4/27/10 Board Hearing
AB 2121
Deadline: 3/26/10 by 12 noon

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SWRCB EXECUTIVE

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March 25, 2010

Jeanine Townsend, Clerk to the Board
State Water Resources Control Board
1001 I Street, 24th Floor
Sacramento, CA 95814

Re: Comments on State Water Resources Control Board (SWRCB) Water Rights Division Proposed Policy for Maintaining Instream Flows in Northern California Coastal Streams

Dear Ms. Townsend,

I provide the comments below on the proposed *Policy for Maintaining Instream Flows in Northern California Coastal Streams* (*Policy*) on behalf of the Living Rivers Council (LRC) and the North Coast Stream Flow Coalition. I have reviewed the current final draft of the proposed *Policy* and several of its attachments as well as comments of professional hydrologist Dennis Jackson (2010). I hereby incorporate by reference my previous comments (Higgins 2008a) on the earlier draft of this *Policy* that I produced for the Redwood Chapter Sierra Club in April 2008. My questions were not sufficiently answered in the response to comments documents produced by the SWRCB; therefore, many still stand as unresolved issues. I note some improved language in this final draft but tangible steps to attainment coldwater fisheries beneficial uses are elusive and a number of critical flaws remain. As a result I find lack of compliance with the California Environmental Quality Act (CEQA), insufficiency with regard to requirements of California Water Code Section 13000 and no workable solution to our regional flow crisis.

The proposed *Policy* fails to deal with groundwater withdrawal that can in and of itself cause loss of stream flow in some basins. It also ignores peer review comments from Band (2008), McMahon (2008), Gearhart (2008) and Lang (2008) that point out that the *Policy* cannot be implemented without flow data in each basin being collected. AB 2121 and the proposed *Policy* also remain delimited in the area of application while acute problems needing immediate attention remain unabated in the Eel River (Higgins 2010) and the Klamath River basin, especially the Scott and Shasta rivers (Kier Associates 2010). My previous testimony and attachments provided here demonstrate that North Coast rivers are in severe crisis with the primary cause of the imminent loss of their salmon resources resulting directly from loss of flow and inaction by the State Water Resources Control Board and its Water Rights Division. This proposed *Policy* has no defined enforcement action to abate existing problems and time lines for reversing problems in a meaningful time frame as required by law.

I do not restrict these comments to the AB 2121 area but rather cover all North Coast basins where Pacific salmon are in crisis and the cause is flow depletion and lack of enforcement by SWRCB WRD is also in evidence.

My Qualifications

I have been a consulting fisheries biologist with an office in Arcata, California since 1989 and my specialty is salmon and steelhead restoration. I authored fisheries elements for several large northern California fisheries and watershed restoration plans (Kier Associates 1991, Pacific Watershed Associates 1994, Mendocino Resource Conservation District 1992) and co-authored the northwestern California status review of Pacific salmon species on behalf of the American Fisheries Society (Higgins et al. 1992). Since 1994 I have been working on a regional fisheries, water quality and watershed information database system, known as the Klamath Resource Information System or KRIS (www.krisweb.com). This custom program was originally devised to track restoration success in the Klamath and Trinity River basins, but has been applied to another dozen watersheds in northwestern California, including most of those included in the AB 2121 area. Consequently I have intimate knowledge of the watersheds being dealt with by the proposed *Policy*.

From 2004 to this year, I worked under contract with the Klamath Basin Tribal Water Quality Work Group, a consortium of environmental departments of Lower Klamath River Basin Indian Tribes. I helped provide technical information to improve enforcement of the Clean Water Act, assist with Klamath Hydroelectric Project removal and to challenge the California Department of Fish and Game (CDFG) Shasta and Scott River coho salmon incidental take permits (ITPs). Through this work I have become further acquainted with factors limiting Pacific salmon, including those related to flow depletion. I am attaching recent work products as appendices that are relevant to the proposed *Policy*, including Mendocino General Plan update comments bearing on water availability and use (Higgins 2008b), on the Pelton House winery project in the Russian River (Higgins 2009), the final CDFG Shasta and Scott River coho salmon ITPs (Kier Associates 2009), and the Eel River Potter Valley Project (PVP) (Higgins 2010). All four show that water diversion and illegal water use is driving river ecosystem collapse regionally and causing the extirpation of Pacific salmon.

Scientific Deficiencies

The proposed *Policy* has a number of scientific flaws that undermine its credibility and many of these issues remain unresolved despite constructive criticism from peer reviewers and the public on the previous draft. Although I covered some issues below in previous comments (Higgins 2008a), they remain an impediment to successful implementation of the proposed *Policy*.

Exemption of Streams Above Pacific Salmon Migration: While one of the proposed *Policy's* objectives is to protect Pacific salmon, your sensitivity analysis does not consider impoundments and diversions on headwater streams and swales above anadromy. Even a basic hydrology text book makes clear that subsurface flow accumulates in headwater areas, sometimes flowing on the surface during periods of high rainfall, but otherwise contributing to downstream flow through groundwater connections. Peer reviewer McMahon (2008) stated: "Dams on ephemeral streams have the potential to greatly dampen the early fall/winter freshets important for access to the upper reaches of small spawning tributaries by their capture of the entire flow within the stream until the reservoir is filled, potentially resulting in significant dewatering downstream." It is also my experience from reviewing environmental documents for proposed wineries that these ponds in headwater swales are often filled year round through pumping of groundwater. Permit requirements should include an entire watershed and there is no scientific justification for not including the entire stream length.
Cumulative Effects: CEQA applies to the proposed *Policy* and requires that cumulative effects be considered, defining them as "indirect or secondary effects that are reasonably foreseeable and caused by a project, but occur at a different time or place." There are a number of aspects raised in

my previous comments regarding this topic and also by peer reviewers Band (2008), McMahon (2008) and Gearhart (2008) that have been wholly ignored. The proposed *Policy* states that "cumulative effects of water diversions on instream flows needed for the protection of fish and their habitat shall be considered and minimized." However, reading the *Policy* and related supporting documents indicates that there has been no substantive change or response to earlier concerns.

The comments of Dennis Jackson (2010) note that streams flowing across alluvial fans or deltas may sink into the stream bed, thus making the stream lose surface flow in some reaches downstream of the headwaters, not consistently gain flow as is assumed in *Policy* assumptions for determining instream flow. As pointed out in my previous comments on the prior Policy draft, landslides triggered by logging, roads and other land use has caused major bedload build up or aggradation that makes the problem pervasive throughout the region. Figure 1 shows lower North Fork Navarro River tributary Flynn Creek running underground, although its sub-basin has little agricultural development or domestic water use. As previously stated, when aggradation is severe and pervasive, there may no longer be enough water for previously issued senior and even pre-1914 water rights permits. As documented in previous comments aggradation is also a major problem in the Gualala, Noyo, Eel, Russian and Mattole rivers that also have water supply shortages.

Band's (2008) observation about interaction between diversions is completely ignored. He asserts that if multiple diversions are operated that the *Policy* basin-wide flow depletion estimate of 5% may in fact total as much as 28% because of synergy. The SWRCB WRD continues to avoid the topic of this potential for interaction and none of the modeling methods recommended even have parameters that factor it in. Lang (2008) and McMahon (2008) pointed out that flow diversion into

Figure 1. Flynn Creek at Highway 128 lacked surface flow in late September 2001, as illustrated by this photo taken just upstream of the highway bridge. Photo by Pat Higgins from KRIS Navarro.

dozens or hundreds of legal and illegal reservoirs, when Chinook and coho salmon are trying to ascend streams, may prevent them from successfully completing their spawning migrations. These fish have life histories that include adult migration and spawning from October through January. Therefore, even diversions after the December 15 start date could cumulatively effect the ability of these fish to access their home streams, yet this in not discussed in the proposed *Policy*. Similarly, the relationship of increased sedimentation from agricultural operations and diminished flows pointed out by Band (2008) are also ignored. He notes that the combination is likely to cause sediment deposition in channels at points of convergence that are often preferred spawning sites.

Another significant problem with cumulative effects is the 1771 illegal reservoirs estimated by Stetson Engineers (2007) in the *Policy* area and their interaction with other legal and illegal diversions. Since the *Policy* deals only with new applications for water rights and winter flows, there is no prospect that problems will be dealt with let alone resolved (see Enforcement).

The proposed Policy notes that impoundments create ideal habitat for invasive species, such as the bull frog, which is yet another cumulative effect of illegal ponds. The still water environment created by reservoirs is completely different than almost any naturally occurring habitat. Once these warm water environments to which few native animals are adapted are created, there is no way to stop their colonization by invasive species. In fact, these artificial waterbodies are often purposefully stocked with warmwater game fish species such as largemouth bass, catfish and sunfish species that can compete with or predate upon native salmonids. While there are vague statements about mitigation to prevent proliferation of invasive species, there is no guidance provided or specific actions required.

The current proposed *Policy* does not take a comprehensive approach to analysis of cumulative effects that are already well advanced and clearly in evidence and will instead allow additional uses on a case by case basis. Although Dunne et al. (2001) focused on cumulative effects related to California timber harvest, their observations on problems with piece-meal planning apply equally to diversion applications:

> "The concern about cumulative effects arises because it is increasingly acknowledged that, when reviewed on one parcel of terrain at a time, land use may appear to have little impact on plant and animal resources. But a multitude of independently reviewed land transformations may have a combined effect, which stresses and eventually destroys a biological population in the long run."

As stated below previously and below, the consequence of SWRCB WRD ineffective and insufficient action under the proposed *Policy* is the rapid loss and likely imminent extirpation of Pacific salmon species and other native aquatic biota.

To be CEQA compliant the proposed *Policy* needs to require an analysis of changes in land use that have related hydrologic impacts, such as timber harvest, road building, development, vineyards and agricultural and calculate changes in water yield. Similarly, channel changes need to be acknowledged and effects on gaining or losing flow related to aggradation factored in to water allocation. Additionally, all legal and illegal diversions and groundwater use must also be included. Baseline flow data collected prior to disturbance are available for some basins, so regional changes in the rainfall to runoff ratio could be estimated. The proposed Policy use of data from the last decade as a preference means that flows are likely to considerably depart from pre-disturbance conditions with which salmon and steelhead co-evolved. Since intensive land use has been pervasive since about 1950, flow data from before that time would be optimal.

Lack of Data Confounds Meaningful Implementation

Most peer reviewers of the earlier draft (Band 2008, Gearhart 2008, Lang 2008, McMahon 2008) note that peak flow discharge can be modeled but that base flow, average flow and median flow may all be highly variable and cannot be accurately assessed without data collection over a widespread area, including in the watershed in which a permit is being applied. Dennis Jackson (2010) notes that geographically adjacent paired watersheds used for modeling flow may have very different rainfall to runoff ratios due to differences in geology, slope, soil types and depth, vegetation, impervious area, and existing water use. A partial solution for improved modeling would be to use watershed pairs that had similar rainfall to runoff ratios, instead of just using adjacent watersheds for comparison (Jackson 2010). However, the fragmentary nature of regional flow data means that most analyses will be based on synthetic data where model assumptions may be difficult to check and results hard to verify.

Dunne et al. (2001) point out that models used for land use decisions are often run by a consultant to the land manager, or water extractor in this case. This means that the public has to hire a consultant too, if they want to check results and decisions to make sure they are protective. One solution to that problem is to have an objective third party running models influencing resource management decisions that effect public trust (Dunne et al. 2001). Optimally decisions would be based on flow data collected within the watershed and results would be more accurate and easier for the public to understand.

The proposed Policy continues to create the illusion that it will help stem the decline of salmon and steelhead, but in fact only flows for adult passage and spawning are considered not those for juvenile rearing. McMahon (2008) pointed out this problem: "Implementation of a diversion season along with the proposed minimum base flow (MBF) and maximum cumulative diversion (MCD) standards to maintain the fall-winter hydrograph could offer a false sense of protection to the listed species if flow levels during other seasons are insufficient to support the completion of rest of the freshwater life cycle." As substantiated in previous comments (Higgins 2008a, 2008b), the lack of flow to support the juvenile life history phase of coho salmon and steelhead trout is most limiting in the region. Therefore, ignoring summer and fall flows before the proposed season of diversion means that the most serious water supply question is not even discussed let alone resolved.

The North Coast Stream Flow Coalition stands ready to mobilize volunteers to help collect data, observe streams and to work essentially as an extension of SWRCB WRD staff. The WRD currently treats water users as its clients and seems reluctant to partner with interests that seek improvement in stream conditions that support public trust values. We may be more able to expand the capacity of the SWRCB WRD with regard to monitoring than water users because of lower overhead and would not have the same conflict of interest as water extractors.

Basin Plan Compliance Requires Specific Action, Time Line and Monitoring

The proposed *Policy* language in Section 8.3 states that " the State Water Board may modify existing permits or licenses if the State Water Board determines that such modification is necessary to meet water quality objectives contained in water quality control plans established or modified pursuant to Division 7 (commencing with section 13000) of the Water Code." This indicates that the *Policy* must meet Basin Plan standards, when in fact legal and illegal water diversion are currently greatly reducing flow and contributing to pollution. The relationship between depleted flows and water quality problems, such as increased stream temperature and nutrient pollution promoted by stagnation, are well recognized in the region but ignored in the proposed *Policy*. For details on this line of argument, please see Higgins (2008a).

Since Basin Plan implementation is subject to §13242, the proposed Policy should meet those standards. The requirements are listed below with comments following noting problems with compliance. "The program of implementation for achieving water quality objectives shall include, but not be limited to:

a) "A description of the nature of the actions which are necessary to achieve the objectives, including recommendation for appropriate action by any entity, public or private."

In order to materially improve water quality during the critical summer and fall seasons for juvenile salmonid rearing, there would need to be flow data collected in these seasons and some plan for reducing illegal diversions that are the causal mechanism of flow depletion and pollution. If the SWRCB WRD were already enforcing §1243 this problem would not be continuing because they would be maintaining suitability for aquatic recreation and flows for the "preservation and enhancement of fish and wildlife resources." Since the proposed Policy only deals with new permits that would extract water in winter, when there are fewer water quality problems, the whole problem of summer Basin Plan compliance is avoided. The language of §13242 suggests exploring all avenues to attain compliance, which could include cooperative volunteer monitoring proposed herein. However, since illegal water use is a substantial contributor to the problem, restoring flows sufficient to attain Basin Plan standards would require speedy enforcement action as part of the solution. There is no strategy or schedule for increased enforcement in the proposed *Policy*, only a statement that there are more enforcement personnel being hired State-wide.

b) "A time schedule for actions to be taken."

It is approaching 20 years ago when the Friends of the Navarro Watershed began their battle to try and restore the flows of that once thriving stream.

> "Illegal and unreasonable water diversions from the Navarro River and its tributaries, primarily for agricultural purposes, have significantly impaired instream fish and wildlife beneficial uses, to the point where the river was literally pumped dry during August and September of 1992. Such illegal and unreasonable diversions threaten again this fall to eliminate the natural flow of the river and its tributaries necessary to sustain constitutionally and statutorily protected instream fish and wildlife beneficial uses." - Volker (1994).

The SWRCB turned down the petition based on public trust and refused to use enforcement to reverse problems of dewatering, despite identifying "121 reservoirs in the Navarro River Watershed without any apparent water rights" (SWRCB, 1998). None of these illegal ponds were ordered removed and the annual dewatering of what was once a magnificent salmon and steelhead stream is now routine. Coho salmon have gone extinct and if nothing is done to improve conditions and monitor use to prevent further depletion, it is likely that the estuary will soon become too eutrophic to function and even the hearty steelhead may perish. The Navarro is under the AB 2121 jurisdiction. When will it be back on the surface in summer in compliance with §1243 and;

therefore, also be meeting Basin Plan standards for water quality? The proposed Policy would need to define a rate of expected recovery and a date for compliance to conform to §13242.

Peer reviewers all noted the necessity for including climate change when the *Policy* was revised, but there is no expanded discussion despite regional data showing that effects are already being felt (Van Kirk and Naman, 2008). As noted in previous comments (Higgins 2008a), the need for speedy action is also supported by information on decadal cycles of ocean productivity and wet and dry climatic cycles in northern California (Collison et al. 2003). The proposed Policy should have acknowledged the possibility that less productive ocean cycles and dry climatic regime is expected to recur sometime between 2020 and 2025 and set its schedule for enforcement and compliance accordingly. Lack of prompt action is likely to lead to irretrievable and irreversible Pacific salmon stock losses that will deprive all generations of Californians going forward.

c) "A description of surveillance to be undertaken to determine compliance with objectives."

There is no explicit monitoring plan offered in the proposed Policy other than that those issued permits will collect data and share it back with the SWRCB. It is unclear from the language of the Policy whether required flow data would be made available to the public in either real time or at least annually. A workable plan to meet §13242 requirements would include monitoring of larger tributaries and mainstem rivers with real time data gages that could be viewed by the public over the Internet similar to those operated by the Yurok Tribe (http://exchange.yuroktribe.nsn.us/lrgsclient/stations/stations.html). As noted above, volunteers could supply data on tributary flows and could document conditions by using photopoints and geo-positioning data (GPS) to tie in locations. Use of automated temperature sensing probes should also be considered because it is an indirect way to learn when flows levels trigger impairment and fluctuations can indicate when the stream goes dry.

The Klamath Resource Information System (KRIS) (www.krisweb.com) covers almost the entire AB 2121 area with the exception of the Albion River and Big Salmon Creek (Figure 2). This water quality, fisheries and watershed database has already had more than $1 million in public funds invested in collection of baseline data, including all large flow data sets. All versions are in the public domain and could be updated without charge in perpetuity. There is interest among North Coast Stream Flow Coalition members to become your data partners and they may be pursuing grant funding to achieve this objective. The KRIS system is geared for cooperative updating, with many data processing tools built in, and has a metadata system that makes quality assurance and quality control possible even with a number of data contributors. Another advantage of using KRIS is that it has coverage of other critical watershed areas outside the AB 2121 area. The SWRCB keeps using lack of funding as an excuse, but with more innovation and collaboration, lack of funding could easily be overcome.

Figure 2. Map of completed Klamath Resource Information System (KRIS) database projects with potential cooperators and SWRCB data partners.

Groundwater Use Cannot Be Ignored Inside and Outside AB 2121 Area

Peer reviewers Band (2008), Gearheart (2008) and McMahon (2008) point out that no real water budget can be calculated without knowing the influence of ground water withdrawal. Since the proposed Policy lacks any substance with regard to groundwater and its effect on surface flow, its water budget calculations and any of those seeking permits will lack any scientific validity. This is a very clear and direct cumulative effect of the Policy since it makes acquiring a new water right very rigorous, agricultural operations will switch more and more to ground water extraction. Consequently, this another major deficiency with regard to CEQA compliance.

Jackson (2009) established that the Napa River had gone from a gaining stream, with the mainstem increasing in volume and suitable for salmonids in 1972 (Faye 1973), to one that was flow depleted due to increased groundwater by 2009. The SWRCB (2000) also recognized the connection between surface water and groundwater at the mouth of the North Fork Gualala River when it prohibited pumping from water for domestic use from the gravel alluvium of the stream when surface flows drop below 4 cfs. This is the way all North Coast rivers work and the connection between the groundwater and surface water would both feed the stream with flow and provide temperature buffering through hyporheic connections (U.S. EPA 2003). Depletion of flow contributions from groundwater due to pumping in alluvial aquifers not only decreases surface flow volume, but also contributes to thermal pollution that does not meet Basin Plan standards nor protect coldwater fish beneficial uses as required under the Clean Water Act. The SWRCB WRD can no longer claim ignorance of these connections because of your SWRCB (2000) finding and the recognition within the proposed Policy that: "Groundwater is the primary source of water for streamflow" (p109 of 128). Consequently, the proposed Policy must be amended to include groundwater and lay out a §13242 compliant course of action and time line.

Scott River Crisis Needs SWRCB Action Now: The SWRCB WRD also needs to exert its authority on the Scott and Shasta rivers because lack of flows due to dereliction of enforcement has created a fisheries and water quality crisis. As clearly established in my prior comments (Higgins 2008a) and by Van Kirk and Naman (2008), the Scott River is flow depleted because of increased groundwater extraction and low flow levels are unprecedented. Figure 3 shows the average daily flow of the Scott River at Jones Beach at the bottom of the Scott Valley agricultural area. SWRCB (1989) adjudicated levels to protect aquatic resources in the Scott River canyon were not met during the summer and fall of 2009. In fact flows dropped to less than 10 cfs and extremely low flow extended into the season when fall Chinook salmon migrations began. CDFG (2009) noted that fall Chinook were unable to disperse far from the mouth (Figure 4) and that disease (Figure 5) due to warm water and associated stress. This had the potential risk of precipitating an adult fish kill (Eureka Times Standard 9/26/09). Luckily a disease epidemic did not occur due to colder night time temperature onset.

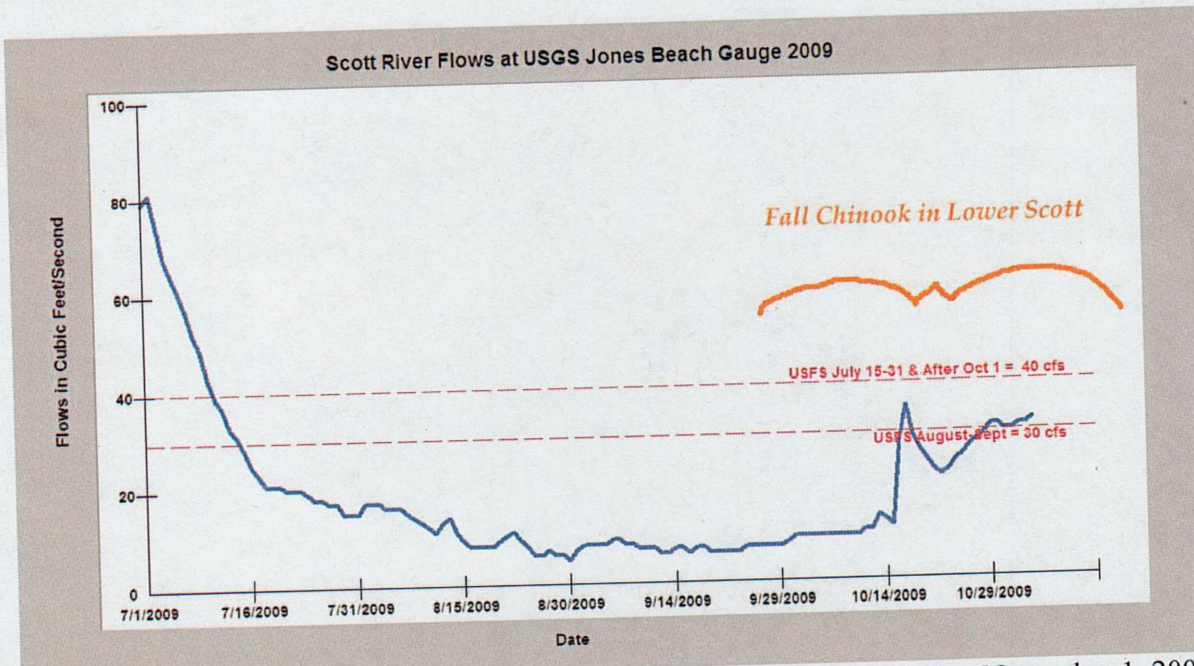

Figure 3. Average daily flow of the Scott River at Jones Beach from July 1 to November 1, 2009 with the adjudicated flow levels for seasons referenced as thresholds. After July 15, these levels were never met.

Figure 4. Adult fall Chinook circle in a pool not far upstream of the convergence with the Klamath River in late September 2009. Unable to disburse and subjected to warm water temperatures, the fish were becoming diseased as indicated by white spots of fungus visible in photo. (CDFG 2009).

Figure 5. Photo of fall Chinook salmon mortalities in late September 2009 from the Scott River showing lesions on the sides of the fish from Furunculosis and gill whitening caused by the bacteria Columnaris. These are the fish diseases that caused the mainstem Klamath River adult fish kill of September 2002. CDFG 2009.

Dive observations in the Scott River canyon (Kier Associates 2009) indicate that there have been 100 summer steelhead or more in several recent years and base flows that meet adjudicated levels need to be enforced for this listed species also.

What is not shown in Figure 3 is the adjudicated level of flow after October 31, which is 200 cfs. I personally went into the field on November 1, 2009 to observe conditions for fall Chinook salmon. Flow depletion was impeding migration (Figure 6) and fish were being forced to choose suboptimal locations for spawning (Figure 7). As pointed out in prior comments (Higgins 2008a), this diminishes the likelihood of survival of fall Chinook eggs and alevin due to high levels of decomposed granitic sands and likelihood of bedload transport. The very large redd area in Figure 7 is the result of fish aggregating in an attempt to clean gravels to increase oxygen flow for eggs. Unfortunately, the abundant sand mobilizes during even moderate subsequent storm events and is likely to smother eggs or plug spaces that would allow for alevin to successfully emerge as fry.

Coho salmon migrations are underway in early November; therefore, lack of flows were also hampering access to spawning areas for this endangered species. CDFG has abandoned its enforcement authority in the Shasta and Scott as a political tactic to win support from farmers and ranchers for its coho salmon ITP and as result both streams were nearly dried up (Kier Associates 2009). In the response to one of my comments (3.1.10) on the draft policy, the SWRCB staff stated the following:

> "The State Water Board set the priority streams for enforcement following consultation with the Department of Fish and Game. The Scott River was not identified by the Department of Fish and Game as a high priority stream for the State Water Board's water rights enforcement resources."

The SWRCB WRD needs to be informed that the Shasta and Scott ITP implementation by CDFG is currently being held in abeyance by a lawsuit filed by Earthjustice, Klamath Riverkeeper (2009) and several Coalition members because it is a flagrant violation of public trust and the California Endangered Species Act (CESA). The SWRCB has other responsibilities that overlap here, such as its delegated authority from the U.S. Environmental Protection Agency to protect coldwater fish beneficial uses under the CWA. That authority requires that more priority be given the Scott River regardless of AB 2121 process.

Ironically, the low flows that were failing to meet even summer adjudicated levels, let alone the 200 cfs for salmon migration after October 31, were lauded by the Scott River Water Trust in the Siskiyou Daily News (11/05/09):

> "The Water Trust's effort is significant because the amount of added water helped the flows reconnect through the dry reaches of the Scott River in Scott Valley. Some water users are also donating water."

This indicates that water has been privatized and the "buying" of temporary flows for salmon is unacceptable and in this instance was a fraud because flows remained pathetically low and insufficient for both fall Chinook and coho salmon. The SWRCB WRD division must enforce the law and not allow such bartering for public trust rights to be arbitrated by water users.

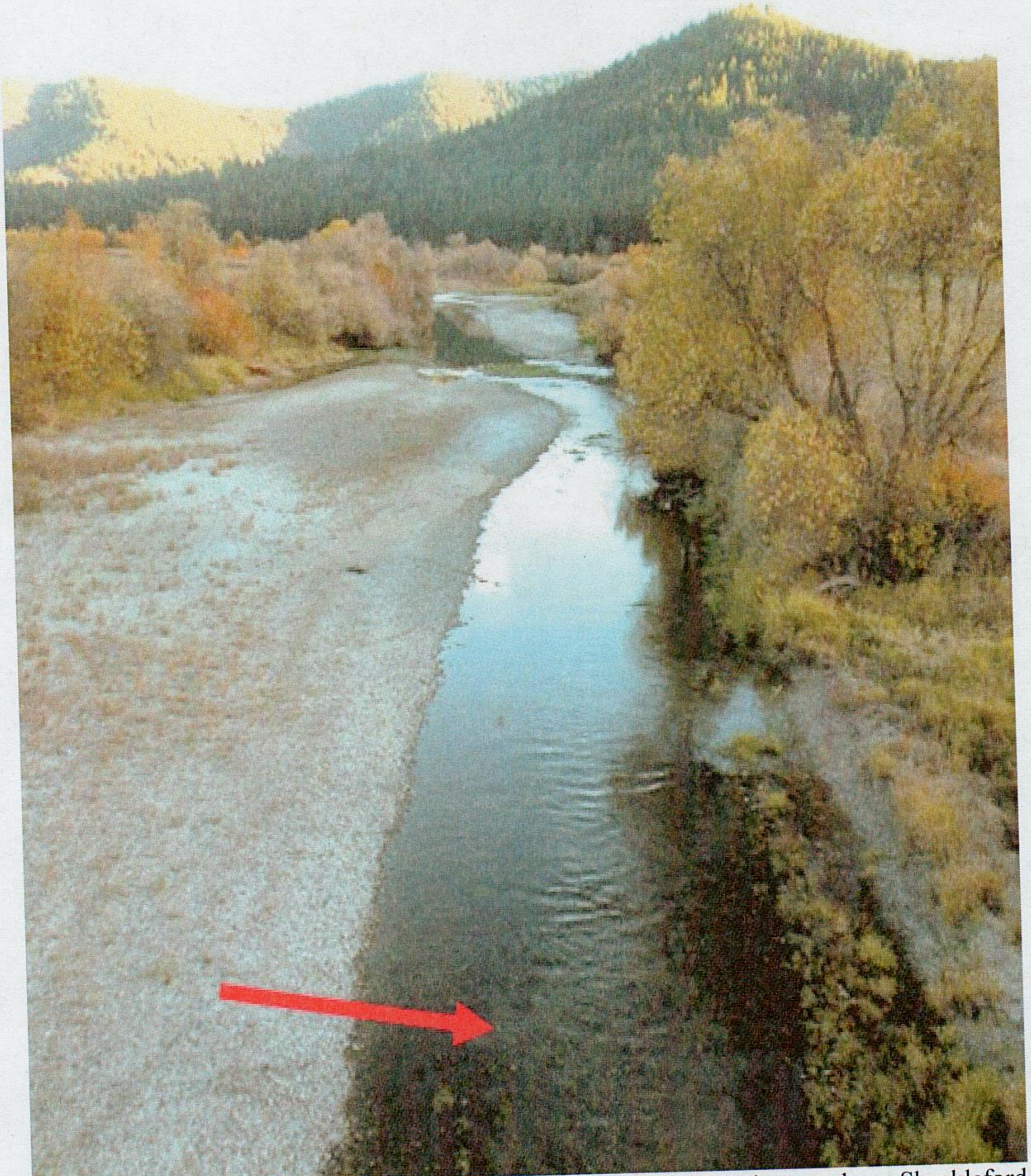

Figure 4. Scott River Fall Chinook spawning redd (arrow) in the mainstem above Shackleford Creek at 35 cfs on November 1, 2009. Spawning conditions here are poor and likelihood of survival of eggs and alevin is low. Photo by Patrick Higgins.

Figure 5. Fall Chinook salmon in the Scott River making its way upstream in a flow depleted channel choked with aquatic vegetation that is due to restricted flows and lack of scour. These flows were prevailing as of November 1, 2009, when endangered coho salmon are also migrating. Photo by Patrick Higgins.

Shasta River Illegal Groundwater Use Also Needs SWRCB WRD Action: As detailed in Higgins (2008a), Shasta River flows were critically depleted by illegal water withdrawal from subsurface flows connected to groundwater. Please refer to Higgins (2008a) for full context and case study of Shasta River. The Nature Conservancy (TNC) has purchased land surrounding Big Springs Creek, but as noted previously the springs has been tapped above the property and flows of 105 cfs had been diminished to sometimes less than 20 cfs (Kier Associates 1999). TNC recognizes that it has no authority over water flow but is involved in negotiations to try and improve flow conditions (Amy Moss, TNC, personal communication). This seems to be another example where there is again a sale of water by illegal extractors and back room bartering by private parties for flows to better meet public trust needs is also on-going. The job of the SWRCB WRD is to restore flow to meet §1243 and their responsibility cannot be abrogated and the water of Big Springs privatized.

The Shasta River also experienced extremely low flows during the summer and fall of 2009 increasing risk of a fall Chinook fish kill in this basin as well. Severely low flows in summer and early fall 2009 (Figure 6) caused major problem with stagnation and departure from Basin Plan standards. Summer conditions have now become almost universally hostile for juvenile salmonid rearing with water temperatures in the lower Shasta up to 30 C (86 F). To the credit of the Shasta River water users, they cut water use substantially after October 1 and flows increased to nearly 100 cfs. This is partially in response to their agreement to restrict irrigation to only stock watering needs after that date, but in comparison to the neighboring Scott Valley it shows some sensitivity to the needs of fall Chinook.

Figure 6. Shasta River at Montague Road bridge on Aug 21, 2009 with a flow or 16 cfs, which promotes stagnation. Algae blooms drive pH up above 9.0-9.5, which causes levels of dissolved ammonia to rise to lethal for salmonids. Photo used with permission of Klamath Riverkeeper.

Enforcement

Another weakness in the proposed Policy is the lack of enforcement and removal of the 1771 illegal reservoirs detected by the previous draft assembly in a timely fashion to restore public trust and prevent further loss of salmon and steelhead stocks. The SWRCB response to comments (18.3.7) states:

"The State Water Board has taken 35 formal enforcement actions in the AB 2121 area. In some cases those actions have resulted in litigation. Water right enforcement actions are extremely controversial and can be very resource intensive to pursue. A recent case took six years to resolve, including the time it took for the case to make its way through the courts. The State Water Board does not have sufficient resources to prosecute every case, and must rely on voluntary compliance efforts where voluntary actions can achieve compliance. The State Water Board must also set enforcement priorities. This policy attempts to do that."

Although the SWRCB does not indicate the success of the 35 enforcement actions and implies each may take years, let us presume that all have been successful for the sake of discussion. Since the AB 2121 process has been on-going for six years and there are 1771 illegal ponds and diversions noted in the area, if the pace of enforcement does not accelerate then all actions will be completed in approximately 295 years. Section 1055 of the State Water Code allows administrative civil liability fines of $500 and the 1771 illegal ponds could generate could generate $885,000 daily for the SWRCB WRD and fund all the positions needed. It would also send a clear message that illegal water users have to dismantle their dams or face major financial consequences. The claim of the SWRCB that funding is a constraint rings hollow when their civil liability authority is considered.

Extractive Use Given Preference Over Protection of Salmon and Steelhead

Higgins (2008a) and other appendices attached build an irrefutable case that the North Coast coho salmon are on a slide to extinction and that other species like spring Chinook and even fall Chinook stocks may follow the same fate, if radical reform of water use is not implemented rapidly. While the SWRCB WRD considers cracking down on illegal water users to be "controversial", they seem positively blasé about the on-going wave of salmon and steelhead decimation and extirpation. The bias of the SWRCB staff is apparent in the following response to comments on the previous draft, with authors identified at the end of the statement answered immediately below:

Comment 31.0.9: The future of California fisheries depends on our ability to address the threats to salmonid survival and to improve habitat and stream flows conditions throughout their historic range. (Brian Johnson, Trout Unlimited and Richard Roos-Collins, Peregrine Chapter of the National Audubon Society)

Response: Comment noted.

Comment 1.7.4: The Draft Policy has substantial technical merit but much more action is needed on regulation of water use to prevent the further decline of salmon stocks and likelihood of stock extinctions. (Patrick Higgins, Consulting Fisheries Biologist/Sierra Club Redwood Chapter)

Response: Comment noted.

Response to Comment 21.0.6: "By law, the State Water Board is required to adopt a policy to maintain instream flows to protect habitat for fish species that are threatened with extinction. In doing so, the Board is required to consider balancing the needs of the water users against the needs of natural resources."

There seems to be no bureaucratic incentive for staff protection of public trust and strong disincentive for stopping criminal behavior within the SWRCB WRD. One can only surmise that political influence exerted by wealthy land owners is preventing enforcement and shielding law breakers who are greatly enriched by using stolen water while at the same time depriving the public of its right to fish, swim and get a clean drink of water. It is outrageous that SWRCB WRD staff is paid by the people of the State, not just irrigators, but turns a blind eye as North Coast salmon and steelhead go extinct.

Because it is outside the AB 2121 area and due to time constraints, the Eel River flow and salmon crisis is not broached here-in. However, that river is suffering flow depletion from illegal diversion related to marijuana growing and coho salmon counts basin-wide are often in the dozens and fall Chinook in the low hundreds (Appendix C). The resolution to this dispersed water use throughout the basin may take time to resolve, which is why Friends of the Eel River is requesting the SWRCB to order higher releases from the Potter Valley Project immediately.

Reeves et al. (1995) make clear that for Pacific salmon to be recovered, aquatic habitat conditions must restored to be similar to those with which they co-evolved. There is no assurance presently provided in the proposed Policy that such conditions will result in meeting this objective anywhere on the North Coast.

Sincerely,

Patrick Higgins

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Appendix A

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November 17, 2008

Mr. Daniel Meyers, Water Rights Committee Chair
Mendocino Group of the Sierra Club
P.O. Box 499
Philo, CA 95466-0178

Re: Adequacy of Mendocino General Plan Update and Draft Environmental Impact Report (DEIR) with Regard to Pacific Salmon Recovery and Meeting CEQA Requirements

Dear Mr. Meyers,

At your request as Redwood Chapter Sierra Club Water Rights Committee Chair, I have reviewed the Mendocino County General Plan and the Hydrology and Water Quality and Biological Resources chapters of the related *Draft Environmental Impact Report* (DEIR) (MCPD 2008). In addition I have also read numerous Mendocino County Total Maximum Daily Load (TMDL) reports (U.S. EPA 1998, 1999, 2000, 2000a) and associated technical documents (GMA 1999, 2000) and reviewed consulting hydrologist Dennis Jackson (2008) report regarding changes in Navarro River flow over the last several decades.

I find that the Mendocino County General Plan has insufficient relevant implementation measures or action items to be effective in preventing further declines in aquatic resources. Their DEIR mentions coho salmon four times in voluminous tables of sensitive plant and animal species, but there is absolutely no discussion of fisheries resources, water flow and the impacts of implementing the updated General Plan on Pacific salmon. This is incredible negligence since coho salmon (*Oncorhynchus kisutch*), Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*Oncorhynchus mykiss*) are all recognized as being in danger of extinction in Mendocino County (Good et al. 2005). Furthermore, the existing problems with over-allocation of water, illegal diversions and lack of stream flow (Higgins 2008) are wholly ignored. Consequently, the DEIR is fatally flawed when it comes to meeting the requirements of the California Environmental Quality Act (CEQA), which requires use of best available scientific literature and analysis of cumulative effects. The DEIR invokes the power of various agencies to prevent damage to resources in lieu of ordinances or action, but in fact these agencies are not capable of doing this without more cooperation from Mendocino County.

My Qualifications

I have been a consulting fisheries biologist with an office in Arcata, California since 1989 and my specialty is salmon and steelhead restoration. In that capacity I have authored fisheries elements for several large northern California watershed restoration plans (Kier Associates, 1991; Pacific Watershed Associates, 1994; Mendocino Resource Conservation District, 1992) and co-authored the northwestern California status review of Pacific salmon species on behalf of the American Fisheries Society (Higgins et al., 1992). I prepared the *Gualala River Watershed Literature Search and Assimilation* (Higgins 1997) to capture the historical changes of the river and its fish runs but also to outline steps for potential restoration. I have provided comments on timber harvest plans or vineyard conversions for more than a dozen private clients in Mendocino County watersheds and I am attaching several for your reference and potential use of County staff (Higgins, 2003, 2004, 2007). I am also providing my comments (Higgins 2006) on the *Jackson Demonstration State Forest Management Plan and EIR* (CDF 2006) to provide further evidence of cumulative watershed effects in Mendocino County that need to be considered in the revised DEIR.

I have played a key role in design and implementation of a regional fisheries, water quality and watershed information database system, known as the Klamath Resource Information System or KRIS (www.krisweb.com). This custom program was originally devised to track restoration success in the Klamath and Trinity River basins, but has been applied to another dozen watersheds in northwestern California including the Gualala, Garcia, Navarro, Big, Noyo, Ten Mile, Mattole and Russian Rivers. The data incorporated in these projects allow comprehensive analysis of watershed and aquatic health and should be acknowledged and fully utilized by Mendocino County.

Since January 2004, I have been working under contract with the Klamath Basin Tribal Water Quality Work Group, a consortium of environmental departments of Lower Klamath River Basin Indian Tribes, to improve enforcement of the Clean Water Act and to expedite Klamath Dam removal (www.klamathwaterquality.com). Through work on review of Total Maximum Daily Load (TMDL) reports, I have become further acquainted with factors limiting Pacific salmon, including those related to flow depletion. I also have extensive experience as a field biologist in Mendocino County (Higgins 1995) starting as a seasonal aid with the California Department of Fish and Game on the Navarro and Mattole Rivers in 1972. From 1994-96 I collected data for a water pollution assessment of the Eel River basin (Friedrichsen 1997), including portions in Mendocino County. Some of my comments below are direct observation in the field of current river conditions in Mendocino County that contrast with historic accounts and data (Kimsey 1953) from the same locale.

DEIR Fails to Properly Characterize Current Mendocino County Watershed and Aquatic Habitat Conditions

There is no recognition of the degraded condition of Mendocino County watersheds relative to those extant when the General Plan was last adopted in 1981. While the DEIR cites Clean Water Act pollution abatement efforts through the Total Maximum Daily Load (TMDL) program, they do not delve into the extent of impairment, the relationship to land use or the implications for Mendocino County General Plan implementation. All major river systems in Mendocino County are recognized by the California State Water Resources Control Board (SWRCB, 2006) as impaired under section 303d of the Clean Water Act (Table 1). The DEIS has a partial list of impaired water bodies but fails to acknowledge that the Garcia, Albion and Noyo Rivers are temperature impaired.

The most pervasive water quality problem in Mendocino County is water temperature, which is driven by cumulative effects of riparian vegetation removal, increased sedimentation leading to expanded width to depth ratios, reduced flows and wetland destruction leading to loss of connection between surface water and groundwater. Cold water beneficial uses (COLD) include coho salmon, Chinook salmon and steelhead populations within Mendocino County Pacific salmon species that are significantly and negatively impacted (Higgins et al.1992, IFR 2003).

Listings for sediment are driven by erosion related to roads, timber harvest, agricultural activities and urban and rural residential development (SWRCB 2006). These current conditions need to be recognized and the interaction with continuing development evaluated to meet CEQA requirements. Since 1981, many Mendocino County watersheds such as the Noyo River have been logged in 70% of their watershed area (GMA 1998) (Figure 1). In basins like the Gualala and Navarro the effects of conversion to vineyards combine with previous and on-going timber harvest and development to cause

Table 1. California SWRCB 303d listed waterbodies in Mendocino County

Stream/Watershed	Reason for Listing
Albion River	Temperature
Big River	Temperature
Garcia River	Sediment
Gualala River	Sediment
Mattole River	Temperature
MF Eel River	Temperature
Middle-Main Eel River	Temperature
Navarro River	Temperature
NF Eel River	Temperature
Noyo River	Sediment
Pudding Creek	Temperature
SF Eel River	Temperature
Ten Mile River	Temperature
Upper Eel River	Temperature, Sediment, Mercury
Upper Russian River	Sediment, Temperature, Mercury

major productive river systems to lose surface flow (Figure 2) where they were formerly deep and perennially cold. This eclipses all beneficial uses seasonally, seriously compromises fisheries productivity and may constrain downstream agricultural water supply as well.

Environmental data, such as CDFG (2004) habitat typing can be used to understand conditions as can data from Friedrichsen (1996). Figure 3 shows water temperatures for the upper South Fork Eel within Mendocino County, indicating that even as of 1996 lethal conditions for salmonids (Sullivan et al. 2000) prevailed in the mainstem above Rattlesnake Creek and in lower Ten Mile Creek. After collecting temperature data in Ten Mile Creek in 1995-96, I returned to study a nearby stream and found that Ten Mile Creek now loses surface flow where it formerly was perennial (Figure 4).

The DEIR also does a particularly poor job of dealing with the aquatic impacts of urbanization (Booth and Jackson 1997). Rural residential and urban development increase risk of non-point source pollution from herbicides and pesticides that are known to negatively impact salmonids (Ewing 1999,

Figure 1. Twenty square miles of redwood clearcuts near Ft. Bragg in the Pudding Creek and Little North Fork Noyo watersheds. The line of trees extending to the right below center in the photo is the Little NF riparian zone. Photo by Nicholas Wilson, 1990 from KRIS Noyo.

Figure 2. Gualala River Wheatfield Fork running dry during summer 2001 due to more than 20 feet of sediment deposition. Rural residential and vineyard use of water contribute to the problem. Photo by the California Geologic Service (CGS) from KRIS

Gualala.

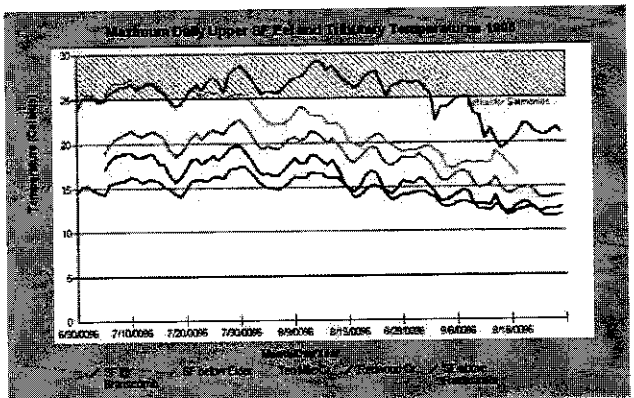


Figure 3. Water temperatures during summer of 1996 in the upper South Fork Eel and show some streams are recovering but that the mainstem and Ten Mile Creek have major problems supporting salmonids. Data from Friedrichsen 1997).

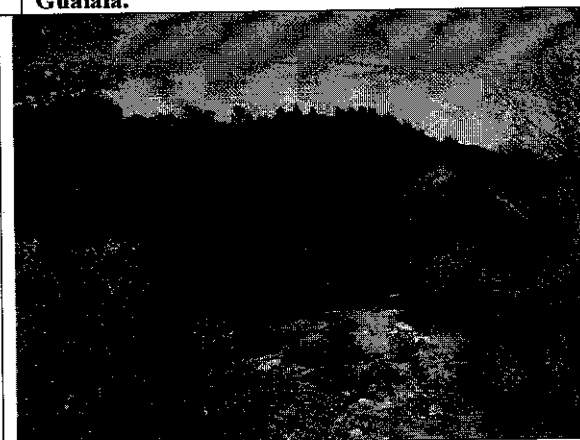


Figure 4.Ten Mile Creek north of Laytonville in Mendocino County running dry in October 2002 where less than ten years before it had been perennial (Friedrichsen 1997). Photo by Diane Higgins.

NCAP 1999). Friedrichsen (1997) found that urban creeks in Willits had the poorest biodiversity (Barbour et al. 1998) of any other Eel River tributaries as indicated by the number of pollution intolerant taxa present in the mayfly (Ephemeroptera), stonefly (Plecoptera) and caddisfly (Trichoptera) orders (Figure 4). To be credible, the Mendocino County General Plan and the revised DEIR must clearly define challenges of urbanization and water quality impacts and formulate specific action items for storm water retention and pollution control.

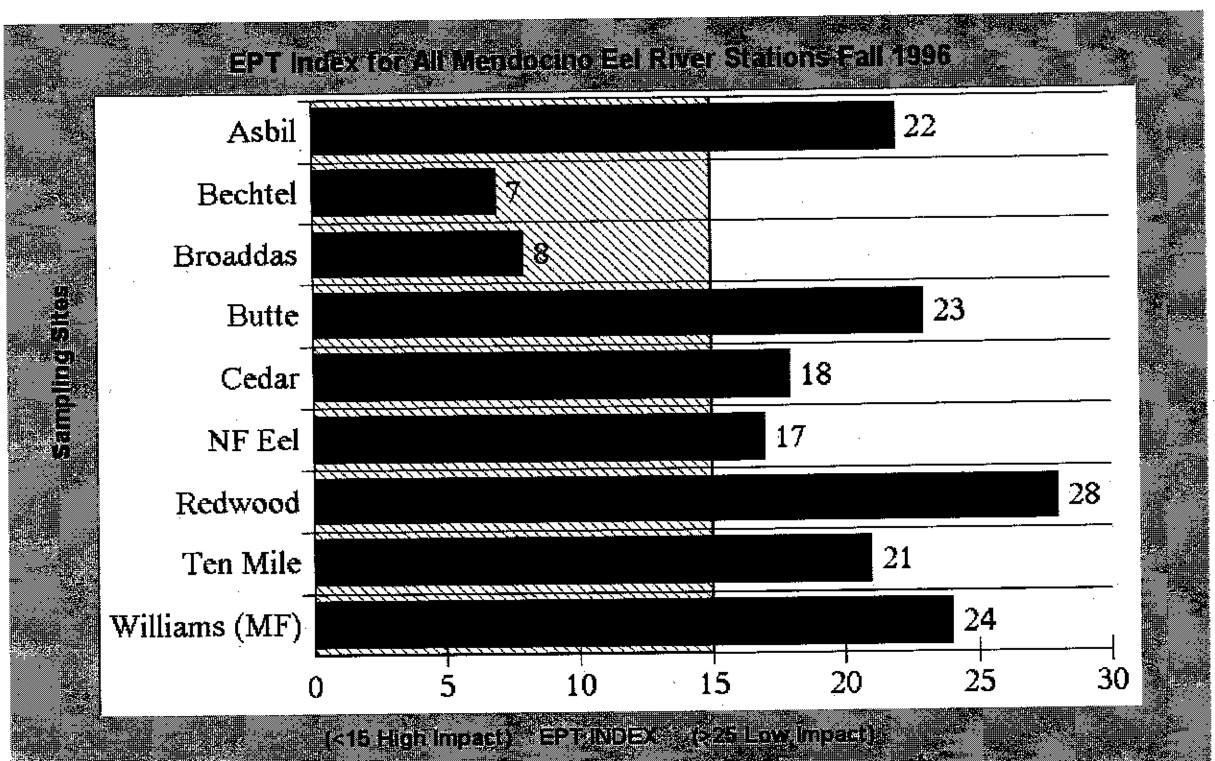


Figure 4. This chart shows Mendocino County Eel River tributary fall samples of aquatic macroinvertebrates, specifically mayfly, stonefly and caddisfly (EPT) species present, indicating very poor health for Willits urban streams Bechtel and Broaddas. Data from Friedrichsen (1997) and KRIS Coho.

DEIR Does Not Acknowledge Problems with Decreasing Water Availability

The DEIR does not acknowledge the decrease in surface water availability since 1981, when the Mendocino County General Plan was last adopted. Massive aggradation (geologic term to describe a stream being buried) has occurred as a result of cumulative watershed effects (CWE) due to logging and road building in too wide an area for the watershed and stream to maintain equilibrium. The DEIR also fails to acknowledge the dramatically increased demand for surface and groundwater due to rural residential and agricultural development, especially vineyards.

<u>Cumulative Watershed Effects and Decreased Flows</u>: The DEIR ignores recent regional scientific studies regarding how widespread watershed disturbance affects aquatic ecosystems (Ligon et al. 1999, Dunne et al. 2001, Collison et al. 2003). Dunne et al. (2001) described cumulative effects as follows:

> "Generally speaking, the larger the proportion of the land surface that is disturbed at any time, and the larger the proportion of the land that is sensitive to severe disturbance, the larger is the downstream impact. These land-surface and channel changes can: increase runoff, degrade water quality, and alter channel and riparian conditions to make them less favorable for a large number of species that are valued by society."

One of the species "valued by society" that is being lost because of watershed and aquatic disturbance that is too extensive is the coho salmon (See Endangered Pacific Salmon). Although Dunne et al. (2001) focused on the timber harvest process, their observations on problems with piece-meal planning apply equally to the Mendocino County General Plan:

> "The concern about cumulative effects arises because it is increasingly acknowledged that, when reviewed on one parcel of terrain at a time, land use may appear to have little impact on plant and animal resources. But a multitude of independently reviewed land transformations may have a combined effect, which stresses and eventually destroys a biological population in the long run."

Mendocino County streams were in recovery from the 1964 flood when the General Plan was last revised. Although the wave of timber harvest from 1985-2000 often caused less ground disturbance than the post WW II logging, it was even more widespread and associated with significant expansion of road networks (GMA 1999, GMA 2000; NCRWQCB 2001). Road densities in logged or developed Mendocino County watersheds often exceed 5 miles of road per square mile of basin area with many miles of streamside roads (GMA 1999, NCRWQCB 2001), whereas properly functioning watershed condition for Pacific salmon is 2 mi./mi.^{2} with few or no streamside roads (NMFS 1996). Streamside roads cause both chronic and potential for catastrophic sediment yield (Spence et al. 1996). Jones and Grant (1996) point out that watershed hydrology can recovery rather quickly from timber effects, but that hydrologic perturbations from road networks such as increased peak flows and decreased base flows can persist for decades. The Mendocino General Plan and DEIS need to deal with these issues in a real way to comply with CEQA and to limit very undesirable impacts on aquatic resources and water supply. This problem is likely one that could be at least partially addressed through passage of a grading ordinance.

The combined effects of increased sediment yield (U.S. EPA 1998, 1999, 2000; GMA 1999, 2000, NCRWQCB 2001) and increased peak flows (Leopold and McBain1995) resulting from timber harvest and roads is that stream channels within Mendocino County have profoundly changed. Formerly deep and cold streams ideal for salmon and steelhead are now wide, warm and open (Figure 5) and some completely lose surface flow in late summer and fall. Water extraction from rivers prior to disturbance

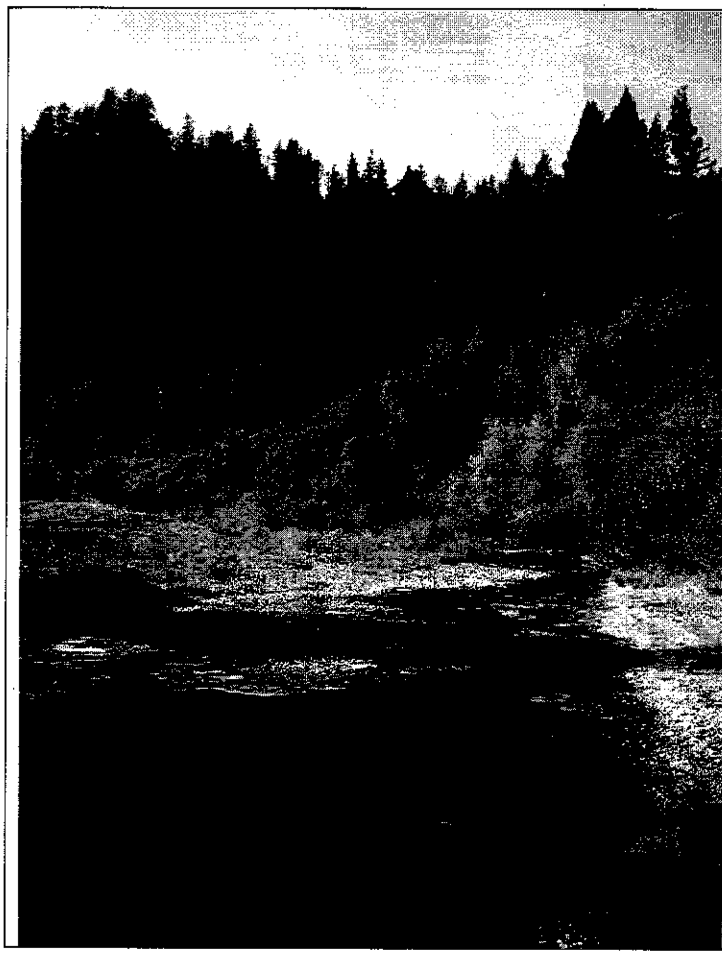


Figure 5 (at left). The lower mainstem Navarro River near Flume Gulch during low flow conditions on September 21, 2001 when the USGS gauge read 1.1 cfs. The algae on the margins of the stream indicate stagnation and no fish were present at the time of observation.

CDFG (Kimsey 1953) sampled this exact location in August 12, 1952 and found dozens of young of the year steelhead and yearling steelhead trout and a flow of 15 cfs during what was an average water year. See Pacific Salmon section below for more discussion.

Photo by Pat Higgins from KRIS Navarro (www.krisweb.com).

that had deep pools and healthy riparian zones did not seriously compromise beneficial uses, however, in their present condition these streams cannot support further water extraction and may not even be able to meet needs of priority water users without causing streams to become unsuitable for sensitive fish species.

The North Fork Gualala River serves as an example of cumulative effects of logging and diminishment of domestic surface water supply (Higgins 1997). The North Gualala River Water Company (NGRWC) originally drew its water in 1938 directly from Robinson Gulch and other lower Gualala River tributaries, but switched to the mainstem North Fork Gualala after intake systems were damaged by sediment transport in 1964 (Sommarstrom 1992). Ultimately a well was drilled adjacent to the North Fork to supply the needs of the community of Gualala but the well was found to be connected to surface water. NGRWC's water right allowed 2 cfs extraction with a required by-pass flow of 4 cfs (Sommarstrom 1992), but the company subsequently failed repeatedly to meet this requirement (Coast Action Group, 1995). The number of NGWD customers grew from 671 in 1985 to 902 as of 1995 but the California Department of Health Services has limited hook-ups to 1034 unless the storage and delivery system are substantially upgraded (Coast Action Group, 1995). Despite 40-70 inches of rainfall in the Noyo River watershed, the City of Fort Bragg has had concerns over its water supply (Richard LaVen personal communication) as surface flows and fish habitat have diminished due to erosion related logging and roads (Higgins 2006).

Vineyard development creates permanent disturbances that are unlike the forests they replace with regard to both sediment yield and hydrology. Whereas forest headwaters stored cold water in colluvium, vineyards reduce infiltration, tap groundwaters in these locations with wells and create impoundments that reduce streamflow. Loss of soil is chronic, and may be massive if vineyards are constructed improperly on steep slopes (Higgins 1997). My comments on a proposed forest to vineyard conversion in the North Fork Gualala in Mendocino County (Higgins 2007) are an illustrative case study and are provided in electronic form for continuing use by planning staff.

According to McMahon (2008) "dams on ephemeral streams have the potential to greatly dampen the early fall/winter freshets important for access to the upper reaches of small spawning tributaries by their capture of the entire flow within the stream until the reservoir is filled, potentially resulting in significant dewatering downstream." Band (2008) points out that October diversions to fill irrigation ponds may impede fall Chinook salmon migrations in Mendocino County and that synergistic effects between multiple diversions will lead to potential severe flow restrictions below tributary junctions. This increases risk of fine sediment deposition in these reaches that are often utilized by spawning salmonids (Band 2008).

Uncontrolled Surface Water Diversion and Groundwater Use: The recent study by the SWRCB Water Rights Division (2008), *Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams* and its appendices (Stetson Engineers 2007, 2007a), show clearly that California Water Codes are not being enforced in Mendocino County and that there is an epidemic problem with unpermitted diversions (Higgins 2008). This needs to be taken into consideration in Mendocino County's General Plan process and discussion incorporated as the DEIR is revised. Figure 6 shows the permitted impoundments in Mendocino County, but also those that have permits pending or are operating with no permits (non-filers) and Figure 7 is an aerial photo of the Navarro River basin showing legal and illegal impoundments. Volcker (1994) pointed out that the Navarro was losing surface flow in the early 1990s for the first time ever and filed a law suit based on public trust so that flows could be restored, although the law suit was not successful (SWRCB WDR 1998). Jackson (2008) examined Navarro River data and concluded that the 1980-2008 period had statistically significant lower minimum discharge, lower minimum 7-day discharge and lower median discharge than the period from 1951 to 1979 and there was a "statistically significant increase in the duration of low flows during the 1980-2008 time period."

Both rural residences and vineyards use wells to tap groundwaters that are connected to surface waters and thereby reduce habitat for salmon and steelhead and supply for downstream water users with prior rights. The SWRCB WRD hired peer reviewers for its flow study and they (Band, 2008; Gearheart, 2008; McMahon, 2008) found that no real water budget can be calculated without knowing the influence of ground water withdrawals. The California Department of Water Resources (DWR) has oversight over ground water withdrawal, but all well logs are treated as proprietary and restriction of ground water use is uncommon. While off-stream use or impoundments require permits, riparian water extraction by streamside land owners is not limited under California Water Codes nor does it require a permit. The Mendocino County General Plan revision and DEIR need to acknowledge that water is over-allocated and that a crisis exists with regard to meeting beneficial uses, such as providing cold water fish habitat and recreational opportunities, and provision of water for long time agricultural users (priority water rights holders). Stream conditions will have to be improved and illegal appropriation problems resolved before there is likely to be any "surplus" water for new development.

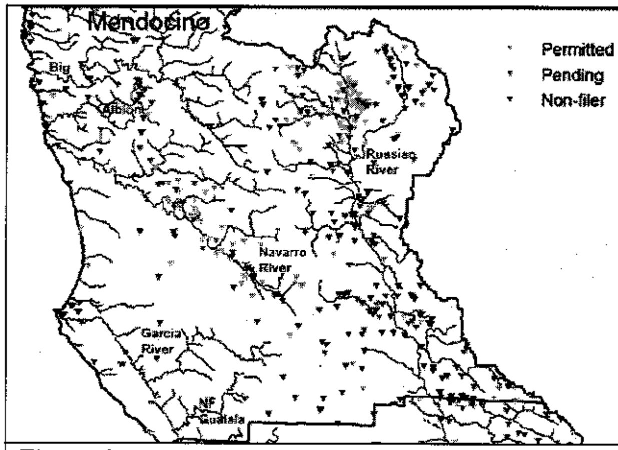


Figure 6. Map from Stetson engineers (2007) showing permitted, pending and illegal diversions (non-filer) for Mendocino County outside the Eel River basin.

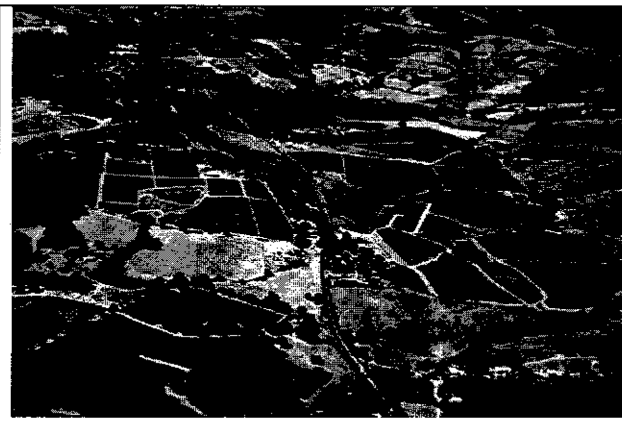
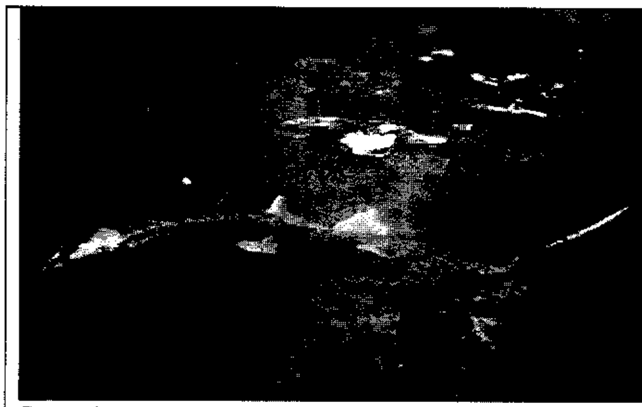


Figure 7. Aerial photo of agricultural development in the Navarro River basin circa 1998 shows ten ponds of different types typical of water storage. Photo by Rixanne Wehren from KRIS Navarro

DEIR Does Not Address Pacific Salmon Status or Measures for Protection

The DEIR makes reference to coho salmon and other sensitive Pacific salmon species only in tables with no discussion of their status within Mendocino County or the potential impacts of development on their chances for persistence and recovery. Sommarstrom (1984) characterized populations of salmon and steelhead as already diminishing in the *Mendocino County Salmon and Steelhead Management Plan* but noted that the California Department of Fish and Game (CDFG) did not collect enough data to gauge trends. There are still no trend data for salmon and steelhead populations, however, CDFG presence and absence surveys for juvenile coho salmon from 2000-2002 show that this species is disappearing (Figure 8). One can also infer from the number of rivers and streams that are losing surface flow or have otherwise become unsuitable habitat for coho, Chinook and steelhead that all these species are declining in the Mendocino County and at risk of loss (IFR 2003).



Spawning coho salmon in Mendocino County. Photo provided by Wendell Jones, CDFG retired. Date unknown.

Summer steelhead holding in the Middle Fork of the Eel River. Photo courtesy of Mike Ward. Summer 1988.

Coho Salmon: Higgins et al. (1992) noted that most Mendocino County coho salmon populations were either at high risk of extinction or "stocks of concern" based on declining freshwater habitat conditions. Brown et al. (1994) noted that Mendocino County "coho salmon appear to be absent or very rare in many of the streams they occupied historically" but also that populations in Noyo and upper SF Eel Rivers within the County (Figure 9) were two of the last of seven adult coho populations

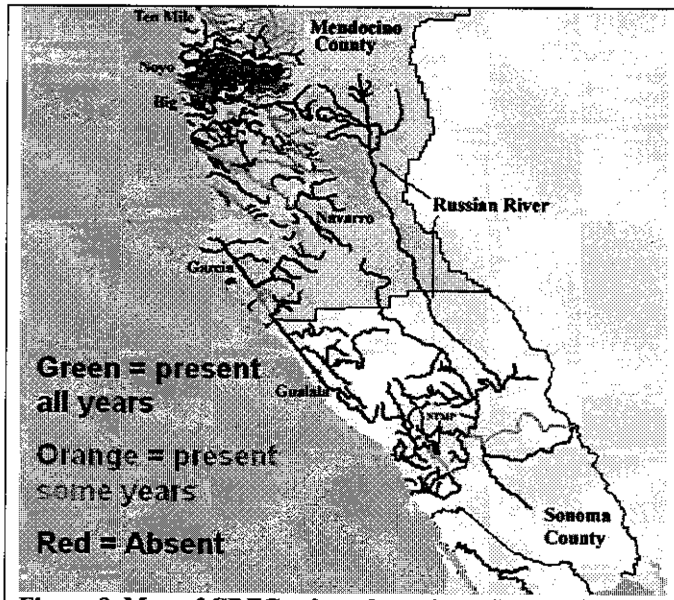


Figure 8. Map of CDFG coho salmon juvenile presence absence surveys conducted from 2000-2002. Absence for three years means extreme risk of local extinction.

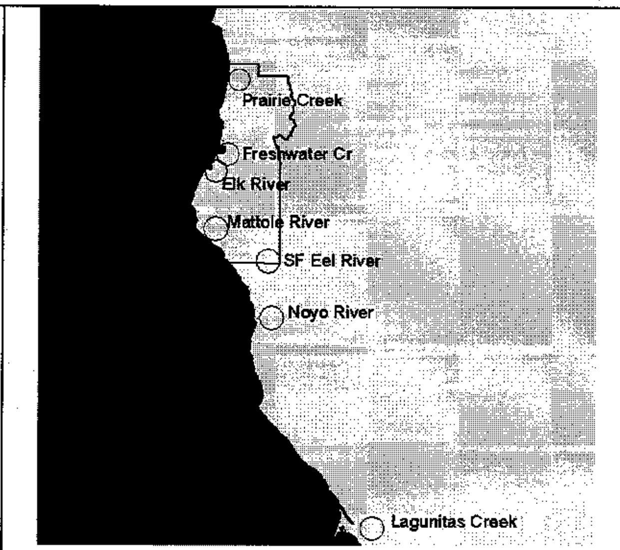


Figure 9. This map above shows the last populations of coho salmon in the hundreds in all of northwestern California, according Brown et al. (1994). If these last populations are lost, then the coho recovery will not be possible.

in the hundreds. The National Marine Fisheries Service (NMFS, 2001) group Mendocino County coho within the Central California Coast Evolutionarily Significant Unit (ESU) which is "presently in danger of extinction with the condition of coho salmon populations in this ESU worse than indicated by previous reviews."

The *Status Review of Coho Salmon North of San Francisco* (CDFG 2002) characterized the coho meta population including Mendocino County as follows:

> "Extant populations in this region appear to be small. Small population size along with large-scale fragmentation and collapse of range observed in data for this area indicate that metapopulation structure may be severely compromised and remaining populations may face greatly increased threats of extinction because of it. For this reason, the Department concludes that coho salmon in the Central Coast Coho ESU are in serious danger of extinction throughout all or a significant portion of their range."

Coho salmon were recognized as Threatened under the federal Endangered Species Act in 1997 (NMFS 1997) and subsequently upgraded to Endangered (Good et al. 2005). CDFG (2004a) also has recognized coho salmon as Threatened under California ESA.

