

Attachment
Save the American River Association
Letter of April 2, 2014 to
Thomas Howard - Executive Director
State Water Resources Control Board

Complaint. Failure of the Bureau of Reclamation to operate the Folsom / Nimbus facilities in a manner that keeps Chinook salmon and steelhead trout that utilize the Lower American River ecosystem “in good condition,” failure to enforce Fish and Game Code Section 5937, and failure to protect the Public Trust.

The Bureau of Reclamation operates the Folsom / Nimbus facilities of the Central Valley Project. Such operations have caused and continue to cause irreparable harm to fish and fish habitat, other Public Trust uses and values of the Lower American River in violation of California Fish and Game Code Section 5937; the California Constitution, Article X, Section 2; Section 401 of the Federal Clean Water Act; and the Public Trust Doctrine.

Background

The headwaters of California’s Public Trust Doctrine and the American River begin at the Sierra crest as springs and rivulets, continuing down slope through several reservoirs including Folsom and Nimbus Reservoirs, to the Sacramento River, the San Francisco Bay-Estuary and the Pacific Ocean. The Public Trust Doctrine provides that certain resources belong to the people and are to be administered by the state for the benefit of the people. The Public Trust Doctrine is a background principle of property law (Lin – 2012). The core principle of the Public Trust Doctrine is that every sovereign government has a property interest in its water, fish and wildlife, held as a trust for the benefit of today’s generations and generations yet born (Wood – 2004). The Public Trust Doctrine, as a back ground principle, predates today’s environmental laws and applies to every water right that impacts trust resources and may, in fact, define or limit the very nature of the right to put water to beneficial use (Klass & Huang - 2009).

The importance of the Public Trust cannot be diluted by treating it as merely another beneficial use under California Constitution Article X, Section 2, coequal with irrigation, power production and municipal water supply. The Public Trust Doctrine occupies an exalted position in any judicial or administrative determination of water resources allocation (Moskovitz -1994).

The people of California in People v. Truckee Lumber Company (116 Cal.397 - 1897) learned that fish within our waters (and the ecosystem that supports them) constitute the most unique species of property commonly designated as wild game, with ownership of that property in the people of the state. This ownership of fish extends to all waters of the state. Protecting water quality of aquatic ecosystems and biodiversity are trust interests covered by the public trust doctrine (Johnson - 1989).

Folsom Dam and Reservoir has a capacity of about 977,000 AF. Folsom and Nimbus Dams and Reservoirs were completed in 1955. The Bureau of Reclamation operates these facilities under a State Water Resources Control Board (State Board) water right permit (Nos11315 and11316) and D-893, issued in 1958. This water right is a usufructuary permit. It is not ownership. Decision 893 allows flow at the mouth of the American River to fall as low as 250 cubic feet per second (cfs) between January through mid September, with a minimum of 500 cfs required between September 15 and December 31. Temperature criteria / water quality objectives were not a part of D-893. One must note, about 785,000 acre –feet of storage was constructed after Folsom / Nimbus facilities were completed. Sacramento Municipal Utility District has at least 393,000 AF and Placer County Water Agency has 344,000 AF of storage. Impacts to aquatic resources resulting from the timing, amount and quality of the water discharged from these reservoirs extend down stream, through the Lower American River, the Sacramento River, to the Delta, to San Francisco Bay and the Pacific Ocean.

California Fish and Game Code Section 5937, in part, reads: *The owner of any dam shall allow sufficient water at all times to pass through the 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.* The “allow to pass at all times sufficient water” is to maintain “in good condition” populations of fish and other aspects of the aquatic ecosystem that may reside, are in transit, or may be planted below the dam. The “in good condition” embodies the chemical, physical, and biological parameters of water, i.e. everything necessary to keep the fish and other components of the aquatic ecosystem healthy and in good condition. Code section 5937 could be called a background principle. Code section 5937 allows for water to be diverted from a stream by a dam so long as the principle of the Trust, the fish resources, associated uses and values remain viable, productive and economically meaningful to the people of the larger community or region (Thomas - 1991). For fish such as Chinook salmon, the esthetic, commercial and recreational fisheries, social and economic values, extend to trust beneficiaries in communities of California’s south central coast, to northern California and into Oregon and Washington.

The people recognize that fish and fish habitat, wildlife and wildlife habitat, water quality, ecosystem protection, swimming, rafting, boating, fishing, other recreational uses and scenic values are beneficial uses of water are assets protected by the Public Trust Doctrine. A review of escapement records reveals the American River supports important fall-run Chinook salmon spawning and nursery habitat historically supporting about 20 to 25 percent of the Sacramento Basin escapement. Such escapement is a measure of the past run success and fish available to the commercial and sport fisheries. Chinook salmon from the American River contribute significantly to the commercial and sport fisheries along the Pacific Coast and to recreational fishing in the lower American River, Sacramento River and Delta. Steelhead, American shad and striped bass support significant sport fisheries in the American River. See **Table 1** for American River Fall-run Chinook Salmon Spawning Escapement numbers 1982 to 2012, and **Table 2** for Natural Spawning escapement numbers, sex ratio and percentage of successful natural spawners for years 2001 to 2012.

The American River Steelhead is listed as threatened under the Federal Endangered Species Act. American River flows contribute to habitat conditions in the Sacramento River and Delta for the winter-run Chinook salmon listed as endangered, the spring-run Chinook salmon and the Delta smelt are listed as threatened. According to well established tenets of conservation biology, species near extinction face increasing risk of continuing to decline or actually become extinct the longer they remain at a depressed population levels. Actions that worsen or just perpetuate the status quo of a listed species greatly reduces their chances to continue to exist and over time the greater the risk of extinction or being extirpated from a river or area (Wood - 2004).

The Lower American River, Nimbus Dam to its confluence with the Sacramento River (about 23 miles) is a resource of extraordinary value. It was added to the State Wild and Scenic River System in 1972 (pursuant to Pub. Res. Code Section 5093.54 (e), and was designated as a Federal Wild and Scenic River in 1981, pursuant to 16 U.S.C. Section 1271 et. seq. The California Department of Fish and Wildlife has authority to manage, control and protect the salmon and steelhead spawning, and nursery areas that occupy state owned land, and the bed and bottom of the American River. This area extends from Nimbus Dam downstream to a point approximately 1 mile downstream of Arden Way, about River Mile 12 (Fish and Game Code Section 1505).

Assets and interests of the Lower American River protected by the Public Trust Doctrine can be summarized as follows:

1. The migration route, adult holding, spawning and nursery areas utilized by Chinook salmon and steelhead, which are held in trust by the State with the management of these resources to benefit the people.
2. Public ownership of the bed and bottoms (spawning gravel, pools and riffles) are subject to the Public Trust for purposes of commerce, navigation and fisheries.
3. A public navigational easement over any privately held lands are covered by navigable waters. The incidents of this easement include boating, swimming, fishing and recreational purposes.
4. Public ownership of the banks and shore lands of the river are subject to the Public Trust for purposes of commerce, navigation, fishery and wildlife needs.
5. Public rights, which have arisen through implied dedication, may include access points, trails to the bank and along the shore since the days of the gold miners and trappers to today's recreationists, fishers, hikers and etc.

