that an additional 110 TAF of groundwater has been pumped in each water-year type from District wells and by individuals, to meet the total irrigation demand of approximately 710 TAF to 800 TAF, depending on water-year type. In critical water-year types, which occur 20 percent of the time, unmet demand under the baseline is estimated to be 169 TAF (24 percent of full demand). Full deliveries in 80 percent of all years provides a high degree of water supply reliability and is the reason growers have invested millions of dollars of permanent crops and capital infrastructure needed for dairies and cattle & calf operations. The frequency of shortages and the pattern of those shortages under Alternative 3 tell a different story than the annual average story (Figure 5 [see ATT16:ATT10]). Most notable is that unmet demand now occurs in all but wet years (70 percent of the time). In dry and critical water-year types (38 percent of the time) unmet demand ranges from 201 TAF (28 percent of full demand) to 403 TAF (56 percent of full demand and 32 percent higher than the critical dry year baseline shortage of 24 percent). And these shortages are somewhat offset by the SED's assumption that additional groundwater can and will be pumped to make up for lost surface water supplies. The SED assumes that additional groundwater will be pumped in every water year type, ranging between 2 TAF (wet years) to 50 TAF (dry years), water that will not be available in a post-SGMA world, increasing dry-year shortages by an additional 7 percent. In summary, compared to baseline, water supplies would be 30 percent less than baseline in dry and critical years, or more than one in three years. That is a far cry from reporting the project-wide average annual water shortages is 11 percent of baseline. The average economic impact of this reduction in surface water supplies is estimated to be $40 million by the SWRCB (Figure 6 [ATT16:ATT11]). However, when disaggregated by water year type the true impact is much more clear. In critical water-year types, 20 percent of all years, the SWRCB's estimated impact is over $120 million. In dry water year types, 16 percent of all years, the impact is over $70 million. And in below normal years, 16 percent of the time, the impact is estimated to be $35 million. Even in above normal years, 16 percent of the time, there is an estimated $5 million impact. This variation in income would have a long-term impact on the agricultural sector, a fact that is obfuscated by reporting annual average impacts.	
1344	242	[ATT16:ATT9: Figure 4. TID and MID Baseline Irrigation Water Supply by Source and Water-Year Type.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	243	[ATT16:ATT10: Figure 5. Irrigation Water by Source and Water-Year Type Provided by TID and MID under SED Alternative 3 (40% UF).]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	244	[ATT16:ATT11: Figure 6. SWRCB's Estimate of Agricultural Economic Impact by Water Year	The commenter is providing this attachment for reference purposes in support of their comments. Those

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		Type.]	comments are addressed in these responses to comments; therefore, no additional response is required.
1344	245	[From ATT16:] Estimates of a Reduction in the Acres of Tree Crops is not Explained. Issue: The SED states that the acres of trees changes from year to year due to a change in irrigation supplies. Impact: Misrepresents the management of permanent crops during periods of reduced irrigation supply and understates or ignores the lag impact that stress irrigation has on the yield of tree nuts and fruits. Discussion: The acres of nut trees estimated by the SED model varies by year, depending on irrigation water supplies (Figure 7 [see ATT16:ATT12]). It is unclear how to interpret this result. It could mean that trees are removed from the fields in drier years and replanted when irrigation supplies are available--which would not be consistent with orchard management best management practice. Or rather, the reduction in acres is a proxy for a reduction in the yield of almond orchards, but not an actual removal of trees from the field. However, it is difficult to understand why the results report a reduction in tree-nut acres. Also, water stress can negatively affect both the primary yield components in almond: kernel size (Girona et al. 1993) and fruit load (Goldhamer and Smith 1995, Goldhamer and Viveros 2000, Esparza et al. 2001). And this effect persists a year or two, even if irrigation returns to yield maximizing volume. It does not appear that the SED has accounted for this lag effect, based on the pattern of nut-crop land and revenue shown in Figure 7 [ATT16:ATT12]. Note that in wet and above normal water-year types nut-tree acres are approximately 47,250 acres (left-hand vertical axis) and nut-tree revenue is approximately $55 million (right-hand vertical axis). In critical water-year types both acres and revenue fall. Acres of nut-tree crops fall up to 3,000 acres (1988, 1990 and 1992). However immediately following the critical dry water-year types land and revenue immediately return to pre-drought levels. For example, in 1993, a wet year sandwiched between two critical years, revenue and acres return to levels seen during consecutive wet and above normal years (e.g. 1996 through 2000) when there would be a lag effect due to water stress that occurs in 1988 through 1991.	Please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, for discussion of the SWAP model and assumptions about stress irrigation and permanent crops.
1344	246	[ATT16:ATT12: Figure 7. Graph of Estimated Acres and Revenue of Tree Crops, SED Alternative 3 (40% UF).]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	247	[From ATT16:] Using 2008 as the baseline year for data. Issue: The SED states all of the impacts in 2008 dollars. Impact: Stating the value of agricultural production in 2008 dollars gives the appearance that the impacts are less than they are. Discussion: Most readers assume a report is estimating value in dollars that are relatively current. It is understandable that a report may estimate value using dollars that are a few years old, simply due to the time it takes to produce a report of this magnitude, but it is hard to understand why the SWRCB uses dollars that are 8 years old. The U.S. Department of Labor CPI inflation calculator suggests that a 2008 dollar should be inflated by 12 percent	Please see Master Response 8.0, Economic Analyses Framework and Assessment Tools, regarding the presentation of economic results in 2008 dollars.

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		to reflect a current 2016 dollar. Just based on the SED's estimate of impacts to TID and MID, restating the impacts in 2016 dollars would increase annual impacts between $200 thousand and $9.3 million depending on water-year types.	
1344	248	[From ATT16:] Chapter 11, Williamson Act contracts. Issue: The SED says there will be minimal impact to Williamson Act contracts because agricultural land currently enrolled in the Williamson Act can still be dryland farmed. The assumption that it is financially viable to dryland farm in the project area is an overstatement. Impact: Williamson Act subscriptions may fall and the impact of un-enrolling land that is no longer profitable to farm is understated in the SED. Discussion: Growers who originally enrolled land in the Williamson Act did so with an expectation that irrigation supplies would continue to be available. That expectation changes under the SED and could change whether growers will or can remain enrolled. The Williamson Act Program enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use. Private land within locally-designated agricultural preserve areas is eligible for enrollment under contract. The minimum term for contracts is ten years. However, since the contract term automatically renews on each anniversary date of the contract, the actual term is essentially indefinite. Landowners receive substantially reduced property tax assessments in return for enrollment under Williamson Act contract. Property tax assessments of Williamson Act contracted land are based upon generated income as opposed to potential market value of the property. Local governments receive a partial subvention of forgone property tax revenues from the state via the Open Space Subvention Act of 1971. Contracts may be exited at the option of the landowner or local government by initiating the process of term nonrenewal. Under this process, the remaining contract term (nine years in the case of an original term of ten years) is allowed to lapse, with the contract null and void at the end of the term. During the nonrenewal process, the annual tax assessment continually increases each year until it is equivalent to current tax rates at the end of the nonrenewal period. Under a set of specifically defined circumstances, a contract may be cancelled without completing the process of term nonrenewal. Contract cancellation, however, involves a comprehensive review and approval process, and the payment of a fee by the landowner equal to 12.5 percent of the full market value of the property in question. Local activities such as eminent domain, or, in some rare cases city annexation, also result in the termination of Williamson Act contracts. The impact to landowners whose best interest may be served by exiting the program have not been considered in the SED. Because a decision to exit the program would be predicated on the SED's reduction in long-term irrigation water supply, the estimated cost of the 12.5 percent fee should be included in the SED.	Williamson Act enrollment is voluntary and growers can maintain Williamson Act lands in agricultural (e.g., dry land farming, fallowing) or open space activities, that meet the Williamson Act definition of agricultural uses, without irrigation. As such, the plan amendments are not expected to result in unenrollment as discussed in Impact AG-3. Numerous variables dictate individual decisions of growers to remain enrolled or to unroll; these could include: the Williamson Act cycles and where the grower is within the cycle and the land use opportunity presented to the grower not involving an agricultural use covered by the Williamson Act, which are beyond the control or purview of the plan amendments. For example, repurposing of land to nonagricultural uses may result in net gains above the Williamson Act early termination fees (12.5% as identified by the comment) because there could be another land use opportunity that would generate more net revenue than if the land remains in the Williamson Act and that is why the individual grower could choose to unenroll. However, it is speculative to determine the cost or gain without knowing the alternative land use, the Williamson Act cycles, and market conditions. Please see Master Response 3.5, Agricultural Resources, for discussion of dry land farming.
1344	249	[From ATT16:] Errors in the SED Model	In reviewing the SWAP model it was determined that stress irrigation was not being properly applied for

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		Issue: It appears that there are errors in the SED model's production function, calibration or input substitutability. Impact: The SED's impact on crop commodities is understated. Discussion: The model used in the SED incorporates a production function which allows substitution between inputs in agricultural production. For example, when water supplies are reduced the SED model's production function might substitute technology and/or labor in the form of an increase in irrigation efficiency, to maintain the baseline per acre yield. Clearly, a reduction in irrigation supplies must be replaced by some other input (e.g., irrigation technology) or the per-acre yield of the crop would decline, modeling deficit irrigation. However, in reviewing data from the SWRCB's spreadsheet entitled "Agricultural Economic Analysis 09142016.xls" with additional data provided by SWRCB staff, we compared the estimates of per acre water use in almond trees to the estimates of per acre almond yield (Table 6 [see ATT16:ATT13]). [Footnote 34: Personal e-mail communication from Rich Satkowski, SWRCB to Susan Burke, Cardno, dated 12/15/2016.] In critical water-year types per acre water use declined 12 percent compared to baseline, however per acre yield did not change relative to baseline. The only way this is possible is if some other factor of production, for example irrigation technology, increased significantly. The SED does not include all of the SED model output, so it is not possible to check. However, the model output is highly suspect, suggesting that either the calibration or input substitutability is not correct in the model.	permanent crops in the results presented in the 2016 SED. The model was rerun and an updated "Agricultural Economic Analysis" spreadsheet has been posted on the SWRCB website: https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/. Please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, for discussion of the revised SWAP model run. Using crop gross revenue as a proxy for crop yield, the results show that when there is a reduction in applied water per acre there is also a reduction in gross revenue per acre.
1344	250	[ATT16:ATT13: Table 6. Per-Acre Applied Water and Yield, Critical Year Average of TID and MID.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	251	[From ATT16:] Existing Condition Section Missing from the Economics Chapter. Issue: SED does not describe the existing condition in the project area. Impact: Impossible for a reader to fully understand the impact of the proposed plan without an understanding of the demographics and current economic conditions of the region. Discussion: Stanislaus and Merced Counties' demographic and economic data show an area characterized by higher projected population growth, lower household income, higher unemployment, and a higher percentage of people living in poverty than within the state. The agricultural industry supports nearly one quarter to one third of the counties' jobs. Approximately 18 percent of counties' agricultural jobs are on-farm jobs, compared to 3 percent for the state. Farms in the area tend to be family owned and smaller when compared to farms throughout the state. The data supporting these summary statements follows. The population in the two-county area has grown and is projected to continue to grow faster than the population in the rest of the state. Between 1970 and 2010, the population in two counties grew at an annual average 2.4 percent, 52 percent faster than the state's annual average growth rate of 1.6 percent (Table 7 [see ATT16:ATT14]). Population projections between 2020 and 2060 show that growth rates in the two counties is expected	The commenter is suggesting that the Economic Chapter contain baseline demographic and economic setting discussion; however, disclosing the baseline setting is a CEQA requirement to measure the impacts to the physical environment from a project and is inapplicable here. (See Cal. Code Regs., tit. 14, § 15125.) That said, we appreciate the commenter's perspective and information and they are part of the record and will be considered by the State Water Board to the extent relevant when considering the economic impacts of the plan amendment. Please see Master Response 8.2, Regional Agricultural Economic Effects, for an overview of the regional agricultural economic setting.

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		to continue to outpace the state by 84.7% percent. County population is projected to grow at an annual average rate of 1.6 percent from 2020 to 2060, compared to the state's 0.6 percent average annual growth rate for the same period of time. For the last 12 years (2005 through 2016) the two-county area's unemployment rate has been significantly (between 48 percent and 92 percent) higher than the state's unemployment rate (Table 8 [see ATT16:ATT15]). In all but two years (2006 and 2016) the two-county unemployment rate has been in double digits, ranging between 9.1 percent (in 2016) and 18.0 percent (in 2010). For example, in 2014 there were an estimated 242,000 people in the labor force of the two counties, of which 27,000 were unemployed, a 9.1 percent unemployment rate--over 69 percent higher than the state's unemployment rate of 5.4 percent for the same period. Total median household income and benefits in the two counties (Table 9 [see ATT16:ATT16]) in 2015 ($47,714) was approximately 30 percent lower than in the state ($61,818). More than half of the households in the two counties (52 percent) received less than $50,000 in 2015 in income and benefits. Compared to more than half the households in California (58 percent) that received less than $75,000 in 2014 in income and benefits. It follows that with a lower median household income there are also more people in poverty in the two-county area than in California. In 2015, 16 percent of Californians were below the poverty level compared to 22 percent of all people in the two-county area (Table 10 [see ATT16:ATT17]). Or 36 percent higher than the state. Agriculture accounts for between 1 in 4 to 1 in 3 jobs in the two-county area. Farms in the two-county area are characterized as smaller family owned operations compared to the state (Figure 8 [see ATT16:ATT18]). Farms in the two county area average between 236 acres (1997) to 272 acres (2002). Compared to farms in the state which average between 313 (2007) and 346 (2002). Farm size in the two-county area has been increasing since 1997, meaning individual farms are getting larger. This represents a consolidation of farms in the area. That average farm size in the state has remained steady over the same timeframe. In summary, the two-county area is heavily dependent on family-owned farms for jobs and household income. The farms are heavily invested in permanent crops and animal operations with little flexibility to absorb a long-term reduction in water supply reliability. This story of character of the community is not told in the SED because the Existing Condition is not included in the Economic Chapter.	
1344	252	[ATT16:ATT14: Table 7. Population Growth in Stanislaus and Merced County compared to California 1970-2060.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	253	[ATT16:ATT15: Table 8. Labor Force, Employment and Unemployment in Merced County and California, 2005-2014.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	254	[ATT16:ATT16: Table 9. Total Household Income and Benefits, 2015.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	255	[ATT16:ATT17: Table 10. Percentage of Families and People Whose Income is Below the	The commenter is providing this attachment for reference purposes in support of their comments. Those

Table 4-1. Responses to Comments			
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		Poverty Level, Merced County and California, 2014.]	comments are addressed in these responses to comments; therefore, no additional response is required.
1344	256	[ATT16:ATT18: Figure 8. Graph of Average Size of Farms in the Two-County Area and the State.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	257	[From ATT16:] Environmental Justice Issue: SED does not address the environmental justice impacts of the proposed plan. Impact: The proposed plan's long-term impact to agriculture will have an impact on disadvantaged communities. Discussion: Environmental Justice considers the potential impact of the project on the environmental and public health issues and challenges confronting the nation's minority, low-income, tribal and indigenous populations (e.g. disadvantaged communities). The SED partially defines disadvantaged communities as "those communities with an annual median household income (MHI) that is less than 80 percent of the statewide annual MHI" (page 22-1). The reviewer could find no mention of the fact that environmental justice also means the "fair treatment of people of all races and cultures." [Footnote 35: California Government Code § 65040.12.12.] However, the SED does not consider how the proposed project would impact the disadvantaged communities in Stanislaus and Merced Counties with respect to an impact in the agricultural sector. The median household income in California in 2015 was $61,818 (Table 9 [see ATT16:ATT16]). Eighty percent of that MHI is $49,454. Fifty-two percent of the households in the two-counties made less than $50,000 in income in 2015, passing the threshold for a disadvantaged community. Additionally, 46 percent of the population reports itself as Hispanic or Latino in the two-counties compared to 38 percent in the state. [Footnote 36: US Census, American Fact Finder, 2015.] A recent study conducted by UC Davis Center for Regional Change entitled California's San Joaquin Valley: A Region and its Children Under Stress describes the demographics and poverty challenges facing the area (Page 8): "The agriculture/food processing industry is expected to be the primary employer in the San Joaquin Valley for years to come . . . these industries rely heavily on low-wage and seasonal laborers, including undocumented immigrants, who often face poor working conditions and workplace violations such as wage theft. "As a result, poverty remains an acute problem in the region, where 1 in 3 families with children under 18 have incomes below the FPL [Federal Poverty Level]. Poverty rates are even higher for children of color and children with immigrant parents, while children of undocumented immigrant parents have still higher poverty rates. It is estimated that 1 in 5 children in the San Joaquin Valley has at least one undocumented parent, and that nearly 3 in 4 children with an undocumented parent have family incomes that are below 150% of the FPL. "In the words of a social justice advocate who works in the southern San Joaquin Valley, 'The root of many of the Valley's problems is poverty and the lack of economic diversity in the region. It is a cycle that limits options in employment to low-wage, low-skill work. That	Please see response to Comment 1344-104 Also refer to Chapter 20, Economic Analyses, regarding consideration of regional economic effects due to implementing the plan amendments, which includes jobs and fiscal analysis in Section 20.3. Please see Master Response 8.2, Regional Agricultural Economic Effects regarding potential effects of the plan amendments on employment. Please refer to Master Response 3.5, Agricultural Resources, for a discussion regarding the plan amendment's potential impacts on agriculture.

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		affects educational attainment, and impacts the environmental quality.'"	
1344	258	[From ATT16:] Social Impacts are not Considered. Issue: SED does not address social impacts caused by the uncertainty of the long-term feasibility of the agriculture economy and community. Impact: The proposed plan's potential long-term impact to the communities and social fiber of the region is not considered, vastly understating the total impact of the proposed project. Discussion: The long-term change in agricultural output caused by the proposed project only begins to tell the story of the impact the proposed project would have on the region. Because of a lack of economic diversity in the region a reduction in the size of the agricultural economy, with a commensurate reduction in jobs, will further stress people living within the study area. These stresses have not been addressed in the SED. While it can be difficult to quantify social impacts, the SED should at least acknowledge the potential types of impacts that have been seen in other regions undergoing similar shifts in water allocations. Impacts to communities that face water re-allocation decisions include loss of social capital, increases in community services ranging from mental health treatments to increases in crime fighting forces. [Footnote 37: Water Allocation in the Klamath Reclamation Project, 2001: An Assessment of Natural Resource, Economic, Social and Institutional Issues with a Focus on the Upper Klamath Basin, Oregon State University and UC Davis, April 2004.] In a 2004 study of the social impact of a reduction of irrigation water supplies to the Klamath Project researchers interviewed a variety of community members--beyond farmers--including business owners, social service providers, police, etc. The interviews describe increased stress due to increased uncertainty and a threat to a change in lifestyle. Topic areas that should be addressed to thoroughly analyze the proposed project on the community include: * Sense of division in the community causing a loss in social capital. Tension can be created for many residents who might support the farmers as members of the community but hold other perspectives as well. Members from these groups told the Klamath researchers that people who became especially vocal in their support of the farmers and ranchers had silenced others' voices and concerns. Exemplified in this quote from the Klamath report (page 192): "People are just not as friendly. You know this is a small town, everyone knows each other. Everyone talks to everyone else; now people just don't talk, they don't go out and socialize, don't go to festivals like the Potato Festival. It's been an annual event for 60+ years. I didn't even go this year. "Every other weekend someone would be having a party or barbecue. You'd go over and have a few beers and cook a steak. I don't know that I went to one barbecue all this summer. Nobody wants to socialize, there's nothing to celebrate." * Uncertainty about the future and long-term planning. Farming is inherently filled with uncertainty from such sources as weather, prices and disease. The proposed project adds	This 2004 study referred to by the commenter came after the 2001 decision by the United States Bureau of Reclamation not to release about 336,000 acre-feet of water from Upper Klamath Lake and the Klamath River to hundreds of growers served by the Klamath Project. The Bureau's action was in service to the senior water rights held by several of the region's Native American tribes. The growers, as junior rights holders, were not entitled to receive any water. In the instance evaluated by this study, the growers had received no water for irrigation. This is not an accurate comparison to the plan amendments. As discussed in Master Response 1.1, General Comments, a common misconception is that no water would be available for other uses under the unimpaired flow requirement. The unimpaired flow requirement specifies the amount of water that is required to stay in stream for the protection of fish and wildlife. The State Water Board is, and has been, considering concerns about how implementation of the plan amendments could affect local communities and heard from many community members directly during the six-month comment period on the SED and during the five days of public hearing. In addition to hearing concerns, the State Water Board acknowledges that ongoing local involvement will be critical to implementing the plan amendments and encourages voluntary agreements as a way for stakeholders to develop management options that directly address their concerns and needs. The numeric flow objective is proposed as an adaptive range and the program of implementation includes a seat at the table for local water managers: the Stanislaus, Tuolumne and Merced Working Group. The SED properly evaluates the physical environmental impacts that may result from the plan amendments as required by CEQA and provides information to support State Water Board consideration of societal, economic, and environmental factors as required by California Water Code § 13241. For additional information, please see Master Response 1.1, General Comments, acknowledging the concerns of elected representatives and community members and for responses to comments regarding use of an SED to meet CEQA requirements, economic effects, and voluntary agreements. Please see Master Response 1.2, Water Quality Control Planning Process, for responses to comments regarding appropriate consideration of Water Code § 13241 factors such as economic considerations. For more information about the SED economic analysis and economic effects, please refer to SED Chapter 20, Economic Analysis, and Master Responses 8.0, Economic Analyses Framework and Assessment Tools, 8.1 Local Agricultural Economics Effects and the SWAP Model, and 8.2, Regional Agricultural Economic Effects.