The DEIS does not address or acknowledge the conditions described in status reviews nor use existing databases in Mendocino County KRIS projects (IFR 1999, 2003) to at least infer trends. For example, in the Noyo River basin data from historical memos and recent samples from CDFG show coho distribution shrinking from the 1960s (Figures 10) to the 1990s (Figure 11). In the 1960's, coho salmon dominated many of the tributaries of the Noyo River watershed, including the eastern portion of the watershed, except in reaches with steep gradient where steelhead were more numerous. By the 1990s, eastern Noyo sub-basins lacked coho or retained them at remnant levels, while the western Noyo watershed tributaries were dominated by steelhead, with coho still present but sub-dominant.

CDFG surveys of the Gualala River in 2001, including the North Fork in Mendocino County found coho salmon to be absent, despite planting of thousands yearling hatchery coho from 1995-1998,

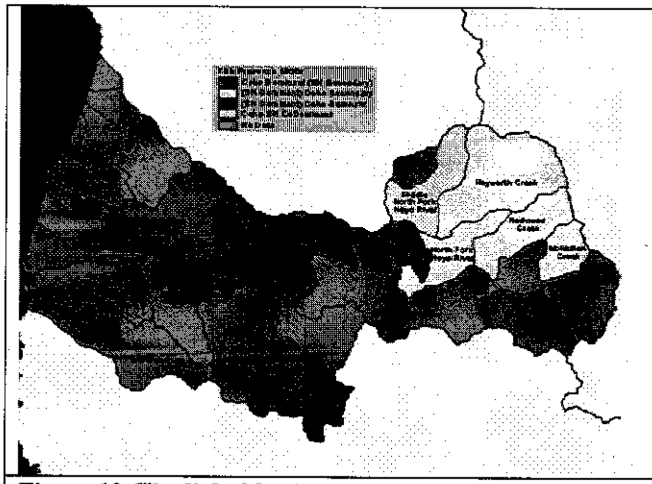


Figure 10. The light blue basins above are those dominated by coho salmon according to 1960's CDFG surveys, while yellow basins had coho present but less numerous than steelhead juveniles. From KRIS Noyo.

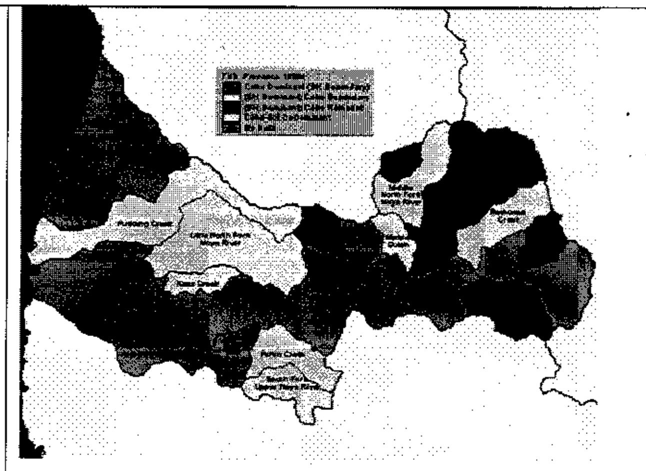


Figure 11. Electrofishing and dive samples in the 1990s show a shift in the distribution of coho in the Noyo River since the 1960s. Steelhead dominate western basins (yellow), except for Bear Creek (light blue), and coho are at remnant levels or absent (red). From KRIS Noyo.

indicating loss of ability to support the species (Higgins 2004). Similarly, coho salmon were not found in presence/absence surveys of Russian River tributaries within Mendocino County and these populations are likely extirpated (Figure 8).

Stocks of coho are plummeting in the Ten Mile River in response to intensive land use (IFR 2001). NMFS (2001) noted that coho were absent from 80% of tributaries to the Ten Mile River that formerly harbored them in 2000, with particular decline noted in the South Fork Ten Mile River. The period during which the decline occurred (1990-1999) coincided with logging in 76% of the South Fork watershed and expansion of road densities to 5-10 miles per square mile (GMA, 2000). The NMFS *Coho Status Review* (Weitkamp et al., 1995) regarded Ten Mile River coho as an important wild population, without history of hatchery introduction.

Caspar and Hare Creeks and Russian Gulch are some of the last streams that are still dominated by coho salmon (Higgins 2006). It is worthy of note that habitat conditions in the Garcia River are improving sufficiently to where coho salmon recovery is possible.

<u>Steelhead</u>: Steelhead of the North Central California Coast ESU, which includes Mendocino County, have been listed as Threatened under ESA (NMFS 1997, Good et al. 2005), although few populations are monitored and trend data are largely lacking. Sommarstrom (1984) noted a decline at Van Arsdale Dam of 86%; from 1938-1960 with a high of approximately 9500 adult winter steelhead diminishing to a low of just a few hundred fish. The only recent adult steelhead counts come from the Noyo River (Gallagher et al. 2000) where the estimated population was 300-400 fish, which is down an order of magnitude from former estimates of 6000 in the 1960s (Taylor, 1978). The extremely low return of adult steelhead suggests diminished Noyo River freshwater carrying capacity, and its watershed conditions are very similar to other Mendocino County rivers. An exception to downward steelhead population trends is likely the Garcia River, although no hard data are available. Pool depth is improving in the mainstem due to bank stabilization, cessation of gravel mining and less intensive upland management within the basin that is allowing habitat recovery (IFR 2003). Mendocino County has one of the larger summer steelhead populations in California in the Middle Fork Eel that deserves recognition and protection (Sommarstrom 1984).

Chinook salmon: Mendocino County fall Chinook salmon populations are grouped within the California Coastal Chinook salmon ESU that was recognized as Threatened in 1999 (NMFS, 1999) and that status was confirmed in 2006 (NMFS, 2006). Spring chinook salmon returned to the Middle Fork Eel River prior to 1964 and the upper Eel River before the construction of Pillsbury Dam in 1919 (Higgins et al. 1992), but are now extinct in the Eel River and in Mendocino County. Sommarstrom (1984) documented South Fork Eel River fall Chinook salmon declines at Benbow Dam (1940-1970) of 70%. Tomki Creek once had distinct early fall runs of Chinook and a later pulse of fish in December that were larger and more silver than the earlier group (Morford 1983). Although Chinook salmon were never dominant over coho and steelhead in the short coastal rivers of Mendocino County, they were likely present before European colonization and to have persisted in basins like the Ten Mile River and Garcia River, although the former also had some hatchery supplementation.(Maahs 1997). Chinook salmon are once again spawning in the mainstem Garcia River (Craig Bell personal communication), which is another sign that this ecosystem is trending in the opposite direction than the adjacent Navarro and Gualala Rivers, which have different watershed management intensity.

Gauging Historic Change Using Fish Community Structure: As aquatic habitats of Mendocino County have changed in response to intensive upland management, fish community structure has changed from one dominated by diverse species and age classes of Pacific salmon to less diverse communities dominated by warm water fishes. In August 2002 I used a mask and snorkel to do dive estimates on the lower Garcia, Gualala and Navarro Rivers at the same locations as those sampled by CDFG (Kimsey 1953) in August 1952 to see whether fish community structure had changed over 50 years. Kimsey (1953) counted 75 steelhead of four age classes along with sculpin, stickleback and dace on the lower Navarro River below Flume Gulch. In August 2002 the mainstem Navarro was nearly dry and no fish life was present (Figure 6). The Gualala River fish community below the North Fork was much different in August 2002 than when CDFG sampled 50 years earlier (Kimsey 1953). Only 12 young of the year steelhead were present in 2002 and they were significantly outnumbered by warm adapted stickleback and speckled dace where as in 1952 steelhead out numbered all other species combined and older age steelhead (1+ and 2+) made up a significant portion of the sample. Garcia River dive observations 100 yards upstream of Highway 101 in August 2002 found a community identical to that found by Kimsey (1953) with steelhead of several age classes predominating (Figure 12). This comparison is illustrative of differing watershed conditions and trends in the Gualala and Navarro Rivers versus those in the Garcia River.

U.C. Davis (Johnson et al. 2002) surveyed many miles of the Navarro River from 1999-2001 and found coho in only one tributary. Just as significantly, native suckers were observed at only one location whereas they were the dominant species in Mendocino County streams after the 1964 flood (CDFG 1968). Loss of suckers indicates that mainstem habitats are becoming unviable and that there are no islands of habitat for their winter survival because of homogeneously disturbed conditions. Collison et al. (2003) characterize this condition as a "press" disturbance which contrasts with natural watershed disturbance regimes where only a small fraction of a watershed would experience degradation from fires, floods or earthquakes over any 100 year cycle (Reeves et al. 1995). Similar aquatic ecosystem stress is evident in the Gualala River basin where CDFG electrofishing samples throughout the basin in 2001 also failed to capture suckers (Higgins 2004).

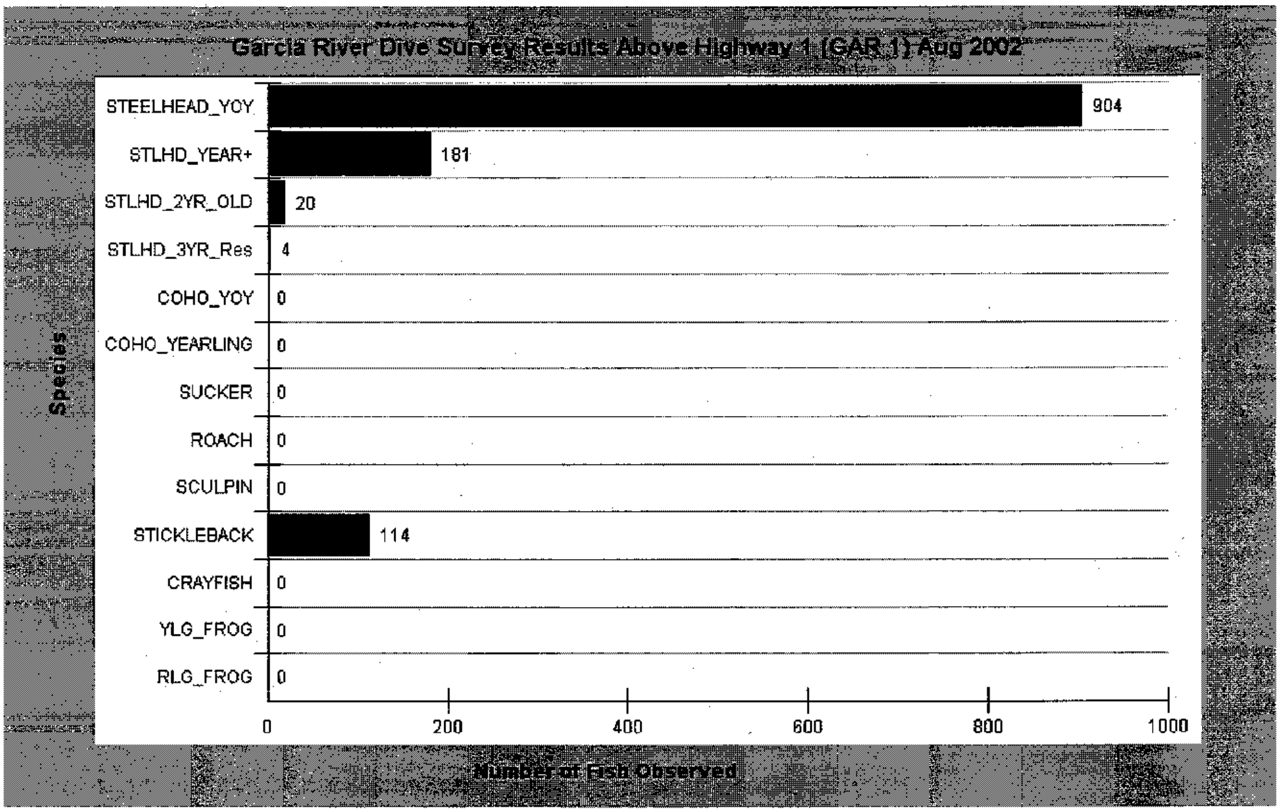


Figure 12. Dive observations in the mainstem Garcia River upstream of Highway 101 on August 21, 2002 demonstrate that, just as in 1952, steelhead are the predominant species and that multiple age classes (YOY = young of the year) are present. Data from Patrick Higgins and KRIS Garcia.

Mendocino County General Plan and DEIS Does Not Support Efforts of Other Agencies

The DEIR lists dozens of agencies and their authorities as if this absolves Mendocino County from any need to coordinate with them and to cooperate in attainment of things like TMDL implementation goals or recovery of endangered Pacific salmon species. In fact, many of the invoked processes can not succeed without County participation. Other areas of authority have been neglected, such as surface water allocation and groundwater oversight, and Mendocino County would be wise to take on more responsibility for oversight instead of ignoring the attendant problems. The following is an analysis of overlapping authorities with some suggestions for how the County should coordinate planning with other processes.

<u>TMDL</u>: The DEIS states the U.S. EPA and SWRCB have the authority under the Clean Water Act for pollution abatement as mapped out in TMDL reports. In fact, only the Garcia River TMDL (U.S. EPA 1998) has been implemented, while there has been no coordinated action in other basins. The NCRWQCB (2008) *Work Plan to Control Excess Sediment in Sediment Impaired Watersheds* is partially geared to accomplish TMDL implementation objectives and it envisions working closely with Mendocino County. With regard to continuing sediment pollution in the NCRWQCB jurisdiction, the document recommends use of "progressive enforcement" or development of Waivers of Discharge Requirements (WDRs) to develop a schedule of compliance. Mendocino County roads are specifically targeted for WDRs which would require 1) identification sediment sources related to roads, 2) prioritization of problem areas, 3) scheduling sediment reduction measures, 4) monitoring success and 5) adjusting future actions using adaptive management. The *Work Plan* (NCRWQCB 2008) specifically mentions close coordination with Mendocino County planning staff in updating the General Plan and also invokes the stalled grading ordinance:

"Work with Mendocino County to research and determine the adequacy of Mendocino County's current grading regulations under the Uniform Building Code, the draft grading ordinance as of April 2007, and the draft road grading regulations currently under development. Propose changes based on Regional Water Board staff's research of an adequate and effective grading ordinance. Work with County staff and the BOS to revise their draft ordinance/regulations if necessary. Encourage Mendocino County to develop and approve measures to better control excess sediment from grading activities."

Mendocino County would be better served in working proactively with the NCRWQCB and embedding actions and implementation items in the revised General Plan or it may find itself out of compliance and ultimately subject to enforcement action. Furthermore, temperature pollution problems are even more pervasive and actions or implementation measures to protect shade or prevent other activities that contribute to thermal pollution should be considered. In fact, any Mendocino County planning document must not only acknowledge impaired status and define how actions will affect that status, it must also comply fully with the NCRWQCB *Basin Plan* (2006) and its anti-degradation language. Ultimately the County of Mendocino is responsible for insuring compliance with the *Basin Plan* on all projects that occur within its jurisdiction.

<u>California Forest Practice Rules</u>: The DEIR credits the California Department of Forestry with timber harvest oversight with the implicit assumption that they are sufficiently protecting resources, such as fisheries and wildlife. However, Collison et al. (2003) state that timber harvest and road building under the California Forest Practice Rules have significant sediment and hydrologic impacts. Ligon et al. (1999) also acknowledged cumulative watershed effects from timber harvest were causing the diminishment of Pacific salmon habitat, with specific deficiencies being lack of sufficient riparian protection or limits to the extent of watershed disturbance. Mendocino County has a history of involvement in forestry issues through its Forest Advisory Committee and it might be wise to have them revisit the issue of prudent risk limits to logging and vineyard conversion related watershed disturbance. CDF staff has no capacity to judge flow issues related to vineyard conversion and a shift of oversight and regulation authority to an other agency should be considered (Higgins 2003, 2004a, 2004b, 2007).

<u>Flow Issues</u>: Mendocino County needs to urge the SWRCB WRD to perform its duty and uphold Water Code Sections § 1052, 1055, 1243, and 1375 and also CDFG to maintain stream flow under Fish and Game Code § 5937. The County should consider monitoring groundwater and exercising authority in regulation of its extraction since DWR has abdicated its role in this regard. In addition the General Plan needs specific action items and measures for implementation that limit water consumption, maximize conservation and reduce cumulative effects that have negative impacts on water supply and other beneficial uses. Development restrictions should be greatest in basin where stream courses have lost surface flows, until watershed conditions and flows in streams are showing measurable progress toward recovery.

<u>Endangered Salmon</u>: The *Recovery Strategy for California Coho Salmon California* (CDFG 2004) that resulted from the California ESA listing and anticipates cooperation from Mendocino County as an "action entity." The CDFG (2004) envisioned actions to protect and restore coho include:

- "Advise Mendocino County to consider recommendations to offset impacts from county policies and operations, as developed in the report, *Effects of County Land Use Policies and Management Practices on Anadromous Salmonids and Their Habitat* (Harris et al, 2001).

- Mendocino County should develop a grading and erosion control standard supported by a grading ordinance, to minimize sediment impacts to coho salmon habitat.

- Mendocino County's Public Works, Water Agencies and Flood Control District's should reduce native riparian vegetation clearing and sediment removal adjacent to and in streams with coho salmon. Retain large wood within streams to the extent possible. When woody material is removed it should be stored and made available for stream enhancement projects.

- Mendocino County planning and public works should promote alternatives to conventional bank stabilization for public and private projects, including bioengineering techniques.

- Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers."

NMFS's Santa Rosa office is also currently working on coho salmon recovery planning under federal ESA statutes and they will also need close coordination and assistance from Mendocino County. While Section 7 of the federal ESA compel compliance by federal agencies, the nexus for enforcement on private land is weak and has been insufficient to this point in preventing habitat alteration related to development and land management. The failure to even attempt protection of salmon and steelhead in the General Plan Update and DEIR is much different than the proactive approach anticipated by Sommarstrom (1984) and not at all in line with Mendocino County's historic traditions. The call by CDFG under ESA and the NCRWQCB under the CWA for the County to finish its grading ordinance highlights the importance of this action in attaining both fish recovery and water pollution abatement.

Ocean Conditions and Salmon Populations

The DEIR makes an absurd statement without scientific support that the principal cause for Mendocino County salmon and steelhead population decline is ocean conditions. Collison et al. (2003) point out that northern California Pacific salmon respond to climatic and oceanic cycles of productivity known as the Pacific decadal oscillation (PDO) cycle (Hare, 1998, Hare et al., 1999). Positive ocean cycles coincide with wet on-land conditions in northwestern California for a period of about 25 years, then alternate with ocean conditions prone to warm El Nino events and periods of lesser rainfall. Positive PDO conditions prevailed from 1950-1975 and negative ocean and dry on-land conditions extended from 1975-1995. We are currently in a productive ocean and wet climatic phase that provides an opportunity to recovery coho and Chinook salmon and steelhead (Collison et al. 2003). Collison et al. (2003) concluded that, if freshwater habitat was not recovered by the time the next switch in the PDO occurred sometime between 2015-2025, then many Pacific salmon stocks will likely go extinct. Therefore, the DEIS needs to scientifically characterize the affect of ocean conditions on Mendocino County's salmon and steelhead populations and the updated General Plan must incorporate action items and implementation measures that reverse the trend of aquatic habitat decline in a timely fashion.

What is Really Needed for Pacific Salmon Recovery?

Rieman et al. (1993) characterize extinction risk for salmonids: "When habitat disruption is spread among all populations, all populations are more likely to decline during unfavorable periods in the regional environment (for example, drought). Severe or prolonged conditions increase the potential for regional extinction." Pacific salmon populations in Mendocino County face high risk of loss due to disturbed watershed conditions and continuing downward flow and aquatic habitat trends. The General Plan needs to urgently consider a new integrated approach to planning so that true sustainability can be achieved.

Get Water Back in Streams: Band (2008), Gearhart (2008) and McMahon (2008) all describe problems with current instream flow regimes and patterns of water use with regard to maintaining Pacific salmon species. Mendocino County needs to take a more proactive approach and become more engaged in water management issues to help better protect public trust, to insure future water supply and to assist in expeditious restoration of all beneficial uses.

Limit Watershed Disturbance: Reeves et al. (1995) recommend that primary consideration be given to historic disturbance regimes that Pacific salmon co-evolved with and that we try to make human disturbances more closely mimic those patterns. They recommend that high quality habitat (refugia) be protected and that redundancy is needed because of potential for catastrophic floods or fires in any given watershed. Studies from coastal Oregon by Reeves et al (1993) showed that logging in more than 25% of a watershed in 30 years or less lead to simplification of stream habitats and greatly diminished Pacific salmon species diversity. Developed areas of a watershed all depart from historic patterns of sediment and hydrologic function and, despite the assertion of the DEIR they cannot be mitigated to the point where they prevent cumulative effects. This is especially true of vineyards which not only increase sediment yield, but decrease water supply through changing infiltration rates and directly consume surface and groundwater.

Reduce Road Densities: NMFS (1995) has directed the U.S. Forest Service in the Columbia River basin to decrease road densities to less than 2.5 $mi./mi.^2$ to reduce sediment and hydrologic impacts to sensitive aquatic species. Mendocino County needs to target reduction of road densities through action items and clear implementation language in the General Plan and a meaningful grading ordinance.

Protect Riparian Zones and Wetlands: Vegetation on the margins of a stream in the zone of aquatic influence is known as the riparian zone and this area is recognized as directly linked to aquatic health. Riparian zones provide shade and a cool microclimate to buffer water temperatures and absorb or buffer nutrient runoff or non-point source pollution (Spence et al. 1996). Trees along the banks of streams help to define the channel and provide habitat for fish under root masses or when large trees fall in to streams. Surface water-groundwater connections are also often common in riparian wetland areas and equipment operation or building in these zones thereby decreases cold water availability and decreases other riparian functions. This problem is compounded if a well is drilled in the stream side zone and water withdrawn to support development. Therefore, the Mendocino County General Plan needs to have action items and implementation language that specifically addresses minimizing riparian impacts of development or land use.

Decrease Use of Toxic Herbicides and Pesticides: Ewing (1999) did a review of the literature on impacts of herbicides and pesticides on Pacific salmon and documents numerous sublethal effects in addition to numerous documented fish kills due to large scale spills. Effects may include altered swimming ability, reduced feeding, reduced ability to avoid predators, disruption of schooling behavior, inability to smolt and reduced resistance to disease. Some pesticides and hormones like estrogen from waste water facilities can "mimic or block of sex hormones, causing abnormal sexual development, feminization of males, abnormal sex ratios, and unusual mating behavior" even at low concentrations. Ewing (1999) recommended the following:

> "Pest management approaches that do not depend on pesticide use in agricultural and non-agricultural settings should be encouraged and further developed. There is ample evidence that ecologically sound and economically viable methods can be successfully implemented. The adoption of such alternatives can be encouraged through technical assistance, financial incentives and disincentives, demonstration programs, and information exchange opportunities."

Conclusion

In 20 years as a biological consultant I have never seen a land use planning document that was as patently flawed with regard to coverage of fisheries and cumulative effects as the Mendocino County General Plan revision and its associated DEIS. It may seem politically expedient and seemingly deft to pass off public trust responsibilities to other agencies, but Mendocino County shares these responsibilities and must act accordingly. The result of this pattern of avoidance of issues of substance and lack of clear action or implementation language makes these documents fundamentally flawed and doomed to failure, if tested in court for CEQA compliance. Mendocino County KRIS projects are available on the Internet, but I am attaching my previous environmental reports for your use and that of the Mendocino County Planning Department. I hope that Mendocino County begins to better integrate scientific knowledge into its planning framework not only to comply with CEQA but to achieve more enlightened planning outcomes that protect public trust resources and the quality of life of its citizens into the future. If Planning Department staff wants to have KRIS projects loaded on their computers, where they have greater analytical power and more functions for review, I would be happy to provide them CD or DVD copies.

Should you have any questions, please feel free to call me. I would also be happy to discuss these issues with Mendocino County Planning Department staff as well.

Sincerely,

Patrick Higgins

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Personal Communications

Bell, Craig. Garcia River Watershed Coordinator, Gualala, CA.

LaVen, Richard, Hydrologist and NR staff to the City of Ft Bragg.

Appendix B

Patrick Higgins
Consulting Fisheries Biologist
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(707) 822-9428

December 29, 2008

Ms. Traci Tesconi
County of Sonoma
Permit and Resource Management Department
2550 Ventura Avenue
Santa Rosa, CA 95403

Re: Pelton House Winery Application #PLP05-0010 from Jess Jackson and Barbara Banke

Dear Ms. Tesconi,

I have reviewed Application # PLP05-0010 for a development of the Pelton House Winery for the Maacama Watershed Alliance and provide comments below on why the project proposes substantial risk to coho salmon (Oncorhynchus kisutch) and steelhead trout (Oncorhynchus mykiss). My conclusion is that there needs to be a full Environmental Impact Report (EIR) under the California Environmental Quality Act because of the need for study of cumulative effects of surface water and groundwater diversion on coho and steelhead in downstream areas. Existing cumulative effects in the Redwood Creek watershed are widespread and the project may contribute to these effects in ways that cannot be mitigated satisfactorily to meet CEQA requirements. Approval of a new discretionary use permit in a conservation area (Sonoma County 1979) where this project's specific land uses have previously been denied would also be a growth-inducing impact and potentially detrimental to critical habitat. Mitigation measures for the cumulative or growth-inducing impacts of this project have not been addressed in the Mitigated Negative Declaration.

In addition to the proposal itself, I have reviewed the Sonoma County (2008) proposed Mitigated Negative Declaration for the project and the November 10th, 2008 revised document, and I have also read or reviewed numerous other related documents, including those by Brelje and Race (2008), Siegal (2008), Richard Slade and Associates (2008), North Coast Regional Water Quality Control Board (NCRWQCB 2008, 2008 a), National Marine Fisheries Service (NMFS 2008), LSA Associates (2006), Curry and Jackson (2008) and Wiemeyer Ecological Services (2008). The project has two discrete sites and that are geographically separate and Figure 1 is adapted from Curry and Jackson (2008) to make the scale of impacts more clear.

My Qualifications

I have been a consulting fisheries biologist with an office in Arcata, California since 1989 and my specialty is salmon and steelhead restoration. I authored fisheries elements for several large northern California fisheries and watershed restoration plans (Kier Associates 1991, Pacific Watershed Associates 1994, Mendocino Resource Conservation District 1992) and co-authored the northwestern California status review of Pacific salmon species on behalf of the American Fisheries Society (Higgins et al. 1992).

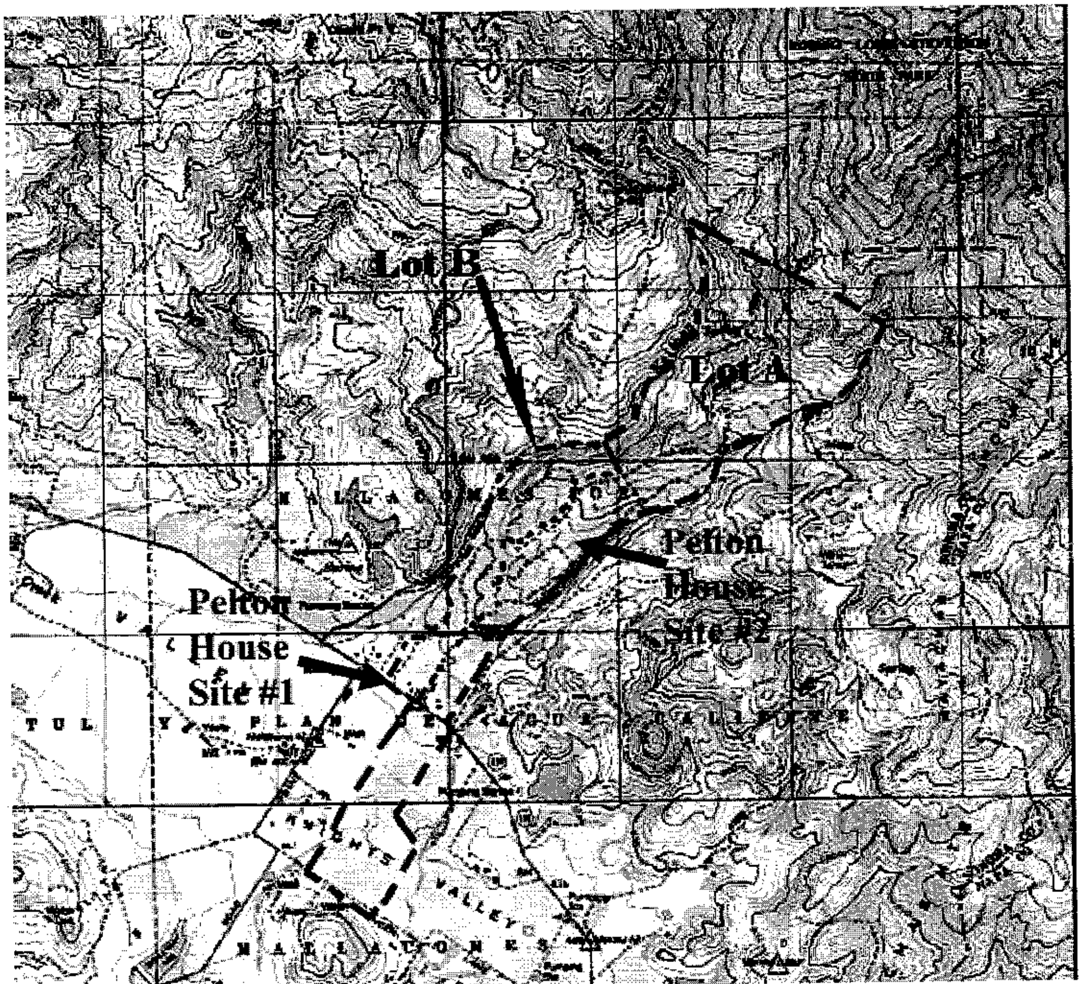

Figure 1. USGS topographic map showing the parcels involved in the Pelton House Winery project and the location of both sites slated for development (arrows).

Since 1994 I have been working on a regional fisheries, water quality and watershed information database system, known as the Klamath Resource Information System or KRIS (www.krisweb.com). This custom program was originally devised to track restoration success in the Klamath and Trinity River basins, but has been applied to another dozen watersheds in northwestern California. The California Department of Forestry (CDF) funded KRIS projects in six northern California watersheds as part of the North Coast Watershed Assessment Planning effort. The Sonoma County Water Agency (SCWA) also funded regional KRIS projects (IFR 2003), including one for the Russian River (KRIS Russian), in order to provide a seamless regional coverage for coho salmon recovery planning. The NCRWQCB served in an oversight capacity on the latter project for quality assurance and quality control. I draw extensively on information in KRIS Russian River and all data are available with metadata on-line at www.krisweb.com.

I have recently addressed the problems of illegal diversion of water in northwestern California, including Sonoma County, on behalf of the Redwood Chapter of the Sierra Club (Higgins 2008) in commenting on the California State Water Resources Control Board (SWRCB) Water Rights Division (WRD) *Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams* (SWRCB WRD 2008). I draw on those comments herein, but also am providing them in their original form as Appendix A.

My comments on Mendocino County's updated Draft General Plan (Higgins 2008a), also for the Redwood Chapter of the Sierra Club, are included as Appendix B and are not only relevant to the Pelton House Winery project but may also be useful in your own plan updating process.

Pelton House Proposal and Negative Declaration Regarding Mitigation of Impacts

Sonoma County's (2008) Draft Mitigated Negative Declaration (MND) for the Pelton House Winery has language regarding CEQA compliance that serves as the focus of these comments, because assumptions are not met and the deficiencies are sufficient to warrant a full EIR on the project.

Migration of Native Fish and Wildlife Species: The MND states that the project may not:

> "Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites."

The response is rhetorical and inadequate: "The project site and surrounding areas are partially developed with existing structures, vineyards, and fencing. The project development does not include any work within a creek or wildlife corridor." In fact further withdrawal of water from Yellowjacket, Kellogg, and Redwood Creeks, which is a likely side effect of this project, is a highly significant impact to migration of coho salmon and steelhead adults and juveniles. The underlying issue being ignored here is contributions of the Pelton House Winery to cumulative effects of surface water and groundwater withdrawal on aquatic resources.

Endangered Fish and Wildlife: The CEQA question captured in the MND regarding endangered species is as follows:

> "Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?"

Coho salmon in the Redwood Creek drainage and in the Russian River as whole are on the verge of extirpation (CDFG 2001, Good et al. 2005) and they are present in some years downstream of the project. Withdrawing water from the alluvial aquifer at the convergence of Kellogg and Yellowjacket Creeks will very likely affect flows downstream in Redwood Creek. The tactic in the Initial Study was nothing more than denial, claiming that mitigations will lessen impact to less than significant, but the project proponents actually fail to deal with the subject of endangered coho very near the project site (NMFS 2008, CDFG 2001). The project and MND should at least consider these impacts on the scale of the Maacama Creek watershed where both coho and steelhead face local extirpations due to extensive dry stream reaches and major problems with habitat quality (CDFG 2005). See discussion of Status of Pacific Salmon species.

Cumulative Effects: CEQA requires full recognition of interaction between land uses past, present and foreseeable:

> "Does the project have impacts that are individually limited, but cumulatively considerable ('Cumulatively considerable' means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?"

Once again, there is no analysis in the MND: "No cumulative or long-term impacts have been identified that were not fully mitigated." Numerous other projects with substantially greater impact that are already permitted or built are acknowledged but with the false assumption that all their impacts have been fully mitigated as well. Figure 2 shows the location of the proposed project with annotations illustrating the existing high level of cumulative watershed effects, to which the project will add. As a discretionary project, this application is subject to a higher level of review, requiring full disclosure of potential impacts and mitigation.

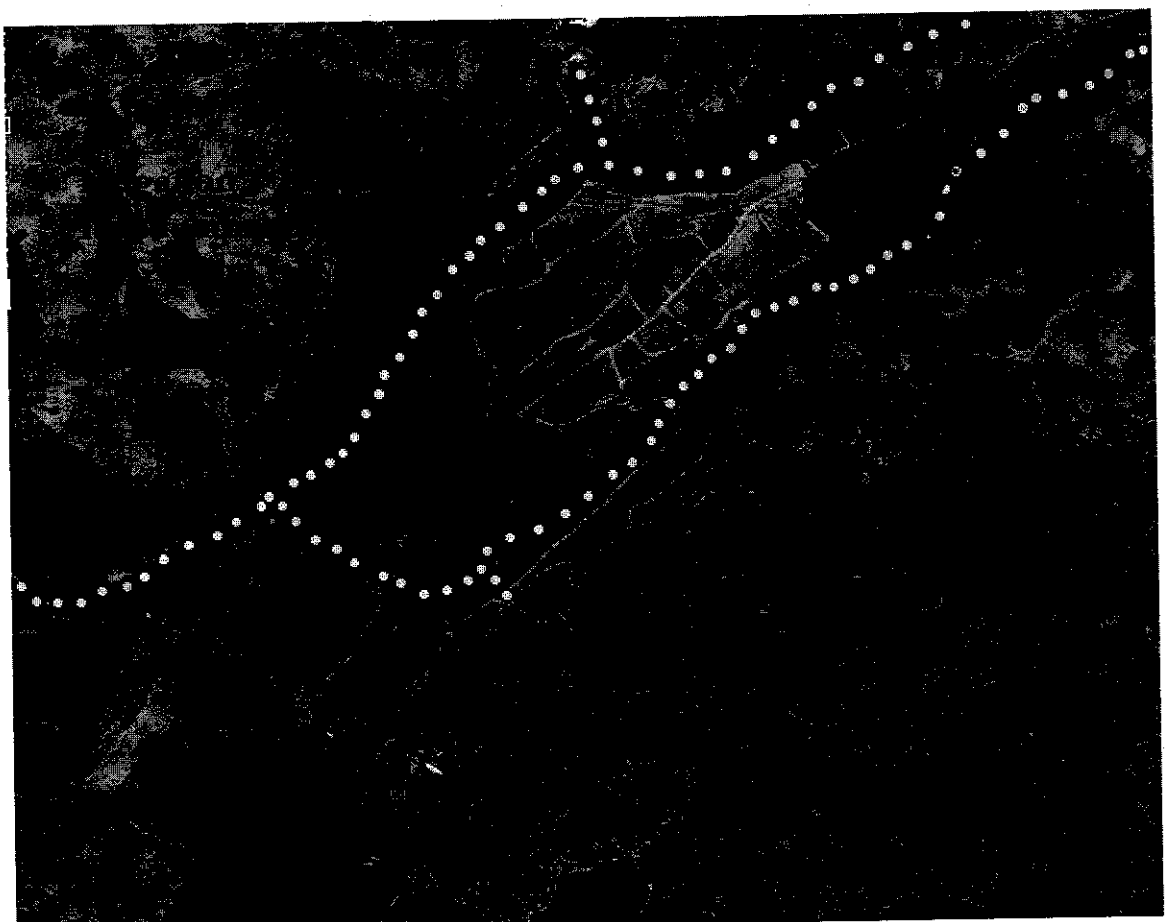

Figure 12. A number of impoundments adjacent to the proposed development sites are causing cumulative effects to downstream reaches of Redwood Creek (Band 2008), and water use associated with the Pelton House Winery will add to flow depletion endangering coho and steelhead. Blue dots approximate stream courses from USGS 1:24000 topographic maps.

Cumulative impacts from the project will be discussed at length below, but in summary they include groundwater withdrawal likely connected to surface water downstream and increased roads and total impervious caused by the project. The water use discussion also needs to acknowledge the extent of lawless use of water in the vicinity of the project (Stetson Engineers 2007, Ball 2005) and implications for cumulative watershed effects on coho salmon and steelhead.

Groundwater/Surface Water Connections in the Project Area and Downstream Flows

The project site is at the southern edge of the Kellogg Creek sub basin in the Maacama Creek watershed and Yellowjacket Creek is within the project site and Bidwell Creek is adjacent to the west. Waters on the project site (surface and subsurface) flow with the topography into Redwood Creek, thence Maacama Creek and the Russian River.

Curry and Jackson (2008) and Siegel (2008) point out that the aquifer under the proposed development site of the Pelton House Winery is in an alluvial valley likely connected upstream and downstream to surface water. Their criticism that pump tests were not conducted between July 15 and October 15, when other users would also be drawing on the aquifer, is valid and the response by Richard C. Slade & Associates (2008) is evasive. He claims a Sonoma County groundwater classification system as a basis for arguing that his client does not have to conduct the test during this period. In fact the MND is explicit that the applicant must show they do not "deplete groundwater supplies or interfere substantially with groundwater recharge," including prevention of decreasing supply for existing projects or users already permitted. This relationship cannot be discerned without data collection between July 15 and October 15. Sonoma County should require a full EIR for the Pelton House Winery project and make it consider the interaction of surface and groundwater interactions at least on the scale of the Kellogg Creek sub basin.

Sonoma County has direct evidence from neighbors (Ball 2005) that Yellowjacket Creek has been drying up as a result of illegal water extraction on or near the project site. Results of a recent consultants report (Stetson Engineers 2007) also show rampant illegal water diversion, including a number of unpermitted impoundments in the vicinity of the project. In fact there is an acute shortage of surface water supply in Yellowjacket Creek and in Redwood Creek downstream (see Habitat Condition). If surface and groundwater are connected, as hypothesized by Curry and Jackson (2008) and Siegel (2008), then additional water withdrawals at this time should not be allowed until such time as the SWRCB WRD can show there is a surplus of water as required by State Water Code.

Widespread Lawless Use of Water Needs Examination in Full EIS

The study by Stetson Engineers (2007), which was part of the SWRCB WRD (2007) *Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams,* determined that there were 1357 permitted impoundments in the Policy's area of interest and another 1771 unpermitted ones (Figure 3). Hundreds of illegal diversions are located in Sonoma County, but furthermore, many of these diversions are adjacent to the project site (Figure 4). The data for these legal and illegal diversions must be in the public domain and it is recommended that Sonoma County obtain a copy of electronic data for consideration of this MND and for other land use decisions reliant on additional water use. Figure 4 is derived from a map image in Adobe Acrobat Portable Document File (pdf) format provided by Stetson Engineers (2007) and Figure 5 is a zoom in closer to the project area of the same map. Although the stream resolution of the close up is poor, a major problem with illegal impoundments immediately adjacent to the proposed project is clearly established. A cluster of illegal diversions appears to be within the Redwood Creek watershed, although it is possible that some are in adjacent Maacama tributary watershed of Franz Creek. Figure 6 shows one such impoundment off Franz Valley Road near Highway 128 and not far from the proposed project location. The permit status of the impoundment shown is unknown, but Sonoma County has evidence that implicates the permit applicant as being one of the "unpermitted" operators who surreptitiously deepened irrigation ponds (Ball 2005). There are clearly existing flow related cumulative effects issues that are being ignored by Sonoma County that do not comport with the requirements of CEQA. Your negligence in this regard extends to CEQA's requirements that coho salmon be protected from harm by this project.

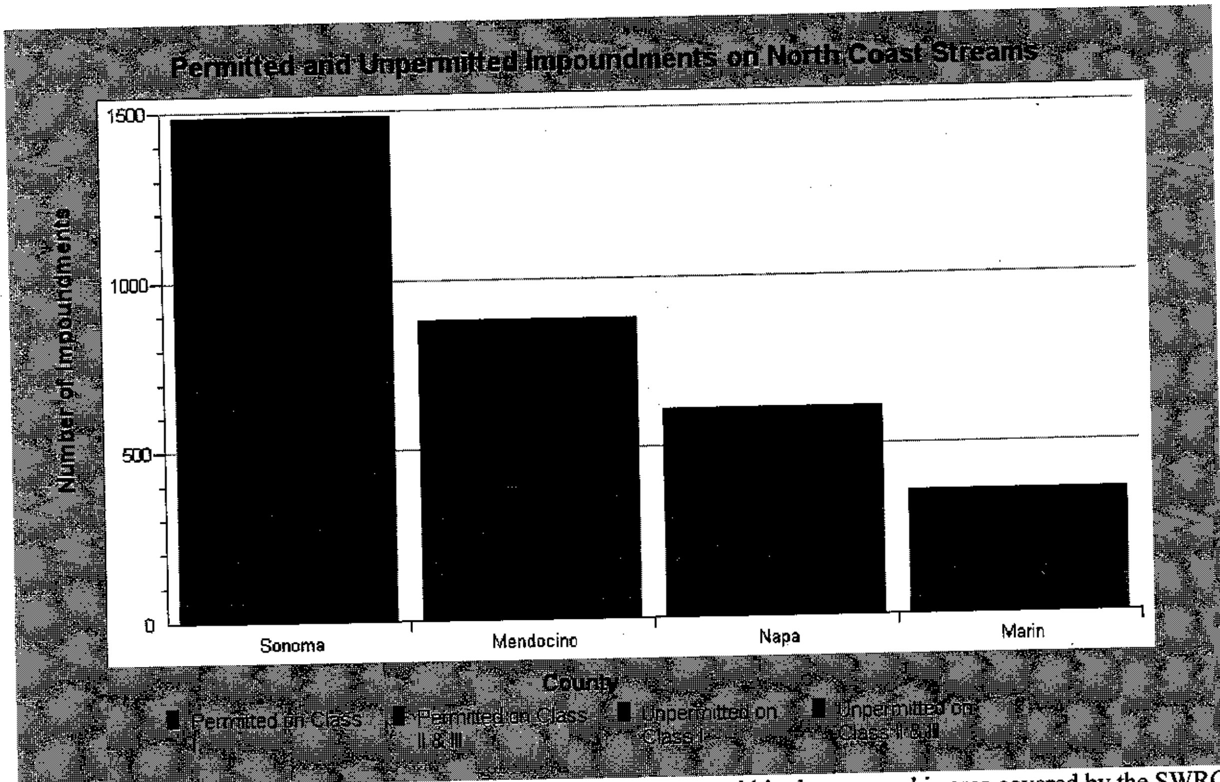

Figure 3. The number of permitted and unpermitted impoundments within the geographic area covered by the SWRCB WRD (2007) study is displayed above with illegal diversion impoundments outnumbering legal ones. Data from Stetson Engineers (2007a).

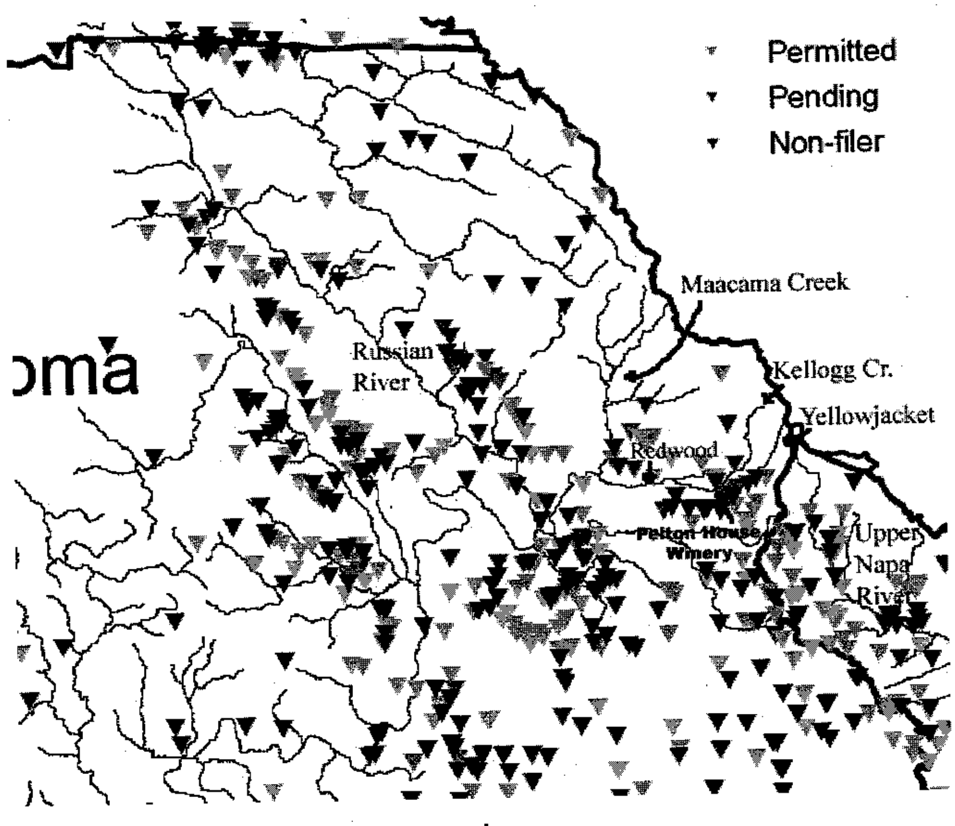

Figure 4. Map shows impoundments by categories of permitted, unpermitted and pending and is modified from Stetson Engineers (2007). Note the large number of unpermitted diversions near proposed site.

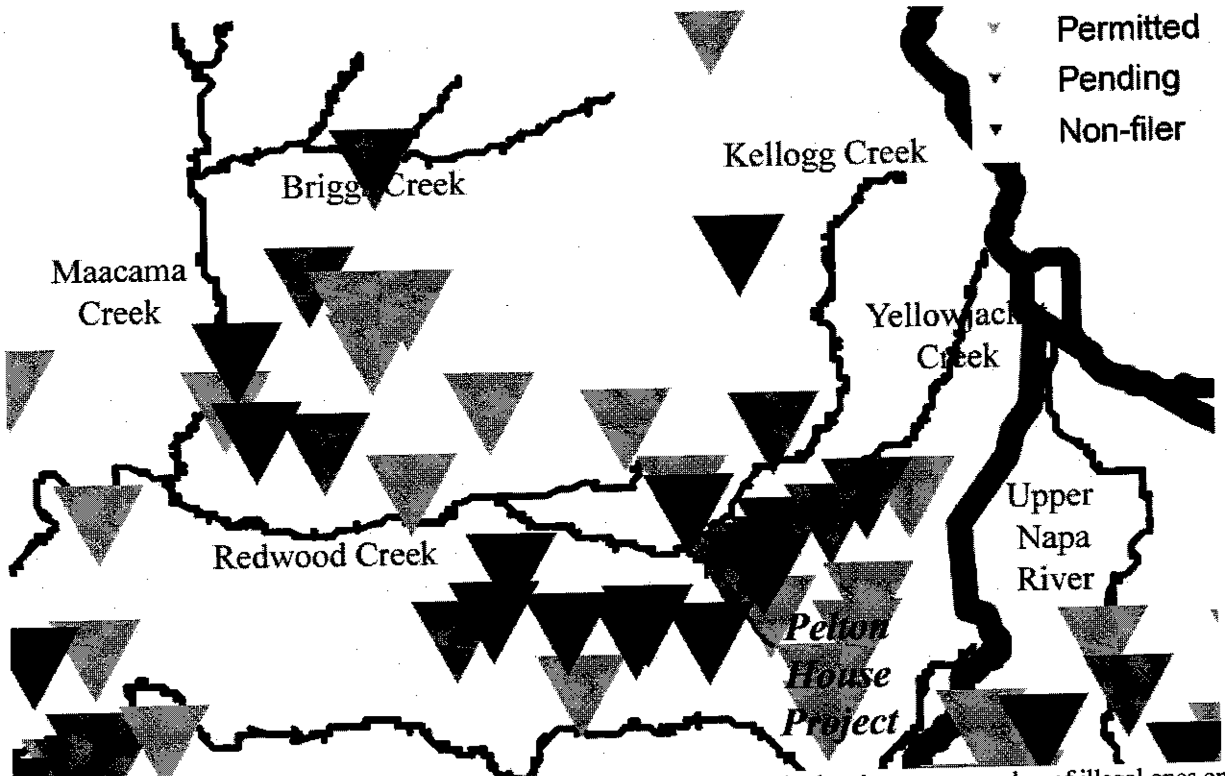

Figure 5. This close up map of legal and illegal impoundments shows clearly that there are a number of illegal ones on or near the project site, although the stream networks are not fully shown due to the scale of the original map by Stetson Engineers (2007).

Figure 6. Looking north off Franz Creek Road not far from Route 128. One of many permitted and unpermitted impoundments in the Redwood Creek drainage that affect stream flow and serve as sources of bull frogs and warmwater non-native fishes that can have undesirable effects on native species. Photo from KRIS Russian by Pat Higgins. 7/13/03.

As part of an EIR for this project's cumulative effects, impoundments and diversions in Redwood Creek and Maacama Creek below it need to be considered. When all reservoirs are filled simultaneously with the first rains of fall or winter, Chinook and coho salmon spawning migrations may be impeded (Band 2008). In a drought year, adult steelhead may be similarly stranded or unable to migrate to spawning grounds due to reservoir induced drops in flow. When reservoirs are filled in summer using stream flows or connected groundwater, nearby streams may dry up. Sonoma County has evidence that the permit applicant was apparently drying up Yellowjacket Creek in July 2005 (Ball 2005) in violation of CDFG Code 5937, and this incident is not likely isolated. Other impoundment related impacts that Sonoma County should be considering are effects of legal and illegal impoundments on water temperatures, the potential they have for introduction of bull frogs that decimate native frog populations, and their contribution to release of non-native warmwater fish that predate upon salmonids or displace them through competition (Higgins et al., 1992).

Status of Pacific Salmon Species in the Russian River and Potential Project Impacts

The MND has no in-depth discussion of the status of Pacific salmon species native to the Russian River and, particularly coho salmon and steelhead trout in the sub basins where impacts will occur. In fact, the Pelton House winery project will likely further deplete flows in reaches of Redwood Creek that have been known to recently support coho salmon and steelhead trout, which are both recognized as at risk of extinction in the Russian River basin. Flow depletion at the project site and in the Redwood Creek watershed also has ripple impacts on Chinook salmon that utilize Maacama Creek downstream.

<u>Status of Russian River Pacific Salmon Populations</u>:. There are no baseline data for Russian River salmon and steelhead populations before the early 1960's when CDFG (Taylor, 1978) estimated that annual adult returns were 50,000 steelhead, 5,000 coho salmon and 500 Chinook salmon (<u>Oncorhynchus tshawyscha</u>). Pink salmon (<u>Oncorhynchus gorbuscha</u>) were also once native to the lower Russian River (Moyle et al. 1989), but no spawning has been documented since 1955 (Fry 1967). While pink salmon are not further discussed or likely restorable, they are worthy of note because they represent a species lost due to a much earlier wave of development and land use impacts. Substantial changes in land use will be necessary to prevent further extinctions, including enforcement of California Water Codes and CDFG Code 5937.

According to the National Marine Fisheries Service (1996, 1999, Good et al. 2005), Russian River coho salmon and steelhead fall into the Central Coast Evolutionarily Significant Unit (ESU), while Chinook salmon group with the California Coast ESU that extends south of the Klamath River. NMFS (1996) listed the Central California Coast coho salmon as threatened under the Endangered Species Act (ESA) and more recently upgraded their risk level to endangered (Good et al., 2005). Brown et al. (1994) noted that populations of coho salmon in California were at less than 5% of historic levels and that there were only seven streams with adult returns numbering in the hundreds.

CDFG (2002) acknowledge the need to list Central Coast ESU coho under the California ESA and surveys conducted annually from 2000-2002 indicated widespread regional extirpations (Figure 7). "Extant populations in this region appear to be small. Small population size along with large-scale fragmentation and collapse of range observed in data for this area indicate that metapopulation structure may be severely compromised and remaining populations may face greatly increased threats of extinction because of it."

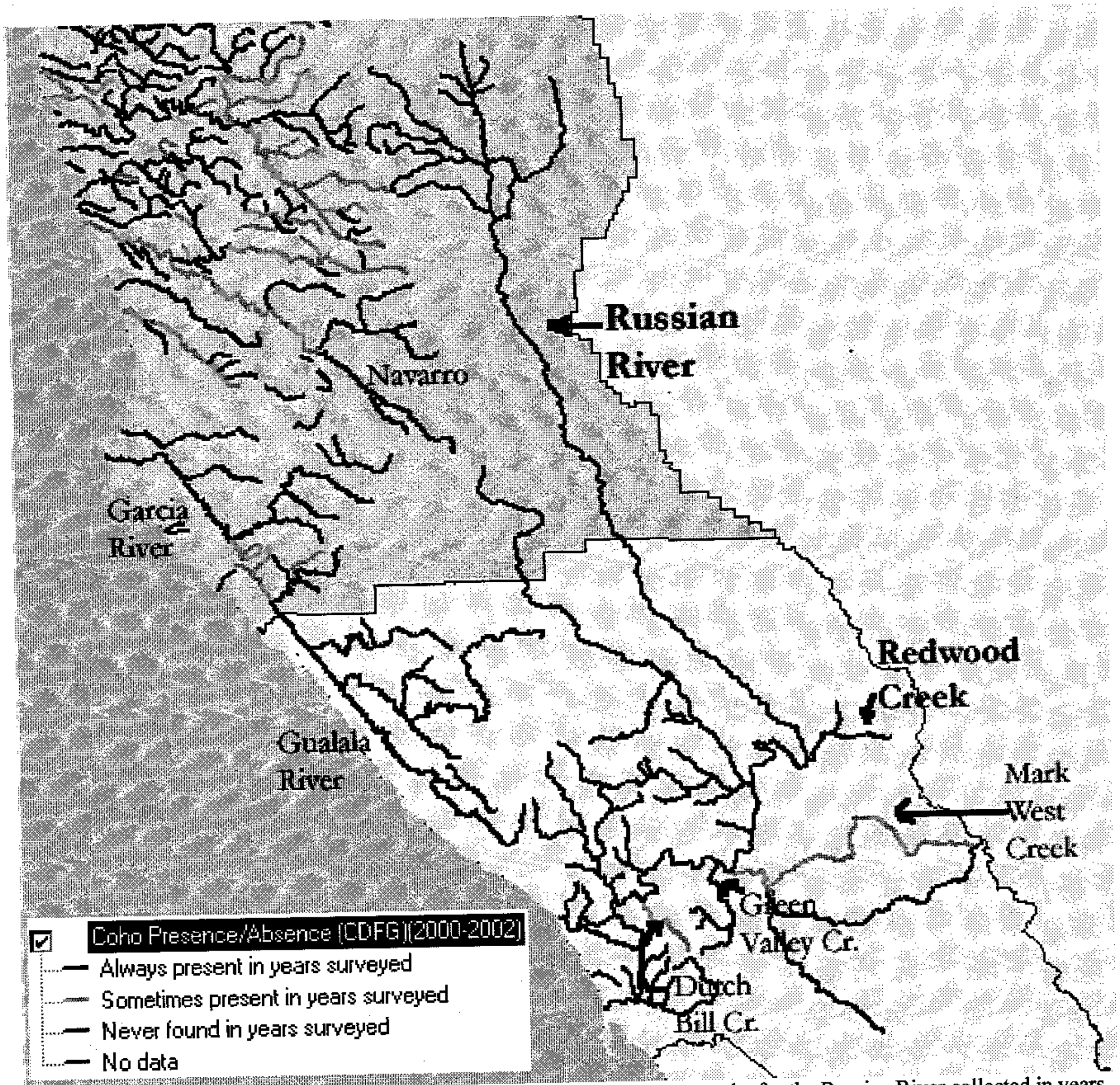

Figure 7. This map shows the CDFG coho salmon presence/absence survey results for the Russian River collected in years 2000-2002. Red = no coho found in all three years, orange = absent in at least one year and green = present all years. Only Green Valley Creek had coho all three years in the entire Russian River basin.

CDFG (2002) concluded that "coho salmon in the Central Coast Coho ESU are in serious danger of extinction throughout all or a significant portion of their range" and characterized the Russian River population as "extirpated or nearly so." Figure 8 is a summary chart of CDFG presence/absence coho salmon survey data from 2000-2002 showing a very high rate of coho extirpation in Sonoma County Coastal watersheds and the Russian River.

The recent NMFS (2008) Biological Opinion for large scale water users in the Russian River includes information on the viability of Russian River coho, including loss of genetic diversity that threatens their future existence:

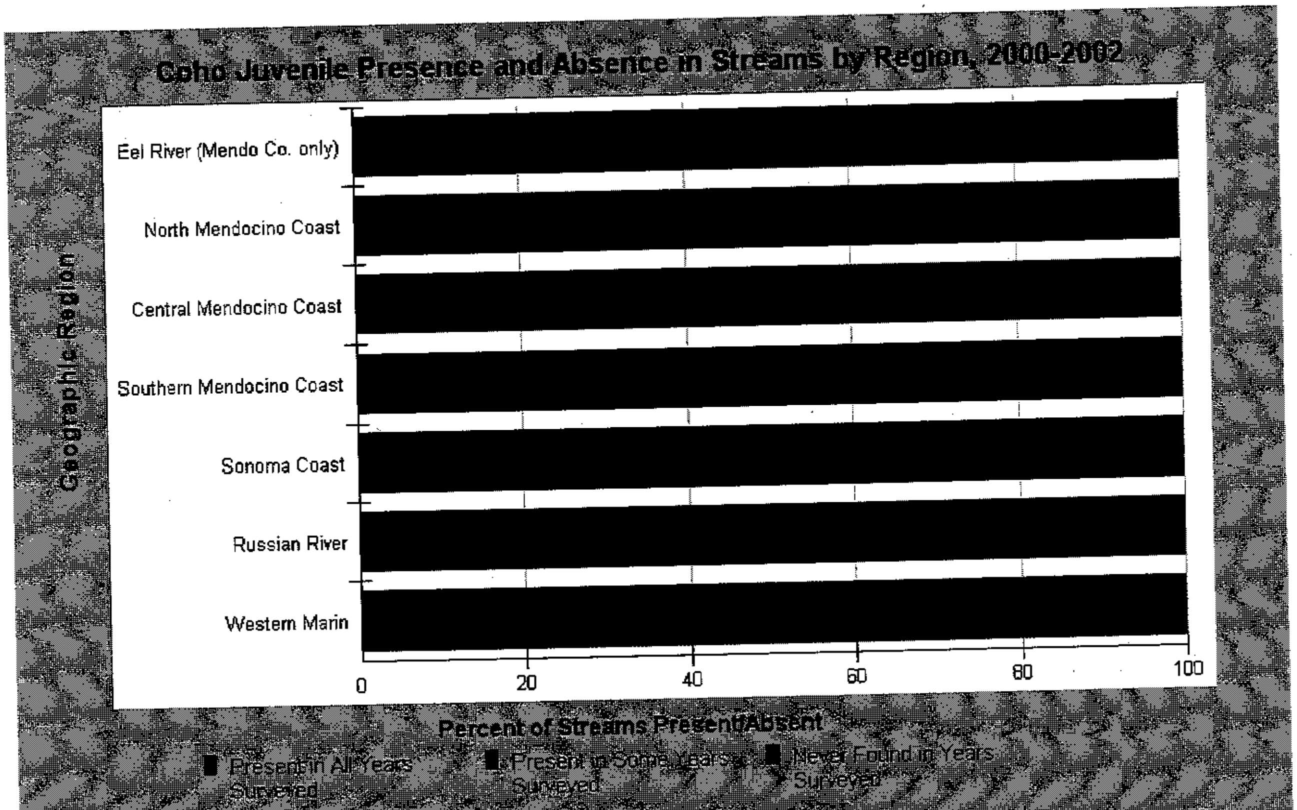

Figure 8. This chart shows a summary of the presence/absence of coho salmon juveniles in streams examined by CDFG in the years 2000-2002. The numbers shown on the chart bars indicate the number of streams in each region in which surveys always, never, or sometimes found coho. Note high absence rate for the Sonoma County Coast and Russian River basin.

> "Genetic analyses of coho salmon sampled from Russian River tributaries are consistent with what would be expected for a population with such extremely reduced abundance……This evidence suggests an acute loss of genetic diversity for the Russian River coho salmon population."

> "Based on its decline in abundance, restricted and fragmented distribution, and lack of genetic diversity, the Russian River population of coho salmon is likely in an *extinction vortex*, where the population has been reduced to a point where demographic instability and inbreeding lead to further declines in numbers, which in turn, feedback into further declines towards extinction."

Because of the scarcity of coho salmon in the Russian River basin, it would be highly undesirable to make Redwood Creek less able to support them at this critical juncture. See below for more discussion of salmonids in Maacama and Redwood Creeks based on KRIS Russian River data and other sources.

Steelhead in the Central California Coast ESU, including in the Russian River, were listed by NMFS (1997) as threatened and their status was reaffirmed in 2005 (Good et al., 2005). Similarly, the California Coastal Chinook salmon ESU were recognized as threatened in 1999 (NMFS, 1999) and their status confirmed in 2006 (NMFS, 2006).

<u>At Risk Salmonids Potentially Impacted by Pelton House Winery Project</u>: For the purpose of cumulative effects discussions related to Pacific salmon species, it is useful to focus on the scale of at least the Maacama Creek watershed, to which Redwood, Kellogg and Yellowjacket Creeks are tributary. Locally, coho would have utilized all habitats under 2% in gradient (Figure 9) and had easy access through gradients of at least 4%; therefore, coho were present historically in the project area.

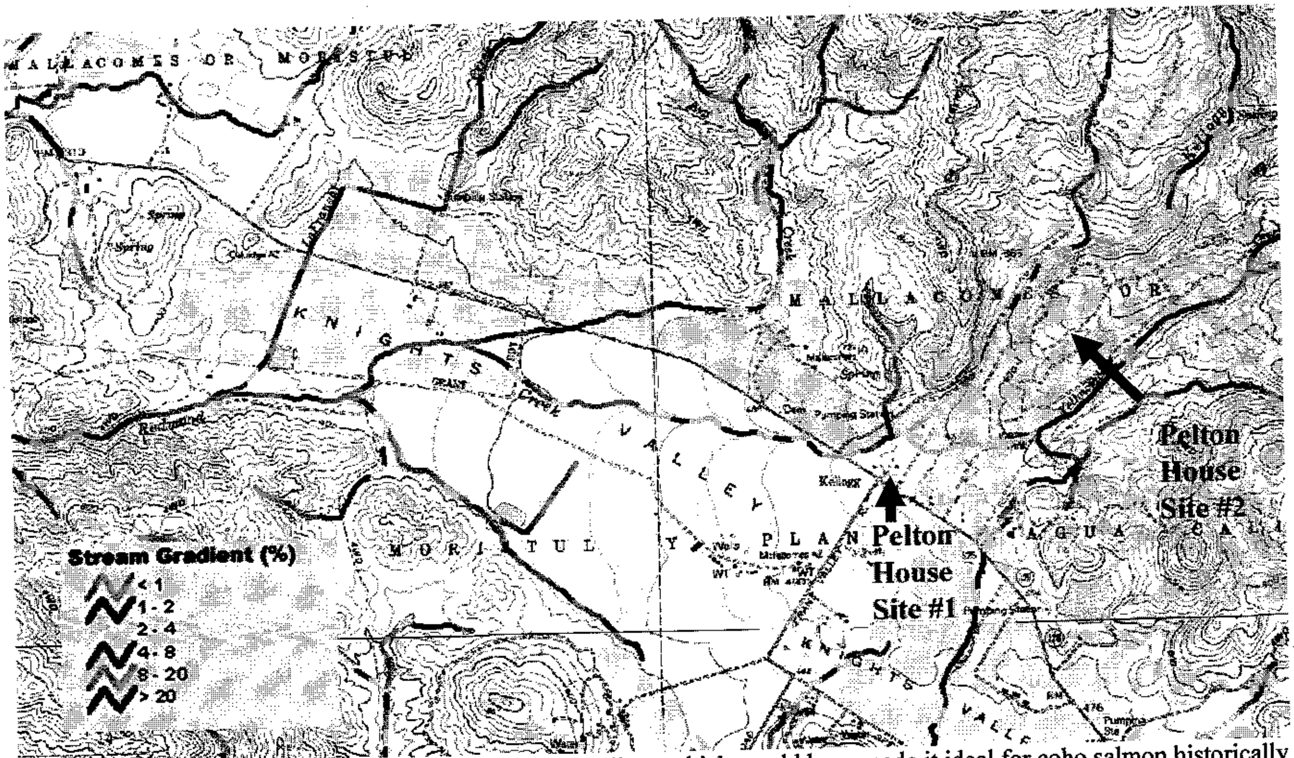

Figure 9. Stream gradient in Redwood Creek is 1-2% gradient, which would have made it ideal for coho salmon historically along with lower reaches of LaFranchi and Foote Creeks. Gradient constructed from 10 meter DEM. KRIS Russian River.

Headwaters of Kellogg and Yellowjacket Creeks rise too steeply for coho (4-20%), but they would have supplied spawning gravels, large wood and cold water that helped maintain coho in the mainstem of Redwood Creek just downstream. The alluvium that built up below Kellogg and Yellowjacket Creeks for millennia likely serves as a cold water storage bank that provided cold base flows during historic seasonal cycles. The Pelton House winery is tapping into this alluvial aquifer and diminishing whatever flow might remain to keep Redwood Creek functioning.

In Redwood Creek, CDFG (2001) collected biological data associated with a stream habitat inventory (CDFG 2004) and results of their electrofishing sample are displayed in Figure 10. While the sample collected reflects a diverse fish community, it is one dominated by warmwater adapted species such as the Sacramento sucker, stickleback and the California roach. A downstream migrant trap was operated in Redwood Creek and Maacama Creek in 1965 (CDFG 1965), likely to discern the effects of the 1964 Flood that devastated streams in the region. Although the trap on the mainstem of Maacama Creek and a tributary had large numbers of warmwater species, both native and introduced, the trap in Redwood Creek produced almost exclusively steelhead (146 of 148 fish captured). Thus, the ecological conditions in Redwood Creek have shifted away from favorable for cold water fish species due to changes in flow and channel conditions related to agricultural, particularly vineyard development (see Habitat Conditions). It should also be noted that coho salmon may have been absent from the 1965 Redwood Creek sample due to 1964 flood effects and the sample does not indicate that they were historically absent.