Some of the above public rights and easements are under the general control and management of the State Lands Commission. The fish and wildlife resources are under the management of the California Department of Fish and Wildlife. The flow, timing and water quality are under the regulatory control of the State Water Resources Control Board. The day-to-day flow and control of the lower American River is under the management of the Bureau of Reclamation. The American River Parkway is managed by Sacramento County Regional Parks. Public trust duties apply to all sovereigns at federal, state and local levels (Lords - 2008). In addition each trustee bears a duty of loyalty to administer trust assets. Loyalty must flow to present and future beneficiaries of the trust, not to a singular or moneyed interest (Wood -2014).

Discussion

Water is the environment in which fish and other aquatic life must carry on all their life processes. Therefore, healthy and diverse aquatic populations are usually indicative of good stream conditions (water quality, temperature, oxygen and chemical parameters). For healthy and sustainable fish populations to exist, the total aquatic environment and its shore / land interface must be suitable for the desired species. The “good condition” criterion of Fish and Game Code Section 5937 includes, 1) the health of individuals, fish are healthy, free of disease, parasite and etc., and have reasonable growth rates with adequate habitat; 2) diversity and abundance of aquatic populations, diversity of age class, sufficient habitat to support all life stages and support self-sustaining populations; 3) the community, its overall health including co-evolved species and the health of the aquatic ecosystem at several trophic levels. (Moyle, et al. -1998; Putah Creek v. Solano Irrigation District, Sacramento Superior Court No. CV515766, April 8,1996; Cal Trout 1 -1989, and Cal Trout 2 -1990). Maintaining aquatic life in good condition (both the resource and the fishery) through releases from an upstream reservoir is the purpose and intent of Fish and Game Code Section 5937.

The people learned from Audubon (National Audubon Society v. Superior Court Alpine County, (33 Cal. 3d 419, 189 Cal. Rpt. 346 -1983) and its findings that there are guidelines for the State Board to uses to protect the people's aquatic ecosystems, associated resources, uses and values using the Public Trust Doctrine. Professor Mary Wood used the Illinois Central RR v. Illinois to simplify such guidelines. Privatization of Public Trust assets can be allowed where: (1) the grant serves trust purposes “prompting the interests of the public;” and (2) the grant does not ”substantially impair” the public interest in the lands, waters, resources and uses remaining (Wood - 2014).

The Audubon Court clarified the State Board has the affirmative duty to take the Public Trust into account in the planning and allocation of water resources, to protect the Public Trust and is to avoid or minimize any harm to trust resources when ever feasible. From Audubon, the people learned that the Public Trust is not merely another beneficial use under Article X, Section 2, of the State Constitution equal to irrigation, power production and M & I supply, but that the Public Trust Doctrine occupies an exalted position in any judicial or administrative determination of water resource allocation and use and that the State Board has the obligation to continuously supervise

previously issued water right permits. The State Board can review a water right at any time and if the water diversion or use impacts trust resources, the water right can be revoked or its terms and conditions modified to protect trust resources and ecological values. The Audubon Court effectively tied public trust protection to maintaining natural resources for their innate value and swept away the argument that offsite consumptive uses could enjoy parity as “trust interests” (Koehler - 1995).

During the 1977 drought, Mr. Ron Robie, Director of the DWR, (now Appellate Judge), in an article “The Public Interest in Water Rights Administration” asserted the State lacks the power to transfer water in amounts that is necessary to protect the Public Trust (Robie - 1977).

The people learned from the Racanelli 1986 decision (U.S. v. State Water Resources Control Board (227 Cal. Rptr. 161-1986) that the State Board should set water quality standards to protect all beneficial uses of water. The State Board should take a “global perspective” and consider all competing upstream diverters and polluters (past, present and probable future beneficial uses of water) in its water quality planning duties. The State Board can impose water quality standards to protect beneficial uses on all projects upstream of the Delta under its reserved jurisdiction and has a mandate under the Porter – Cologne Act and the Federal Water Pollution Control Act to set water quality standards to protect fish, wildlife and recreational uses of tributaries to and in the Sacramento – San Joaquin Delta Estuary.

The Cal Trout 1 Court recognized that code section 5937 as a limit on the amount of water that can be appropriated from a river or stream. The Cal Trout 2 Court recognized that as a price of continued appropriation of water, an appropriator can be compelled to take reasonable steps (means and measures necessary) to restore flow and protect water quality and fish resources (Cal Trout 2, 218 Cal App 3d, 187 at 210).

In 1990, the State Board reviewed a complaint by California Trout against the Walker River Irrigation District (WRID) and determined that WRID drained Bridgeport Reservoir six times. The 1988 draining resulted in high turbidity and suspended solids that contributed to an extensive fish kill in the East Walker River. At other times elevated water temperature caused by the discharge of solar heated water from Bridgeport Reservoir did not keep fish in East Walker River in good condition. At other times, reduced flow in the winter produced poor quality over wintering habitat for young of the year brown trout. The State Board concluded these negative affects constituted a violation of Fish and Game code section 5937, and that they resulted as a failure of the owners of Bridgeport Dam to keep the fish below the dam in good condition (SWRCB – WR- 90-18, December -1990).

Water temperature has profound effects on various biochemical processes affecting metabolic rates, which in turn affect activities, behavior and growth of salmonid fishes (Marine –1992). Any efforts to restore steelhead and Chinook salmon runs to the American River must focus on what water temperature do Chinook salmon and steelhead prefer and need at various life stages, not what water temperature can each

life stage tolerate on a mortality curve. Chinook salmon and steelhead immune system is robust in the range of 55 to 59DF. The upper limit of the optimal water temperature range for adult Chinook salmon holding while eggs are maturing is 59 to 60DF. Above this temperature, prespawning adult mortality becomes pronounced and survival of egg to the eyed stage decreases (McCullough–1999). Female salmon forced to hold at elevated water temperature (63.5DF) leads to smaller egg size, poor egg quality, delayed or slower development and poor overall survival compared to fry produced by females held at 57.2DF. The larger the fry, the greater chance for survival to maturity. Smaller size fry have a much lower survival rate than larger fry. Latent embryonic mortality and growth abnormalities are also associated with adult Chinook salmon exposed to water temperature to 63.5DF (McCullough – 1999). Elevated water temperature exerts indirect effects on Chinook salmon by increasing their oxygen demand while the oxygen availability in elevated temperature water decreases. Risk of disease increases as water temperature increases above 60DF and can become highly infectious and virulent above 64DF (U.S. EPA –2001, Carter–2005-CRWQCB-NCR).