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		considerably to the uncertainty and threatens the long-term viability of farming and ranching. This uncertainty impacts individuals by adding uncertainty about their future. For example, one farmer interviewed in the Klamath report states (page 197): "Where am I going to be 10 years from now? I don't even know where I'm going to be next year. You can't make any long-term plans right now. When I got out of college I had a plan with goals, knew what I was going to do. This is where I wanted to make my career." "One business owner wondered (page 198) 'How easy will it be to attract new industry here if you don't know if you can keep an educated workforce?'" * Impacts on social service providers in the region should be considered. The Klamath researchers saw how the uncertainty about the future had affected those parts of the community that had little voice in the conflict--farm workers, the unemployed and other traditional clients of social service agencies such as head Start, County Health, Mental Health, etc. One service provider from a small community reports: "Suicide calls have increased . . . They feel like they have no choice--'I can't do this anymore.' We bring it around to what they can't do anymore and it is the fear of living in the unknown. Not knowing what to expect. What's going to happen? What's going to happen to my family? What's going to happen to my kids? I can't take care of myself anymore and no one understands." The SED should at least acknowledge these potential impacts, particularly to forward potential settlements. The SWRCB should consider reaching out to groups that stand to be significantly impacts however do not currently have a voice in the process.	
1344	259	[From ATT16:] The SED model Input Data is not Provided in the SED. Issue: The SED does not present most of the data that is used as input to the SED model. Impact: Not possible to complete as thorough a review as would be possible if the data were available. Discussion: Missing data include crop prices, yields and costs; irrigation water rates used in the SED model's cost function, the aggregation of district crops to the SED model crops and the representative crop used for each of the SED model crops.	Please see Master Response 8.1, Local Agricultural Economics Effects and the SWAP Model, for discussion of the SWAP model and its input data.
1344	260	[From ATT16:] Impact on Irrigation Districts' Rate Structure Issue: The Districts' irrigation rate structure is dependent in part on the delivery of water. A long-term reduction in canal diversions which reduces the Districts' ability to delivery water would necessitate a change in irrigation rates. Impact: The SED does not address the magnitude of the change in irrigation rates or the ability of the growers to continue to pay for water given the increase in the long-term uncertainty of supply. Discussion: Chapter 20 of the SED includes a section entitled Potential Rate Payer Effects (page 20-32) which states: "Ratepayers in districts that substantially rely on surface water	Please see Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, regarding the long term economic effects of changes in water supply availability and district water rates.

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		diversions from the eastside tributaries, and where current rates do not account for unexpected capital costs, would likely be the service providers most affected by the additional costs of replacing lost surface water supplies. Over the long term, most districts would be expected to recover most, if not all, capital costs through rate adjustments. Certain water service provider may consider temporarily halting construction for new treatment facilities, as a project could become less economically viable as a result of reduced surface water diversions; however, over time, districts would be expected to re-spread the fixed costs of its projects, whether completed or not, among their ratepayers to achieve the revenue needed to remain economically viable." That discussion seems to be aimed more at residential and M&I providers than agricultural districts. However, the same argument holds. The difference is that the proposed project would increase both the growers' cost of surface water and directly reduce the grower's income. The SED takes account of an increase in water costs from additional pumping, but does not take into account an increase in irrigation rates. This inconsistency in the application of the SED's method should be addressed by considering how irrigation rate could be impacted and that impact on growers' profit. TID and MID both have tiered irrigation rate schedules based on the volume of water delivered (Table 10 [see ATT16:ATT17] and Table 12 [see ATT16:ATT20]). TID has both a normal year and a dry year water rate schedule (Table 11 [see ATT16:ATT19].) MID has a provision to maintain revenue in the event that there are no water deliveries via a facilities maintenance charge, however TID does not have the same provision in their rate structure. The proposed project would reduce the long-term average annual irrigation supplies delivered from TID by 18 percent. Which in turn would reduce the revenue generated by water charges by the same percentage.	
1344	261	[ATT16:ATT19: Table 11. TID's 2015 Irrigation Rate Schedule.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	262	[ATT16:ATT20: Table 12. MID's 2016 Irrigation Rate Schedule.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	263	[From ATT16:] Manure Management Issue: SED does not mention how manure management plans would be impacted by a change in cropping patterns. Impact: The estimated reduction in field and forage crops would limit dairies opportunities to manage manure, potentially increasing costs or necessitation a reduction in herd size. Discussion: California dairy farmers have had to adapt to regulations implemented by the Central Valley Regional Water Quality Control Board (CVRWQB) aimed at protecting water quality by managing impacts from waste generated at dairies. Many Central Valley dairies have systems to store and distribute manure, and research has shown that more than 50 percent of excreted nutrients collected in these systems are applied to crops (Pettygrove, et al. 2003). [Footnote 38: Pettygrove, G. Stuart, et al. 2003. Integrating Forage Production with Dairy Manure Management in the San Joaquin Valley. University of California, Davis.]	Please see Master Response 3.5, Agricultural Resources, and Chapter 11, Agricultural Resources, Section 11.2.2, Other Agricultural Production, for information about manure management and nutrient management plans. Please see Appendix G, Section G.4.1.1, Effects on Crop Acreage, and Master Response 8.2, Regional Agricultural Economic Effects, regarding economic considerations as they relate to dairies and feedstock.

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		To do so, a dairy is required to develop a nutrient management plan (NMP) and waste management plan (WMP), and to follow a monitoring and reporting program (MRP), which includes annual reporting. The NMP requires that any land to which dairy waste is applied must be planted to crops. Consequently, continuous disposal of dairy waste from a herd of given size requires cultivation of a minimum number of acres of proximate crops and, therefore, supplies of fresh water adequate to dilute dairy waste for application to those crops. If supplies of irrigation water are reduced, dairy farmers must change their operations, e.g., by transporting waste to other locations for ground application or reducing the size of their herds.	
1344	264	[From ATT16:] Housing Issue: SED does not include an analysis of the impact of the proposed project on housing in the region as required by California Code (Regs § 15131(c)). Impact: The SED's recommendation that groundwater be pumped to replace the loss in canal diversions does not analyze the impact the increased pumping will have on the ability of urban and rural water purveyors to meet increasing demand for water supply, nor does it address impacts to domestic wells. Discussion: "Economic, social, and particularly housing factors shall be considered by public agencies together with technological and environmental factors in deciding whether changes in a project are feasible to reduce or avoid the significant effects on the environment identified in the EIR. If information on these factors is not contained in the EIR, the information must be added to the record in some other manner to allow the agency to consider the factors in reaching a decision on the project." (14 Cal. Code Regs. § 15131(c)). Given the estimated increase in population estimated by the California Department of Finance (Table 7 [see ATT16:ATT14]) the pressure on groundwater aquifer will only increase. The SED recommends that groundwater pumping increase to offset limits to surface water diversions.	Please see response to comment 1344-218. Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, regarding a discussion of the groundwater analysis and the relationship of the plan amendments to SGMA. As described in Master Response 3.4, the State Water Board is not recommending groundwater be pumped to replace a potential reduction in surface water supplies. As note in Master Response 6.1, Cumulative Analysis, and Master Response 8.4, Non-Agricultural Economic Considerations, urban water providers engage in long-term planning, and must demonstrate in UWMPs that they are prepared to meet future demands. Communities facing impending shortages or without an assured water supply in the future would already be in planning stages of pursuing options to close the shortages.
1344	265	[From ATT16:] Alternative Findings and Conclusions Issue: Because of the shortcomings of the SED, the [Modesto and Turlock Irrigation] Districts have undertaken and independent impact estimate in order to fully inform water resource decision makers. Impact: Whereas the SED finds that the annual average impact to all of the irrigation districts is $64 Million per year. The Districts have concluded that the impact in their two districts alone could be as high as $1.6 billion in critical dry year types (20 percent of the time) (Table 13 [see ATT16:ATT21]). Discussion: Table 13 [ATT16:ATT21]. Compares the SED's impact estimate to the Districts' impact estimate, both for a critical water-year type and the annual average. While we do not agree that considering the long-term annual average is the correct way to present the economic impact of a long-term change in water supply reliability on the two county area it is useful in comparing the methodological differences of the two impact estimates. SED's estimated impacts of reducing irrigation supplies to TID's and MID's growers,	Please see Master Response 8.2, Regional Agricultural Economic Effects, for discussion of economic analysis performed by Turlock and Modesto Irrigation Districts.

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		compared to the Districts' estimates of the same, are summarized below. The differences in the SED's estimate of surface water supplies are not vastly different either on average or for a critical water year types than the Districts estimated (Table 13 [see ATT16:ATT21]). However, the SED does estimate that additional ground water would be available to offset a portion of the reduction in surface supplies, 11.0 TAF in critical water year types and 18.0 TAF on average. The difference in the reduction in acres in production are also not that great for either an average year or a critical dry water-year type. The SED estimates that 65 thousand acres would come out of production in a critical water-year type, only 5.4 thousand acres less than the Districts' estimate of a reduction in 70.4 thousand acres. The average annual estimates of the reduction in acres in production are nearly the same, 27.4 thousand for the SED and 25.5 thousand for the Districts. The SED's estimated decline in crop commodity revenue of $81.3 million in a critical water-year type, is much lower than the Districts' estimate of a $166.9 million decline. The difference reflects the SED's assumption that growers will transfer water to keep "high valued" tree, fruit and vegetable crops in production and let the acres of "lower valued" animal feed decline (Table 13 [see ATT16:ATT21]). As discussed above this assumption is incorrect for two reasons 1) TID does not accommodate grower-to-grower water transfers and 2) dairy and cattle operations are dependent on those crops to feed their animals and to as an integral part of their manure management programs. The Districts' estimate of a decline in crop commodity assumes that all crops would decline at close to the same rate. The SED also estimated that additional ground water would be available to pump in critical water-year types, offsetting the decline in crop commodities by approximately $10.7 million. The Districts do not assume that additional groundwater can be pumped due to the existing chronic overdraft of the basin and the pending implementation of SGMA. The SED's estimate of the decline in indirect and induced economic activity on crop commodities is $61.8 million dollars, $71.1 million dollars lower than the Districts' estimated impact. This difference is due almost entirely to the difference in the estimate of crop commodity revenue. The majority of the remainder of the difference in impact estimates are due to the SED's omission of impacts to animal commodities (from a reduction in optimal feed) and the food and beverage processing sector impacts (from a reduction in raw inputs). Those impacts total $1,285.5 million dollars annually. The only other difference between the Districts' impact estimate and the SED's is the base-year used for the valuation. The Districts' analysis is expressed in 2012 dollars where the SED's analysis is expressed in 2008 dollars. A difference of $9.3 million annually. In summary the primary differences between the two analyses are the SED's omission of animal commodities and the food and beverage processing sector. The Districts' estimate is the minimum impact because it does not account for a structural change to the agricultural sector from the long-term reduction in water supply reliability of the proposed project.	

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1344	266	[ATT16:ATT21: Table 13. Comparison of SED Impact Estimate for TID and MID to the Districts' Impact Estimates.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	267	[ATT17: APPENDIX D -- Response to the Resource Agencies' Presentations at the January 3, 2017 Sacramento Public Hearing.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	268	[ATT17:ATT1: Attachment D-1: Response to SWB Staff Presentation at the January 3, 2017 Sacramento Public Hearing. Prepared by HDR for Turlock Irrigation District and Modesto Irrigation District. Dated March 2017.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	269	[From ATT17:ATT1:] Slide 3: Carryover Storage. Mr. Grober said one of the main areas of misunderstanding seemed to be whether the "project" included carryover storage requirements. He referred to Appendix K, wherein it is explicitly indicated that the "LSJR flow objectives" will include "minimum reservoir carryover storage targets or other requirements…" So, Mr. Grober said, these targets "are very much a part of the project". Comments: It is asserted in the SED that regulation of carryover storage in Don Pedro is necessary to mitigate the potential adverse effects on downstream water temperatures resulting from the SED's preferred alternative (40%UF F-J). The SED acknowledges that the reservoir carryover storage targets affect the water supply that would be available for irrigation and M&I purposes. To then mitigate the adverse effects on agriculture potentially resulting from the carryover storage requirements, the SWB's analysis uses a modeling rule that establishes a "minimum diversion" for water supply of 363 TAF for the Districts (TID/MID) under all alternatives and a maximum draw from storage which is different for each SED alternative. Mr. Grober affirmed that carryover storage is part of the proposed Amended Plan. However, Slide 3 only serves to magnify and confirm the very issue that Mr. Grober said is being misrepresented -- that it is unclear what is actually being proposed. From the Districts' perspective, the SED remains unclear. Will there be carryover storage restrictions -- yes. What are they -- not specified. In Appendix K, what are the possible "or other requirements"? How will they be established? Will there be a minimum water supply established by the SWB as well? What is it? So the actual SED proposal still remains unclear. How can the SED evaluate alternatives if the alternatives are yet to be defined?	Please see Master Response 2.1, Amendments to the Water Quality Control Plan for clarification on the LSJR Flow Program of Implementation, including carryover storage. Please also see Master Response 3.2, Surface Water Analyses and Modeling Model, for information on carryover storage assumptions in the WSE model.
1344	270	[From ATT17:ATT1:] Slides 4, 5, and 6: Carryover Storage Analysis. To demonstrate the rationale underlying the need to have carryover storage restrictions, Mr. Grober went through a series of slides. Slide 4 is a table of September carryover storage "guidelines" showing both the carryover storage restriction evaluated by the SWB as part of the LSJR baseline and alternatives (Don Pedro Reservoir = 800 TAF) and a new alternative being shared at the Hearing by Mr. Grober (Don Pedro Reservoir = 400 TAF). A footnote on Slide 4 states the 40% flow objective with the lower carryover storage was "not analyzed in the SED because not included within the project alternatives" (emphasis added). Slide 5 then shows the results of the WSE modeling for the three alternatives presented (base case,	Please see Master Response 3.2, Surface Water Analyses and Modeling, regarding carryover storage and how CALSIM and the WSE Model represent reservoir operations in baseline. As discussed in Appendix F1, Hydrologic and Water Quality Modeling, the baseline end-of-September storage guidelines for New Don Pedro Reservoir was set to be 800 TAF so the WSE model closely matches the storages for the reservoir in the CALSIM II results.

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		SED’s 40%UF and the new 40%UF with the lower carryover storage). Mr. Grober explained the graph on Slide 5 showed that the lower carryover storage would just “allow the reservoirs to run dry”, that there would “simply be no water left”. Slide 6 shows the difference in water supply under the three alternatives for each of the five WY types. Comments: There are a number of problems with the SWB’s analysis. First, for the Tuolumne River, it incorrectly shows the baseline restriction (“minimum September carryover storage guideline) on storage to be 800 TAF. The “base case” in the SED is supposed to represent the FERC conditions. If there is a “restriction” on Don Pedro storage, it would be “dead pool” at 309 TAF, not 800 TAF. The tables on Slide 4 clearly display the severe restrictions on reservoir storage contained in the SED’s 40% Flow Objective alternative. By asserting a baseline Don Pedro carryover storage of 800 TAF, it suggests the SED’s preferred alternative of 800 TAF for Don Pedro as being no change from current conditions, yet in actuality it is a very significant change going from 309 TAF to 800 TAF. But more prominent in these slides is this -- what Mr. Grober said at this point in the presentation about the reservoirs being “allowed to just run dry” is not shown in the plot because the plot provided in Slide 5 only shows the increased level of annual diversions and nothing about the reservoirs’ storage levels. So we are left to having to trust Mr. Grober’s words that each of the three reservoirs (New Melones, Don Pedro, Exchequer) would “simply run dry”. Slide 6 presents the effect of the lower carryover storage restrictions, and it is readily observed the only significant differences in annual diversion are in the “dry” and “critically dry” years.	
1344	271	[From ATT17:ATT1:] Slides 7, 8 and 9: Effects of Lower Carryover Storage. To demonstrate the effects of the lower carryover storage, Mr. Grober presents three slides. These slides all deal with modeled conditions at New Melones. It’s worth pointing out that New Melones is the reservoir with the most significant proposed change in carryover storage under the SED’s preferred alternative (carryover storage of 700 TAF) when compared to the lower carryover storage (new) alternative (85 TAF). At this point, Mr. Grober tells the Board that Slide 7 shows a plot of the end of September storage level in New Melones for the period 1922 to 2003 for the “Modified (new) 40% Alternative” and explains the reservoir would be ‘drained in 10 of the years’. But when you look at the plot closely, which no one had time to do during the presentation, a question arises -- is the alternative modeled and plotted actually the alternative with the lower carryover storage of 85 TAF? More on this below. Taking the results from that modeled alternative, Mr. Grober then presents two slides of modeled temperatures. Slide 8 purports to compare New Melones release temperatures for the SED’s 40%UF preferred alternative with the modified (new) alternative with carryover storage. The time period of the plot is from Oct. ’89 to Apr ’94. The modified alternative results in generally higher release temperatures, with the maximum release temperature being about 54°F under the SED’s preferred alternative and between 65°F and 70°F for the alternative with the modified (new) carryover storage. Slide 9 is a river profile of water temperature for those same two alternatives, and the base case alternative, for “October 1991”. While showing these two slides, Mr. Grober said that the new alternative with the modified storage “doesn’t achieve the goals of the proposal” and results in “lethal temperatures” because the modified temperature alternative “loses	Please see Master Response 3.2, Surface Water Analyses and Modeling, for general information about modeling in the SED, the HEC-5Q temperature model, temperature effects of carryover storage for each of the eastside tributaries, including results with and without carryover storage guidelines, and adaptive implementation using flow shifting and shaping. Please see Master Response 3.1, Fish Protection, regarding the benefits of February through June flows and fall flows, reductions in harmful and lethal temperatures through implementation of the plan amendments, and addressing uncertainty. SED Appendix F1, Hydrologic and Water Quality Modeling, describes the hydrologic, water supply, and water quality modeling methods and assumptions used to evaluate the LSJR alternatives. Modeling methods and results for baseline conditions and the three LSJR alternatives are described in SED Appendix F1.