Maacama Creek is a substantially larger than Redwood Creek (4^{th} & 5^{th} Order) and its lower reaches would harbor native warm water adapted fish species from the adjacent mainstem Russian River during summer and early fall, such as Sacramento suckers, California roach and northern pikeminnow (then known as squawfish). In winter and spring Maacama Creek was dominated by salmonids as documented by CDFG memos (1954) that note spawning Chinook salmon in January of 1954, and the average angler catch on opening day of trout season in 1955 (three steelhead juveniles each) (CDFG

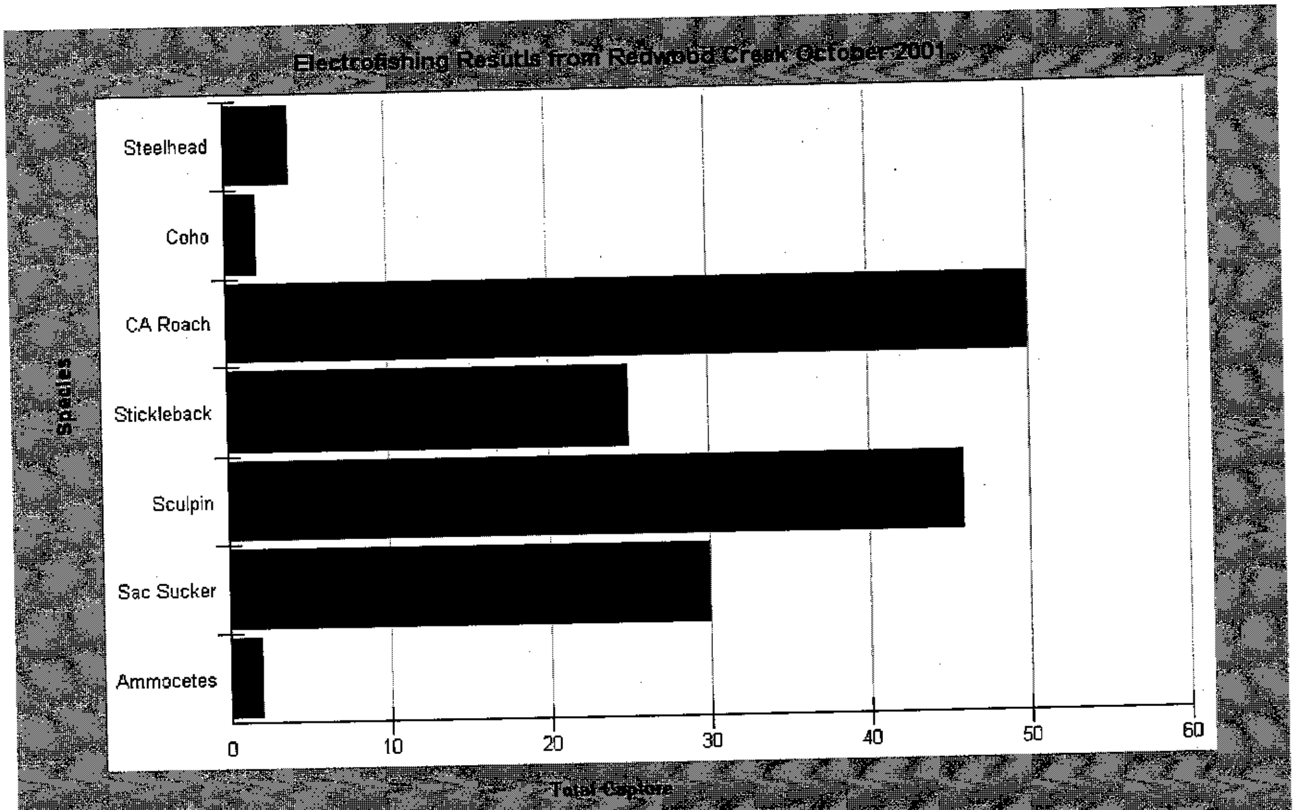

Figure 10. CDFG Redwood Creek electrofishing sample shows a fish community dominated by warmwater species but also containing two rare coho salmon juveniles and four steelhead trout juveniles.

1955). Angler catch was down from an average of nine "trout" each in 1953 (CDFG 1954) before the 1955 Flood. CDFG (1955) memos acknowledge "changing conditions" after the flood away from steelhead trout production, however, CDFG downstream migrant traps on Maacama Creek in 1965 caught four coho salmon along with hundreds of steelhead.

CDFG sampled an index site in Maacama Creek (IFR 2003) from 1993-2001 and data are useful in understanding standing crops of steelhead juveniles in summer and fall to determine survival during low flow periods (Figure 11). Maacama Creek summer carrying capacity for steelhead is much greater in wet years, such as 1995, 1996, 1998 and 1999, but survival is variable and appears to be declining. Standing crops of fall fish show a major reduction in many years, suggesting that low flow conditions are limiting, and these low flow conditions are likely linked to agricultural water use. Scientists (Hare et al. 1999, Collison et al. 2003) now recognize wet and dry climatic cycles that are linked to changes in ocean productivity and fish population dynamics and wet conditions in most years since 1995 are owing to a positive shift in the Pacific decadal oscillation cycle (PDO) (Hare et al. 1999).

Aquatic Habitat Conditions

Habitat data for Redwood and Maacama Creeks and other tributaries are available as a result of CDFG surveys conducted in accordance with their habitat typing protocols (CDFG 2004). Other lines of evidence presented below include remote sensing data and additional field reconnaissance photos. Pool frequency by length and average maximum depth are useful measures of stream health, particularly, since coho salmon juveniles prefer with a depth greater than three feet (Kier Associates and NMFS 2008). In an undisturbed Pacific Northwest streams, pool frequencies range from 37% to greater than 80% (Murphy et al. 1984 and Grette 1985) and CDFG (2004) rates frequencies greater than 40% as

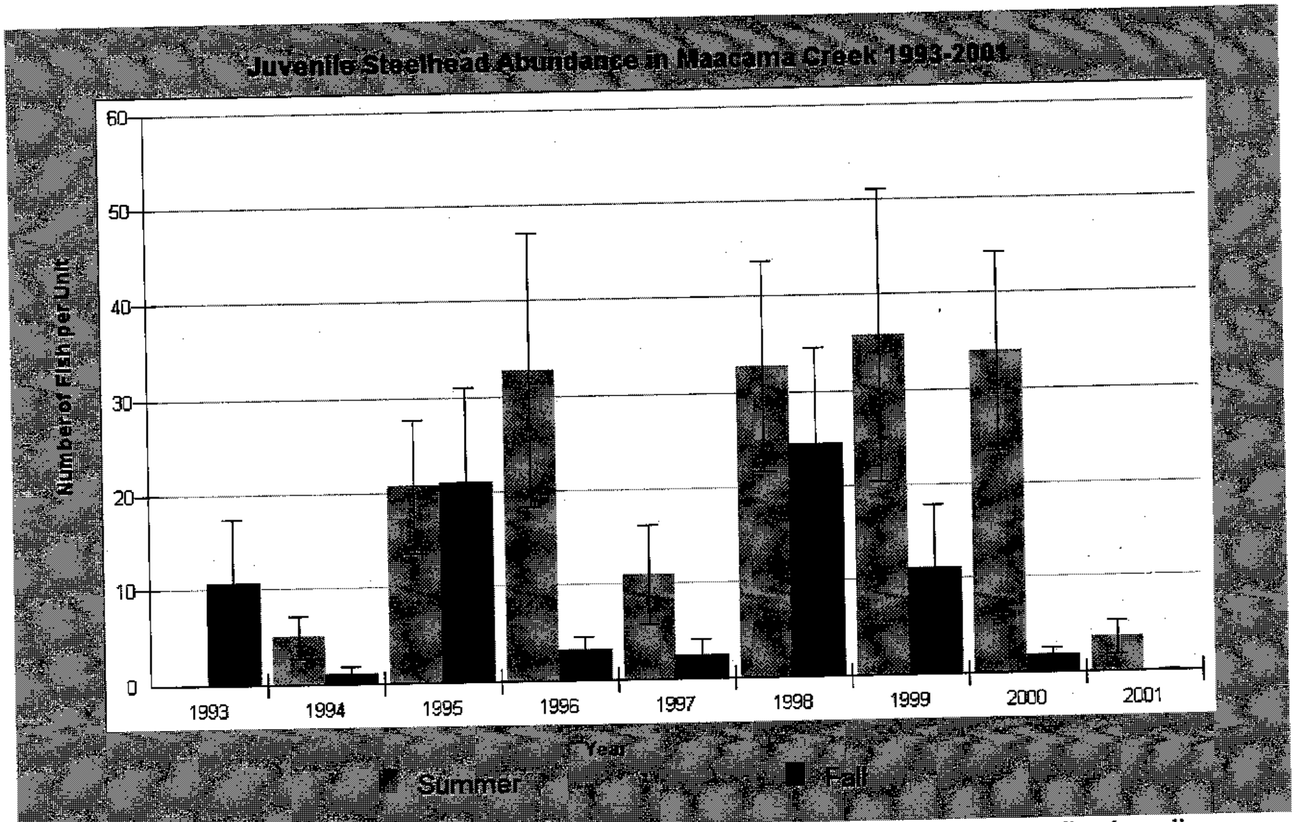

Figure 11. CDFG Maacama Creek electrofishing samples from 1993-2001 show summer and fall steelhead standing crops in a fish community dominated by warmwater species but also containing two rare coho salmon juveniles and four steelhead trout juveniles.

functioning for salmon and steelhead. Figure 12 shows that pool frequencies were under 10% on Redwood and Foote Creeks in some reaches and only about 25% of most Maacama Creek reaches. Pool depths are similarly compromised (Figure 13) with none over three feet deep in Foote Creek and the majority on Redwood Creek as well. Only Maacama Creek rates well on this scale and its pools should likely be 6-10 feet deep at least.

Habitat typing data also shed light on the problem of stream dewatering as indicated by almost 70% of habitats in Redwood Creek being dry (Figure 12) and all other streams showed signs of dewatering related to diversion of surface water and likely contributed to by over-use of groundwater. Riparian conditions on Maacama Creek and its tributaries (Figure 14). Upper reaches of some smaller Maacama Creek tributaries like upper McDonnel and Blue Gum have high conifer and shade components, but Redwood Creek has approximately 40% of its reaches exposed with no shade. Poor riparian conditions contributed to elevated water temperatures in Redwood and Maacama Creeks that will be discussed below. Coho salmon prefer pools formed by large wood (Reeves et al. 1988) and the high conifer components likely represent increased opportunity for large wood recruitment.

Landsat data provides another avenue for analysis of the riparian condition in and around the proposed Pelton House Winery project. The U.S. Forest Service Remote Sensing Lab and the California Department of Forestry analyzed 1999 Landsat images to formulate a California-wide electronic map layer of vegetation (Warbington et al., 1999). Figure 15 shows tree size classes in average diameter at breast height (dbh) for buffer strips that span 90 meters of each side of the stream center line. The alluvial valley reach of Redwood Creek and its tributaries provided 24 miles of habitat of low gradient, highly suitable habitat for coho salmon (CDFG 1954). The riparian zone before disturbance would have not only provided 100% shade, a gallery forest that extended back from the stream and a system

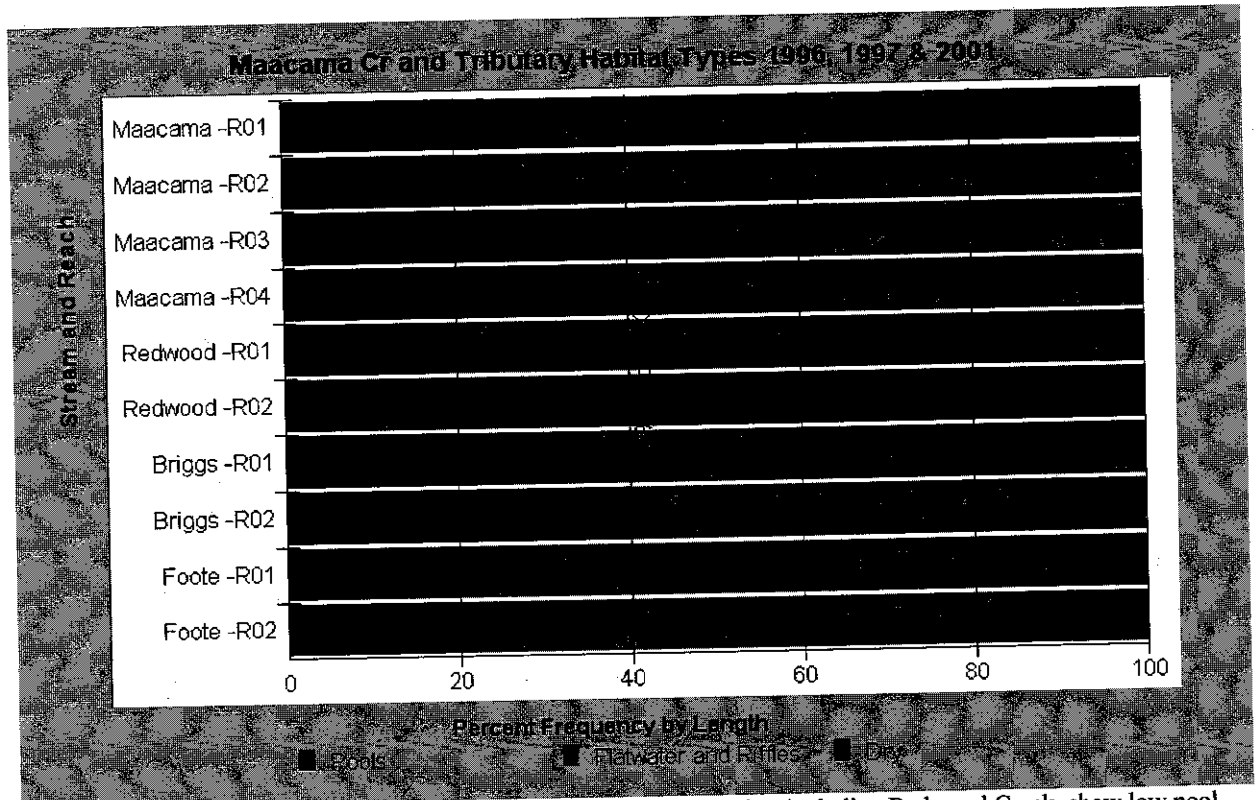

Figure 12. CDFG habitat typing data for Maacama Creek and its tributaries, including Redwood Creek, show low pool frequencies and a high percentage of dry habitats likely caused by stream diversions. Data from CDFG and chart from KRIS Russian River database.

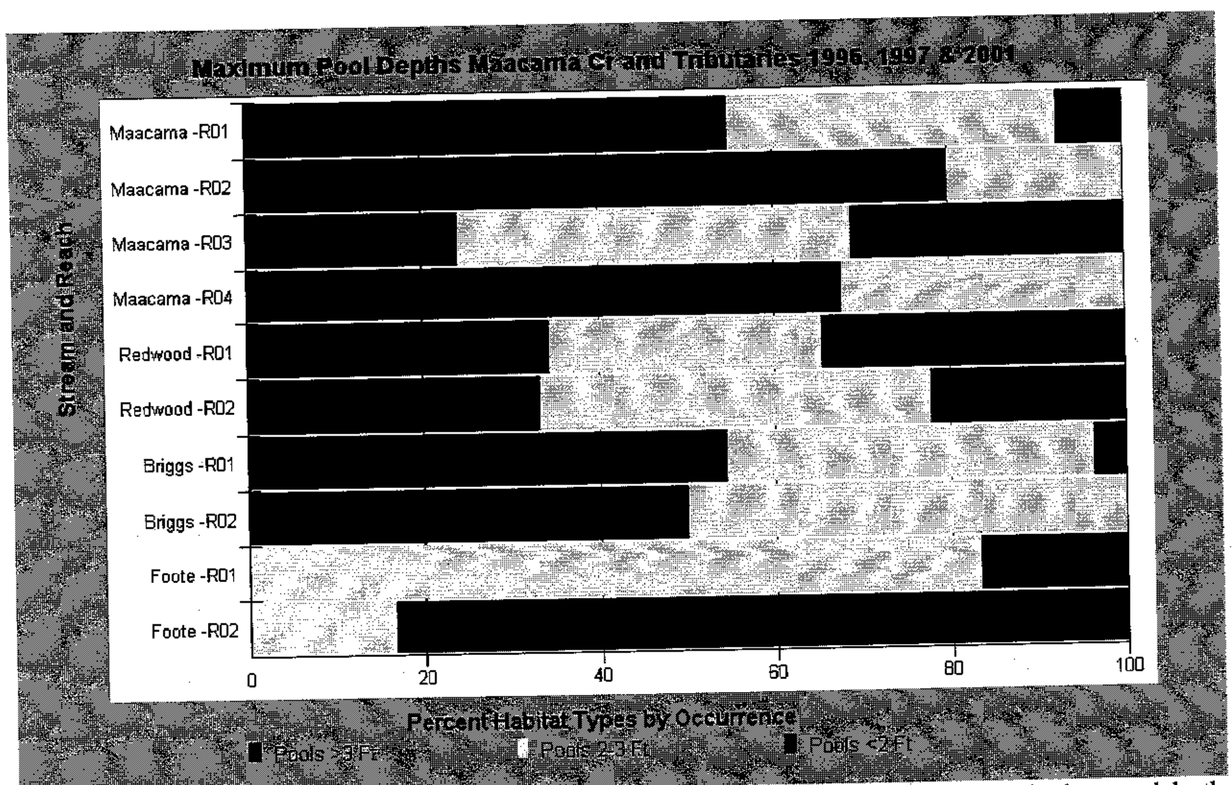

Figure 13. CDFG habitat typing data for Maacama Creek and its tributaries, including Redwood Creek, show pool depths are often restricted to less than two feet. Data from CDFG and chart from KRIS Russian River database.

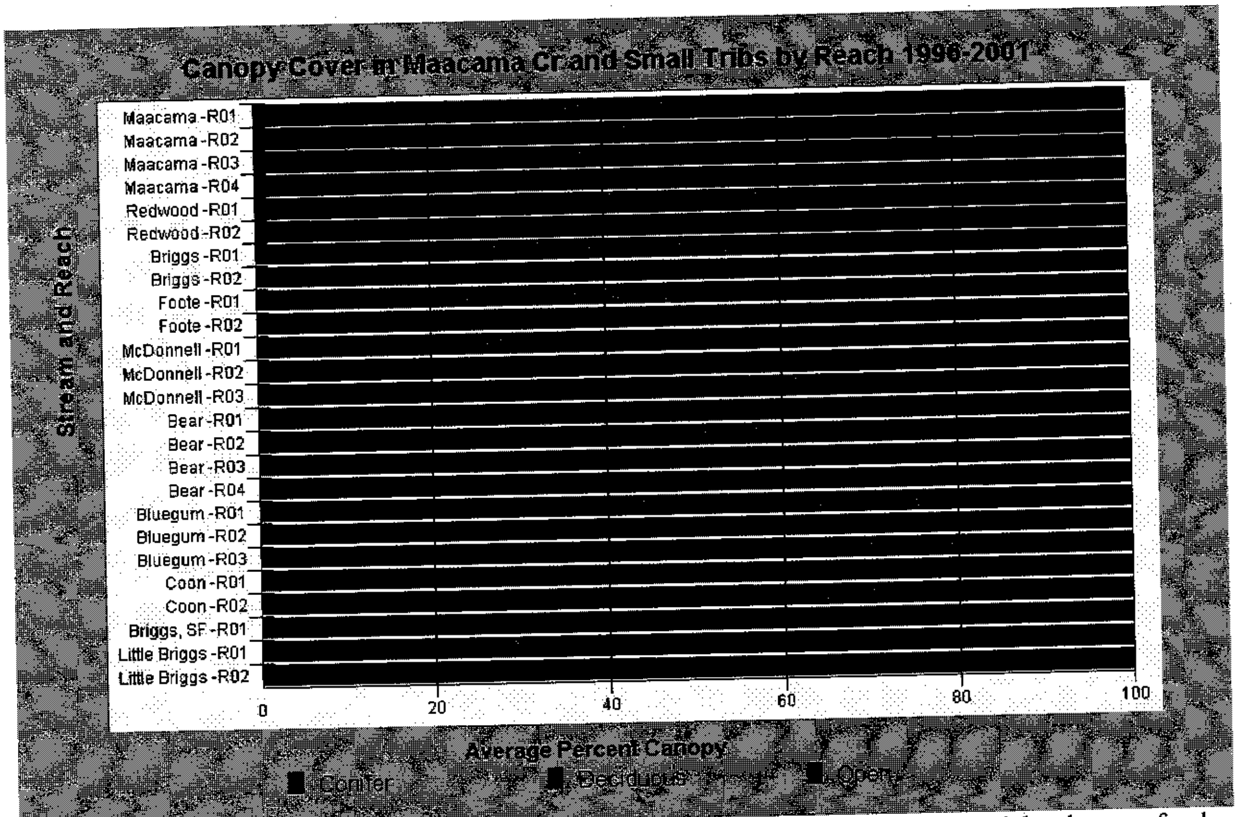

Figure 14. CDFG habitat typing survey data show shade canopy in Redwood Creek is deficient and that there are few large conifers adjacent to the stream. Data from CDFG and chart from KRIS Russian River database.

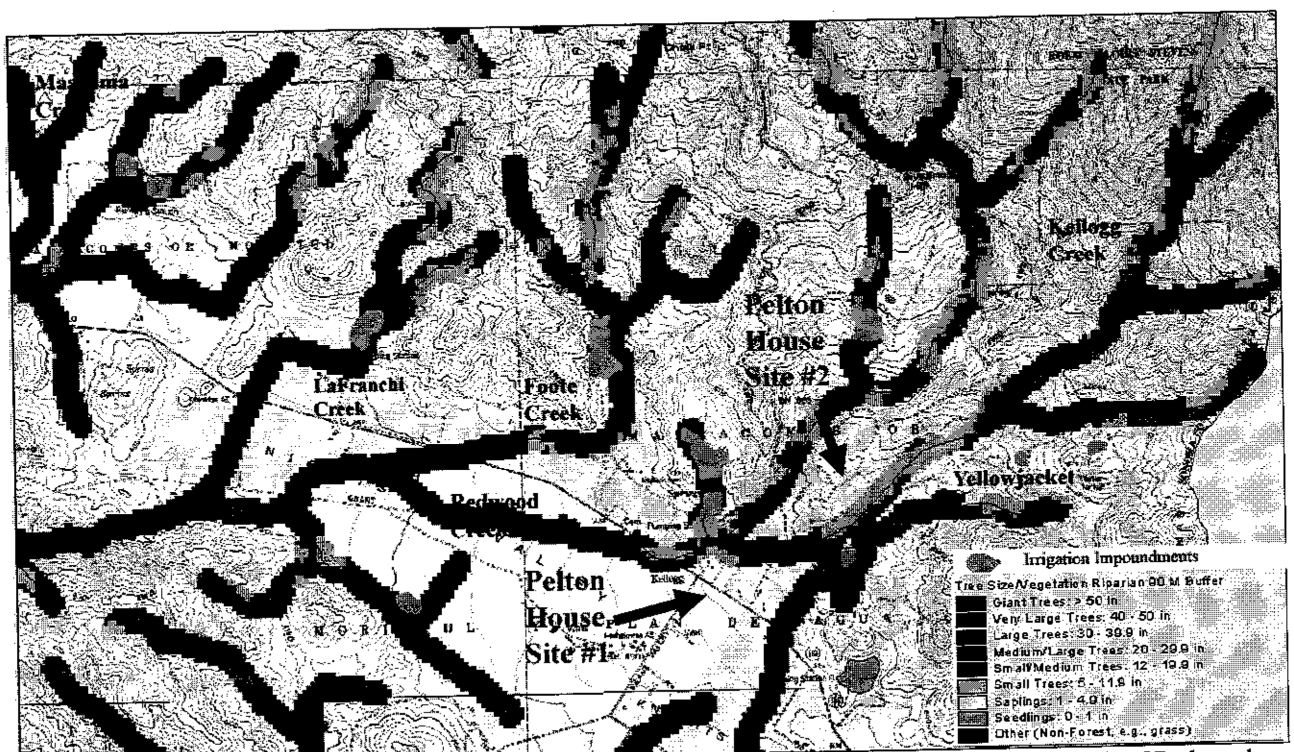

Figure 15. Classified Landsat imagery displays 90 meter (approx. 300') on each side of the stream channels of Redwood, Kellogg, Yellowjacket, Foote and LaFranchi Creeks and show that riparian zones are highly altered with spectral signature indicating grass or shrubs, not trees in most nearby stream side zones. Data from USFS (1999) and KRIS Russian River.

of inter-connected wetlands. Now they are reduced thin shade buffers or wholly lacking (Figures 16 and 17), which shows in Figure 15 as non-forest conditions indicative of riparian alteration by agriculture. Another major riparian disruption is construction of impoundments directly within the riparian zone and these are highlighted in Figure 15. Pool and Berman (2001) notes that surface water-groundwater connections in tributaries assist in maintaining cool water in streams during periods of low flow, and the capture of these cold water sources certainly has major consequences for both riparian function and carrying capacity of fish in downstream reaches.

Figure 16. LaFranchi Creek below Highway 128 shows a channelized stream bed and simplified riparian conditions indicative of fully non-functional salmonid habitat. Photo by Pat Higgins from KRIS Russian River. 7/14/03.

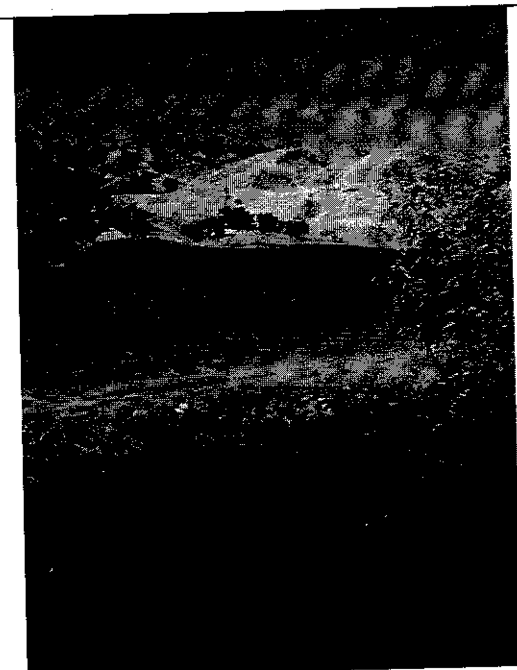

Figure 17. Foote Creek above Highway 128 is shown looking upstream with road adjacent, riprap confined bank, poor riparian conditions and vegetative cover on the stream bed indicative of chronic dewatering.

Original upland and riparian vegetation, at least on north facing slopes and areas of steep topography, would have included old growth redwoods and there are tiny patches of giant (>50" dbh) and very large trees (40-50" dbh) on upper Kellogg Creek. Medium-large (20-30" dbh) and large (30-40" dbh) mid-seral stands trees are also present in patches on Kellogg, Yellowjacket, Foote and LaFranchi Creeks, but most other riparian zones are predominantly small diameter conifers or hardwoods. However, some areas of sparse vegetation may be due to natural grasslands due to local geology.

When assessing impacts to Redwood Creek by the proposed Pelton House Winery project, one must also consider the health of proximate tributaries, such as LaFranchi and Foote Creek. Although historically likely productive because of their gradient, these streams are now severely disrupted by channelization by levees or dikes, which is evident both from the linear channels on the USGS stream maps (Figure 15) and in the ground reconnaissance photos (Figures 16-17). Disconnection from the floodplain and channel straightening causes loss of slow edge water habitats and side channels that would have been ideal coho salmon habitat, in part due to their connection with cold groundwater. Wetlands that have now been diked off or drained would have been inundated during flood flows and would have provided winter shelter for coho salmon that must spend at least one year in freshwater before going to the ocean. The disconnection of wetlands also diminishes their water storage and water filtration capacity. For example, both La Franchi and Foote Creeks have roads and field immediately adjacent with no buffer, which discharges of sediment and chemicals directly to these water courses and Redwood Creek just downstream.

Coho salmon prefer maximum floating weekly maximum water temperatures of no more than 18.4 C or 64 F (Welsh et al. 2001, McCullough 1999) and Redwood Creek is over this limit. According to data provided in the Russian River GIS (Circuit Rider Productions 2003) the maximum water temperature of Redwood Creek fluctuates from 65 F to 70 F , while Maacama, Briggs and lower Franz Creek are over 70 F (Figure 18).

Water temperature is a function in part of transit time and volume; therefore, any additional flow depletion should be prevented at this time to make sure that Redwood Creek doesn't depart further from coho requirements and into the acutely stressful range for steelhead.

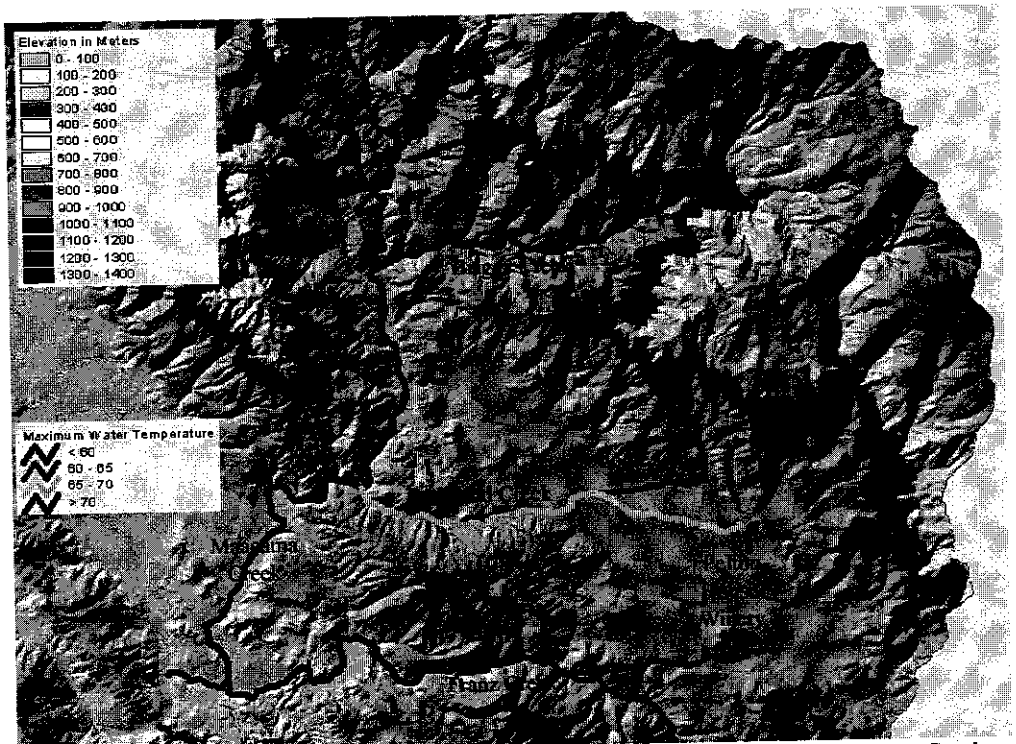

Figure 18. Elevation of surrounding terrain and maximum water temperature ranges for the Maacama Creek and its tributaries, including Redwood Creek. Data from Circuit Rider Productions and KRIS Russian River.

Cumulative Watershed Stress Due to Upland Disturbance

When considering the cumulative effects of the Pelton House Winery project, the full extent of development must be acknowledged as well as all other past, present and foreseeable off-site impacts. Sonoma County has information indicating non-discretionary land-uses and water diversions on the subject property have substantially impacted habitat and streams flows of Kellogg Creek and Yellowjacket Creek (Ball 2005), which flank the upper winery development site (#2). The project will take place in over ¾ in both the Kellogg and Yellow Jacket Creek riparian zones and the two sites must be linked with infrastructure that will cause further disruptions.

CDFG (1955) noted decreased suitability for salmonids in Maacama Creek, which was likely related to post WWII logging. Timber harvest for vineyard conversion continues on the slopes of Mt. St. Helena upstream from this project. Forest conversion for new vineyards in the upland areas of Knights Valley area is also projected to double as noted in the EIR for GP2020 (Sonoma County 2008a). These add to the already substantial impacts of road densities and road stream crossings left over from logging era or developed for on-going non-discretionary agricultural activities.

though timber harvest is no longer active in these watersheds, they have substantial road densities and road stream crossings left over from logging or developed for agricultural activities.

High road densities act to extend stream networks and intercept ground water flows (Jones and Grant, 1996), resulting in increased peak flows and decreased base flows (Montgomery and Buffington, 1993). U.S. Forest Service (1996) studies in the interior Columbia River basin found that bull trout were not found in basins with road densities greater than 1.7 mi/mi^2. They rank road-related cumulative effects risk as Extreme when road densities exceed 4.7 mi/mi^2 (Figure 19). National Marine Fisheries Service (1996) guidelines for salmon habitat characterize watersheds with road densities greater than 3 mi/mi^2 as "Not Properly Functioning" while "Properly Functioning Condition" is defined as less than or equal to 2 mi/mi^2 with no or few stream side roads.

Road densities were calculated as part of the KRIS Russian project on a large sub basin scale (Figure 20). Not surprisingly the urbanizing sub basins, such as Cloverdale Creek, have the highest densities (>5.0 mi/ mi^2). The Kellogg Creek Calwater Planning Watershed actually encompasses all of Yellowjacket Creek and Redwood Creek to its mouth and has 4.2 mi/ mi^2 and falls into the High risk (USFS, 1996) category (1.7-4.7 mi/mi^2).

Existing high road densities and stream-side roads are likely contributing substantially to channel damage in Redwood Creek and other Maacama Creek tributaries and reaches that are manifesting low pool frequency and depth. The Pelton House Winery proposal will increase total impervious area by constructing driveways and converting naturally vegetated areas into parking lots for both Site #1 and Site #2 and these aspects of development need to be considered in conjunction with high pre-existing impacts.

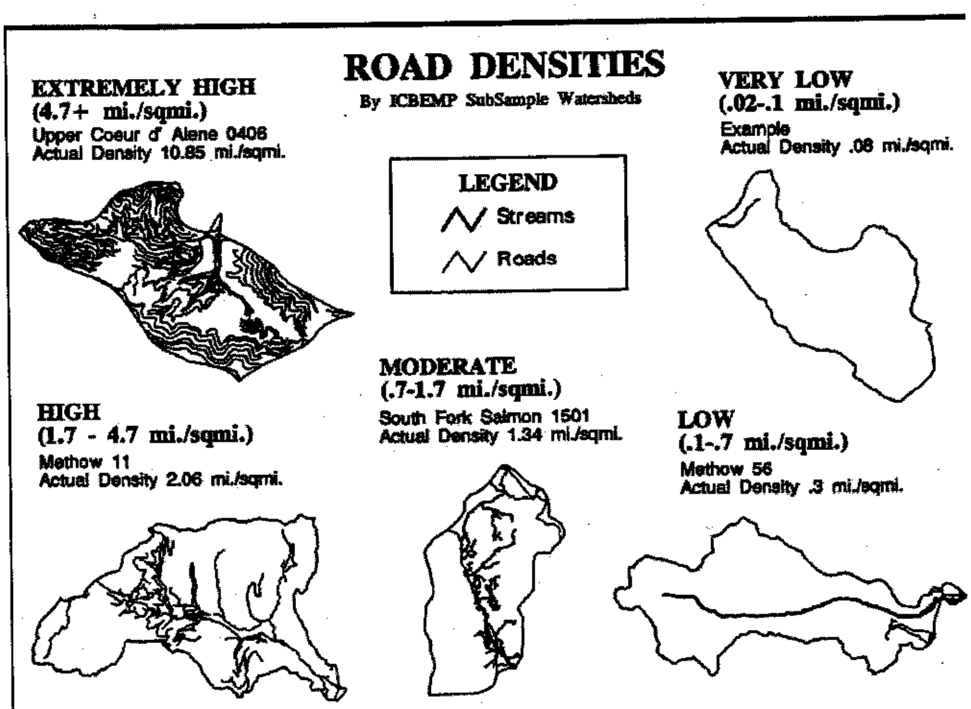

Figure 19 The USFS (1996) Interior Columbia River basin criterion for ecological and hydraulic risk from road densities is displayed here. The Bohemian Grove falls into the High (1.7-4.6 mi/mi^2) category.

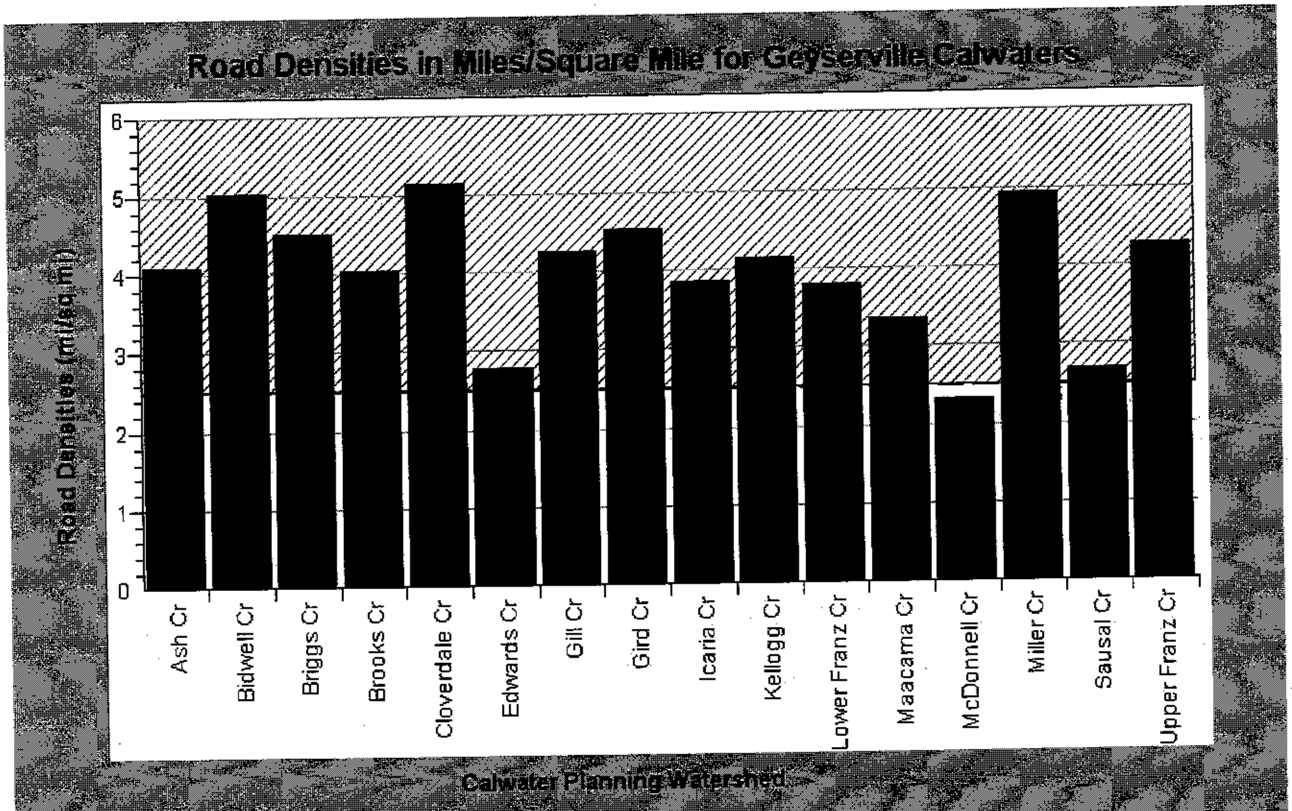

Figure 20. Road densities in various Calwater Planning watersheds are contrasted above based data from CDF. Kellogg Creek is over levels recommended for Properly Functioning watershed condition (2.5 mi/sq mi) for Pacific salmon (NMFS, 1996). KRIS Russian.

A further consideration under the topic of cumulative effects is that channel changes discussed above have likely diminished surface water availability. Highly aggraded stream channels may sometimes lose surface flow because of the depth of their bedload (Kier Associates 1991) and dry streambeds near the project area may be a reflection of both (Figures 21). Also compromised depth of pools may cause greater loss of fish habitat with the same amount of water withdrawn because of the changes in stream profile. Consequently, the SWRCB WRD needs to examine all pending and unpermitted use in light of this currently diminished surface water supply. If upland stresses are decreased through road decommissioning and allowing vegetation to approach its more normal range of variability, the channel will deepen and surface water availability could once again increase.

Thus, a combination of channel changes, adverse water quality and depleted flows are all acting synergistically to eliminate coho salmon. Redwood Creek (Figure 22) barely flows at present below the proposed project site and it is known to lose surface flow in more than half its length as it flows to Maacama Creek. All land use, including the proposed Pelton House Winery need to take these considerable impacts into consideration when considering the need for mitigation.

Conclusion

Coho salmon are at very high risk of extinction in the Russian River basin, yet NMFS (2008) considers their gene resources to be of extremely high importance for rebuilding of the entire CCC ESU. Expensive recovery efforts to restore Russian River coho salmon using captive broodstock from Green Valley Creek is failing to re-establish breeding populations in any Russian River tributary (NMFS2008). In fact, the problem is that there aren't any coho salmon refugia; perennial cold water streams with complex, deep pools. Problems are partially caused by development in uplands that exceed prudent risk thresholds, thereby increasing sediment yield and altering hydrology to the

Figure 21. Franz Creek running dry at its convergence with Maacama Creek, which may be caused by a combination of stream bed aggradation and upstream diversion. Photo by Pat Higgins from KRIS Russian River. 7/13/03.

Figure 22. Redwood Creek barely flowing upstream of Highway 128 just below the proposed project site. Photo by Pat Higgins from KRIS Russian River. 7/13/03.

the detriment of coho salmon. But the biggest problem is over-consumption of water to which the Pelton House Winery project will contribute

To meet CEQA requirements for use of best scientific information in analysis and for consideration of cumulative effects, the County of Sonoma needs to require development of a full EIR for the proposed Pelton House Winery project that covers topics above, including connections of groundwater to adjacent wells and connections to surface flow downstream in Redwood Creek in former and potential coho habitat. A full evaluation of fisheries resources and fish habitat within the project site should be provided with the EIR and survey results for sensitive amphibians, such as red-legged and yellow-legged frogs. Amphibians require moist riparian habitats for survival, and as shown above riparian habitat is profoundly altered and fragmented.

In light of existing road densities, the EIR needs to consider effects of increased impervious area, removal of naturally-vegetated areas, and the contribution of the event center's vehicular traffic and roadside parking areas to elevated sediment yield and altered hydrology that can both have negative impacts on downstream critical habitat. Finally, the EIR should address the projects growth-inducing stimulus for commercial destination development in a water-scarce area previously designated for resource conservation (Sonoma County 1979).

Sincerely,

Patrick Higgins

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Appendix C

MEMORANDUM REPORT

To: Klamath Basin Tribal Water Quality Work Group
From: Patrick Higgins, Kier Associates
Date: November 21, 2009
Re: Comments on Final *Scott River Watershed-Wide Coho Salmon Incidental Take Permitting Program* and *Shasta River Watershed-Wide Coho Salmon Incidental Take Permitting Program Environmental Impact Reports*

(If there are questions regarding any of the content in this memorandum, please contact Patrick Higgins at phiggins@humboldt1.com or 707-822-9428)

These comments were prepared for the Klamath Basin Tribal Water Quality Work Group (Work Group), an association of the water quality and environmental departments of five Lower Klamath River Basin tribes (see www.klamathwaterquality.com). Work Group members have been submitting comments on the proposed Incidental Take Permits (ITPs) for coho salmon for agricultural activities for the Scott and Shasta River basins for several years (QVIC 2005, 2006a, 2006b, 2006c, 2008a, 2008b). The foregoing documents provide more detail than these comments except on the subject of jeopardy, but the main purpose here is to advise the Work Group as to whether the final approved Scott and Shasta ITP Environmental Impact Reports (EIRs) were changed significantly as a result of information they had provided. In fact the California Department of Fish and Game has chosen not to deal in substance with points raised. Consequently, the final *Scott River Watershed-Wide Coho Salmon Incidental Take Permitting Program* and *Shasta River Watershed-Wide Coho Salmon Incidental Take Permitting Program* EIRs have numerous terminal flaws both in terms of effectiveness for preventing coho salmon extinction and with regard to meeting the requirements of the California Environmental Quality Act (CEQA) and the California Endangered Species Act (CESA). A number of deficiencies extend to both the Scott and Shasta ITPs; therefore, both basins are included in these comments.

EXECUTIVE SUMMARY

The primary deficiency of the ITP approach and both EIRs is that they consider only the impact of "Project" mitigation measures, but not those of agricultural activities that are the primary stressors. The latter effects will continue to cause jeopardy and the eventual the demise of endemic Scott and Shasta River coho salmon (Oncorhynchus kisutch) as well as spring and fall Chinook salmon (O. tshawytscha) and summer and winter steelhead (O. mykiss). The original ITP permit applications (SVRCD 2005, SRCD 2005) that are driving the whole process made the following statements with regard to areas and activities covered:

> "The proposed project includes ongoing legal agricultural water diversions and other agricultural activities occurring within the Shasta River watershed" (SVRCD 2005), and.
>
> "The proposed project includes ongoing permitted agricultural water diversions, other agricultural activities, and salmonid research and restoration projects to occur within the Scott River watershed (SRCD 2005).

The reason that the effect of on-going agricultural activities and water use is not honestly evaluated is because the ITPs take few real steps to mitigate them. These activities include Scott River dewatering and flows at the USGS gage far below those required by the California State Water Resources Control Board (SWRCB 1980) adjudicated levels. This is a major ongoing "take" due to elimination of miles of habitat that had previously served as refugia for coho salmon and all other Pacific salmon species. Operation of Dwinnell Dam would be permitted under the Shasta River ITP with the California Department of Water Resources (DWR) being the Permittee despite the fact that the Shasta River is dried up below the dam and hundreds of miles of salmon and steelhead spawning and rearing habitat are blocked. The National Academy of Sciences (NAS 2004) also found that extreme low flows in both basins were linked to acute water quality problems and attendant salmonid stress and disease, yet the final EIR does not have any discussion of these relationships.

The EIRs treat the key question of jeopardy of coho salmon stocks in the Scott and Shasta rivers superficially, referring to CDFG "Jeopardy Assessments" that are not part of either report or available separately as yet from the Department. The data on adult and juvenile coho salmon (CDFG 2009), however, show jeopardy of both the Scott and Shasta stocks. Since jeopardy precedes ITP implementation and will remain unabated due to insufficient action under the Project, the EIR and anticipated permits will not meet Fish and Game Code §2081(c).

Analysis of pesticides in the final Shasta and Scott ITP EIRs is also avoided because mitigation measures proposed in both basins will not increase pesticides use. A truly valid ITP that had some chance of recovering the species would require that basin cooperators work toward phasing out use of substances known to present a high risk to salmonids (NMFS 2008).

Fish and Game Code §2018 (b)(1) states that an ITP can only be issued when the "take is incidental to otherwise lawful activity." A number of Permittees are unlawfully dewatering streams, or extracting surface water connected to groundwater without a permit, within the Scott and Shasta river basins. Such activities will continue under the ITPs, which means that permit coverage will extend to illegal activities.

Both the Shasta and Scott ITP EIRs present strong evidence that groundwater extraction is causing diminished surface flows, but then take no action to improve conditions citing lack of CDFG authority. Their finding of "less than significant impacts" with regard to the ITP and groundwater pumping ignores the fact that it rises to a major, ongoing "take" of coho salmon in both basins; therefore, simply declaring impacts insignificant flies in the face of the facts. The CDFG assumption is that greater cost associated with drilling a well and installing and operating a pump versus the low comparative cost of a gravity-fed surface water diversion is not met. Although CDFG may lack direct authority over groundwater use, they should have at least defined measures of performance in gauging groundwater problems and set deadlines for when issues would be resolved and needed flow levels restored.

While the EIRs claim that monitoring and adaptive management will allow for assessment of coho recovery, all monitoring required is proximate to "Projects" and is concerned only with their direct effects. No reference values or targets for basin-wide coho salmon habitat are set with regard to critical factors such as flow and temperature, dissolved oxygen, spawning gravel fine sediment, pool depths or riparian condition. Consequently, the ITP does not provide a framework for understanding habitat trends that are a critical element of coho salmon recovery monitoring. To avoid the perception that they are turning their regulatory authority over to the RCDs, CDFG reclaimed responsibility for conducting compliance monitoring, however, there are no specific plans described in the EIR or Appendices. The Work Group is concerned that CDFG might not have sufficient budget for staffing to conduct compliance monitoring. The final EIR remains unsatisfactory in terms of explicit requirements for data sharing and transparency with regard to information collected by the Shasta and Siskiyou RCDs.

One of the most alarming precedents of the ITP is CDFG's clear abandonment of public trust protection and willingness to pay for any flow that is left in the Scott River for coho salmon through a Water Trust. Water will be purchased only for periods of known coho migration; therefore, in the future water would presumably have to also be purchased for steelhead and Chinook salmon. This precedent not only runs counter to California Fish and Game Code (§ 5937) and Water Code (§ 1052), it absolves land owners of all responsibility for maintaining flows for fish.

Shasta and Scott River Coho Stocks are in Jeopardy and Will Remain So

The Shasta and Scott ITP EIRs completely dodge the question of the imminent risk of extinction for coho salmon or jeopardy:

> "The jeopardy determination is an ITP issuance criterion pursuant to Fish and Game Code, § 2081(c), but not a CEQA requirement….Furthermore, the EIRs are not intended to be, nor should they be interpreted as constituting, the jeopardy determination required under Fish and Game Code, § 2081(c). That determination is a statutory requirement (under CESA) separate from any requirement under CEQA."

No CDFG Jeopardy Assessments are available as appendices or attachments to the EIRs and Kier Associates (2009) has made a California Public Records Act (CPRA) request for these documents of CDFG for both the Shasta and Scott basins. However, all data used by CDFG were obtained through a similar CRRA request in December 2008 (Higgins, 2008) and they are sufficient to prove high extinction risk or jeopardy of both Shasta and Scott River coho salmon stocks. Both adult survey and juvenile survey data show some or all year classes far below those recognized as sufficient for maintaining genetic diversity (Bjornn and Horner 1980, Gilpin and Soule 1991).

<u>Adult Population Data</u>: Both the Scott and Shasta River adult salmon and steelhead population estimates have improved in recent years, particularly since video cameras at weirs were installed. Shasta River weir data for adult coho salmon captured by video (CDFG 2009) are included as Appendix A. The data are highly accurate and the weir is often operated through the end of the calendar year, which would encompass the majority of the adult coho salmon run. Adult Shasta River coho salmon returns from 2001 to 2008 (Figure 1) show extremely low population levels with fewer than 100 adults in some years. A clear pattern also emerges in that year class strength varies considerably with 2001, 2004 and 2007 returns considerably higher than others.

The minimum viable population size for adult anadromous salmon to maintain genetic diversity for long term survival is estimated as 200 by Bjornn and Horner (1980), and as 500 by Gilpin and Soule (1990). Since coho salmon almost all spawn at age 3, weak year classes present conservation challenge because there is little genetic exchange, such as in Chinook salmon and steelhead that spawn at many different ages. These failing year classes; therefore, constitute jeopardy.

In its initial ITP submission the Shasta Valley Resource Conservation District (SVRCD 2005) claimed that coho salmon were rebounding and within the range of historic norms. Their discussion did not include effects of ocean and climatic cycles (Hare et al. 1999) on coho salmon populations or the cessation of commercial or sport catch of coho salmon since 1994. Considering the fact that we are currently in the favorable portion of the Pacific Decadal Oscillation (PDO) cycle and that fishing has been banned, a more significant population rebound would be expected when looking at long term trends (Figure 2). Historic highs approached 900 coho salmon and, although effort varied substantially in the entire period of record (1933-2007), return years adjacent to previous historic highs do not show the missing year class pattern exhibited by recent returns. Furthermore, the maximum adult coho salmon population in recent years was 373 in 2004 in the strongest brood year, yet it is still at or below critical minimums for maintaining genetic diversity. Therefore, there are three weak year classes on the Shasta River. There are no data for 2005, but the average of other years between 2001 and 2008 was 180 adults and the minimum ranged as low as 25 in 2008. No other conclusion can be reached from these data but that Shasta River coho salmon are in jeopardy.

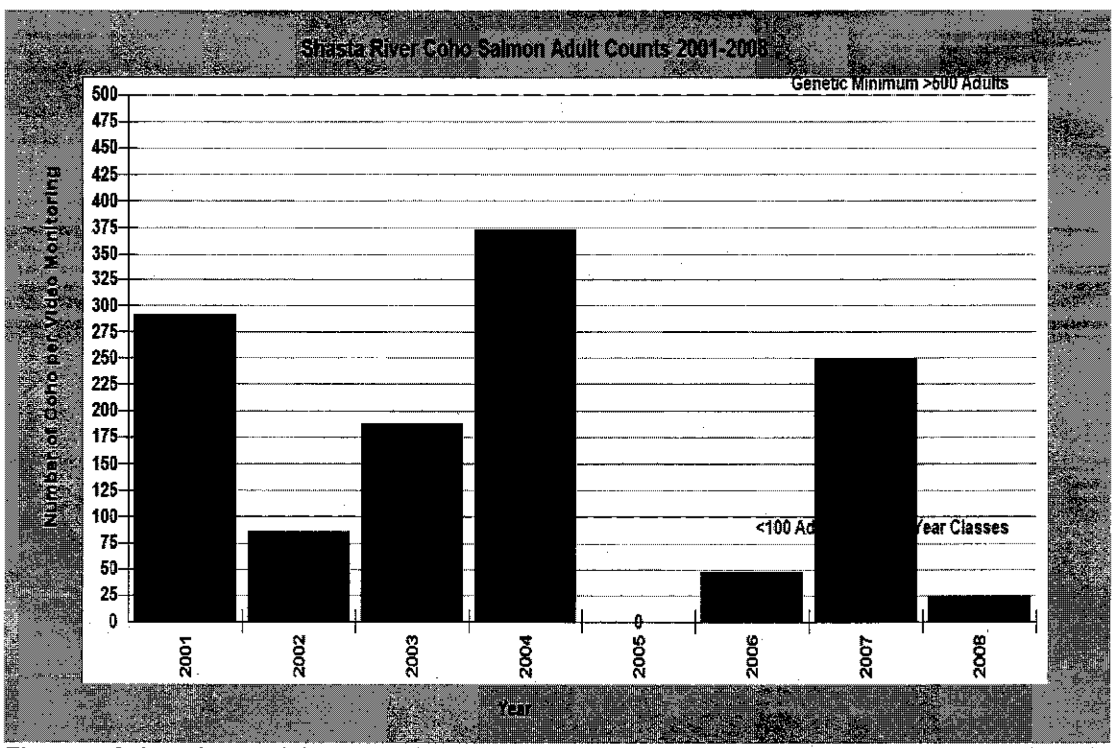

Figure 1. Coho salmon adults counted using the CDFG (Appendix A) video at the Shasta Racks weir just upstream of the convergence with the Klamath indicate very low population levels and very weak year classes indicating jeopardy.

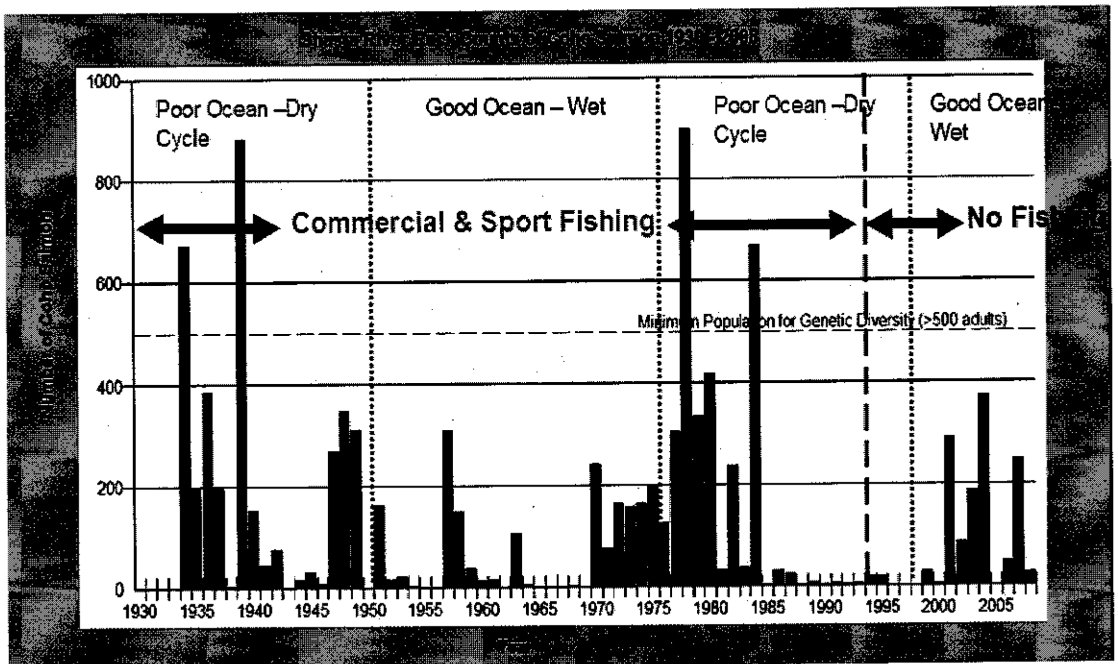

Figure 2. Shasta River coho salmon return data from 1933 to 2008 with an over-lay of Pacific Decadal Oscillation (PDO) cycles and periods with high fishing effort and complete fishing closures with recent returns (2000-2008) showing distinctly weak year classes.

Scott River adult coho salmon data represented by redd counts (Figure 3) also show two very weak year classes, but with the strong year class return sometimes numbering more than 1000 adults. Despite having one viable year class, this pattern reflects jeopardy of Scott River coho salmon. Redd counts in 2001-2002 (Figure 4) show that coho spawn in a number of Scott River tributaries that are routinely dried up by irrigation (QVIR 2008b). The ITP fails to curtail illegal agricultural activities that dewater these major coho salmon producing basins such as Shackleford, French, Moffett, Patterson and Etna Creeks and the mainstem and East Fork Scott River.

Juvenile Coho Salmon Data: Downstream migrant trapping data and electrofishing data in the Shasta and Scott River basins also show patterns representing weak year coho salmon year classes and jeopardy in both cases. CDFG (Chesney and Yokel 2003) operated a downstream migrant trap on the Shasta River from 2000 to 2002 (Figure 6). All years had just a few hundred juveniles on the Shasta River, confirming three weak year classes.

Chesney and Yokel (2003) show that coho young of the year and yearlings continue to leave the Shasta River throughout spring and early summer. The SVRCD (2005) noted that these juveniles may take refuge in Middle Klamath River tributaries and found that an acceptable mechanism for maintaining populations. In fact, flow depletion since 1991 at Big Springs has erased most functional coho salmon rearing habitat in the Shasta River basin (Kier Associates 1999) and fish migrate out because flows and water quality drop below levels suited for their survival. For example, Chesney and Yokel (2003) found water temperatures of 83° F on June 29, 2000. Furthermore, as pointed out in Work Group Klamath TMDL comments (Yurok Tribe 2009, Karuk DNR 2009, QVIC 2006d, 2007, 2009), Middle Klamath tributaries are not stable environments and sediment pollution from upland

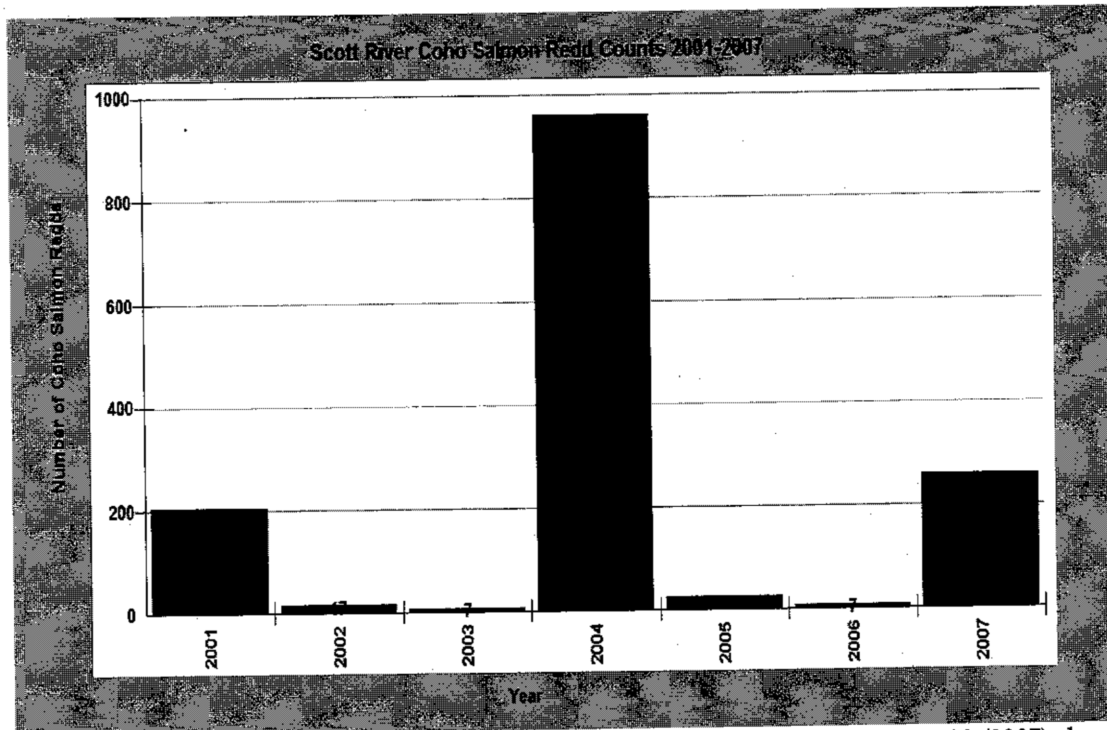

Figure 3. Coho salmon redd counts from 2001-2002 spawning year (2001) to 2007-2008 (2007) show that only one coho year class is currently viable and the other two are at remnant levels (jeopardy).

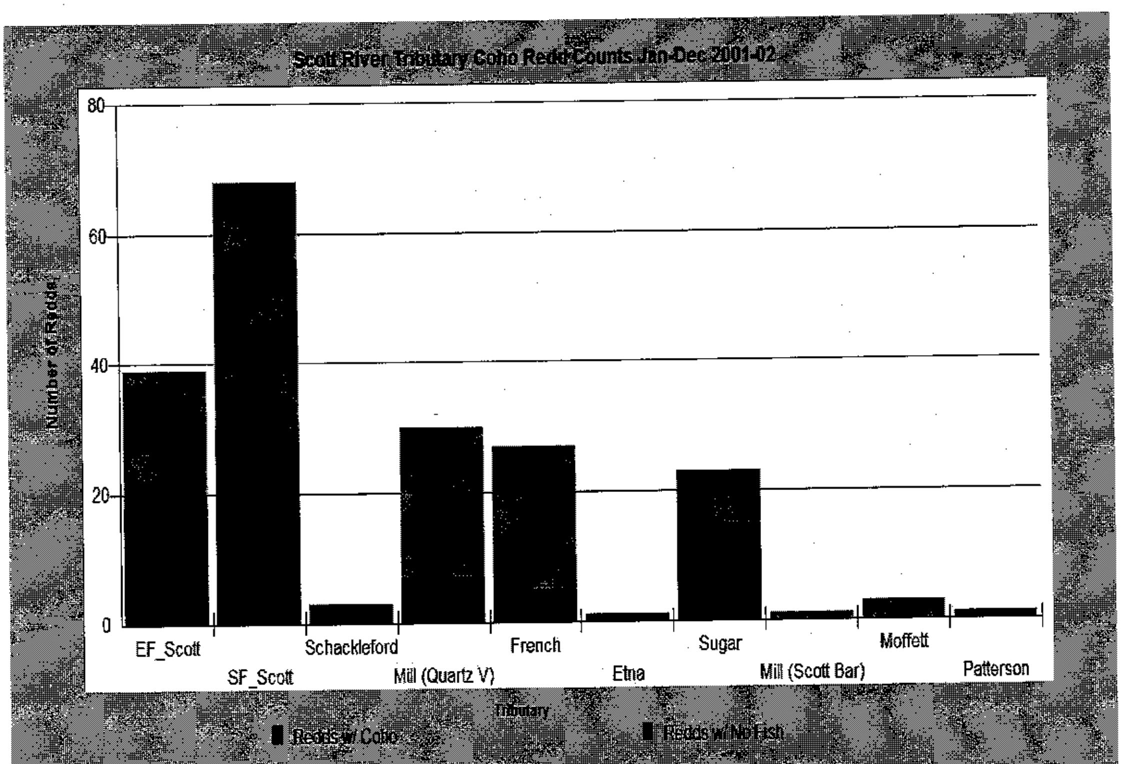

Figure 4. Coho salmon redds in various tributaries of the Scott River show wide distribution but all tributaries except the South Fork are dried up during summer thereby disrupting coho rearing.

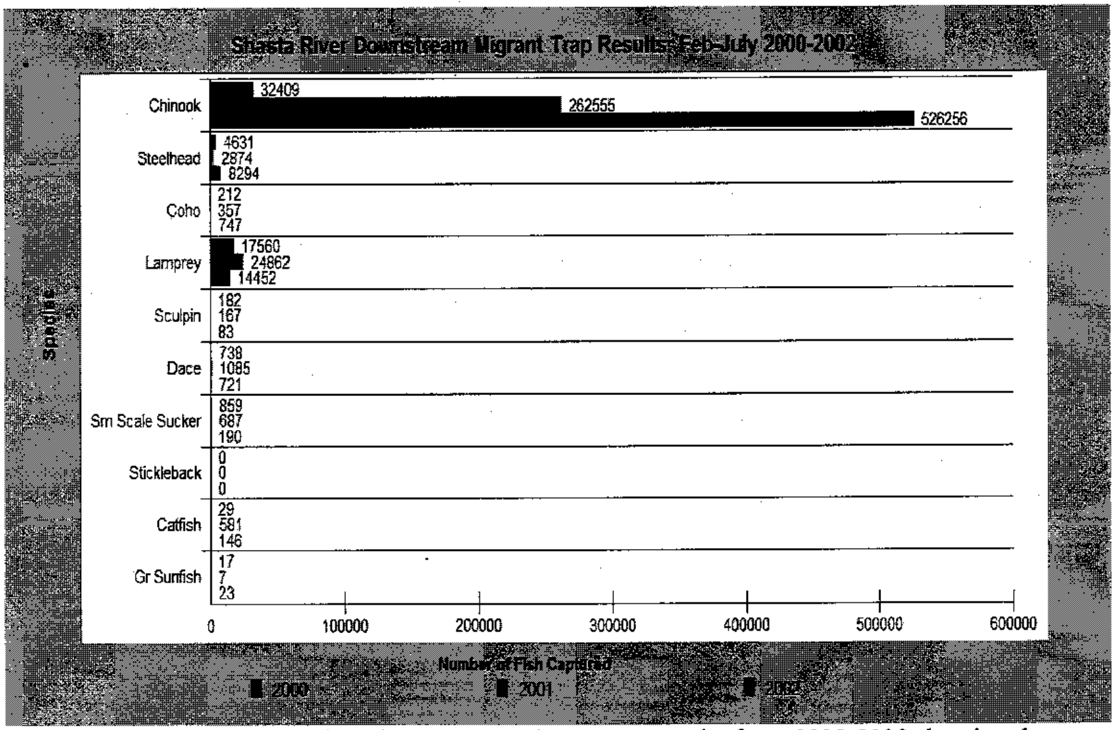

Figure 6. Data from Shasta River downstream migrant trap results from 2000-2002 showing three weak coho salmon year classes. Data from Chesney and Yokel (2003).

management poses substantial problems (de la Fuente and Elder 1998). When populations are at low levels, they can be eliminated by stochastic events (Rieman et al. 1993) and such events could include flood damage to Middle Klamath refugia. Consequently, Shasta River coho salmon juvenile rearing habitat within the basin needs to be restored to diversify areas available for rearing and reduce extinction risk.

Scott River downstream migrant trapping records show a similar pattern to adult returns, with one year class substantially larger than the two others. Chesney and Yokel (2003) found the highest levels of coho juveniles in 2002, which correlates with the 2001 larger adult spawner returns (Figure 7). More recent data collection showed that there was a very robust year class and high survival from the 2004 spawning run (Figure 8) with both young of the year in 2005 (80,498) and yearlings in 2006 (75,097) showing extremely high abundance. Other years like 2004 had fewer than 100 young of year or yearlings captured meaning both antecedent year classes were weak and survival low.

U.S. Forest Service (2005) electrofishing data from French Creek shows a similar pattern of weak coho salmon year classes (Figure 9). While the number of juveniles is high in 1999, 2002 and 2005, all other broods are very low or missing. Increased frequency of presence in more recent years may also reflect a switch to the positive phase of the PDO (Collison et al. 2003) and increased rainfall.

In sum, there are no data to refute the jeopardy status of coho salmon in the Scott and Shasta River basins when using accepted scientific thresholds for population viability and extinction risk (Bjornn and Horner 1980, Gilpin and Soule 1991, Rieman et al. 1993).