Steelhead young and juveniles are at the mercy of the temperature of their environment. The steelhead immune system is compromised at water temperature above 60DF and severely so at or above 64DF. A sign of thermal stress is disease, parasites and / or bacterial infection that the immune system cannot handle. The anal vent bacterial-caused inflammation “rosy anus and prolapsed rectum” was identified in late summer of 2004. Internally, the fish showed inflammation of the posterior intestine with moderate to high numbers of mixed motile bacteria observed. This inflammation was prevalent in juvenile steelhead throughout much the American River in August, September and October of 2004 when river flow was low and water temperature elevated. The frequency of “rosy anus” occurrence increased as the duration of exposure to elevated water temperature increased with mean daily temperature often well above 65 DF to 68/69DF. At one site, the frequency of occurrence of anal vent inflammation increased from about 10 percent in August, to about 42 percent in September, and to 66 percent in October. The incidence of anal vent inflammation decreased when water temperature decreased at 62DF and was no longer evident after water temperature fell below 60DF (Titus –2007).

Water temperature records from Hazel Ave and Watt Ave USGS gages show water temperature (65 to 68DF and higher) during August, September and October from 2001 through 2012, see **Tables 3** and **4**. One could conclude that elevated water temperature, coupled with significant flow reduction, the evidence of “rosy anus and prolapsed rectum” would have been found during most years through a systematic and ongoing fish health / disease monitoring study. The anal vent inflammation “rosy anus and prolapsed rectum” was identified in juvenile steelhead, to varying degrees, during 2005, 2007, and 2008 during August through October, with water temperature elevated, well above 65DF, frequently above 68/69DF. There was no sampling during 2010 or 2011. In 2008, 2012, and 2013 less than 75 fish were handled and few during August through October (Titus, CDFW unpublished data, Dec. 2013).

The condition of inflamed vent “rosy anus and prolapsed rectum” in juvenile steelhead did not just happen over night, but most likely incubated over several days to weeks. Frequency of infection increased significantly during late summer through fall 2004. Juvenile steelhead are most sensitive to elevated water temperature during the smolt stage as opposed to their greater resilience to elevated water temperature as pre-smolt juveniles (U.S. EPA Issue Paper 5 - May 2001-McCullough, et al). Steelhead juveniles may be more susceptible to bacteria infection due to stress from higher than optimal water temperature during August, September and October. The extent of anal vent inflammation and prolapsed rectum could be widespread and acute, gradually causing mortality over few to several days to several weeks. Dr. William Cox of the CDFW stated the bacterial infection that results in anal vent inflammation could “*resolve on its own if temperatures would drop to a level that the fish’s immune system would prevail*” (Titus per. com. - Nov 2013, also see Titus - 2007).

Nimbus Salmon and Steelhead Hatchery (NSSH) is a mitigation hatchery (funded by the Bureau), but operated by the CDFW. NSSH production replaces habitat inundated or blocked by Folsom / Nimbus Dams and Reservoirs. NSSH production and returning steelhead and Chinook salmon adults of that production (particularly from the off site release of smolts) mask many of the instream conditions and water quality / temperature problems of the Lower American River.

At NSSH optimum temperature for steelhead rearing is 58DF, with fish began showing signs of stress at 60 DF to 62DF. At 62DF and above fish start becoming very stressed because of low oxygen concentration of the water and high oxygen demand in salmonid fishes. Incidence of disease increases above 63DF. Failure to meet the water temperature needs of steelhead and salmon becomes an issue of water quality.

In the Steelhead Restoration Plan for the American River (1991), CDFG (now CDFW) listed these preferred temperature ranges for various life stages of steelhead:

Adult migration	46 – 52DF
Spawning	39 – 52DF
Incubation and emergence	48 – 53DF
Fry and juvenile rearing	45 – 60DF
Smoltification	<57DF

The public now realizes that they and future generations are the beneficiaries of the fish trust and have a property right, a property right that is antecedent and supreme to individual private property rights (Wood –2007). The Public Trust Doctrine embodies the ethical touchstone from which all water resources / aquatic ecosystems decisions should be made (Klass & Huang - 2009). The State’s trust duties to protect steelhead trout and Chinook salmon, other fishes and ecological values of the American River converge with its trust duties to protect similar fish resources and ecological values of the Sacramento / San Joaquin Delta, San Francisco Bay and extending to the Pacific Ocean. The “coequal goals” (Cal. Water Code. Sec. 85054) of providing a more reliable water supply for California and protecting, restoring and enhancing resources the Delta ecosystem extends from the Sierra crest to the Pacific Ocean.

The Center for Biological Diversity, Inc v. FPL Group, Inc (83 Cal Rptr 3d 588 (Cal Ct. App. 2008) Court affirmed the right of citizens to sue the state for failing to uphold trust duties, in this case protect wildlife --raptors and other birds being killed by turbines on a private wind farm. A beneficiary can sue the trustee for harm to the trust. The Court in Center for Biological Diversity affirmed that members of the public have the right to bring an action against appropriate public agencies to enforce the wildlife trust. The same concept would apply to water, fish and other aquatic life.

The people have learned that the public trust doctrine empowers courts to invalidate executive and legislative acts that violate the peoples' property rights in trust assets (Wood -2014). This complaint is within the meaning of People v. Kerber (152 Cal.731, 732-736, 1908). There is no statute of limitation on a member of the public to compel the State Board to modify a previous decision such as D-893. The State Board should take all necessary action to modify the Bureau's operation or recommend modifications to facilities to protect ecological conditions (including water quality) and the trust resources of Chinook salmon and steelhead trout in the American River. This complaint is timely because harm from the Bureau's operation of the Folsom / Nimbus facilities is ongoing and has been so since 1955.

First Cause of Complaint (Fish and Game Code Section 5937, Clean Water Act Section 402 Certification, and the Public Trust Doctrine).

Section 8 of the Reclamation Act of June 17,1902, reads in part; --That nothing in this Act shall be construed as affecting or intended to affect or in any way interfere with the laws of any state – relating to the control, appropriation, use and distribution of water used for irrigation or any vested right -- the Secretary of the Interior in carrying out the provisions of this Act shall proceed in conformity with such laws --.

The operation of Folsom / Nimbus facilities is inconsistent with the Reclamation Act and subsequent reauthorizations of the CVP including the CVPIA of 1992. The CVPIA directed the Bureau to protect fish and wildlife, requires that project operations be modified (re-operated) to comply with applicable State and Federal water quality standards, and to obey State law. Courts have recognized that Fish and Game Code Section 5937 is California law (Cal Trout 1 and II, Natural Resources Defense Council v. Patterson II, 333 F. Supp 2d 906 (E.D. Cal - 2004). In Patterson II, both sides agreed to the meaning of 5937. Patterson II laid the path for applying Code Section 5937 to all the Bureau of Reclamation Dams (Bork, et al. -2012). State law also applies to the Public Trust Doctrine, Clean Water Act, Section 401 certification, and water right laws. The timing and quality of discharges / releases from Folsom / Nimbus Reservoirs have not received Clean Water Act, Section 401 certification by the State Board.