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		temperature control”. Comments: It’s hard to know where to begin. First and foremost, only the results of the SWB’s modeling of the Stanislaus River is provided and “analyzed”. No comparison for Don Pedro is shown or described. New Melones has the greatest change in carryover storage between the two alternatives (700 TAF vs. 85 TAF). One would expect New Melones to show a significant difference in the temperature of reservoir releases under this comparison. But let’s go back to the question raised above -- what “modified alternative” did the SWB staff actually model? It’s not clear. A close look at the plot reveals that the SWB apparently didn’t actually model the end of September lower carryover storage of 85 TAF that was supposed to be the alternative carryover storage. Mr. Grober stated that for the lower carryover storage option using 85 TAF, the reservoir is “drained in 10 of the years”. It was never clear in the presentation if Mr. Grober intended to mean drained to the minimum 85 TAF, or fully drained? By inspection of the slide, but left unsaid in Mr. Grober’s presentation, there’s a footnote on slides 7, 8 and 9 that states the assessment of the new “modified alternative” was done assuming “no carryover storage”. That’s why slide 7 shows that in 10 of the years modeled, the reservoir went below the 85 TAF carryover storage restriction at the end of September. So, in fact, it appears the SWB’s “analysis” of the “modified alternative” of 85 TAF was actually an analysis of a modified, “modified alternative” with zero carryover storage (the footnote also states “no refill criteria”, which likely means the WSE model would try to provide maximum water supply diversion each year, so the reservoir would keep “draining” in successive dry years). Then, on slide 8 to “prove” his case about higher river temperatures resulting from the modified “modified alternative”, the slide shows the dry period of ’89 to ’94. So, to depict the effects of the lower carryover storage alternative on water temperatures in the Stanislaus River, Mr. Grober selects the drought of record (and uses the modified, “modified alternative” where 85 TAF carryover storage wasn’t what was actually modeled). A look at the plot on Slide 7 shows that the water years ’89 to ’94 are the only period of the 81-year period of record where there are five years in a row where the end of September storage was below 85 TAF (’90 through ’94). Slide 9 even goes further. Slide 9 then takes a single slice of the ’90 to ’94 drought period (October ’91) to depict the temperature effects as the flow goes down the river comparing the preferred alternative to the modified, “modified storage” alternative. In the ’90 to ’94 period, October ‘91 is the month with the greatest modeled temperature effect. At this point, the comparison seems a bit “rigged”, but to complete the lopsided nature of the comparison, the modified, modified alternative also has “no flow shifting” (another note in the slide’s footnote), while it is likely the preferred alternative does. Even after all of that manipulation, the total difference in temperature at the Stan confluence (never mind the LSJR), is 21°C vs. 18°C. There are seemingly a number of problems with this analysis, but this analysis of the two alternatives is tilted to favor the SED’s preferred alternative. In essence, this “temperature analysis” of the two “alternative storage” levels is meaningless about the two alternatives effects on fish populations. The only conclusion that one can draw is that based on the assumptions the SWB input to the model (which are not explicitly provided) here is what the model output was. Whether that actually reflects anything but playing with the computer model is doubtful.	

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		Here's a few other items worth noting from examining Slides 7, 8 and 9: * Would this analysis hold for the Tuolumne? Would the results be similar in terms of temperature effects? It's doubtful, and likely a "no", but the SWB staff should be asked to perform a similar analysis for the Tuolumne and provide it to the Districts for review and comment. * More than anything, these slides leads one to question the purpose and effectiveness of the Amended Plan? If the Amended Plan is trying to increase survival of fry and juvenile outmigrants by providing flows from February through June, what does an analysis of October temperatures have to do with that? The analysis only exemplifies the potentially disastrous effects of the SED's preferred alternative on October temperatures, effects that then have to be mitigated by further restricting water supplies. * Even under the SED's preferred alternative, where the SWB's adult upstream migration temperature "criteria" (Table 19-1) is 18°C (64.4°F) for both the Stan/LSJR confluence and at Vernalis, the SED's temperature criteria are still not met. * Slide 9 is instructive though, just not for the purpose Mr. Grober tries to use it. Under the modified, "modified storage" alternative, the reservoir is essentially empty in October 1991, the period selected by Mr. Grober to make his case. So, the "modified storage" alternative is essentially showing the model's estimated value of the natural, unaltered temperature in the Stanislaus River at River Mile 60 (New Melones), and that temperature is 69°F (21°C), already well above the SWB "criteria" of 18°C. But if this is the temperature associated with unimpaired or natural flow, shouldn't this be the natural temperature the fish are adapted to, by the hypothesis put forward in the SED? It is apparent from the slide that the temperature of 69°F is the natural temperature of the river because as shown on the slide the water temperature is virtually unchanged all the way down the river, meaning it has reached equilibrium with the meteorological conditions. The only way the "preferred alternative" maintains a lower temperature to the confluence is by discharging a higher flow (via "flow shifting") than the natural, unimpaired flow. Unfortunately, the SWB presentation provided no details of the model run input which resulted in this output.	
1344	272	[From ATT17:ATT1:] Slides 10 through 18: Importance of June Flows. Mr. Grober spends 9 slides trying to show why June flows are important. What's never made clear is whether the flows are important for the outmigrating fall-run Chinook salmon (the "indicator species") or just important to add volume to the "block of water" concept. Each slide is discussed below. Slide 10: Slide 10 lists five reasons why June flows are "important" biologically. Two of them are just wrong; the other three might be half-right at best, but do not tell the whole story. The quotations below are from the slide. * "Salmon and steelhead growth and migration period": Except in very wet years, the first week or two of June is neither a growth nor an outmigration period for fall-run Chinook (more on this below) in the eastside tributaries, and only to a very small degree in the LSJR.	The information and conclusions in the slides quoted by the commenter are supported by SED Chapter 7, Aquatic Biological Resources, SED Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, SED Appendix C, Technical Report on the Scientific Basis for Alternatives San Joaquin River Flow and Southern Delta Salinity Objectives, Master Response 2.2, Adaptive Implementation, and Master Response 3.1, Fish Protection. Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, and Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provide the scientific justification for providing higher and more variable flow during the February 1 through June 30 time period. Studies conducted more recently also show the positive benefits of flow during the entire outmigration period (e.g., Sturrock et al. 2015; SWRCB 2017; TID and MID 2013, USFWS 2014; Zueg et al. 2014). In the SED Chapter 7 contains a table summarizing the geographic and seasonal occurrence of indicator fish species and life stages including Central Valley fall-run Chinook and Central Valley Steelhead. This table shows that juvenile rearing and emigration period for fall-run Chinook and Central Valley steelhead spans

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		Also, there is no evidence of a viable steelhead population in the Tuolumne River or Merced River, and nothing in this SED will change that. Steelhead in the Stanislaus River normally outmigrate earlier -- like January through April, maybe May. This is actually shown on Mr. Grober's Slide 13. * "Spawning period for sturgeon and splittail": This may be true in the LSJR, but not in the Tuolumne. There is only anecdotal evidence of green sturgeon in the LSJR and no evidence at all in the Tuolumne. Fully 80% of the of the available floodplain area that might support splittail spawning on the LSJR is above the Tuolumne (see Table 19-21 of the SED), and under the SED's preferred option, the flow is generally not sufficient (except for Wet Years) to provide access to floodplain habitat because of the lack of contribution of flow from the Upper SJR. . * "Higher flows can disrupt and displace non-native species, including predatory fish and water hyacinth": This contention is repeated with great frequency in the SED without there ever being any scientific evidence put forward to support it. Except in very wet years (e.g., 2011), the June flows under the SED will not displace non-native predators or disrupt their spawning. Water velocities through the Special-run Pools of the Tuolumne River remain well within non-native predator preferences, and the deep pools are likely to provide ideal refugia from temporary higher flows. June is also a time for striped bass spawning. The increased flows in June under the SED's preferred alternative may even improve spawning success for striped bass, thereby increasing the populations of this voracious non-native predator. It is a major flaw of the draft SED that the effects of increased May and June flows on a host of non-native predators is not seriously analyzed, but simply whisked away by unsupported statements like the one on this slide. Providing increased flows in June may have the unintended (and unanalyzed) consequence of aiding predator species more that native species. And regarding water hyacinth: where does it go when it is "washed out" of the eastside tributaries. If the flows are adequate to move the infestations out of the tributaries, the mats don't just disappear; they move downstream and reestablish in the LSJR. * "June extends the window of opportunity available to native fish, and allows for additional life history diversity": This statement is just plain wrong. Without some sort of biological explanation and evidence, using a phrase like "window of opportunity available to native fish" doesn't mean anything unless particular species with flow dependent life history events in June are identified (like spawning of non-native Striped bass). But wrong to the extent of being disturbing is the reference to "life history diversity" as used in the slide. "Life history diversity refers to the potential benefit to the fall-run Chinook population of having fish leave the eastside tributaries at different life stages, not which day of the month the fish exit. Fall-run Chinook can exit the tributaries as fry, parr, or smolts. Fry and juvenile fish may benefit from floodplain inundation, but not smolts (or parr) which quickly migrate. There are no fry or juveniles left in the tributaries in June and except possibly in the wettest of years, very few parr. If there are fall-run Chinook in the tributaries in late May or June, they would overwhelmingly be smolt-sized, and for this reason flows reaching levels of floodplain inundation in May or June do not benefit the growth of fry, parr, or smolts. There is no contribution to or "additional" life history diversity from a smolt exiting the system on May 31 versus June 1. Smolts leave the system as smolts,	from January to June. This is consistent with slide 13 that shows juvenile steelhead captured at the Oakdale trap in June. Please refer to Master Response 3.1, Fish Protection, for a discussion of juvenile chinook salmon out-migration timing in the San Joaquin Basin, and considerations to acknowledge such as 1) the importance of migratory phenotypes; 2) the unsuitability of historic conditions; 3) the limited operation of rotary screw traps in June; and 4) and the need for suitable habitat conditions downstream. As described in the SED Chapter 7, Central Valley steelhead were thought to be extirpated from the SJR Basin. However, recent monitoring has detected small self-sustaining populations of steelhead in the Stanislaus, Mokelumne, and Calaveras Rivers and other streams previously thought to be devoid of steelhead (McEwan 2001; Zimmerman et al. 2008). Incidental catches and observations of steelhead juveniles also have occurred on the Tuolumne and Merced Rivers during fall-run Chinook salmon monitoring activities, indicating that steelhead are widespread throughout accessible streams and rivers in the Central Valley (Good et al. 2005). The SED Executive Summary explains that the first goal of the LSJR flow objectives and associated program of implementation to maintain inflow conditions from the SJR Watershed sufficient to support and maintain the natural production of viable native fish populations migrating through the Delta. Please also see Master Response 3.1 for responses to comments regarding steelhead out-migration timing and June migration. It is important to recognize that, as described for fall-run Chinook salmon above, the rotary screw traps have historically been removed or disabled in late May or early June in many years. The LSJR flow objectives are intended to benefit native fish species, including splittail and sturgeon, in the three eastside tributaries and the lower SJR. When the June benefits are combined with the expected benefits earlier in the February through June period, it is expected that anadromous fish will be in better condition and will have improved odds of survival and success. It is also important to recognize that many other native fish species (e.g. sturgeon and splittail) will benefit from improved and extended habitat conditions during the February through June time period. As described in Appendix C increased and more variable flows associated with a more natural flow regime during February through June are anticipated to benefit native fish communities (see Section 3.7.1). As described in Chapter 19, it is anticipated that the plan amendments will facilitate habitat benefits to the indicator species, and other native fish species, including imperiled Bay-Delta species such as sturgeon and splittail. Chapter 7 and Appendix C contains supportive information regarding flow effects on non-native predators. SED Chapter 7, impact category AQUA-10 evaluates the changes in predation risk resulting from changes in flow and water temperature. Consistent with broadly recommended restoration strategies in the literature, summarized in SED Appendix C (see Section 3.7.1), a number of studies in Central Valley streams have shown that higher, more variable flows that mimic the natural flow regime to which native fish communities are adapted can effectively limit the success of nonnative fish species, including a number of warmwater species that are predators of juvenile salmonids (EA 1992; McBain & Trush 2000; Brown and Ford 2002; Kiernan et al. 2012). The commenter does not provide supporting evidence for the contention that the plan amendments may improve striped bass spawning. Additionally, complementary non-flow measures made as recommendations in the plan amendments include habitat restoration actions such as modifying/removing predator habitat (see Appendix K, Revised Water Quality Control Plan, and Chapter 16, Evaluation of Other Indirect and Additional Actions). Also, please refer to Master Response 3.1 regarding the SED's consideration of predation. As described in Appendix C and Master Response 1.1, General Comments, other benefits of the plan amendments include beneficial effects to water quality. More flow would restore the watershed's proper chemistry, diminishing the growth of cyanobacteria and increasing oxygen levels allocating or allowing the ecosystem to flourish and naturally maintain its health. Furthermore, increased flow may reduce the growth

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		there is no life stage distinction of "late May smolts" versus "early June smolts". A smolt leaving the system on May 31 is the same as a smolt leaving on June 1; this is not adding to "life history diversity". This slide is either very misinformed or very misleading, actually both. * Flows are important for migration through the San Joaquin River and Delta: That's true as far as the LSJR is concerned, just not beyond mid-May and possibly early June in Wet Years. The SED's preferred alternative will have little effect on wet years' flows. More importantly, the SED fails to show any analysis of "flows through the Delta and their importance for any fish species. This is just one more presumption the SWB makes without any valid, scientific assessment to support it.	of water hyacinth Please see Master Response 3.1 for responses to comments regarding February through June flows and the fish benefits resulting from lower temperatures associated with higher June flows, out-migration timing, salmon and steelhead presence in June, and life history diversity. As described in Master Response 3.1, two studies by Sturrock et al. (2015) and Miller et al. (2010) found that all migratory phenotypes (fry, parr, and smolt) of the outmigrating population in February through June contributed to the returning adult population. Furthermore, providing flow to manage and conserve life history diversity within this time-period through the expression of all three phenotypes is necessary to support resilient salmon populations. Please see Master Response 3.1, Fish Protection, for responses to comments regarding benefits of unimpaired flow for migration through the Delta and the benefits of June flows on the LSJR at Vernalis. Habitat improvements during June will provide anadromous fish with an extended window of opportunity to migrate to the Bay-Delta or ocean by increasing suitable conditions and reducing harmful and lethal conditions (see the Reductions in Harmful and Lethal Temperatures section in this master response). Master Response 2.2 explains that June flows are important in and of themselves for fish and wildlife in some years. The longer season allows fish additional time to rear and grow if temperature conditions are suitable. In years when June flows are not suitable for fish rearing or migration, the volume of water represented by June flows can be very important if used to help shape flows between February and May, if shifted to later in the year to prevent adverse impacts to fisheries as is allowed under adaptive implementation.
1344	273	[From ATT17:ATT1:] Slides 11 and 12: Slide 11 is purported to be a plot of historical "maximum daily temperatures" versus "average daily flow near Vernalis". A horizontal line is drawn through the plot at about 77.5°F (25°C), and labeled "Lethal Water Temperature". There is no citation for source of information on lethality. Mr. Grober just explained that it is an "important metric". There is also a vertical line drawn from the lethal temperature line to the flow axis at a point where no maximum daily temperatures occur above the lethal line. This flow is 3,100 cfs. Slide 12 is provided next to show that under the SED's preferred alternative, the SJR flow at Vernalis will exceed 3,100 cfs 71% of the time instead of 41% of the time under the base case. Comments: This plot is meaningless for a number of reasons, just some of which are discussed below. Where did the "lethal temperature" of 25°C come from? How is it defined? Is it meant to be "upper incipient lethal", "acute lethal", "chronic lethal", or some other "criteria"? In the plot, because the temperature axis (y-axis) is "maximum daily temperature", it would then be reasonable, and proper, to assume that SWB is referring to "acute" temperature effects on salmon. In Myrick and Cech (2001) Temperature Effects on Chinook Salmon and Steelhead: A Review Focusing On California's Central Valley Populations, in the section on "Juvenile Thermal Tolerance" [Footnote 1: Myrick, C.A. and J.J. Cech 2001. Temperature effects on Chinook salmon and steelhead: a review focusing on California's Central Valley populations. Bay-Delta Modeling Forum Technical Publication 01-1. 57 pp], it is reported that "Chinook salmon subjected to acute temperature changes can tolerate temperatures as	The information and conclusions in the slides quoted by the commenter are supported by the SED Chapter 7, Aquatic Biological Resources, Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, Appendix F.1 Hydrologic and Water Quality Modeling, and Master Response 3.1, Fish Protection. Please see Master Response 3.1, Fish Protection, for responses to comments regarding the use of U.S. Environmental Protection Agency's (USEPA's) recommended temperature criteria for the temperature analysis, and the reductions harmful and lethal water temperatures for salmonids in the plan area and downstream. The lethal water temperature threshold presented on slide 11 of the January 3, 2017 State Water Board staff presentation is shown at approximately 25°C (77.5°F). This lethal threshold is consistent with the juvenile rearing lethal temperature range of 23 – 26°C (73.4 – 78.8°F) identified by USEPA's recommended temperature criteria for the protection of salmonids (USEPA 2003) and other studies cited in Master Response 3.1, Fish Protection. Please also refer to response to comment 1344-62 regarding findings of the study of Myrick and Cech (2001), and other studies investigating a relationship between water temperatures and the health and survival of juvenile salmonids. The lethal temperature threshold was shown on slide 11 to demonstrate that temperature is a significant stressor for migrating salmonids and other cold water fishes in the LSJR. The LSJR from the Merced River to the Delta provides migration habitat for fall-run Chinook salmon and steelhead. The commenter refers to temperature criteria that protect rearing and smoltification. The USEPA recommends a 20°C (68°F) maximum 7DADM numeric criterion for waterbodies that are used almost exclusively for migrating salmon and trout (typically in the lower reaches of major rivers) during the warmest periods of potential migration

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		high as 28.8°C (84°F) when acclimated to 19°C". Why does SWB staff show the "lethal" temperature instead of the SED's "criteria" temperatures in Table 19-1 of the SED which are 16°C (61°F) for rearing and 14°C (57°F) for smoltification? It is readily apparent why these temperatures are not "evaluated" in Mr. Grober's slide by looking at the SWB's own data on slide 11. To meet the SED's "criteria" temperature of 61°F, it would take a flow exceeding 10,000 cfs which occurs 13% of the time under base case conditions with no change in that flow condition to occur under the SED's preferred alternative. Amazingly, what the plot and table of Slides 11 and 12 actually show very clearly is that the LSJR is highly unsuitable in June under the SED's preferred alternative for fry or juvenile rearing or smoltification. By the SWB's own presentation, the only logical conclusion is that the LSJR is not suitable for any life stage of fall-run Chinook salmon in June now or under the SED's preferred alternative.	(USEPA 2003). The commenter is not correct by stating that the LSJR does not provide suitable habitat for any life stage of fall-run Chinook salmon. The LSJR provides suitable fall-run Chinook habitat for migration. This habitat is impaired due to elevated temperature conditions (see Chapter 7 Section 7.2.2). The SED analysis shows that migration habitat and temperature conditions are improved in the LSJR under the plan amendments (see Chapter 19 sections 19.2.3 and 19.2.4). These improvements are also shown in longitudinal temperature profiles for the LSJR in Master Response 3.1, Fish Protection (see the discussion regarding the importance of seasonal flows from February through June).
1344	274	[From ATT17:ATT1:] Slide 13: This slide purports to show juvenile "steelhead" captured in the Stanislaus River Oakdale trap in all months from 1995 to 2009. The point Mr. Grober attempts to make is that there are significant outmigrating juvenile steelhead after June 1. Comments: All of the fish on the plot are captured in the Oakdale rotary screw trap (RST), the upper RST located at RM 39. The juveniles captured in June at sizes ranging from 50 to 100 mm are not migrating, they are behaving as normal O. mykiss fry and juveniles by dispersing. The fish on the plot larger than 150 mm may be "steelhead" smolts and may be migrating downstream, but for Mr. Grober to make the case about outmigrants in June, he would have had to also show the results of the corresponding passage at the RST at Caswell at RM 8 (the downstream trap), where these same fish, if migrating, would have shown up later, but he didn't do this. FishBio, the operator of the RSTs, reports that "in 20 years of monitoring Oakdale from 1995-2015 (no monitoring in 1997) there have only been 3 [steelhead] smolts captured in June and all of these were captured in 2000". Another logical question would be why show "juvenile steelhead" when there are 20 years of fall-run Chinook RST data available? That would be because the records show 99% of them have left the Stan before June 1.	Please see Master Response 3.1, Fish Protection, for responses to comments regarding steelhead out-migration timing and June migration. It is important to recognize that the rotary screw traps on the Stanislaus River has historically been removed or disabled in late May or early June in many years. The multi-year figures shown in Slide 11 and other charts in Master Response 3.1 for the Stanislaus River include many years when data was not collected for the month of June. The sampling periods for the rotary screw traps on the Stanislaus River are provided in Master Response 3.1. Because YOY O. mykiss leave the tributaries later in the year compared to fall-run Chinook salmon, they are even more susceptible to low flow conditions which have the effect of creating high water temperatures particularly in April, May, and June in the LSJR and major eastside tributaries (including the Stanislaus River). The plan amendments are expected to reduce the amount of time that native fish are exposed to harmful or lethal temperatures in all of these rivers during February through June (see the importance of seasonal flows from February through June, and the expected reductions in harmful and lethal temperatures discussions in Master Response 3.1).
1344	275	[From ATT17:ATT1:] Slide 14: The next slide then tries to show "significant" fall-run Chinook juvenile outmigration in June on the Tuolumne River. The slide shows 2006 as an "example" year. Comments: Why 2006, one might ask? It's the 5th wettest year on record since 1922 and the wettest year when there were RST records in the years considered in the SED (through, apparently, 2010). The Districts have consistently maintained that in Wet Years, like 2006, there are some juvenile Chinook outmigrating through mid-June. But even in 2006, only a small percent of the total fish passing Grayson did so in June (it was 8% in 2006); therefore, this slide only supports the Districts' prior statements that when you include all years, about 99% of the fall-run Chinook are out of the Tuolumne by June 1; in Wet Years, some fish will exit the system in early-to-mid-June. This will continue to happen in the future under base case conditions in Wet Years just as it does now.	Master Response 2.2, Adaptive Implementation, explains that June flows are important in and of themselves for fish and wildlife in some years. The year 2006 is an example of one of the years in which June flows are important and provide suitable habitat for fish rearing and migration. In years when June flows are not suitable for fish rearing or migration, the volume of water represented by June flows can be very important if used to help shape flows between February and May, if shifted to later in the year to prevent adverse impacts to fisheries as is allowed under adaptive implementation. Please refer to Master Response 3.1, Fish Protection, for a discussion of juvenile chinook salmon out-migration timing in the San Joaquin Basin, and considerations to acknowledge such as 1) the importance of migratory phenotypes; 2) the unsuitability of historic conditions; 3) the limited operation of rotary screw traps in June; and 4) and the need for suitable habitat conditions downstream. The SED analysis shows that migration habitat and temperature conditions are improved in the LSJR and major eastside tributaries (including the Tuolumne River) under the plan amendments (see Chapter 19 sections 19.2.3 and 19.2.4).. These improvements are also shown in longitudinal temperature profiles for the Tuolumne River in Master Response 3.1, Fish Protection (see the discussion regarding the importance of seasonal flows from February