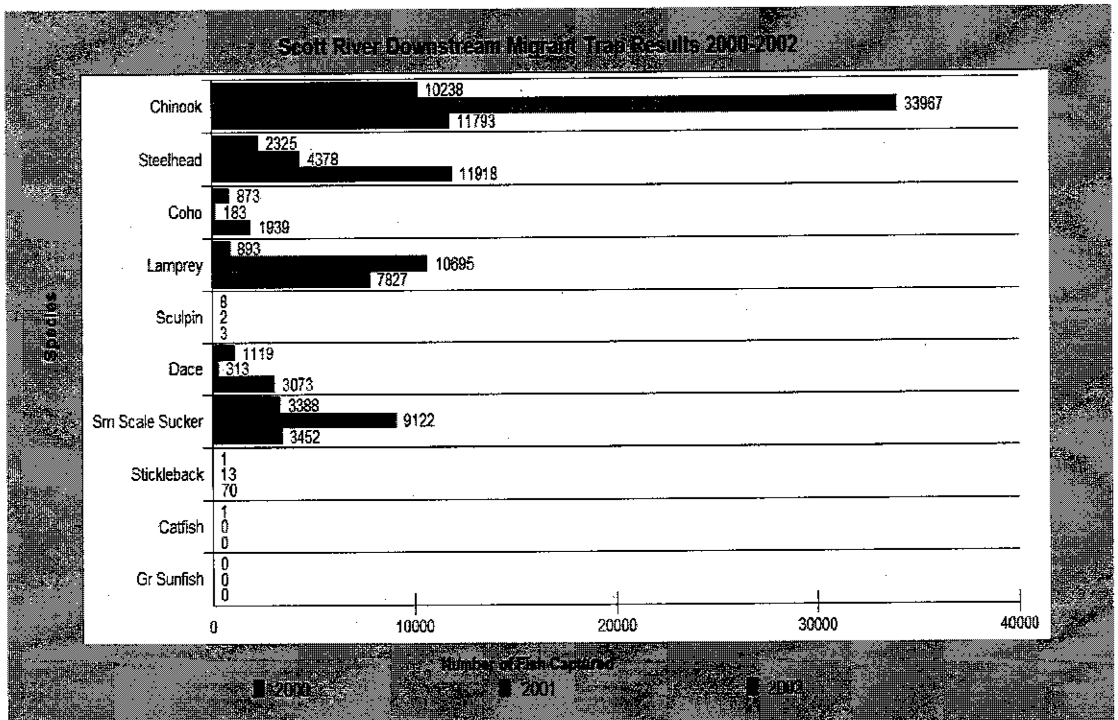

Figure 7. Data from Scott River downstream migrant trap results from 2000-2002 shows one strong coho salmon year class in 2002 following high adult returns in 2001. Data from Chesney and Yokel (2003).

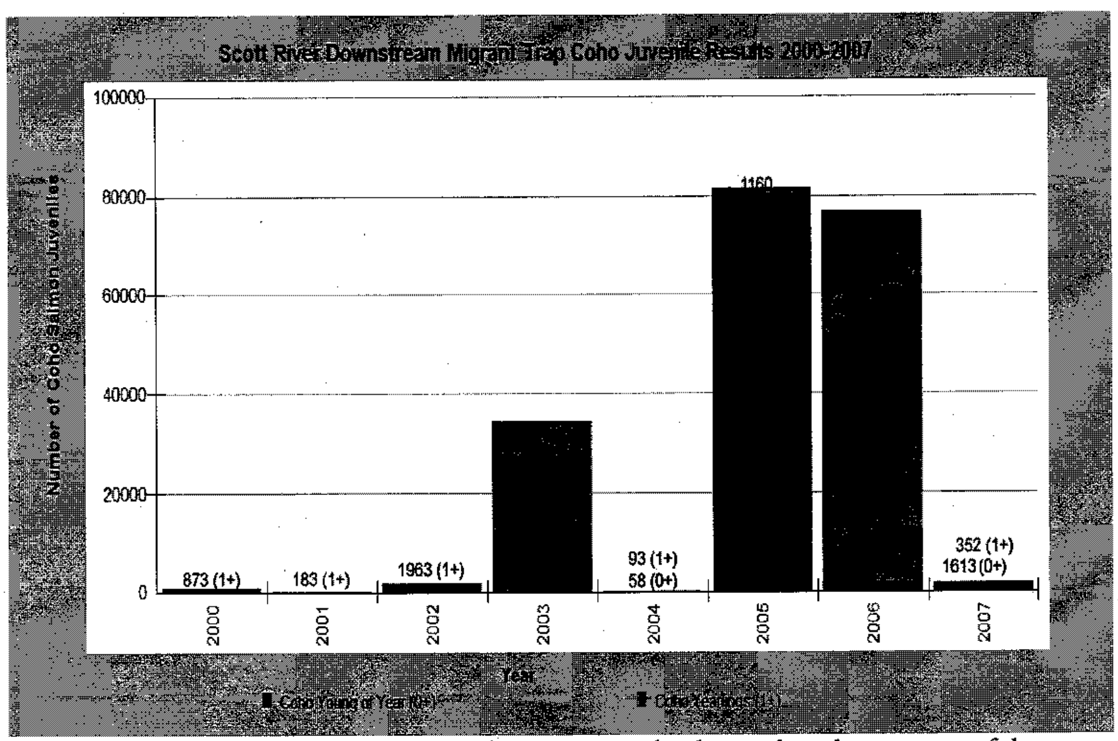

Figure 8. CDFG Scott River downstream migrant trap results show coho salmon young of the year (0+) and yearling (1+) trends with all high catch rates associated with 2001 and 2004 strong year class returns. Other weak year classes indicate jeopardy.

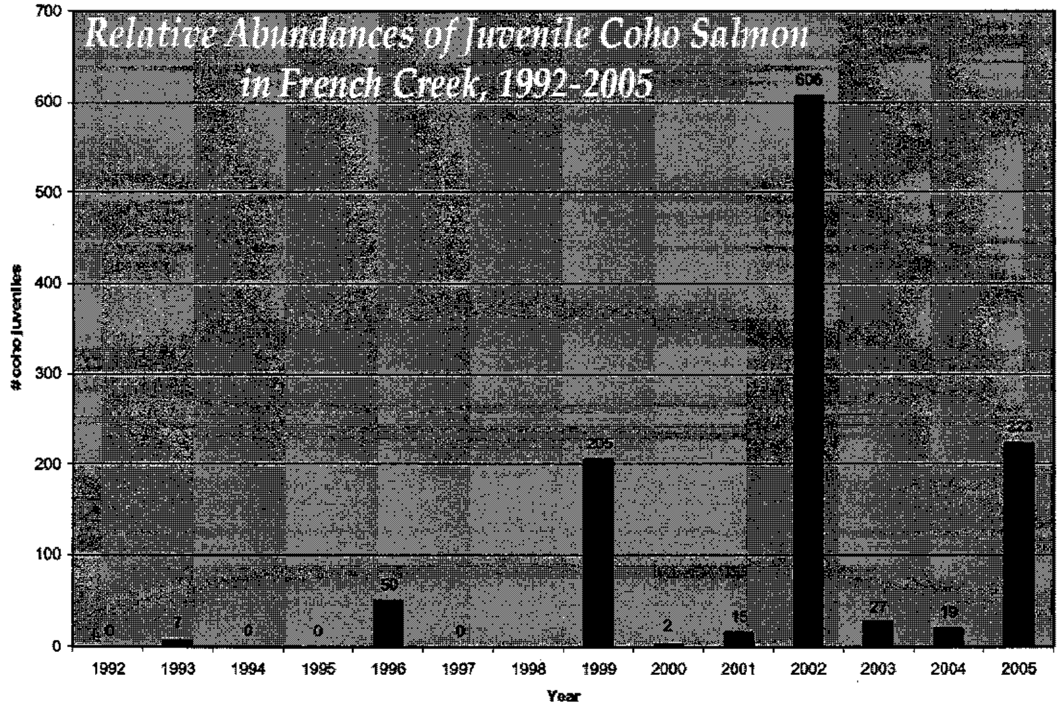

Figure 9. USFS electrofishing results from French Creek from 1992-2005 show high coho salmon abundance in 1999, 2002 and 2005, which coincides with the strong year class exhibited by CDFG downstream migrant trapping data. Taken from USFS (2005).

Upland Forest Management, Cumulative Effects and Coho Salmon

While the Shasta and Scott ITP EIRs chose to interpret questions related to upland management and cumulative effects only in terms of changes in flow, the report is negligent in not dealing with interaction of all habitat stressors as required by CEQA. For example, the January 1997 storm caused 437 miles of stream channels in the Scott and Middle Klamath basin to scour as a result of debris torrents (de la Fuente and Elder 1998)(Figure 10). These effects are described in previous Work Group comments that are copied into the final Scott EIR, but the document then fails to deal discuss or analyze consequences of a significant number of coho salmon tributaries experiencing debris torrents and becoming much warmer. Scott River coho bearing tributaries such as Kidder, Sugar, French, Etna, Kelsey and Middle Creek as well as Thomkins Gulch and the East and South Fork Scott were affected by debris torrents (de la Fuente and Elder 1998).

Scott River canyon tributaries like Kelsey Creek have provided refugia in their lower reaches for coho salmon and cold water islands at their mouths. As Kelsey Creek and others became warmer after the January 1997 storm, water use was increasing (Van Kirk and Naman 2008) and the Scott River canyon itself has since experienced unprecedented low flows. Extremely high temperatures result from low flows at the same time tributaries are compromised in terms of their ability to provide refugia for juveniles. Flood effects from 1997 also reduced Middle Klamath refugia (de la Fuente and Elder 1998, Kier Associates 1999) available for Scott River juveniles once they enter the Klamath River. U.S. EPA (2003) stresses the importance of maintaining refugia when mainstem water temperature problems exist.

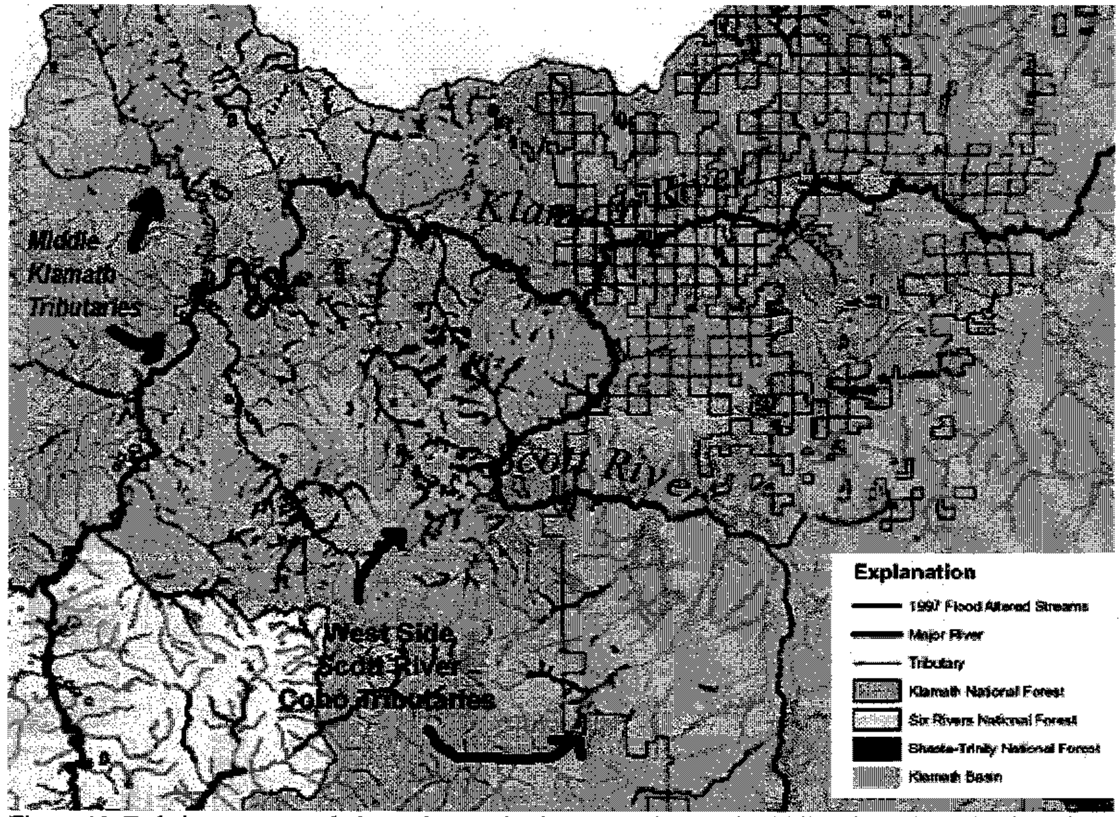

Figure 10. Debris torrents and channel scour in the Scott River and Middle Klamath Basins based on data from de la Fuente and Elder (1998). The consequences with regard to coo habitat and interactions with agricultural activities are ignored in the EIR.

Both the Shasta and Scott ITP EIRs fail to address the issue of fluctuating refugia conditions and the extent of rearing habitat available to the coho metapopulation that includes the Scott and Shasta River stocks. The Van Kirk and Naman (2008) finding of a rise in the elevation of snow accumulation to above 5,000 feet should have been factored into discussion of persistence of Middle Klamath refugia, for example.

Summer Steelhead Present in Scott River Canyon

Past comments from the Work Group on the Scott River ITP DEIR pointed out that summer steelhead are present in the canyon reach. QVIC (2009) and the Karuk Tribe Department of Natural Resources (DNR) have been conducting dive surveys of the Scott River canyon since 2007 and there have been approximately 100 adult summer steelhead and half-pounders in each year of the survey.

Pesticides

The EIR skirts the issue of pesticides by saying that "Program" activities, restoration and mitigation actions, will not increase their use. As pointed out above, an ITP that covers all existing agricultural practices would in turn encompass use of pesticides and herbicides. According to the California Pesticide Use Reporting Database, thousands of pounds pesticides are being applied annually in the Shasta and Scott River basins and several compounds used are known to be harmful to salmonids (Ewing 1999, NCAP 1999). NMFS (2008) Biological Opinion for the U.S. EPA recognized chlorpyrifos, diazinon, and malathion as having significant effects on endangered salmonid species and all three chemicals are in use in both the Scott and Shasta basins and pose a potential take under CESA and ESA. Consequently, the EIR position that they are outside the scope of the project is not valid.

Groundwater

In both the Shasta and Scott final ITP EIRs groundwater extraction "was determined to be less than significant" as an impact and requiring "no mitigation measures." The EIRs describe problems with groundwater withdrawal and depletion of cold water sources and flow impacts to coho salmon that are a major source of "take" on both the Shasta and Scott rivers, but then use diversionary tactics in saying that they are only dealing with covered activities (i.e. restoration/mitigation). As with other similar topics above, the permits as requested (SVRCD 2005, SRCD 2005) are intended to cover all agricultural activities, which includes groundwater withdrawal.

Van Kirk and Naman (2008) used rigorous scientific techniques to conclude that the recent, rapid increase in groundwater use, and application with sprinklers as opposed to flood irrigation, was causing Scott River flow levels to drop to historic lows.

> "Irrigation withdrawal in the Scott watershed has increased from about 48 Mm3 per year to over 100 Mm^3 since the 1950s, and the amount of ground water withdrawn for irrigation has increased from about 1 Mm^3 per year to about 50 Mm^3. We estimate that 39% of the observed 10 Mm^3 decline in July 1-October 22 discharge in the Scott River has been caused by regional-scale climatic factors and that the remaining 61% is attributable to local factors, which include increases in irrigation withdrawal and consumptive use."

The Scott ITP EIR cites Van Kirk and Naman (2008), however, issues of increased groundwater use and diminished flow trends and implications for coho recovery under the ITP are ignored.

The Work Group has provided evidence from the California Department of Water Resources (DWR) that installation of wells continues, including subsidized pumps from the Natural Resources Conservation Service (NRCS) through the EQUIP program. It is also a fact that at least some Scott River basin agricultural operators are already incurring expenses related to establishing wells to avoid entanglements with CDFG and ITPs.

An even more glaring problem with groundwater pumping in the Shasta River is the reduction by 90% of flows to Big Springs Creek without any permit (QVIC 2006aq, 2006c, 2008a, Kier Associates 1999). This is acknowledged by NAS (2004) as a major constraint on coho salmon because of diminished rearing habitat in Big Springs Creek and in the Shasta River downstream. They point out that increased transit time of water and reduced flow volume, due to the loss of 100 cfs at Big Springs, adds to thermal loading substantially. The Shasta ITP EIR states that CDFG lacks authority over groundwater but does not admonish the SWRCB WRD to take action on unpermitted use that rises to a major "take."

CDFG also sets no deadlines for Siskiyou County on groundwater studies or action to decrease extraction, although they are acting as lead under the Scott River TMDL implementation (NCRWQCB 2006). Therefore, this major take will continue unabated likely confounding any other recovery efforts for coho salmon in both basins.

ITPs Would Allow Continuing Illegal Water Use

As noted above, there are clear examples in both the Scott and Shasta River watersheds where streams are dried up seasonally in violation of F&G Code § 5937. The EIRs make the case that existing diversions and depleted stream flows are part of "baseline conditions", but they are illegal and thus should prevent issuance of an ITP that covers agricultural activities under F&G Code § 2081 that requires that "take be incidental to an otherwise lawful activity."

Similarly, on the Shasta River flows have been shut off by Dwinnell Dam since 1928 in violation of F&G Code § 5937 and Parks Creek, which has its headwaters in USFS lands, is not allowed to feed the Shasta River. Instead the flow from the latter is shunted into Dwinnell Reservoir. Both Dwinnell and Parks Creek are a major on-going major "take" that will not be abated. Instead CDFG would permit the California Department of Water Resources (DWR) for its operation in violation of F&G Code § 2081 as well.

Fish Screens/Fish Rescue

Rescue of young coho salmon trapped at diversions proximate to fish screens has a number of problems with regard to both policy and "taking" of coho. For example, in some cases coho salmon juveniles rescued at fish screens will be at points where streams are being completely de-watered. By "rescuing" coho salmon juveniles at these locations CDFG is actually aiding and abetting the violation of F &G Code § 5937 instead of requiring flows for passage of juveniles downstream. Furthermore, juveniles are likely migrating downstream because of insufficient carrying capacity in reaches above; therefore, transporting them back upstream into cool forested tributaries may cause density related effects that result in low survival. Conversely, when juvenile coho are transported downstream they are often placed in extremely stressful mainstem Scott River conditions as described above. The supposed rescue of these juveniles and transport to non-viable reaches is a constant and unsustainable "take". The *Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program* (Kier Associates 1991) raised questions about survival of salmonids captured at fish screens. The recommendation to "Study fish rescue efforts associated with diversions and determine the survival of fish captured and transferred downstream" was never followed.

Water Trust Will Waste Money and Water Conservation Measures Under ITP Will Constitute Continuing "Take"

A major solution to flow problems offered by the Scott and Shasta ITP EIRs is establishment of a Water Trust to purchase flows for coho salmon adult and juvenile migration.

> "The establishment of local Water Trusts will allow a Program participant to voluntarily sell or lease water that will be left instream to benefit fish and wildlife

resources in accordance with guidelines prepared by the RCDs and approved by CDFG."

The lack of flow in the Scott and Shasta Rivers during summer of 2009 were considered a disconcerting portent of flows expected under the ITPs as CDFG refused to take action even when both streams were almost drying up. Low flows of 10 cfs and 7 cfs, respectively, caused acute water quality problems that persisted into September when fall Chinook salmon were entering both the Shasta (Eureka Times Standard 2009) and Scott Rivers (Hampton 2009). Thousands of fall Chinook salmon were stranded in the lower canyon because of extreme low flows in September and CDFG was very concerned about the possibility of a fish disease epidemic or fish kill as a result. This condition will not likely change under the ITPs in the Scott and Shasta rivers because water purchase targets are primarily for coho migration periods.

According to the Siskiyou Daily News (11/05/09), the Scott River Water Trust purchased 400 acre feet of water during October 2009 that they claimed allowed Chinook salmon and steelhead passage in what would otherwise be dry reaches. In fact the flow levels even with this subsidy remained below SWRCB (1980) adjudicated flow levels of 40 cfs after October 1 let alone the 200 cfs required after November 1 (Figure 11). Although flows spiked up slightly over 30 cfs in mid-October as a result of rainfall, they never reached 40 cfs even with the water the Water Trust purchases. That water was being purchased and yet the needs of fall Chinook were not being met is a major concern with this arrangement and flows were still deficient before rains in November and would likely have remained so for adult coho without the onset of winter rains.

Observations just above Shackleford Creek on November 2, 2009 (Figure 12) showed that the Scott River channel was almost so choked with vegetation that it blocked migration because of chronic low flow for months. The majority of Chinook salmon were unable to reach high quality tributaries like the South Fork and were once again stuck spawning in sub-optimal habitat (Figure 13). Previous comments have noted the very high sand levels in the lower Scott River and potential for loss of eggs due to shifting substrate during the period of incubation. It is apparent from 2009 that water purchases may not increase mainstem flows for fish passage even to the adjudicated flow level. The most dangerous precedent here, however, is that laws that maintain stream flow and that protect fish and other public trust values will no longer be enforced. Under the Water Trust scenario, when revenue to buy water for flows and fish is not available at some point in the future, then salmon and steelhead populations would be lost.

As in the previous drafts, RCDs would determine which streams are critical for coho salmon after the ITPs are signed and then determine where more water rights should be purchased. Critical coho salmon streams are already known and this is CDFG again assigning responsibilities to the RCDs that it should be taking and shrinking from its enforcement authority under CESA Fish and Game Code 5937. Summer flows in the mainstem Scott River will continue to go dry as they did in 2009 (Figure 14) and the Shasta River will continue as a stagnant pool (Figure 15) based on the assumption that coho do not use the mainstem habitats in summer (SVRCD 2005, SRCD 2005). In fact the entire Scott Valley meander zone was habitat with beaver ponds (ODFW 1995), cold water habitat fostered by

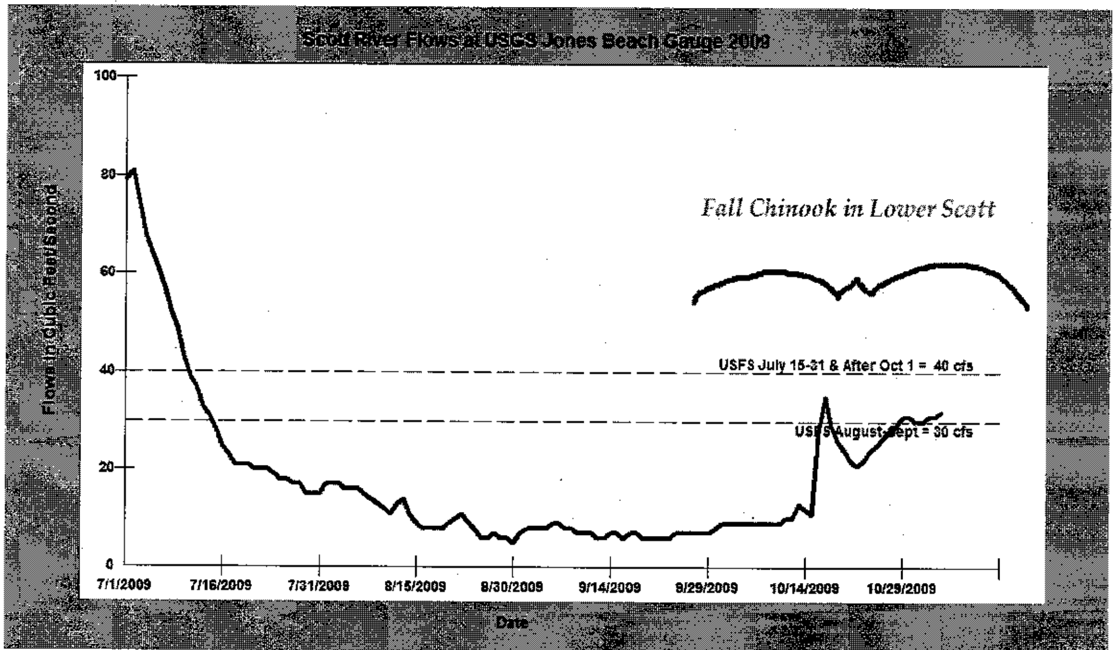

Figure 11. Average daily flow of the Scott River at Jones Beach USGS gage from July to November 2, 2009 shows that adjudicated flow levels were not being met even with Water Trust purchases.

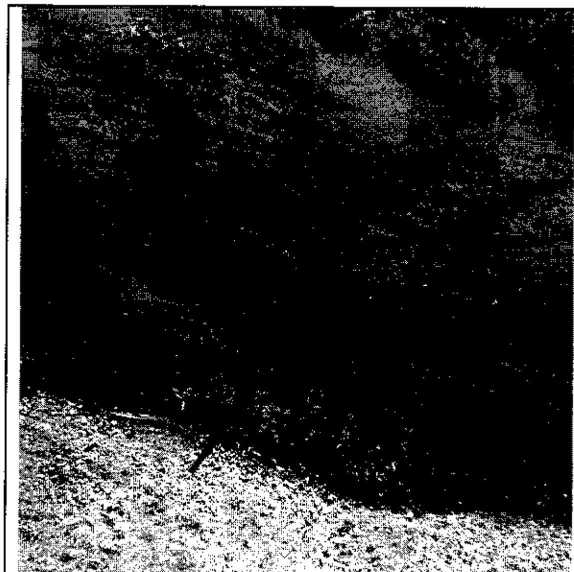

Figure 12. Red arrow highlights migrating fall Chinook salmon in Scott River just above Shackleford Creek. Note aquatic vegetation that nearly chokes channel, which is also related to prolonged low flow conditions. As a result of low flows that impede migration, few fall Chinook will reach the optimal habitat of the South Fork above agricultural impacts. Photo by Patrick Higgins. 11/2/09.

Figure 13. Scott River looking upstream off the Quartz Valley Road Bridge above Shackleford Creek shows redd location in very poor substrate (red arrow). This location will likely experience bed scour or fill with sand during subsequent high winter flows resulting in poor survival of eggs and alevin. Photo by Patrick Higgins. 11/2/09.

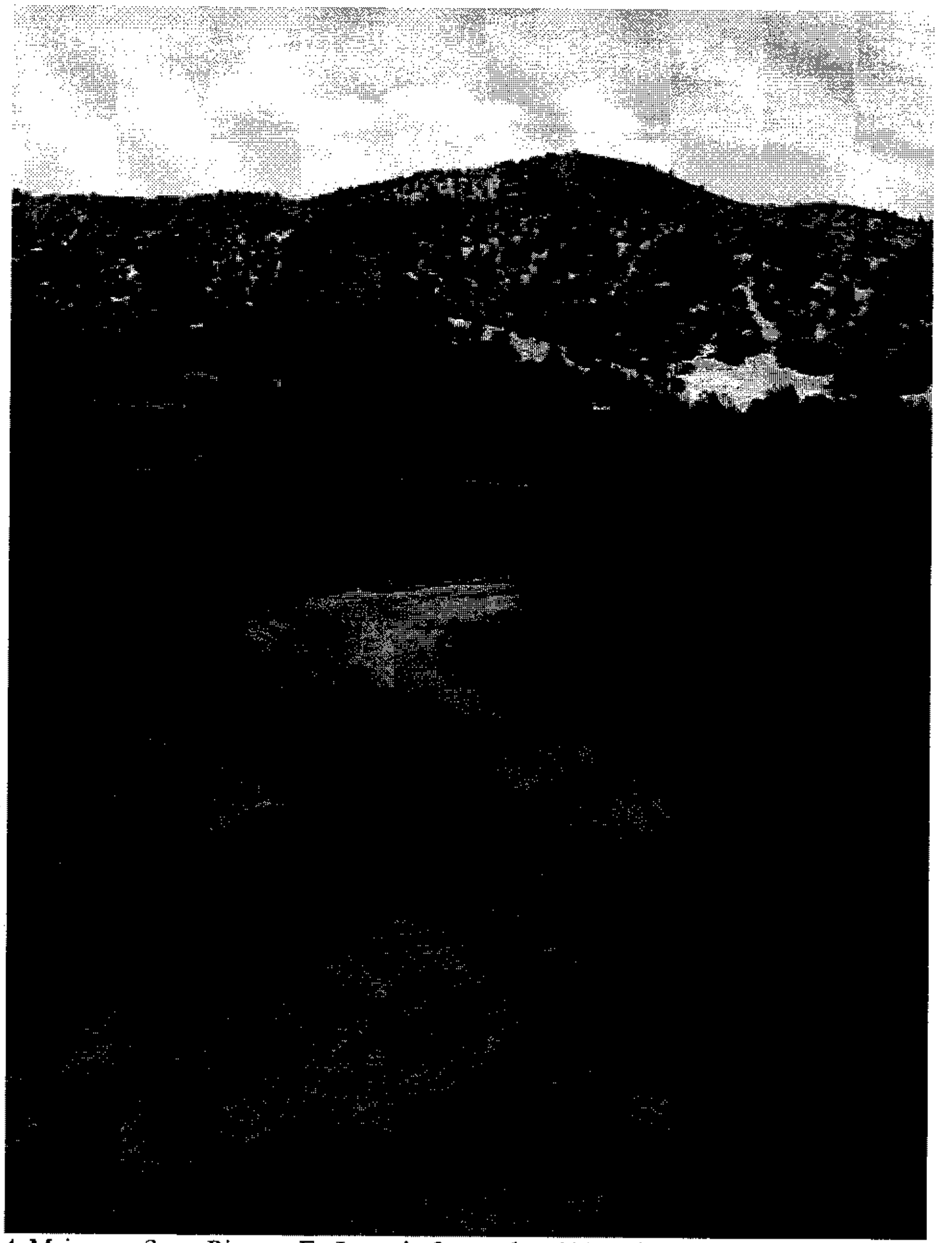

Figure 14. Mainstem Scott River at Ft. Jones in September 2009. Photo courtesy of NEC.

hyporheic connections (ODEQ 2008) and was ideal habitat for coho juveniles year-round. NAS (2004) points out that springs in the Shasta Valley made that river one of the Klamath's most productive tributaries with optimal conditions for rearing throughout the year as well.

Figure 15. Shasta River at Montague Road bridge on Aug 21, 2009. River at 16 cfs. Photo used with permission of Klamath Riverkeeper.

Shasta and Scott Flow Depletion and Cumulative Effects on Mainstem Klamath River Conditions

The flow depletion of both the Scott and Shasta Rivers results in cumulative effects on the mainstem Klamath River, but the final ITP EIRs does not make any connection between low flows in these vital arteries and mainstem ecosystem function. The unprecedented fish kill of mostly adult Chinook on the lower Klamath River in September 2002 was acknowledged in both EIRs and the cause ascribed in part to low flows (CDFG 2002, Guillen 2003a, Guillen 2003b). Most of the focus in reports is on the unprecedented 750 cfs flow from Iron Gate Dam, but both the Scott and Shasta rivers were running near all-time historic lows at the time of the fish kill as well (Figures 16 & 17). As pointed out by NAS (2004) increased flows in both the Scott and Shasta River basins would help ameliorate water temperature and other water quality problems and also assist with improvement of mainstem Klamath River conditions. The Scott and Shasta ITP EIRs do not acknowledge or address cumulative effects due to flow depletion in these tributaries and their ripple impacts on the mainstem Klamath River and coho survival there. This is yet another CEQA short-coming.

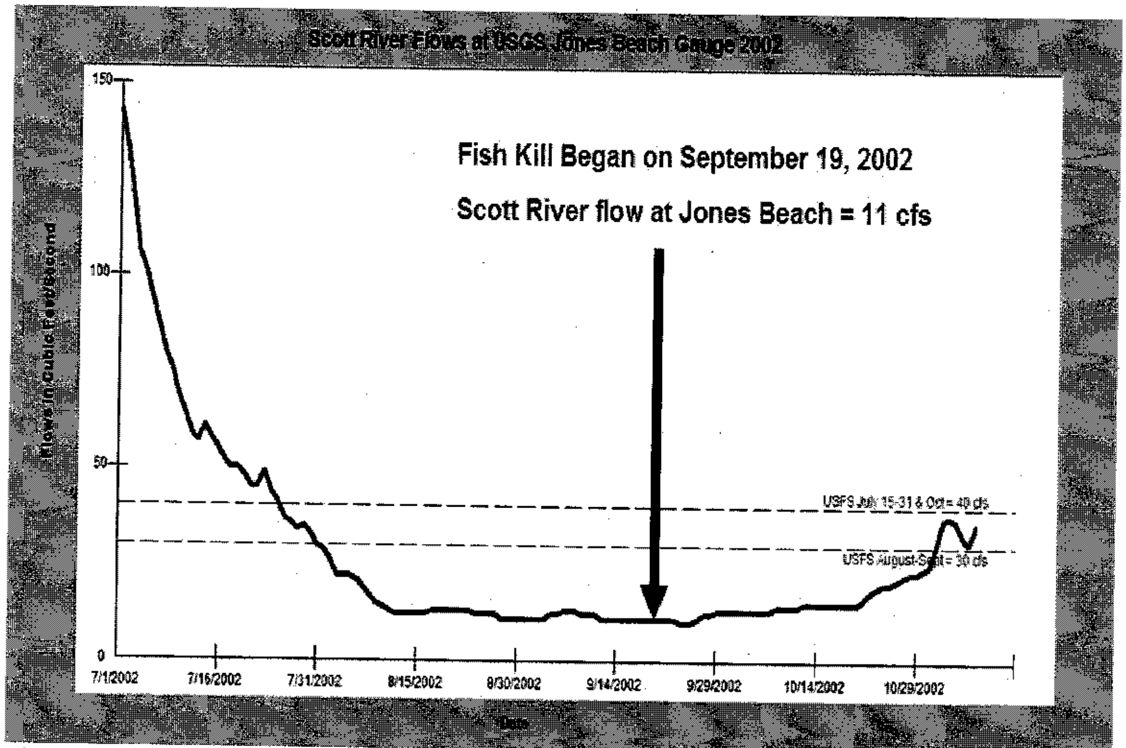

Figure 16. Average daily flow of the Scott River at Jones Beach from July 1 through November 2, 2002, which includes the period of the Lower Klamath Fish Kill (9/19-22/02). Data from USGS.

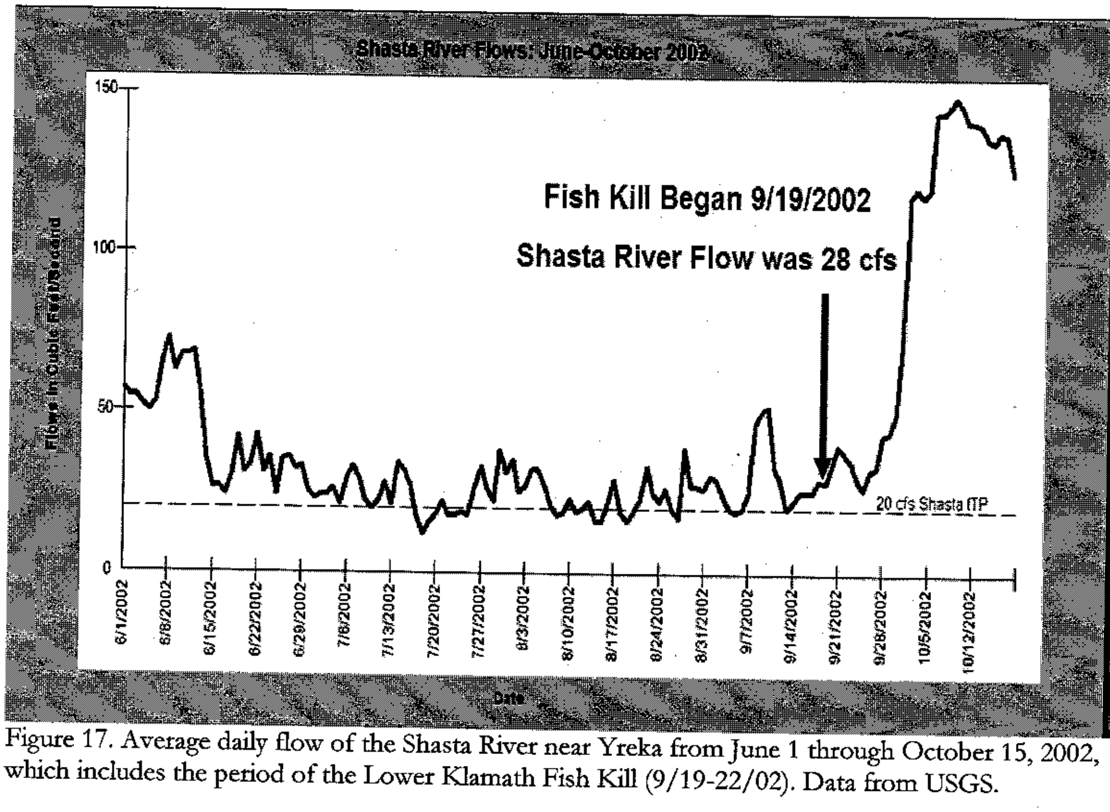

Figure 17. Average daily flow of the Shasta River near Yreka from June 1 through October 15, 2002, which includes the period of the Lower Klamath Fish Kill (9/19-22/02). Data from USGS.

Monitoring and Adaptive Management

The most significant change in sections of the Shasta and Scott ITP EIRs is that CDFG would assume all responsibility for compliance monitoring:

> "CDFG will conduct compliance monitoring of all activities it authorizes under the Programs and will review all monitoring documents and checklists prepared by the RCDs and the subpermittees. CDFG is responsible for determining whether or not the RCDs and/or sub-permittees are in compliance with the conditions of the Permit or any sub-permits."

While it is preferable that CDFG staff do compliance monitoring as opposed to RCD staff, ITP enforcement could become problematic if there is inadequate funding. Furthermore, there is still problems with the ITP EIR language with regard to information sharing by RCDs that are still performing implementation and effectiveness monitoring. Data sharing requirements are vague and analysis is left to RCD staff that are not qualified.

> "SQRCD shall summarize the results of its monitoring activities in each of its Annual Reports (described below). Analysis of the past year's monitoring activities and the monitoring data shall be provided to the Department at that time."

As pointed out in several prior work Group Shasta and Scott ITP comments, the monitoring strategy offered in the EIRs is fundamentally flawed. While the ITP invokes the *California Coho Recovery Strategy* (CDFG 2004) as a guide for monitoring efforts, the program offered falls far short of meeting criteria in that document. Key coho salmon habitat tolerances are not discussed (Kier Associates and NMFS 2008) and no basin-wide strategy to gage trends based on these criteria can be found. Monitoring will be piece meal and locations will not be strategic but rather specific to where Program restoration or mitigation projects take place.

> "Monitoring activities will be only those properties of agricultural operators who become sub-permittees or within stream reaches where activities occur and appropriate permissions have been received."

Monitoring photopoints that were publicly available on the Internet would be a great tool for insuring transparency of ITP implementation, but the Scott ITP makes them proprietary or accessible only to RCD and select CDFG staff.

> "SQRCD and Department project evaluators shall have access to photographs and project files to take with them on site visits."

Privatization of information and lack of collection of key data at strategic locations precludes scientific trend monitoring of suitability for coho salmon and the practice of adaptive management.

CONCLUSION

The historically unprecedented low flow regimes that would continue under the ITPs contribute to acute water quality problems and are far less than Pacific salmon stocks endemic to the Scott and Shasta River basins need for survival. Tribes of the Lower Klamath Basin have harmony based cultures where their people are indivisible from the environment. If the environment is treated well, then the culture of the people will thrive. The depletion of flows in the Scott and Shasta river basins is not in balance with historic range of these rivers and represents a disruptive force to the harmony of man and nature in both basins. Ecologically, the change in flow regime is far from any that Pacific salmon have experienced in the several million years of evolution in the Scott and Shasta River basins. When aquatic habitat conditions fall outside the range of historic norms, Pacific salmon cannot survive (Bradbury et al. 1995, Reeves et al. 1995). Consequently all stocks in both basins are at perilously low levels and, unless major changes are made to restore flow and water quality, coho salmon stocks and others will likely go extinct in the next period of poor ocean conditions and dry climatic cycle expected to begin sometime between 2015 and 2025 (Collison et al. 2003).

Van Kirk and Naman's (2008) finding of a rise in the elevation of snow accumulation indicates decreasing water storage. They suggest that just returning to flow levels of the recent past would suffice in helping salmon and steelhead survive:

> "Even after accounting for climatic factors, returning water use to pre-1970s patterns of withdrawal sources and quantities, conveyance mechanisms, and application methods in the Scott River watershed could benefit salmon and other aquatic biota by increasing July 1-October 22 streamflow by an average of 0.65 m3/s."

If the Shasta and Scott ITPs were approaching the flow issue from an enlightened perspective, they would be counseling maximum implementation of water conservation due to an expected diminished supply. Flow levels in the Scott and Shasta River basins have been defined previously (Taft and Shapovalov 1935, CDFG 1974), but CDFG has given up in their charge to restore them to adequate levels.

The current DEIR and proposed ITP would provide subsidies (i.e. paying for short-term water) and legal protections to farm and ranch operations in the name of protecting endangered species. Rather than enforcing existing laws and protecting public trust resources, CDFG has neglected its duties and instead proposed an ITP that would offer only marginal benefits to coho salmon while allowing larger ongoing cumulative threats (i.e. excessive water use) to continue unabated. Without addressing the factors that have driven coho salmon into jeopardy, the ITP will be ineffective and hence should not be enacted.

Neither Scott nor Shasta River coho salmon stocks can be managed at current extremely low levels because the likelihood of loss due to storms or other stochastic events is high (Rieman et al. 1993). Coho populations must be aggressively rebuilt by providing refugia (Reeves et al. 1995) in habitats that have high intrinsic potential (Williams et al. 2006). Substantial use of floodplain easements in critical response reaches on the mainstems and key tributaries of the Shasta and Scott Rivers would allow redevelopment of meander patterns and hydrologic connections, including reintroduction of beaver. Truly scientific and valid ITPs would have the RCDs and CDFG working with farmers and ranchers to reduce pesticide use and providing incentives for organic farming or practices more compatible with recovery such as the "Salmon Safe" program in Oregon (www.salmonsafe.org/farms/index.cfm).

The members of the Work Group are very disappointed in the approach taken by CDFG in Shasta and Scott ITP EIR development and the final products are not ones that uphold Indian Treaty Rights nor can they be supported by Tribes.

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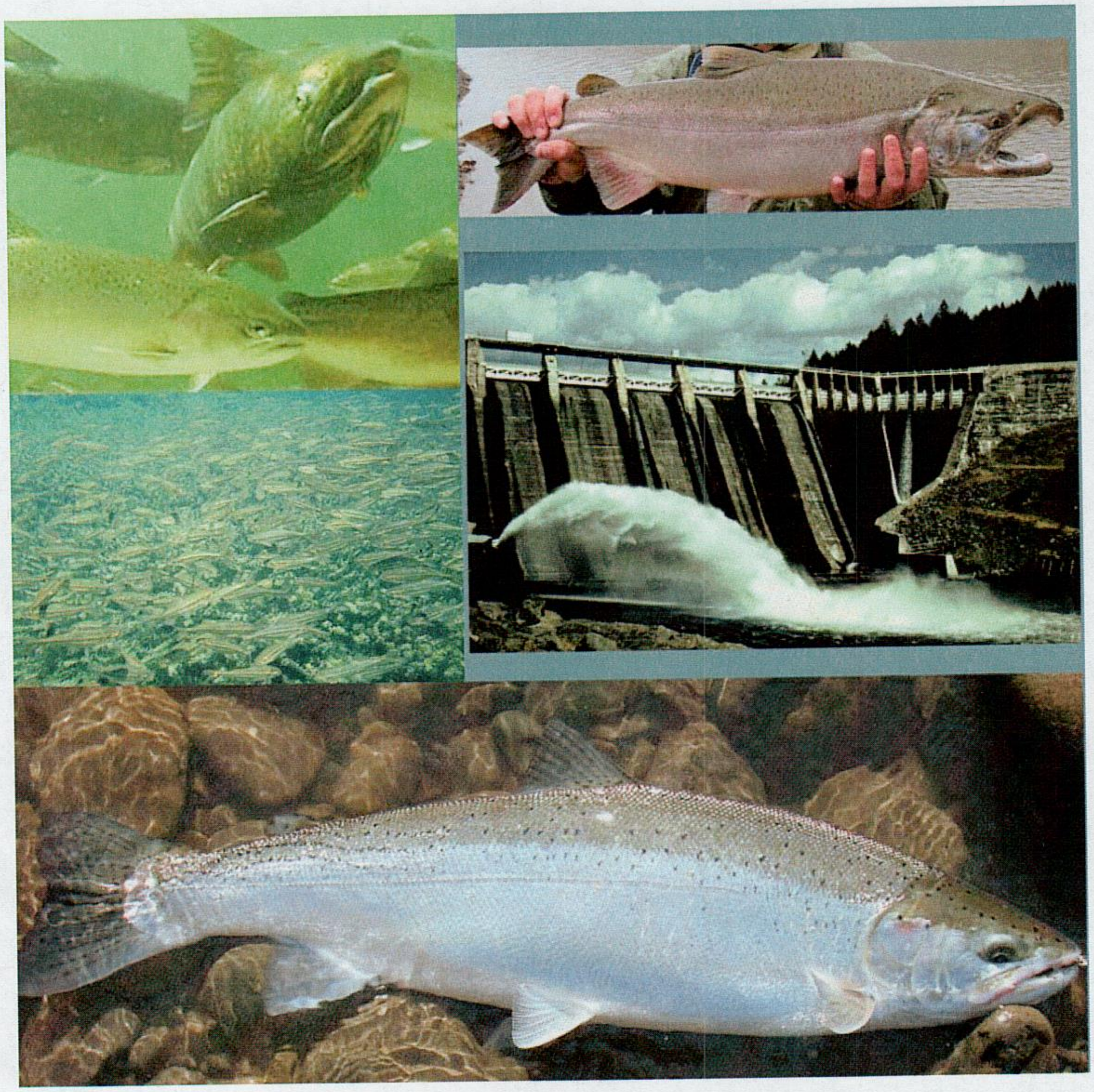
Appendix D

Evaluation of the Effectiveness of Potter Valley Project National Marine Fisheries Service Reasonable and Prudent Alternative (RPA): Implications for the Survival and Recovery of Eel River Coho Salmon, Chinook Salmon, and Steelhead Trout



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Executive Summary

The migration of salmon and steelhead to the headwaters of the mainstem Eel River has been blocked since the construction of Scott Dam and the creation of Pillsbury Reservoir in 1922. The project impounds and diverts water from the upper Eel River into the East Branch Russian River and is licensed by the Federal Energy Regulatory Commission (FERC) as the Potter Valley Project (PVP). Project components include 1) Scott Dam, 2) Lake Pillsbury, 3) Cape Horn Dam, 4) Van Arsdale Reservoir and 5) the East Fork Russian tunnel and powerhouse. The effects of the PVP are acknowledged to have significant negative impacts on the entire mainstem Eel River downstream of Cape Horn Dam and the Russian River from the East Fork downstream to the ocean and on all native Pacific salmon species. Although power production is small (9.4 megawatts), large volumes of water (averaging 160,000 acre feet per year) have been transferred from the Eel to the Russian River basin and the timing of those transfers in fall and early winter are particularly problematic.

The original license ran from 1922 to 1972, but re-licensing did not occur until 1983 after a study was conducted for Pacific Gas and Electric (PG&E), which acquired the PVP during the initial license period. A ten-year study was required by Article 39 of the FERC license to assess the need for changes of structures and operations to protect and maintain anadromous salmonids in the Eel River. Steiner Environmental Consulting (SEC 1998) collected field data and analyzed effects of PVP on salmonids, but the more significant and useful contribution is from VTN (1982), and their *Potter Valley Project (FERC No. 77) Fisheries Study Final Report, Volume 1* is sited below as authoritative on issues related to flow needs of fall Chinook salmon (Oncorhynchus tshawytscha) and summer and winter steelhead trout (Oncorhynchus mykiss) and PVP operation.

In 1998, PG&E issued its report pursuant to Article 39 and recommended a new flow release schedule, which FERC treated as a license amendment request. With the listing of southern Oregon and northwestern California (SONCC) coho salmon (Oncorhynchus kisutch) in 1996, the National Marine Fisheries Service (NMFS) began consultation with FERC regarding the license amendment to insure compliance with Section 7 of the Endangered Species Act (ESA). Chinook salmon (Central Coast) and steelhead (North and Central Coast) were subsequently listed under ESA and are also affected by the PVP. Although NMFS temporarily signed on to a flow recommendation (PG&E 1999) for project operation, they later completed a Biological Opinion (BO) (NMFS 2002) that concluded that implementation of the proposal would jeopardize ESA-listed salmonids in the Eel River.

The reasonable and prudent alternative ("RPA") issued by NMFS as part of the BO is to prevent violation of ESA. This white paper explores the question of whether actions required under the RPA are sufficient to: 1) prevent the extinction of Pacific salmon species endemic to the upper Eel River drainage and 2) foster the recovery of those species. The principal components of the NMFS RPA are 1) modification of flows to improve conditions for salmon and steelhead, 2) Pacific salmon population monitoring, 3) Sacramento pikeminnow (Ptychocheilus grandis) suppression and monitoring, and 4) study of summer water temperatures related to flows.

Although the NMFS' BO (2002) asserts that the RPA will attain salmonid conservation objectives, the evidence is to the contrary. The flows required by the RPA are supposed to mimic unimpaired flows, but comparison with the nearby un-dammed Middle Fork Eel River basin show peaks below the PVP bearing no resemblance to that of the un-dammed basin. The Tomki-Upper Eel fall Chinook salmon population is hovering near critical levels (<500 adults) and is not likely to persist over the next several decades given continuing environmental problems associated with PVP operations. The flow regimes below Van Arsdale Dam constitute an acute stress to upper Eel River salmon and steelhead populations and the intent of the RPA to improve flow for fall Chinook spawning during critical fall periods is not being met nor will it be met by RPA required flows in the future.

Coho likely once thrived in Gravelly Valley, submerged by Pillsbury Reservoir since 1922, and there is a possibility they might recur if Scott Dam was removed. Steelhead are hearty and more tolerant of warm water than coho or Chinook salmon juveniles, but they are not as well adapted to mainstem spawning as Chinook salmon (Groot and Margolis 1991) and their population trends show cause for concern as well. All three at-risk Pacific salmon species would benefit from significant flow increases as recommended below, and their extinction forestalled somewhat. Real population recovery and perpetuation of Pacific salmon endemic to the upper Eel watershed, however, requires expeditious PVP removal.

While the RPA recommended increasing minimum flow requirement for migrating adult fall Chinook after December 1 from PG&E's proposed 35 cubic feet per second (cfs) to 100 cfs in some years, VTN (1982) showed 235 cfs was required for up stream migration above Outlet Creek, substantially higher flows than required under the RPA. Since hundreds of miles of habitat are blocked, the target flows for Chinook trapped within and below the project should be at least 200 cfs from Pillsbury dam, when tributaries are at baseflow levels (VTN 1982). These flow levels have rarely been met under the NMFS RPA. Very dry year minimum flows could be reduced to 35 cfs in December under the RPA, which would have a disastrous impact on fall Chinook migration ability and spawning success. There is also a large discrepancy between PG&E reported flows in some years and those indicated by the California Data Exchange Center (see Adaptive Management).

Annual PG&E (2004-2008) reports show that the non-native Sacramento pikeminnow problem is intractable and the RPA objective of suppression or control is infeasible. Large reservoirs on river systems confer a major competitive advantage to pikeminnow (Moyle et al. 1995) and Pillsbury Reservoir is thus a major source of the problem. Therefore, removal of Pillsbury and Van Arsdale Reservoirs would be an effective measure for controlling Sacramento pikeminnow. Short of PVP removal, higher spring and early summer flows would help downstream migrating Chinook and steelhead juveniles avoid predation. Ultimately, the ecological imbalance limits viability of salmonids because of the inexhaustible supply of competitive pikeminnow from Pillsbury Reservoir and the altered Eel River conditions below the PVP that so favor them.

NMFS (2002) acknowledges that water temperatures would be more suitable for salmonids for a longer period in spring with higher flows. VTN (1982) indicated that optimal flows for juvenile steelhead rearing and optimum thermal benefits are at 68-265 cfs, but this flow level is not required by the RPA and has not been achieved. VTN (1982) also demonstrated that Chinook and steelhead downstream migration could be stimulated by fluctuating flows and temperatures of Pillsbury flow releases from April through June, but this strategy has not been employed under the RPA.

A sounder solution to thermal problems, however, is to allow passage of salmon and steelhead upstream through the removal of Scott Dam and Pillsbury Reservoir. This would allow fish to find thermal refugia (U.S. EPA 2003) that are likely scattered throughout the upper Eel River headwaters. If freshwater habitat improvement, such as removal of the PVP, is not conducted during favorable ocean and wet on-land climatic conditions, then prospects for Pacific salmon recovery will be greatly diminished (Collison et al. 2003). Given our understanding of Pacific Decadal Oscillation (PDO) cycle (Hare et al. 1999), a switch from currently favorable to less favorable ocean and climate conditions is predicted to occur somewhere from 2015 to 2025. If decommissioning is just being considered in 2022 and it takes several years to carry out, there may be few viable Chinook salmon and steelhead gene resources remaining for rebuilding.

Status of Eel River Pacific Salmon Stocks

The PVP affects coho salmon, Chinook salmon and steelhead trout, and project impacts are recognized as extending downstream to the Pacific Ocean (NMFS 2002). NMFS (2008) has recognized that excess flows in the Russian River, which are exacerbated by flows diverted from the Eel River to the Russian River, are detrimental to historical flow regimes and native Pacific salmon species there, but discussion of Russian River stocks and PVP impacts is beyond the scope of this report.

Scott Dam that forms Pillsbury Reservoir has never provided fish passage and has blocked over 100 miles of spawning and rearing habitat since 1922 (Shapovalov 1938). Adult salmon and steelhead counts are available for Cape Horn Dam as a result of FERC license requirements, and Tomki Creek Chinook salmon counts have been added under the recent license amendment implementing the RPA. Annual salmon carcass surveys have been conducted by PG&E and reports are filed as part of the Annual Data Report on Reasonable and Prudent Measures (RPM) (PG&E 2004, 2005, 2006, 2007, 2008).

NMFS (2002, Good et al. 2005) has concerns about the natural variability of flow and its effect on migration and return of salmon and steelhead to the Van Arsdale Fish Station; consequently, they do not use the data to characterize trends under the assumption that fish may be successfully spawning in lower mainstem Eel River reaches. This report interprets data conservatively under the assumption that survival of egg to smolt is very low for mainstem spawners that do not reach Van Arsdale in dry years due to potential bedload movement, thermal problems and Sacramento pikeminnow predation. In summary, the case will be made that available data indicates that the PVP is posing a high risk of extinction to coho salmon and Chinook salmon and steelhead of the upper Eel River.

Coho Salmon

NMFS (1996) listed the Southern Oregon-Northern California Coastal (SONCC) coho salmon populations as threatened under the Endangered Species Act (ESA) and more recently affirmed that level of risk (Good et al., 2005). CDFG (2002) found coho salmon in need of protection under the California ESA and they were subsequently listed as Threatened in northern California in 2004. Brown and Moyle (1991) published an historical estimate of the Eel River coho salmon as 40,000 fish, but estimated runs as of 1991 at less than 1,000 fish. Higgins (2007) chronicled the decline and disappearance of coho salmon in the Van Duzen River basin and lower Eel River due to widespread clear cut logging and road building and resulting flood damage from the January 1997 storm.

Tributaries of the Van Duzen and lower Eel River were recovering from post WW II logging and harbored coho, but changed rapidly in response to sediment yield. For example, the stream bed of Bear Creek in the lower Eel River basin was buried 8-15 feet deep (Pacific Watershed Associates 1998). Ecological impacts to macroinvertebrates and elevation of water temperatures due to stream widening is well documented (Friedrichsen et al. 1998; Higgins 2007). Adult fish counts at the Van Arsdale Fish Station and Cape Horn Dam included 47 adult coho in 1946-47, but there has been no other occurrence before or since. Williams et al. (2006) estimated that there was approximately 54 km of high intrinsic potential (IP) coho salmon habitat above the convergence of Tomki Creek on the upper mainstem Eel River. Scott Dam blocks 99% of this habitat (Figure 1).

Williams et al. (2006) analysis of habitat potential is based on gradient and valley width. Much of the area in the mainstem Eel River that would have been optimal for coho is the river reach now submerged by Pillsbury Reservoir. They estimated that an average of 39 spawning coho per kilometer likely used the habitat, which equates to a spawning population in the upper Eel River without disturbance at 2100 adults annually. Other areas of optimal IP habitat for coho are in Tomki Creek, Outlet Creek, Mill Creek (MF Eel) and the upper South Fork Eel River, including Ten Mile Creek. Historic photos of Gravelly Valley (Figure 2) show a broad meandering stream course, a channel form known to accumulate substantial quantities of large wood (Sedell et al. 1988) and multiple braided channels suitable for spawning and rearing of Pacific salmon species. Williams et al. (2006) also point out that the geology underlying Pillsbury Reservoir is alluvium that would provide excellent spawning gravel substrate in the upper Eel River watershed. Such valley segments of rivers are also known as response reaches (Montgomery and Buffington 1993), and historically these had the highest Pacific salmon species diversity and productivity (Frissell et al. 1992). Shapovalov (1938) stated that Scott Dam "has cut off some of the best spawning grounds in the entire watershed (Gravelly Valley)".

Although coho have not been seen in the vicinity of Cape Horn Dam, they are known to at least sporadically persist in Outlet Creek (CDFG 2004). There is concern otherwise that the coho population in the Eel River above the South Fork is on the verge of extinction. Coho salmon are thought extinct in the Middle Fork and North Fork Eel River (Moyle et al. 2008), and no adult coho salmon have been found in Tomki Creek in recent surveys (PG&E 2004, 2005, 2006, 2007, 2008).

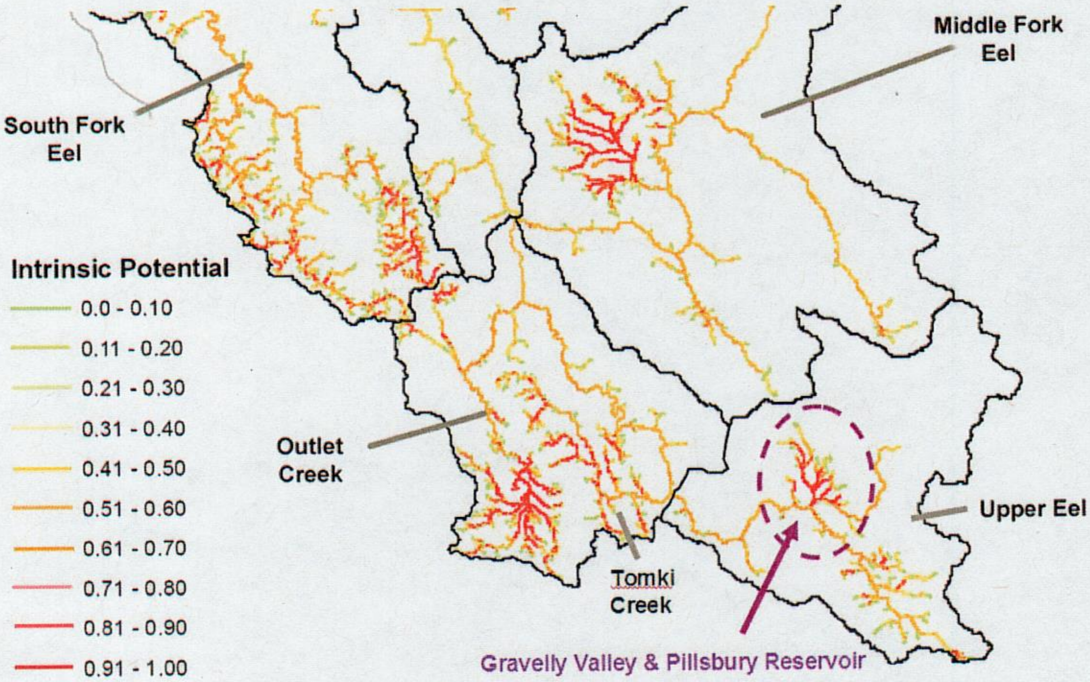


Figure 1. Williams et al. (2006) indicates highest intrinsic potential coho salmon habitat in red with a highlight on location of Gravelly Valley and Pillsbury Reservoir.

Figure 2. Historical photo of Gravelly Valley during the construction of Scott Dam. Trees from the flood plain have been logged in anticipation of reservoir filling. Photo from the Heald-Poage Museum in Ukiah, CA.

California Department of Fish and Game (CDFG 2009) adult salmon live fish and carcass counts point to a very spotty distribution of coho, and there are only a few dozen spawners in the creeks that retain them (Figure 3). Trends from surveys may not be representative of run strength in all years because of turbid conditions during surveys or high flows that make counts infeasible, but recent trends in overall returns (Figure 4) are not positive. Groot and Margolis (1991) note that most coho salmon return to spawn at three years of age, so if returns are very low in one year the pattern tends to recur 3 years later. Such a pattern of "weak year classes" is evident in the CDFG (2009) data and, because of this rigid life history, Eel River coho salmon may have trouble rebuilding weak brood years naturally, which elevates their extinction risk (Rieman et al. 1993). Coho salmon in the Eel River appear to be facing a similar challenge for survival as the Russian River population where NMFS (2008) has declared them to be in an "extinction vortex." This means that numbers are so low that finding mates is problematic and likelihood of extinction due to stochastic events is high.

Key questions for coho survival revolve around access to Outlet Creek and whether timely flows from Cape Horn Dam are sufficient to assist passage upstream for adults in fall and downstream migration of juveniles in spring. Flow levels recommended by VTN (1982) for adult Chinook salmon fall passage and improved downstream migrant survival of juvenile steelhead in spring would also assist coho salmon adults and juveniles. Removal of Scott Dam and Pillsbury Reservoir would open up historically optimal habitat, but the ability of native Eel River coho salmon to rebound and re-colonize is compromised because distribution and productivity of the population may have dropped too low (Rieman et al. 1993). If action to increase flows at crucial times below Cape Horn Dam for Chinook salmon and steelhead is delayed too long, these species may also fall below levels where recovery is possible.

Chinook Salmon

The California Coastal Chinook salmon ESU, which includes the Eel and Van Duzen River, was recognized as threatened under ESA in 1999 (NMFS, 1999) and this status was later confirmed in 2005 (Good et al. 2005). Historic basin-wide returns of Chinook salmon were estimated at 500,000 adults based on cannery pack records from the lower Eel River (Higgins 1991)(Figure 5). In fact it is likely that the Tomki Creek and upper Eel River populations form one metapopulation. The blockage of passage for spawners by man-made structures (Titus et al. 2006) or natural impediments caused by natural events like volcanic eruptions (Dale et al. 2005) can cause populations to disperse to adjacent areas with viable habitat that are still accessible. After Scott Dam was erected, Chinook salmon only had access to downstream mainstem reaches and tributaries such as Tomki Creek. Spring Chinook likely returned to the upper Eel River (Bjorkstedt et al. 2005, Spence et al. 2007) but there were insufficient deep, cold holding pools below Cape Horn Dam; as a result, spring Chinook populations were lost. The following discussion of population trends pertains only to fall Chinook.

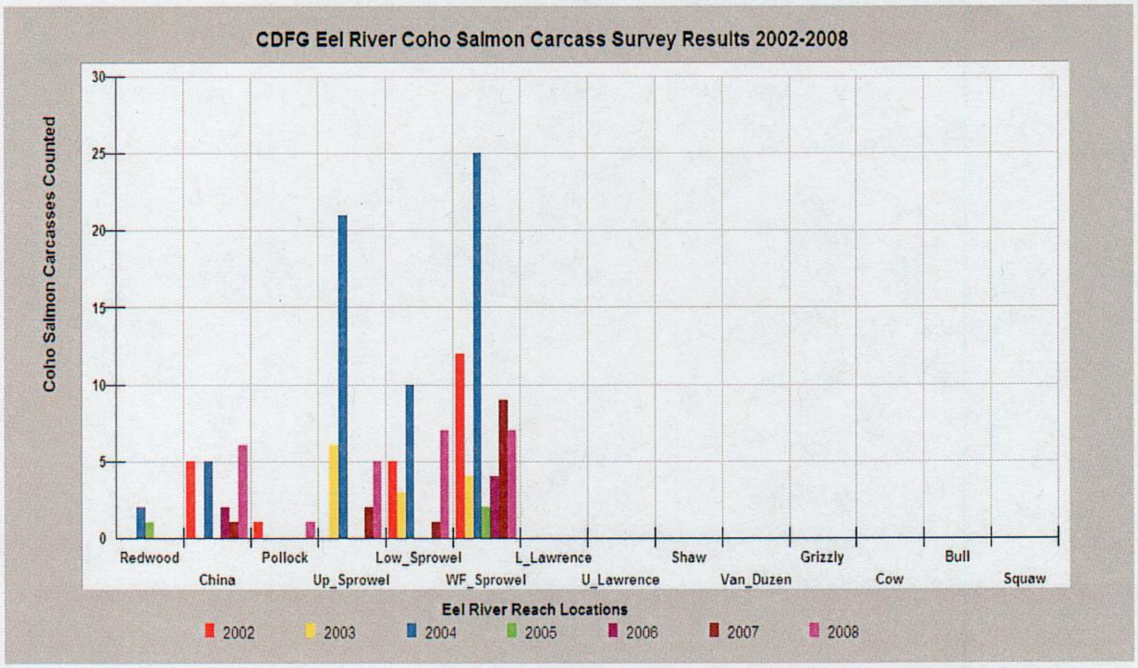


Figure 3. CDFG (2009) carcass survey results by tributary for coho salmon show them absent from more than half the 14 streams surveyed and that only a few dozen fish are counted even in high return years. Years convention reflect fall survey start but counts extend to following year (2002 = 2002-03).

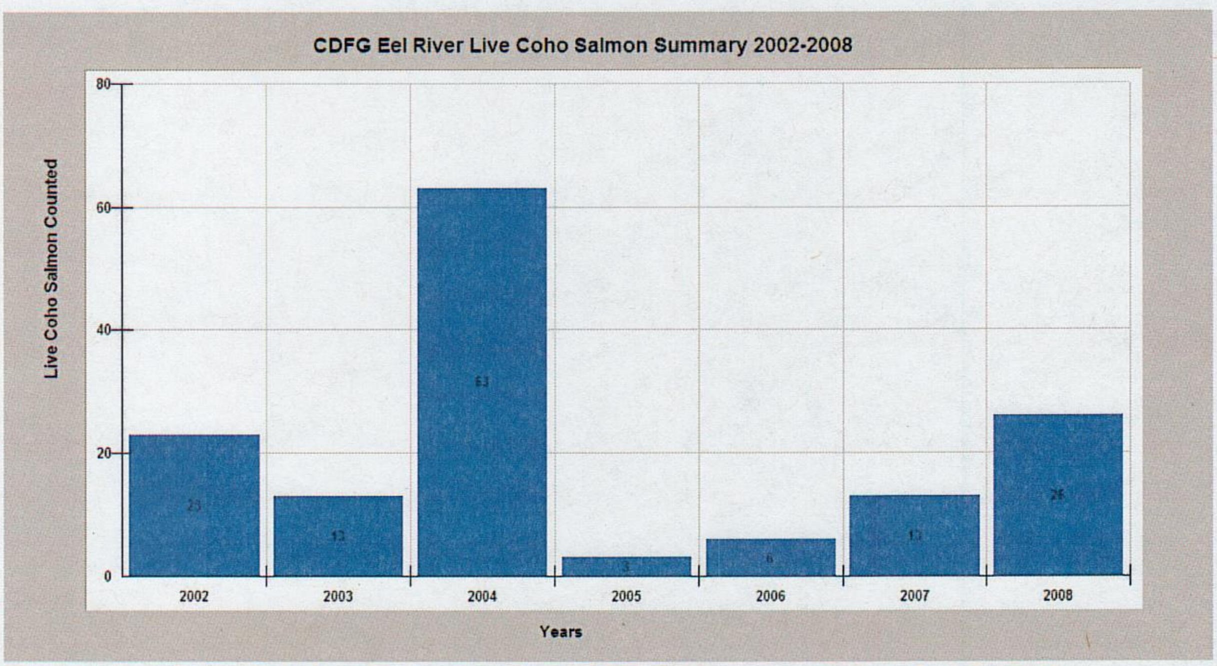


Figure 4. Cumulative live coho salmon counts from CDFG (2009) surveys of 14 creeks from 2002-2008 show very few coho salmon sited in any year. The 2001, 2004 and 2007 returns are recognized as a stronger year class for northern California coho salmon, but 2007 returns do not reflect this. However, flow conditions make survey variability high and there may be more coho in some years of high fall and winter rainfall, but turbidity or flow skews counts low.