The Bureau of Reclamation is the holder of the water rights for the operation of the Folsom / Nimbus facilities on the American River. The State Attorney General filed an Amicus Curiae in Reynolds v. City of Calistoga stated, "the City's obligation to protect the public trust is to not cause harm by its own actions" as the City of Calistoga diverts water from the Napa River (Cal. A.G.- 2013). The Bureau's obligation to protect

the Public Trust is not to cause harm to the trust by its own actions by operating the Folsom / Nimbus facilities. The Bureau has failed in its obligation to do what ever is necessary so its actions (including re-operation of these facilities) do not cause harm to the people's Chinook salmon and steelhead trust. The evidence of elevated water temperature is documented by measurements at USGS gages (see **Tables 3 and 4**); failure to meet the temperature criteria in the NOAA-Fisheries Biological Opinion of 2009 (see **Table 5**), the high rate of prespawning mortality of adult Chinook salmon, and the incidence of disease / infection (rosy anus and prolapsed rectum) in juvenile steelhead trout (FESA listed *threatened*), are just some of the evidence of harm.

Second Cause of Complaint (Fish and Game Code Section 5937 and Public Trust Doctrine).

California Fish and Game Code Section 5937, in part, reads, The owner of any dam shall allow sufficient water at all times to pass through the 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. Section 5937 could be called a background principle. Code Section 5937 allows for the use of water off site so long as the Public Trust resources, uses and values remain viable, productive and economically meaningful to the people of the larger community or region where the water is diverted and to beneficiaries in coastal communities.

The operative words of Code Section 5937 are "The owner of any dam shall allow sufficient water at all times to pass downstream to keep in 'good condition' any fish that may be planted or exist below the dam." The guiding principles of "good condition" are discussed in Putah Creek and in California Trout 1 and 2. The "good condition" includes 1: the health of individuals, fish are healthy, free of disease, parasites, etc., and have reasonable growth rates with adequate habitat; 2) diversity and abundance of aquatic populations, diversity of age class, sufficient habitat to support all life stages and support self-sustaining populations; 3) the community, its overall health including co-evolved species and the health of the aquatic ecosystem at several trophic levels (see Moyle, et al.- 1998).

Marginal water temperature (66 to 70+Degrees F) do not keep or provide an ecological setting to conserve and protect "in good condition" Chinook salmon and steelhead trout in the Lower American River. During the passed 13 years the 65DF upper temperature limit in NMFS Biological Opinion (2009) has been exceeded for weeks in 10 of those years. The upper temperature threshold was relaxed because the Bureau did not manage the available water supply to conserve sufficient cold water to maintain less than 65DF in the Lower American River. Increasing the upper threshold to 67 to 69DF does not benefit the steelhead and Chinook salmon resources or improve their habitats. Increasing the temperature threshold benefits the Bureau so it can continue to move water to the Delta for export. Bureau representatives can then say they met the upward adjusted temperature target of the Annual Temperature Plan. See **Table 5** for a summary of historical conditions with temperature targets and relaxed targets, 2001 to 2013. See **Table 3** for water temperature at the Fair Oaks (USGS) gage and **Table 4** for water temperature at the Watt Ave (USGS) gage.

The operation of Folsom Reservoir affects juvenile steelhead trout (FEAS listed as *threatened*) because the water discharged from Folsom increases the temperature of the River particularly during the period of mid-August through October. Such conditions produce very poor quality summering over habitat for juvenile steelhead trout and poor quality habitat for adults Chinook salmon that have arrived, holding and maturing in the American River waiting for spawning conditions.

The Bureau of Reclamation has failed to comply with the “in good condition” of Fish and Game Code Section 5937 relative to the various Chinook salmon and steelhead trout life stages that utilize the American River. Therefore, it has failed to adequately protect the Public Trust.

Third Cause of Complaint (California Constitution, Article 10, Section 2; Clean Water Act Section 401 Certification, the Public Trust Doctrine and enjoin a public nuisance).

The California Constitution, Article 10, Section 2, requires that water resources be put to beneficial uses to the fullest extent for which they are capable. The uses must be both reasonable and beneficial. Elevated temperature water pollutes cold-water habitats, destroys a beneficial uses and harms Chinook salmon and steelhead trout.

The California Code of Regulations (CCR), Title 23, Section 782, provides the State Board with the authority to enforce Fish and Game Code Section 5937 and ensure that a water right holder complies with the Code Section 5937. Pursuant to CCR, Title 23, Section 782, the State Board has clear and non-discretionary duty to ensure that the Bureau operates the Folsom / Nimbus facilities to comply with Fish and Game Code Section 5937 by modifying the Bureau’s water right permit to include water quality / temperature criteria that is protective of Chinook salmon and steelhead trout.

Folsom Reservoir’s expansive surface area is a great accumulator of heat over the long summer. In the fall, natural seasonal cooling of this heat sink is delayed by several weeks. When this heated water is discharged through Folsom Dam’s hydroelectric facilities to the river it becomes a water quality problem. This heated water degrades cool water fish habitat and impacts steelhead and Chinook salmon utilizing the Lower American River. This elevated water temperature has been a problem so since the early days of Folsom Reservoir.

The Federal Water Pollution Control Act, (CWA as amended (33 U.S.C. 466 et seq.)), has the goal of providing water quality for the protection and propagation of fish, wildlife shellfish, and recreation in and on the Nation’s waters and to eliminate all discharges that may pollute public waters and impact beneficial uses. CWA Section 401 requires that any discharge to the Nation’s waters be regulated. The State Board handles water quality certification of discharges from Bureau hydroelectric facilities.

Chinook salmon migrate up the American River starting in mid-August to mid-September. The early arriving fish must hold over in water having elevated temperature (above the mid 60s DF) through September and October and in some years into mid

November waiting for proper spawning conditions. The hope is spawning temperature will be attained about November 1. In many years it has been later. The Chinook salmon spawning period has been delayed 3 to 8 weeks (from pre-project) by elevated water temperature. This delay increases the pre-spawning mortality (females that died before spawning). This delay results in a compressed spawning period of just 6 to 8 weeks. As a result, spawning is later, emergence of fry, growth and out migration is later. This leads to a smaller and less diverse gene pool, to a more uniform size and less vigorous young to reduce their survival as they migrate to the ocean.

A common measure of thermal stress for Chinook salmon is the 7-Day Average of Daily Maximum temperatures (7DADM). For holding Chinook salmon the water temperature should be less than 60.8DF for the 7-day average daily maximum temperature. In the American River, Chinook salmon can be holding in elevated temperature water for 3 to 8 weeks. In many years, daily high water temperature is 65 to 68DF for weeks. This is far above the 60.8DF or less recommended. (U.S. EPA Issue Paper 5, May 2001- McCullough, et al, Carter-2005) See **Tables 3** and **4**.