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			through June).
1344	276	[From ATT17:ATT1:] Slide 15: This slide should be amended to show only the period of historical record since the implementation of the 1995 settlement agreement between the Districts and other parties which was fully implemented starting in 1997, therefore 1997 to 2015.	Please see Master Response 1.1, General Comments, for responses to comments that either make a general comment regarding the plan amendments or do not raise significant environmental issues.
1344	277	[From ATT17:ATT1:] Slides 16, 17 and 18: Slide 16 shows the significance of June flow volumes to the five month Feb-Jun period. For the Tuolumne, 23% of the UF occurs in June on average. Comments: It is noteworthy that the June volume is about the same as the combined February/March volume. June flows are important for water supply purposes, and much less important for anadromous fish purposes. In fact, June flows as proposed in the SED's preferred alternative of 40% UF Feb-Jun may benefit non-native predators more than fall-run Chinook. The increased velocities in the LSJR associated with the higher June flows may improve spawning success of striped bass and the reduction in temperature on the LSJR from 70°F to 68°F (see Table 19-3) is favorable for largemouth bass spawning (USFWS 1982). Slide 18 tells the story. This slide compares the diversions for water supply under a 40% UF Feb-May option compared to the 40% UF Feb-Jun preferred alternative. The impression meant to be portrayed by this slide entitled "June Effect On Diversions" is that there is little difference in water supply diversions in Critical Water Years between the two options. The reasonable question then is -- where does the June runoff go? Slide 17 shows that in Critical Years on the Tuolumne fully 17% of the 40% UF Feb-Jun block of water is contributed in the month of June. The apparent reason very little of that water is going to water supply is that it is going into storage because the WSE model has perfect foresight and this water is needed to maintain the required water level restrictions embodied in the WSE model's rules.	Please refer to Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, Adaptive Implementation, for information regarding adaptive implementation and the plan amendments. The plan amendments do not mandate certain velocities, and the STM working group may determine that fluctuating flows to disrupt spawning events of non-native predatory fish is beneficial to native fish species. It is envisioned that real-time information will inform these types of decisions. Please see Master Response 3.1, Fish Protection, regarding the importance of June for native salmonids and predation. The plan amendments will dramatically improve temperature conditions in the Tuolumne and Merced Rivers during June. Meaningful improvements to water temperatures occur on the Stanislaus in June during years in years when the 40% flow requirement provides substantially more flow during June. Table 19-3 does not show temperature information regarding the LSR as the commenter has stated. We presume the commenter is referring to SED Table 19-13. As described in Chapter 7, largemouth bass spawn for the first time during their second or third spring, when they are approximately 180–210 mm. Spawning begins in March or April when water temperatures reach 59°F-60.8°F and may continue through June when water temperatures reach 75.2°F (Moyle 2002; ICF International 2012). Males build nests in a wide variety of substrates, including sand, mud, cobble, and vegetation, and gravel. Gravel seems to be preferred, while silty substrates are unsuitable (Stuber et al. 1982). The eggs adhere to the nest substrate and hatch in 2–5 days (Moyle 2002). They are brackish water tolerant but tend to stay in freshwater and can persist in waters with low DO content (Moyle 2002). Please see AQUA-10 in SED Chapter 7 for an evaluation of potential changes in predation risk under the proposed plan amendments. Also, see Master Response 3.1, Fish Protection, regarding predation. The June water volume required to meet a Feb–June 40 percent UF objective in a critically dry year is approximately equivalent to the increase in water deliveries made in a Feb-May 40 percent UF objective relative to a Feb-June 40 percent UF objective. Slide 17 of the January 3, 2017 State Water Board staff presentation shows the percent contribution to the flow requirement in June for each tributary for all years and by water year type. The slide shows that between 13 and 17 percent of the February to June flow requirement is provided by June flows in critical water years, depending on tributary. Critical years will have a low unimpaired flow volume and accordingly the volume required by the percent of unimpaired flow requirement will be low. For the Tuolumne River, the June portion of the 40 percent of unimpaired Feb-June flow requirement equals 49 TAF, or 17% of the total Feb-June requirement of 286 TAF average in critically-dry years. The difference in critically dry year Tuolumne River diversions based on comparison of unimpaired flow requirements in Feb-May to Feb-June is 52 TAF. These quantities do reflect an effective change in diversion and do not support the comment assertion that the water volume differential between a Feb-June objective and a Feb-May objective goes to storage instead of deliveries in critically dry years. Across all water year types, maintaining carryover storage guidelines accounts for a significant portion of water supply impacts in the study period. However, in the WSE model, a minimum allocation quantity

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			overrides the carryover guideline allowing water allocation from storage in severe conditions, such as the critically dry conditions referenced in slides 17 and 18 and by the comment. The important distinction is that in critically-dry years, water is being used from storage rather than being allocated to storage. For more information regarding carryover storage guidelines and model foresight, refer to Master Response 3.2, Surface Water Analyses and Modeling.
1344	278	[From ATT17:ATT1:] Slide 19 and 20: Multiple Dry Years. Slide 20 is intended to show the effect of the SED's preferred alternative in successive dry years. It doesn't do that; it shows the average annual surface water diversion through the '87 to '92 period. Having run both the WSE model with its rules, including the rule of a minimum water supply diversion of 363 TAF for the TR, and the Districts' Tuolumne River Operations Model (TROps) with SED restrictions, we present the results below [see ATT17:ATT1:ATT1]. We were able to confirm within a reasonable degree the SWB's numbers presented in slide 20. However, the major, and significant, difference is the annual allocations of water for water supply. In the WSE rules which depend on perfect foresight, water supply in 1989 (middle of the drought) is significantly higher. In the Districts' model, the first year of the drought is close to normal diversion because there is no way of knowing in the first year of a drought that you're in for a five year drought. Cutbacks, as one would expect, begin in Year 2 of the drought. So, in years 2 through 6 of the drought, under the SED's preferred alternative, the Districts would only get the minimum supply (? 363 TAF) for five years in a row. This is basically less than 40% of full supply for five straight years. But some of the real-time and real-life problems associated with the model results are discussed below. The basic problem is that these are modeled results. In real time decision-making, the Districts and the farmers/growers do not know that a year will be a minimum diversion year at the beginning of the irrigation season (February). It is quite possible that most of a 363 TAF allotment could be used very early in the season because the Districts do not have perfect foresight like the WSE model and initial soil moisture levels would be very low following a dry winter. . As the total diversions are reduced, the percent of those diversions that are made up of the fixed amount of water needed to operate the irrigation system goes up. For example, the entire irrigation system must be primed, meaning the canals and laterals filled and flowing at the beginning of the irrigation season. This takes a significant amount of water and once filled, must be kept flowing. Therefore the percent of water dedicated to maintaining the system in operation goes up in critical years relative to the total water consumptively used by crops. So while the Districts might be allotted 40% of full supply, the farmers would receive less than 40% supply because of the significantly larger percentage of the supply needed to maintain the irrigation system primed and running. Beyond this, it is also absolutely critical to understand the errors and assumptions built into the WSE model. One of the assumptions that especially affects the drought years is that the	The title of slide 20 is "Estimated Effect on Average Annual Surface Water Diversion – Baseline and 40% Unimpaired Flow." State Water Board staff description of this slide during the presentation explained that it shows the average of critical years, not just 1987-1992. State Water Board staff did not describe the information on this slide as the commenter asserts. Transcripts of the presentation are located at this link https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/2016_sed/docs/transcript_day5_01032017.pdf. The WSE a planning-level tool used to assess the environmental impacts of the proposed plan amendments. It is not intended for use in real-time operations. The primary utility of a planning-level model is a comparative analysis, where the physical system is represented at a sufficient level of precision in order to accurately represent the most important effects of changes. In this case, the WSE model is configured to determine the change from baseline of water supply stored and available to meet diversion demands as a result of alternatives incorporating streamflow requirements. The general approach is to calculate available water for diversion in each water year based on inflows, net available water from storage after carryover guidelines, after streamflow targets are met. The Tuolumne River Operations Model results presented in the letter (Appendix D-9, page 9) show that over a six-year sequence, average annual model results between the WSE model and the TROps are very similar, although model allocation decisions do vary within any given year. The WSE estimates water supply available for diversion demands after consideration of the streamflow objective and carryover storage guidelines, and only uses foresight within each water year (through September). Please refer to Master Response 3.2, Surface Water Analyses and Modeling, for responses to comments regarding general approach to water balance modeling for the SED, model foresight, WSE model assumptions, water supply reliability, and additional information regarding accretions and depletions.

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		WSE model has greatly overestimated the amount of accretion water entering the Tuolumne River downstream of the La Grange gage. Under the WSE model, about 25% of the 40% UF block of water comes from assumed accretion flows. This is especially incorrect in drought years, when the river may not be a "gaining" stream at all, but may actually be losing flow to the groundwater system. The WSE model should be adjusted to reflect the 40% UF as being required at the La Grange gage to permit a more realistic evaluation of the effects of the SED's preferred alternative on the Districts and its farmers.	
1344	279	[ATT17:ATT1:ATT1: Table of Annual Tuolumne Surface Water Diversions, 1987-1992.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	280	[From ATT17:ATT1:] Slides 21 through 26: SED Has More Than Averages. Mr. Grober attempts to make a case in these slides that the SED is not skewed or biased by mainly presenting "average values". Comments: Using average values for water supply allows the wet years to skew the average water supply diversions over the long-term because in virtually all the wet and above normal flow years, the Districts customers are able to obtain most of their needed full supply of water. But estimates of long-term average diversions do not provide any assurance that the TID and MID service areas will continue to be viable agricultural areas over the long-term under the SED's preferred alternative. Using averages is akin to locking you in a room for a day and saying your average oxygen supply will be 90% of maximum (which sounds pretty good), but the 90% will be doled at 100% for 22 hours and zero for the other two hours. Of course, it is apparent how that will come out. Proper water supply planning is not focused on the average conditions. Prudent and proper water supply planning evaluates what happens under reasonable worse case periods ("design drought" periods). It is worth pointing out that all the slides presented by Mr. Grober are still just different ways of reporting average annual results over the 81 year period of analysis. Slide 25 is especially meaningless from a water supply planning perspective. This slide is meant to visually portray that the 40% UF preferred alternative in the SED strikes a "reasonable balance" because visually it is halfway between base case and the 60% UF alternative. This is unsupported, and has nothing to do with the ability of irrigators to survive an extended drought. A more appropriate and informed perspective would treat the water supply analysis as a "tipping point" assessment. Given the range of adverse of the SED's UF flows proposal in the SED alternatives, a rational, scientific method of determining the effects of flow proposals is needed, not a visual comparison.	Please see Master Response 2.3, Presentation of Data and Results in SED and in Response to Comments, for a description of how the SED uses multiple types of statistics and graphs to show the distribution of modeling results, not just overall averages. Please see Master Response 3.2, Surface Water Analyses and Modeling, regarding water supply reliability and reservoir operations. Please see Master Response 3.4, Groundwater and the Sustainable Groundwater Management Act, regarding groundwater pumping and water supply reliability. Please see Master Response 3.5, Agricultural Resources, for a discussion of multi-year dry periods and permanent crops. In addition, please see Master Response 8.1, Local Agricultural Economic Effects and the SWAP Model, for a discussion of water supply reliability and economics. Please see Master Response 1.1, General Comments, regarding the overall approach to the analyses contained in the SED. Please also see Chapter 4, Introduction to Analysis, for a discussion of the analytical framework of the SED and all methodology and approach sections in Chapters 5–15 and Chapter 19 for specific details on the methods for analyzing impacts or benefits on different resources.
1344	281	[From ATT17:ATT1:] Slides 32: Groundwater. There are numerous issues with the SED's treatment of groundwater in the SED. Two things worth mentioning here are:	Please see Master Response 1.1, General Comments, regarding the public outreach process. Please see response to Comment 1344-102 regarding comments on the 2006 Review Panel Report: San Joaquin River Valley CalSim II Model Review. The fact that a Board staff member was involved in the 2006 review of the CalSim II model underscores how Board staff were intimately familiar with how credible the

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		* The slide asserts and Mr. Grober states that the SWB reached out to the Districts for groundwater information. The only "outreach" conducted by the SWB to TID and MID was a request to provide some information. This does not qualify as "outreach to affected parties" in any sense of the current uses of the term to indicate a conversation or collaboration. If the SWB is aware of other "outreach", it would be valuable to have the SWB reference it. * It is worth noting that the 2006 Review Panel Report: San Joaquin River Valley CalSim II Model Review (the CalSim II Peer Review) had this to say about CalSim II (the WSE primary flow database) and groundwater. By the way, Mr. Grober was a member of the Peer Review Panel. + "Groundwater is the most important process not included in the newer [CalSim II] model, and was absent from previous models. It is clear from the documentation and the oral presentations that adding groundwater to the model was not part of the scope of work for this project. Thus our comments on groundwater are not intended as a criticism of the work done to improve the model. They are intended to point out an important missing element in modeling water management in the San Joaquin valley. Groundwater interaction with various components of the model is critical for several reasons: - Groundwater is an important basin water supply, especially during droughts. - Groundwater is an important source of tributary inflows, mainstem inflows, and is a potentially important source of salinity from the Westside. - Groundwater is an important subject of management within the basin, with important interactions with the surface water demands and processes involved in the CalSim model of this region. + …Without explicit groundwater representation, the model's applicability to planning, policy, and operational problems under future water management and hydrologic conditions could be severely limited. This problem will become increasingly limiting for planning applications involving activities that affect the availability of groundwater (including any ongoing overdraft), groundwater return flows, and groundwater management. Given the difficulties and expense of groundwater modeling and data for such a large region, it is understandable why this was not included in the effort being reviewed. However, explicit groundwater representation is likely to be important for future applications."	model is.
1344	282	[From ATT17:ATT1:] Slides 36 through 40: SalSim. These slides are intended to present the SWB staff's position on SalSim. Consistent with how SalSim is treated in the draft SED, the presentation provided by Mr. Grober both condemns, but later then uses, the SalSim model. Slide 36 states that the SWB did not "rely on" the SalSim model in its "analysis of fish benefits" because its representation of "water temperature and floodplain inundation" is not "consistent with current scientific information" and because the model "appears to underrepresent the benefit of habitat improvements related to floodplain and water temperature" expected to occur under the	The comments contain inaccuracies. The State Water Board did not rely on SalSim for its impact conclusions or determinations of fish benefits, but rather used the model to provide insight into potential management decisions being evaluated for the plan amendments. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides a use advisory for SalSim and specifically describes the limitations of SalSim. Please also see Master Response 3.1, Fish Protection, for more information regarding the State Water Board's use of SalSim, and the acknowledgement of limitations of SalSim.

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		SED's preferred alternative. Comments: Consistent with what was the theme of this entire presentation, neither Mr. Grober, nor the slides, provided much of any technical explanation to support the statements made. In this case, there was no reference to exactly what "current scientific information" was being referenced. Also, the statement "appears to underrepresent the benefit…" gives the impression that the model didn't provide SWB the results it was hoping to see because there was no explanation provided of the rational basis for SWB's expectation of the greater benefits to occur under the SED. Perhaps the model is not underrepresenting the benefits; there just aren't any significant benefits from the SED's proposal. What evidence does the SWB possess that would provide a reasonable expectation of greater fish production or benefits at the population level? Absent SalSim, there is not a single quantitative estimate of benefits to fish at the population level in the entire SED. Then after dismissing any use of SalSim in Slide 36, the SWB spends the next three slides resurrecting SalSim to show on Slide 39 greater fish production numbers. Why go through this exercise if the model wasn't relied upon by the SWB? Is this the first time the SWB went through the exercise shown on slides 37, 38 and 39? What purpose does it serve if SalSim is not useful because of fundamental flaws to continue showing analytical results from the model? Chopping out certain years would not address the "fundamental flaws" associated with how SalSim treats water temperature and floodplains. It is imperative that CDFW not be allowed to submit a "new and improved" version of SalSim without giving the public a chance to review the new model and comment on it. If the SWB has indeed not relied in any way on SalSim, then all references to the use of SalSim should be removed from the final SED. Currently in the SED, there are over 100 individual references to how the SWB used and relied on the SalSim model, and roughly 10 references about the SWB's concerns with SalSim. On January 3, the SWB tries to step-back from its often-stated reliance upon SalSim, more probably because the increase in fish production it predicts is minimal for all the water being taken from beneficial water supply purposes.	
1344	283	[From ATT17:ATT1:] Slides 44 and 45: Tuolumne River Fish Studies. These slides highlight three studies performed jointly by TID and MID as part of the Don Pedro relicensing. The three studies are what we refer to as the Swim Tunnel study, the Predation Study, and the Fall-run Chinook Population Model. The Districts have performed over 200 individual investigations and studies on the resources of the lower Tuolumne River. The SED uses just one of them in the SED -- an instream flow study performed by Stillwater Sciences -- but then fails to apply the results in a prudent fashion that would benefit fall-run Chinook at lower water cost to the Districts. The Districts will comment on this particular study in their March 17 filing.	The State Water Board used the best available science throughout the SED. A variety of data were obtained for the water quality planning process: quantitative data from peer-reviewed published literature on topics specific to the plan area; peer-reviewed published literature outside the plan area but on topics relevant to the plan amendments; unpublished quantitative data from within the plan area and from outside of the plan area; qualitative data or personal communication with topical experts; and expert opinion if no other sources were available. Please see Master Response 1.1, General Comments, for additional information regarding the scientific basis of the plan amendments. Please also see Master Response 3.1, Fish Protection, for additional information regarding the use of best available science, the adequacy of modeling to support the analyses, and predation studies conducted on the Tuolumne River. Please see response to comment 1344-110 regarding the consideration of FERC studies, and specifically predation studies on the Tuolumne River, and the model cited as "the Fall-run Chinook Population Model". Please see response to comment 1344-59 regarding the study cited by the commenter as "the Swim Tunnel study".