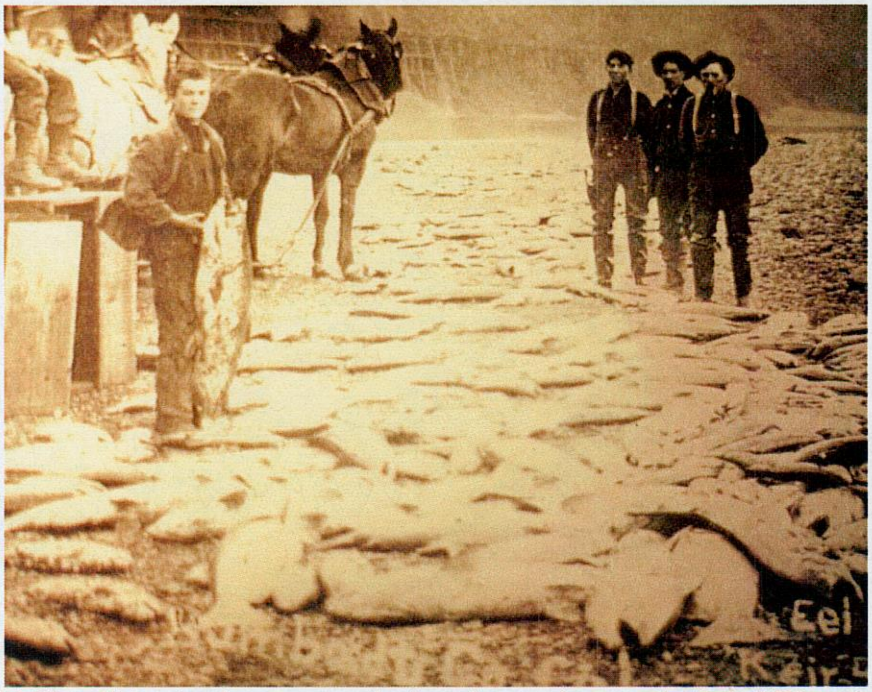


Figure 5. Eel River Chinook salmon captured using a horse seine near Scotia in 1892 are indicative of the great abundance in the watershed prior to human alteration of habitat. Photo courtesy of the Humboldt Room Collection, HSU Library.

The U.S. Fish and Wildlife Service (UFWS 1960) counted 25,000 redds in 1958 in the Eel River basin, likely indicating 50,000 to 75,000 adult fall Chinook based on two to three fish per redd. This estimate is similar to the CDFG (1965) estimate of 76,000 Eel River fall Chinook prior to the 1964 flood. USFWS (1960) surveys covered the upper Eel River and Tomki Creek (Figure 6) and they found 3,500 redds, which would indicate 7,000-10,500 spawners. More recent trends noted by Spence et al. (2007) give an indication of the precipitous drop in Eel River sub-populations, including Tomki Creek. They point out that Tomki Creek Chinook salmon returns have varied from 0 to 2,187 since the late 1970s, but the mean is only 244, and over the last 12 years the average number of spawners declined to 144. Although Sprowel Creek is one of the highest producing index streams for fall Chinook salmon in the Eel River basin (Figure 7), it has seen a similar decline to Tomki Creek. In the 4.5 miles of Sprowel Creel surveyed, spawner counts have varied from 3 to 3,666, with a mean of 741, but again the most recent 12 years averaged only 68 spawners (Spence et al. 2007). This order of magnitude drop indicates an Eel River stock collapse. Further, recent live fish and carcass surveys by the California Department of Fish and Game (2009) show very low fall Chinook totals (Figure 8).

Van Arsdale Fisheries Station (VAFS) and Tomki Creek spawner counts (PG&E 2008) are a source of concern. PG&E carcass surveys (2005, 2007, 2008) find so few fall Chinook spawning in the mainstem in the mile reach below Tomki Creek that no population estimate could be generated, indicating that most upper Eel River fall Chinook are passing VAFS and spawning in the reach above. In aggregate the VAFS-Tomki population did not exceed 500 fish (Figure 9), a recognized floor for maintaining long term genetic diversity (Gilpin and Soule 1991), from 1990 through 2000 and in 2002. The total population estimate again in

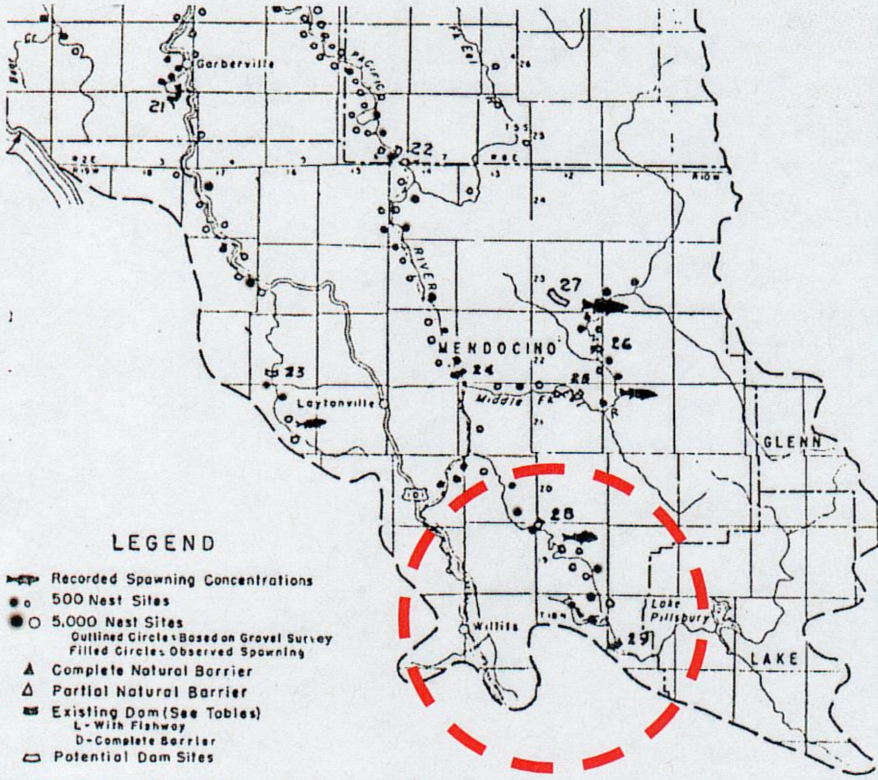


Figure 6. USFWS (1960) Chinook salmon redd map indicates 5,000 redds in the upper Eel River including Tomki and Outlet Creeks, which equates to greater than 10,000 fish in 1958.

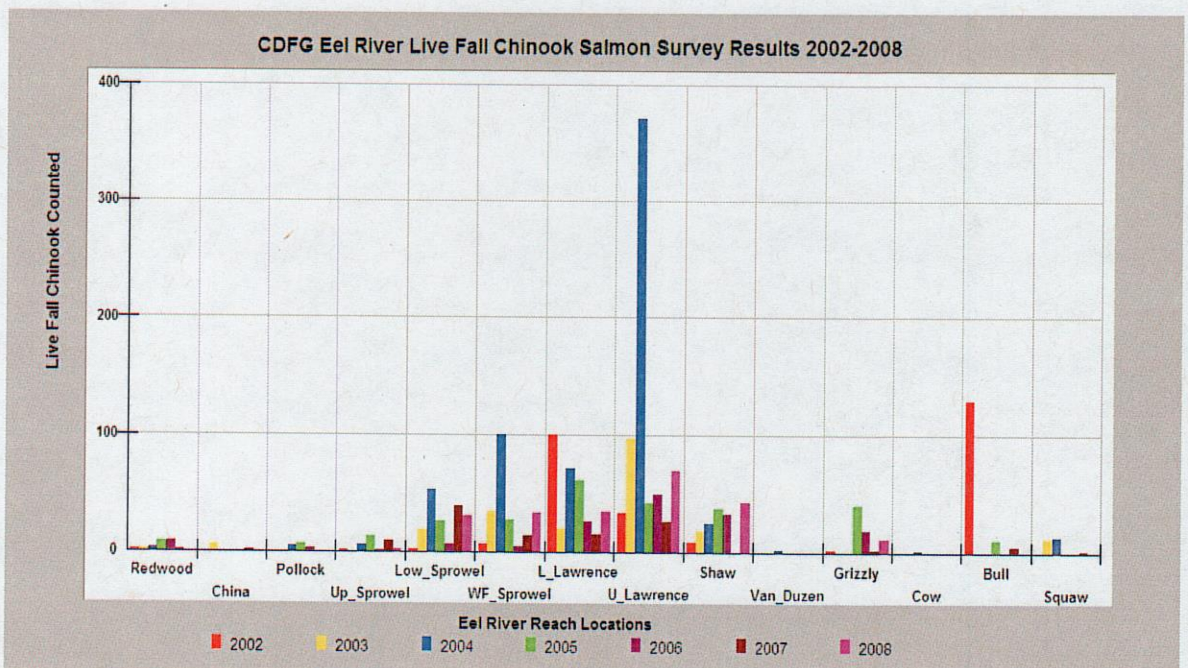


Figure 7. Eel River survey fall Chinook live fish counts by stream from 2002-2008 by CDFG (2009). Results show very low returns in most sub-basins.

2005 and 2007 hovered near this level after RPA measures had been instituted. More troubling is the almost complete failure of natural production in Tomki Creek, which is likely owing to a loss of flow further discussed below. Another concern is that Van Arsdale counts may be inflated by hatchery supplementation (PG&E 2008) that is poorly documented (see below).

> "It is clear that the majority of returns to the upper mainstem Eel River watershed since 1995/96 have been counted at Cape Horn Dam. The preference for returns to Cape Horn Dam may be partially explained by significant numbers of hatchery fish that have been released since December 1995 and have contributed to escapements in most of the following years. These fish have all been imprinted and released from Van Arsdale Fisheries Station, with the exception of limited releases in fall 1995 and fall 1996 from String Creek in the Tomki Creek drainage. However, the persistence of the trend favoring high returns to Van Arsdale in recent years when hatchery supplementation was not conducted suggests other factors may be at work. None of the 478 Chinook recorded at Van Arsdale were of hatchery origin in 2007/08" (PG&E 2008).

Hatchery fish brood handling practices may compromise the genetic integrity and fitness of wild fish (Simon et al. 1986, Simon 1988) and Upper Eel River fall Chinook may be experiencing such negative impacts.

Salmon fishing restrictions brought on by the Pacific Fisheries Management Council (PFMC) circa 1984 caused a large increase in returns to rivers of northern California from 1985-1988 (Kier Associates 1991) and this cessation of fishing is likely linked to the high number of fall Chinook salmon in Tomki Creek at that time (Figure 8). Chinook salmon returns should be showing a similar resurgence now due to complete ocean closures precipitated by the Central Valley fall Chinook stock collapse (Lindley et al. 2008), however, this rebound is not apparent in either the Tomki/Van Arsdale returns or in basin wide live fish and carcass counts by CDFG (2009). Lichatowich and McIntyre (1987) found that depressed stocks returning to poor habitat are vulnerable to accelerated extirpation in mixed stock ocean fisheries and certainly this would apply to Eel River basin fall Chinook stocks, if ocean salmon fisheries are reinitiated.

The upper Eel/Tomki Creek fall Chinook metapopulation is likely limited in its recovery potential by Sacramento pikeminnow, but declining flows and habitat trends in Tomki Creek may also be a factor (Higgins 2003)(see Cumulative Effects). Risk factors described by Rieman et al. 1993 may be impacting fall Chinook, which have not improved under the RPA and instead appear headed for extinction. This trend will likely continue unless flows are increased to levels recommended by VTN (1982) and, ultimately, fish passage upstream of Scott Dam remedied. Moyle et al. (2008) made this categorical statement regarding the upper Eel River Chinook population recovery: "Until water transfers out of the Eel River basin are reduced to provide necessary spring and fall flows for juvenile and adult Chinook, recovery of these multiple populations is unlikely."

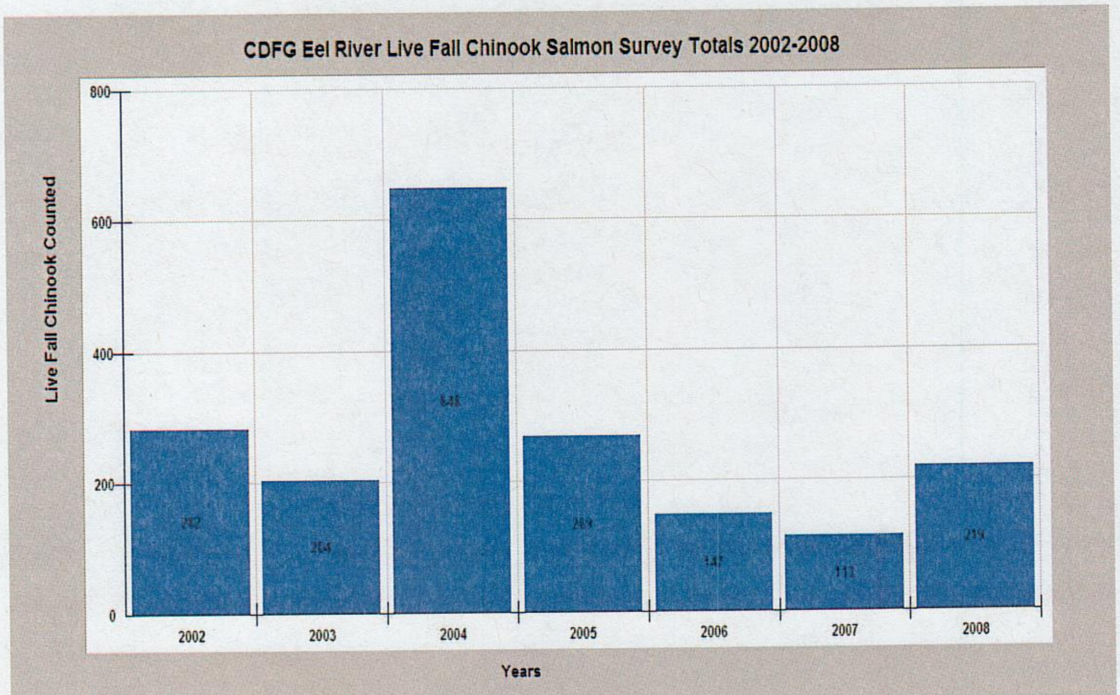


Figure 8. Basinwide index stream fall Chinook live fish count survey totals from CDFG (2009).

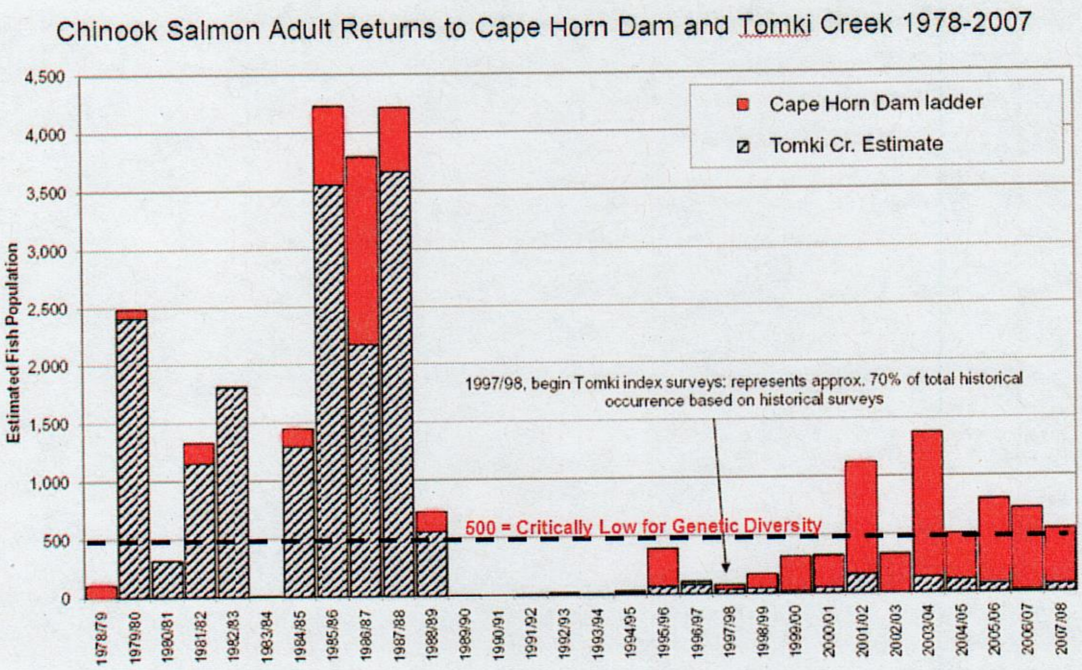


Figure 9. PG&E (2008) Tomki Creek spawner estimates and Cape Horn Dam returns indicate a substantial decline from the 1980s and an almost complete failure of Tomki Creek production.

Steelhead Trout

Steelhead were listed as Threatened in the North Coast California ESU by the National Marine Fisheries Service (2000) and listing was upheld and reconfirmed in 2006 (NMFS, 2006). Most trend data below focus on winter steelhead, but the upper Eel River watershed likely had summer steelhead (Bjorkstedt et al. 2005, VTN 1982) and so a brief discussion of that species is also warranted. Although they are not subject to discussions in the BO and RPA, the upper Eel summer steelhead population is potentially recoverable, if the PVP is decommissioned, due to likely colonization by fish from the adjacent Middle Fork Eel River.

Summer steelhead are recognized as an at-risk species state-wide (Moyle et al. 1995) with the Middle Fork Eel having one of the last three viable populations (Moyle et al. 2008). VTN (1982) reported the occurrence of summer steelhead at Van Arsdale Fisheries Station in 1982: "Three steelhead, one female and two males, arrived at Cape Horn Dam in the first three days of June in 1982. The fish were very bright and firm, indicating a short residence and migration time from the ocean to Cape Horn Dam and appeared to be summer run steelhead (Weldon Jones, CDFG, personal communication)."

Moyle et al. (2008) reported Middle Fork Eel summer steelhead (Figure 10) trends from 1966 to 2005, with overall average of 796 (Figure 11). However, if one examines the trends before and after the introduction and spread of the Sacramento pikeminnow (Brown and Moyle 1997), the average is 900 adults from 1966-1990 but only 561 after 1990 (see Pikeminnow Control). Moyle et al. (2008) noted potential significant impacts to Middle Fork Eel summer steelhead from the PVP: "Increased spring withdrawals from the Upper Eel River at Scott Dam likely reduces the time available for migrating juvenile and adult summer steelhead to move through the mainstem river."

NMFS (2002) provided average returns of winter steelhead to the VAFS by decade for the period of the 1930s to the 1980s demonstrating a substantial long-term decline (Figure 12). A more recent indication of the status of this steelhead population's can be found in the following passage from the 2005 Sacramento pikeminnow report (PG&E 2005):

> "Prior to 1986, summer rearing populations in this 12-mile section were sufficient to maintain wild adult steelhead returns in excess of 1,000 fish in many years, By the 1988/89 season (when juveniles from the 1986 brood year would begin returning as adults), wild steelhead returns to Van Arsdale Fisheries Station had dropped to 138 fish. Since that time, wild steelhead returns have ranged from 19 to 355 fish."

The Upper Eel River TMDL (U.S. EPA 2004) provided a chart of long-term annual winter steelhead population returns to the Van Arsdale Fisheries Station (Figure 13) and it is modified to show a critical minimum reference of 500 fish based on Gilpin and Soule (1991). Low flows and Sacramento pikeminnow predation are likely suppressing wild upper Eel River winter steelhead populations. As with fall Chinook returning to VAFS, it is difficult to discern hatchery effects on winter steelhead population trends because there is a significant undocumented history of supplementation. Figure 14 is taken from PG&E (2008) and indicates that a large percentage of steelhead returning to the VAFS were of hatchery origin. (See Hatchery Supplementation and Potential Genetic Effects).

Figure 10. Middle Fork Eel River summer steelhead in pool above the Eel River Guard Station in July 1988. Photo by Mike Ward.

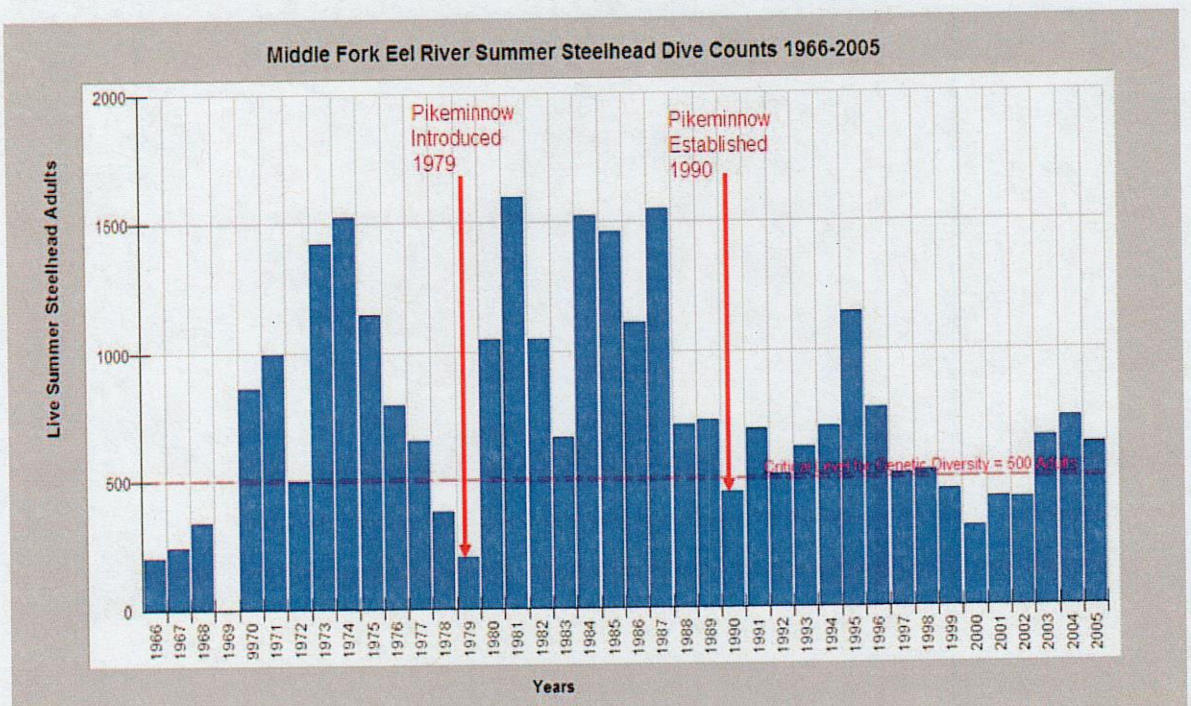


Figure 11. Middle Fork Eel River summer steelhead population from dive counts from 1966 to 2005 with critically low population level of 500 from Gilpin and Soule (1991) indicating that runs often below this critical minimum. Data from Moyle et al. (2008) and pikeminnow highlights from Brown and Moyle (1997).

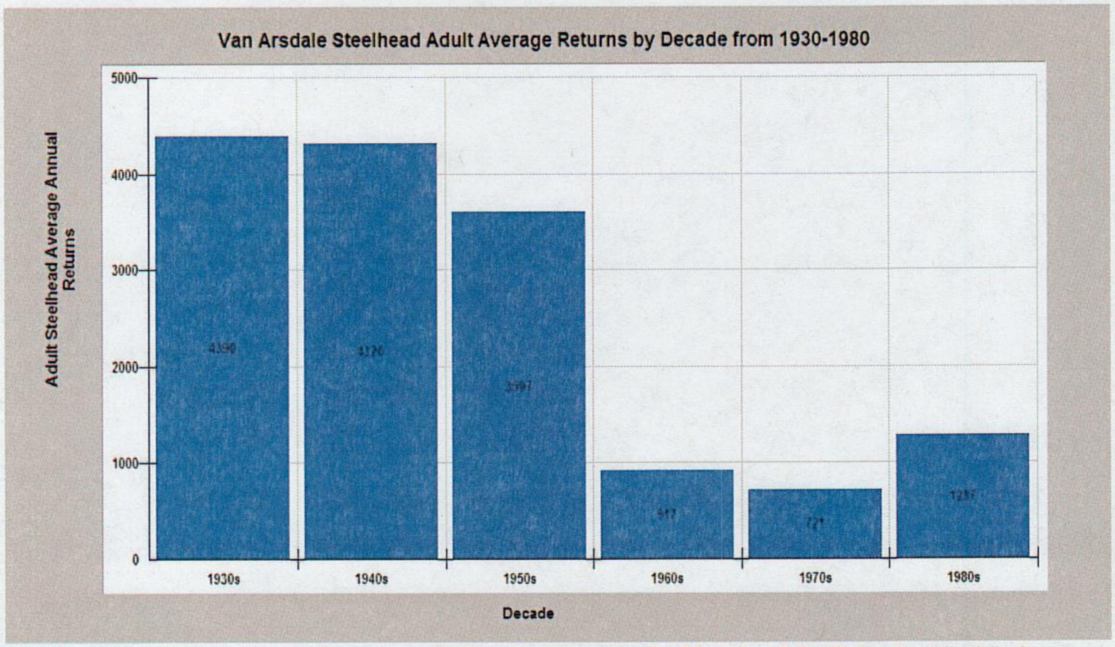


Figure 12. Decadal average of annual steelhead returns to the Van Arsdale Fisheries Station from NMFS (2002).

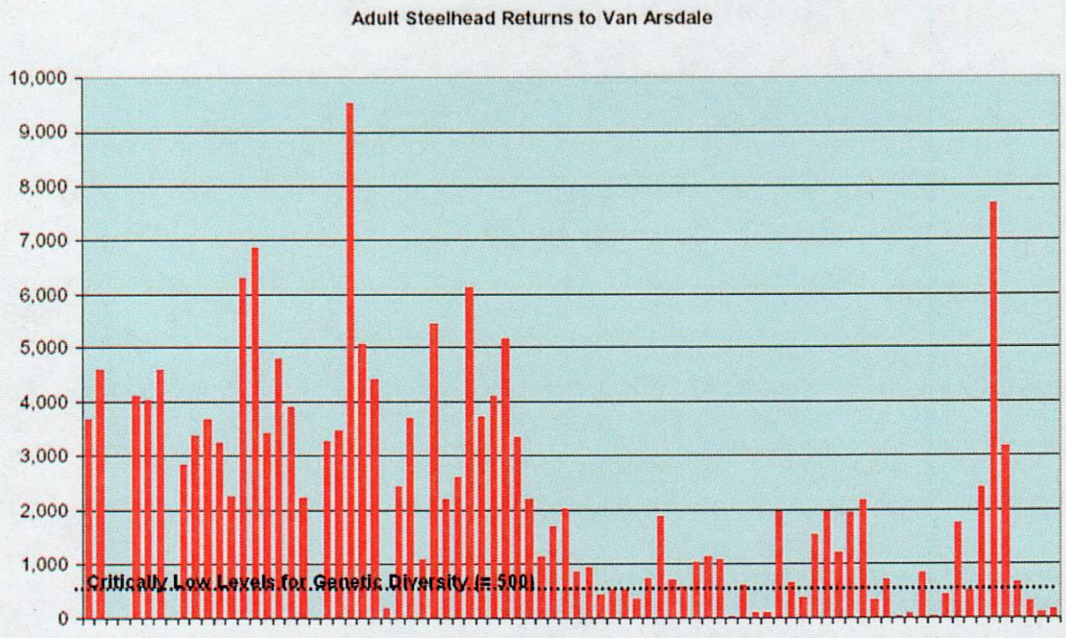


Figure 13. Annual steelhead returns to the Van Arsdale Fisheries Station from 1922 to 2004 from U.S. EPA (2004).

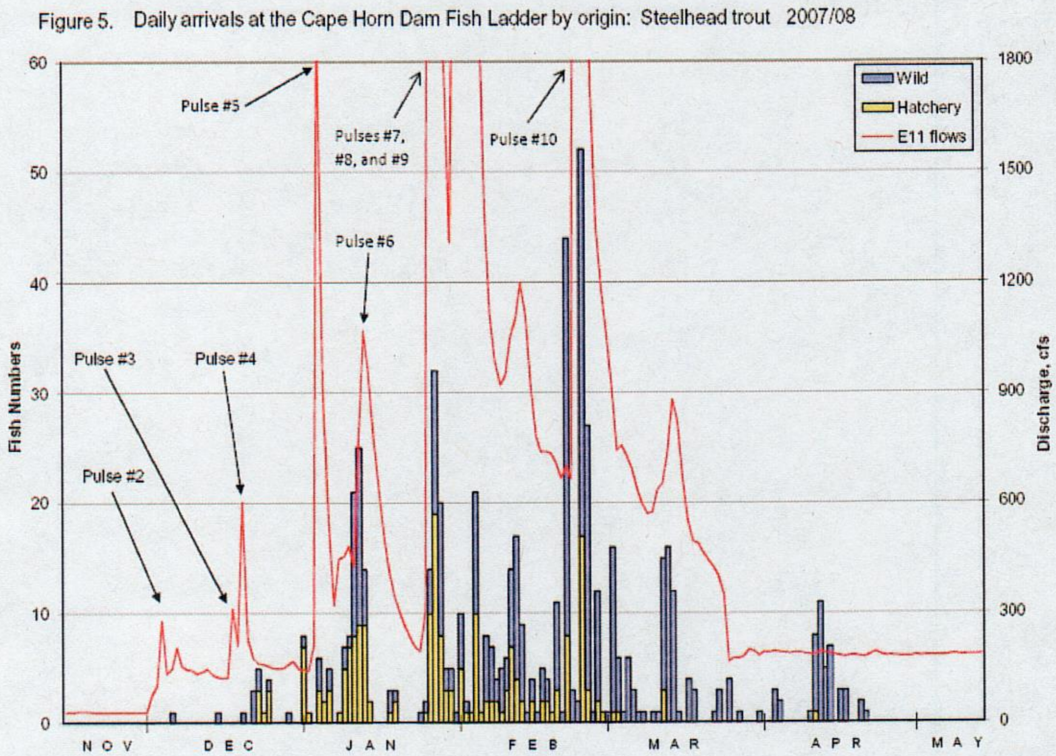


Figure 14. PG&E (2008) published this chart which is copied here to show that a significant number of hatchery fish comprised the 2007 Van Arsdale Fisheries Station adult steelhead returns.

Populations like the summer steelhead in the adjacent Middle Fork are at high risk because of their isolation (Moyle et al. 2008) and potential for stochastic events (Rieman et al. 1993). Winter steelhead returns to VAFS are mostly low and highly unstable and with approximately 500 adults or less in 17 of 30 years between 1977 and 2007, which is below critical genetic minimums (Gilpin and Soule 1991). This pattern indicates winter steelhead are also at high risk of loss (Rieman et al. 1993), even with ongoing artificial culture to maintain population levels. In addition to pikeminnow problems and flows as noted above, steelhead are not as well adapted to mainstem spawning as Chinook salmon due to substrate size (Groot and Margolis 1991) so loss of viability for Pacific salmon in Tomki Creek may have an even greater impact on steelhead locally than on Chinook salmon. Although winter steelhead might respond positively to flow levels as recommended by VTN (1982), Dam removal is what is really needed so that summer and winter steelhead could re-expand into the headwaters of the upper Eel, where excellent habitat exists today (MNF 1995). This would greatly lessen the probability of losing summer steelhead because the Upper Eel would join the Middle Fork as a population center, with less risk of loss due to stochastic events (flood or drought conditions). Rieman et al. 1993 document the dynamics effecting risk of extinction that support this hypothesis.

Analysis of PVP Flows and Pacific Salmon Recovery Prospects

VTN (1982) defined fall flow needs for fall Chinook salmon migration and spawning and also spring and early summer flows needed for successful rearing and downstream migration of salmon and steelhead juveniles. Their report is based on a combination of locally collected field data and results generated by widely accepted models. Their recommendations have the soundest scientific footing of any available regarding PVP operation and salmonids of the upper Eel River. Their findings include the following:

> "Peak flows above Outlet Creek of at least 235 cfs occurred before Chinook arrived at Cape Horn Dam with 60% arriving after peak flows of 900 cfs or more above Outlet Creek. These data suggest releases at Cape Horn Dam that result in flows of at least 235 cfs above Outlet Creek to stimulate migration. Peak releases of at least 135 cfs below Cape Horn Dam should be adequate for Chinook migration during periods of normal storm activity when tributary inflow is 100cfs or greater. In the absence of natural storm activity, artificial peak releases of 205 cfs below Cape Horn Dam would be necessary assuming tributary inflow of at least 30 cfs.
>
> The timing of peak flows also appears more critical to Chinook salmon than steelhead because of the shorter duration of Chinook runs; Chinook counts at Cape Horn Dam are smaller in years where peak flows did not occur until December.
>
> A flow release of 175 to 250 cfs is the optimum range (>90% of peak total) for Chinook salmon spawning considering total available habitat area (AHA) in the Eel River from Cape Horn to Outlet Creek. .....A flow release of 175-300 cfs is the optimum range for Reach Type I (Emandal and Big Bend sub-reaches), where the majority of AHA occurs....Considering both reaches, an optimum flow release appears to be in the range of 175 to 200 cfs.
>
> An evaluation of summer rearing habitat for steelhead trout, modified for existing temperature suitability, indicates the most important rearing area exists between Scott and Cape Horn Dams. Summer rearing habitat in this section (>80% of optimum) at flows releases from 68-265 cfs.....Releases ranging from 76 to 166 cfs would be required to achieve suitable temperature conditions between Tomki Creek and Outlet Creek.
>
> It appears that manipulation of water releases from Scott Dam can affect the timing of emigration of Chinook salmon from the Eel River above Cape Horn Dam, and is an effective tool for improving timely emigration of salmon from the study area."

VTN (1982) found flow releases below Cape Horn Dam were insufficient in the majority of years to allow Chinook salmon passage upstream and that shallow flows over the riffle just above Outlet Creek stopped migration in many years.

NMFS (2002) recognized flow releases from the PVP as still insufficient and set forward the following objectives for flow under the RPA:

> "The RPA should provide Eel River salmonids with a quasi-natural hydrograph with sufficient flows for fall and winter migrations, spring emigrations, and in some years will provide improved summer rearing habitat in the mainstem below Cape Horn Dam. Project flows under the RPA will support salmonid recovery efforts by providing improved salmonid habitat conditions that will benefit multiple salmonid life stages. All three listed salmonids would be expected to benefit from better habitat conditions, especially Chinook salmon and steelhead."

Average daily flow releases at Cape Horn Dam and Pillsbury Reservoir elevation data were obtained from the California Data Exchange Center and are used to assess whether flows meet the foregoing criteria. Only 2007-2009 data were available for download; consequently, those years are the subject of discussion. Fall flows have been far below those needed for upstream passage of Chinook and to maintain coverage of redds (VTN 1982) and spring hydrographs remain non-normative and, therefore, not conducive to increasing steelhead populations. Major discrepancies between Cape Horn Flow data and pulse peak flows and durations reported by PG&E (2008) are discussed later in this white paper.

NMFS RPA Flow Criteria is Flawed

NMFS (2002) B.O. criteria for flow are in conflict with the VTN (1982) study values that were based on field measurements and well reasoned science. For example:

> "The RPA introduces a fixed minimum flow floor which is generally equal to 100 cfs from December 1 through May 15, with some exceptions. The 100 cfs floor corresponds to ensuring availability of about 80% of the maximum potential physical habitat conditions for spawning and incubation of steelhead and Chinook salmon."
>
> "Increasing the floor from 35 cfs to 100 cfs in December through May 15 will increase flows for Chinook salmon and steelhead migration in all but critically dry years and will provide out-migrating salmonids additional flow to migrate farther downstream in spring."

These recommended flow values are far below those cited from VTN (1982). VTN (1982) noted that Chinook salmon and steelhead trout arrived at Cape Horn Dam "from mid-November to early December, after one or two peak flows have occurred. It appears that peak flows are a necessary trigger to stimulate upstream movement." It is well established that Eel River fall Chinook historically entered the lower river beginning in August (Higgins 2007), but even today heavy runs can begin in October. Therefore, minimum flows requirements are needed starting at least on November 1. Waiting for December 1 to increase flows, therefore, leaves fall Chinook salmon stranded downstream in many years, lessening their survival and opportunities for successful reproduction. The 100 cfs flow is also inconsistent with BO (NMFS 2002) emphasis on the need to assist upper Eel River fall Chinook that have early run timing:

> "Early access to spawning areas is important to Chinook salmon productivity. Broods from fish that spawn earlier are more likely to hatch and emigrate before the onset of thermally adverse conditions."

VTN (1982) also estimated that optimal mainstem Eel River spawning for Chinook salmon was at flows from 175 to 200 cfs, but maximizing spawning in the most productive reaches (Type I) would require flows as high as 300 cfs. The NMFS (2002) BO notes that maintaining flows after redds are established is important to prevent desiccation of eggs. If maintaining and rebuilding Chinook populations within and below PVP were the main goal, minimum flows of 200 cfs after November 15 would be required, with a ramp up beginning by November 1. The 200 cfs flow for passage would then be maintained to February 15 in order to accommodate maximum spawning success and egg incubation. A major problem with defining flow release requirements for the PVP is the lack of gauges for inflow into Pillsbury Reservoir. Instead of requiring such gauges as a term of the RPA, NMFS (2002) put their request in voluntary "Conservation Recommendations":

> "DOI and NMFS have concluded that additional gages above Lake Pillsbury would be beneficial in developing an indexing equation for unimpaired flow calculation. This may be especially important for implementation of more natural pulse flows as part of the flow schedule."

It is the lack of this flow gauge data that necessitates the comparison of the upper Eel to the nearby Middle Fork to answer the question of whether flows are simulating natural ones that foster salmon and steelhead conservation and recovery.

Cape Horn Dam 2007-2009 Fall Releases, Reservoir Storage and Chinook Salmon Migration and Spawning

Flow releases at Cape Horn Dam show a pattern of neither meeting objectives for improved Chinook salmon passage nor for optimal spawning. Although flows may be meeting the letter of the RPA requirements, they clearly do not meet the intent of simulating natural flows with which upper Eel River fall Chinook salmon co-evolved. Furthermore, PVP flow patterns impede migration, increase adult stress, decrease fecundity and cause conditions that reduce egg and larvae (alevin) survival. U.S. Geologic Survey (USGS) Middle Fork Eel River flow records are used to represent a natural un-dammed hydrograph as opposed to the regulated flow below the PVP. When the mainstem Cape Horn Dam flows are compared to the Middle Fork Eel River hydrograph for the fall periods of recent years, the peaks evident in the Middle Fork are wholly lacking in the upper mainstem Eel below the PVP.

The upper Eel River watershed above Scott Dam is 288 square miles which equates to about 38% of the area of the Middle Fork Eel River (753 sq. mi.). Although flows in the upper Eel may not be linearly related to the Middle Fork basin because of differences in area at higher elevations, a comparison on an area basin is useful (Table 1). For example in the fall and early winter of 2007-2008 base flows were below the PVP were at or around 35 cfs (Figure 15), which is well below passable for Chinook salmon (VTN 1982) throughout October and November with only a two day fluctuation around the seasons first rain on October 19. The October 20 flow of 1600 cfs on the Middle Fork (Figure 16) indicates that substantially greater releases were warranted below and within the PVP.

Table 1. Flow comparison between Cape Horn Dam Eel River gauge below PVP in fall 2007 and 2008 and Middle Fork Eel River gauge for same dates plus a column showing 38% of MF flows as a rough approximation of natural flow scaled by area.

Date	Middle Fork Flow	Cape Horn Flow	Scaled Flow Estimate (38%)
10/20/07	1300 cfs	75 cfs	494 cfs
12/4/07	2950 cfs	324 cfs	1121 cfs
12/14/07	3070 cfs	614 cfs	1166 cfs
01/02/08	1090 cfs	143 cfs	414 cfs
11/04/08	1220 cfs	161 cfs	463 cfs

The subsequent peak on November 28 of 104 cfs shows no corollary peak on the Middle Fork hydrograph and may have been a pulse flow, but it is still less than half of the VTN (1982) recognized 235 cfs needed for Chinook salmon distribution. Flows on December 4, 2007 of 324 cfs below Cape Horn represented only 11% of the Middle Fork peak of 2950 cfs, and December 14: were 614 cfs vs. 3070. The flow in the first few days of December were ramped down to approximately 50 cfs, which failed to meet the NMFS (2002) RPA flow level of 100 cfs, in prime Chinook salmon emigration and spawning time. Fall Chinook salmon returns to the Van Arsdale Fisheries Station (PG&E 2008) on November 16 despite baseflows of 35 cfs.

The small fluctuation in flow (104 cfs) on November 28 brought up four adults, but the bulk of the run came with the storm peaks of early December, when flows exceeded the VTN (1982) recommended passage levels of 235 cfs twice.

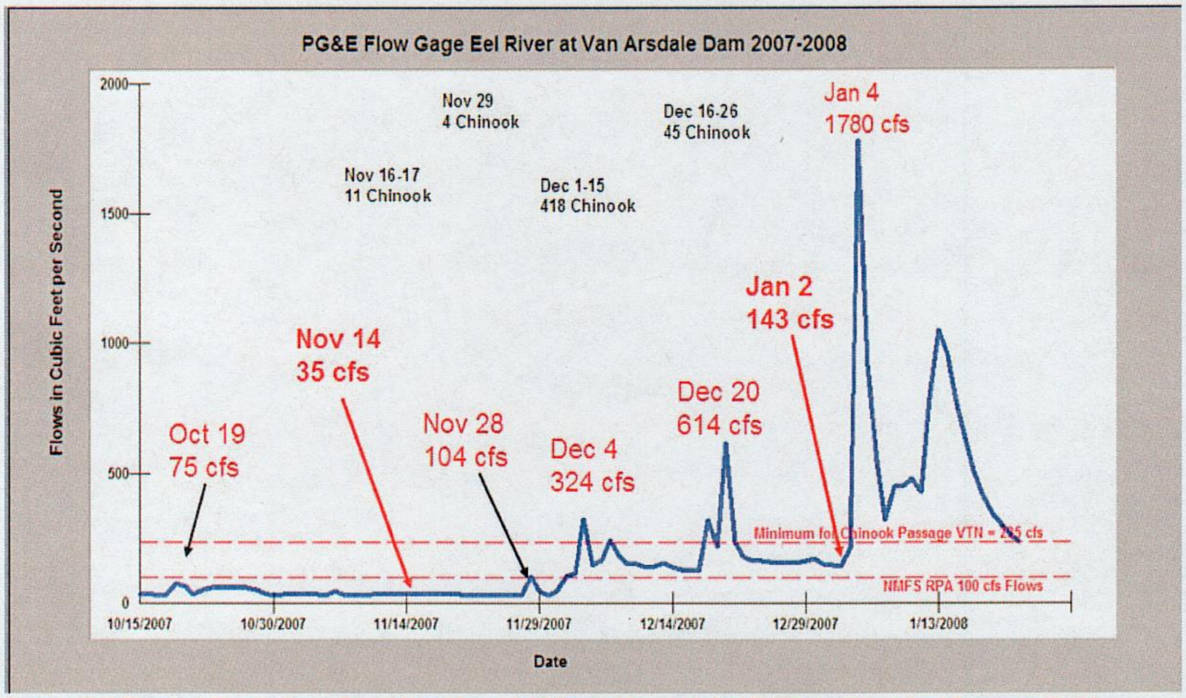


Figure 15. Flow at Cape Horn Dam for the period from October 15, 2007 to the end of January 2008 with flow peaks and levels labeled with bold indicating particularly damaging to fall Chinook migration and spawning. Data from CDEC and PG&E via the Internet.

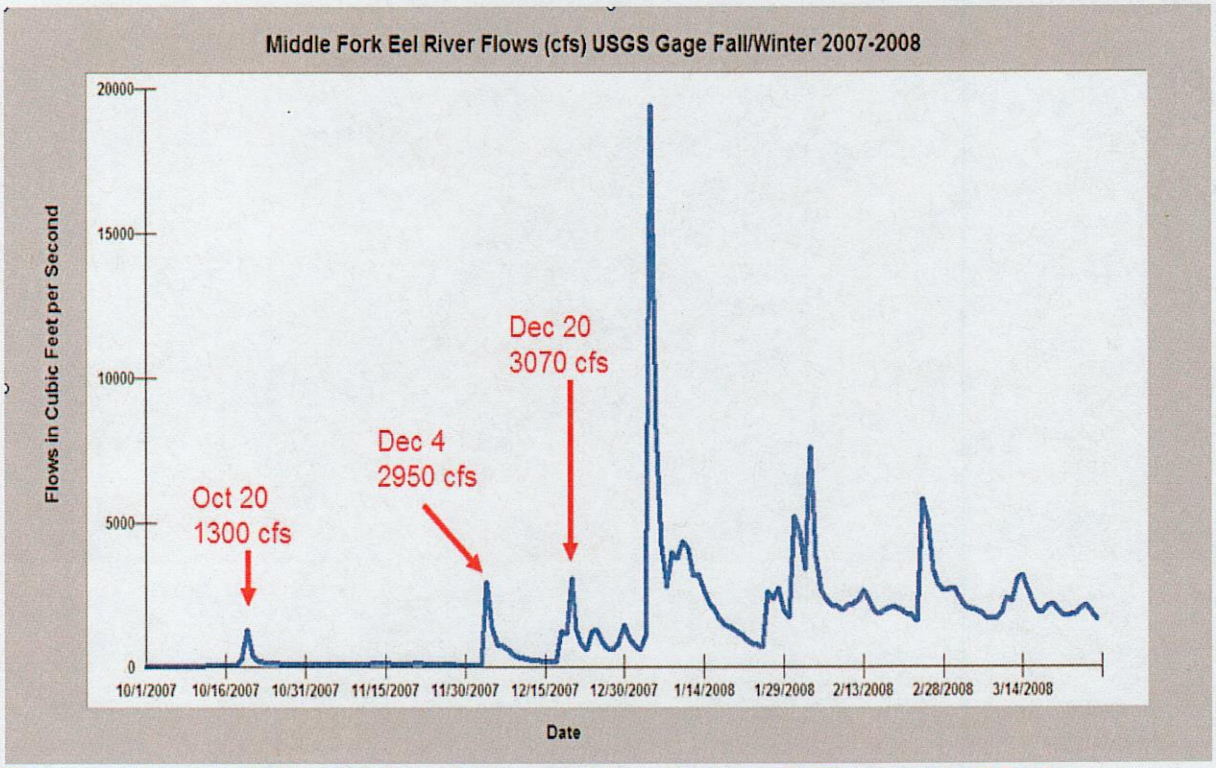


Figure 16. of the Middle Fork Eel River for the period from October 1, 2007 to the end of March 2008 with flow peaks labeled. Data from U.S. Geologic Survey via the Internet.

Unfortunately, flows after the peak spawning in late December and early January were reduced to 150 cfs or less after the flows had been up high enough for Chinook salmon to spawn in stream margins. If the PVP were being operated for maximizing Chinook salmon survival, flow reduction would not have dropped below the recommended optimum spawning flow level recognized by VTN (1982) of 175 to 200 cfs. This drop in flow may have dewatered redds. Reservoir levels of Pillsbury Lake during fall and winter of 2007-2008 shows that filling was occurring during critical times for Chinook salmon spawning when flow releases were needed for the fish (Figure 17).

Fall Chinook tuned to early spawning, which NMFS (2002) recognizes as in need of protection, are forced to spawn in the deepest part of the river channel or thalweg, as opposed to edges when flows of less than 100 cfs are released in November and early December. This makes the nest or redd more vulnerable to scour on subsequent high flows that often occur before the gestation period for eggs and larvae is complete and fry have emerged. Incubation in the upper mainstem Eel River below Scott and Cape Horn Dams would likely require 90 to 120 days before hatching, alevin gestation and emergence of fry, due to low water temperatures water temperatures (6-8°C) (PG&E 2009). Therefore, the 200 cfs for optimum spawning habitat should be maintained through at least the end of February. Also, salmon spawning areas would be very limited at flows such as the 35 cfs of experienced in November and December 2007 and super-imposition of redds may occur. This is where eggs laid prior are scoured from the gravel when later waves of fish spawn in the same area.

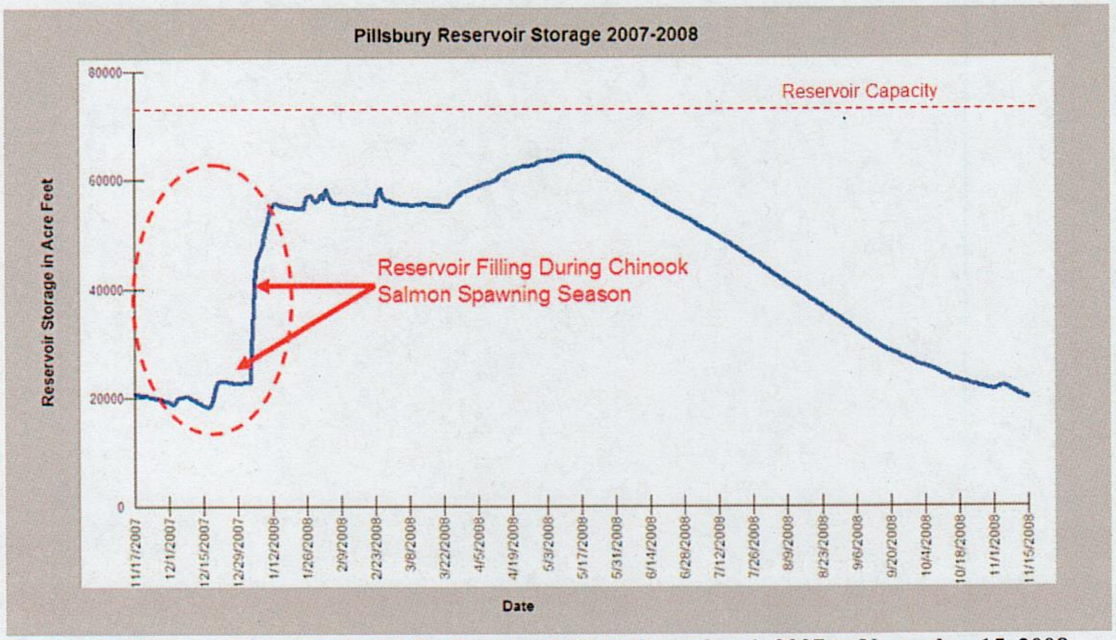


Figure 17. Pillsbury Reservoir levels for the period from November 1, 2007 to November 15, 2008. The level increased during the time of migration and spawning of fall Chinook salmon indicating that peak flows in tributaries went into storage. Data from CDEC and PG&E via the Internet.

Optimal passage and spawning flow for Chinook salmon of 175 or 200 cfs are more in the range of norm that should be released based on Middle Fork flow scaling and would allow Chinook to select habitats more in the margin of the stream and reduce risk of scour and likelihood of redd super imposition.

PG&E (2008) provided a chart of pulse flows at Cape Horn Dam with Chinook salmon returns (Figure 18) and it shows that attracting flows of 200 cfs caused a major migration upstream to Cape Horn Dam. Lower and upper optimal Chinook salmon spawning flows determined by VTN (1982) are overlaid on the chart and show that 175 cfs was only reached a few times until Pillsbury Reservoir was filled. Analysis of the 2008-2009 fall and early winter period shows even less favorable conditions for fall Chinook salmon as a result of non-normative flow releases at Cape Horn Dam (Figure 19). Flows in the Middle Fork Eel River (Figure 20) provide a comparison to a natural hydrograph from similar watershed and the difference with below PVP is clear. The slight increase in flow on October 16 to 48 cfs was not significant in terms of its ability to stimulate salmon migration, but the storm of November 4 had the potential to do so. Instead the flow from upper tributaries was captured in Pillsbury Reservoir (Figure 21).

PG&E (2008) published a chart of the rate of Pillsbury Reservoir filling contrasted to the NMFS (2002) BO model curve and there is a distinct departure from the curve at a time critical to Chinook salmon spawning and egg and alevin development (Figure 22). This difference is highlighted in orange and shows non-compliance with the intent of the RPA. If PG&E had opted to defer storage as suggested by language of the RPA, optimal flows for all reaches could have been attained, greatly increasing Chinook salmon production. Earlier flow releases would provide additional storage space in Pillsbury Reservoir possibly allowing diminished later peaks that otherwise cause red scour.

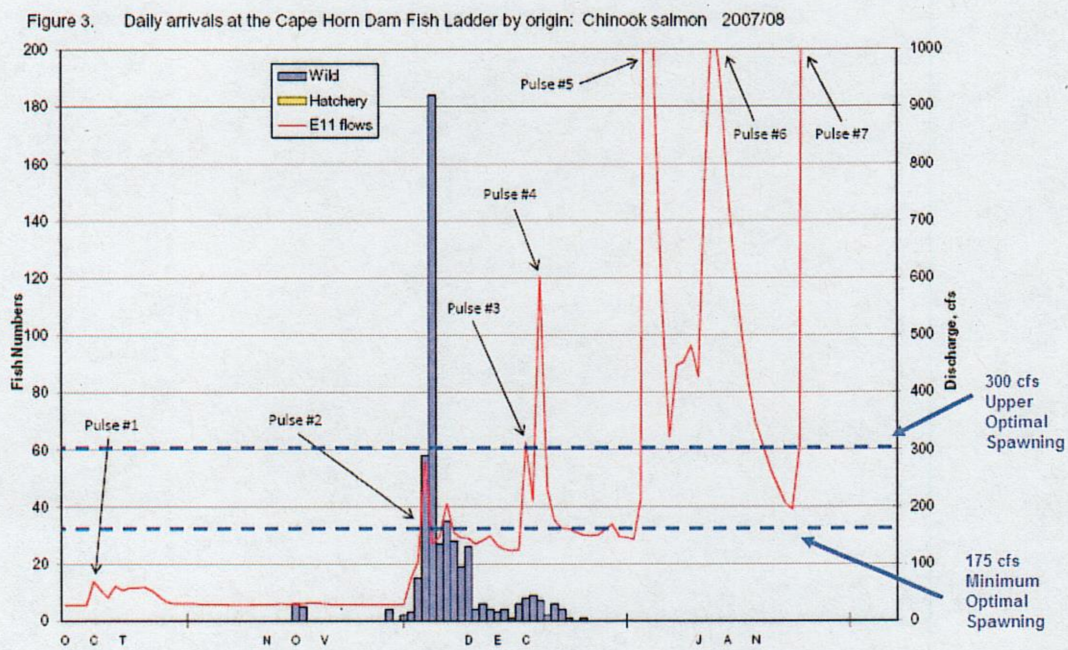


Figure 18. Flows at Cape Horn Dam with fall Chinook salmon returns to the Van Arsdale Fisheries Station from PG&E (2008). Note that VTN (1982) lower optimal (175 cfs) and upper optimal (300 cfs) are infrequently attained during peak migration and spawning season.

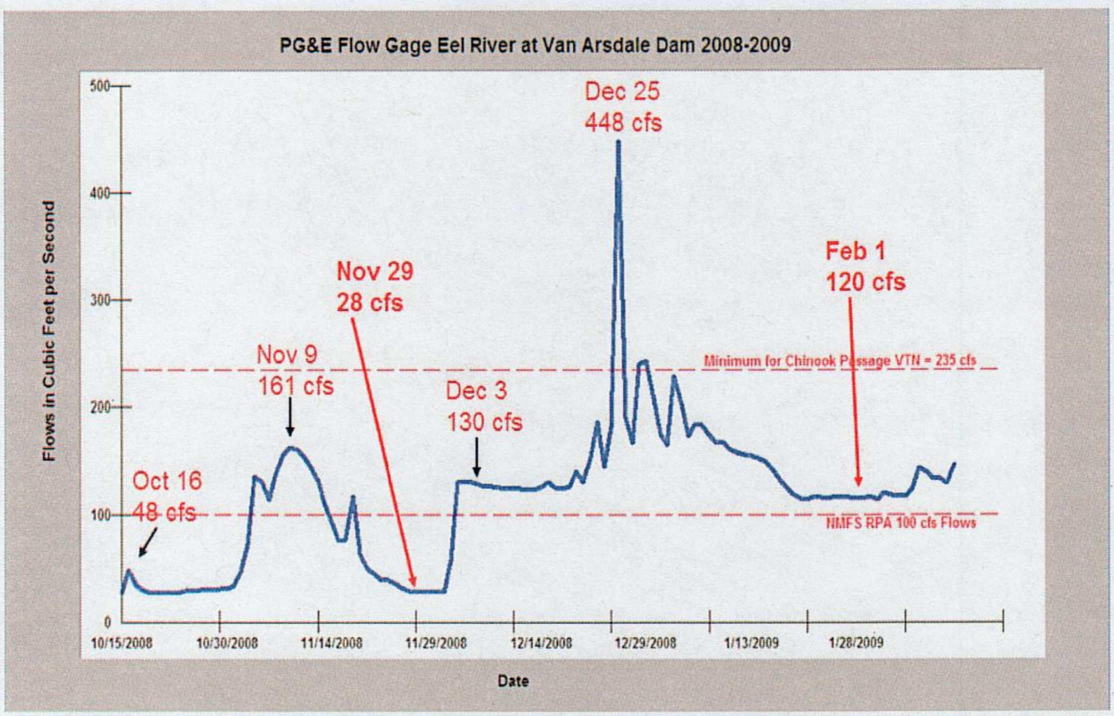


Figure 19. Flow at Cape Horn Dam for the period from October 15, 2008 to the end of January 2009 with flow peaks and levels labeled with bold indicating particularly damaging to fall Chinook migration and spawning. Data from CDEC and PG&E via the Internet.

The same problems with releases were manifest in fall and early winter 2008. Flows were ramped down to 28 cfs prior to being raised to 130 cfs on December 2, 2008. The pulse flow of early November would have triggered upstream movement of Chinook salmon and spawning in the several days of increased flow during that period. The subsequent decrease to 28 cfs would decrease the wetted width and very adversely affect any existing redds in stream margins. This action of de-watering a section of the streambed critical for salmon spawning success might also result in stranding of adult Chinook salmon that would be trying to spawn. Similarly, the drop in flow in February 2009 to 120 cfs had a potential to de-water redds. All flow peaks once again show major reductions in mainstem Eel River flows and differences in the shape of the hydrograph when compared with Middle Fork Eel River (Figure 20). The increases Pillsbury Reservoir levels (Figure 21) show how much water is stored during peak runoff times that is not being released for salmon.

The flow releases in 2009 at Cape Horn Dam are provisional data, but results with peak and baseflow levels labeled (Figure 22) show meager releases. Releases at Cape Horn Dam are less than 10 cfs for many days, which causes major thermal problems downstream. Once again flows during Chinook salmon migration and spawning periods were run well below VTN (1982) guidelines recognized as necessary for passage and spawning. However, this does not violate NMFS (2002) RPA flows because they don't apply until December 1. No data for reservoir inflow or Middle Fork Eel were available for the Chinook salmon run timing in fall 2009, but there was a large run in the lower Eel River as a result of ocean closures and the lack of flows did not help maximize survival and spawning success. All three years examined show that flows under NMFS RPA are not working to maximize production of fall Chinook salmon and have been incompatible with recovery.

Cape Horn Spring Flows 2007-2009 and Chinook and Steelhead Juvenile Survival

Once again, availability of flow release data for Cape Horn Dam is limited to the period from March 2007 to November 2009 and so only that period can be examined to determine whether spring flows under the NMFS RPA are benefiting juvenile Chinook salmon and steelhead and fostering their recovery. To understand spring flow patterns in a watershed like the upper Eel that has high elevation and significant snowfall, comparison with flows in the adjacent Middle Fork Eel River watershed is instructive. USGS flow data for the 1995 water year was chosen because it clearly shows snow melt peaks that are expected in watersheds like the Middle Fork and Upper Eel River that have significant area over 5,000 feet in elevation (Figure 23). These show up as peak flow events in April, May and June after rainfall events have subsided. These wide fluctuations in flow are followed by long descending hydrographs that often take over a month to reach baseflows (June 28, 200 cfs), a pattern with which Chinook salmon and steelhead co-evolved. Water from snowmelt would also have major benefit for salmonids because of its cooling influence. When examining flow releases in the Eel River at Cape Horn Dam from 2007-2009, however, very few similarities are evident.

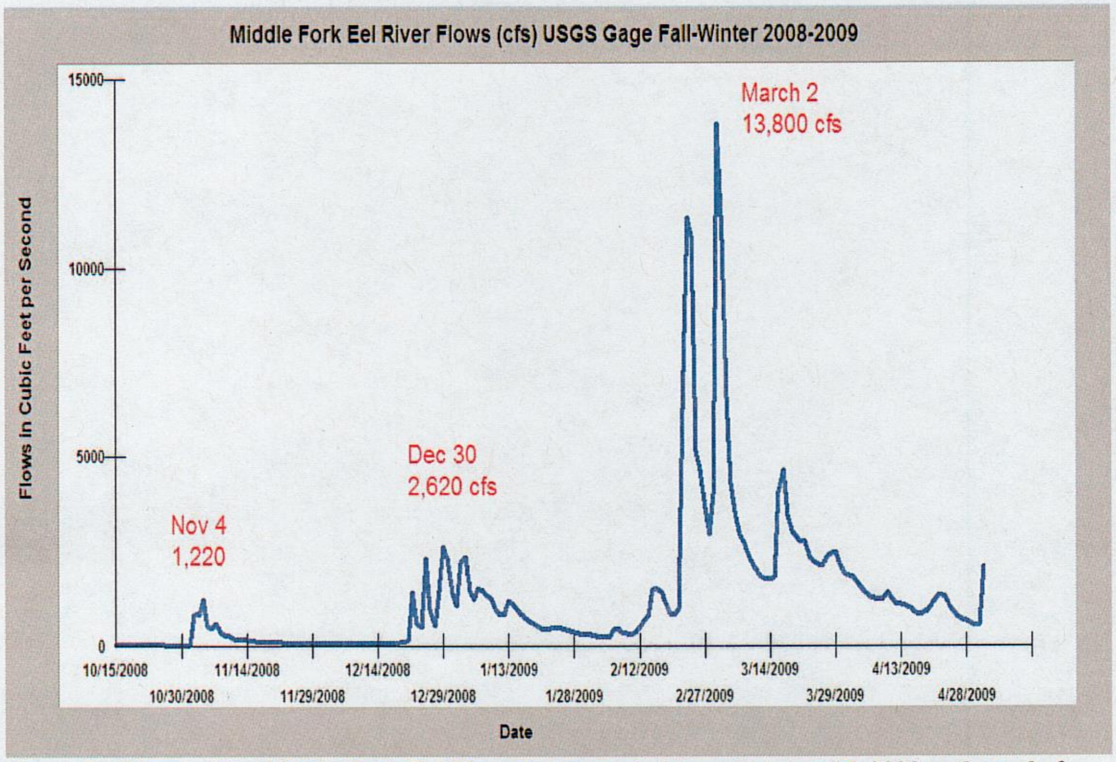


Figure 20. Flows of the Middle Fork Eel River for the period from October 15, 2008 to the end of April 28, 2009 with flow peaks labeled. Data from U.S. Geologic Survey via the Internet.

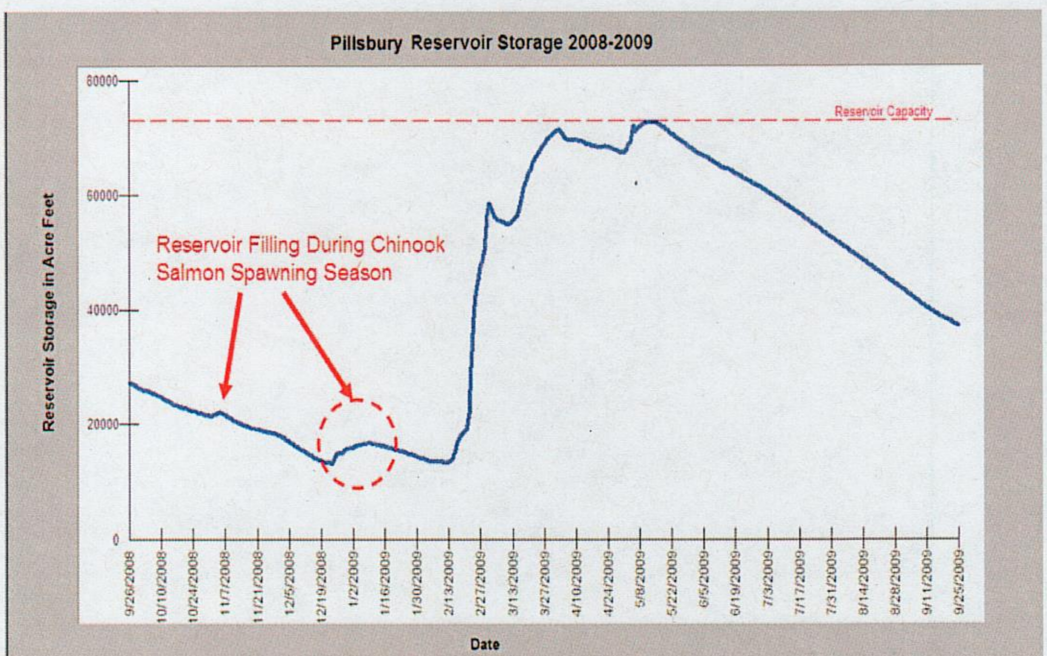


Figure 21. Pillsbury Reservoir levels for the period from September 26, 2008 to September 25, 2009. The level increased during the time of migration and spawning of fall Chinook salmon indicating that peak flows in tributaries went into storage. Data from CDEC and PG&E via the Internet.

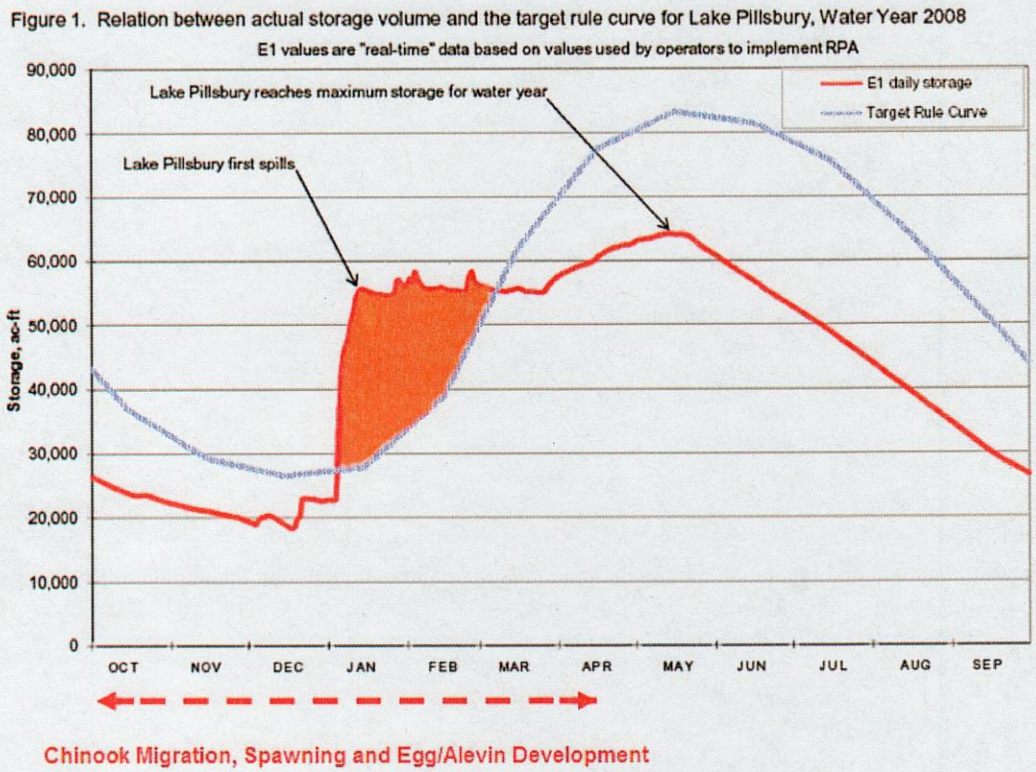


Figure 22. Pillsbury Reservoir storage in 2008-09 with departure from RPA curve (orange) during the most important time for Chinook salmon spawning and egg incubation. From PG&E (2008).