Elevated water temperatures can increase the susceptibility of salmon and steelhead to disease / infection, increase pre-spawning adult mortality, decrease the viability of eggs in female and sperm in male Chinook salmon and result in environment conditions conducive to increased predation. Elevated water temperature impacts summering over young and juvenile steelhead and increases the incidences of disease. The high pre-spawning mortality suffered by adult fall-run Chinook salmon holding and maturing as they wait for proper water temperature to initiate spawning is frequently mentioned as a concern in CDFW annual Chinook Salmon Spawning Escapement Survey reports. See **Table 6** for the number of days water temperature exceeded 60DF at the Fair Oaks gage. The stream temperature at the Watt Ave gage can be 3 to 5 degrees warmer than that at the Fair Oaks gage, note **Tables 3** and **4**. See **Table 2** regarding the escapement of Natural Spawning Fall-run Chinook Salmon to the Lower American River, the number of spawners, the extent of pre-spawning mortality and minimum estimate of Chinook salmon eggs lost.

The people learned from People v. Truckee Lumber Co. that the fish within our waters is unique property called wild game, the general right and ownership is with the people of the state, and the power to protect and preserve such property is a recognized prerogative of the sovereign. The people also learned that it is a well established principle that every person shall use and enjoy his own property, however absolute and unqualified his title, so his use shall not be injurious to the equal enjoyment of others having an equal right to the enjoyment of their property, nor injurious to the rights of the public. Truckee Lumber Co. was letting / dumping sawdust, slabs, shaving and other substances in to the Truckee River. The effect was to pollute the Truckee River, kill fish and other aquatic life and destroy a fishery. This pollution destroyed beneficial uses of the Truckee River as a water supply, as habitat for the fish trust - trout and a fishery. All of which was alleged to be in violation of the rights of the people, and a public nuisance. Truckee Lumber Company's pollution acts were

deemed to violate the rights of the people and a public nuisance under statute and common law. The State's police powers were used to enjoin Truckee Lumber's actions.

The Bureau of Reclamation operates the Folsom / Nimbus facilities of the CVP. Folsom Reservoir accumulates heat from solar radiation and high temperatures during the long summer. Stratification of the Reservoir occurs during most years. In the fall, natural seasonal cooling of this heat sink is delayed by several weeks. The present system and facilities for managing the total reservoir storage including the solar heated water, is inadequate to protect downstream beneficial uses and Chinook salmon and steelhead resources. The shutter facilities to the hydroelectric intakes are inadequate for managing the elevated temperature water discharged from Folsom Reservoir. This discharge of heated water pollutes the cold water habitat of the Lower American River, has impacted and will continue to adversely impact beneficial uses, ecological values and habitats used by various life stages of steelhead trout and Chinook salmon, the people's fish trust. The extent of prespawning mortality (10 to 62 percent of the run has been lost, see **Table 2**), the incidence of disease / infections (rosy anus), can, in part, be attributed to elevated water temperature / poor water quality over 3 to 8 weeks from mid August, September, October and in a few years into mid to late November.

Discharge of this solar heated water from Folsom / Nimbus Dams and associated facilities to the American River impacts water quality (cold freshwater habitats, i.e. holding, spawning and rearing) and steelhead trout and Chinook salmon resources "the people's property"; degrades beneficial uses; violates the California Constitution, Article X, Section 2; the purpose and intent of the Public Trust under which these salmonid resources are held; and is a public nuisance that should be enjoined. Corrective means and measures are needed.

Summary

Steelhead and Chinook salmon life stages utilizing the American River are not being maintained in good condition through a major portion of the year; therefore this is a violation of Fish and Game Code Section 5937. There is great public interest in maintaining and preserving the important steelhead trout and Chinook salmon resources of the American River, resources held in trust, "in good condition".

This solar heated water when discharged degrades or destroys trust resources and beneficial uses of coldwater aquatic ecosystems. Disease and prespawning mortality associated with elevated water temperature cannot be endured if one expects improvement of the steelhead or Chinook salmon runs of the American River. Elevated temperature water that pollutes (thermal pollution) a cold-water ecosystem violates the Clean Water Act, the rights of the people, and is a nuisance that should be enjoined.

Controlling thermal pollution and abating its impacts by modifying the operations of and improving the shutter and penstock intakes at Folsom / Nimbus Dams should be a good thing. Establishing temperature criteria that is protective of steelhead trout and Chinook salmon life stages with implementation deadlines should spur innovation in the

way Folsom / Nimbus facilities are managed to prevent thermal pollution impacts to the Steelhead and Chinook salmon resources of the Lower American River. Providing environmental conditions to meet biological needs of steelhead and Chinook salmon life stages is protecting beneficial uses and the Public Trust, “the people’s fish property”.

Conclusion and Recommendations

Stewardship of the American River resources, uses and values is essential to life, liberty and the pursuit of happiness to the people of the Greater Sacramento Region and the State of California. Caring for Public Trust resources, uses and values is an ancient duty of the sovereign. This duty is not discretionary. It is an obligation that is perpetual and requires preventive measures to protect the public assets and requires remedial measures where past behavior has breached that trust (Wood -2014).

The Bureau of Reclamation has some long-standing responsibilities and mitigation obligations to the American River resources, uses and values as a result of the construction and operation of Folsom / Nimbus Dams and Reservoirs. Attaining an acceptable water temperature regimen to meet the life history needs of American River steelhead and Chinook salmon is critical to the future survival and restoration of these fish runs. To protect and restore steelhead trout and Chinook salmon populations, the recommended temperature criteria must emphasize high survival by life stages (e.g. egg, juvenile, smolt, migrants and holding adults). When and where multiple species and life stages are present, temperature criteria should protect the most sensitive species and life stages.

Establishing temperature criteria of 63DF or less for the Steelhead juvenile rearing, and less than 60 / 61DF for Chinook salmon holding, maturing, and spawning periods should spur innovation in the way Folsom / Nimbus facilities are operated to prevent elevated temperature impacts to trust resources of the Lower American River. Where multiple species and life stages are present, temperature criteria should protect the most sensitive species and life history stages. The ability to perform all life functions in a routine manner is important to individual fitness, species fitness, and population viability. The effort must be more than sustaining minimal populations, but to move on to restoring steelhead trout (FESA listed as *threatened*) and fall-run Chinook salmon populations envisioned in the CVPIA. Professor Wood (2004) in her article “Protecting the Wildlife Trust: A Reinterpretation of Section of the Endangered Species Act” presents two cardinal principles of the trust doctrine to help guide the protection and restoration of *threatened* and *endangered* species. 1. Government trustees are required to preserve wildlife assets and protect them against damage. 2. Where there has been damage to trust assets, the trustees have an affirmative duty to recoup damages and to restore the corpus of the trust. The Central Valley steelhead trout has been listed as *threatened* since 1998. Meeting an improved temperature regime would aid restoration.

The Audubon Court clarified the State Board has the affirmative duty to take the Public Trust Doctrine into account in the planning and allocation of water resources, to protect the Public Trust and is to avoid or minimize any harm to trust resources when

ever feasible. The entire Folsom Reservoir storage including coldwater pool below the penstock intake must be managed in a way that is protective of steelhead trout and Chinook salmon life stages in the Lower American River.