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1344	284	[From ATT17:ATT1:] Temperature Study Comments: Mr. Grober's comments reflect a significant lack of familiarity with the cited study, to say the least. He criticizes this study of the thermal tolerance and capability of wild juvenile O. mykiss (rainbow trout/steelhead) because the study, according to Mr. Grober, did not evaluate growth, disease vulnerability, predation vulnerability, or behavioral responses. This is a partially true, but completely irrelevant, statement. Like every other of the 200 studies performed by the Districts over the years, the Swim Tunnel study was planned and designed to address a specific question or set of questions. No single study could ever examine all the items raised by the SWB staff, and of course the SWB understand that. In fact, although generalized growth relationships with temperature have been shown based on laboratory studies, we are not aware of any specific studies from the Central Valley addressing disease vulnerability, predation vulnerability, or behavioral responses of O. mykiss over a range of temperatures. The Districts' Swim Tunnel study was specifically designed and executed to investigate the degree to which wild O. mykiss in the lower Tuolumne River are, or have become, acclimated to the relatively higher temperatures of the Tuolumne River when compared to rivers in the Northwestern US, which have been suggested by EPA to apply to the rivers of Central Valley. This study was planned and executed by leading experts in the field of fish physiology, including Dr. Nann Fanque, Associate Professor & Master Adviser, Department of Wildlife, Fish & Conservation Biology, UC Davis and Dr. Tony Farrell, University of British Columbia. The results of this site-specific study carried out on actual, wild Tuolumne River fish are highly instructive and the study concludes that the wild O. mykiss juveniles of the Tuolumne River have a high thermal tolerance and are acclimated to the local conditions experienced in the lower Tuolumne River, including observations of active feeding and near optimal swimming performance at temperatures well above SWB criteria. This study and its findings were recently published in the journal of Conservation Physiology, and is now a part of the published scientific literature on this subject. The SWB's comments are misguided and misinformed. The results of the study conflict with CDFW and SWB opinions that the current temperatures of the lower Tuolumne River are unsuitable for O. mykiss, and need "improvement". Rejecting a well-done, scientific study because its results do not comport with the goals of the SWB is the opposite of informed decision-making. Indeed, if the SWB staff had taken the time to examine data collected and analyses performed by the Districts' scientists over the past 20-plus years, it would have noticed that (1) Farrell et al. (2015) did identify active feeding at elevated temperatures, (2) the Districts' O. Mykiss Scale Collection and Age Determination Study did report fish size at age, and (3) the USGS' prior Otolith studies done for CDFW and NMFS (Zimmerman et al. 2009) also reported fish size at age. All of these studies, and others with which the SWB is familiar, have all indicated that compared to other CV rivers, there is no statistical difference in size at age for Tuolumne River O. mykiss. In this way, the SWB staff could have made informed statements about the Districts' studies.	Please see response to comment 1344-110 regarding the consideration of FERC studies, and the model cited as "the Fall-run Chinook Population Model". Please see response to comment 1344-59 regarding the study cited by the commenter as "the Swim Tunnel study". Please see Master Response 1.1, General Comments, regarding the scientific basis. Please also refer to Master Response 3.1, Fish Protection, regarding the use of best available science and adequacy of modeling to support the analyses, which includes a discussion of temperature modeling and the use of EPA Criteria.
1344	285	[From ATT17:ATT1:] Predation Study: The Predation Study is another site-specific study undertaken by the Districts as part of relicensing. The study was performed in accordance with a study plan approved by FERC and reviewed by the SWB. The study concludes that predation may	It is difficult to assess the effectiveness of and ecological response to a particular flow or non-flow action, because 1) there can be many other stressors in the river that are affecting the survival of the concerned species but cannot be isolated from the system; and 2) in order to draw a robust scientific conclusion, ecological studies often require multiple years of data and observation to capture the full life cycle of the

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		account for a large part of the high mortality loss of juvenile fall-run Chinook observed in the river. A range of flows and habitat types were examined in the study, in stark contrast to the misinformed statements provided on the SWB's slide. If SWB had actually read the study, they would have seen that fourteen habitat units were sampled between RM 3.7 and RM 41.3, and that when combined with prior predation studies dating back to 1990, over 90% of the river's habitats have been investigated. That the one year of study did not consider all "water year types" should not be a surprise because, of course, it would be impossible since there are five water year types. It is fairly safe to say that a study conducted in one water year did not evaluate all five water year types. The SWB slide also claims that because the Predation Study selected specific habitat types to investigate, the study should not be used for river-wide estimates. Abundance of predators was sampled in run-pool and SRP habitat units downstream of RM 39.4, the preferred habitat of these fish. Riffles, which would be expected to have low predator densities, were not sampled and these areas were also excluded from the calculations to estimate total predator abundance in the 39.4 mile study reach. If predators are using riffle habitats, then the estimates generated by the 2012/2013 study underestimated total predator abundance. This study is another example of the best scientific information available on the Tuolumne River being ignored in the SED because of its inconvenient results.	species in a wide range of hydrological and climate conditions. The State Water Board recognizes the importance of implementing non-flow measures, such as predator removal, for protection and recovery of salmon population. Many years of research of rivers in California have shown that flow is the main variable that limits the distribution and abundance of riverine species and regulates the ecological integrity of rivers; and that non-flow factors, such as predation, are affected by flow, because a reduced, flattened flow regime favors nonnative species. Increasing flow in the river will enhance the effect of predator removal. The scientific basis and relevant research for the LSJR flow objectives to protect fish and wildlife are documented in Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives. For further discussion regarding the scientific justification for flow in protecting fish and wildlife, and a detailed clarification of predation as the non-contributing factor to salmon population decline, please see Master Response 3.1, Fish Protection. Please see Master Response 5.2, Incorporation of Non-Flow Measures, for further discussion of the role of non-flow measures, and consideration of non-flow measures in the plan amendments.
1344	286	[From ATT17:ATT1:] Salmon Population Model: The SWB reports that the Districts' salmon population model did not account for mortality due to high water temperatures, increased productivity on floodplains, and predator effects. In this case, the SWB is simply wrong on all three counts. Specific thermal temperature limits from the scientific literature are included in the model, as are floodplain habitat, specific parameters for floodplain food availability, as well as addressing predation risk. Although the model is provided with higher food ration estimates at floodplain than in-channel habitats, the SWB is correct when it points out that the Chinook Population Model does not predict "increased" juvenile productivity due to floodplain access. The reason for this is that food availability and growth rates in the Tuolumne River are already high and water temperatures within floodplain habitats are generally similar to in channel locations during critical fry rearing periods. During the development of the Population Model, the Districts held a series of Workshops with all interested parties, including SWB, CDFW, USFWS, and NMFS in which the Districts requested any and all evidence that the parties might have on floodplain food availability for the Tuolumne River. None was forthcoming. This points out a fundamental problem with the SED's prediction of higher growth on the Tuolumne River floodplain -- there is no evidence or information of food sources on the Tuolumne floodplains. Therefore, there is no rational basis for the SWB to "expect" benefits from floodplain flows.	Please see response to comment 1344-110 regarding the consideration of FERC studies, and the model cited as "the Fall-run Chinook Population Model". Please see Master Response 3.1, Fish Protection, regarding the adequacy of floodplain analysis and the expected benefits of increased floodplain inundation.
1344	287	[From ATT17:ATT1:] Slides 49, 50, and 51: Predation. The SWB offers three slides on the topic of Predation. Comments: The Districts' studies, data, and modeling demonstrate that, at least for the Tuolumne River, predation by non-native species on fry and juvenile fall-run Chinook salmon is a major cause of the very poor outmigration survival on the Tuolumne River. Studies by	Please see response to Comment 1344-285.

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		other parties show that fry and juvenile survival is low on the lower San Joaquin River as well. A host of non-native predators were introduced primarily by CDFW many years ago for recreational fishing purposes. Now the Districts are being asked to fix the problem. The Districts agree that physical conditions on the Tuolumne River and the LSJR are currently favorable for these non-native predators. The primary cause of these favorable conditions are the legacy of in-channel and floodplain gold and gravel mining of the river, agricultural development, levee construction, and urban development. The Tuolumne River is now largely a mixture of stream channel and in-channel ponds, in many places confined within levees. Flows will not "fix" these problems, and will not result in improving fish survival unless and until the role of these other physical conditions are understood. Temperatures on the Tuolumne River are suitable for fall-run Chinook salmon for the periods and locations they occupy in the river. However, temperatures on the LSJR are less than suitable, and the SED's own analyses show that the preferred alternative will not materially improve these conditions. On Slide 51, the SWB picks out a single table from the Districts Predation Study report, a large study with a tremendous amount of data, to claim that there is "very little survival" of fall-run Chinook at "low flows". But at the hearing, it was apparent that the SWB's purpose was much more than that. At the hearing, Mr. Grober admonished the Districts' consultant that prepared the report of being selective related to displaying certain data in the report, asserting that the report's author should "look at the full data set" and "show all the data". For the SWB to pick out a single table of a large report and then accuse someone else of "cherry-picking" data seems a bit ironic. In any event, the table Mr. Grober shows as being the "corrected" version prepared by the SWB is in fact itself incorrect. The flows at the Modesto gage include the inflows from Dry Creek, while the study reach referred to in the table is predominantly upstream of Dry Creek. It would be incorrect to claim, as the SWB does, that the revised table is "showing flows through the actual study reach". It is more accurate for this table to use the La Grange gage flow just as the Districts' consultant did. But even further, the purpose of the study was not to investigate flow vs survival at different flows, contrary to what the SWB was trying to use the table to show. If the SWB wanted to make a point about flow and survival, why didn't the SWB consider the results of thirteen years of TAC-reviewed CWT studies that were actually designed to evaluate the flow vs survival relationship?	
1344	288	[From ATT17:ATT1:] It was unfortunate that the [SWB] presentation [on 1/3/17 in Sacramento] was done quickly and provided no opportunity for questions from the public at the Public Hearing. Going through the slides quickly did little to shed light on the "misinformation" Ms. Spivy-Weber hoped to clarify.	Please see Master Response 1.1, General Comments regarding the public outreach process. The public hearing lasted five days, in November and December 2016, and January 2017, in order accommodate all persons wishing to speak and comment on the proposed Plan Amendments and revised SED. Two days of staff technical workshops were held in December 2016 to assist interested persons in their review of the proposed plan amendments and the SED, including opportunities to ask questions after each presentation.
1344	289	[ATT17:ATT2: Attachment D-2: Review of CDFW SalSim Presentation (Bay-Delta Phase 1 Hearing, January 3, 2017). Prepared by LGL Limited for Turlock Irrigation District and Modesto Irrigation District. Dated January 11, 2017.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	290	[From ATT17:ATT2:] Executive Summary.	This comment responds to CDFW's comments made during their presentation at the public hearing on the 2016 Recirculated Draft SED. For the full context of CDFW's comments and a complete response to those remarks, please refer to the index of commenters in Volume 3; the material from the public hearing will be

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		The SalSim portion of the presentation [on 1/3/17] by Dean Marston (CDFW) focused primarily on some of the factors that could have impacted the SWRBC SalSim analysis, resulting in lower fall-run Chinook returns than expected. The CDFW highlighted three potential problems that could have resulted in lower adult returns than expected, these include errors in the SalSim model and errors in the HEC-5Q hydrology scenarios used by the SWRBC. The CDFW also made assertions about the importance of flow on fall-run Chinook abundances which will also be reviewed as these can be considered relevant to some of the design consideration behind SalSim. SalSim errors highlighted by the CDFW include excessive egg mortality and insufficient juvenile mortality, which were suggested could have been part of the reason for lower than expected adult returns in the SWRBC analysis. The CDFW also suggested that they have corrected these errors and have recalibrated SalSim, details of which will be released in March, 2017. Investigations into these errors revealed merits to both claims, however the investigation also reveals the difficult in directly testing such claims as SalSim reports population abundances, which are the combined result of birth, death and movements. As such, mortality rates can only ever be indirectly tested. The claim of insufficient juvenile mortality is also quite vague as it could occur in multiple SalSim modules (i.e., SJR tributaries and SJR main stem, or river Delta), each of which model survival differently. More importantly the two highlighted are antagonistic, that is fixes employed to reduce egg mortality will be offset in part by downstream fixes to juvenile mortality. It is unclear how much the final SalSim output will change after the recent CDFW error correction and recalibration effort. Furthermore, there were no mentions of the other errors uncovered by LGL investigations (e.g., apparent pre-spawn mortality), so it is unlikely that a full audit of SalSim was conducted. The CDFW also highlighted an issue in the SWRBC HEC-5Q hydrology scenarios and emphasized that the reliability of SalSim output depends on the quality of inputted hydrology scenarios. While at first glance this claim seems reasonable, further investigation revealed that the highlighted problem in the SWRBC HEC-5Q hydrology file (i.e., Mossdale flow/temp anomalies in December) should not have affected SalSim output as SalSim only selectively uses portions of the inputted HEC-5Q hydrology. While the CDFW's claim is possible, they did not provide the appropriate supporting evidence to back up their claim. As such, the final claim by the CDFW that Mossdale flow and temperature problems resulted in lower than expected Chinook production in the SWRBC analysis is currently unsubstantiated. Finally, the CDFW concluded by highlighting the importance of flow, and by extension flow actions, on fall-run Chinook abundances. However, the evidence presented was largely anecdotal, had inconsistencies (e.g., declines of abundances in wet years) and was generally insufficient to validate the claims made. Furthermore, the highlighted claim of the importance of June flows on fall-run Chinook production (assisting outmigration of smolts) is at odds with the CDFW's SalSim model which outmigrates most juveniles well before June.	identified by the person's name and is assigned a letter number. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides a use advisory for SalSim and specifically describes the limitations of SalSim. Please also see Master Response 3.1, Fish Protection, regarding the State Water Board's use of SalSim, and the acknowledgement of limitations of the model. Please also see Master Response 3.1 regarding the use of best available science, the current trend of fish decline and the need for increased flow, and the presence of salmon and steelhead in June, and expected temperature improvements from the plan amendments during that month. Please see Master Response 3.2, Surface Water Analyses and Modeling, regarding use of the HEC-5Q temperature model in the SED.
1344	291	[ATT17:ATT2:ATT1: Slide11: SWRCB's use of SalSim.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.

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1344	292	[From ATT17:ATT2:] Overall CDFW states that the SWRCB's use of SalSim highlighted issues in SalSim that resulted in less fish being produced than expected given empirical data. The CDFW then goes on to claim that this was the result of errors in egg mortality (excessive mortality) and juvenile mortality (insufficient mortality). While the surface this claims seems reasonable, further investigation reveals that some claims are either difficult to verify based on SalSim output or too vague to verify directly. It is also not clear whether "fixing" these errors will result in desired corrections to adult production. SalSim is a full life-cycle model, "correcting" one component can have unintended downstream effects especially if other components are also incorrect. The two changes that CDFW claims have implemented (improved egg survival and higher juvenile mortality) in many sense are competing. For increase adult production to occur the reduction in egg mortality will have to exceed the increase in juvenile mortality. It will be interesting to see if any notable changes to production occur after "recalibrating" SalSim.	This comment responds to CDFW's comments made during their presentation at the public hearing on the 2016 Recirculated Draft SED. For the full context of CDFW's comments and a complete response to those remarks, please refer to the index of commenters in Volume 3; the material from the public hearing will be identified by the person's name and is assigned a letter number. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides a use advisory for SalSim and specifically describes the limitations of SalSim. Please also see Master Response 3.1, Fish Protection, regarding the State Water Board's use of SalSim, and the acknowledgement of limitations of the model.
1344	293	[From ATT17:ATT2:] Egg mortality: Proximate Measure of Survival. In general, the impacts of mortality in SalSim are difficult to assess because only final population numbers (either daily or annualized) are provided. The most granular result are daily population numbers which are outcome of eggs production and egg mortality combined. As such, we can never get a direct estimate of mortality without either assumptions or re-implement parts of the SalSim model based on the SalSim documentation (which has already been shown to be in error in parts). That said, as a first order approximation of mortality can be obtained by looking at the daily population numbers change, with large mortality events showing up as rapid decreases in the population numbers. CLAIM: High egg mortality occurred in the fall period during spawning, which occurred over a few days what should have occurred over a longer period-of-time (2 weeks - month) It is not clear what constitutes "excessive" mortality, but there are clear instances of rapid declines in the daily number of eggs in both wet and dry years in all tributaries for at least some of the years (Figure 1 and Figure 2 respectively [see ATT17:ATT2:ATT11 and ATT17:ATT2:ATT12]). Rapid mortality can be seen when the daily population numbers suddenly drop. These rapid declines also occur earlier in the season (September to December) which appears to support the CDFW's claim of this error occurring during spawning. That said, the magnitude and frequency appear to vary by tributary and year under both wet years (Figure 1 [ATT17:ATT2:ATT11]) and dry years (Figure 2 [ATT17:ATT2:ATT12]). Daily egg population numbers also show good survivorship (e.g., Tuolumne in most years). We will need to review the CDFW SED comments to get a better understanding whether the CDFW intends to change egg mortality in some tributaries or all tributaries.	This comment responds to CDFW's comments made during their presentation at the public hearing on the 2016 Recirculated Draft SED. For the full context of CDFW's comments and a complete response to those remarks, please refer to the index of commenters in Volume 3; the material from the public hearing will be identified by the person's name and is assigned a letter number. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides a use advisory for SalSim and specifically describes the limitations of SalSim. Please also see Master Response 3.1, Fish Protection, regarding the State Water Board's use of SalSim, and the acknowledgement of limitations of the model.

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1344	294	[From ATT17:ATT2:] Juvenile Survival. The CDFW made clams in the audio is that there were instances insufficient juvenile survival due to "flow levels were overriding effects of temperature". This claim is rather vague and it is not clear whether CDFW was referring to juvenile survival within the tributaries and SJR main stem or the river Delta, as SalSim models survival in these scenarios differently. Investigations into both possibilities reveal that the CDFW was likely referring to survival in the SJR tributaries and SJR main stem. . Tributary and SJR Main Stem Survival. Daily density independent survival (there are also fry density dependent survival effects) in the tributaries and SJR main stem is determined by the following equation: P(Survival) = Expit(a + b * T + c * Q + d * Q * L + e * L(squared)) with parameter estimates based on the following table [see ATT17:ATT2:ATT2]: The CDFW's statement implies that parameter value for flow and potentially flow-length interaction may be too large relative to temperature. If the CDFW is referring to tributary survival, the best way to assess this claim would be to input a variety of spring flow/temp conditions and compare the survivorship. We can gain some insight into juvenile tributary mortality by looking at the daily juvenile population numbers (Figure 3 [ATT17:ATT2:ATT13] and Figure 4 [ATT17:ATT2:ATT14] for CDFW designated wet and dry years respectively). Caution needs to be taken when assessing these figures as population numbers as decreases can be caused by mortality our outmigration. When there are long periods without outmigration events (e.g., Feb-Apr, 1997 in the Tuolumne; Figure 3 [ATT17:ATT2:ATT13]) we can see that the population numbers are largely stable, so there may be some merit to the CDFW statement. Delta Survival. Survival in the Delta is computed as a single time step based on the following equation: Pr(Survival) = baseSurvivalProb * overallFactor * fryFactor * MRHFactor with the baseSurvivalProb is based a number of predictors including flow at Stockton Ship: Channel (Q) and the temperature at Mossdale (T) baseSurvivalPr = Min(Exp(a(sub 0) + a(sub 1) * Q + a(sub 2) * stripers + a(sub 3) * T + a(sub 4) * releaseCode)^m , 0.99) Parameter values used in the baseSurvivalPr equation are based on the following table [see	This comment responds to CDFW's comments made during their presentation at the public hearing on the 2016 Recirculated Draft SED. For the full context of CDFW's comments and a complete response to those remarks, please refer to the index of commenters in Volume 3; the material from the public hearing will be identified by the person's name and is assigned a letter number. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides a use advisory for SalSim and specifically describes the limitations of SalSim. Please also see Master Response 3.1, Fish Protection, regarding the State Water Board's use of SalSim, and the acknowledgement of limitations of the model.