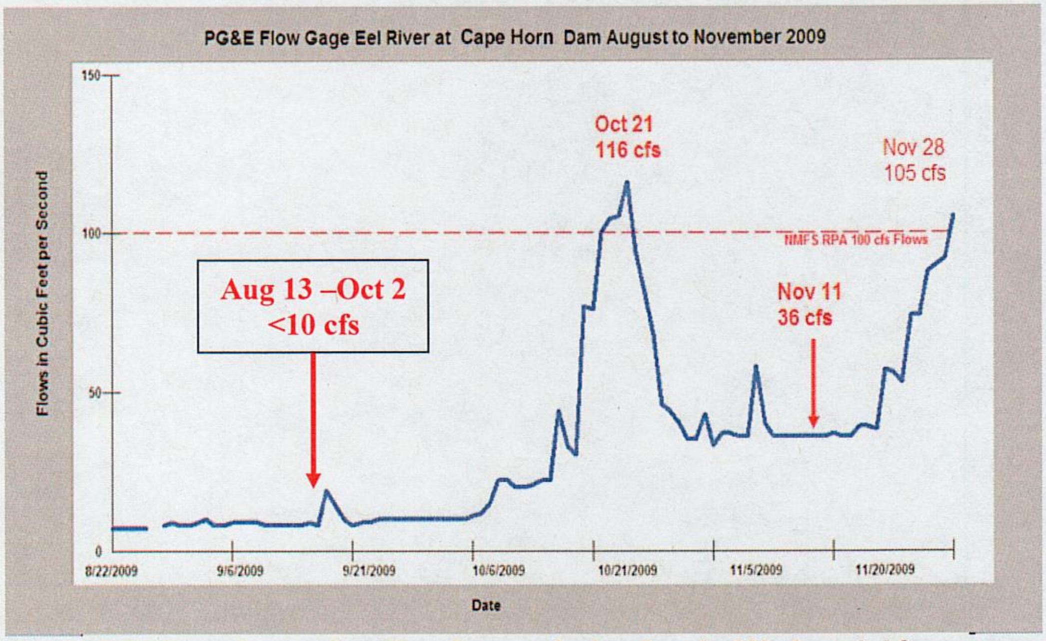


Figure 23. Eel River flows at Cape Horn Dam are far less than the 230 cfs needed for passage and minimum of 175 cfs needed for optimal spawning (VTN 1982). NMFS 100cfs guideline not required until December 1. Data from CDEC and PG&E via the Internet.

Eel River flow releases at Cape Horn Dam in spring of 2007 (Figure 25) can be contrasted with Middle Fork Eel River flows in the same year (Figure 26). The Middle Fork peak flow of 2130 cfs on April 22 and descending hydrograph of more than a week reflect characteristics of releases from melting snow fields. This is completely unlike the sharp spike in flow of 328 and fall to less than 200 cfs in less than 72 hours at Cape Horn Dam. Using the 38% scaling to reflect watershed size, the flow at Cape Horn Dam should have been nearer 814 cfs with releases only representing 17% of those of the Middle Fork due to reservoir storage. The extremely sharp rise is also not normal (non-normative) and may strand juveniles and trigger inappropriate behaviors with associated low survival of juvenile salmonids (VTN 1982). An upper Eel flow peak at Cape Horn Dam coupling with Middle Fork flows would help adult summer steelhead upstream passage and trigger migration of Chinook and steelhead juveniles at a time when Sacramento pikeminnow predation would be low.

The spring flow releases in 2008 from Cape Horn Dam (Figure 27) show an even greater departure from the Middle Fork Eel River flow patterns (Figure 28). The constant release of 200 cfs from April 1 to June 1 may have kept steelhead redds submerged but its lack of fluctuation makes it completely ineffective in triggering downstream migration of salmonid juveniles. VTN (1982) noted that flow fluctuation and varying the temperature by changing the depth of release from Scott Dam could be used as an effective tool to trigger downstream migration, but the 2008 patterns are the opposite of their recommendations and also not in concert with what is known about maximizing juvenile salmonid survival.

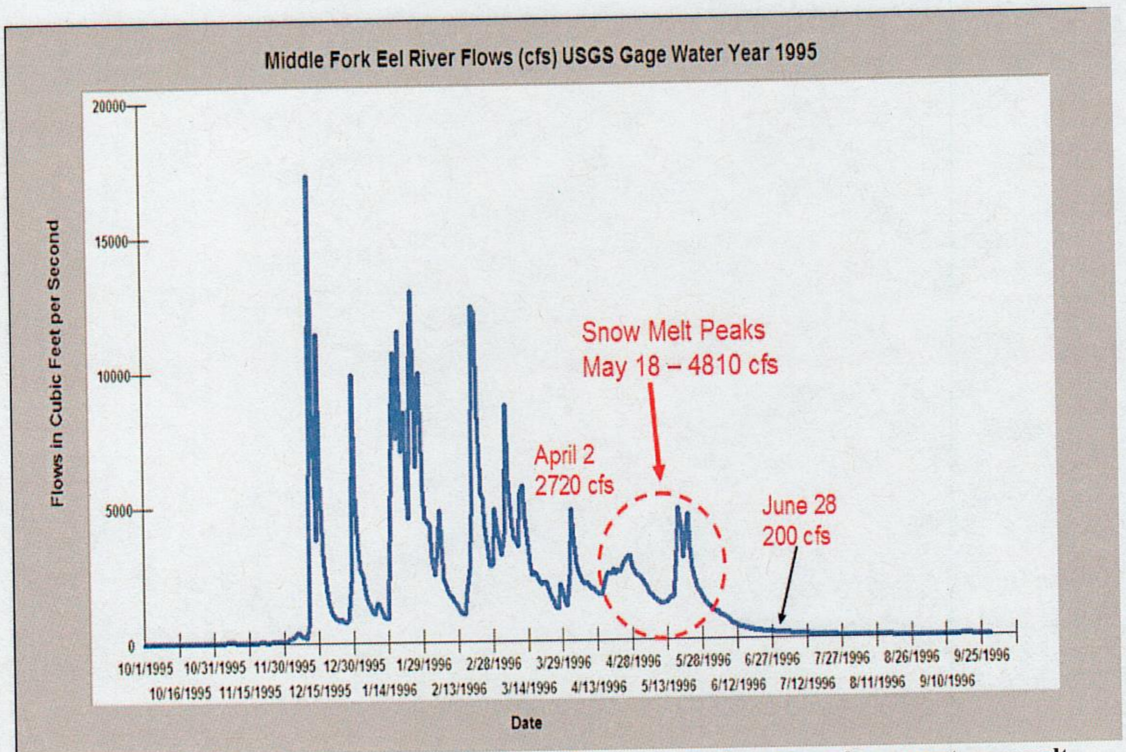


Figure 24. Middle Fork Eel River flows for the 1995 water year show several apparent snowmelt peak flows in late April and late May that are highlighted. Data from USGS.

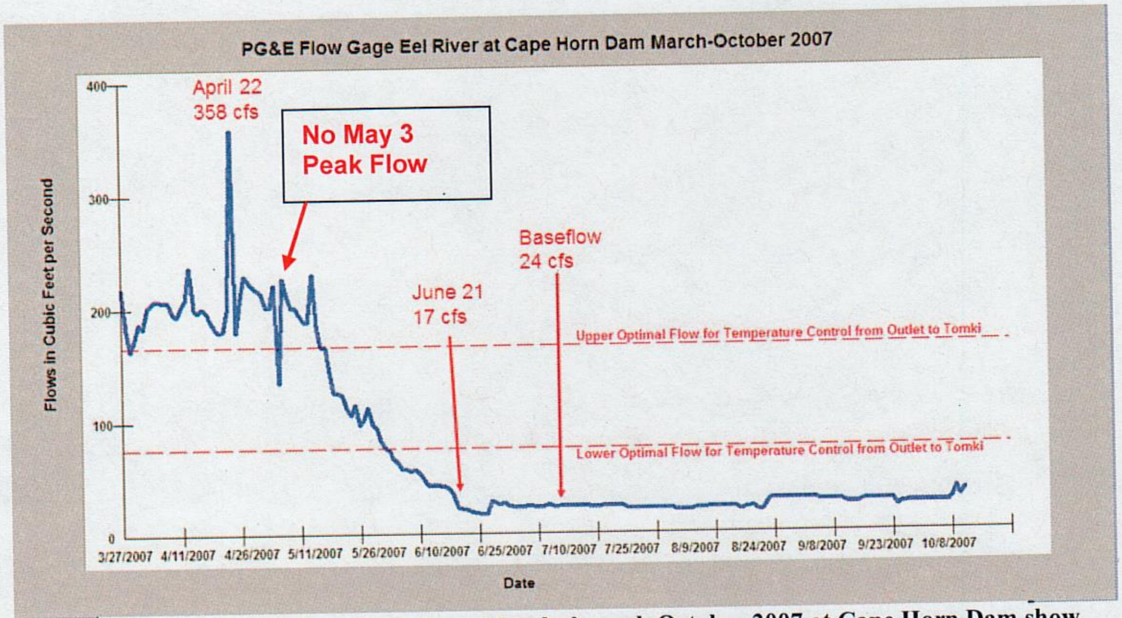


Figure 25. Mainstem Eel River flows from March through October 2007 at Cape Horn Dam show considerable departure from normal spring flow patterns in that the early May peak flow in the Middle Fork Eel is not evident. Also, summer base flows are less than those recommended for temperature control between Tomki and Outlet Creeks (VTN 1982).

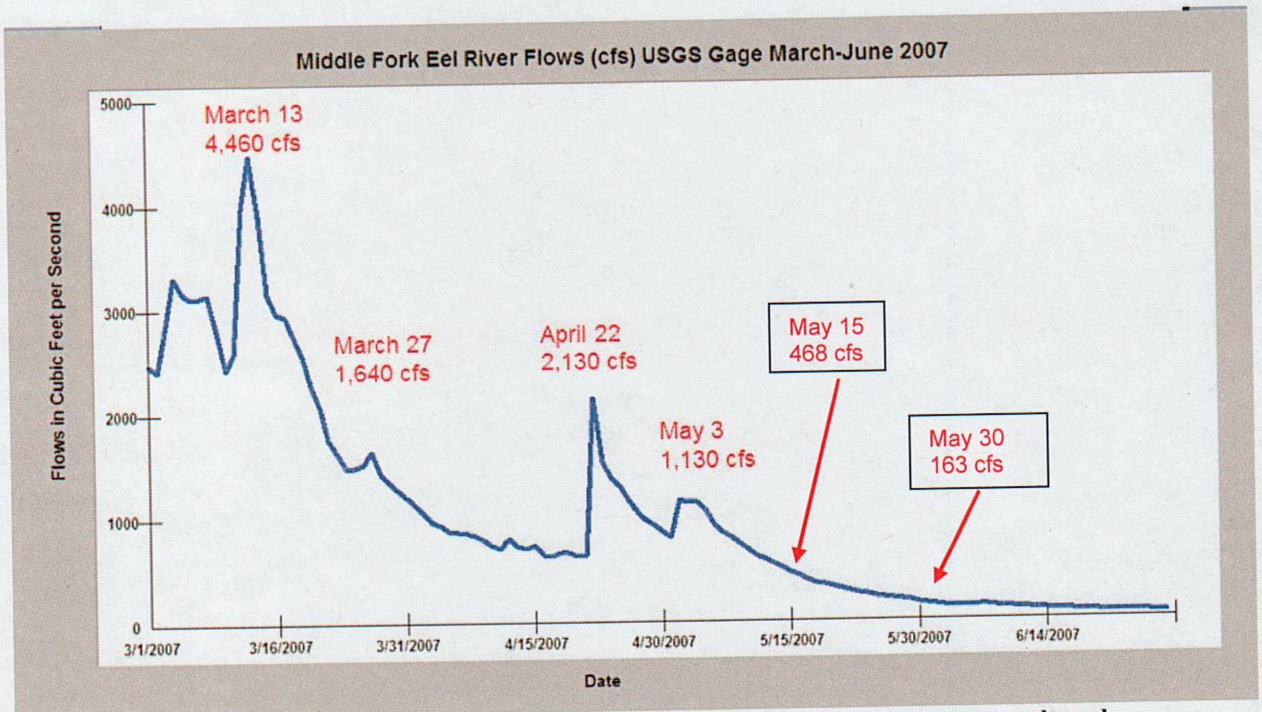


Figure 26. Middle Fork Eel River flows March 1 to June 2007 show several apparent snow melt peak flows (April 22 and May 3) that are highlighted. Data from USGS.

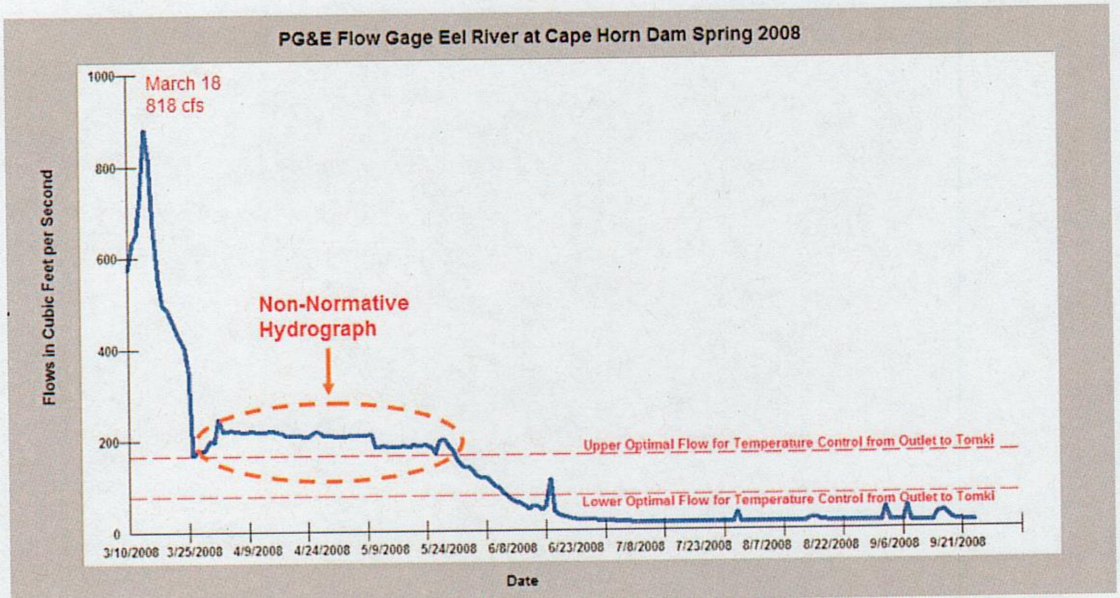


Figure 27. Mainstem Eel River flows from February 10 through October 2008 at Cape Horn Dam show considerable departure from normal spring flow patterns in that flow releases were a constant flow of 200 cfs from April 1 to June 1. Also, summer base flows are less than those recommended for temperature control between Tomki and Outlet Creeks (VTN 1982). Data from CDEC and PG&E via the Internet.

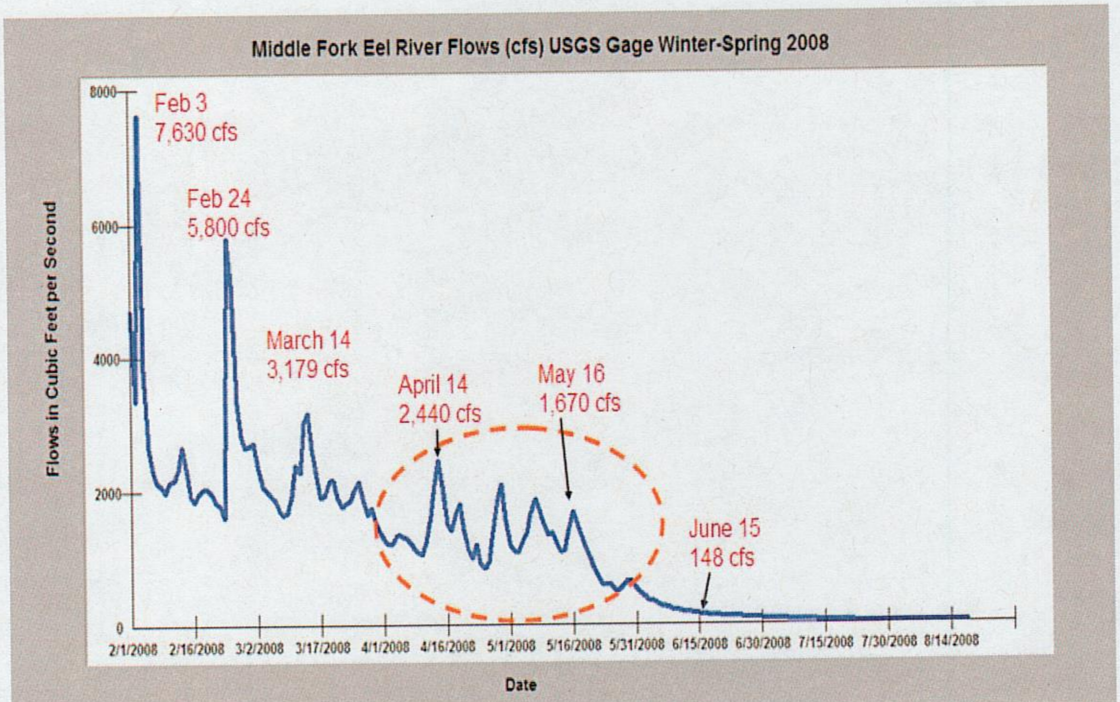


Figure 28. Middle Fork Eel River flows February 1 to August 2008 show several apparent snow melt peak flows (April 14 to late May) that are highlighted. Data from USGS.

There was a major release to the Eel River below Cape Horn Dam in 2009 reflecting a snow-melt peak (Figure 29), but again the ramping down was much more rapid in comparison with the Middle Fork Eel River for the same period (Figure 29). The mainstem Eel at Cape Horn Dam was reduced from 2,448 cfs on May 5 to 248 cfs a week later on May 13, but the descent of the Middle Fork Eel hydrograph took a month. Also notable for the period is the lack of a flow peak similar to the Middle Fork (4,660 cfs) on March 17 when only 319 cfs was released at Cape Horn Dam. Baseflows below 10 cfs from August to October were noted above in discussion of fall flows. None of the summer release patterns were anywhere near the VTN (1982) maximum flow for steelhead habitat between Scott and Cape Horn Dams (68-265 cfs) or for thermal benefits in the reach between Tomki and Outlet Creeks (76-166 cfs). Low spring and summer flows are contributing to continued low survival of both upper Eel River fall Chinook and winter steelhead when both are at already low and perilous population levels despite the RPA.

Pikeminnow Control

Moyle et al. (2008) give the following summary of the problems caused by the introduction of the predatory Sacramento pikeminnow into the Eel River for Chinook salmon:

> "In the Eel River, Sacramento pikeminnow were introduced illegally in 1979 and they quickly spread throughout much of the watershed (Brown and Moyle 1997). They are now one of the most abundant fish in the river and it is highly likely that they are suppressing Chinook salmon populations through predation on emigrating juveniles. This effect on Chinook juveniles is likely compounded by stress associated with other factors discussed above (i.e. water temperatures)."

Brown and Moyle (1991, 1991a, 1997) also noted that the pikeminnow predated on juvenile steelhead and caused a shift in habitat preference from pools to riffles when pools were inhabited by the pikeminnow, which is a particular problem for steelhead in the reach between Scott Dam and Van Arsdale reservoir.

A memo from CDFG Inland Fisheries Supervisor L.B. Boydstun (1991) to Emile Ekman of the Mendocino National Forest documented the population explosion of Sacramento pikeminnow in Pillsbury Reservoir a little over a decade after their introduction. His account from April 1991 refers to the pikeminnow as squawfish, which was their formerly accepted common name:

> "We did, however, catch lots of squawfish (20?) up to 7 pounds....They were particularly abundant up the Rice Fork arm, where I took about five casts and hooked a similar number of squawfish."

Clancy (1993) reported on dive counts conducted in 140 miles of the lower Eel River and Van Duzen River that documented the presence of 180,000 Sacramento pikeminnow and extensive river reaches where they were the predominant species. Pikeminnow flourish in

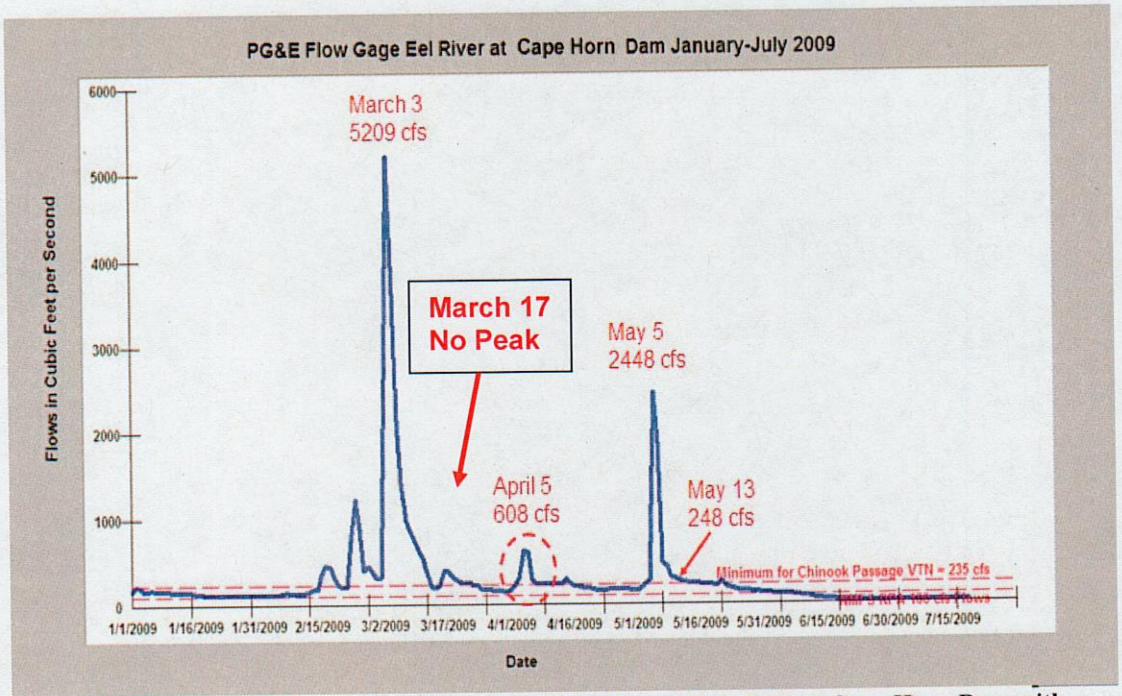


Figure 29. Mainstem Eel River flows from January 1 through July 2009 at Cape Horn Dam with peaks highlighted. Again there is considerable departure from normal spring flow patterns with sharp drops after peaks. Data from CDEC and PG&E via the Internet.

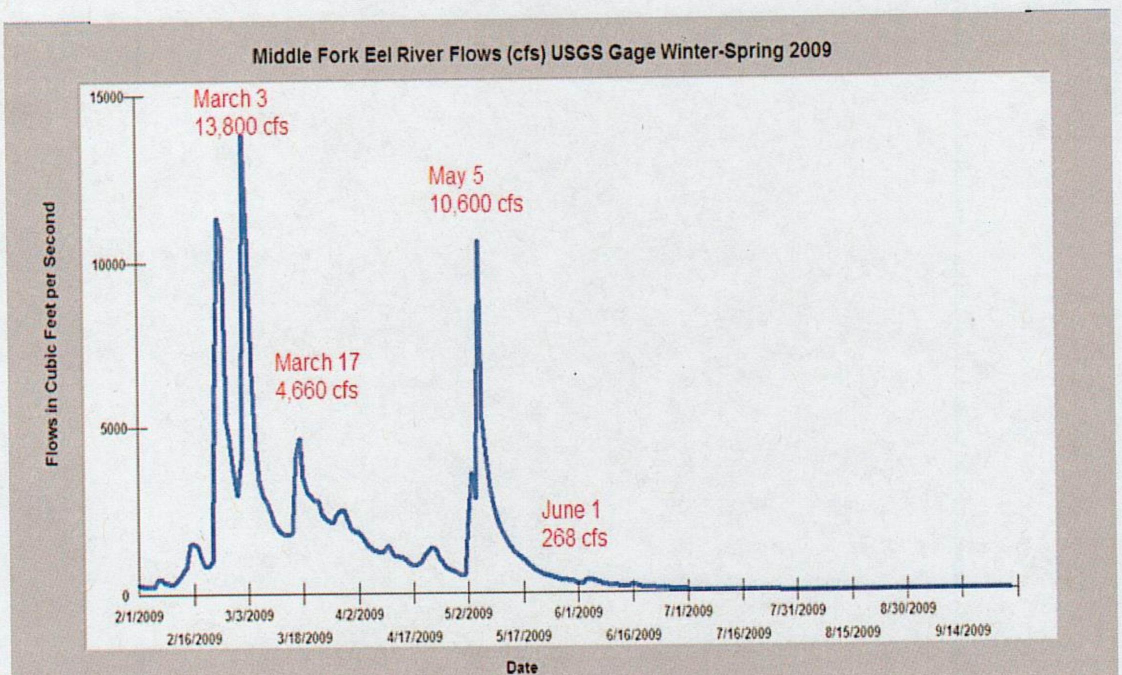


Figure 30. Middle Fork Eel River flows February 1 to September 2009 shows one major apparent snow melt peak on May 5 and earlier rain or rain-on-snow peaks that are highlighted. Data from USGS.

reservoirs (Moyle 2002, NWPPC 2004) and Pillsbury Reservoir is a constant source population that confounds suppression of pikeminnow through removal of individuals.

The effect of the PVP in elevating water temperatures provides another competitive advantage to Sacramento pikeminnow over salmonids. The following is information on temperature tolerance of Sacramento pikeminnow (SEC 2007):

> "Pikeminnow are found in summer water temperatures of 18°C to 28°C (Brown and Moyle 1993, Baltz et al. 1987, Dettman 1976) and often seek warmer temperatures if other habitat features are appropriate (Baltz et al. 1987, Dettman 1976). Knight (1985) determined Sacramento pikeminnow had a preference for average water temperatures ranging from 13.2°C to 27.8°C at acclimation temperatures of 10°C and 30°C, respectively (Dettman 1976). The final preferred temperature for pikeminnow was 26.0°C. The CTM for pikeminnow increased with acclimation temperature, beginning at 28.3°C for an acclimation temperature of 10 and peaking at 38.0°C at an acclimation temperature of 30°C. Temperatures above 38°C are lethal (Knight 1985).

This summary indicates that the pikeminnow optimal temperature of 26° C is over that recognized as lethal for all Pacific salmon species (Bartholow 1999, Sullivan et al. 2000), which is 25° C.

Although pikeminnow suppression is a stated objective of the NMFS (2002) BO, there has been no success of measures stipulated as part of the RPA. Review of Pikeminnow Adaptive Management and Suppression Operations Plans (PG&E 2005, 2006, 2007, 2008) indicate that activities have been completely ineffective. In 2005 seven gill net samples captured only 56 Sacramento pikeminnow. Table 1 shows 2006 gillnet capture results as part of the Sacramento pikeminnow suppression efforts but only 62 of the target species was captured and 13 juvenile steelhead mortalities occurred due to by-catch. Gillnet capture for three stations below Trout Creek, above Bucknell Creek and above Benmore Creek in 2006 are displayed as Figure 31 with a breakdown of fish species.

In a letter to PG&E (2007) in May 2007, NMFS requested that gillnet sampling be discontinued. Consequently, suppression efforts went forward in the summer of 2007 using electrofishing, but incidental steelhead trout mortality still occurred (Figure 32). Results were similar for 2008 electrofishing sampling and a summary of catch can be reviewed as Figure 33.

Table 1. Catch totals for gillnet suppression in 2006 in the Eel River at four sites within and below the PVP (PG&E 2007).

Species	**Number Captured**
Sacramento pikeminnow	61
Sacramento sucker	46
Steelhead trout	13

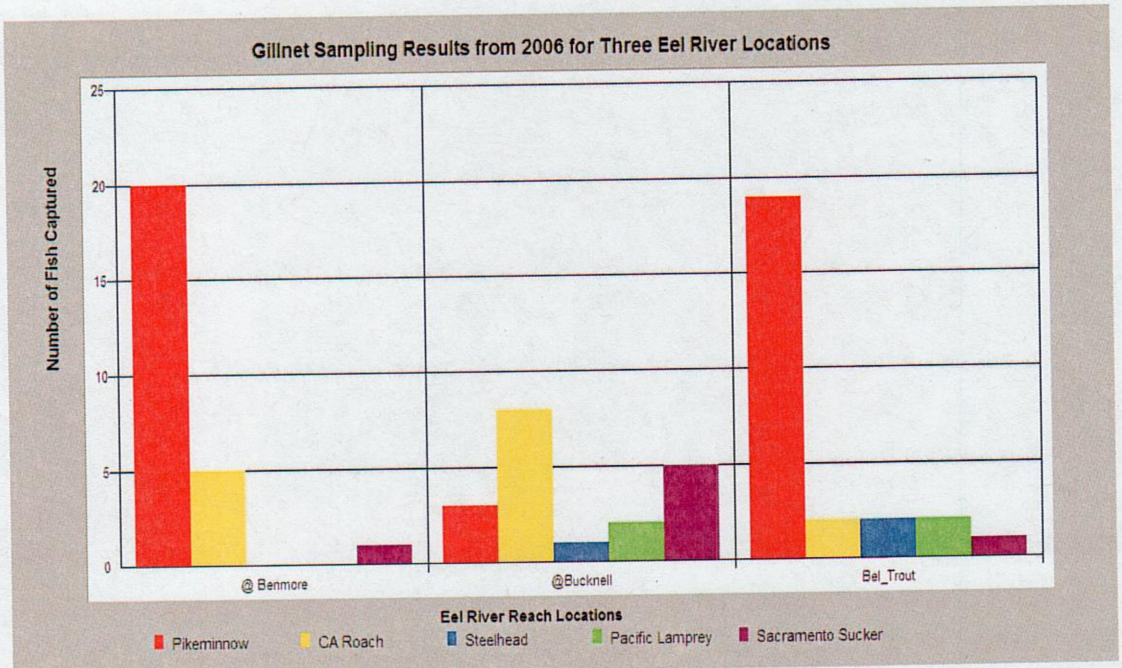


Figure 31. Gillnet samples in the Upper Eel in 2006 by species. While Sacramento pikeminnow were predominant in the catch above Benmore Creek and below Trout Creek, California roach and suckers were more numerous above Bucknell Creek. Data from PG&E 2008.

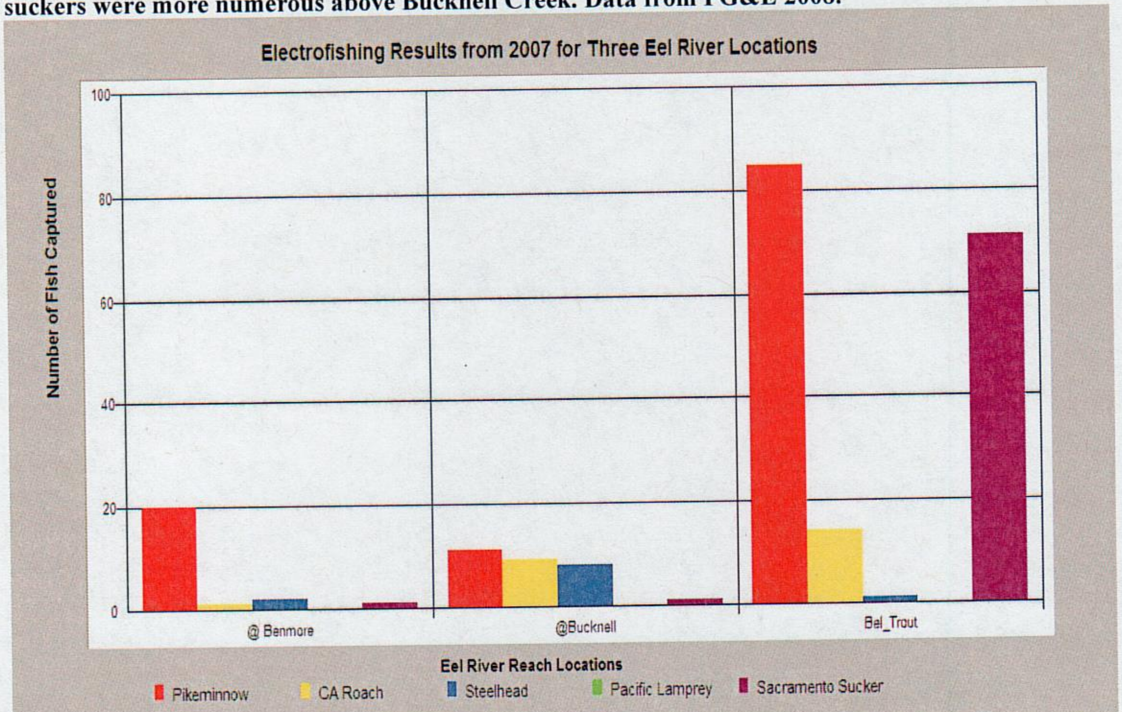


Figure 32. Electrofishing samples in 2007 at three Eel River monitoring sites yielded similar results to gill netting in 2006 except that Sacramento pikeminnow were most numerous at all locations. (@Benmore = above Benmore Cr., @Bucknell = above Bucknell Cr. and Bel_Trout = below Trout Cr.). Data from PG&E 2008.

Figure 33. Electrofishing samples in 2008 at three Eel River monitoring sites had a similar community as in previous sampling years. (@Benmore = above Benmore Cr., @Bucknell = above Bucknell Cr. and Bel_Trout = below Trout Cr.). Data from PG&E 2008.

Suppression efforts in the reach between Scott and Cape Horn Dams, which was formerly a steelhead juvenile refugia (Moyle and Brown 1997), are not feasible. Rapid flows and a confined channel proved so challenging that the electrofishing boat almost capsized in that reach (PG&E 2006). The sampling indicates that there is a diverse age structure of Sacramento pikeminnow and suckers and that steelhead trout make up part of the fish community, along with the warm water adapted California roach that was also introduced to the Eel River. As discussed above, flows have not approached or attained the 68-265 cfs that VTN (1982) calculated would expand steelhead habitat maximally, moderate temperatures and provide competitive advantages for both Chinook and steelhead juveniles in helping them avoid pikeminnow predation.

Discussions of temperature follow, and flows have not been sufficient to moderate water temperatures to the benefit of juvenile salmonids. Although the RPA claims that flows could benefit salmonids in some water years, recent water year classification has left spring and summer baseflows at extremely low levels. In 2009 CDEC flow data indicated flows dropped as low as 7 cfs for several days in August 2009, which would set up ideal conditions for pikeminnow. This is despite the following in the NMFS (2002) BO:

> "Sacramento pikeminnow have enjoyed a competitive advantage over Eel River salmonids since their introduction as a result of Project operations. Low flows below the Project in recent years have limited salmonids, and at the same time have provided ideal conditions for the Sacramento pikeminnow. It is NMFS biological opinion that improved flows, particularly in summer months, in

conjunction with a pikeminnow suppression program, are absolutely necessary to decrease the decline of Eel River salmonids."

"Flows that mimic unimpaired flows, especially spring and summer flows may also aid in the suppression of Pikeminnow by providing less conducive habitat conditions for pikeminnow especially in wet years."

Summer base flows have continued to favor Sacramento pikeminnow and the spring flows under the RPA at least since 2007 have not been operated to couple with natural peaks. This clearly deviates from any reasonable or cogent program to limit this invasive, non-native fish species that is a major threat to Chinook salmon and steelhead recovery. There is no suppression strategy that will work and Sacramento pikeminnow are likely in the Eel River to stay. The question needs to be shifted to how we can decrease the pikeminnow's competitive advantage over salmonids. In the short term, that is letting more water out of Scott Dam and Cape Horn Dam when salmonid juveniles need it. In the longer term, Pillsbury Reservoir must be removed.

Water Temperatures and Water Flows

While water temperature data and reports are required of PG&E (2005, 2006, 2007, 2008) under the RPA, older reports have illegible temperature graphics, printed tables of flows and temperatures are difficult to use, raw data are not available, temperature data for above the PVP is sparse and PG&E probes continually turn up missing in the upper watershed. The datasets in legible charts provided for 2008 are a step in the right direction, but temperature records are cutoff in terms of covering dates when flows are high and temperature buffering benefits likely occurring (Figure 34). Flow levels in summer are not those envisioned as benefiting salmonids and moderating temperatures and instead summer base flows have ranged from 7-24 cfs. The relationship between lower flows and higher water temperatures is well established (Bartholow 1999, NAS 2004) with less water volume moving at a slower speed more subject to warming. In the upper Eel River this creates an advantage for pikeminnow (Figure 35).

Figure 35 clearly shows that flows in 2008 were insufficient to prevent the maximum floating weekly average temperature (MWAT) of below Thomas Creek from rising to 25.7 ° C, which is above the lethal temperature of 25 ° C for juvenile steelhead (Sullivan et al. 2000). This indicates ideal conditions for Sacramento pikeminnow that have a thermal optimum of 26° C. Flow conditions in 2007 were slightly better at 24 cfs, but temperature information in PG&E reports does not show significant improvement. No temperature data are available for 2009, but flows of 10 cfs from August through October likely created even more adverse conditions below Cape Horn Dam for salmonids and even better ones for pikeminnow. Alteration of flow and temperature at Cape Horn Dam propagate downstream and create adverse conditions for summer steelhead adult migrations and juvenile immigration of wild Chinook and steelhead juveniles well downstream earlier in the season than if the PVP was not in operation.

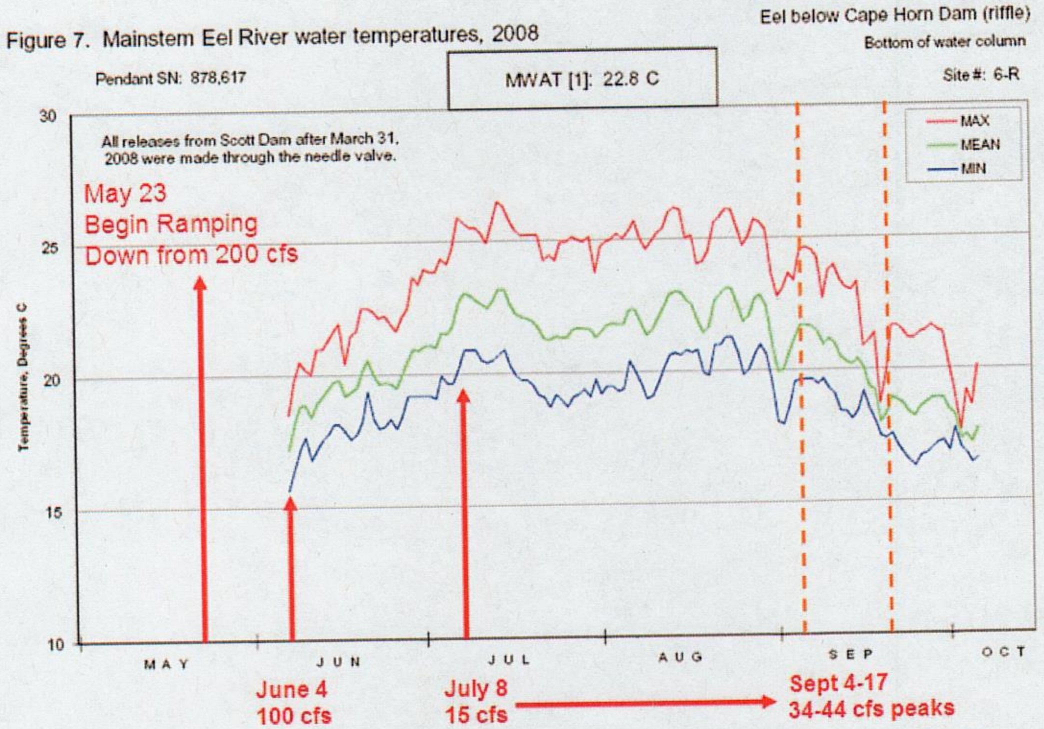


Figure 34. Water temperature chart of mainstem Eel River below Cape Horn Dam from PG&E (2008) with annotation showing missing records during periods of high flow and timing and level of flow releases.

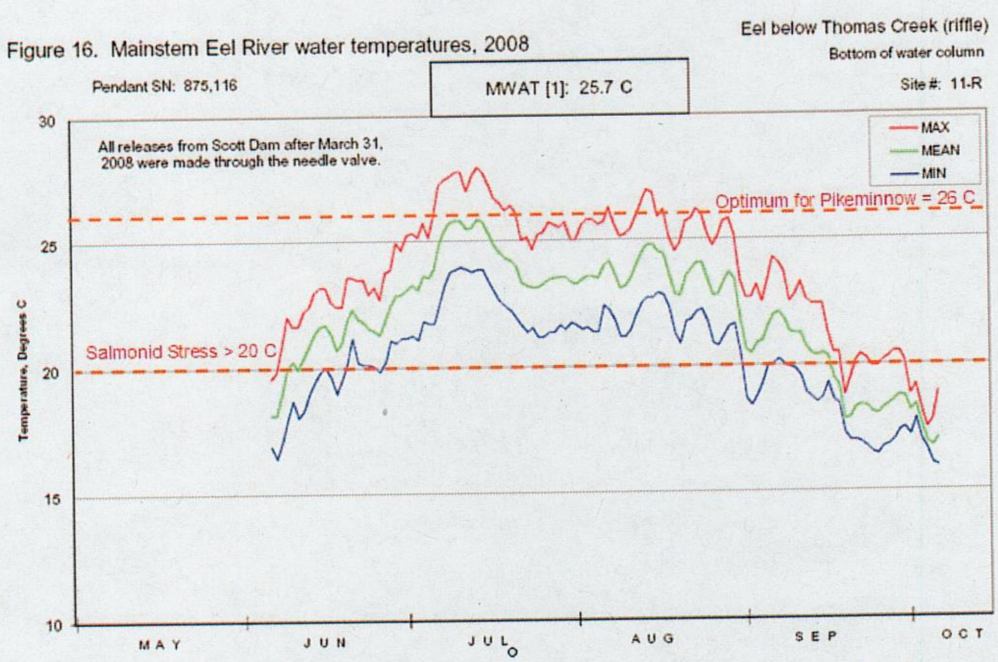


Figure 35. PG&E (2008) minimum, average and maximum water temperature chart from a riffle below Thomas Creek shows optimal conditions for Sacramento pikeminnow and lethal ones for salmonids.

Friedrichsen (2003) provided comprehensive electronic water temperature data for the Eel River basin and the summary of results for the upper Eel River basin is displayed as Figure 36. The maximum floating weekly average water temperatures (MWATs) from 1999-2003 show a pervasive pattern where conditions are lethal to salmonids and optimal for pikeminnow at sites below Cape Horn Dam, such as above Outlet Creek and at Emandal. Sites above Pillsbury Reservoir have more moderate temperatures where night time lows likely allow salmonid survival (U.S. EPA 2003). The paucity of data from PG&E (2008) for sites upstream of the PVP likely overlook a great deal of temperature suitable habitat for salmon and steelhead, if passage were open. The U.S. EPA (2003) points out the importance of access to refugia when mainstem river temperature conditions are elevated.

Tributaries like Tomki Creek were highly suitable for salmonids throughout the year prior to the 1964 flood, but channel changes caused warming throughout the Eel River basin (Kubicek 1977). Many additional factors now also contributed to temperature pollution, including flow depletion in tributaries (U.S. EPA 2004). For example, lower Tomki Creek from 1999 to 2003 ranged from 19.3 ° C to 25.2 ° C (Friedrichsen 2003) with the majority of years favoring pikeminnow over salmonids (Harvey and Nakamoto 1999, Harvey et al. 2002). This deterioration of tributary habitat leaves little suitable rearing habitat in the region and makes it necessary to allow access to thermal refugia in the upper Eel River, if Pacific salmon species are to survive into the future.

A map taken from Friedrichsen (2003) of MWATs (Figure 37) shows mainstem temperatures below the PVP to be lethal for salmonids in most years (23.2 ° -28 ° C), while sites like Bloody Rock above are within the range of suitable for steelhead juveniles (MWAT range of 18.9 ° to 21.3 ° C). The PG&E (2008) probe data (Figure 38) indicate a somewhat higher MWAT of 22.4 C, but the night time minimum temperatures fall below 20 ° C and provide a period of recovery from thermal stress for juvenile steelhead. These areas would be optimal for attainment of two years of age for summer steelhead juveniles that would colonize this area after PVP removal. Moyle et al. (2008) point out that summer steelhead need to rear for two years before ocean entry and two year old downstream migrants would have a high likelihood of avoiding pikeminnow predation.

Geology of the upper Eel watershed includes volcanic terrain in the high country along its eastern rim (Figure 39) that likely manifests in cold groundwater storage in the upper watershed not described by PG&E data.

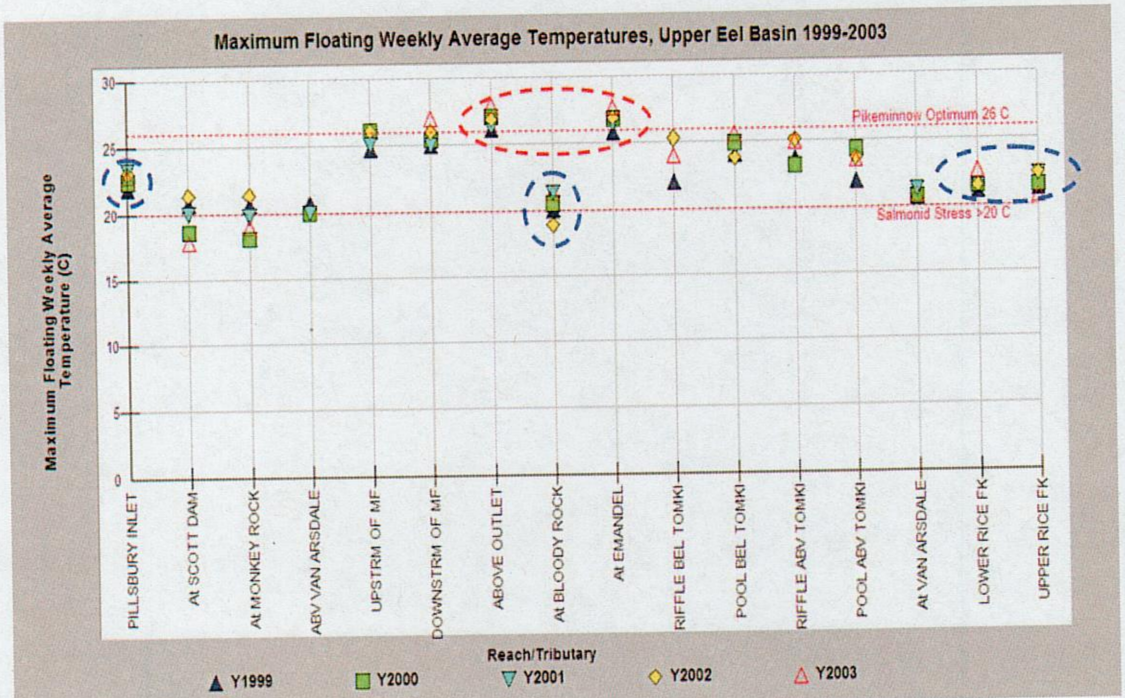


Figure 36. Humboldt County RCD (Friedrichsen 2003) maximum floating weekly average water temperature (MWAT) scatter plot for 1999-2003 shows below project sites lethal for salmonids (red), Tomki Creek supportive in only some years (pink) and locations above PVP as suitable or optimal for salmonids (blue).

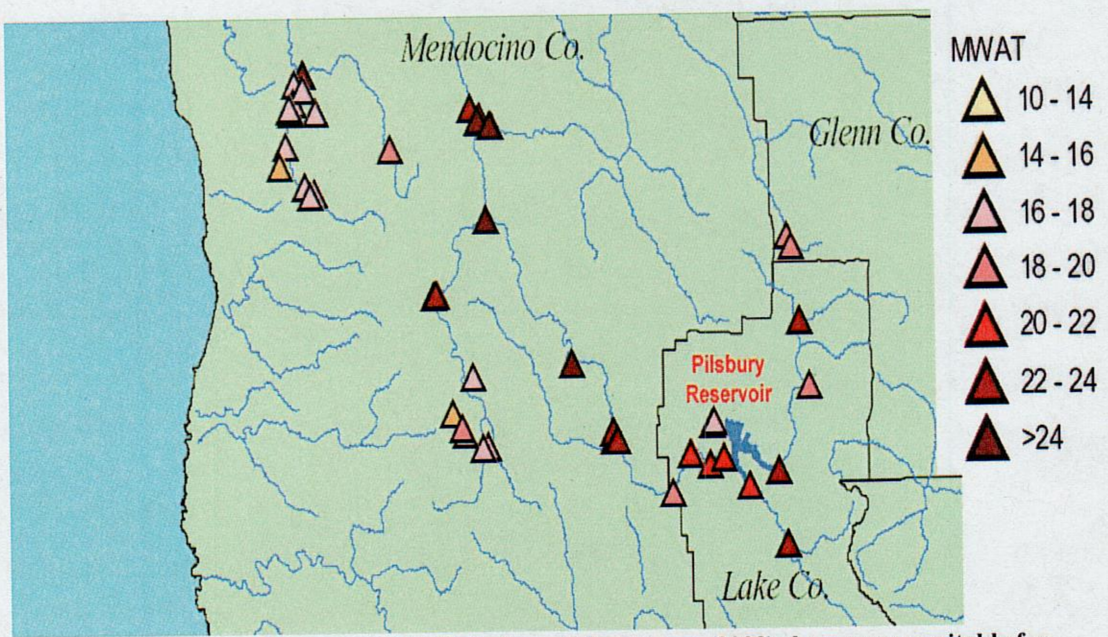


Figure 37. Upper Eel River map of MWATs from Friedrichsen (2003) show ranges suitable for salmonids at several locations above Pillsbury Reservoir.

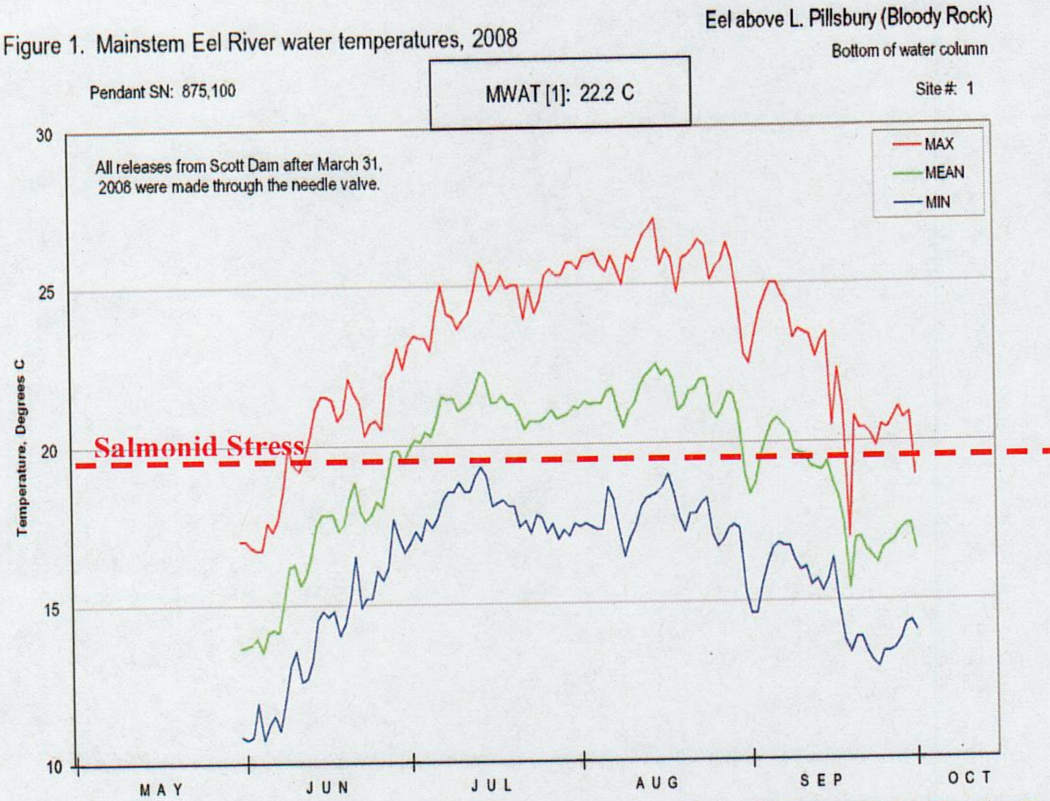


Figure 38. The Upper Eel at Bloody Rock minimum, average and maximum water temperatures show an MWAT of 22.4 ° C, but the night time minimum temperatures fall below 20 ° C and provide a period of recovery from thermal stress for juvenile steelhead at this location above Pillsbury Reservoir. Data from PG&E (2008)

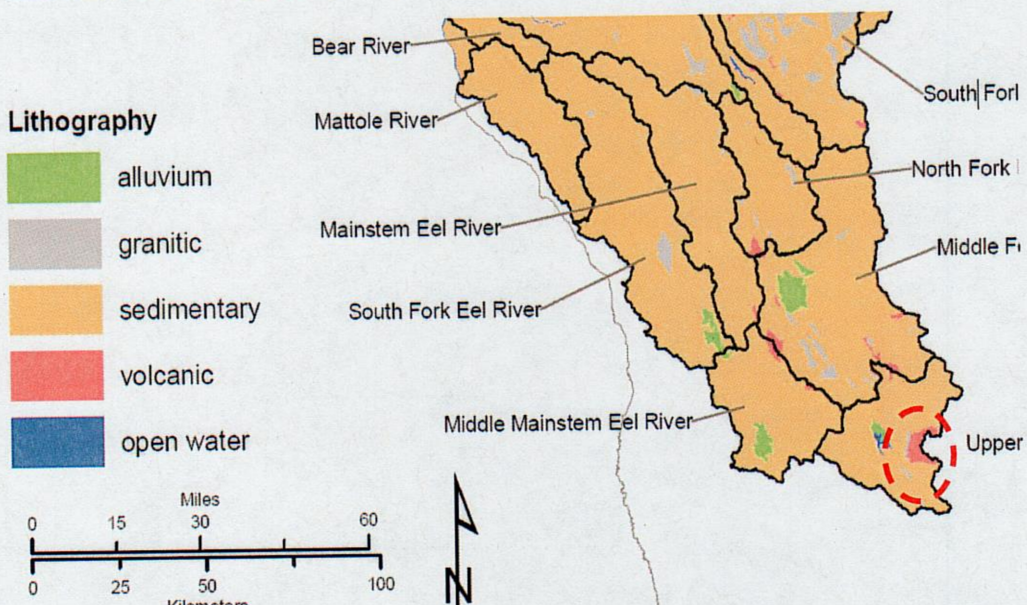


Figure 39. Lithology map from the *Upper Eel River TMDL* (U.S. EPA 2004) shows volcanic terrain (red circle) on the eastern watershed boundary that likely gives rise to high groundwater storage and spring areas down-slope in tributaries above the PVP.

Higher flow releases from Cape Horn Dam might create more pressure in subsurface gravels through downwelling that also forces cold water back to the surface downstream (ODEQ 2008). U.S. EPA (2003) notes that such connections can create critical refugia for salmonids. VTN (1982) noted potential for such hyporheic zone connection, but flows have been insufficient in recent years to trigger such effects. Furthermore, it would be impossible to determine any such relationship on the limited data available. If summer flow levels were maintained at the 76 to 166 cfs recognized by VTN (1982), surface water temperatures would drop due to effects described above, increased volume and decreased transit time and steelhead could successfully rear between Tomki and Outlet Creeks in the mainstem. These flows would also delay onset of lethal mainstem temperatures below the Middle Fork benefiting summer steelhead adults and juvenile downstream migrants.

Low summer flows are allowed under the RPA based on agreement with PG&E about water year classification. These discussions reflect only the needs of salmonids and do not delve into the specifics of the flaws in formulas and questions related to water years, which could be better answered by a hydrologist.

One additional note is warranted regarding the blending of surface and deeper water at Scott Dam. PG&E (2008) shows that blending of surface and deeper waters took place in March, likely to warm stream flow, but not later in spring. VTN (1982) noted that using reservoir surface waters in April and May to cause warming pulses triggered earlier salmonid juvenile downstream migration and this option is open to PG&E and NMFS but is not specified in the RPA.

In sum, the low flows required by the RPA, especially in the summer, often produce temperatures lethal to listed fish species in the Eel River and beneficial to predatory pikeminnow, resulting in a compounding adverse effect on salmonids. Based on available science, increasing flows in the Eel River to 68-265 cfs in the summer will produce corresponding temperature benefits for salmonids that will likely support survival of the species. Bradbury et al (1995) point out that Pacific salmon cannot be recovered without having access to habitat similar to that with which they co-evolved; therefore, to ensure longer term salmonid recovery, access to refugia above the PVP must be provided

Immediate Action to Increase Flows and Remove PVP Due to Current Eel River Cumulative Watershed Effects and Potential Salmonid Loss

The Eel River has experienced an aquatic habitat collapse with regard to its ability to produce Pacific salmon (Higgins et al. 1992, Brown and Moyle 1997, Moyle et al. 2008) during the time that the PVP has been in place. The press disturbance (Reeves et al. 1995) related to widespread logging on private land (Higgins 2007, 2009), urbanization (Friedrichsen 1998) and rural residential development has caused a massive decline in all Pacific salmon species. Mainstem environments in the South Fork and Van Duzen are so aggraded and flow depleted that they are optimal temperatures for Sacramento pikeminnow (Figure 40). Warm Eel River tributaries were found by Harvey et al. (2002) to produce numerous juvenile pikeminnow, while cool streams instead produced steelhead juveniles.

Friedrichsen (1998) noted that there was a general lack of recovery of suitable water temperatures for salmonids in the Eel River when comparing data with the findings of Kubicek (1977) collected in the year 1972.

Figure 40. Underwater view of juvenile Sacramento pikeminnow in a back water pool below Dora Creek on the South Fork Eel River. Photo by Pat Higgins, June 1994.

The Eel River estuary lies in the fog belt and once provided vast habitat area for juvenile salmonid rearing, but it has been diminished due to sedimentation and warming (Puckett 1977, Higgins 1991).

When Scott Dam blocked upper Eel River migrations, it is likely that fish spawned in high concentrations downstream in the mainstem and strayed into Tomki Creek in very large numbers. This is confirmed by historic accounts from Michael Morford (1982) and Robert Keiffer (1983) who interviewed Mendocino life-long residents Herman Sagehorn and Donald and Roland Graf, respectively. The following descriptions are of those accounts and are excerpted from Higgins (2003), a report that evaluated habitat restoration efforts on String Creek, a tributary of Tomki Creek.

> "Herman Sagehorn (Morford 1982) described Tomki Creek as ideal salmonid habitat, with abundant deep pools, good spawning gravel, low fine sediment and tree-lined banks. Several Chinook runs were described with an early run of highly colored fish, described by the locals as 'black salmon'. A run of brighter fish came with high flows in December, when coho salmon also ran. Steelhead runs began in January and fish of up to 25 pounds were occasionally caught in Tomki and String creeks.
>
> The degree to which these fish used tributaries, such as String Creek, varied depending on flows. Chinook for example might use riffles in the main Eel River

near Hearst, if low flow conditions persisted, but might also use Tomki and tributaries like String Creek if high flows prevailed. Holes in Tomki Creek were up to fifteen feet deep and salmonid juveniles ("trout") thrived in them even when summer low flows caused loss of connection between pools because of connections to cold groundwater. Pools below the convergence of String Creek in Tomki Creek were ten to twelve feet deep. String Creek was perennial and had adult winter steelhead sometimes holding through summer in pools (Keiffer 1983). Conservative estimates of the old-timers were that there were at least 200 spawning pairs of Chinook per mile. One hole on the main Eel at Hearst was measured by the Graf brothers and found to be greater than 70 feet deep (Keiffer 1983)."

In 2002, Higgins (2003) conducted a habitat survey in spring and fall of String Creek for the Mendocino County Resource Conservation District (RCD) to determine whether a bioengineering restoration project was effective in restoring fish habitat. Although the use of living plant materials like willow in combination with large rock had caused the scour of 6 feet deep holes and narrowed the stream course, there was no surface flow in String Creek in late summer. Higgins (2003) provided the following discussion:

> "String Creek is completely dewatered in summer, although it was noted to have perennial surface flows prior to the 1964 flood. Streams that have an over-burden of gravel often regain surface flows when the stream down cuts to its original bed. There are two potential hypotheses as to why String Creek still runs dry after it has reached its original grade: 1) a profound change in hydrology due to cumulative effects of past land use, and 2) increased diversion related to increased rural sub-divisions in the headwaters. Altered hydrology could cause an increase in peak flows but reduction in base flows."

Regardless of the causal mechanism, flows in String Creek are greatly decreased from historic and the ripple impacts of such decreased flows are reflected in Tomki Creek downstream. The high water temperature in Tomki Creek noted above is in part as a result of this reduced flow as well as changes in width to depth ratio caused by sediment from logging. In short, Tomki Creek served as a refugia for upper Eel River Chinook salmon, coho salmon and steelhead prior to 1964 and productivity has been so diminished that coho went extinct and fall Chinook are down in the dozens. This change in habitat argues strongly for the removal of Pillsbury Dam because some of the best habitat for salmon in steelhead in the entire Eel River watershed lies above the PVP.

This long term change in temperature regime is doubly damaging because of the introduction and spread of the predacious and warm adapted Sacramento pikeminnow. The latter species is now likely permanently established in the Eel River basin and the continual infestation from Pillsbury Reservoir must be curtailed if a new equilibrium is to be established between salmonids and the pikeminnow.

Climatic Cycles and Climate Change

Collison et al. (2003) point out that northern California Pacific salmon respond to climatic and oceanic variations known as the Pacific decadal oscillation (PDO) cycle (Hare, 1998, Hare et al., 1999). Positive ocean cycles coincide with wet on-land conditions in northwestern California for a period of about 25 years, then alternate with ocean conditions prone to warm El Nino events and periods of lesser rainfall. Positive PDO conditions prevailed from 1950-1975 and negative ocean and dry on-land conditions extended from 1975-1995 (Collison et al. 2003). We are currently in a productive ocean and wet climatic phase that provides an opportunity to recovery coho and Chinook salmon and steelhead. However, if freshwater habitat is not recovered by the time the next switch in the PDO occurs sometime between 2015-2025, then additional Pacific salmon stocks will likely go extinction.

NMFS (2002) and PG&E (2008) do not seem aware of emerging science on climate change that have bearing the sustainability of Pacific salmon populations. Snowy Mountain at the upper Eel River headwaters is the southern extent of the Klamath Mountain Geologic Province and Van Kirk and Naman (2008) studied snow fall patterns in this range about 150 miles north. They concluded that the snow level had risen approximately 1,000 feet over the last 50 years as a result of climate change resulting in diminished snow pack and likelihood of diminished cold water flows for salmonids. NMFS (2002) BO is designed around water and flow years that may be becoming less frequent as a result of climate change. This results in much less flow than expected over the remaining years of the license and higher likelihood of extinct.

Hatchery Supplementation and Chinook and Steelhead Recovery

The RPA does not deal directly with hatchery supplementation yet (PG&E 2005, 2007, 2008) reports give indications that both Chinook salmon and steelhead have continued to be cultured despite misgivings regarding genetic effects in other NMFS (Good et al. 2005) reports. If the broodstock of contributing parents is low (<50 adults), salmon or steelhead may suffer from inbreeding that can cause extremely poorly adapted fish (Simon 1988) that experience high incidence of rare diseases and other defects. A common problem from inbreeding of hatchery fish is "inbreeding depression" in which fertility of hatchery broodstock may drop dramatically (Simon et al. 1986). Inbreeding is extremely undesirable, because even if fish are of local origin, they may become unfit to survive in the wild. If inbred fish spawn with wild fish, they can also decrease the success of natural reproduction.

Although Chinook salmon hatchery culture at VAFS may have ceased, steelhead hatchery fish returns continued through 2007. Given the potential for genetic consequences of hatchery practices, it is surprising that NMFS has not required or conducted genetic testing to see if previous practices have compromised stocks. The sporadic and unreported use of hatchery supplementation can mask habitat decline and poor wild fish productivity. Artificial culture at VAFS should not be conducted unless the facility is operated as a conservation hatchery with appropriate budget and brood handling measures (Riggs 1990, Kier Associates 1991, 1999).

Adaptive Management: No Change in Action Despite Negative Results

The RPA invokes adaptive management (Walters 1997, Walters and Hilborn 1978, Walters and Holling 1990) with regard to the Sacramento pikeminnow suppression and the rebound of Chinook and steelhead, but there is no indication that appropriate action implied by use of the term is contemplated or forthcoming. The National Research Council (2004), in recommending that adaptive management be used to recover the endangered fishes of the Klamath basin, described it as follows:

> "Adaptive management is a formal, systematic, and rigorous program of learning from the outcomes of management actions, accommodating change, and improving management (Holling 1978). Its primary purpose is to establish a continuous, iterative process for increasing the probability that a plan for environmental restoration will be successful. In practice, adaptive management uses conceptual and numerical models and the scientific method to develop and test management options."

Walters (1997) points out that a common failure in the application of adaptive management is that change is insufficient to discern changes in conditions associated with the project from those that reflect natural variability. As noted above, flows have been so low that no temperature benefits or suppressing effects on pikeminnow were discernable from 2007-2009. It seems that NMFS may be using the term adaptive management to imply flexibility in action, but is actually using it to defer management decisions. NRC (2004) characterized such an approach as follows:

> "In the deferred-action approach, management methods are not changed until ecosystems are fully understood (Walters and Hilborn 1978, Walters and Holling 1990). This approach is cautious but has two notable drawbacks: deferral of management changes may magnify losses, and knowledge acquired by deferred action may reveal little about the response of ecosystems to changes in management. Stakeholder groups or agencies that are opposed to changes in management often are strong proponents of deferred action."

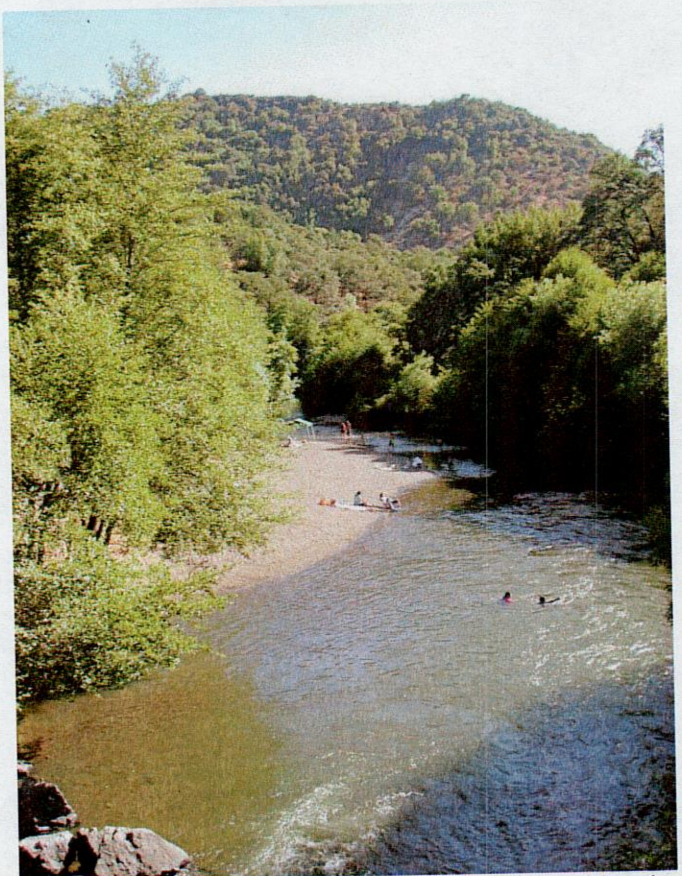
Given the strong evidence that Chinook salmon and steelhead are not rebounding, that flows under the RPA are not improving and that habitat has collapsed in Tomki Creek, alternative courses for perpetuating salmon and steelhead of the upper Eel River need to be explored. At present the delay offers PG& E continuing opportunities for revenue, but the natural capital of upper Eel Pacific salmon populations is nearly exhausted and may be irretrievably and irreversibly lost in the near future due to lack of prompt action.