The U.S. EPA encourages States and authorized Native American Tribes to adopt temperature Water Quality Standards that it can approve consistent with its obligations under the Clean Water Act and the Federal Endangered Species Act (USEPA – 2003). With this understanding the State Water Resources Control Board should immediately modify Decision D-893 or issue a new decision that incorporates the following “Temperature Criteria Protective of Salmonids utilizing the Lower American River”.

Temperature Criteria Protective of Salmonids utilizing the Lower American River.

Time / Period	Temperature criteria. Not to exceed at Watt Ave.
October 1 to 30	60 Degrees F. Fall-run Chinook salmon holding and maturing. Initiate early Chinook spawning. Juvenile steelhead rearing.
November 1 to April 30	Less than 58 / 56 Degrees F. Fall-run Chinook salmon spawning, egg incubation, fry rearing. Steelhead spawning, egg incubation, fry rearing. Late Fall-run spawning, egg incubation and emergence. Fall-run Chinook smolt migration.
May 1 to 15	56 to 63 Degrees F (as a transition) Chinook smolt migration. Steelhead rearing.
May 16 to August 31	63 Degrees F. Steelhead, Late Fall Chinook rearing
September 1 to 30	63 down to 60 Degrees F (as a transition) Juvenile steelhead rearing. Adult Chinook salmon early arrivals, holding.

Based on criteria in Carter - 2008, Yuba River SWRCB Order WR 2008 –14, and US EPA Region 10, Guidance –2003.

In addition to the temperature criteria, management actions and facilities are needed to help ensure healthy and viable steelhead trout and Chinook salmon populations in the American River. The measures and facilities are reasonable and feasible and should be incorporated into any new or modified water right for the operation of the Folsom / Nimbus facilities, American River Division of the Central Valley Project. The State Water Resources Control Board should:

1. Require the Bureau of Reclamation to modify as soon as possible at least one Folsom Dam’s powerhouse intake to access the coldest water in Folsom Reservoir. A progress report on this activity will be needed.
2. Require the Bureau of Reclamation as soon as possible to construct an automated temperature activated shutter system on at least one powerhouse intake at Folsom Dam. The Sacramento Area Flood Control Agency in 2001 committed to spend \$2 million to cover design and up grade one penstock to a fully mechanized shutter

facility or better alternative that accomplishes the same. This information is from Contract Number 03-XC-20-0377, between the United States of America and the Sacramento Area Flood Control Agency concerning the operation of Folsom Dam and Reservoir (Jones & Stokes – 2001). Personal communication from Tim Washburn, February 11, 2014. A progress report on this activity will be needed.

3. Require the Bureau of Reclamation to implement the Annual Temperature Plan as a strategy for managing Folsom's coldwater pool to meet the salmonid resource needs in the American River particularly during August through mid to late November. During this time frame, various life stage of naturally spawned and rearing juvenile and smolt steelhead trout and Fall-run adult Chinook salmon migration, holding, spawning and egg incubation are occurring in the American River. Achieving the Temperature Criteria Protective of Salmonids in the Lower American River as measured at Watt Avenue should help meet the intent and purpose of Fish and Game Code Section 5937. Verification through monitoring of physical parameters, fish populations and aquatic community health will be necessary.
4. Require the Bureau of Reclamation to modify the daily / weekly operation of Nimbus Reservoir as needed to meet revised temperature criteria in the Lower American River. This may require modifying the intake structure to the Nimbus Dam power generating facilities (it pulls water from the surface). It also may require at certain times of the year that Nimbus Reservoir be operated as run of the river facility in order to reduce its heat sink affect during low flow periods.

The physical facilities, strategies and water quality (water temperature) discussed and recommended to meet the life stages needs of steelhead and Chinook salmon do not consume water, but are needed real time to improve a beneficial use, i.e., cold water habitat for steelhead trout and Chinook salmon. The physical facilities, strategies and water quality parameters can be considered as water conservation measures because the water quality, the amount and timing of discharge can be better controlled to meet the real time life stage needs of steelhead trout and Chinook salmon compared to the cumbersome operation of the present shutters and related facilities and should not require a power bypass via bottom outlet. Meeting Clean Water Act, Section 401 water quality certification would require the Bureau of Reclamation to manage Folsom Reservoir coldwater pool to meet the freshwater temperature criteria that is protective of steelhead trout and Chinook salmon in the Lower American River. Long term monitoring of the ecosystem and associated resources will be required.

Public Law 356, of Oct.14, 1949, incorporated the American River Division including Folsom Dam and Reservoir into the reauthorization of the CVP. According to PL 356, the uses of project water shall be in accordance with state law including, but not limited to such laws giving priority to the counties and areas of origin for present and future need. The average annual runoff at the Fair Oaks USGS gage is about 2,683,000 acre-feet (DWR-2013). About 18 - 20 percent of this amount is projected for use within the American River Basin by 2030 (Water Forum –2000). The remainder is used outside of the Basin to protect water quality in the Delta and for export mostly for

agriculture uses. It is this 80 plus percent of the average annual runoff that should be discharged from Folsom Reservoir in such a manner, timing and quality to meet the life stage needs of steelhead trout and Chinook salmon utilizing the Lower American River.

State Water Resources Control Board Decision D-893 for the operation of the Folsom / Nimbus facilities was issued in 1958. Biological, socio-economic, legal and institutional conditions have changed substantially since then. Public Trust protection was broadened and the legal standing of an individual was clarified in Marks v. Whitney in 1970. The Court in Center for Biological Diversity, Inc v. FPL Group, Inc (83 Cal Rptr 3d 588 (Cal Ct. App.- 2008) affirmed that members of the public have the right to bring an action against appropriate public agencies to enforce or uphold their trustee duties. The same concept would apply to trustee agencies managing such resources as water, fish and other aquatic life.

The people learned from City of Long Beach v. Mansell (476 P.2d 423 – 1970) – the implied powers of the state as trustee include everything necessary to proper administration of the trust in view of its purposes -. If the public trust doctrine is going to operate to protect the trust, it is time for the State Water Resources Control Board to set temperature criteria for the water discharged from Folsom / Nimbus Reservoirs to the American River. It is time to bring the Bureau's operation of these facilities up to today's laws, court findings and the biological needs of the American River steelhead trout and Chinook salmon. Therefore, the State Board under its continuing authority should set temperature criteria for the Lower American River that truly conserves and protects Chinook salmon, Steelhead and other aquatic resources, uses and values protected by the Public Trust. The State Board's duties and responsibilities under the Public Trust Doctrine require nothing less.