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		ATT17:ATT2:ATT3]: If the CDFW's assertion about flow and temperature was referring to Delta survival, then the parameter value flow at Stockton Ship Channel could too high relative to the Mossdale temperature parameter. It is also unclear if the CDFW is referring to survival of some juvenile stages versus others as SalSim tends to have fry dominant juvenile compositions entering the Delta (Figure 5 [see ATT17:ATT2:ATT15]). While the SalSim manual suggests that fry have higher mortality in the Delta, the overall mortality rates of juveniles in the Delta do not appear to be affected by the proportion of fry making up incoming juveniles into the Delta (Figure 6 [see ATT17:ATT2:ATT16]) and if anything SalSim appears to associate higher production with fry dominant juvenile compositions entering the Delta (Figure 7 [see ATT17:ATT2:ATT17]). However, differences in fry survival, relative to other stages, will not be impacted by flow and temperature, as the Delta survival is formulation treates all juveniles the same in this regards. The only place where juvenile stage is used is in the fryFactor, which a constant factor based on juvenile origin. Taken together, it is unlikely CDFW was referring to the issues of higher than expected fry survival in the Delta survival uncovered by LGL investigations when referring to insufficient juvenile survival.	
1344	295	[ATT17:ATT2:ATT2: Table 14. Parameters and variables for juvenile density-independent survival.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	296	[ATT17:ATT2:ATT3: Table 19. Parameters and variables for juvenile Delta mortality.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	297	[ATT17:ATT2:ATT4: Slide 12: Mossdale Water Temperature.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	298	[From ATT17:ATT2:] In this slide [ATT17:ATT2:ATT4] the CDFW asserts that inaccuracies in the HEC-5Q will impact the accuracy of SalSim estimates. While overall the message has merit, I find it odd that the highlighted Mossdale flows inaccuracies (December) are in a period that, to my best knowledge, is unused by SalSim. Mossdale flows and temperatures are used when determining spawning date, egg viability and juvenile survivorship in the Delta. The dates shown are outside the spawning date flows used by SalSim (according to the SalSIm manual) and the no juveniles should be entering the Delta this late in the season, so their survival should not be impacted either. Egg viability is the only remaining possibility and it is determined in part by the Mossdale temperature 24 days before nest creation and egg deposition. As such, exposure to Mossdale temperature in December could affect January egg depositions. However, no eggs appear to be deposited in January in any years (i.e., a lack of daily population increases in Figure 1 and Figure 2 [ATT17:ATT2:ATT11 and ATT17:ATT2:ATT12]) and the HEC-5Q anomaly highlighted in the slide should not have affected egg viability either.	This comment and the information presented in the referenced slide by CDFW at the January 03, 2016 hearing does not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the SED. This comment includes inaccuracies. The results presented by CDFW in the referenced slide represent data from the entire period of January of 2000 to December of 2010. The results that are highlighted approximately represent the springtime salmonid migratory period of February through June for the years 2005 and 2006, not the individual month(s) of December as the commenter suggests. The time period for each unit on the x-axis is one year, with the month of December indicating the start of a new unit (except for the beginning of the x-axis which is the month of January in the year 2000). Please see Master Response 3.1, Fish Protection, for more information regarding the State Water Board's use of SalSim.

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		Taken together, while it is generally true that errors in the HEC-5Q can affect SalSim accuracy, the highlighted anomaly used as evidence by the CDFW should not have impacted SalSim output and therefore does not sufficiently back their claim.	
1344	299	[ATT17:ATT2:ATT5: Slide 13: Model Tool -- Take Home.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	300	[From ATT17:ATT2:] This slide [ATT17:ATT2:ATT5] was used to make the claim that HEC-5Q anomalies at Mossdale have resulted in higher juvenile mortality and therefore lower adult production. However, the CDFW has not provided any real evidence for Mossdales temperature and flows being a problem during juvenile outmigration. The Mossdale example presented occurred in December, a period when SalSim does not appear to be using Mossdale flows for any of its computations. As such, the CDFW claim is plausible, but not supported by the evidence shown in the slides.	This comment responds to CDFW's comments made during their presentation at the public hearing on the 2016 Recirculated Draft SED. For the full context of CDFW's comments and a complete response to those remarks, please refer to the index of commenters in Volume 3; the material from the public hearing will be identified by the person's name and is assigned a letter number. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides a use advisory for SalSim and specifically describes the limitations of SalSim. Please also see Master Response 3.1, Fish Protection, regarding the State Water Board's use of SalSim, and the acknowledgement of limitations of the model. Please see Master Response 3.2, Surface Water Analyses and Modeling, regarding use of the HEC-5Q temperature model in the SED.
1344	301	[ATT17:ATT2:ATT6: Slide 14: Importance of June Flows -- 2011.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	302	[From ATT17:ATT2:] June flows very well may be important in the natural system, but in its current configuration there is little way for this to be assessed or quantified with SalSim. as most juveniles in most tributaries have outmigrated from their respective tributaries before June under both wet and dry years (Figure 3 and Figure 4 respectively [see ATT17:ATT2:ATT13 and ATT17:ATT2:ATT14]). (The exception to this appears to be Merced which consistently has smolts in June, which few of any appear to outmigrate). Thus, most of the juvenile population has left the SJR and entered the delta prior to June (Figure 8 and Figure 9 [see ATT17:ATT2:ATT18 and ATT17:ATT2:ATT19], wet and dry years respectively). Therefore, the statement by the CDFW about the importance of June flows is contradicted by the programmed behaviour of SalSim.	This comment responds to CDFW's comments made during their presentation at the public hearing on the 2016 Recirculated Draft SED. For the full context of CDFW's comments and a complete response to those remarks, please refer to the index of commenters in Volume 3; the material from the public hearing will be identified by the person's name and is assigned a letter number. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides a use advisory for SalSim and specifically describes the limitations of SalSim. Please also see Master Response 3.1, Fish Protection, regarding the State Water Board's use of SalSim, and the acknowledgement of limitations of the model. While the State Water Board acknowledges the limitations of the SalSim model, the importance of June flows is supported in the State Water Board's own analysis. Please see Master Response 3.1 for information regarding the presence of salmon and steelhead in June, and expected temperature improvements from the plan amendments during that month.
1344	303	[ATT17:ATT2:ATT7: Slide 15: Importance of June Flows -- 1999.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	304	[From ATT17:ATT2:] Similar to slide 14 [ATT17:ATT2:ATT6:], SalSim itself does not support this view. Furthermore, this is presented as evidence without any indication of the numbers of juveniles in the tributaries in June. If few juveniles exist in the tributaries or SJR in June in 1999, there would be limited benefit to additional flow during this period.	This comment responds to CDFW's comments made during their presentation at the public hearing on the 2016 Recirculated Draft SED. For the full context of CDFW's comments and a complete response to those remarks, please refer to the index of commenters in Volume 3; the material from the public hearing will be identified by the person's name and is assigned a letter number. Please see response to comment 1344-302 regarding the limitations of SalSim and the importance of June flows.

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1344	305	[ATT17:ATT2:ATT8: Slide 16: Is Flow Important?]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	306	[From ATT17:ATT2:] In this slide [ATT17:ATT2:ATT8:] the CDFW makes an assertion the importance of higher flows on fall run Chinook production by highlighting wet and dry year production in Tuolumne and the Stanislaus tributaries. There are a few problems with the comparison. Both Tuolumne and Stanislaus start to show the declines well into the "Wet Years" period. Furthermore, the comparison ignores the lag between juvenile rearing conditions and adult returns 2-4 years later. This implies that the decline that appears start in 2001 could relate to juvenile conditions from 1997-1999, a period of high spawning activity. One could also argue that density dependent effects may be a driver in the recent decline. Either way, the comparison and evidence presented for the importance of flow is overly simplistic, which is odd given the complexity undertaken by the CDFW in developing SalSim.	This comment is made in response to another entities' comments on the draft SED. Please refer to the index of commenters in Volume 3 to locate the letter number(s) of interest to review responses to comments submitted by other entities within the comment period on the 2016 Recirculated Draft SED. The commenter misrepresents the intent of the slide which was to simplisticly illustrate the difference in salmonid population status between a river that has increased flow as a population restoration action, and a river that has non-flow measures as a population restoration action. Describing the complexity of salmon survival with illustrations of rearing conditions to adult returns, and density dependent effects was beyond the intent of the slide. Providing suitable flow conditions is a necessary component of providing reasonable protection of beneficial uses and is an action that is within the State Water Boards' water rights and water quality authority. The State Water Board does recognize, however, that complementary non-flow measures are needed to address other stressors. As described in Appendix K, Revised Water Quality Control Plan, and Chapter 16, Evaluation of Other Indirect and Additional Actions, other complementary non-flow actions are included in the plan amendments. See Master Response 5.2, Incorporation of Non-Flow Measures, regarding incorporation of non-flow measures and the State Water Board's authority to implement non-flow measures. The information presented by the commenter does not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the SED
1344	307	[ATT17:ATT2:ATT9: Slide 17: Is Flow Important?]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	308	[From ATT17:ATT2:] In this slide [ATT17:ATT2:ATT9] the CDFW asserts that the recent divergence in adult returns between the Stanislaus and Tuolumne is the result of flow actions that occurred in the Stanislaus, but not in the Tuolumne. As was adeptly pointed out in the question and answer period the end of the presentation, it is not an "apples-to-apples" comparison. Namely, non-flow actions occurred in both the Tuolumne and the Stanislaus and during this period and that these non-flow actions differed in both tributaries. As such, the impact of flow actions and non-flow actions on adult returns are confounded and cannot be separated. Differences in either flow action or non-flow actions may have been responsible for the differences in observed adult escapement. For example, creation of special run pools in the Tuolumne could have facilitated Bass predator populations which could have also have impacted Chinook populations or the non-flow projects implemented on the Stanislaus could have had more successful.	Please see response to Comment 1344-285.
1344	309	[ATT17:ATT2:ATT10: Slide 18: Closing.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	310	[ATT17:ATT2:ATT11: Figure 1. Daily in/river egg and alevin populations under the SalSim calibration hyrology (SalSimHist) and the SWRBC Base Case (SBBASE) during wet years.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.

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Ltr#	**Cmt#**	**Comment**	**Response**
1344	311	[ATT17:ATT2:ATT12: Figure 2. Daily in/river egg and alevin populations under the SalSim calibration hydrology (SalSimHist) and the SWRBC Base Case (SBBASE) during dry years.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	312	[ATT17:ATT2:ATT13: Figure 3. Daily in/river juvenile populations (fry, parr and smolts) under the SalSim calibration hydrology (SalSimHist) and the SWRBC Base Case (SBBASE) during wet years.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	313	[ATT17:ATT2:ATT14: Figure 4. Daily in/river juvenile populations (fry, parr, and smolt) under the SalSim calibration hydrology (SalSimHist) and the SWRBC Base Case (SBBASE) during dry years.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	314	[ATT17:ATT2:ATT15: Figure 5. Average composition of outmigrating juveniles at each tributary (Stanislaus, Tuolumne, and Merced) over all study years.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	315	[ATT17:ATT2:ATT16: Figure 6. Percentage of juveniles entering the Delta that survived to ocean entry for differing smolt/fry mixtures. Error bars indicate standard error.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	316	[ATT17:ATT2:ATT17: Figure 7. Relationship between the percentage of juveniles entering the Delta as A) fry and B) smolts and the average total adult production. Bars indicate standard error. Blue line indicates a simple linear regression fit and gray shading indicates the 95% confidence band for the regression.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	317	[ATT17:ATT2:ATT18: Figure 8. Total numbers of juveniles, excluding hatchery releases into the Delta, entering the Delta by month under the SalSim calibration hydrology (SalSimHist) and the SWRBC Base Case (SBBASE) during wet years.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	318	[ATT17:ATT2:ATT19: Figure 9. Total numbers of juveniles, excluding hatchery releases into the Delta, entering the Delta by month under the SalSim calibration hydrology (SalSimHist) and the SWRBC Base Case (SBBASE) during dry years.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	319	[ATT17:ATT3: Attachment D-3: Review of CDFW Presentation at January 3, 2017 Public Hearing on the SWRCB's Draft Revised SED. Prepared by FISHBIO for Turlock Irrigation District and Modesto Irrigation District. Memo dated January 26, 2017.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	320	[From ATT17:ATT3:] Hydrology. (Slides 2-4) Flattening of the hydrograph is a combined result of reduced flows at times for storage and flood control, and higher than natural flows during other times to meet regulatory requirements (i.e., October flows). A more natural flow regime would also include lower flows in the fall which CDFW and the State Water Resources Control Board (SWRCB) continue to ignore. CDFW also fails to acknowledge the significance of other alterations to the aquatic environments of the San Joaquin Basin such as in channel mining, levees, and introduced species, which have had profound effects on native fish populations. Changes in the hydrograph were not made in isolation of these other significant factors, and management decisions also should be made within the context of other ecosystem alterations.	This comment is made in response to another entities' comments on the draft SED. Please refer to the index of commenters in Volume 3 to locate the letter number(s) of interest to review responses to comments submitted by other entities within the comment period on the 2016 Recirculated Draft SED. As described in Appendix C, Scientific Basis Report, scientific evidence indicates that reductions in flows and alterations to the flow regime resulting from water development over the past several decades have negatively affected native fish in the San Joaquin River basin. While numerous other factors (i.e. habitat alteration, water quality, introduced species and predation, hatchery operations, disease, etc.) also have contributed to the negative effects seen over the past several decades, flow during the spring time period remains a primary limiting factor (NMFS 2014). Please refer to Section 7.2, Environmental Setting, for a description of the environmental stressors, including disease, that affect the abundance of aquatic biological resources in the LSJR, and three eastside tributaries. While evidence indicates that the spring time period is the limiting factor, the State Water Board also recognizes the importance of flows at other times of the year and includes elements in the plan

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		For instance, while we agree that the proliferation of non-native species (i.e., predation) is a significant problem as slide 3 of the CDFW presentation indicates, the claim that the altered hydrograph has favored the proliferation of non-native species, is not supported. We are not aware of any studies in the San Joaquin Basin that have linked trends in predator abundance with flows. Just as we monitor salmon and steelhead abundance, there is a need to monitor and understand the responses of non-native fish populations to flow and non-flow measures. Estimates of the abundance of non-native fishes are required to document population trends, but CDFW has repeatedly denied permit requests for studies such as the Tuolumne Predation Study, required by FERC. One key element of that study was to estimate predator abundance. Similarly, CDFW claims that a more natural flow regime would boost natural production and reverse the decline in anadromous fish population abundance. CDFW fails to substantiate this claim with citation to scientific studies or with the information presented, and this issue is further discussed in our comments in subsequent sections. Another claim made by CDFW is that the altered hydrograph has made fish sick/injured and unhealthy. Again there is no reference to scientific data to support this claim. In the Stanislaus and Tuolumne, health studies conducted by the U.S. Fish and Wildlife Service have found low to no disease in their samples, and fish were generally found to be in good health. There have been high rates of BKD infection on the Merced River and the degree to which this affects outmigrant success is unknown (Nichols 2013). CDFW and others continue to cite the "portfolio effect" as justification for flows allowing for all lifestages to be expressed, with particular emphasis on June flow. All lifehistory strategies are currently expressed as is clear from the observation of fry, parr, and smolts in the upper rotary screw traps on the Stanislaus and Tuolumne rivers each year. However, in years with no natural run-off events or pulses during the fry outmigration period, fry do not make it out of the tributaries. So the expression of the fry lifehistory persists, but the strategy may not be successful in all years. This is not a new finding, and was occurring well before the current rim dams were in operation, as the absence of fry in the San Joaquin River in dry years was documented by CDFW using the Mossdale trawl during 1939-1941 (Hatton and Clark 1942). Recent otolith studies suggest that fry contribution to adult escapement may be improved during dry years with brief pulse flows (Sturrock et al 2015, Demko 2003).	amendments that will allow protection of fish and wildlife outside the February–June time period. Please refer to Master Response 2.2, Adaptive Implementation, and Master Response 3.1, Fish Protection, regarding the importance of flows during the entire year, and the flexibility of adaptive implementation to provide year-round benefits. Providing suitable flow conditions is a necessary component of providing reasonable protection of beneficial uses and is an action that is within the State Water Boards' water rights and water quality authority. The State Water Board does recognize, however, that complementary non-flow measures are needed to address other stressors. As described in Appendix K, Revised Water Quality Control Plan, and Chapter 16, Evaluation of Other Indirect and Additional Actions, other complementary non-flow actions are included in the plan amendments. See Master Response 5.2, Incorporation of Non-Flow Measures, regarding incorporation of non-flow measures and the State Water Board's authority to implement non-flow measures. A paradigm that is well understood in aquatic ecology: in a river with relatively constant flows during all seasons, and with warm temperatures and low flow velocities a certain composition of aquatic organisms will be present, whereas a river with higher, more variable, and seasonally time flows of a more natural pattern with cold water temperatures and high flow velocities and volumes, a different composition of organisms will be present. The hydrologic characteristics of the Lower San Joaquin River (LSJR) and its three major eastside tributaries, the Stanislaus, Tuolumne, and Merced Rivers (plan area), have been so dramatically altered that native fish species are struggling to survive and nonnative fish species are thriving. Please also refer to Master Response 3.1, Fish protection, regarding the need for higher and more variable flow during the February through June time frame and a description of findings from supporting studies, including Sturrock et al. (2015), which provide evidence that the early emigration of fry can contribute significantly to adult spawning population approximately 2.5 years later. The adaptive implementation process, as described in Appendix K, Water Quality Control Plan Update, will allow the flexibility to shift flows into the early migration period of February – June to facilitate the emigration of fry according to the best available science. Please refer to Master Response 2.2, Adaptive Implementation for additional description and clarification of adaptive implementation.
1344	321	[From ATT17:ATT3:] Implementation. (Slides 5-9) CDFW claims a need to focus on achieving connectivity between tributaries and the Bay-Delta. Since the Stanislaus, Tuolumne, and Merced rivers maintain year-round connection to the San Joaquin, and the San Joaquin remains connected to the Delta downstream of the respective tributary confluences, it is not clear what CDFW is referring too. We suspect that this may be a reference to temperature conditions potentially presenting a barrier to migration as has been claimed by CDFW in the past. However, if this is the case, why not be more direct in identifying the concern? Similarly, CDFW notes that "decisions on implementation of flow and non-flow measures should be tied to achieving clearly defined fish and wildlife narrative objectives." If CDFW	Please see Master Response 3.1, Fish Protection, for responses to comments regarding benefits of the plan amendments for fish, including temperature and migration corridors. Please refer to Master Response 2.1, Amendments to the Water Quality Control Plan, and Master Response 2.2, Adaptive Implementation, for responses to comments and additional information regarding migratory corridors, biological goals, the STM Working Group, and the San Joaquin Monitoring and Evaluation Program. Based on this and other comments received, the Biological Goals section in Appendix K has been appended to state the specific State Water Board intent that biological goals should be specific, measurable, achievable, relevant, and time-bound—so-called S.M.A.R.T. objectives. Representatives from CDFW, Modesto Irrigation District, Turlock Irrigation District, and other agencies will have an opportunity to work collaboratively in the STM Working Group to advise the State Water Board as it implements the LSJR flow objectives.