A requirement of successful application of adaptive management is also complete sharing of data, including raw data. NMFS (2002) requested that PG&E post a website for sharing PVP information with agencies, tribes and the public and yet only a minimal amount of flow data (3 years) and no temperature or fish data are posted. As noted above, data are shared in paper not electronic and datasets that are shared in electronic are not easily useable because of formatting (spreadsheets versus large databases). Flow data related to Pillsbury Reservoir inflows and temperatures above the PVP are critical data gaps that PG&E seems to have no desire to fill.

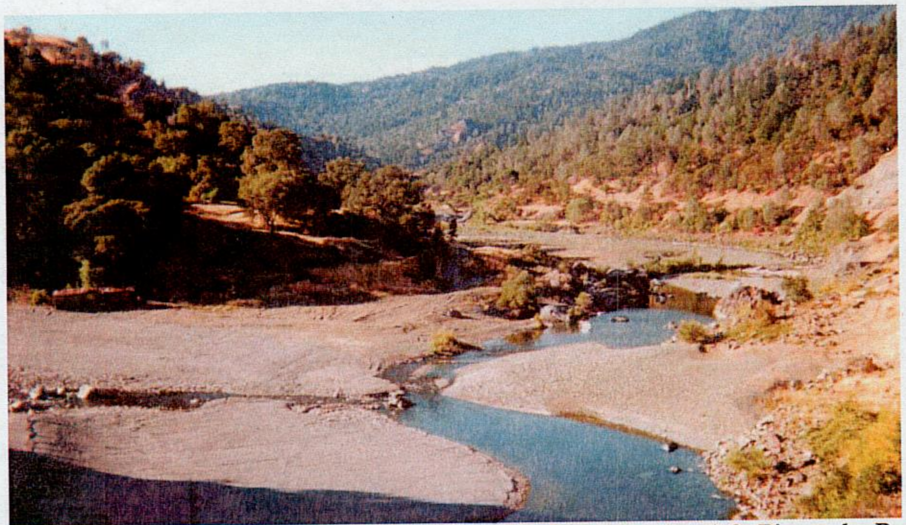
Data reported by PG&E (2008) on flows have major discrepancies versus those reported on the CDEC website (Table 2) and it calls data reliability into question.

Table 2. Start dates and end dates, duration (Days) and maximum flows (PGE Max) are from PG&E (2008) and these dates and values are contrasted with CDEC gage data for Cape Horn Dam downloaded from the Internet.

Start Date	End Date	Real Peak	Days	PGE Max	CDEC_Max
10/19/2007	10/21/2007	10/19/2007	2	164	75
12/2/2007	12/5/2007	12/7/2007	3	592	243
12/18/2007	12/19/2007	12/18/2007	1	526	320
12/20/2007	12/22/2007	12/20/2007	2	1011	614
1/4/2008	1/7/2008	1/4/2008	3	3732	1780
1/13/2008	1/16/2008	1/13/2008	3	3439	1046
1/26/2008	1/27/2008	1/26/2008	1	5380	2433
1/28/2008	1/30/2008	1/28/2008	2	5970	2532
2/3/2008	2/5/2008	2/3/2008	2	10380	4704
2/24/2008	3/2/2008	2/25/2007	7	6483	4532



This photo shows the East Fork Russian River above Lake Mendocino with swimmers and sun bathers enjoying flows that are actually a result of Eel River diversion. Picture taken by Patrick Higgins. July 13, 2003.



This photo shows the mainstem Eel River being joined by Outlet Creek at left. Picture by Patrick Higgins, October 1996.

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March 25, 2010

By FedEx Overnight Delivery
Jeanine Townsend, Clerk to the Board
State Water Resources Control Board
1001 I Street, 24th Floor
Sacramento, CA 95814

Re: Exhibits to Comment Letter From Living Rivers Council Regarding the State Water Board Policy for Maintaining Instream Flows in Northern California Coastal Streams

Dear Ms. Townsend:

Enclosed, please find Exhibits C, D, and E (together with sub-exhibits E1 – 12) to Living Rivers Council's comment letter regarding the State Water Board Policy for Maintaining Instream Flows in Northern California Coastal Streams. The comment letter will be transmitted via email to commentletters@waterboards.ca.gov before noon on March 26, 2010.

Sincerely,

Thomas N. Lippe

Exhibit C

EWB-D... Ranch

Law Offices of
THOMAS N. LIPPE

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June 7, 2002

Submitted by FAX (916) 341-5400 ; Original to follow by mail

Joan Jurancich
State Water Resources Control Board
Division of Water Rights
1001 I Street
Sacramento, CA 95814

Re: Application No. 30627; Comments on Mitigated Negative Declaration.

Dear Ms. Jurancich:

This office represents the Sierra Club and San Francisco Baykeeper, a project of WaterKeepers Northern California, with respect to Application No. 30627. I am writing to provide comments on the Mitigated Negative Declaration prepared by your office for this application and to object to any approval of the project.

The Sierra Club is located at 85 2nd Street, 2nd Floor, San Francisco, CA 94105. San Francisco Baykeeper is located at Presidio Building 1004, P.O. Box 29921, San Francisco, CA 94129-0921. However, all correspondence to these organizations relating to this protest should be directed to the Law Offices of Thomas N. Lippe at the address on this letterhead.

Preliminarily, in March of 2001, Ms. Chris Malan and Mr. John Stephens of the Sierra Club and I met with Michael Falkenstein, Steve Herrera and Ross Swenerton of your division to discuss the Sierra Club's concerns regarding water appropriation permits in Napa County. The meeting occurred shortly after the Sierra Club submitted its protest on the petition for change in Water Right Permit 20579, Application No. 29600 by William Hill. At that meeting, all participants agreed that the Sierra Club and Baykeeper could submit their documentary evidence supporting their objections to permit applications or petitions just once, and in subsequent objections could incorporate those documents by reference.

Therefore, the Sierra Club and Baykeeper hereby incorporate by reference the 12 exhibits submitted in support of their protest on the Hill petition. For your reference, those 12 exhibits are identified at the end of this letter. If for any reason you decide that you need a new copy of any of those exhibits, please contact my office and we will forward them to you.

In addition, Mr. Dennis Jackson, the Sierra Club's consulting hydrologist, is submitting under separate cover, his report on this application, which I hereby incorporate by reference.

Finally, I am also submitting under separate cover, 5 additional documents, as follows:

Exhibit 13	Stipulation and Order Re: Permit No. 6960; Richard Shown v. City of Napa
Exhibit 14	Report to the State Water Resources Control Board Summarizing the Position of the Department of Fish and Game on Water Rights Permit 6960, Application 10990, Conn Creek, Napa County, California, January, 1978; Jones, Weldon and Garland, Wallace
Exhibit 15	Division of Water Rights; Permit No. 6960 and Related Order
Exhibit 16	City of Napa: Flow Records for Lake Hennessey/Conn Dam, 1999-2000
Exhibit 17	City of Napa: Flow Records for Lake Hennessey/Conn Dam, 2000-2001

A complete list of Exhibits is set forth at the end of this letter. I have also submitted, by email, the flow records from the City of Napa for Conn Dam for the last seven water years, (1994-95 through 2000-01). Based on our conversation this morning, I understand that email transmission of these documents is acceptable for this purpose.

Based on the evidence submitted herewith, this application will damage beneficial uses of water in Chiles Creek, Conn Creek and the Napa River, particularly populations and habitat (including resources for feeding, sheltering and breeding) of several species of anadromous fish, including steelhead. In addition, there are several glaring legal deficiencies in the negative declaration for this project. Therefore, preparation of an Environmental Impact Report is required to comply with the California Environmental Quality Act.

First, the MND/IS does not assess the potential for this project, both incrementally and cumulatively, to adversely impact anadromous fish (i.e. steelhead) by reducing stream flows below Conn Dam. Three creeks, Conn, Chiles and Sage flow into Lake Henessey, which was created by Conn Dam, and which the City of Napa manages to provide municipal water supplies and release for instream uses and downstream entitlement holders.

The primary value of the emailed flow records is that because they are in Excel spreadsheets, you can see the formulas that the City uses to determine the amount of water it releases from the dam by clicking on the appropriate cells in the spreadsheet. Without going into the minutiae of how the City determines the quantity of water to release from the dam, suffice it to say that the amount is entirely dependent on the amount of water flowing into Lake Hennessy from its three tributary streams ("total inflow" in the flow records). Therefore, any reduction in inflow caused by this project will make it that much more difficult for the City to release sufficient quantities of water from the dam to protect public trust resources such as steelhead.

This is especially true when this project is considered cumulatively, in combination with the 15 other pending applications in the watershed above Conn Dam that are referenced in the letter from your office to the applicant dated April 3, 2000, which is in your file for this project. The City's historic problems in providing sufficient flows below the dam for aquatic species are well documented by the 1978 DFG report to the SWRCB (Exhibit 14.)

Clearly this project will contribute to further reductions in flows into Lake Hennessy; thereby exacerbating a condition of continuing, existing significant adverse impacts. Therefore, an EIR is required to assess these potentially significant adverse impacts.

I have also submitted, as Exhibits 13 and 14 , the City of Napa's Permit No 6960 and several SWRCB Orders relating to the permit. The purpose of these submissions is to provide you with the starting materials for a more in depth analysis of the incremental and cumulative impacts of this project on populations and habitat of sensitive aquatic species in Conn Creek and the Napa River below Conn Dam. The Sierra Club does not have either the resources or the time in the short comment period on this negative declaration to conduct this analysis. However, it is clear that any quantitative analysis of the issue must include an assessment of the constraints imposed on the City of Napa water releases by other entitlements (referred to as protestants in the flow records) and by operational and environmental factors (i.e rainfall, flood control measures, etc.).

The current MND/IS studiously avoids this entire subject. Indeed even the biological assessment prepared by Kjeldsen and Kjeldsen does not include any discussion of aquatic resources, either upstream of downstream of Lake Hennessy.

A second major problem with the negative declaration is the lack of any factual basis for its conclusion that aquatic species above Lake Hennessy will not suffer any significant incremental or cumulative adverse impacts. Since the biological assessment does not assess this possibility, the only basis for this conclusion is the minimum bypass term requiring a bypass flow equal to of 85% of the median February discharge at the location of each POD.

As discussed by Dennis Jackson in his report of today's date, there are numerous problems with the calculation used to reach the median February discharge figure, including erroneous assumptions about the size of the watershed upstream of the project, the failure account for or even explain conflicting data sources that yield dramatically different results, etc. Moreover, even without these calculation problems, there is no scientific basis for believing that the median February discharge is adequate to protect public trust resources either upstream or downstream of Conn Dam, much less that 85% of that figure is adequate for that purpose.

Under CEQA, "The [initial] study must also 'provide documentation of the factual basis for the finding in a Negative Declaration that a project will not have a significant effect on the environment.'" *City of Redlands v. County of San Bernardino*, (2002) 96 Cal. App. 4th 398, 406; Guidelines section 15063, subdivision (c)(5). This MND/IS does not meet this standard.

These site specific comments need to be assessed in light of the information we now have regarding the loss of anadromous fisheries in the Napa River drainage and other coastal drainages and the key role that water diversions play in causing these impacts. Since 1985, there has been a sea change in the environmental setting in the Napa River drainage and surrounding region. Populations and habitat conditions for coho salmon and steelhead in this region have declined to the point where, in 1996 (coho) and 1997 (steelhead), the National Marine Fisheries Service ("NMFS") listed local ESUs of these species as "threatened" under the federal Endangered Species Act. This occurred in the context of the Board's identification of the Napa River as "water quality limited" under § 303(d) of the federal Clean Water Act due to excessive sedimentation and nutrient loading. Indeed, coho salmon have been extirpated from the Napa River.

Some of the causes for these changed circumstances are described in detail in the accompanying reports by Dennis Jackson (Exhibit 1), Dr. Robert Curry (Exhibit 2), Dr. Robert Abbot and Dr. Robert Coates (Exhibit 3), as well as the Board's own report on Russian River bypass flows (authored by Dr. Peter Moyle and Dr. Mathias Kondolf) (Exhibit 4), which applies equally to the Napa River. In light of all this information, the sparse analysis in the negative declaration for this project is clearly inadequate.

The listing decisions and reports referenced above provide a wealth of information regarding the adverse environmental impacts associated with water appropriations in the Napa River and other coastal rivers. The Board's own investigation of impacts of water appropriations on fish bypass flows in the Russian River concludes that environmentally damaging processes at work in that drainage, such as vineyard expansion onto hillsides, which are perhaps even more pronounced in the Napa River drainage, are contributing to adverse impacts on federally listed fish species:

> "In the Russian River watershed increasing pressure to develop hillside agriculture (especially vineyards) has led to a proliferation of water rights applications for diversions from headwater streams, which support federally listed coho salmon or steelhead, or support larger streams that do. Similar conditions occur in other coastal watersheds. The State Water Resources Control Board (SWRCB) is presently wrestling with the issue of how to condition permits for water rights to protect ecological resources, a task made difficult by the lack of information on the physical and ecological functioning of these channels, and their influence on downstream channels. For example, proposed methods for determining minimum instream flows in these streams have been developed using stream gauge data - all of which are from larger channels downstream, where scale differences lead to a very different hydrology. Similarly, the need for streamside protection zones along these headwater channels is not widely recognized, because most guidance has been developed for larger channels. In any case, existing institutions are poorly suited to regulating activities that impact these streams. The State Board can decide how much water (if any) should be diverted but has limited authority to regulate land use changes that influence runoff and erosion rates. Similarly, the Department of Fish and Game can put conditions on activities within the stream itself, but has limited authority beyond the stream banks. Land-use decisions are made at the county level, with varying levels of scientific analysis and political concerns influencing decisions. The most advanced county-level ordinance in the region is the Napa County Conservation ordinance, which is now under review in part because of concerns over its effectiveness in addressing the effects of multiple headwater impacts. <u>Moreover, there is presently no mechanism for taking cumulative effects into account</u>." (Exhibit 3, emphasis added).

This report recognizes that the Board has no mechanism to assess the cumulative impact of the appropriation permits that it approves. Frankly, this is incredible considering that an environmental impact report prepared pursuant to CEQA is specifically designed and required to assess the cumulative impacts of projects. The mechanism exists; the Board is just failing to use it up to now.

Additional significant information includes:

- Numerous critiques of the Board's use of the Tennant method for determining bypass flows, while directed to the Navarro and Russian rivers, are equally applicable to the Napa River (See Exhibits 10, 11 and 12).

- The July 2000 "Water Diversion Report for Napa County" prepared by the Watershed Asssociate. (Exhibit 9). This comprehensive report catalogues and presents data from the water appropriation permit files maintained by the Board for all surface water appropriation permits issued by the Board in Napa County through June 5, 2000 and all appropriation permit applications pending in Napa County as of June 5, 2000. As far as we know this is the first effort to provide a comprehensive data base of all appropriative rights in Napa County, that the Board can and should use to evaluate the cumulative impacts of every appropriation application in the County.

The Board should use an EIR to evaluate the water flow depletion effects of this project, especially as these effects interact with and combine with other hydrologic, geomorphologic and chemical changes in the Milliken/Napa drainage, as those effects are described in the reports by Dennis Jackson (Exhibit 1 (decrease in stream flow)), Dr. Robert Curry (Exhibit 2 (increases in peak flow destabilizing stream banks and increasing sediment downstream sedimentation)) and Dr. Robert Abbot and Dr. Robert Coates (Exhibit 3 (changes in chemical and biological properties of streams)).

The application violates applicable Water Code provisions, including Water Code sections 1205 (fully appropriated streams), 1243 (protection of fish and wildlife), 1243.5 (same), 1257 (same), 1257.5 (same), and 1258 (consideration of applicable San Francisco region water quality control plan, which requires protections of the Napa River's fish, wildlife and recreational beneficial uses). Contrary to these statutory requirements, this application captures for private use the public waters and dependent fish and wildlife of the unnamed tributary which the applicants would impound for their private benefit. As documented in the exhibits submitted herewith, this application, together with the numerous other existing and proposed diversions from the Napa River and its tributaries, would cause significant adverse cumulative watershed effects, harming fish, wildlife and public recreation.

The application also violates Fish and Game Code Section 5937. This statute directs that "[t]he owner of any dam shall allow sufficient water at all times to pass through a fish way, or in the absence of a fish way, 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." This project will likely violate this section.

Approval of this application would also violate the public trust obligations of the Board. The SWRCB, "as trustee, has a duty to preserve [public] trust property from harmful diversions by water rights holders." *United States v. State Water Resources Control Board* (1986) 182 Cal.App.3d 82, 106. Approving this petition would contravene this duty, by allowing an impoundment and diversion of water by the applicants that would cause significant harm to the Napa River watershed and the fish, wildlife and public recreation dependent on this river system. The SWRCB should deny the application in order to preserve trust property from harmful diversions by water rights holders.

Thank you for your attention to this.

Very Truly Yours,

Thomas N. Lippe

cc: Diane Wilson, Napa Valley Vineyard Engineering
Chris Malan, Sierra Club
Leo O'Brien, WaterKeepers Northern California

List of Exhibits

1. Dennis Jackson letter to Tom Lippe. January 28, 2001

2. Cumulative Effects of Conversion of Upland Woodlands and Chaparral to Vineyards Report prepared by Robert R. Curry, PhD. December 24, 2000

3. Expert Witness Report: Cumulative Impacts on Fisheries Resources from Intensive Viticulture Practices in Napa County, CA prepared by Robert R. Abbot, PhD., and Robert N, Coates, Ph.D. February 1, 2001

4. Fish Bypass Flows for Coastal Watersheds: A Review of Proposed Approaches for the State Water Resources Control Board prepared by Peter B. Moyle and G. Mathais Kondolf. June 5, 2000

5. National Marine Fisheries Service Endangered and Threatened Species: Listing of Several Evolutionary Significant Units (ESUs) of West Coast Steelhead Final Rule Fed. Reg. Vol. 62, page 43937. August 18, 1997

6. National Marine Fisheries Service Endangered and Threatened Species; Threatened Status for Central California Coast Coho Salmon Evolutionarily Significant Unit (ESU) Final Rule Fed. Reg. Vol. 61, No. 212, page 56138. October 31, 1996

7. Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams prepared by California Department of Fish and Game and National Marine Fisheries Service. May 22, 2000

8. Comments on the State Water Resources Control Board (SWRCB) report on Proposed Actions on Pending Water Rights Applications within the Russian River Watershed and NMFS Draft Recommended Guidelines for Maintaining Instream Flows to Protect Fisheries Resources in Tributaries of the Russian River.

9. Water Diversion Report for Napa County prepared by The Watershed Associate, July 2000.

10. Review of the Tennant Method as applied on the Navarro River and in Coastal California watersheds. Stacy Li, Robert Curry and Brett Emery.

11. Letter from William Hogarth, National Marine Fisheries Service, to Edward Anton, State Water Resources Control Board. October 26, 1998

12. A Commentary on the SWRCB Staff Report: Russian River Watershed, Proposed Actions to be Taken by the Division of Water Rights on Pending Water Right Applications within the Russian River Watershed, August 15, 1997 by McBain and Trush. March 12, 1998.

13. Stipulation and Order Re: Permit No. 6960; Richard Shown v. City of Napa.

14. Report to the State Water Resources Control Board Summarizing the Position of the Department of Fish and Game on Water Rights Permit 6960, Application 10990, Conn Creek, Napa County, California, January, 1978; Jones, Weldon and Garland, Wallace.

15. Division of Water Rights; Permit No. 6960 and Related Order

16. City of Napa: Flow Records for Lake Hennessey/Conn Dam, 1999-2000.

17. City of Napa: Flow Records for Lake Hennessey/Conn Dam, 2000-2001

Exhibit D

Dennis Jackson - Hydrologist
708 - 14th Avenue
Santa Cruz, CA 95062-4002
(831) 464-7580
djackson@cruzio.com

June 1, 2002

Joan Jurancich
State Water Resources Control Board
Division of Water Rights
1001 I Street
Sacramento, CA 95814

Re: Application No. 30627; Comments on Mitigated Negative Declaration.

Submitted by FAX (916) 341-5400; Original to follow by mail

Dear Ms. Jurancich:

I am writing to comment, on behalf of the Sierra Club, on the proposed negative declaration for Application 30627 to appropriate water from Chiles Creek or its tributaries.

Project Description

Dollar Reservoir is a recently constructed off-stream reservoir on the Dollar Ranch. As of May 2002, no point of diversion has been constructed specifically for this reservoir. The Dollar Ranch has two existing licensed water rights, License 13300 and 13301. Three points of diversion (POD) are proposed to be used to fill the Dollar Reservoir. POD-1 is the POD for License 13300, POD-2 is the POD for 13301. POD-3 is proposed to be constructed on Wood Canyon and is expected to be the primary source for the Dollar Reservoir. Additional piping would be added to connect POD-1 and POD-2 to Dollar Reservoir.

The *Notice of Proposed Negative Declaration (NOPND) sets* bypass terms for POD-1, 2, and 3 associated with Application 30627. A fourth POD is alluded to in the maximum diversion rate but is not described in the NOPND. No bypass flow or maximum diversion rate is set for POD-4 in the NOPND. However, POD-4 is mentioned in the *Hydrology* section of the Environmental Checklist. In addition, the *Water Availability Analysis* includes calculations for POD-4.

The NOPND sets the season of diversion to December 15 through March 31 and a total of 49-acre-feet diverted to storage from any combination of the PODs.

Incomplete Project Description

The project description, as given in the NOPND, appears to be incomplete since it does not mention the location of POD-4 and sets neither a minimum bypass nor a maximum diversion rate for POD-4. However, both the *Hydrology* section of the Environmental Checklist and the *Water Availability Analysis* mention POD-4. In particular, both documents state that the maximum combined rate of diversion for all *four* PODs shall be limited to no more than 2.0 cfs. Therefore, it appears that the project actually includes four PODs.

It is essential to have a clear project description since a fundamental purpose of the California Environmental Quality Act (CEQA) is to provide full public disclosure. Without a clear project description, members of the public and staff of government agencies can not assess the environmental impacts of the project. This NOPND should be withdrawn so that the State Water Resources Control Board staff can amend the Project Description to include POD-4.

A SWRCB memorandum to Linda Hansen, DFG, dated April 4, 2002 states that the applicant has removed POD-4 from the project. If this is true, the NOPND should be withdrawn so that the term describing the maximum diversion rate should be re-written to reflect the actual project.

According to page 5 of the *Initial Study*, the actual location of POD-3 is unknown. How can the potential environmental impacts of POD-3 be assessed if its location is unknown? In addition, the estimates of water availability and minimum required bypass for POD-3 depend on the watershed area above POD-3. The California Environmental Quality Act (CEQA) requires full disclosure of all the potential environmental impacts. A full and complete project description can only be provided once the actual location of POD-3 is known. The NOPND should be withdrawn until the actual location of POD-3 is known.

Conflicting Water Availability Studies

A SWRCB memorandum to File Application 30627, from Hugh Smith, dated August 20, 1999 attempts to determine is there is adequate water available for Application 30627. Mr. Smith based his analysis on;

- the flow records of Chiles Creek collected by the City of Napa (City),
- an estimate of demand based on existing water rights and pending application,
- an estimated bypass flow equal to 60% of the estimated unimpaired average daily flow.

Mr. Smith states that the observed average daily discharge at the City's Chiles Creek gauge is 10.82 cubic feet per second (cfs). Apparently, Mr. Smith did not realize that the City's gauge measures the combined flow from Chiles Creek and Moore Creek, a major tributary of Chiles Creek that joins Chiles Creek approximately 1,070 feet upstream of Lake Hennessey as shown on the 7.5-minute USGS topographic map for the area. The basis for the assumption that Mr. Smith did not realize the City's gauge measured the combined flow of Moore and Chiles Creek are,

1. Mr. Smith states that the watershed area of Chiles Creek is 5,925 acres, whereas my own measurements indicate that the approximate watershed area of Chiles Creek, including Moore Creek, above Lake Hennessey is 10,400 acres.
2. The details of the calculations for a later *Water Availability Analysis*, dated February 23, 2001 state that,

> Since the City of Napa (City) flow gauge measures the total flow from Chiles Creek and Moore Creek watersheds, the flow data cannot be used.

So, Mr. Smith's estimate of 9,725 AF of unimpaired average annual flow applies to the entire watershed above the City's gauge and not to the smaller watershed of Chiles Creek above its confluence with Moore Creek.

Mr. Smith estimated the total demand from recorded water rights in the Chiles Creek watershed above the confluence with Moore Creek to be 1,905 acre-feet (AF). Mr. Smith's memorandum give the following support for is calculation of the demand.

> **Recorded Water Rights Demand**: According to records on file with the Division of Water Rights (Division), there are a total of 18 registered water rights within the Chiles Creek watershed, including 11 permitted/licensed applications, 3 pending applications (including 30627), 3 Statements of Water Diversion and Use and 1 Small Domestic Registration. The 11 permitted/licensed applications total 232 acre-feet (AF) in storage and 78 AF in direct diversion; the 3 statements total 1,585 AF and the Registration totals 10 AF, together, they total 1,905 AF. For the pending applications, 147 AF will be stored.
>
> All of the recorded water rights and the other pending applications – except Application 27962 and Statement 14151, which are immediately downstream on Chiles Creek – are upstream of Application 30627.

Mr. Smith calculated the bypass flow as 60% of the estimated unimpaired average annual discharge observed at the City's gauge or 5,835 AF. Mr. Smith calculated his estimate of the amount of water available for appropriation by subtracting the bypass from the observed annual average discharge and obtained 1,985 AF. However, as noted above, Mr. Smith's estimate applies to the entire watershed upstream of the City's gauge.

Note that there is no justification in Mr. Smith's memo supporting the use of 60% of the average annual discharge as the bypass flow. Mr. Smith's memo reflects the SWRCB position at the in August of 1999. In a later section of this letter I discuss the fact that there is no sound scientific basis for the bypass flows proposed by the SWRCB.

The following analysis adjusts Mr. Smith's analysis to apply to Chiles Creek above its confluence with Moore Creek. The first step in the adjustment process is to proportion the average annual flow observed at the City's Chiles Creek stream gauge to Moore Creek and Chiles Creek above the confluence.

I measured the watershed areas using digitized USGS 7.5-minute topographic maps and *Terrain Navigator* software from MapTech. I do not know the exact location of the City's gauge, however, it is known to be located downstream of the confluence of Moore Creek and Chiles Creek and upstream of Lake Hennessey. Inspection of the 7.5-minute topographic map for the area shows that there is a small intermittent stream just upstream of Lake Hennessey. Since the purpose of the City's gauge is to measure the total inflow from the Chiles Creek watershed, it is reasonable to assume that the gauge is located downstream of this small tributary. However, the exact location of the stream gauge is not critical to the analysis since the watershed area between Lake Hennessey and the confluence of Moore Creek and Chiles Creek is a small percentage of the entire watershed above the gauge. The Table 1 shows the watershed areas I measured and their percentage of the total watershed area.

Table 1. Distribution of watershed area above the City's stream gauge.

Watershed	Watershed Area acres	Percentage of Total Area
Between Lake Hennessey and the confluence	133	1.3%
Moore Creek	4,990	48.0%
Chiles Creek above the confluence	5,275	50.7%
Total Area =	10,398	100.0%

Mr. Smith's estimate of demand does not include any water rights on Moore Creek. Information from the SWRCB web site indicates that there are at least three water rights on Moore Creek (D029834R, C001086, License 8312) which total approximately 0.012 cfs, when the annual diversion to storage is converted into daily average flow.

Mr. Smith calculates that the total demand of Chiles Creek, upstream of the confluence with Moore Creek totals 1,905 AF or 2.63 cfs when converted to a daily average flow. Thus, the total water demand upstream of the City's gauge is approximately 2.64 cfs. The actual demand might be higher since there may be additional water rights on Moore Creek that I am not aware of.

The following table shows the result Mr. Smith would have obtained if he adjusted his calculations to reflect the watershed area upstream of the confluence of Chiles Creek and Moore Creek.

Table 2. Adjustment of Mr. Smith's estimate of the amount of water available for appropriation.

Watershed	Percent of Total Area	Unimpaired Flow AF	Water Demand AF	Average Annual Gauge Flow AF	Bypass as 60% of Average Unimpaired Flow AF	Estimated Amount Available for Appropriation AF
below confluence	1.3%	125		125	75	50
Moore Creek	48.0%	4,672	9	4,663	2,803	1,860
Chiles Creek above confluence	50.7%	4,939	1,905	3,034	2,963	70
Total Watershed above Lake	100.0%	9,735	1,914	7,821	5,841	1,980

After accounting for the distribution of watershed area upstream of the City's gauge and adding in an estimate of demand on Moore Creek, Mr. Smith's adjusted estimate results in only 70 acre-feet of water being available for appropriation from the Chiles Creek watershed upstream of the confluence with Moore Creek.

The *Water Availability Analysis* (WAA) dated February 23, 2001 for Applications 30627, 30725 and 30756 estimates the amount of water available for appropriation using a different method than Mr. Smith used. The WAA claims that the City's flow record for Chiles Creek cannot be used to estimate the average annual unimpaired flow (AAUF) since it includes the flow from Moore Creek. The WAA gives no evidence to support its claim that the City's flow record cannot be used to estimate the AAUF. The WAA estimates the AAUF from the rational method. The rational method estimates the flow by the following equation.

$$Q = C*I*A$$

Where Q is the total flow to be estimated in acre-feet, C is a runoff coefficient, A is the watershed area (acres) and I is the rainfall in feet. The WAA estimated an average annual rainfall of 37.5 inches (3.125 feet), for the portion of the Chiles Creek watershed upstream of its confluence with Moore Creek, from a contour map of average annual precipitation. The SWRCB estimate of C = 0.46 was derived from a procedure described in a manual developed by CalTrans to estimate C based on features of the landscape.

The average annual rainfall at Application 30627 was estimated by the SWRCB to be 37.5 inches per year. The City's rain gauge has an average annual precipitation of 28.7 inches. So, the SWRCB estimates that annual average rainfall at the location of Application 30627 is about 1.31 times the average annual rainfall at the City's gauge. Consequently, the SWRCB multiplied the February median rainfall at the City's rain gauge by 1.31 to estimate the February median rainfall at Application 30627. The ratio of 1.31 implies that is about 31% more average annual rainfall at the project site compared to the City's gauge.

Table 3 summarizes the calculations made in the WAA to estimate the amount of water available to appropriate at the four PODs for Application 30627 discussed in the WAA. Table 4 shows the value of the various parameters used in the rational method to make the calculation. In order to compare the three methods of estimating the amount of water available for appropriation, I applied the methodology of the WAA to the portion of the Chiles Creek watershed upstream of its confluence with Mill Creek. The estimate of available water for the portion of Chiles Creek above Moore Creek is shown in Table 3.

Table 5 compares the three estimates of the amount of water available to appropriate for the portion of Chiles Creek above Moore Creek.

Table 5. Comparison of the three estimates of the amount of water available to appropriate for the portion of Chiles Creek above Moore Creek.

Watershed	Mr. Smith's Flawed Estimate of Water Available to Appropriate AF	Adjusted Estimate of Water Available to Appropriate AF	WAA Estimate of Water Available to Appropriate AF
Chiles above Moore Creek	1,985	70	1,385

The WAA and Mr. Smith use significantly different estimates of demand, which is discussed in detail in a following section of this letter. The WAA and Mr. Smith's analysis also use significantly different values for the annual bypass flow. The WAA also uses significantly different estimates of the AAUF, when Mr. Smith's analysis is corrected for his incorrect assumption that the City's Chiles Creek flow record applied only to Chiles Creek above Moore Creek. The two SWRCB estimates of water availability for Chiles Creek above Moore Creek do not agree on any of the three key pieces of information used to make the estimate of water availability. This failure to use consistent information in the two SWRCB analyzes suggests that the SWRCB does not have a reliable estimate of the available water.

Comparison of the Estimates of AAUF

In 1974, S.E. Rantz of the U.S. Geological Survey created a contour map of runoff from portion of California surrounding the San Francisco Bay. The map is based on stream gauging data for the 1931-1970 water years. The USGS runoff map was prepared with the cooperation of the California Department of Water Resources, presumably in its effort to locate sources of water. The USGS has a solid reputation as a scientific research organization. So, the mean annual runoff estimated for any area on the map can assumed to be a reliable estimate.

Application 30627 is near the study area boundary of the USGS runoff map. Figure 1 shows approximate location of Application 30627 on the USGS runoff map. Application 30627 lies between the 9-inch and 10-inch runoff contours. So, approximately 9.5 inches of average annual runoff would be expected from the watershed upstream of Application 30627.

The majority of the Chiles Creek watershed above Moore Creek also appears to falls between the 9- inch and 10-inch runoff contours. So, approximately 9.5 inches of mean annual runoff would be expected for Chiles Creek above Moore Creek. My estimate of watershed area was 5,275 acres so 9.5inches of runoff (0.79-feet) would be equivalent to an average annual runoff of 4,176 acre-feet.

Table 6. Comparison of different estimates of the average annual unimpaired flow for Chiles Creek above Moore Creek.

	Mr. Smith's Flawed Average Annual Unimpaired Flow AF	Adjusted Average Annual Unimpaired Flow AF	WAA Average Annual Unimpaired Flow AF	USGS Runoff Map Average Annual Unimpaired Flow AF
Chiles above Moore Creek	9,725	4,939	8,626	4,175
Percentage of USGS Mean Annual Flow	232.9%	118.3%	206.6%	100.0%

Table 6 demonstrates that correcting Mr. Smith's method, based on the City's flow record, for the erroneous assumption that the City's stream gauge only measured the flow from the portion of Chiles Creek above Moore Creek, results in good agreement with the estimate from the USGS runoff map.

Contradictory Water Demand Values

The Water Availability Analysis (WAA), dated February 2, 2001 estimated that the total demand of upstream of Application 30627 was 415 acre-feet (AF). This number was obtained by adjusting the total face value demand shown in Table 2 of the WAA as 410.5 AF for the downstream diversions, the diversion of Application 30627 and converting the direct diversions of S006317 and S009619 to acre-feet.

A SWRCB memorandum to File Application 30627, from Hugh Smith, dated August 20, 1999 states that:

> **Recorded Water Rights Demand**: According to records on file with the Division of Water Rights (Division), there are a total of 18 registered water rights within the Chiles Creek watershed, including 11 permitted/licensed applications, 3 pending applications (including 30627), 3 Statements of Water Diversion and Use and 1 Small Domestic Registration. The 11 permitted/licensed applications total 232 acre-feet (AF) in storage and 78 AF in direct diversion; the 3 statements total 1,585 AF and the Registration totals 10 AF, together, they total 1,905 AF. For the pending applications, 147 AF will be stored.

Table 3. The WAA estimate of the water available for appropriation.

Watershed	WAA Estimate of Watershed Area acres	WAA Estimate of Average Annual Unimpaired Flow AF	WAA Estimate for Diversion Season Flow AF	Upstream Demand AF	WAA Estimate of February Median Flow AF	Bypass as 85% of Estimated February Median Flow AF	Bypass as 85% of Estimated February Median Flow cfs	WAA Estimate of Total Bypass Flow During Diversion Season AF	WAA Estimate of Water Available for Appropriation AF
Chiles Creek Above Moore Creek	6,001	8,626	5,435	491	1,106	940	17	3,559	1,385
POD-1	2,413	3,468	2,185		445	378	7	1,431	
POD-2	232	334	210		43	36	1	138	
POD-3	183	263	166		34	29	1	108	
POD-4	1,879	2,701	1,701		346	294	5	1,114	
Total AAUF for 30627		6,766	4,262	415	868	737	13	2,792	1,056

Diversion season is December 15 through March 31.

Table 4. Parameters used in the WAA calculation of water available to appropriate.

Parameter	SWRCB Value
Runoff Coefficient	0.46
Annual Average Rainfall City Rain Gauge	28.7
Annual Rainfall Chiles Watershed above Moore Creek	37.5
Chiles to City Ratio	1.31
February Median Rainfall at City gauge	3.68
Estimated February median Rainfall for Chiles Creek above Moore Creek	4.81

> All of the recorded water rights and the other pending applications – except Application 27962 and Statement 14151, which are immediately downstream on Chiles Creek – are upstream of Application 30627.

According to Table 2 of the WAA, Application 27962 is 26.5 AF, and Statement 14151 is 2 AF. So, the total diversion downstream of Application 30627 is 28.5 AF. Application 30627 is one of the three pending applications referenced in the memorandum. The demand of the other two pending applications is 98 AF. So, according to the memorandum from Hugh Smith, the total diversion upstream of Application 30627 is 1,905 – 28.5 + 98 = 1,974.5 AF. The 1999 memorandum shows 1,559.5 AF more water demand upstream of Application 30627. The SWRCB should explain the large discrepancy in their estimates of the total demand upstream of Application 30627.

Criticism of the WAA

The SWRCB's *Initial Study* does not explain why the rainfall record from Angwin Pacific College (Angwin) was not used in the *Water Availability Analysis*. The average annual rainfall at the Angwin rain gauge is about 40 inches. The estimated average annual rainfall at the project site (37.5 inches) is about 93% of that at the Angwin rain gauge. So, there is only a 7% difference between the Angwin rainfall and the average annual rainfall at the project site. Thus, it would appear that the Angwin rainfall data would be a more reliable indicator of the actual rainfall at the project site than the City's gauge.

Given the difficulty in estimating C and the unknown level of reliability of the choice for C, it seems prudent to check the runoff estimates from the rational method against the City's flow record for Chiles Creek. Table 6, above, essentially makes the comparison between the City's flow records and the SWRCB estimate based on the rational method. Table 6 also compares both these estimates to the USGS mean annual runoff map. The estimate based on the City's flow record compares favorably to the estimate based on the USGS runoff map.

Declare Chiles Creek above Moore Creek to be Fully Appropriated

The adjustment of Mr. Smith's estimate of water availability to account for his error in the portion of the watershed gauged by the City indicates that there is only 70 AF available for appropriation. The estimate 70 AF of available water is significantly less that the 410.5 AF of pending water rights demand listed in Table 2 of the WAA. Therefore, the SWRCB should either immediately declare Chiles Creek above Moore Creek fully appropriated during the period from December 15 through March 31 or should require an Environmental Impact Report (EIR) for all pending water right applications on Chiles Creek above Moore Creek.

No Scientific Basis for the Minimum Bypass Terms

The *Water Availability Analysis* (WAA) dated February 23, 2001 for Applications 30627, 30725 and 30756 states that the bypass flow for the above three applications were to be set to 85% of the February median unimpaired flow at each POD. The minimum bypass was requested in a May 19, 2000 memo from the Department of Fish and Game (DFG). A phone call to Bill Cox, DFG, on December 28, 2000 confirmed DFG's position that 85% of the unimpaired February discharge at each POD was acceptable for Application 30627.

The NOPND proposes minimum bypass terms, which are significantly lower than those calculated in the WAA. The WAA calculates the minimum bypass as 85% of the estimated unimpaired February median discharge at the POD under consideration. Table 1 shows the minimum bypass flows proposed in the NOPND, the bypass flows determined in the WAA and the difference between the sets of minimum bypass flows.

Table 1. The unexplained decrease in the bypass flows for Application 30627

Point of Diversion	Minimum Bypass Listed in the Proposed Negative Declaration	Minimum Bypass from Water Availability Analysis Estimated as 85% of February Median Flow	Unexplained Decrease in Bypass flow	Unexplained Percentage Decrease in Bypass flow
POD-1	3.16 cfs	6.8 cfs	-3.64 cfs	-53.5%
POD-2	0.31 cfs	0.7 cfs	-0.39 cfs	-55.7%
POD-3	0.15 cfs	0.5 cfs	-0.35 cfs	-70%
POD-4	None	5.3 cfs	-5.3 cfs	-100%

The Initial Study for Application 30627 states that the limit on the rate of diversion, diversion season and bypass were determined by negotiation between DFG, SWRCB and the applicant. The Initial Study does not offer any scientifically supported justification of why the minimum bypass flows were substantially decreased for all of the points of diversion. Negotiations between the applicant and employees of government agencies does not constitute a scientific basis for determining bypass flows design to protect fish and other aquatic organisms. The SWRCB should scientifically determine bypass flows that will adequately protect rainbow trout and other aquatic organisms and not rely on negotiations.

In fact, there is no sound scientific basis to DFG's original requested bypass of 85% of the unimpaired February median discharge at each POD. Bill Hearn of the National Marine Fisheries Service (NMFS) has proposed the unimpaired February median discharge as a minimum bypass flow for water diversions in California streams that support anadromous fish. However, NMFS has no field evidence that their guidelines for water diversions, including setting the bypass flow to the February median discharge does in fact protect all life stages of anadromous fish. The February median discharge does appear to provide a greater measure of protection for anadromous fish that other criteria advanced by the SWRCB. However, no documentation has been provided to the public that demonstrates that the use of the February median discharge to set bypass flows provides sufficient protection to anadromous species in all situations. For example, on a specific stream, it is possible that the February median discharge would not provide enough depth of flow to allow adult steelhead to migrate upstream at a particular location. Flow or discharge, in cubic feet per second, is computed as the product of the velocity of the water (feet per second) and the cross sectional area of the flow (square feet). The slope of the channel and the roughness of the channel determine the velocity. So, for a given discharge in a channel with fixed slope and roughness, if the width increases, then the depth of flow must decrease.

If the flow is diminished, say by a diversion, then the depth of the flow will be less than it was prior to the diversion. Each species of the salmonid family, including rainbow trout and steelhead, has its own minimum flow requirements to successfully migrate. Consequently, it is important to determine the minimum amount of flow to be released downstream of a diversion that will allow all life stages of migrating fish to freely move up or downstream.

Since the geometry of streams (width and depth of flow and the slope of the channel) is influenced by many factors, it is necessary to field inspect critical locations with wide shallow riffles to ensure that they are passable to migrating adult steelhead when the discharge equals the February median. Thus, in certain situations, the February median discharge may not provide enough flow to provide for unimpeded migration of steelhead.

DFG's May 19, 2000 request to set the 85% of the unimpaired February median discharge appears to be based on the NMFS guidelines for water diversions. According to Joan Jurancich, SWRCB, DFG records show that there were rainbow trout in Chiles Creek. Since the rainbow trout in Chiles Creek are probably descendants of anadromous steelhead trout that were land-locked by the construction of Conn Dam it is reasonable to expect that they would require the same bypass flows as steelhead. In her November 28, 2000 Contact Report, Joan Jurancich determined from a map that Moore Creek, a tributary of Chiles Creek would have a higher probability of supporting the rearing and spawning than in Chiles Creek. This is an irrelevant speculation. The important point to note is that DFG has records showing that rainbow trout have used Chiles Creek in the past. The need to speculate about which creek is more likely to support rainbow shows that SWRCB has failed to gather the physical information required to prepare the Initial Study for Application 30627. Given the historic presence of rainbow trout in Chiles Creek, SWRCB should assume that they are there or do the detailed fish sampling studies need to demonstrate that they are present or absent.

Even if it is *assumed* that the NMFS' recommendation of setting the minimum bypass flow to the February median discharge is, in general, reasonable, it is still necessary to verify, in the field, that the February median discharge is actually sufficient to protect rainbow trout in Chiles Creek. That is, special circumstances on Chiles Creek might reveal the need for a larger bypass flow. However, no justification of reducing the bypass flow to 85% of the median February discharge is given in the Initial Study.

Indeed, Table 2 shows that the bypass flows were reduced to a small fraction of the February median discharge. The Initial Study provides no sound scientific justification for the dramatic reduction of the proposed bypass flow to a fraction of the February median discharge.

The scientifically conservative approach is to assume that there are rainbow trout in Chiles Creek upstream of the junction with Moore Creek given that DFG has historic records indicating their presence (Joan Jurancich Contact Report, dated November 29, 2000). If SWRCB can not demonstrate that rainbow are absent then they must show that the proposed bypass flows, for the PODs of Application 30627, which have been substantially reduced from the February median discharge, will not impede the migration of rainbow trout to and from Lake Hennessey. Typically, this would require an assessment of the depth of water over any critical riffles when the stream flow equals the proposed bypass flow. The critical riffles should be identified by a qualified fisheries biologist. A critical riffle is a short relatively steep section of creek that has shallower and faster water than other locations in the creek channel and has the potential to become a barrier to the passage of fish at low flow. In addition, a qualified fisheries biologist should assess whether all of the culverts and stream crossings on Chiles Creek, between Lake Hennessey and the PODs, are passable at the proposed bypass flow.

Table 2. The proposed bypass flows are less than 45% of the estimated February median flow.

Point of Diversion	Minimum Bypass Listed in the Proposed Negative Declaration	Proposed Bypass as a Percentage of the Estimated February Median Flow
POD-1	3.16 cfs	39.4%
POD-2	0.31 cfs	40.1%
POD-3	0.15 cfs	24.7%
POD-4	2.8 cfs [1]	44.8%

[1] Bypass term reported in the *Hydrology* Section of the Environmental Checklist.

Consequently, the Initial Study has not demonstrated that the proposed bypass flows will protect rainbow trout. Therefore, the Initial Study's conclusion that no significant impacts will occur due to the diversions under Application 30627 is unjustified.

Ineffective Bypass Flows

Both POD-1 and POD-2 are diversion points for existing licensed water diversions. License 13300 has a bypass term that is less restrictive than the bypass proposed for POD-1 when it is diverting water for the Dollar Reservoir under Application 30627. The Environmental Checklist states that:

> POD-1 is the source for Lake Nancy, which is authorized by License 13300 (Application 27962), which includes the following bypass term:
>
> For the protection of fish and wildlife, licensee shall during the period: (a) from November 15 through December 31 bypass a minimum of 0.1 cubic-foot per second, and (b) from January 1 through April 30 bypass a minimum of 0.25 cubic-foot per second. The total flow will be bypassed whenever it is less than the designated amount.

License 13300 authorizes the diversion to storage of 26.5 acre-feet to Lake Nancy and an unnamed reservoir. License 13300 also authorizes a withdrawal of 15.9 acre-feet per year for diversion. Apparently, License 13300 does not set a maximum rate of diversion.

The NOPND proposes the diversion season to be December 15 through March 31 and proposes a minimum bypass of 3.16 cubic feet per second (cfs) for POD-1. There is no mechanism to ensure that the minimum bypass proposed for POD-1 under Application 30627 will be adhered to since the destination of the diverted water can be any of the reservoirs on the Dollar Ranch under the proposed piping arrangement. That is, the diversion for POD-1 could be operated under the terms of License 13300 even though the interconnected piping system allows the water diverted at POD-1 to be routed to the Dollar Reservoir.

The bypass at POD-1 is subject to the terms of License 13300 when the water is being delivered to Lake Nancy but the more restrictive bypass terms, proposed for Application 30627, would apply when the valves in the piping system are set to deliver water to Dollar Reservoir. In this situation, the position of valves in the plumbing system dictate the required bypass instead of the bypass being set based on the biological requirement of the aquatic community.

The interconnection of all of the reservoirs by a common piping system renders the minimum bypass at POD-1 ineffective. The co-mingling of the water diverted under Application 30627 and the two existing Licensees makes it impossible to enforce the bypass term for POD-1 under Application 30627. In fact, it may be impossible for the applicant to know which bypass term should be applied at a given moment to POD-1 during the diversion season.

The bypass flows, proposed for Application 30627, are intended to protect the aquatic community from any significant adverse impacts resulted from the water diversion. The arguments presented in the previous section of this letter demonstrate that the bypass flows that are proposed for Application 30627 are inadequate to protect rainbow trout. Therefore, it is clear that the less restrictive bypass flows that are required under License 13300 do not adequately protect rainbow trout.

Environmental Checklist describes POD-2 under Application 30627, which is also the POD for License 13301 as follows:

> POD 2 was constructed as the POD for the 12-acre-foot Catacula Reservoir (License 13301 [Application 29165]). It consists of a flashboard dam on an Unnamed Stream, which raises the level of water sufficiently to allow it to flow into a masonry regulatory box from which it is diverted by gravity pipeline to Catacula Reservoir. The maximum rate of diversion to offstream storage is given in License 13301 as 0.38 cubic feet per second.

Apparently, there is no minimum bypass flow for POD-2 under License 13301. License 13301 authorizes the diversion to storage in Catacula Reservoir of up to 12 acre-feet and the withdrawal of 4.8 acre-feet for irrigation.

The NOPND proposes the diversion season to be December 15 through March 31 and proposes a minimum bypass of 0.31 cubic feet per second (cfs) for POD-2. There is no mechanism to ensure that the minimum bypass proposed for POD-2 under Application 30627 will be adhered to since the destination of the diverted water can be any of the reservoirs on the Dollar Ranch under the proposed piping arrangement. The interconnection of all of the reservoirs by a common piping system renders the minimum bypass at POD-2 ineffective. The co-mingling of the water diverted under Application 30627 and the two existing Licensees makes it impossible to enforcement of the bypass term for POD-2 under Application 30627. In fact, it may be impossible for the applicant to know which bypass term should be applied at a given moment to POD-2 during the diversion season. The inability to enforce the proposed terms of Application 30627 may lead to adverse environmental impacts.

Allowing a the construction of a pipe system that interconnects all of the reservoirs on the Dollar Ranch makes it impossible for the State Water Resources Control Board (SWRCB) to monitor and potentially enforce the terms and conditions of Application 30627. In practice, the applicant may have no effective way of determining if s/he is complying with the terms of Application 30627. Therefore, Dollar Reservoir should be filled only from POD-3.

No Scientific Basis for the Maximum Diversion Rate

The NOPND proposed to set the maximum diversion rate for each POD and for all PODs under Application 30627 as follows:

> A term limiting the rate of diversion to storage from the PODs, both individually and cumulatively, will be included in any permit or license issued pursuant to Application 30627:
>
> For the protection of fish and wildlife, permittee shall limit the rate of diversion to no more than 1.0 cubic foot per second from any one POD and shall limit the combined rate of diversion from all four PODs to no more than 2.0 cubic feet per second.

The purpose of setting a maximum rate of diversion is to ensure that the stream below each POD will have a variable hydrograph that mimics the natural hydrograph. It is generally recognized that preservation of high flow events on small streams tends to promote the development of a biologic community composed of a diverse group of organisms. Sediment transport, particularly the fraction of material that is carried on the streambed (bedload), only occurs during high flow events. Sufficiently large flow events have the potential to mobilize thee upper portion of the streambed. During the process of bed mobilization, fine sediment that had been stored between the larger particles on the bed is washed away. Coarse bed material (stones greater than about 4 millimeters) which is relatively free of fine sediment provide the physical habitat preferred by a large number of macroinvertebrates such as stone flies and may flies. Macroinvertebrates are an important component of the food web, which supports the aquatic community in streams, including salmonids such as steelhead and rainbow trout.

If the number and magnitude of high flow events are reduced by an upstream diversion, then the fine sediment can build up in between the coarser particles of bed material. Only a few species of macroinvertebrates can tolerate high proportions of fine sediments in the bed of a stream. However, the species of macroinvertebrates eaten by salmonids favor bed material with a low proportion of fine sediments. Therefore, it is important to set a maximum diversion rate, which will ensure that the flushing action of high flows is not reduced.

Setting the same maximum diversion rate of 1.0 cfs for each POD under Application 30627 may not accomplish this goal. The watershed area above POD-1 (2,412.5 acres) is about 13.2 times the size of the watershed area above POD-3 (182.9 acres). Therefore, the 1.0-cfs maximum diversion rate will be a much higher percentage of the high flows at POD-3 than at POD-1. Thus, the potential for ecological damage resulting from a maximum diversion rate, which may be set too high, seems greater at POD-3 than at POD-1. The applicant has stated that POD-3 will be the primary POD for Application 30627. Thus, most of the diversion will occur at the POD with the smallest watershed area. Consequently, the SWRCB should demonstrate that the maximum diversion rate at POD-3 will protect the aquatic community.

The Initial Study for Application 30627 states that the limit on the rate of diversion, diversion season and bypass were determined by negotiation between DFG, SWRCB and the applicant. Negotiations between the applicant and employees of government agencies do not constitute a scientific basis for determining bypass flows design to protect fish and other aquatic organisms. The Initial Study does not offer any scientifically supported justification of the maximum diversion rates proposed for each of the points of diversion.

Therefore, the SWRCB must present evidence that the proposed maximum diversion rate for Application 30627 will not significantly harm the aquatic resources downstream of the various PODs, particularly below POD-3, before they can conclude that no significant impact will occur.

Arbitrary Selection of the UPTF

The upstream point of the target fishery (UPTF) was arbitrarily selected. Joan Jurancich, SWRCB, speculates that there may be a higher probability that Moore Creek provides more spawning and rearing habitat than Chiles Creek. Based on this speculation, Jurancich set the UPTF just above the confluence of Chiles Creek and Moore Creek. DFG records, however, show that there were rainbow trout in Chiles Creek, according to the November 28, 2000 *Contact Report* of Joan Jurancich. Given that rainbow trout were known to have been recorded in Chiles Creek, SWRCB should have conducted a field investigation to determine the actual UPTF.

The location of the UPTF plays a pivotal role in calculating the Cumulative Flow Impairment Index (CFII). The CFII is equal to the ratio of water demand to the water supply (CFII = Demand/Supply). The demand is the face value of all of the known water rights upstream, in acre-feet, of the UPTF. The supply is the unimpaired water available at the UPTF, in acre-feet.

Using the arbitrarily selected UPTF of just upstream of the confluence of Moore Creek with Chiles Creek given the maximum watershed area for the UPTF. Maximizing the watershed area maximizes the supply, since it is directly dependent on area. Maximizing the supply results in minimizing the CFII. The SWRCB calculated the CFII to be 5%.

Selecting the UPTF to be POD-1, an assumption that is as justifiable as the SWRCB selection of the confluence with Moore Creek, I calculate the CFII to be 90%. I the used demand upstream of Application 30627 presented in the August 1999 memorandum from Hugh Smith. I also used the proposed diversion season of December 15 through March 31 (63% of total annual rainfall according to page 5 of the WAA) instead of the October 1 to March 31 demand season used by the SWRCB. My estimate is significantly different from the estimate of the SWRCB, but is based on their data and methods. The arbitrary method of selecting the UPTF, the inappropriate use of the October 1 through March 31 demand season and the use of what appears to be an extremely low estimate of demand results in an artificially low CFII.

Cumulative Impacts

The Environmental Checklist in the *Initial Study* for Application 30627 asserts that there will be no cumulative impacts from the proposed diversion. The *Initial Study* does not offer any support for this conclusion. In fact, the proposed diversions will have a negative cumulative impact on steelhead, a federally listed species, in the Conn Creek below the dam and in the Napa River.

The City of Napa ships water to its customers through a pipeline. The only water that is released into Conn Creek is done either to meet bypass flow requirements, satisfy the claim of downstream protestants or because water went over the spillway.

An Order from the SWRCB in 1978 set certain bypass terms on the City of Napa's Conn Creek diversion. The hearing that resulted in the SWRCB Order pertaining to Permit 6960 was called after a downstream user complained that the City's releases to Conn Creek unreasonably interfered with the downstream user's vest riparian right. In addition, the Department of Fish and Game (DFG) also presented evidence at the 1978 hearing that the City's releases to Conn Creek were harming Public Trust resources.

In 1978, a hearing was held to determine if the City of Napa violated the terms of the Permit 6960 for the Conn Creek Dam. Jones and Garland prepared a report summarizing DFG's position for the hearing.

Permit 6960 allows the direct diversion of 35 cfs between November 1 and May 1 into Lake Hennessey for storage of 30,500 acre-feet per annum. Surface flows were to be measured above and below the dam and 10 cfs was to be released during the diversion period. All inflow into the reservoir was to be released between May and October. The Jones and Garland report states that DFG apparently was not invited to participate in the water application procedure. "As such, the permit terms do not reflect specific measures to protect or mitigate pre-project fish and wildlife values." Table 2 of the Jones and Garland report shows the mean number of days, by month, which the Conn Creek project was in violation of the terms of Permit 6960. The table shows that violations occurred in every month of the year and that violations occurred almost daily in October, November and December. The almost constant failure to release 10 cfs during the late fall and early winter would significantly reduce the high flow events in the Napa River, relative to pre-project conditions, that are responsible for attracting returning salmonids.

Jones and Garland go on to state:

> The Department of Fish and Game believes that the project by itself or in conjunction with other appropriations has reduced or modified streamflows to the detriment of fishery resources.
>
> Conn Dam was constructed without a fish ladder. Consequently, steelhead are deprived of 17 miles of the best spawning and rearing habitat in the drainage. Reduction of fish habitat downstream resulting from encroachment of vegetation is, in part, due to modification of streamflows by the project. We believe that the project, with reduced flows during the upstream migration and spawning period, has had an adverse affect upon steelhead populations using Conn Creek. Much of the upstream migration that normally followed periods of heavy storm runoff has been eliminated. Without adequate runoff, attraction and physical transport of the adult fish is questionable.

The report goes on to discuss the fact that salmonids need an adequate amount of water through out the year to complete their life cycle. This report also demonstrates that the failure to enforce the conditions of a permit can result in significant environmental impacts. It took 30 years for a hearing to be held to determine if the City of Napa was in violation of its water rights permit.

On June 26, 1998, a law firm representing the City of Napa filed a protest against Application 30627. The letter accompanying the protest gives a lengthy list of permit terms required by the City prior to its withdrawing of the its protest against 30627. Some of the requested permit terms establish a detailed monitoring program of the applicant's diversion under 30627. Other requested permit terms specify conditions that would require the applicant to release any water captured under Application 30627.

When taken together, the SWRCB Order require certain releases to Conn Creek to satisfy downstream protestants, the City's protest against Application 30627 and presence of steelhead, a federally listed species, all indicate that Application 30627 has a significant potential to decrease the City's ability to meet its Conn Creek release obligations.

The City's flow records provide the means to assess the impact of Application 30627 and all the other pending water right applications above Lake Hennessey on the City's ability to meet their required release to Conn Creek. In addition, DFG claims that the actual releases to Conn Creek are not sufficient to meet the needs of the public trust resources in Conn Creek, including steelhead.

The City of Napa has systematically failed to comply with the terms of their water right. The City's water right stipulates that a minimum of 10 cfs will be released to Conn Creek below the dam from November 1 to May 1. Application 30627 will reduce the flow into Lake Hennessey, therefore, it will directly contribute to the City of Napa's failure to release the required 10 cfs into Conn Creek below the dam during the November 1 to May 1 diversion period. As documented below, DFG believes the amount of water that the City of Napa actually releases into Conn Creek below the dam is inadequate to support steelhead, a federally listed species.

Enforcement of instream flow requirements is questionable at best. The case of the Conn Creek Dam illustrates that the existence of a permit term does not guarantee compliance with the term. In addition, as understanding of the natural world increases, it is not unusual to find that the real requirement of a species are actually different from what they were thought to be in the past. Thus, bypass requirements on water rights permits may not be adequate, by themselves, to prevent significant impacts to threatened species such as steelhead.

In light of the failure of the City of Napa to comply with their bypass requirement, and DFG's belief that the amount of water actually released into Conn Creek below the dam is inadequate to support steelhead, a federally listed species, the Initial Study for Application 30627 should have concluded that the proposed diversion would have a cumulative impact. Given that Application 30627 has a cumulative impact on a federally listed species, the Initial Study should have concluded that there is a Mandatory Finding of Significance for Application 30627. Hence, an Environmental Impact Report (EIR) must be developed for Application 30627.

Summary

- The project description, as given in the NOPND, appears to be incomplete since it does not mention the location of POD-4 and sets neither a minimum bypass nor a maximum diversion rate for POD-4.
- The co-mingling of the water diverted under Application 30627 and the two existing Licensees makes it impossible to enforcement of the bypass terms for POD1 and 2 under Application 30627. The inability to enforce the proposed terms of Application 30627 may lead to adverse environmental impacts. Dollar Reservoir should not be connected to POD-1 or POD-2.
- The Initial Study does not offer any scientifically supported justification of the maximum diversion rates proposed for each of the points of diversion. Evidence that the proposed maximum diversion rates will protect rainbow trout and other aquatic organisms must be presented before a finding of no significant impact can be made.
- The Initial Study has not demonstrated that the proposed bypass flows will protect rainbow trout. The proposed bypass flows are based on negotiations with the applicant and were not objectively determined to protect rainbow trout and other aquatic species. Therefore, the Initial Study's conclusion that no significant impacts will occur due to the diversions under Application 30627 is unjustified.
- The adjustment of the estimate of the amount of water available for appropriation presented in the August 1999 SWRCB memorandum demonstrates that there is no water available for Application 30627. Therefore, I request that the SWRCB declare Chiles Creek upstream of Moore Creek to be *Fully Appropriated* during December 15 through March 31 or that the SWRCB require an EIR for Application 30627 and all other pending applications on Chiles Creek above Moore Creek.

- The SWRCB should withdraw this NOPND and repeat the *Water Availability Analysis* using the City's flow records, the Angwin rainfall data and the USGS runoff map.
- Application 30627 has a cumulative impact on a federally listed species, the Initial Study should have concluded that an Environmental Impact Report (EIR) needs to be developed for Application 30627.

Conclusion

For all of the above reasons, an EIR must be prepared for Application 30627.

Sincerely,

Dennis Jackson

Dennis Jackson
Hydrologist

References:

Jones, Weldon E. and Wallace M. Garland, *Report to the State Water Resources Control Board Summarizing the Position of the Department of Fish and Game on Water Rights Permit 6960, Application 10990, Conn Creek, Napa County, California*, January, 1978.

Rantz, S.E., USGS map of the Mean Annual Runoff for the San Francisco Bay Region, California, 193-1970, USGS map MF-613, 1974.

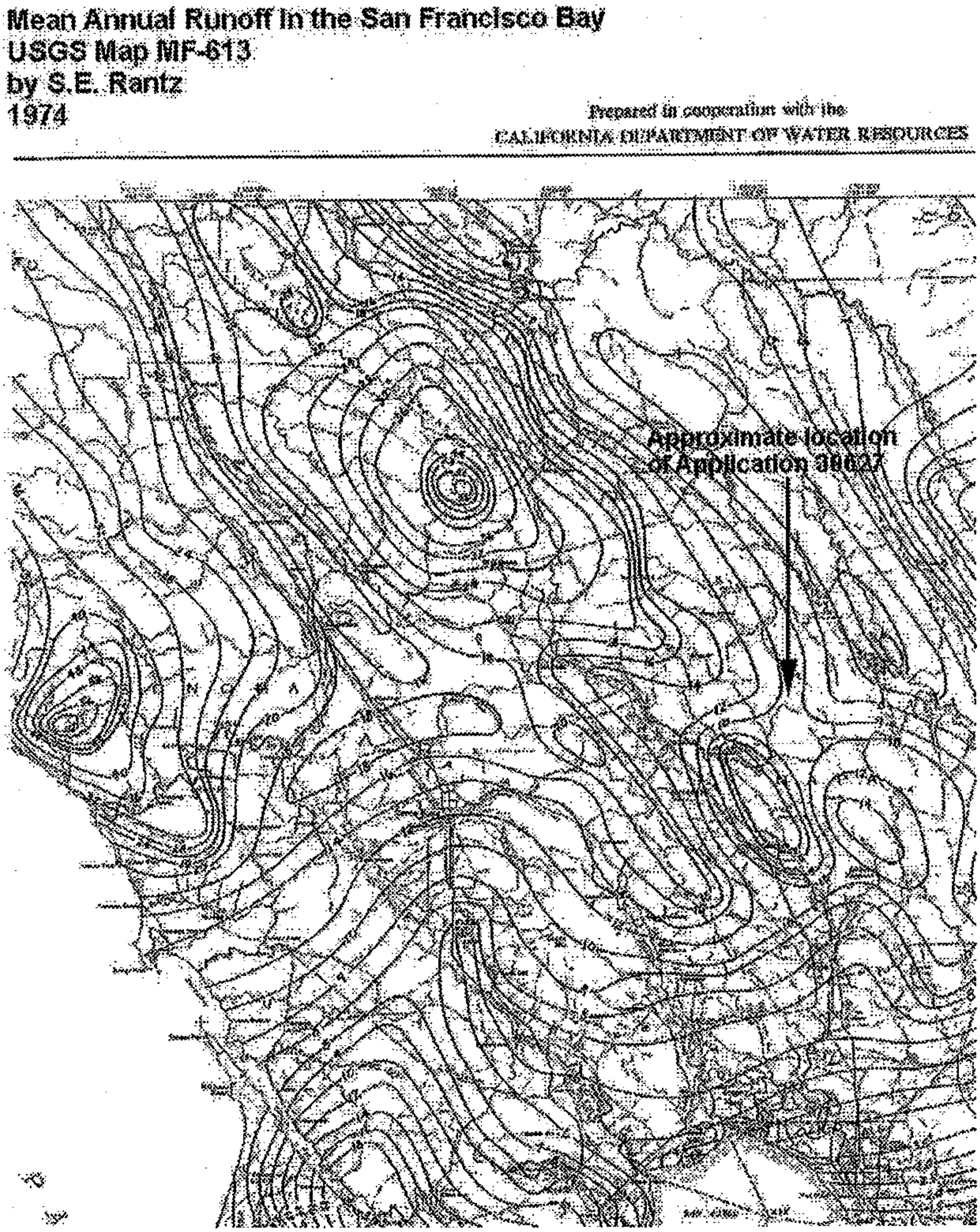

Figure 1. A portion of the 1974 USGS runoff map showing the approximate location of Application 30627. The project is between the 9 and 10 inch runoff contours.

Exhibit E

Law Offices of
THOMAS N. LIPPE

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Facsimile: 415-777-9809
Email:lippelaw@sonic.net

August 5, 2003

By Fed Ex Overnight Delivery
Mitchell Moody
Division of Water Rights
State Water Resources Control Board
1001 I Street, 14th Floor
Sacramento, CA 95814

RE: **Protest to Application to Appropriate Water by Permit (Application No. 31358 - Napa Valley Country Club)**

Dear Mr. Moody:

This office represents Earth Defense for the Environment Now ("EDEN") with respect to the Application to Appropriate Water by Permit, Application No. 31358, Napa Valley Country Club. EDEN submits this protest based on the legal and factual grounds set forth in detail below and in Exhibits 1-10 attached hereto. I have read the above referenced Application as well as the entire application file prior to submitting this protest. Based on the evidence submitted herewith, this Application to Appropriate Water will damage beneficial uses of water in the unnamed tributary to Sarco Creek, in Sarco Creek, and in the Napa River, particularly populations and habitat (including resources for feeding, sheltering and breeding) of several species of anadromous fish, including steelhead salmon. Moreover, the water diversion/use proposed by Application No 31358 will result in significant adverse environmental impacts and would violate the Public Trust Doctrine. Accordingly, EDEN respectfully requests that the SWRCB - Division of Water Rights deny Application No. 31358, or in the alternative, require the exclusive use of reclaimed water for Napa Valley Country Club's irrigation needs.

EDEN's mailing address is 1325 Imola Avenue, West PMB 614, Napa, CA 94559. However, all correspondence with EDEN relating to this protest should be directed to the Law Offices of Thomas N. Lippe at the address shown on the letterhead above.

EDEN served a true and correct copy of this letter and all its exhibits upon the applicant by U.S. Mail to: Napa Valley Country Club, c/o Drew L. Aspergren, 176 Main Street, St. Helena, CA 94574

I. Significant Adverse Environmental Impacts

A. Existing Environmental Setting in Napa River and its Tributaries

EDEN is concerned with the health of the Napa River Watershed as well as all the fish and wildlife that it supports. Once a vibrant and healthy watershed, the Napa River and its tributaries were home to significant populations of several species of anadromous fish, including steelhead and coho salmon. However, conditions are now very different in the Napa River and its tributaries, due primarily to a sea change in the environmental setting in the Napa River drainage and surrounding region over the last 15 years. Today, populations and habitat conditions for coho salmon and steelhead in this region have declined drastically, reaching a point where in 1996 (coho) and 1997 (steelhead), the National Marine Fisheries Service ("NMFS") listed local ESUs of these species as "threatened" under the federal Endangered Species Act. This occurred in the context of the State Water Board's identification of the Napa River as "water quality limited" under § 303(d) of the federal Clean Water Act due to excessive sedimentation and nutrient loading.