End

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Table 1. American River Fall-run Chinook Salmon Escapement 1992 to 2012*

*	Natural spawn adults	Hatchery Spawn Adults	*
1982	29,000	8,100	
1983	18,000	6,400	
1984	25,200	10,200	
1985	44,700	7,300	
1986	44,900	5,600	
1987	18,200	3,400	
1988	14,100	8,000	
1989	14,700	9,200	
1990	5,600	4,600	
1991	16,500	6,800	
1992	3,416	5,107	
1993	22,227	7,342	
1994	28,589	7,676	
1995	72,056	5,172	
1996	67,719	9,219	
1997	46,036	7,293	
1998	41,094	17,797	
1999	48,311	10,095	
2000	93,413	11,060	
2001 # 1	167,062	11,649	
2002	95,711	7,762	
2003	136,238	13,081	
2004	75,090	15,493	
2005	54,001	24,723	
2006	21,755	9,667	
2007	9,855	4,664	
2008 #2	1,791	3,300	
2009	3,118	5,756	
2010 #2	5,831	13,821	
2011	13,484	7,634	
2012	32,656	11,024	

Counts from 1982 to 1991 data of PFMC- Feb 2000 are rounded figures. Counts from 1992 to 2011 are from data from PFMC- Feb. 2013. These are adult fish that could have entered the commercial fishery. There was a very restricted fishery for Fall-run Chinook salmon in 2008, 2009 and 2010 to allow attainment of Sacramento River Fall Chinook conservation objective.

#1. The prespawning Chinook spawning mortality was 67 percent of the entire run.

#2 For years 2008 and 2010 the prespawning mortality (fish that did not spawn) was greater than the estimated number of Chinook salmon that spawned naturally.

LARxCompTable 1

Table 2. Natural Spawning Adult Fall-run Chinook Salmon Escapement to the American River, Estimated Prespawning Mortality and Eggs Lost.

Year	Escapement	Sex ratio	Percent spawned		Eggs Lost / Mil.
		Male / Female	Spawned / Unspawned		
2001	167,062 salmon 98,566 Females	41 / 59	20	67	
	66,039 Unspawned Females x 5400 eggs per adult =				356.610 Mil
2002	95,711 salmon 52,641 Females	45 / 55	55	30	
	15,792 Unspawned Females x 5400 eggs per adult =				85.276 Mil.
2003	136,238 salmon 83,105 Females	39 / 61	48	37	
	30,748 Unspawned Females x 5400 eggs per adult =				166.039 Mil.
2004	75,090 salmon 43,552 Females	42 / 58	50	31	
	13,501 Unspawned Females x 5400 eggs per adult =				72.905 Mil.
2005	54,000 salmon 33,486 Females	38 / 62	68	18	
	6,027 Unspawned Females x 5400 eggs per adult =				32.545 Mil.
2006	21,755 salmon 12,617 Females	42 / 58	70	19	
	2,397 Unspawned Females x 5400 eggs per adult =				12.943 Mil.
2007	9,855 salmon 6,500 Females	34 / 66	82	11	
	715 Unspawned Females x 5400 eggs per adult =				3.861 Mil.
2008	1,791 salmon 841 Females	53 / 47	88	10	
	84 Unspawned Females x 5400 eggs per adult =				.453 Mil.
2009	3,118 salmon 1,466 Females	53 / 47	80	4	
	58 Unspawned Females x 5400 eggs per adult =				.312 Mil.
2010	5,831 salmon 2,100 Females	64 / 36	49	29	
	609 Unspawned Females x 5400 eggs per adult =				3.288. Mil.
2011	13,484 salmon 6,877 females	49 / 51	74	6	
	412 Unspawned Females x 5400 eggs per adult =				2.224 Mil.
2012	32,656 salmon 21,556 females	29 / 71	50	29	
	6241 Unspawned Females x 5400 eggs per adult =				33.701 Mil.

Note: Escapement numbers from the Pacific Fishery Management Council – 2013. These are adult fish that could have entered the commercial and sport fisheries. There were extensive commercial and sport fisheries in all years except for 2008, 2009 and 2010 when these fisheries were very restricted (PFMC- Feb. 2011). Unspawned is based on egg retention. Nimbus Salmon and Steelhead Hatchery processes about 8,000,000 Chinook salmon eggs annually to meet a production target of 4,000,000 smolts.

LARxCompTable 2

Table 3. Water Temperature at Fair Oaks gage (USGS), American River RM 22.7

Year	July	August	September	October	November	Date of 60DF
	High Temp */ Range					
2001	67.1DF 61.7-67.1	68.DF 62.- 68.	68.9DF 64.4-68.9	69.8DF 65.3-69.8	68.2DF 54.5- 68.2	Nov. 17/18
2002	62.8DF 57.4- 62.8	66.2DF 61.7-66.2	66.2DF 61.7-66.2	66.2DF 57.3-66.2	59.DF 56.2-59.	Oct. 29
2003	64.4DF 59.-64.	64.4DF. 58.1- 64.4	64.4DF 60.8-64.4	64.4DF 61.7-64.4	61.7DF 56.3-64.4	Nov. 6
2004	66.2DF 61.7- 66.2	68.DF 62.6-68.	68.DF 63.5 -68.0	66.2DF 60.2 -66.2	60.2DF 53.-60.2	Nov. 5
2005	61.7 DF 57.2 -61.7	62.6 DF 59.0-62.6	64.4 DF 59.0-64.4	63.5DF 57.2-63.5	59.9DF 55.4-59.9	Nov. 1
2006	61.7DF 57.2-61.7	62.6DF 59.9-62.6	63.5 DF 59.9-63.5	63.1DF 59.9-63.1	61.3DF 55.2-61.3	Nov. 6
2007	66.2DF 59.2-66.2	66.6DF 62.6-66.6	66.2DF 63.5-66.2	65.5DF 61.7-65.5	62.2DF 54.9 -62.2	Nov. 10/11
2008	67.5 DF 63.5-67.5	68.2 DF 64.- 68.2	69.3DF 66.6-69.3	71.1DF 60.1-71.1	63.3DF 54.3-63.3	Nov. 4/5
2009	66.2DF 58.8-66.2	65.8DF 59.2-65.8	66.2DF 60.8-66.2	63.9DF 59.7-63.9	61.5DF 54.0 -6.1.5	Nov. 7/8
2010	63.5 DF 57.2- 63.5	64.6DF 58.8- 64.6	63.9DF 60.3-63.9	63.0DF 59.4-63.0	59.7DF 53.2-59.7	Oct. 25
2011	60.1DF 55.4-60.1	61.5DF 57.4 - 61.5	62.8DF 59.2 -62.8	62.6 DF 59.4- 62.6	60.1DF 55.9-60.1	Nov. 1
2012	65.1DF 58.1-65.1	64.8DF 59.4-64.8	64.4DF 59.7-64.4	63.9DF 59.4-63.9	60.3DF 57.9-60.3	Oct. 25/ Nov. 8

*/ High Temperature – Highest temperature measured during the month.

Temperature Range – Minimum to maximum temperature measured for the month.