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		believes that the SWRCB's proposed narrative objectives are "clearly defined", perhaps we should start by revisiting those vague objectives which are far from SMART (Specific-Measurable-Achievable-Realistic-Time Bound). If the objectives are not clearly defined, how can one evaluate progress or the potential merit of conservation measures? This brings us to the issue of effective monitoring. We agree with CDFW that monitoring is necessary to understand progress. The Districts' have invested significant effort in ongoing monitoring activities to inform management decisions. It is unfortunate that management actions are often implemented with insufficient data to describe the baseline or to document response to the action. It is also unfortunate that CDFW provided no examples of what needs to be monitored, where, and how, nor what existing monitoring programs describe the baseline against which progress will be measured. How do they propose to evaluate how non-flow measures such as predator management contribute to meeting the objectives? Over what timeframe will success be measured? By adaptive, does the Department really mean that they want the authority to demand more water when their management of the prescribed block fails?	Master Response 2.2 provides additional description and examples of how adaptive management may proceed, and the bounds under which it may do so.
1344	322	[From ATT17:ATT3:] SalSim. (Slides 10-12) For more than a decade now there has been a consistent pattern of CDFW insisting that SalSim is the best available science then taking years to revise the model when substantial flaws are identified by those reviewing the model. These have been major issues with the statistical validity of the model, not "bugs". It is astonishing that CDFW attempts to dismiss the problems with the SalSim modeling as "bugs" in the model and a common occurrence in the modeling process. The problems identified with the flow and temperature inputs demonstrate a blatant lack of quality control. Clearly there was no consideration of the quality of the outputs from the HEC 5Q model before the data was used as the key inputs to the SalSim model. The problems with the egg and juvenile mortality aspects highlight that CDFW failed to reconcile these functions in the SalSim model with empirical data or logic. CDFW claims that the issues identified with the model have been fixed and that it believes the output will show greater benefit from the proposed spring flows. If the model has been fixed, why can't CDFW make more firm statements about the impact of the correction on modeled juvenile mortality or difference between the SED estimates and estimates generated by the re-calibrated model? Sounds like more of the same -- you caught a huge flaw in our work, and although we now have no scientific basis for our claims, stay tuned for the release of our next version. We're bound to find the right combination of numbers to support our claim at same time. Waiting to provide new numbers in their official comments in March suggests that CDFW is delaying further review of the model or its outputs by the scientific community, which could be reflected in comments to SWRCB. This does not demonstrate a commitment to collaboration or policy based on science.	This comment responds to CDFW's comments made during their presentation at the public hearing on the 2016 Recirculated Draft SED. For the full context of CDFW's comments and a complete response to those remarks, please refer to the index of commenters in Volume 3; the material from the public hearing will be identified by the person's name and is assigned a letter number. Regarding CDFW's revised salmon population model known as SJRSim (see CDFW's comments), the model is considered preliminary and was therefore not used after receiving their comments. Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provides a use advisory for SalSim and specifically describes the limitations of SalSim. Please also see Master Response 3.1, Fish Protection, regarding the State Water Board's use of SalSim, and the acknowledgement of limitations of the model. Please see Master Response 3.2, Surface Water Analyses and Modeling, regarding use of the HEC-5Q temperature model in the SED.
1344	323	[From ATT17:ATT3:] June flows. (Slides 13-14) In discussing Chinook salmon migration during June, CDFW references the work of Dr.	This comment is made in response to another entities' comments on the draft SED. Please refer to the index of commenters in Volume 3 to locate the letter number(s) of interest to review responses to comments submitted by other entities within the comment period on the 2016 Recirculated Draft SED. This comment refers to CDFW's testimony that was given as a part of a joint presentation at the January 3,

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		Sturrock and Dr. Johnson as justification for June flows. It is important to note that this work looked at the relative contributions to escapement of fry, parr, and smolt outmigrants. A smolt migrating on May 31 is not a different lifestage than a smolt migrating on June 1 or June 15 -- they are all smolts. The work referenced by CDFW did not evaluate the relative success or contributions of smolts migrating in May vs. smolts migrating in June. Further, CDFW fails to recognize that late-fall run, if present in the San Joaquin Basin, migrate primarily as yearlings, not later in the spring (Moyle 2002, Fisher 1994). There have been few instances of fry captured in May or yearlings during the spring that would be consistent with the timing of a late-fall run, suggesting that some late-fall run may stray from the Sacramento Basin. There is not a distinct run of late-fall run Chinook salmon in the San Joaquin Basin as evidenced by weir and rotary screw trap monitoring on the Stanislaus and Tuolumne rivers. It should be further noted that, while CDFW recognizes late-fall run as a unique lifehistory strategy, Central Valley fall and late-fall run Chinook salmon are a single ESU. CDFW chose the very wet year of 2011 as an example of smolts leaving in June when flow is provided. This was a year when flows at Vernalis were greater than 20,000 cfs from January through April, straining levees and jeopardizing public safety. Flows decreased to approximately 10,000 cfs during June. Under the SED base case this flow occurred 13% of the time and the SWRCB's modeling shows no increase in the frequency of occurrence of this flow under the 40% unimpaired flow scenario (Table 19-27). Thus, the example is not representative of conditions that may be expected as a result of implementation of the SWRCB's plan. The second example of June outmigration provided by CDFW is 1999 when June flows at Vernalis were approximately 3,000 cfs. During this year 17.4% of smolts passed Mossdale during June. In contrast, at a similar flow of approximately 2,800 cfs at Vernalis during June 2000, only 2.9% of smolts migrated past Mossdale during June. Also, at a higher June flow of approximately 3,700 cfs at Vernalis during 1996, only 5.7% of smolts passed Mossdale during June. In the text of the slide showing June flows and estimated daily abundance of juvenile salmon at Mossdale during 1999, CDFW also claims that more flow equals more juvenile salmon entering and exiting the Delta and more adult salmon production. That is not what this slide shows. This slide only shows the number of salmon that entered the Delta during a single year. It provides no information on the number of salmon from the San Joaquin River that exited the Delta or the number of adult salmon produced, nor does it provide any information from other years to put this single year in context.	2017 hearing. The comment refers specifically to slides 14 and 15, not 13 and 14 as stated. Please refer to Master Response 3.1, Fish protection, regarding the need for higher and more variable flow during the February through June time frame and a description of findings from supporting studies, including Sturrock et al. (2015). According to the authors, all migratory phenotypes (fry, parr, and smolt) of the outmigrating population February–June contributed to the returning adult population. Furthermore, providing flow to manage and conserve life history diversity within this time period through the expression of all three phenotypes is necessary to support resilient salmon populations. Although Central Valley fall-run and late fall-run Chinook salmon are considered races under a single ESU, CDFW recognizes late-fall run as a unique life history strategy and is investigating the genetic relationship of this run with other runs in the Central Valley (Moyle et al. 2015). While the historic distribution of late fall-run Chinook salmon is not well documented, there is some evidence that they once spawned in the San Joaquin River in the Friant region and in other large San Joaquin river tributaries (Yoshiyama et al. 1998). The habitat requirements of late fall-run Chinook are presumably similar to other Central Valley Chinook salmon runs (Moyle et al. 2015), meaning that the migratory functions provided by river flows, cool water, and migratory corridors could also benefit co-occurring migrating late fall-run Chinook salmon. Although flows in the 10,000 cfs range would not occur more often than under baseline conditions, there are many other flows meaningful to salmonids, with corresponding benefits, that would occur with greater frequency under the plan amendments. For instance, Table 19-27 also shows significant increases in the expected percent change under LSJR alternative 3 between 2,000 cfs and 6,000 cfs. Please refer to Master Response 3.1, Fish Protection, regarding the importance of June flow for temperature improvements, and reductions in harmful and lethal temperatures under the plan amendments. The slide showing year 1999 is a simplistic representation for an example year of the importance of June flows on the survival of juvenile salmonids. As described in Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, scientific evidence indicates that reductions in flows and alterations to the flow regime in the SJR Basin resulting from water development over the past several decades have negatively affected fish and wildlife beneficial uses. See Section 3.6 for a summary of studies that examine the relationship between flow and fall-run Chinook salmon population abundance in the SJR Basin. Please also refer to Master Response 3.1 for a discussion of the current trend in fish decline and the need for higher and more variable flows to promote recovery.
1344	324	[From ATT17:ATT3:] Is flow important? (Slides 15-16) The argument is not whether flow is important -- it is. The question is how do fish respond to the volume of water and shaping of that volume, and to non-flow measures. Fortunately, ongoing, long-term monitoring efforts in the San Joaquin Basin provide information to assess fish response to past, current, and future management actions. Unfortunately, this wealth of knowledge was underutilized or ignored in the SED, and CDFW often ignores or	Please refer to Master Response 2.1, Amendments to the Water Quality Control Plan, for responses to comments and additional information regarding the scientific justification for the LSJR plan amendments, biological goals, the STM Working Group, and the San Joaquin Monitoring and Evaluation Program. Please see Master Response 2.2, Adaptive Implementation, for responses to comments and additional information regarding the STM Working Group, and the processes to develop and use information to inform adaptive management, including flow shaping and shifting.

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		interprets the data without the appropriate context. On slide 6 of the presentation, Mr. Marston cites to the importance of monitoring, but the presentation failed to give any examples of what that means, how existing monitoring programs may be used as a baseline against which to measure progress, or examples of what new monitoring may be needed. This is of particular concern given the approach used by CDFW to support its claim that the increase in recent escapement to the Stanislaus River is due to increased flows required by the 2009 Biological Opinion. Escapement reflects factors influencing survival throughout the entire lifecycle. Chinook salmon spend about 4-7 months in freshwater from the time eggs are deposited until juveniles migrate to the ocean (Fisher 1994). A salmon returning at a typical 3 years of age has spent roughly 80% of its life in the ocean.	Please see Master Response 3.1, Fish Protection, for responses to comments regarding benefits of the plan amendments for fish.
1344	325	[From ATT17:ATT3:] Is flow important? (Slides 15-16) One factor that CDFW fails to acknowledge in its assessment of the importance of flow is the impact of excessive growth of water hyacinth in the San Joaquin and Tuolumne rivers on adult upstream migration in 2014 and 2015. Analyses of aerial images indicated that 11.7% of the migration corridor between Vernalis and the Tuolumne River weir was blocked by rafts of water hyacinth in 2014, and this increased to 12.5% in 2015 (TID/MID 2016). There was a clear path to the Stanislaus River, and the growth of water hyacinth likely detoured fish from migrating to the Tuolumne and Merced Rivers. On that note, it is also not clear why CDFW did not consider the Merced River in its assessment.	Please see response to Comment 1344-285.
1344	326	[From ATT17:ATT3:] Is flow important? (Slides 15-16) The claim made by CDFW implies that spring flows resulted in increased juvenile production from the Stanislaus. Rotary screw trap monitoring has been conducted in the Stanislaus River to estimate juvenile production, including before and after implementation of flow measures. Rotary screw trap monitoring at Caswell State Park (RM 8.6) provides a direct measure of trends in the number of juvenile salmon exiting the Stanislaus River annually since 1998 (CFS 2016). It is clear from this data that the number of juveniles exiting the Stanislaus after implementation of the flows required by the Biological Opinion have not increased (Figure 1 [see ATT17:ATT3:ATT1]). If anything, abundance decreased. CDFW presents estimates of natural production based on otoliths and carcass survey estimates (slide 15) or weir counts (slide 16). It is unclear what data were used as the Stanislaus River otolith study looked at samples escapement years 2001-2006 (Sturrock et al 2015), and the Tuolumne study (Sturrock and Johnson 2014) included otoliths from escapement years 2000-2006 and 2010-2012, yet estimates of natural production are provided for each stream from 1995-2015. Using the available otolith data we attempted to reproduce CDFW's estimates and found notable inconsistencies. For example, otoliths examined in the Tuolumne study from the 2011 escapement indicated that 85.7% of unmarked salmon were of hatchery origin (Sturrock and Johnson 2014). Using this with the weir counts of 1,442 marked and 1,375 unmarked salmon (Cuthbert et al 2012) yields an	This comment responds to CDFW's comments made during their presentation at the public hearing on the 2016 Recirculated Draft SED. For the full context of CDFW's comments and a complete response to those remarks, please refer to the index of commenters in Volume 3; the material from the public hearing will be identified by the person's name and is assigned a letter number. Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, and Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, provide the scientific justification for providing higher and more variable flow during the February 1 through June 30 time period. See Appendix C, Section 3.6, for an analysis of flow effects on fish survival and abundance. Studies conducted more recently also show the positive benefits of flow (e.g., Sturrock et al. 2015; SWRCB 2017; TID and MID 2013, USFWS 2014; Zueg et al. 2014). Please see Master Response 3.1, Fish Protection, regarding the use of best available science, the unimpaired flow approach and benefits thereof, and the current pattern of fish decline and the need for increased flow. Please see Chapter 7, Aquatic Biological Resources, Section 7.2.2, Reservoirs, Tributaries, and LSJR, for a description of the environmental setting for the Stanislaus and Tuolumne Rivers, including recognition of the dominance of hatchery fish that stray from other tributaries. The California Hatchery Scientific Review Group has recommended specific standards and guidelines to reduce the influence of hatchery practices on natural-origin salmonid populations by altering marking\tagging strategies to identify hatchery fish, and release practices to reduce straying. See Master Response 3.1 for more information regarding the role of hatcheries.

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		estimated natural production of 197 salmon on the Tuolumne River in 2011 (Table 1 [see ATT17:ATT3:ATT2]). This differs greatly from what appears to be about 750 in slide 16 of CDFW's presentation. Another method to estimate natural production uses coded wire tags recovered on the spawning grounds. Recent improvements to this method include the Constant Fractional Marking Program which was initiated in 2007 to provide more reliable estimates of natural production of Central Valley salmon. Only two reports containing estimates of hatchery and natural production have been released by the CFM for the 2010 and 2011 escapement years. With 2010 representing partial implementation as 4 year old fish were not subject to CFM, it was estimated that 50% of the escapement to the Stanislaus and 49% of the escapement to the Tuolumne were of hatchery origin (Kormos et al 2012). During 2011, the first year in which all returns would have been subject to CFM, the estimates increased to 83% on the Stanislaus and 73% on the Tuolumne (Palmer-Zwahlen and Kormos 2013). During 2012, the estimates were 83% on the Stanislaus and 36% on the Tuolumne (Palmer-Zwahlen and Kormos 2015). Using these numbers in conjunction with the weir counts and carcass surveys, we were able to roughly reproduce the results presented by CDFW in slides 15 and 16 for 2010 and 2011, but not for 2012. It is possible that CDFW used a mix of CWT recovery and otolith data to arrive at the estimates presented. The data used to generate the estimates should be provided by CDFW to support the analysis. Some increase in naturally produced individuals might be expected in 2015 and 2016 resulting from an unusually high number of outmigrants from the Stanislaus River during 2013. However, available data on recent hatchery release practices and the proportion of the escapement to the Stanislaus that was ad-clipped (indicating hatchery origin) in 2015 and 2016 suggest otherwise. During 2015 and 2016, 26% of Chinook salmon passing the Stanislaus River weir were ad-clipped indicating hatchery origin. This means that 26% were known hatchery fish. Since only a fraction of hatchery production is marked, one must look at the proportions of hatchery production released without marks, and either otoliths or coded wire tags recovered on the spawning grounds to quantify the proportion of the unmarked fish that are of hatchery or natural origin. Coded wire tag recovery data is not yet available in the RMIS database for the 2015 or 2016 spawning runs, and we have not seen any results of otolith read. However, it is notable that during brood years (BY) 2012 and 2013, 23% and 26% of the juvenile salmon released from the Merced River Hatchery (MRH) were ad-clipped (Table 2 [see ATT17:ATT3:ATT3]). As most fish return at 2-4 years of age (Fisher 1994), the large escapement to the Stanislaus River during 2015 corresponds to production from BY 2011 -- BY 2013. Production from MRH was low in BY 2011 (262,108) relative to the 1.4 million in BY 2012. In addition, the relatively small number of fish released from BY 2011 were released in the Merced River whereas the much greater production from BY 2012 were trucked to the western edge of the Delta (mostly Jersey Point) and presumably had much better survival (and a higher rate of straying). For the purpose of example, consider the comparison in Table 3 [ATT17:ATT3:ATT4] which begins with the number of juveniles released from MRH and hypothetical survival rates to the Delta. The small number produced in BY 2011 were primarily released on site and had to migrate through the Merced River and San Joaquin rivers, and the Delta. The example assumes 10% survival during each of these three	

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		segments. In contrast, the 1.4 million juveniles produced at MRH in BY 2012, more than 6 times the BY 2011 production, were trucked to a point 160 miles downstream, bypassing the Merced River, San Joaquin River, and Delta segments. This results in only a few hundred MRH salmon exiting the Delta from BY 2011 compared to the 1.4 million in BY 2012. This, combined with the proportions of hatchery production tagged at release, and the proportion of tagged fish observed in the weir counts, suggests a high likelihood that most of the 2015 Stanislaus River escapement was comprised of hatchery fish. During BY 2012-2014 approximately 1 million to 1.5 million juvenile salmon were produced at MRH and released far downstream in the Delta, increasing the odds of straying into other basins such as the Stanislaus River. All returns in 2016 would have been from these years. The proportion of ad-clipped fish in the Stanislaus River in 2016 was 26%, quite similar to the 23%-27% released from MRH, suggesting that the majority of the escapement to the Stanislaus River was also of hatchery origin in 2016.	
1344	327	[ATT17:ATT3:ATT1: Figure 1. Annual abundance of juvenile Chinook salmon in the Stanislaus River at Caswell, 1998-2015. (Source: CFS 2016)]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	328	[ATT17:ATT3:ATT2: Table 1. Estimated numbers of hatchery and natural produced salmon in the 2011 Tuolumne River escapement based on weir counts and otoliths. Sources: Cuthbert et al 2012 and Sturrock and Johnson 2014)]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	329	[ATT17:ATT3:ATT3: Table 2. Summary of releases from Merced River Hatchery during brood years 2010-2014. (Source: Regional Mark Processing Center online RMIS database.)]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	330	[ATT17:ATT3:ATT4: Table 3. Example comparison of differing release strategies and level of production from MRH during BY 2011 and BY 2012.]	The commenter is providing this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	331	[ATT17:ATT4: Attachment D-4: Review of NMFS-UCD Presentation -- Salmon life history portfolios in a regulated river (Bay Delta Phase 1 Hearing, January 3, 2017). Prepared by Stillwater Sciences for Turlock Irrigation District and Modesto Irrigation District. Dated February 27, 2017.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	332	[From ATT17:ATT4:] Slides 2-3. What do we already know? While we generally agree with the life history diversity argument and that early fry dispersal is evident in the LJSR, it should be noted that the generalization attributed to Williams (2006) is not based on information from LSJR tributaries. Early fry dispersal does not consistently result in successful Delta emigration or adult returns.	This comment and information presented in the referenced slides by NOAA and UC Davis at the November 29, 2016 hearing do not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the SED. While current scientific information suggests that fry contributions to adult escapement are relatively low and variable, the benefits of the plan amendments are attributed to the responses of multiple migratory phenotypes (fry, parr, and smolts) to higher and more variable flows throughout the spring emigration period (February thorugh June). Please refer to the Scientific Basis Report (Appendix C); Chapter 19 of the SED, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30; and Master Response 3.1, Fish Protection, for more information regarding the need for higher and more variable flows, and the effects of a more natural flow regime on emigration success and life history diversity of juvenile salmonids.
1344	333	[From ATT17:ATT4:] Slide 4. Life history diversity. On the Stanislaus River, RST monitoring at the Oakdale location (RM 31) shows large fry passage from spawning locations farther upstream, regardless of flow magnitude or variability. This is also seen on the Tuolumne River, where RST passage at	This comment and information presented in the referenced slide by NOAA and UC Davis at the November 29, 2016 hearing do not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the SED. While current scientific information suggests that fry contributions to adult escapement are relatively low and variable, the benefits of the plan amendments are attributed to the responses of multiple migratory phenotypes (fry, parr, and smolts) to higher and more

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		Waterford (RM 29.8) between 2006-2014 also shows large numbers of fry dispersing in all Water Year (WY) types. [Footnote 1: CDWR Bulletin 120 estimates unimpaired runoff as TAF for the San Joaquin River and tributaries. The San Joaquin Basin 60-20-20 Index classifies water years (October 1 through September 30) into five basic types (C=Critical, D=Dry, BN=Below Normal, AN=Above Normal, W=Wet)] However, survival in the lower portions of both rivers is sensitive to both flow and turbidity which affect predation rates. Interestingly, although higher fry survival under high flows is shown in the Tuolumne River by increased RST passage at Grayson (RM 5.2), comparable otolith data from the lower Tuolumne (Stillwater Sciences 2016) shows that very few if any fry-sized emigrants are represented in subsequent escapements, regardless of WY type or discharge level.	variable flows throughout the spring emigration period (February thorugh June). Please refer to the Scientific Basis Report (Appendix C); Chapter 19 of the SED, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30; and Master Response 3.1, Fish Protection, for more information regarding the need for higher and more variable flows, and the effects of a more natural flow regime on emigration success and life history diversity of juvenile salmonids. With regard to the results of the Chinook Salmon Otolith Study (Stillwater Sciences 2016) referenced by the commenter, the commenter failed to incude information from this study which clarifies and provides context for the study findings with regard to the low representation of early emigrating fry contributions to subsequent escapement. According the Stillwater Sciences (2016) "Based upon the limited number of sampling years and otoliths available for analysis by this study, it is apparent that spawning populations in the Tuolumne River exhibit low representation of early emigrating fry, with zero contributions in three out of five outmigration years analyzed and a maximum contribution of 5% in WY 2000. However, a 5% fry contribution in years when escapement on the order of 5,000–10,000 returning adults is a non-negligible number of fish (250–500 spawners) and may be on par with total spawner numbers in low escapement years." Furthermore, the authors indicate that further study is needed: "As previously stated, the conclusions of this study are based upon a relatively small otolith sample size (n=31) for spawners originating from below normal/dry WY types as compared to samples (n=238) from the above normal/wet WY types. Additional analysis of adult otoliths from individuals emigrating under current Delta flow management for both above normal/wet and below normal/dry WY types in the future may help better discern whether variations in spring discharge are associated with greater or lower juvenile size class representation in subsequent spawning populations."
1344	334	[From ATT17:ATT4:] Slide 6: Flow vs Survival. As shown in historical RST data from the Stanislaus as well as Tuolumne River, flow magnitude during emigration results in higher relative passage between the upstream and downstream RSTs, allowing for the development of flow vs survival regressions similar to the one shown on Slide 6. It should be noted however, that although the two plots showing discharge magnitude and discharge variance explaining survival, since discharge variance generally increases with increasing discharge, only the discharge magnitude vs survival plot is necessary to make the case for the importance of flow.	This comment and information presented in the referenced slide by NOAA and UC Davis at the November 29, 2016 hearing do not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the SED.
1344	335	[From ATT17:ATT4:] Slides 7-8. Flow vs Escapement. Regressions of GrandTab (CDFW 2016) escapement vs lagged flow shows little if any relationship in Sacramento River tributaries but does partially explains variations in escapement in the LSJR tributaries. For example, 48% of the variation in escapement is explained by annual discharge 3 years earlier on the Tuolumne River from 1971-2013. Interestingly, however, since implementation of increased outmigration flows on the Tuolumne River since 1996, the escapement vs this "lagged flow" relationship from 1997-2013 explains only 26% of annual escapement. This suggests that recent increases in spring pulse flows under the FERC process as well as the Vernalis Adaptive Management Program (VAMP) have coincided with a declining and weakening relationship between tributary flow and subsequent escapement. Similar data exploration for the Stanislaus River shows the relationship between lagged discharge since the completion of New Melones Dam (ca 1978) explains only 33% of the	The commenter does not explain the methodology used to establish the relationships shown in Figures 1 and 2, so the State Water Board cannot respond directly to the scientific basis for these figures. However, multiple sources of primary literature illustrate the positive relationship between flow and survival. See Appendix C, Section 3.6, for a review of flow effects on fish survival and abundance. Appendix C was peer reviewed in November 2011, and among the peer reviews were experts in aquatic ecology and fishery science specific to salmonids and steelhead. The peer reviewers assessed the report regarding the scientific knowledge (including the relationships presented in Section 3.6), methods, and practices, and indicated an overall agreement with the methodology in the report. Please also see Master Response 3.1, Fish Protection, regarding the peer review of Appendix C, and the science supporting the need for increased flow. The relationships developed from CWT data produced from VAMP were independently peer reviewed in 2010 by the Delta Science Program. The peer reviewers agreed, that in general, increased flows have a positive effect on SJR fall-run Chinook salmon. See Appendix C, Section 3.6.2, VAMP Review, for more information.

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		long term escapement since 1980. More recently, however, even with the large flow increases coinciding with the implementation of the Vernalis Adaptive Management Plan (VAMP) [Footnote 2: Adopted in 2000 as part of SWRCB Decision 1641, the Vernalis Adaptive Management Plan (VAMP) provided a steady 31-day pulse flow at the Vernalis (VNS) gage on the San Joaquin River during the months of April and May, along with a corresponding reduction in Delta exports from the SWP and CVP.] in 2000 as well as more recent flow increases as a result of the Central Valley Project/State Water Project Biological Opinions (BiOps) in 2010, lagged discharge now has no relationship (p=0.68, R(squared)=0.015) with recent escapement on the Stanislaus River (i.e., does not explain any of the variation).	
1344	336	[ATT17:ATT4:ATT1: Figure 1. Graphs showing relationship between Tuolumne River annual discharge and subsequent Chinook salmon escapement (t+3 yrs) is growing weaker since implementation of increased pulse flows in 1996.]	The commenter is providing this attachment for reference purposes in support of their comments. Please refer to response to comment 1344-335.
1344	337	[ATT17:ATT4:ATT2: Figure 2. Graphs showing relationship between Stanislaus River annual discharge and subsequent Chinook salmon escapement (t+3 yrs) is no longer apparent since adoption of increased spring pulse flows under VAMP (2000) and further increases with implementation of the CVP/SWP BiOps (2010).]	The commenter is providing this attachment for reference purposes in support of their comments. Please refer to response to comment 1344-335.
1344	338	[From ATT17:ATT4:] Slides 16-17. Size Composition. As with the Stanislaus RST data, Tuolumne River RST data show relatively higher proportions of fry emigrating in Wetter WY types, presumably related to reduced predation rates under these conditions. However, otolith data from the lower Tuolumne (Stillwater Sciences 2016) shows that few if any fry-sized emigrants are represented in subsequent escapements, regardless of WY type or discharge level.	Please refer to response to comment 1344-332 and 1344-333.
1344	339	[From ATT17:ATT4:] Slides 18-19. Juvenile Productivity (Fry/Parr/Smolt per spawner). For the Stanislaus River, we would expect that increased survival with flow would increase juvenile productivity metrics as a result of increased survival between the Oakdale and Caswell RSTs. On the Tuolumne River, historical seining indices (e.g., fry/spawner indices from seine and spawner data)(TID/MID 2005), more recent analyses of RST data, as well as Tuolumne River Chinook (TRCh) population modeling results suggest similar increases in juvenile productivity metrics (Stillwater Sciences 2013). We would require additional information to examine the inferences regarding carrying capacity and density dependence. On a technical level, the authors seem to assume that density dependence is important by selecting non-linear curves fit to the data shown. While the fry curve is superficially plausible, it is unclear whether conventional statistical criteria (e.g., AIC) would justify the non-linear model. Since juvenile rearing densities, growth rates, or other indications of density dependent factors on the Stanislaus River appear to be unexamined by Sturrock et al (in prep), the inference regarding carrying capacity should be compared to other explanations such as predation losses which would also be proportional to flow.	This comment and the information presented in the referenced slide by NOAA and UC Davis at the November 29, 2016 hearing do not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the SED. The information presented in the referenced slide by NOAA and UC Davis at the November 29, 2016 hearing supports the season and averaging period of the plan amendments, and the need for higher and more variable flows during the spring. As explained in Appendix C, higher and more variable flows during the spring are anticipated to improve conditions for fish, and other ecosystem attributes including, but not limited to, 1) native fish communities; 2) food web; 3) habitat; 4) geomorphic processes; 5) temperature; and 6) water quality. Chapter 19 supplements the information contained in Appendix C by quantitatively evaluating the benefits of the plan amendments for the LSJR flow objectives in terms of potentially available cold water and floodplain habitats, and associated population implications to native salmonids.Please also review Master Response 3.1, Fish Protection, for more information regarding predation, the need for higher and more variable flows, the effects that higher flows during the spring have on the survival of juvenile salmonids, and anticipated benefits from the plan amendments. As described in Appendix K, Revised Water Quality Control Plan, biological goals will be developed and will inform adaptive implementation. Indicators of viability such as population abundance, spatial extent, distribution, structure, genetic life history diversity, and productivity will be used as biological goals to evaluate the effectiveness of the program of implementation and inform potential changes to implementation based on changing conditions. Development of these indicators will facilitate the evaluation

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			of the changing demographis of populations, and will contribute to our understanding of density-dependent mortality and carrying capacity in each of the tributaries. Please refer to Master Response 3.1, Fish Protection, for more information on the importance of biological goals for tracking the status of populations. Please also see Master Response 2.1, Amendments to the Water Quality Control Plan, for clarification regarding development of biological goals.
1344	340	[From ATT17:ATT4:] Slides 20-28. Rearing location and time to ocean entry. We have no comment on the Methods shown or Stanislaus River results. However, in examining timing and estimated sizes at emigration from otolith studies on the Tuolumne River, it was determined that early fry emigrants in Wet years (particularly in WY 2000) typically spent longer rearing in the Delta than for parr- and smolt-sized fish, but that the total time of development from formation of otolith core to ocean entry for juvenile salmonids was relatively constant (Stillwater Sciences 2016). Size-standardized estimated growth rates from this study were generally greater for fish that reared in the Tuolumne River as compared with fish that reared in the Delta, but the pattern was not consistently statistically distinguishable between the two rearing locations.	This comment and the information presented in the referenced slide by NOAA and UC Davis at the November 29, 2016 hearing do not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the SED.
1344	341	[From ATT17:ATT4:] Slides 29-31. Who Survives. Of the five outmigration years examined in otolith studies of the Tuolumne River (1998 [Wet], 1999 [AN], 2000 [AN], 2003 [BN], and 2009 [BN]), there were zero fry contributions to subsequent escapement in three out of five outmigration years analyzed and a maximum fry contribution of 5% for fish emigrating in WY 2000 (Stillwater Sciences 2016). While salmon do express multiple emigration life history strategies, findings on the Tuolumne suggest that fry emigrant contributions are low under a range of Wet to Dry year conditions and apparently not as important a contribution as found in the 7-yr Stanislaus River dataset.	Please see response to comment 1344-332 and 1344-333.
1344	342	[From ATT17:ATT4:] Slides 32-33. Flow Magnitude and Variability since New Melones. It is accepted that dam's primary function in reducing flooding magnitude has consequences upon long-term geomorphic processes as well as flow variability affecting salmonids on shorter biological time scales. However, as discussed above under the flow vs escapement discussion (Slides 7-8), the explanatory power of flow during emigration upon the variations in future escapements appears to be falling in the past 15 years. On the Stanislaus River the statistical relationship since 2000 is negative indicating that antecedent flow has no relationship with the recent escapement increases on the Stanislaus River. This suggests that the other factors not explored by Sturrock et al. (in prep.) such as Delta and ocean conditions may have a much larger effect on salmon escapement than tributary flow prescriptions.	The information presented in the referenced slides by NOAA and UC Davis at the November 29, 2016 hearing supports the need for a greater magnitude of flows and the establishment of flow objective based on a percentage of unimpaired flow which is a component of the plan amendments. Refer to response to comment 1344-335 regarding flow-survival relationships. While aquatic resources in the SJR Basin have been adversely affected by numerous factors, flow during the spring migratory period of February-June is a primary limiting factor (NMFS 2014). Also refer to response to comment 1344-320 regarding the importance of flows, and flows being recognized as a primary limiting factor. As such, the LSJR flow objective is intended to reasonably protect fish and wildlife by restoring more natural habitat conditions for native fish species by increasing flows. The positive effects from the higher flow of the plan amendments (such as reduced temperatures) will also propagate downstream into the Delta. Please refer to Master Response 3.1, Fish Protection, for information regarding the need for higher and more variable flows, the effects that higher flows during the February-June have on the survival of juvenile salmonids, and the anticipated benefits from the plan amendments. Changing ocean conditions is beyond the scope of the plan amendments. The State Water Board recognizes that while ocean conditions affect salmonid populations, a limiting factor in the freshwater environment (which is under the purview of the State Water Board) of salmonid life history is flow during the spring

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			period of February through June (see above). As described in the Executive Summary a goal of the plan amendments is to "Maintain inflow conditions from the SJR Watershed sufficient to support and maintain the natural production of viable native fish populations migrating through the Delta."
1344	343	[From ATT17:ATT4:] Slide 34. Flow Magnitude and Variability effects. This summary slide makes several broad statements not readily tied to the data presented. We offer the following discussion of the environmental considerations discussed: * Carrying Capacity. Separate from discussions of floodplain activation flows and their duration, flow magnitude affects instream habitat availability for salmonid juveniles in that increased flows will generally result in greater depths and velocities within main channel habitats. Detailed comparison of longitudinal fish distribution from bi weekly seining data from the nearby Tuolumne River generally shows a pattern of downstream displacement in wetter WY types which was attributed as passive displacement of emergent fry (Stillwater Sciences 2013). Interpreting the higher fry RST passage at higher flows on the Stanislaus River as carrying capacity limitation would suggest that overall habitat is somehow limiting at high flows. Conversely, the relatively lower seasonal fry passage at low flows could also be interpreted as higher carrying capacity at lower flows than higher flows. For example, typical survey data used to develop habitat suitability criteria for IFIM studies generally show higher fish densities at low discharges than for higher discharges. Although these are simplified arguments and do not take predation effects into account but it is clear that additional spatially explicit information is needed on the Stanislaus River to properly attribute the underlying mechanisms between increasing flow and juvenile production. * Reduced life history diversity. With regard to early fry emigration opportunities and downstream rearing locations, the otolith study on the Tuolumne River (Stillwater Sciences 2016) showed a large predominance of adult spawners that had originally emigrated as smolts and almost no representation of emigrant fry in the subsequent spawner population. Given the high rates of predation (Grossman 2016) and near total absence of tidally influenced wetland habitats in the Delta (Whipple et al 2012) recommendations for increased flows and variability to encourage multiple rearing and emigration pathways does not appear to be an effective strategy. * Migration Cues. With regard to flow as a migration cues, population modeling on the Tuolumne River including RST passage analyses shows that, smolt emigration appears to be related to size and developmental thresholds rather than flow related emigration cues (Stillwater Sciences 2013). For this reason, other than passive fry displacement with flow, flow variability has little effect upon overall emigration timing for fish that are not at the necessary size thresholds for smoltification. Although emigration timing varies from year to year primarily due to changes in spawner timing, the predominant April-May peak in smolt emigration from Tuolumne is largely a reflection of the developmental timing following the November peak in spawning activity (Stillwater Sciences 2013). For the Tuolumne River Chinook salmon, as well as other LSJR tributary populations, fall-run timing occurs later in the year than for Sacramento River tributary populations (Williams 2006) and it is unlikely that this peak will change substantially under a variable flow regime without changes in spawning timing. As discussed previously, encouraging downstream rearing of early emigrating fry may result in heavy predation losses and lower subsequent	The information presented in the referenced slide by NOAA and UC Davis at the November 29, 2016 hearing supports the need for higher and more variables flows which will be facilitated by the establishment of a flow objective based on a percentage of unimpaired flow. Please refer to Master Response 3.1, Fish Protection, regarding the current fish decline and need for increased and more variable flows, the discussion regarding weighted usable area and the need for an assessment of more than just in-channel physical habitat availability, and discussions regarding the importance of the natural hydrograph during February through June as a basis for improving the seasonal flow and temperature conditions for juvenile salmonids. Also see Appendix C, Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives, Section 3, Scientific Basis for Developing Alternate San Joaquin River Flow Objectives, for discussions of the flow needs of San Joaquin Basin salmonids, the ecological functions supported by a more natural flow regime, and the expected benefits to fish populations from implementation of the plan amendments. As described in Master Response 3.1, Sturrock et al. (2015) provided evidence that fry migrants can contribute significantly to adult spawning population approximately 2.5 years later. Refer to Master Response 3.1, regarding the importance of establishing a flow regime based on the unimpaired flow hydrograph, the importance of higher, more variable flows during the February through June timeframe, and the consideration of predation in the SED. Also refer to Chapter 19, Analyses of Benefits to Native Fish Populations from Increased Flow between February 1 and June 30, for discussions of benefits expected from June flows, which include improved water temperatures and opportunities for successful emigration. Master Response 3.1 expands upon the importance of June flows discussion, presents results regarding how the plan amendments reduce harmful and lethal temperatures, and discusses the presence of salmon and steelhead in June. Refer to response to comment 1344-333 regarding the findings of the study the commenter refers to as Stillwater Sciences 2016. Also refer to response to comment 1344-339 regarding biological goals contributing to the understanding of carrying capacity. According to public comments on the District's draft license application, NMFS disagreed with and questioned several aspects of the Chinook Salmon Population Model (refered to by the commenter as Stillwater Sciences 2013), and the studies and literature that pertain to model development, application and preliminary conclusions.

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		escapement. While flow increases in late May and early June might possibly benefit the few remaining smolts emigrating at that time, since the vast majority have emigrated by this time the production benefits will likely not be represented in subsequent escapement.	
1344	344	[From ATT17:ATT4:] Slide 35. Habitat Restoration. Although we generally concur that habitat restoration will benefit rearing conditions for salmonids in the LSJR tributaries, such efforts should be undertaken only after careful consideration of factors limiting individual life stages.	The information presented in the referenced slide by NOAA and UC Davis at the November 29, 2016 hearing supports the element of the plan amendments that includes recommendations of non-flow measures. The State Water Board recognizes that non-flow actions must be part of the overall effort to comprehensively address ecosystem needs in the Delta and tributaries, as a whole, and that results from the implementation of such actions can be used to inform adaptive implementation decisions under the plan amendments (see Master Response 5.2, Incorporation of Non-Flow Measures and Non-Flow Measure Analyses, for more information). For this reason, the State Water Board recommends and incorporates a range of non-flow actions complementary to the flow objectives for the reasonable protection of fish and wildlife in Appendix K, Revised Water Quality Control Plan. Among these recommendations are actions to restore physical habitat including floodplain and habitat restoration. Chapter 16, Section 16.3, Lower San Joaquin River Alternatives – Non-Flow Measures, includes a description of these actions and their associated cost and potential environmental impacts. Please refer to Master Response 3.1, Fish Protection, for information regarding the need for higher and more variable flows, the effects that higher flows during the spring have on the survival of juvenile salmonids, and anticipated benefits from the plan amendments. The information presented by the commenter does not conflict with or contradict the key scientific information used to support the impact determinations or benefit assessments in the SED.
1344	345	[From ATT17:ATT4:] Slide 36. Key Messages. Comments by Summary points below: * Life History Diversity. While contributions vary among years, they also appear to vary among tributaries and it appears that fry emigration strategies may not be viable for the Tuolumne River and likely (not examined here) in the Merced River. Improving the viability of all life history strategies should include a range of measures to improve emigration survival, particularly in the Delta. Missing from the life history diversity discussion is an analysis of the influence of hatchery origin spawners upon life history diversity of naturally produced fish. More simply, because 75-100% of returning fish to the Stanislaus and other LSJR tributaries appear to be of hatchery origin in recent years, the validity and strength of apparent rearing or emigration flow relationships should be carefully re-examined considering only progeny of natural origin fish. * Early Fry Dispersal and Carrying Capacity. As shown by the RST data presented, flow increases have been shown to improve tributary outmigrant survival of all juvenile life stages. We generally concur that improvements in LSJR and Delta conditions through predator control, wetland and other habitat improvements may improve the viability of an early fry emigration strategy. * Flow and Survival. Although not examined by the presentation, survival through the south Delta appears to be consistently low regardless of flow. For this reason, encouraging early fry dispersal may not result in measurable increases in subsequent returns and it is	The information presented in the referenced slide by NOAA and UC Davis at the November 29, 2016 hearing supports the season and averaging period of the plan amendments, and the need for higher and more variable flows which will be facilitated by the unimpaired flow approach of the plan amendments. Refer to response to comment 1344-320 regarding the importance of flows, and flows being recognized as a primary limiting factor. As such, the LSJR flow objective is intended to reasonably protect fish and wildlife by restoring more natural habitat conditions for native fish species by increasing flows. The positive effects from the higher flow of the plan amendments (such as reduced temperatures) will also propagate downstream into the Delta. Please refer to Master Response 3.1, Fish Protection, for information regarding the need for higher and more variable flows, the effects that higher flows during the February-June have on the survival of juvenile salmonids, and the anticipated benefits from the plan amendments. Also refer to response to comment 1344-333 regarding the findings of the study the commenter refers to as Stillwater Sciences 2016. Also refer to response to comment 1344-335 regarding flow-survival relationships. Also refer to response to comment 1344-339 regarding biological goals contributing to the understanding of carrying capacity. Also refer to response to comment 1344-344 regarding non-flow measures as recommendations in the plan amendments.

Table 4-1. Responses to Comments			
Ltr#	Cmt#	Comment	Response
		likely that measures to improve rearing success to smolt sizes that have greater swimming performance relative to predators will lead to increased population viability.	
1344	346	[ATT18: Appendix E -- "Thermal Performance of Wild Juvenile Oncorhynchus Mykiss in the Lower Tuolumne River: A Case for Local Adjustment to High River Temperatures." Final Report, Don Pedro Project. Prepared for Turlock Irrigation District and Modesto Irrigation District. Dated February 2017.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	347	[ATT19: Appendix F -- "Lower Tuolumne River Floodplain Hydraulic Assessment." Final Report, Don Pedro Project. Prepared for Turlock Irrigation District and Modesto Irrigation District. Prepared by HDR, Inc. and Stillwater Sciences. Dated February 2017.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	348	[ATT20: Appendix G -- Final License Application, Don Pedro Project, FERC No. 2299. April 2014.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	349	[ATT21: Appendix H -- "Chinook Salmon Otolith Study," Final Report, Don Pedro Project. Prepared for Turlock Irrigation District and Modesto Irrigation District. Prepared by Stillwater Sciences. Dated February 2016.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.
1344	350	[ATT22: Appendix I -- "Regional Economic Impact Caused by a Reduction in Irrigation Water Supplied to Turlock Irrigation District and Modesto Irrigation District: Methodology Memorandum." Prepared for Turlock Irrigation District and Modesto Irrigation District. Dated March 2017.]	The commenter provided this attachment for reference purposes in support of their comments. Those comments are addressed in these responses to comments; therefore, no additional response is required.