During October 1 to 18, 2005, water temperature was between 59.9 and 54.5DF then increased to 62.6DF for 9 days with little change in temperature (1 to 2DF). At times there is little change in 24 hours or over 7 days. When water temperature is not favorable for spawning, adult Chinook salmon must hold waiting for a 60DF or less spawning window.

LARxCompTable 3

Table 4. Water Temperature at Watt Ave gage (USGS), American River, RM 9.3

Year	July	August	September	October	November	Date of 60DF
	High Temp */ Temp Range					
2001	73.4DF 61.7-73.4	75.2DF 63.5-75.2	72.5DF 65.3-72.5	73.4DF 64.4-73.4	67.1DF 52.7-67.1	Nov. 17/18
2002	69.8DF 58.1-69.8	71.6DF 61.7-71.6	71.6DF 61.7-71.6	68.9DF 56.3-68.9	59.9DF 54.5-59.9	Oct. 29
2003	69.8DF 59.9-69.8	70.7DF 59.9-70.7	68.9DF 61.7-68.9	68DF 60.8-68.	62.6DF 52.7-62.6	Nov. 6
2004	72.5DF 60.8-72.5	73.4DF 62.6-73.4	71.6DF 62.6-71.6	69.8DF 59.-69.8	61.7DF 50.0-61.7	Nov. 1
2005	68.8DF 58.1-68.8	68.8DF 59.0-68.8	67.1DF 59.9-67.1	66.2DF 57.2-66.2	61.7DF 53.0-61.7	Oct. 31
2006	68DF 58.1-68	68.9DF 59.9-68.9	68.9DF 59.9-68.9	66.4DF 58.1-66.4	62.6DF 52.3-62.6	Oct. 30 Nov. 9
2007	71.6DF 59.2-71.6	72.5DF 62.6-72.5	71.2DF 62.8-71.2	67.3DF 59.7-67.3	63.0DF 52.7-63.0	Nov.10/11
2008	73.3DF 63.3-73.3	73.4DF 64.4-73.4	73.2DF 65.5-73.2	71.1DF 60.1-71.1	63.3DF 54.3-63.3	Nov. 5
2009	69.6DF 59.2-69.6	70.3DF 59.7-70.3	70.5DF 61.3-70.5	66.9DF 57.6-66.9	63.3DF 52.5-63.5	Nov. 8
2010	67.1DF 57.4-67.1	68.9DF 65.3-68.9	69.1DF 60.4-69.1	67.1DF 57.6-67.1	62. DF 52.3-62.	Nov. 7
2011	65.7DF 56.7-65.7	67.3 DF 57.7-67.3	67.3DF 58.3-67.3	64.3DF 59.1-64.3	60.9DF 54.8-60.9	Oct 31/ Nov.1
2012	69.8DF 58.3-69.9	69.8DF 59.- 69.1	69.1DF 59 -69.1	67.6DF 58.5- 67.6	62.2DF 55.4-62.2	Oct.26/ Nov. 8

*/ High Temperature – highest temperature measured during the month

Temperature Range – Lowest and highest temperature measured during the month.

During August thru October daily water temperature usually varies less than 4DF. A common measure of thermal stress is the maximum daily water temperature for a period of 7 consecutive days. If water temperature is elevated, Chinook salmon will hold waiting a 60DF or less spawning window. Holding takes a toll on adults (prespawning mortality) and has complications for spawning success, egg and sperm quality and disease.

LARxCompTable 5

Table 5. Summary of Historical Conditions at Folsom Reservoir –2001-2013, with temperature targets and upward adjustments at Watt Ave

Historical Conditions – 2001 to 2013

Year	End of May Storage		End of September Storage		Watt Ave
	Storage	CWP Volume	Storage	CWP Volume	Temperature
	TAF	<58DF TAF	TAF	<60DF	Target DF
2001	696	275	368	30	65 -71
2002	822	455	510	50	65 - 69
2003	962	640	658	135	65 -67
2004	635	300	375	30	65 -69
2005	965	705	652	140	65
2006	928	670	639	125	65
2007	787	355	323	30	65-68
2008	617	250	270	25	65-70
2009	933	550	412	60	65-67
2010	905	580	624	130	65-66
2011	885	590	750	175	65
2012	926	536	450	60	65 / 66
2013	734	272	335	54	65 / 69

From Bureau of Reclamation’s Temperature Operational Plan. Reclamation Annual Report of Activities October 1, 2012 to September 30, 2013
 Note relaxation from Temperature Target of 65 DF at Watt Ave.

LARxCompTable 5.

Table 6. Days per month maximum water temperature exceeded 60DF (15.5C) at Fair Oaks gage with maximum temperature - Lower American River

Year	August	September	October	November	App. Date 60DF
2001	31D HT 68DF	30D HT 68.9DF	31D HT 68.9DF	17D HT 68FD	Nov.17/18
2002	31D HT 68DF	30D HT 68.9DF	28D HT 66.2DF	0D HT 59.DF	Oct 29
2003	31D HT 64.4DF	30D HT 64.4DF	31D HT 64.4DF	5D HT 61.7DF	Nov. 6.
2004	31D HT 68DF	30D HT 68DF	24D HT 69.8DF	0D HT 61.7DF	Nov. 5
2005	31D HT62.6DF	30D HT 64.4DF	12D HT 63.8F*/	0D HT 59.9DF	Nov. 1
2006	31D HT 62.6DF	30D HT 63.8DF	10D HT 63.1F*/	10D HT 61.3DF	Nov. 6
2007	31D HT 66.6DF	30D HT 66.2DF	31D HT 65.5DF	10D HT 62.3DF	Nov.11
2008	31D HT 68.2DF	30D HT 69.3DF	31D HT 68.4DF	10D HT 62.3DF	Nov.4/5
2009	31D HT 65.5DF	26D HT 66.2DF	31D HT 63.9DF	7D HT 61.8DF	Nov.7/8
2010	31D HT 64.6DF	30D HT 63.9DF	25D HT 63.0DF	0D	Oct. 25
2011	19D HT 61.3DF	30D HT 62.6DF	30D HT 62DF	1D HT 60.1DF	Nov.1
2012	30D HT 64.8DF	30D HT 64.8DF	30D HT 63.9DF	8D HT 60.8DF	Oct. 25 Nov. 8

HT = High Temperature

*/ Temperature increased during the middle of October to above 60DF for 10 to 12 days and then decreased to less than 60DF. During a hot spell and with reduced stream flow, Nimbus Reservoir will accumulate heat. At times there is only 1 to 2DF difference between high and low water temperature. Sometimes there can be little change in 24 hours or over 7 days.

Adult Chinook pre-spawning mortality and latent embryonic mortality with growth abnormalities are associated with eggs in adults holding in water greater then 60DF. There is considerable evidence adult Chinook holding for 14 days to several weeks of elevated temperature results in high to very high mortality classified as pre-spawning mortality. Eggs and sperm can be of poor quality, resulting in development abnormalities. The longer adult Chinook salmon are exposed to thermal stress, the less likely they will survive to spawn. Disease also takes a heavy toll.

LARxCompTable 6