Clearly, two of the most significant factors contributing to the decline of coho and steelhead populations are (1) loss of water quantity due to water diversions; and (2) loss of water quality/degradation of habitat (e.g. excessive sedimentation and nutrient loading). These factors are identified in the listing decisions for the coho (Exhibit 1) and steelhead (Exhibit 2) and described in detail in the accompanying reports by Dennis Jackson (Exhibit 3 (decrease in stream flow)), Dr. Robert Curry (Exhibit 4 (increases in peak flow destabilizing stream banks and increasing downstream sedimentation)), Dr. Robert Abbot and Dr. Robert Coates (Exhibit 5 (changes in chemical and biological properties of streams)), as well as the SWRCB's own report on Russian River bypass flows (authored by Dr. Peter Moyle and Dr. Mathias Kondolf)(Exhibit 6), which applies equally to the Napa River. Accordingly, it is against this background that the current Application No. 31358 must be viewed and analyzed.

B. Cumulative Impacts

Knowing that water diversions have played a critical role in the decline of the threatened Coho and steelhead fisheries in the Napa River Watershed, EDEN believes that all new applications for water rights on the mainstem of the Napa River and its tributaries have the potential to result in significant cumulative impacts and should be carefully analyzed and reviewed through the preparation of an Environmental Impact Report. When considered in light of the numerous other water diversion projects on Sarco Creek and in the Napa River Watershed, and as documented in the Exhibits submitted herewith, it is clear that this application would cause significant adverse cumulative watershed effects, harming fish, wildlife and public recreation.

As a preliminary comment, EDEN has been frustrated by the complete lack of substantive information in the Application file upon which to base a comprehensive protest. Both the Application to Appropriate Water by Permit and Environmental Information documents submitted by the applicant contain minimal information about the project let alone any documentation that the water requested is even available during the collection season proposed. Moreover, despite the fact that both a Water Availability Analysis ("WAA") and a Cumulative Flow Impairment Index ("CFII") is typically required by the SWRCB for water rights applications in the Napa River Watershed, neither were submitted by the applicant with its application materials or otherwise included in the file. During a telephone conversation with Joan Jurancich from the SWRCB - Water Rights Division on July 31, 2003, it was learned that the SWRCB does not require the preparation/submission of a WAA and CFII until the CEQA mandated environmental review phase of the project. EDEN believes that in order to facilitate meaningful comments and critiques at the protest stage of an application (prior to CEQA environmental review), both a WAA and CFII must be prepared and available to the public. Otherwise, it is difficult for interested persons to properly protest a project by describing 'the objections to approval of the application and the factual basis for those objections' as required by the SWRCB. In addition to providing crucial information needed by persons to perfect their protests, early identification of water availability and cumulative flow impairment potential is beneficial to all involved and may save both the applicant and the state precious time and resources spent pursuing applications which may prove to be infeasible, in whole or in part, by such detailed hydrological data early on in the process.

Notwithstanding the absence of such WAA and CFII documents here, EDEN's consulting hydrologist, Dennis Jackson, has conducted a preliminary analysis of the CFII for this project that supports EDEN's claim that approval of Application No. 31358 is likely to result in significant adverse cumulative impacts to the Sarco Creek/Napa River watersheds and the threatened fish species supported by those waters. Mr. Jackson evaluated the potential cumulative effects of the water diversion proposed by Application No. 31358 by using the CFII formula and analysis set forth in the Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams ("Guidelines") prepared jointly by the National Marine Fisheries Service ("NMFS") and the California Department of Fish and Game ("CDFG") (Exhibit 7).

Using the total winter discharge (Dec 15-March 31) for neighboring Tulucay Creek, Mr. Jackson calculated estimated total average winter discharge from Sarco Creek, which when factored into the NMFS/CDFG formula for calculating CFII, yields an impairment index of 8.09% (July 31, 2003 letter from Dennis Jackson - Exhibit 8). Despite the fact that Mr. Jackson used only perfected water rights for Sarco Creek as of July 2000 in his calculations (thereby omitting all unpermitted diversions, diversions by riparian owners, and diversions permitted since 2000), the 8.09% CFII calculated for Sarco Creek signifies a real potential for significant cumulative impacts and requires the development of more detailed analysis pursuant to both the NMFS/CDFG Guidelines as well as the January 23, 2001 SWRCB - Division of Water Rights staff report entitled "Assessing Site Specific and Cumulative Impacts on Anadromous Fishery Resources in Coastal Watersheds in Northern California (Exhibit 9). Interestingly, Mr. Jackson notes that even without including the water diversion sought by Application No. 31358, the CFII for the Sarco Creek Watershed is currently approximately 7.5%, confirming an existing impairment to water quantity that will only be exacerbated by the appropriation proposed by Napa Valley Country Club.

Accordingly, based on the evidence submitted herewith, at a minimum, a thorough WAA and complete CFII, accompanied by a full Environmental Impact Report, must be prepared for this project, and due to the potential significant cumulative impacts of this and other water diversions, the SWRCB should deny Application No. 31358, or require Napa Valley Country Club to pursue a project alternative that would provide its golf course irrigation needs through the use of reclaimed water.

EDEN is not alone in believing that the use of reclaimed water at the Napa Valley Country Club is more appropriate than using water diverted from the Sarco Creek Watershed for the irrigation, recreation, fire and aesthetic purposes proposed by this application. In its July 25, 2003 protest of this Application No. 31358, the CDFG addresses the applicant's complete lack of information pertaining to the "availability of recycled water from the Napa Sanitation District as an alternative to diverting surface water" as a basis for its protest (Exhibit 10). In an August 4, 2003 telephone conversation with an employee (Adrian) at the Napa Sanitation District, I was told that reclaimed water is available in Napa and is currently being delivered to both the Napa Municipal Golf Course (Kennedy Park) as well as the Chardonnay Golf Club to supply water for the irrigation of those golf courses. The fact that reclaimed water is already being utilized for golf course irrigation in Napa suggests the feasibility of such an alternative water source in this case.

C. Impacts from Permitting of On-stream Reservoirs

1. NMFS/CDFG Guidelines

In its Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions; NMFS and CDFG include a number protective terms and conditions to be required of all diversions in order to protect and restore anadromous salmonids and their habitats. One of those protections is a prohibition on the permitting of small on-stream reservoirs which states:

> Water diversion projects requiring new permits should avoid construction or maintenance of on-stream dams and reservoirs, including existing unpermitted storage ponds. Thus, storage **must be to an off-stream reservoir**.

As justification for the prohibition against the construction or maintenance of on-stream reservoirs, the Guidelines state:

> On-stream reservoirs should be prohibited, because they 1) eliminate, within the reservoir footprint, free-flowing stream habitat that may either support listed salmonids or the production of riffle-dwelling aquatic invertebrates that serve as food sources for downstream fishes (Corrarino and Brusven 1983; Resh and Rosenberg 1984; Keup 1988), 2) eliminate or reduce the magnitude and frequency of naturally occurring intermediate and high flows necessary for natural channel maintenance processes, 3) trap course bedload material and impede bedload transport, 4) act as barriers to migrating fishes, and 5) provide habitat for non-native aquatic species (*e.g.* bullfrogs).

Despite this guidance from both NMFS and CDFG, the Napa Valley Country Club proposes to construct two reservoirs in the middle of an unnamed intermittent tributary to Sarco Creek. Those two reservoirs, each with a capacity to store 15 acre-ft per year, will block the free flow of the unnamed tributary during the winter rains, totally eliminating seasonal high flows as well as trapping and impeding the transport of coarse bedload material to the detriment of downstream channels and fishes. EDEN agrees with NMFS and CDFG that such impacts are significant and adverse, and that if Application No. 31358 is permitted, the proposed reservoirs must be moved out of the bed and banks of the unnamed tributary. While the NMFS/CDFG Guidelines do include a limited exception to the prohibition against on-stream reservoirs, it is clear that without more analysis, particularly data proving that "the project will not contribute to a **cumulative** reduction of more than 10% of the natural instantaneous flow in any reach where fish are at least seasonally present," the proposed on-stream reservoirs will result in significant adverse environmental impacts.

2. Clean Water Act Section 402 and 404 Jurisdiction

In the Environmental Information document submitted with Application No. 31358, Napa Valley Country Club responds to questions regarding applicable County, State and Federal permit requirements by stating that both a Napa County Grading Permit and a CDFG 1603 (stream alteration) Permit are required for the proposed project. However, it appears that Napa Valley Country Club may have overlooked the fact that the discharge of pollutants and/or dredge and fill material into the waters of the United States may require a Clean Water Act ("CWA") Section 402 and/or 404 permit as well.

Obviously, in order to create the two reservoirs proposed in Application No. 31358 (Lake F and Lake G), Napa Valley Country Club will have to construct some sort of barrier to the flow of the unnamed tributary in question by placing fill material into the stream. Pursuant to the federal CWA, such activities which discharge a pollutant into the waters of the United States trigger the permit requirements of that act. Even discharges into intermittent tributaries can trigger CWA section 402 and 404 permit requirements, so long as the intermittent waterway exchanges water with, and is a tributary to other natural and navigable streams. *See* 40 C.F.R. § 230.3(s)-(t); 33 C.F.R. § 328.3; *Headwaters v. Talent Irrigation District* (9th Circuit 2001) 243 F.3d 526; *Community Association for the Restoration of the Environment v. Henry Bosma Dairy* (9th Cir. 2002) 305 F.3d 943. In the *Headwaters* case, the 9th Circuit Court stated:

> Pollutants need not reach interstate bodies of water immediately or continuously in order to inflict serious environmental damage... It makes no difference that a stream was or was not at the time of the spill discharging water continuously into a river navigable in the traditional sense. Rather, as long as the tributary would flow into the navigable body during significant rainfall, it is capable of spreading environmental damage and is thus a "water of the United States" under the Act.

Headwaters, supra, 243 F.3d at 534, *citing United States v. Eidson,* (11th Circuit 1997) 108 F.3d 1336.

Accordingly, it is clear that the reservoir construction activities proposed by Application No. 31358 may trigger a number of federal CWA permit requirements, including an NPDES permit pursuant to CWA § 402 and a dredge and fill permit pursuant to CWA § 404, and that the appropriate agencies must be consulted by the applicant in this regard.

D. Impacts to Groundwater Resources

The Napa Valley Country Club and the portion of the Sarco Creek Watershed in which it is located sit atop the Milliken/Sarco/Tulocay ("MST") groundwater basin. That aquifer has been recognized by both the County of Napa as well as the United States Geological Service as a groundwater deficient basin (Exhibit 11). As Application No. 31358 proposes to divert and impound 30 Acre-ft per year from an unnamed tributary to Sarco Creek, water that currently flows naturally within the Sarco Creek Watershed, the proposed diversion may adversely impact the MST basin by reducing the amount of water available to recharge the underground basin. Most of the known and mapped sites of streambed infiltration recharge of the MST Aquifer are located upstream of the project along the boundary of the aquifer due to the geologic uplift that marks that boundary. However, due to the highly fractured nature of the MST Aquifer, it is reasonable to conclude that not all infiltration recharge zones have been identified or mapped. Therefore, EDEN opposes the appropriation proposed in this case and requests that the applicant or SWRCB thoroughly evaluate impacts to the MST basin caused by this project, including a survey for any unmapped aquifer recharge zones downstream of the project.

II. Violation of Public Trust Doctrine

In addition to its duties to identify, analyze and mitigate significant environmental impacts pursuant to the California Environmental Quality Act, the SWRCB also has a duty to preserve public trust property from impacts pursuant to the Public Trust Doctrine. Under the Public Trust Doctrine, the SWRCB, "as trustee, has a duty to preserve [public] trust property from harmful diversions by water rights holders." *United States v. State Water Resources Control Board* (1986) 182 Cal.App.3d 82, 106. Approving Application No. 31358 would contravene this duty, by allowing a diversion and impoundment of water by the applicants that would cause significant harm to the Napa River Watershed and the fish, wildlife and public recreation dependent on this river system.

The SWRCB recently applied its duty to preserve public trust property from harmful diversions by reducing the water rights of existing permits and licenses for the protection of fish species and habitat in the Yuba River Watershed. In Revised Water Right Decision 1644 (*see* http://www.waterrights.ca.gov/hearings/decisions/RevisedWRD1644.pdf), the SWRCB recognized the origins of its public trust duty by stating:

> The State Water Resources Control Board has broad authority to establish minimum flows and take other measures needed for protection of fisheries and other public trust resources. That authority is provided by article X, section 2 of the California Constitution, Water Code sections 100 and 275, the public trust doctrine as articulated by the California Supreme Court in *National Audubon Society v. Superior Court* (1983) 33 Cal.3d 419 [189 Cal. Rptr. 346], and Water Code sections 1243 and 1253.

Pursuant to the authority vested in the SWRCB by the California Constitution, Water Code §§ 100, 275, 1243, 1253 and *National Audubon*, it is not only appropriate, but necessary that the SWRCB deny Application No. 31358 which will deter the preservation and enhancement of fish and wildlife resources in the Sarco Creek/Napa River Watersheds (a beneficial use). The SWRCB has a duty to the citizens of the state of California to protect and preserve such beneficial uses, a duty which in this case, requires it to elevate the rights of the general public in the preservation of its endangered species over the rights of a select few to additional water resources to be used for exclusive land based recreational activities.

III. Conclusion

Without the detailed analysis that would be provided by a Water Availability Analysis, Cumulative Flow Impairment Index and an Environmental Impact Report prepared pursuant to the California Environmental Quality Act, EDEN is willing to dismiss its protest of Application No. 31358 only if the application to divert from the Sarco Creek Watershed is dropped in favor of the use of reclaimed water.

Thank you for your attention to this matter.

Very Truly Yours,

Stephen E. Velyvis
Attorney for Protestant EDEN

cc: Applicant

List of Exhibits

1. National Marine Fisheries Service Endangered and Threatened Species: Threatened Status for Central California Coast Coho Salmon Evolutionary Significant Unit (ESU) Final Rule Fed. Reg. Vol. 61, No. 212, page 56138. October 31, 1996

2. National Marine Fisheries Service Endangered and Threatened Species: Listing of Several Evolutionary Significant Units (ESUs) of West Coast Steelhead Final Rule Fed. Reg. Vol. 62, page 43937. August 18, 1997

3. Dennis Jackson letter to Tom Lippe. January 28, 2001

4. Cumulative Effects of Conversion of Upland Woodlands and Chaparral to Vineyards Report prepared by Robert R. Curry, PhD. December 24, 2000.

5. Expert Witness Report: Cumulative Impacts on Fisheries Resources from Intensive Viticulture Practices in Napa County, CA prepared by Robert R. Abbot, PhD., and Robert N. Coats, PhD. February 1, 2001

6. Fish Bypass Flows for Coastal Watersheds: A Review of Proposed Approaches for the State Water Resources Control Board prepared by Peter B. Moyle and G. Mathais Kondolf. June 5, 2000

7. Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams prepared jointly by the California Department of Fish and Game and the National Marine Fisheries Service. June 17, 2002 (errata note, dated 8-19-02)

8. Dennis Jackson letter to Stephen Velyvis. July 31, 2003

9. Assessing Site Specific and Cumulative Impacts on Anadromous Fishery Resources in Coastal Watersheds in Northern California, SWRCB staff report. January 23, 2001

10. July 25, 2003 protest of Water Application 31358, Robert W. Floerke, Regional Manager of the Central Coast Region of the California Department of Fish and Game

11. Evaluation of Groundwater Impacts from the Proposed Palmaz Winery, HSI Hydrologic Systems. February 8, 2001

12. NMFS California Anadromous Fish Distributions, California Coastal Salmon and Steelhead, Current Stream Habitat Distribution Table. January 2000

EXHIBIT J

FEDERAL REGISTER
Vol. 61, No. 212

Rules and Regulations

DEPARTMENT OF COMMERCE (DOC)
National Oceanic and Atmospheric Administration (NOAA)
National Marine Fisheries Service (NMFS)

50 CFR Part 227

[Docket No. 950407093-6298-03; I.D. 012595A]

Endangered and Threatened Species; Threatened Status for Central California Coast Coho Salmon Evolutionarily Significant Unit (ESU)

61 FR 56138

DATE: Thursday, October 31, 1996

ACTION: Final rule.

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--[*56138]

SUMMARY: NMFS is issuing a final determination that the Central California coast coho salmon ESU (Oncorhynchus kisutch) is a "species" under the Endangered Species Act (ESA) of 1973, as amended, and that it will be listed as a threatened species.

In the 1940s, estimated abundance of coho salmon in this ESU ranged from 50,000 to 125,000 native coho salmon. Today, it is estimated that there are probably less than 6,000 naturally-reproducing coho salmon. The threats to naturally-reproducing coho salmon are numerous and varied. In the Central California coast ESU, the present depressed condition is the result of several human caused factors (e.g., habitat degradation, harvest, water diversions, and artificial propagation) that exacerbate the adverse effects of natural environmental variability from drought and poor ocean conditions. Existing regulatory mechanisms are either not adequate or not being adequately implemented to provide for the conservation of the Central California coast coho ESU.

The taking of this species is prohibited, pursuant to section 4(d) and section 9 of the ESA. Certain exceptions to this taking prohibition pursuant to section 10 are provided. The taking prohibitions go into effect as provided in § 227.21.

EFFECTIVE DATE: December 2, 1996.

ADDRESSES: Craig Wingert, NMFS, Southwest Region, Protected Species Management Division, 501 W. Ocean Blvd., Suite 4200, Long Beach, CA 90802-4213, telephone (310/980-4021); or Marta Nammack, NMFS, Office of Protected Resources, 1315 East-West Highway, Silver Spring, MD 20910, telephone (301/713-1401).

FOR FURTHER INFORMATION CONTACT:

Craig Wingert, telephone (310/980-4021), or Matra Nammack, telephone (301/713-1401).

SUPPLEMENTARY INFORMATION:

EXHIBIT 6

Background

The coho salmon (Oncorhynchus kisutch) is an anadromous salmonid species that was historically distributed throughout the North Pacific Ocean from central California to Point Hope, AK, through the Aleutian Islands, and from the Anadyr River, Russia, south to Hokkaido, Japan. Historically, this species probably inhabited most coastal streams in Washington, Oregon, and northern and central California. Some populations, now considered extinct, and believed to have migrated hundreds of miles inland to spawn in tributaries of the upper Columbia River in Washington, and the Snake River in Idaho.

In contrast to the life history patterns of other anadromous salmonids, coho salmon on the west coast of North America generally exhibit a relatively simple 3-year life cycle. Adults typically begin their freshwater spawning migration in the late summer and fall, spawn by mid-winter, and then die. Run and spawn timing of adult coho salmon vary between and within coastal and Columbia River Basin populations. Depending on river temperatures, eggs incubate in "redds" (gravel nests excavated by spawning females) for 1.5 to 4 months before hatching as "alevins" (a larval life stage dependent on food stored in a yolk sac). Following yolk sac absorption, alevins emerge from the gravel as young juveniles, or "fry," and begin actively feeding. Juveniles rear in fresh water for up to 15 months, then migrate to the ocean as "smolts" in the spring. Coho salmon typically spend two growing seasons in the ocean before returning to their natal streams to spawn as 3 year-olds. Some precocious males, called "jacks," return to spawn after only 6 months at sea.

During this century, indigenous, naturally-reproducing populations of coho salmon are believed to have been eliminated in nearly all Columbia River tributaries and to be in decline in numerous coastal streams in Washington, Oregon, and California. Coho in at least 33 stream/river systems have been identified by agencies and conservation groups as being at moderate or high risk of extinction. In general, there is a geographic trend in the status of west coast coho salmon stocks, with the southernmost and easternmost stocks in the worst condition.

Consideration as a "Species" Under the ESA

The ESA defines a "species" to include any "distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." NMFS published a policy describing how it would apply the ESA definitin of a "species" to anandronous salmonid species *(56 FR 58612,* November 20, 1991). More recently, NMFS and the U.S. Fish and Wildlife Service (FWS) published a joint policy, consistent with NMFS' policy, regarding the definition of distinct population segments *(61 FR 4722,* February 7, 1996). The earlier policy is more detailed and applies specifically to Pacific salmonids and, therefore, was used for this determination. This policy indicates that one or more naturally reproducing salmonid populations will be considered distinct, and hence species under the ESA, if they represent an ESU of the biological species. To be considered an ESU, a population must satisfy two criteria: (1) It must be reproductively isolated from other population units of the same species, and (2) it must represent an important component in the evolutionary legacy of the biological species. The first criterion, reproductive isolation, need not be absolute, but must have been strong enough to permit evolutionarily important differences to occur in different population units. The second criterion is met if the population contributes substantially to the ecological/genetic diversity of the species as a whole. Guidance on the application of this policy is contained in a scientific paper "Pacific Salmon (Oncorhynchus spp.) and the Definition of Species' Under the Endangered Species Act" and a NOAA Technical Memorandum "Definition of Species' under the Endangered Spcies Act: Application to Pacific Salmon." NMFS' proposed listing determination and rule *(60 FR 38011,* July 25, 1995) for west coast coho salmon and the west coast coho salmon status review (Weitkamp et al., 1995) describe the genetic, ecological, and life history characteristics, as well as human-caused genetic changes, that NMFS assessed to determine the number and geographic extent of coho salmon ESUs.

Previous Federal ESA Actions Related to Coho Salmon Listing

The history of petitions received regarding coho salmon is summarized in the proposed rule published on July 25, 1995 *(60 FR 38011).* The most comprehensive petition received was from the Pacific Rivers Council and 22 co-petitioners on October 20, 1993. In response to that petition, NMFS assessed the best available scientific and commercial data, including technical information from Pacific Salmon [*56139] Biological and Technical

Committees (PSBTCs) in Washington, Oregon, and California. The PSBTCs consisted of scientists (from Federal, state, and local resource agencies, Indian tribes, industries, professional societies, and public interest groups) with technical expertise relevant to coho salmon.

NMFS established a Biological Review Team (BRT), comprised of staff from its Northwest Fisheries Science Center and Southwest Regional Office, and completed a coastwide status review for coho salmon (NOAA Technical Memorandum, September 1995, entitled: "Status Review of Coho Salmon from Washington, Oregon, and California" [Weitkamp et al., 1995]).

Based on the results of the BRT report, and after consideration of other information and a review of existing conservation measures, NMFS published a proposed listing determination *(60 FR 38011,* July 25, 1995) which identified six ESUs of coho salmon ranging from southern British Columbia to central California. The Olympic Peninsula ESU was found to not warrant listing; the Puget Sound/Strait of Georgia ESU and the lower Columbia River/southwest Washington coast ESU were identified as candidates for listing; and the Oregon Coast ESU, Southern Oregon/Northern California ESU, and Central California coast ESU were proposed for listing as threatened species.

Pursuant to section 4(b)(6)(B)(i), NMFS may make a finding "that there is a substantial disagreement regarding the sufficiency or accuracy of the available data relevant to the determination" and, on that basis, may extend the 1-year period for up to 6 months to solicit and analyze additional data. NMFS has concluded that a 6-month extension is warranted for the Oregon Coast and Southern Oregon/Northern California ESUs. For NMFS' determination on the 6-month extension, see the Notices section of this Federal Register.

Summary of Comments Regarding the Central California Coast Coho ESUs

NMFS held two public hearings in California (Rohnert Park and Eureka) to solicit comments on the proposed listing determination for west coast coho salmon. Forty-seven individuals presented testimony at the hearings. During the 90-day public comment period, NMFS received 17 written comments on the proposed rule from state, Federal, and local government agencies, Indian tribes, non-government organizations, the scientific community, and other individuals. Of the comments received, 35 supported the listing and 5 opposed the listing. The majority of comments (44) addressed factors for the decline of coho salmon. Twenty-two commenters stated that existing regulatory mechanisms, including enforcement, were inadequate to protect coho salmon and their habitats. A summary of major comments received during the public comment period and public hearings, grouped by major issue categories, is presented below.

Issue 1: Sufficiency of Scientific Information

Many commenters urged NMFS to use the best available scientific information in reaching a final determination regarding the risk of extinction faced by coho ESUs in California. All but one commenter supported the scientific conclusions reached by NMFS. This commenter specifically questioned the data used to determine the risk of extinction of coho salmon in the Russian River Basin.

NMFS is required under section 4(b) of the ESA to use only the best scientific and commercial data available in making a determination. However, the available information regarding the historic and present abundance of coho salmon throughout the Central California coast coho salmon ESU is limited. NMFS' 1995 west coast salmon status review (Weitkamp et al., 1995), together with recent information collected by NMFS scientists and information provided to NMFS by other sources since the proposed listing determination was published, represent the best scientific information presently available for coho salmon populations in the Central California coast ESU. This information indicates that coho salmon in the southern portion of the ESU (south of San Francisco Bay) are severely depressed, though most of the coho production within this ESU originated from coastal watersheds north of San Francisco Bay (CDFG, 1991). Nehlsen et al. (1991) provided no information on individual coho salmon in central California but identified coho in streams and rivers north of San Francisco as being at moderate risk of extinction and those south of San Francisco as being at high risk of extinction. Higgins et al. (1992) considered only drainages from the Russian River north and identified four coho salmon stocks within the central California coast ESU as being at risk (three of special concern and one, the Gualala River, as being at a high risk of extinction). The most comprehensive review of coho salmon in California was conducted by Brown and Moyle (1991) and summarized by Brown et al. (1994). They reported that coho in California have declined or disappeared from all streams in which they were historically recorded.

Issue 2: Status of the Central California Coast Coho ESU

Forty comments received by NMFS addressed the status of California coho salmon populations. The vast majority of the comments (91 percent) stated that the Central California coast ESU should be listed as endangered based on the scientific information available and presented in the state and federal status reviews. The remaining commenters stated coho salmon in central California should be listed as threatened, primarily based on conservation efforts currently being implemented.

In determining the status of the Central California coast coho ESU under the ESA, NMFS considers both the scientific information on the status and risk faced by the ESU. In assessing the risk of extinction faced by a species, NMFS considers "those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species" *(16 U.S.C. 1533*(b)(1)(A); 50 CFR 424.11(f)).

Based on a review of the status of coho south of San Francisco (Anderson, 1995), the California Fish and Game Commission decided to list coho south of San Francisco as endangered under the California ESA (CESA), effective January 1, 1996. The California Department of Forestry (CDF) and the California Department of Fish and Game (CDFG) have implemented protective measures for coho salmon stocks and their habitats south of San Francisco Bay which represent an improvement over the existing forest rules and practices.

NMFS thinks that the State's efforts to protect coho south of San Francisco may prove to be effective in mitigating adverse impacts, but it is premature to conclude that they reduce the risk facing the species to such an extent that the determination would be different. In the remainder of the ESU, NMFS has collected information indicating that coho are present in streams in which they were not previously reported historically and from which they had been reported to have been extirpated (Adams, 1996; August 27, 1996, Memorandum A. MacCall to H. Diaz-Soltero). In addition, a number of water-shed groups are involved in restoration projects within this ESU, and steps have been taken by the Pacific Fishery Management Council (PFMC) and NMFS to curtail the adverse effects of ocean fishing. Therefore, NMFS has determined that, even though the [*56140] absolute numbers of fish in this ESU are low, the ESU is not in imminent danger of extinction, and it is appropriately designated as threatened.

Issue 3: Factors Contributing to the Decline of Coho Salmon in California

Forty-four comments addressed factors regarding the decline of coho salmon and the damage or loss of their habitats. Thirty-eight individuals commented on the degraded, blocked, fragmented, and generally poor quality of coho salmon habitat; 24 cited the adverse effects of logging, and 11 discussed adverse effects of agricultural activities on coho salmon and their habitats; 21 commented that poor water quality conditions, primarily excessive warm water temperatures, were outside the preferred range for salmonids during the summer; 19 indicated that point and non-point source pollution including sedimentation, municipal and industrial effluent, and herbicides/pesticides, have contributed to the decline of the species; 8 commented that hatchery practices, primarily excessive out-of-basin plantings, disease, and competition with natural fish for food and space, have contributed to the decline of the species; 7 commented that excessive fishing had occurred; 6 commented that past and present mining activities have contributed to the decline of the species; 6 commented that urbanization activities have contributed to the decline of the species; 5 commented that there has been increased predation on coho salmon from pinniped, fish, and avian predators; and two commented on the effects that drought (e.g., 1976-77 and 1986-92) has had on coho salmon populations in California.

NMFS agrees with the commenters that many factors, past and present, have contributed to the decline of coho salmon. New information provided by commenters and responses to this information have been incorporated in the Summary of Factors Affecting Coho Salmon.

Issue 4: Existing Regulatory Mechanisms

Two commenters acknowledged that past timber and mining activities contributed to the decline of coho salmon but maintained that existing regulatory mechanisms (e.g., the California Forest Practices Act (CFPA), Clean Water Act (CWA), mining regulations) and review processes are sufficient for the protection of coho salmon and their habitats. Twenty-two commented that existing regulatory mechanisms (e.g., CFPA and CWA), including enforcement, and inadequate to protect coho salmon and their habitats.

Several commenters stated that current logging practices have dramatically improved over those of the past, decreasing the impact of present-day logging on habitat. Present-day logging practices have improved over those of the past; however, timber harvest is still a major land use in the Central California coast ESU, and fish habitat is still recovering from past logging practices. In addition, the incremental impacts of present-day land management practices, when added to impacts of past land management practices and other risk factors, continue to pose a serious threat to Central California coast coho.

Although several commenters describe the CFPA as being capable of protecting coho salmon and their ecosystems, little evidence has been provided to support these claims. While the CFPA attempts to achieve fish habitat protection by establishing "Water and Lake Protection Zones," there is no substantive body of evidence to demonstrate that the level of protection is sufficient to conserve the anadromous fish habitat and ecosystems upon which coho salmon in the Central California coast coho salmon ESU depend. Neither has the CWA been used to its full potential. Seventeen water bodies in central and northern California have been designated as impaired under section 303(d) of the CWA, and the Environmental Protection Agency has been sued for failure to develop Total Maximum Daily Load (TMDL) standards for these waterbodies.

Comments Received After the Close of the Comment Period

On September 27, 1996, the California Resources Agency requested NMFS to reopen the comment period and extend its decision date for 6 months because (1) there was substantial disagreement between scientists as to the sufficiency and accuracy of the data upon which NMFS was relying to make a determination; (2) during the 1996 field season, fisheries biologists obtained significant new information which, once complied, may influence NMFS' decision; (3) NMFS has not had an opportunity to evaluate the cumulative effects of the variety of efforts by landowners in California to complete multi-species Habitat Conservation Plans (HCPs) and sustainable yield plans (SYPs) under the California Forest Practice Rules (CFPRs); and (4) NMFS has not thoroughly evaluated the protections for coho salmon provided under the CFPRs and other existing State protective programs.

The California Resources Agency cites Oregon's recent submission to NMFS on the role of ocean survival in judging coho population viability as a basis for disagreement in California. While the results of these modeling exercises and additional population viability analysis relative to Oregon may be broadly applicable to California, California does not have available the underlying information of stock abundance that Oregon has to support its claim. Information in California, over which there is no scientific debate, indicates that coho are severely depressed and that they have been eliminated from nearly half of the streams in which they occurred historically.

The California Resources Agency claims that data being developed since the close of the comment period calls into question the accuracy and sufficiency of the information currently in the administrative record. Since the close of the comment period, NMFS has collected additional information indicating that coho are present in streams in which Brown and Moyle (1991) found none, and NMFS has received new information from landowners indicating that new coho sites have been identified. NMFS has incorporated most of the information provided in the State's letter in its deliberations on this rule. This new information did not substantially alter this final determination or the reasons upon which it is based.

The California Resources Agency also suggests that NMFS would benefit from waiting to evaluate the results of HCPs and SYPs that are being developed by large timber landowners. While NMFS is encouraged by these activities and intends to pursue these HCPs, NMFS cannot defer a listing based on the prospect of future development of conservation measures. NMFS' determination must be based on the best available information after consideration of state and other efforts to protect the species. These HCPs and other planned conservation efforts are still in the developmental phase and, therefore, cannot be considered to reduce the risks facing the species at this time. Neither does the promise of a plan constitute a scientific disagreement, thus, despite NMFS' support of these plans, they do not constitute a basis for delay.

Lastly, the California Resources Agency claims that NMFS has not evaluated the CFPRs. NMFS has reviewed these rules and determined that they are not being adequately implemented. While the CDFG commented during the comment period in support of the proposed rule, the CDF did not. Further, the Board of Forestry rejected efforts of the CDFG to designate [*56141] coho as a sensitive species and develop special protective measures for coho habitat. Nonetheless, NMFS is involved in discussions with the CDF to determine how to improve implementation of the CFPRs. While the CFPRs contain measures protective of watercourse and lake protection zones, they allow activities in those zones that are harmful to coho habitat. The CFPRs also contain exceptions that allow salvage without environmental review or monitoring. However, as with the HCPs under development, disagreement over the effectiveness of the State program does not constitute a scientific disagreement and is likewise not a reason for delay.

NMFS concludes that it would not be prudent to delay listing and risk further population declines or habitat degradation in any part of the Central California coast ESU. Moreover, the ESA requires that a listing determination be made based "* * * solely on the basis of the best scientific information available after conducting a review of the status of the species and after taking into account those efforts, if any, being made by a state or foreign nation or any political subdivision of any state or foreign nation to protect such species * * *" (*16 USC 1533*(b)(1); 50 CFR 424.11(b)). Such a determination must be made in accordance with the timeframes set forth in the ESA. Therefore, NMFS finds it appropriate to make a final listing determination at this time.

Summary of Factors Affecting the Species

Section 4(a)(1) of the ESA and NMFS listing regulations (50 CFR part 424) set forth procedures for listing species. The Secretary of Commerce must determine, through the regulatory process, if a species is endangered or threatened based upon any one or a combination of the following factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors affecting its continued existence.

In the 1940s, estimated abundance of coho salmon in this ESU ranged from 50,000 to 125,000 natural spawning adults. Today, it is estimated that there are probably less than 6,000 naturally-reproducing coho salmon, and the vast majority of these fish are considered to be of non-native origin (either hatchery fish or from streams stocked with hatchery fish).

The factors threatening naturally-reproducing coho salmon throughout its range are numerous and varied. For coho salmon populations in the Central California coast ESU, the present depressed condition is the result of several long-standing, human-induced factors (e.g., habitat degradation, harvest, water diversions, and artificial propagation) that serve to exacerbate the adverse effects of natural environmental variability from such factors as drought and poor ocean conditions.

A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Logging, agricultural and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals and unscreened diversions for irrigation have contributed to the decline of the Central California coast coho ESU. The following discussion provides an overview of the types of activities and conditions that adversely affect coho salmon in central California coast watersheds.

Depletion and storage of natural flows have drastically altered natural hydrological cycles in many central California rivers and streams. Alteration of streamflows has increased juvenile salmonid mortality for a variety of reasons: migration delay resulting from insufficient flows or habitat blockages; loss of usable habitat due to dewatering and blockage; stranding of fish resulting from rapid flow fluctuations; entrainment of juveniles into unscreened or poorly screened diversions; and increased juvenile mortality resulting from increased water temperatures (California Advisory Committee on Salmon and Steelhead Trout, 1988; CDFG, 1991; CBFWA, 1991a; Bergren and Filardo, 1991; Palmisano et al., 1993; Reynolds et al., 1993; Chapman et al., 1994; Cramer et al., 1995; Botkin et al., 1995). In addition, reduced flows degrade or diminish fish habitats via increased deposition of fine sediments in spawning gravels, decreased recruitment of new spawning gravels, and encroachment of riparian and non-endemic vegetation into spawning and rearing areas.

Sufficient quantities of good quality water are essential for coho survival, growth, reproduction, and migration. Important elements of water quality include water temperatures within the range that corresponds with migration, rearing and emergence needs of fish and the aquatic organisms upon which they depend (Sweeney and Vannote, 1978; Quinn and Tallman, 1987). Desired conditions for coho salmon include an abundance of cool (generally in the range of 53.3 [degrees] F to 58.3 [degrees] F (11.8 [degrees] C to 14.6 [degrees] C) Reiser and Bjornn, 1979), well oxygenated water that is present year-round, free of excessive suspended sediments and other pollutants that could limit primary production and benthic invertebrate abundance and diversity (Cordone and Kelley, 1961; Lloyd et al., 1987).

Numerous studies have demonstrated that land use activities associated with logging, road construction, urban development, mining, agriculture, and recreation have significantly altered coho salmon habitat quantity and quality. Impacts of concern associated with these activities include the following: alteration of streambank and channel morphology, alteration of ambient stream water temperatures, elimination of spawning and rearing habitat, fragmentation of available habitats, elimination of downstream recruitment of spawning gravels and large woody debris, removal of riparian vegetation resulting in increased stream bank erosion, and degradation of water quality (CDFG, 1965; Bottom et al., 1985; California Advisory Committee on Salmon and Steelhead Trout, 1988; CDFG, 1991; Nehlsen et al., 1991; California State Lands Commission, 1993; Wilderness Society, 1993; Bryant, 1994; CDFG, 1994; Brown et al., 1994; Botkin et al., 1995; McEwan and Jackson, 1996). Of particular concern is the increased sediment input into spawning and rearing areas that results from the loss of channel complexity, pool habitat, suitable gravel substrate, and large woody debris (Bottom et al., 1985; Higgins et al., 1992; FEMAT, 1993; USFS and BLM, 1994b; Botkin et al., 1995).

Further, historical practices, such as the use of splash dams, and widespread removal of beaver dams, log jams and snags from river channels, have adversely modified fish habitat (Bottom et al., 1985).

Agricultural practices have also contributed to the degradation of salmonid habitat on the West Coast through irrigation diversions, overgrazing in riparian areas, and compaction of soils in upland areas from livestock (Palmisano et al., 1993; Botkin et al., 1995). The vigor, composition and diversity of natural vegetation can be altered by livestock grazing in and around riparian areas. This in turn can affect the site's ability to control erosion, provide stability to stream banks, and provide shade, cover, and nutrients to the stream. Mechanical compaction can reduce the productivity of the soils appreciably and cause bank [*56142] slough and erosion. Mechanical bank damage often leads to channel widening, lateral stream migration, and excess sedimentation.

Urbanization has degraded coho salmon habitat through stream channelization, floodplain drainage, and riparian damage (Botkin et al., 1995). When watersheds are urbanized, problems may result simply because structures are placed in the path of natural runoff processes, or because the urbanization itself has induced changes in the hydrologic regime. In almost every point that urbanization activity touches the watershed, point source and nonpoint pollution occurs. Water infiltration is reduced due to extensive ground covering. As a result, runoff from the watershed is flashier, with increased flood hazard (Leopold, 1968). Flood control and land drainage schemes may concentrate runoff, resulting in increased bank erosion which causes a loss of riparian vegetation and undercut banks and eventually causes widening and down-cutting of the stream channel. Sediments washed from the urban areas contain trace metals such as copper, cadmium, zinc, and lead (CSLC, 1993). These, together with pesticides, herbicides, fertilizers, gasoline, and other petroleum products, contaminate drainage waters and harm aquatic life necessary for coho salmon survival. The California State Water Resources Control Board (1991) reported that nonpoint source pollution is the cause of 50 to 80 percent of impairment to water bodies in California.

B. Overutilization for Commercial, Recreational, Scientific, or Education Purposes

Marine harvest of coho salmon occurs primarily in nearshore waters off British Columbia, Washington, Oregon, and California. Recreational fishing for coho salmon is pursued in numerous streams throughout the central California coast when adults return on their fall spawning migration. There are few good historical accounts of the abundance of coho salmon harvested along the California coast (Jensen and Startzell, 1967). Consequently, those early records did not contain quantitative data by species until the early 1950s.

Tody, coho salmon stocks are managed by NMFS in conjunction with the PFMC, the states, and certain tribes. The central California coast falls within the Federal salmon fishery management zone that stretches from Horse Mountain, just north of Fort Bragg, CA, to the Mexico border (PFMC Salmon Fishery Management Plan). Coho ocean harvest is managed by setting escapement goals for Oregon Coastal Natural coho salmon. This stock aggregate constitutes the largest portion of naturally produced coho salmon caught in ocean salmon fisheries off California and Oregon (PFMC, 1993). Using this index may have resulted in pre-1994 exploitation rates higher than central California populations could sustain. The confounding effects of habitat deterioration, drought, and poor ocean conditions on coho salmon survival make it difficult to assess the degree to which recreational and commercial harvest have contributed to the overall decline of coho salmon in West Coast rivers.

Collection for scientific research and educational programs has had little or no impact on California coho salmon populations. In California, most of the scientific collection permits are issued to environmental consultants, Federal resource agencies, and universities by the CDFG. Regulation of take is controlled by conditioning individual permits. The CDFG requires reporting of any coho salmon taken incidental to other monitoring activities; however, no comprehensive total or estimate of coho salmon mortalities related to scientific sampling are kept for any watershed in the State (F. Reynolds, pers. comm.). The CDFG does not believe that indirect mortalities associated with scientific use are detrimental to coho salmon in California (F. Reynolds, pers. comm.).

C. Disease or Predation

Relative to effects of fishing, habitat degradation, and hatchery practices, disease and predation are not believed to be major factors contributing to the decline of West Coast coho salmon populations. However, disease and predation may have substantial impacts in local areas.

Coho salmon are exposed to numerous bacterial, protozoan, viral, and parasitic organisms in fresh water and marine environments. Specific diseases such as bacterial kidney disease (BKD), ceratomyxosis, columnaris, furunculosis, infectious hematopoietic necrosis, redmouth and black spot disease, Erythrocytic Inclusion Body Syndrome, whirling disease, and others are present and known to affect salmon and steelhead (Rucker et al., 1953; Wood, 1979; Leek, 1987, Cox, 1992; Foott et al., 1994; Gould and Wedemeyer, undated). Very little current or historical information exists to quantify changes in infection levels and mortality rates attributable to these diseases for coho salmon. However, studies have shown that native fish tend to be less susceptible to these pathogens than hatchery-reared fish (Buchanon et al., 1983; Sanders et al., 1992).

Infectious disease is one of many factors that can influence adult and juvenile survival (Buchanan et al., 1983). Disease may be contracted through waterborne pathogens or by interbreeding with infected hatchery fish (Fryer and Sanders, 1981; Evelyn et al., 1984 and 1986). Salmonids typically are infected with several pathogens during their life cycle; however, a high intensity of infection (number of organisms per host) and stressful conditions must usually occur before the host/parasite balance favors the parasite (pathogen) and a disease state occurs in the fish.

Many natural and hatchery coho populations throughout California's coast have tested positive for the bacterium, Renibacterium salmoninarum, the causative agent of BKD (Cox, 1992; Foott, 1992). The overall incidence of BKD measured by direct fluorescent antibody technique among Scott Creek coho salmon was 100 percent (13/13 fish) and 95.5 percent (21/22 fish) among San Lorenzo River coho (Cox, 1992). Waddell Creek coho salmon are also suspected of having near 100 percent infection (D. Streig, pers. comm.). The CDFG recently initiated a treatment protocol to attempt to control BKD outbreaks in hatchery fish released into the Russian River and Scott Creek

(Cox, 1992). The impacts of this disease are subtle. Juvenile salmonids may survive well in their journey downstream but may be unable to make appropriate changes in kidney function for a successful transition to sea water (Foott, 1992). Stress during migration may also cause this disease to come out of remission (Schreck, 1987). Water quantity and quality during late summer is a critical factor in controlling disease epidemics. As water quantity and quality diminishes, stress may trigger the onset of these diseases in fish that are carrying the disease (Holt et al., 1975; Wood, 1979; Matthews et al., 1986; Maule et al., 1988).

Freshwater predation by other salmonids is not believed to be a major factor contributing to the decline of central California coho salmon. Avian predators have been shown to impact some juvenile salmonids in fresh water and near shore environments. Ruggerone (1986) estimated that ring-billed gulls (Larus delawarensis) consumed 2 percent of the salmon and steelhead trout passing Wanapum Dam, in the Columbia River, during the spring smolt outmigration in 1982. Wood (1987) estimated that the common merganser (Mergus merganser), a known freshwater predator of juvenile [*56143] salmonids, were able to consume 24 to 65 percent of coho salmon production in coastal British Columbia streams. Known avian predators in the nearshore marine environment include herons, cormorants, and alcids (Allen, 1974). Cooper and Johnson (1992) and Botkin et al. (1995) reported that marine mammal and avian predation may occur on some local salmonid populations; however, they believed that it was a minor factor in the decline of coastwide salmonid populations. With the decrease in quality riverine and estuarine habitats, increased predation by freshwater, avian, and marine predators will occur. With the decrease in avoidance habitat (e.g., deep pools and estuaries, and undercut banks) and adequate migration and rearing flows, predation may play a small role in the reduction of some localized coho salmon stocks.

Harbor seal and California sea lion numbers have increased along the Pacific Coast. At the mouth of the Russian River, Hanson (1993) reported that the foraging behavior of California sea lions and harbor seals with respect to anadromous salmonids was minimal. Hanson (1993) also stated that predation on salmonids appeared to be coincidental with the salmonid migrations rather than dependent upon them.

Salmonids appear to be a minor component of the diet of marine mammals (Scheffer and Sperry, 1931; Jameson and Kenyon, 1977; Graybill, 1981; Brown and Mate, 1983; Roffe and Mate, 1984; Hanson, 1993). Principal food sources are small pelagic schooling fish, juvenile rockfish, lampreys (Jameson and Kenyon, 1977; Roffe and Mate, 1984), benthic and epibenthic species (Brown and Mate, 1983) and flatfish (Scheffer and Sperry, 1931; Graybill, 1981).

Predation may significantly influence salmonid abundance in some local populations when other prey are absent and physical conditions lead to the concentration of adults and juveniles (Cooper and Johnson, 1992). Low flow conditions in streams can also enhance predation opportunities, particularly in central California streams, where adult coho may congregate at the mouths of streams waiting for high flows for access (CDFG, 1995).

Several studies have indicated that piscivorous predators may control the abundance and survival of salmonids. Holtby et al. (1990) hypothesized that temperature-mediated arrival and predation by Pacific hake may be an important source of mortality for coho salmon off the west coast of Vancouver Island. Beamish et al. (1992) documented predation of hatchery-reared chinook and coho salmon by spiny dogfish (Squalus acanthias). Pearcy (1992) reviewed several studies of salmonids off the Pacific Northwest coastline and concluded that salmonid survival was influenced by the factional responses of the predators to salmonids and alternative prey.

The relative impacts of marine predation on anadromous salmonids are not well understood, but most investigators believe that marine predation is a minor factor in coho salmon declines. Predators play an important role in the ecosystem, culling out unfit individuals, thereby strengthening the species as a whole. The increased impact of certain predators has been to a large degree the result of ecosystem modification. Therefore, it would seem more likely that increased predation is but a symptom of a much larger problem, namely, habitat modification and a decrease in water quantity and quality.

D. Inadequacy of Existing Regulatory Mechanisms

A variety of state and Federal regulatory mechanisms exist to protect coho habitat and address the decline of coho salmon in the Central California coast ESU, but they have not been adequately implemented.

The State of California has listed coho as endangered in streams south of San Francisco pursuant to the State ESA, initiated a recovery planning effort, and implemented a biological opinion and incidental take statement to improve the implementation of CFPRs in the range of the listed streams. In CDFG's comment letter (October 23, 1995), CDFG relayed the determination of its Ad-hoc Coho Salmon Advisory Committee that coho south of Punta Gorda qualify for state listing and acknowledged that, while state listing (subsequently implemented by the Fish and Game Commission) did not encompass the entire ESU, it is essential to manage the ESU as a population unit. While the CDFG may intend to expand its recovery planning effort to the entire ESU, it cannot provide the protective measures of the State ESA unless it expands the current listing to encompass the remainder of the ESU.

The Northwest Forest Plan and its Aquatic Conservation Strategy provide a mechanism to ensure protection of functional salmonid habitat on Federal lands. This is accomplished through a set of guidelines and processes for watershed assessment to determine what forest practices are acceptable within certain riparian buffer zones. Federal lands comprise only about 5 percent of the Central California coast coho salmon ESU, a proportion too small to secure recovery even with the strictest of Federal forest management practices.

The CFPRs contain provisions that are protective if fully implemented. For example, provisions for sensitive species designation allow the Board to adopt special management practices for sensitive species and their habitat. The Board did not adopt CDFG's proposal to designate coho salmon as a sensitive species. The current process for approving Timber Harvest Plans receives inadequate environmental review, and monitoring of impacts of timber harvest operations is insufficient to determine whether a particular operation damaged habitat and, if so, how it might be mitigated. There are also exceptions to the rules that allow timber harvest to occur without any requirement for environmental review or monitoring.

The CWA provides for the protection of beneficial uses, including the protection of fishery resources. However, implementation of this statute has not been adequate to protect coho habitat. Seven streams or rivers in central California have been designated as impaired waterbodies pursuant to Section 303(d). The State Water Quality Control Board is required to develop and implement water quality standards for these waterbodies, and, if they do not, the Environmental Protection Agency (EPA) is required to do so. EPA is currently involved in litigation for its failure to designate water quality criteria for these water bodies.

While ocean fishing is regulated to reduce impacts on coho, state sport fishing regulations continue to allow fishing for coho in inland waters. The contribution of coho salmon to the in-river sport catch is unknown, and losses due to injury and mortality from incidental capture in other authorized fisheries, principally steelhead, are also unknown. Current funding and personnel are not available to implement monitoring programs to evaluate these impacts.

E. Other Natural or Human-made Factors Affecting Its Continued Existence

Natural Factors

Long-term trends in rainfall and marine productivity associated with atmospheric conditions in the North Pacific Ocean may have a major influence on coho salmon production. [*56144]

a. Drought

Much of the Pacific coast has experienced drought conditions during the past 8 years, a situation which has undoubtedly contributed to the decline of many salmonid populations. Drought conditions reduce the amount of water available, resulting in reductions (or elimination) of flows needed for adult coho salmon passage, egg incubation, and juvenile rearing and migration. There are indications in tree ring records that droughts more severe than the 6-year drought that California recently experienced occurred in the past (Stine, 1994). The key to survival in this type of variable and rapidly changing environment is the evolution of behaviors and life history traits that allow coho salmon to cope with a variety of environmental conditions.

Populations that are fragmented or reduced in size and range are more vulnerable to extinction by natural events. Whether recent climatic conditions represent a long-term change that will continue to affect salmonid stocks in the future or whether these changes are short-term environmental fluctuations that can be expected to reverse in the near future remains unclear. Many of the coho salmon population declines began prior to these recent drought conditions.

b. Floods

With high inherent erosion risk, urban encroachment, and intensive timber management, flood events can cause major soil loss (Hagans et al., Nawa et al., 1991; Higgins et al., 1992). As previously mentioned, sedimentation of stream beds has been implicated as a principal cause of declining salmonid populations throughout their range. Floods can result in mass wasting of erodible hillslopes and failure of roads on unstable slopes causing catastrophic erosion. In addition, flooding can cause scour and redeposition of spawning gravels in typically inaccessible areas.

During flood events, land disturbances resulting from logging, road construction, mining, urbanization, livestock grazing, agriculture, fire, and other uses may contribute sediment directly to streams or exacerbate sedimentation from natural erosive processes (California Advisory Committee on Salmon and Steelhead Trout, 1988; CSLC, 1993; FEMAT, 1993). Judsen and Ritter (1964), the California Department of Water Resources (CDWR, 1982b), and the California State Lands Commission (1993) have stated that northwestern and central coastal California have some of the most erodible terrain in the world. Several studies have indicated that, in this region, catastrophic erosion and subsequent stream sedimentation (such as during the 1955 and 1964 floods) resulted from areas which had been clearcut or which had roads constructed on unstable soils (Janda et al., 1975; Wahrhaftig, 1976; Kelsey, 1980; Lisle, 1982; Hagans et al., 1986).

As streams and pools fill in with sediment, flood flow capacity is reduced. Such changes cause decreased stream stability and increased bank erosion, and subsequently exacerbate existing sedimentation problems (Lisle, 1982), including sedimentation of spawning gravels and filling of pools and estuaries. Channel widening and loss of pool-riffle sequence due to sedimentation has damaged spawning and rearing habitat of all salmonids. By 1980, the pool-riffle sequence and pool quality in some California streams still had not fully recovered from the 1964 regional flood. In fact, Lisle (1982) and Weaver and Hagans (1996) found that many Pacific coast streams continue to show signs of harboring debris flow. Such streams have remained shallow, wide, warm, and unstable since these floods.

c. Ocean Conditions

Large fluctuations in Pacific salmon catch have occurred during the past century. Annual world harvest of Pacific salmon has varied from 347 million lb (772 million kg) in the 1930s to about 184 million lb (409 million kg) in 1977 and back to 368 million lb (818 million kg) by 1989 (Hare and Francis, 1993). Mechanisms linking atmospheric and oceanic physics and fish populations have been suggested for Pacific salmon (Rogers, 1984; Nickelson, 1986; Johnson, 1988; Brodeur and Ware, 1992; Francis et al., 1992; Francis, 1993; Hare and Francis, 1993; Ward, 1993). Many studies have tried to correlate the production or marine survival of salmon with environmental factors (Pearcy, 1992; Neeley 1994). Vernon (1958), Holtby and Scrivener (1989), and Holtby et al. (1990) have reported associations between salmon survival and sea surface temperature and salinity, especially during the first few months that slamonids are at sea. Francis and Sibley (1991), Rogers (1984), and Cooney et al. (1993) also found relationships between salmon production and sea surface temperature. Some studies have tried to link salmon production to oceanic and atmospheric climate change. For example, Beamish and Bouillon (1993) and Ward (1993) found that trends in Pacific salmon catches were similar to trends in winter atmospheric circulation in the North Pacific.

Francis and Sibley (1991) and Francis et al. (1992) have developed a model linking decadal-scale atmospheric variability and salmon production that incorporates hypotheses developed by Hollowed and Wooster (1991) and Wockett (1967), as well as evidence presented in many other studies. The model developed by Francis et al. (1992) describes a time series of biological and physical variables from the Northeast Pacific that appear to share decadal-scale patterns. Biological and physical variables that appear to have undergone shifts during the late 1970s include the following: abundance of salmon (Rogers, 1984, 1987; Hare and Francis, 1993) and other pelagic fish, cephalopods, and zooplankton (Broadeur and Ware, 1992); oceanographic properties such as current transport (Royer, 1989), sea surface temperature and upwelling (Holowed and Wooster, 1991); and atmospheric phenomena such as atmospheric circulation patterns, sea-surface pressure patterns, and sea-surface wind-stress (Trenberth, 1990; Trenberth et al., 1993).

Finally, Scarnecchia (1981) reported that near-shore conditions during the spring and summer months along the California coast may dramatically affect year-class strength of salmonids. Bottom et al. (1986) believed that coho salmon along the Oregon and California coasts may be especially sensitive to upwelling patterns because these regions lack extensive bays, straits, and estuaries, such as those found along the Washington, British Columbia, and Alaskan coasts, which could buffer adverse oceanographic effects. The paucity of high quality near-shore habitat, coupled with variable ocean conditions, makes freshwater rearing habitat more crucial for the survival and persistence of many coho salmon populations.

El Nino

An environmental condition often cited as a cause for the decline of west coast salmonids is the condition known as "El Nino." El Nino is a warming of the Pacific Ocean off South America and is caused by atmospheric changes in the tropical Pacific Ocean (Southern Oscillation-ENSO). During an El Nino event, a plume of warm sea water flows from west to east toward South America, eventually reaching the coast where it is reflected south and north along the continents.

El Nino ocean conditions are characterized by anomalously warm sea surface temperature and changes in thermal structure, coastal currents, and [*56145] upwelling. Principal ecosystem alterations include decreases in primary and secondary productivity and changes in prey and predator species distributions. Several El Nino events have been recorded during the last several decades, including those of 1940-41, 1957-58, 1982-83, 1986-87, 1991-92, and 1993-94. The degree to which adverse ocean conditions can influence coho salmon production was demonstrated during the El Nino event of 1982-83, which resulted in a 24 to 27 percent reduction in fecundity and a 58 percent reduction (based on pre-return predictions) in survival of adult coho salmon stocks originating from the Oregon Production Index area (Johnson, 1988).

b. Manmade Factors

Artificial Propagation

Non-native coho salmon stocks have been introduced as broodstock in hatcheries and widely transplanted in many coastal rivers and streams in central California (Bryant, 1994; Weitkamp et al., 1995). Potential problems associated with hatchery programs include genetic impacts on indigenous, naturally-reproducing populations (see Waples, 1991), disease transmission, predation of wild fish, difficulty in determining wild stock status due to incomplete marking of hatchery fish, depletion of wild stock to increase brood stock, and replacement rather than supplementation of wild stocks through competition and continuted annual introduction of hatchery fish (Waples, 1991; Hindar et al., 1991; and Stewart and Bjornn, 1990).

While non-native fish have been introduced in the Central California coast ESU, most hatchery programs are currently being conducted without inter-ESU import of broodstock. Hatchery fish releases are conducted based on a determination that the hatchery stocks are considered similar to the native run. Efforts are made to return hatchery fish to their natal streams, and they are held for an acclimation period to increase the probability of imprinting. However, there are inadequate resources to tag enough (perhaps all) hatchery coho to monitor return rates and rates of straying (CDFG memorandum dated October 23, 1995).

Listing Determination

The listing determination is based on the best available information provided by the PSBTCs which were formed for the purpose of collecting information from diverse and remote repositories, information provided by co-manager agencies and tribes, information provided in response to the solicitation for comments, new information collected by NMFS and other scientists subsequent to the publication of the proposed rule, and the results of two BRT meetings (September 2, 1994, memorandum from Michael Schiewe to William Stelle, Jr., and October 15, 1996 memorandum from Michael Schiewe to William Stelle, Jr. and Hilda Diaz-Soltero).

The rationale for the delineation of the Central California coast coho salmon ESU is contained in the Status Review of coho salmon for Washington, Oregon, and California (Weitkamp et al., 1995) and summarized in the proposed rule *(60 FR 38011,* July 25, 1995). There was no disagreement over the designation of the boundaries of the Central California coast coho Eus. Moreover, the CDFG's Ad-hoc Salmon Advisory Committee confirmed that the appropriate unit for consideration is that which NMFS had described (i.e., all coho reproducing in streams between Punta Gorda, Humboldt County, CA and the San Lorenzo River, Santa Cruz County, CA). The second BRT meeting on October 7 and 8, 1996, reaffirmed the boundaries of this ESU.

The BRT also evaluated the status of existing hatchery coho populations in this ESU and concluded, with the exception of Warm Springs Hatchery, that hatchery fish should be included in the definition of this ESU (BRT Memo, October 16, 1996). The hatchery programs in this ESU are relatively small and they are being operated as supplementation hatcheries rather than production hatcheries. They are taking eggs from the rivers in which they operate and returning fish to the river from which they were taken. Release of hatchery fish occurs in streams with stocks similar to the native runs. The Warm Springs Hatchery is a relatively recent mitigation hatchery established in 1980. It was established with brood stock from an adjacent ESU and non-native coho have been imported for brood stock on several occasions. Based on recent and periodic use of non-native brood stock, the BRT recommended that these hatchery fish not be considered part of this ESU. In its comments on the proposed rule, CDFG stated that its coho hatchery programs can be integrated into recovery plans for each ESU within California through re-evaluation of each hatchery's goals and constraints with program modifications where appropriate (CDFG, October 23, 1995). NMFS is deferring its decision on the BRT's recommendation until it has had the opportunity to discuss with the CDFG and its cooperators/permit holders how they would incorporate these hatchery programs into a coho conservation strategy.

The Status Review of Coho Salmon from Washington, Oregon, and California (Weitkamp et al., 1995) and the proposed listing determination for west coast coho salmon *(60 FR 38011,* July 25, 1995) summarized the best available information regarding the current status of the Central California coast coho ESU. In its proposed listing determination, NMFS concluded that the Central California coho salmon ESU should be proposed for listing as a threatened species, but indicated that additional information would be gathered prior to making a final determination. Specifically, NMFS indicated that it would: (1) Gather additional biological information on the status of coho salmon populations in this ESU; (2) assess the response, if any, of coho salmon populations to recent coho protection measures proposed by the PFMC and implemented by NMFS; (3) review and evaluate any new protective measures implemented as a result of the State of California's decision to list coho salmon south of San Francisco; (4) review and evaluate any additional protective or conservation measures implemented by the State or private landowners; and (5) evaluate the progress made by the Resources Agency in its effort to coordinate the development and implementation of a long-term conservation plan for coho salmon in California.

NMFS scientists have collected new biological information on the presence-absence of coho salmon in the Central California coast ESU since the proposed listing in July 1995, and they have gathered additional information on coho salmon presence for the period of 1994-96 from other sources. Based on this new information, coho salmon show a higher frequency of presence in this ESU than reported by Brown and Moyle (1991) and Brown et al. (1994). Specifically, the new information showed that coho salmon were present in 57 percent of the streams of historical record in the Central California coast ESU compared with the 47 percent reported by Brown and Moyle (1991). Coho salmon were found in an additional 23 streams where there was no historical record of their occurrence. In addition, sampling data recently supplied by several timber landowners suggest similar increases in occurrence of coho in streams on their property. These new data suggest that coho salmon are more widely distributed in the ESU than was previously thought to [*56146] be the case, and indicate that additional and more widespread sampling would improve our ability to assess the status of coho in this ESU. The BRT reviewed this new information and concluded that the Central California coast coho salmon ESU should be listed, but they did not reach a consensus on whether the ESU was at risk of extinction or whether it was likely to become at risk of extinction in the near future.

Since 1994, the PFMC has recommended an ocean harvest management regime that prohibits retention of coho and sets incidental ocean harvest impact rate for coho of 12 percent. Recent data from Oregon suggest that the in-river escapement of coho has increased during the last few years due to the reduction in ocean harvest impacts. However, without an adequate in-river sampling program in California to monitor coho escapement levels, NMFS is not able to evaluate the relative benefit of this level of fishing mortality other than to conclude that the harvest impact rate is low compared to harvest rates for healthy stocks, and incidental harvest rates authorized for endangered winter chinook salmon in the Sacramento River and threatened spring/summer chinook salmon in the Columbia River Basin.

The CDFG has implemented a cooperative effort with the CDF and Santa Cruz County to address habitat issues and improve implementation of the State's forest practice rules. The primary administrative vehicle for this effort was a consultation between the CDFG and CDF and the subsequent issuance of a biological opinion and incidental take statement pursuant to section 2090 of California ESA. NMFS is encouraged by the effort shown by the CDF, Board of Forestry, and County of Santa Cruz to provide greater protection for coho salmon habitat. However, these programs need to be evaluated for a period of time to determine whether they are providing the intended habitat protection.

NMFS has also identified and evaluated existing and new conservation measures contributing to the conservation of coho salmon in this ESU. Examples of watersheds where local coho conservation efforts are being implemented are: San Lorenzo River (Santa Cruz County), Lagunitas Creek (Marin County), Russian River and Gualala River (Sonoma County), and the Garcia River and Navarro River (Mendocino County). Specific efforts within these basins vary in scope and complexity. In Santa Cruz County restoration and recovery efforts range from coho trapping at a water diversion facility and movement to rearing facilities, to County sponsored in-stream fish passage and stream restoration projects. In Marin, Sonoma, and Mendocino Counties, Resource Conservation Districts (RCD) are providing the focus for agriculture and local conservation groups to use Federal grants to develop and implement prioritized restoration plans. One of the best examples of a coordinated effort has been the Garcia River Watershed Advisory Group. In 1991 this group developed a restoration and enhancement plan, and to date has completed many of the prioritized actions. In the summer of 1996, this group began to focus on sediment delivery and monitoring plans to evaluate restoration success, identify data gaps, and monitor population trends. A similar, cooperative effort has been initiated in the Russian River between the local RCD and the Sonoma County Water Agency. NMFS encourages agencies and other groups to continue these efforts and believes that successful watershed restoration initiatives may provide an effective and efficient approach to salmonid conservation on non-Federal lands in a manner that may reduce the vulnerability of landowners to potential section 9 "take" liabilities through their adoption into a 4(d) rule.

In July 1995, the California Resources Agency initiated the Coastal Salmon Initiative (CSI). The CSI is a community oriented planning effort designed to produce a conservation program based on voluntary measures and incentives to protect fish and wildlife habitat in a manner that would protect the economic interests of communities within the range of coho salmon. The process has been slow to progress and is currently not expected to develop a plan for NMFS review until March 1997. If the plan is gauged likely to be successful, NMFS will consider implementing it via a section 4(d) rule comparable to the FWS's 4(d) rule for gnatcatchers in southern California. Because this effort is only in its early stages of development and little concrete progress has occurred to date, the CSI itself can have only a de minimis effect on this listing decision. However, MNFS encourages the Resources Agency to continue to process as it provides small timber land owners, ranchers, and farmers a mechanism for fulfilling the requirements of the ESA.

Based on its assessment of the available scientific and commercial information on coho salmon in this ESU and the conservation measures which are being implemented, NMFS has determined that the Central California coast coho salmon ESU should be listed as a threatened species. The Central California Coast coho salmon ESU consists of all coho salmon naturally reproduced in streams between Punta Gorda, Humboldt County, CA and the San Lorenzo River, Santa Cruz County, CA. The determination as threatened is appropriate because of the information contained in the original status review and received during the comment period, confirmed by new information, indicating that coho are present in watersheds where they had been reported to be extirpated or not present historically, and because of the conservation efforts being implemented by NMFS and the PFMC regarding the ocean fishing impacts, measures to improve habitat south of San Francisco under the State's 2090 agreement, and local efforts by RCDs to acquire funding and restore coho aquatic habitat elsewhere within the ESU.

Prohibitions and Proposed Protective Measures

Section 9(a) of the ESA contains specific prohibitions that apply to all endangered fish and wildlife species. These prohibitions, in part, make it illegal for any person subject to the jurisdiction of the United States to "take" (including harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt any such conduct), import or export, transport in interstate or foreign commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. It also is illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taking illegally. These prohibitions apply to all individuals, organizations, and agencies subject to U.S. jurisdiction. Certain exceptions apply to agents of NMFS and State conservation agencies.

Sections 10(a)(1)(A) and 10(a)(1)(B) of the ESA provide NMFS with authority to grant exceptions for the ESA's "taking" prohibitions (see regulations at 50 CFR §§ 222.22 through 222.24). Section 10(a)(1)(A) scientific research and enhancement permits may be issued to entities (Federal and non-Federal conducting research that involves intentional take of listed species.

Section 4(d) of the ESA allows the promulgation of regulations "to provide for the conservation of [threatened] species," which may include extending any or all of the prohibitions of section 9 to threatened species. Section 9 also prohibits violations of protective regulations for threatened species promulgated under section 4(d). [*56147]

In this rulemaking, NMFS is extending, pursuant to section 4(d) of the ESA, the section 9 prohibitions to the threatened Central California coho salmon ESU, with the exceptions provided for under section 10 of the ESA, in order to provide it with maximum and immediate protection. As discussed below, NMFS may develop a regulation pursuant to section 4(d) for the conservation of the species that would be more flexible and more specific than the generic section 9 prohibitions.

NMFS is delaying, for 60 days, the prohibitions of section 9 both with respect to scientific research and enhancement programs to provide time to accept applications and process permits for such programs, and, generally, in order to conclude discussions with CDFG and CDF regarding agreements that will define activities that may occur without taking coho salmon. Thus, the requirements of section 7 will be effective on December 2, 1996, and the section 9 prohibitions on take will be effective on December 30, 1996. This will minimize the disruption of otherwise legal activities within the geographic range of this ESU.

For listed species, section 7(a)(2) of the ESA requires Federal agencies to ensure that activities they authorize, fund, or conduct are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with NMFS.

Examples of Federal actions most likely to be affected by listing the Central California coast ESU include Corps of Engineers (COE) section 404 permitting activities under the CWA, COE section 10 permitting activities under the River and Harbors Act and Federal Energy Regulatory Commission licensing and relicensing for non-Federal development and operation of hydropower and EPA promulgation of TMDLs. These actions will likely be subject to ESA section 7 consultation requirements which may result in conditions designed to achieve the intended purpose of the project and avoid or reduce impacts to coho salmon and its habitat within the range of the listed ESU.

There are likely to be Federal actions ongoing in the range of the Central California coast ESU at the time that this listing becomes effective. Therefore, NMFS will review all ongoing actions that may affect the listed species with the Federal agencies, and will complete formal or informal consultations, where requested or necessary, for such actions as appropriate, pursuant to ESA section 7(a)(2).

NMFS has issued section 10(a)(1)(A) research or enhancement permits for other listed species (e.g., Snake River chinook salmon, Sacramento River winter-run chinook salmon) for a number of activities, including trapping and tagging to determine population distribution and abundance, and collection of adult fish for artificial propagation programs. NMFS is aware of several sampling efforts for coho salmon in the Central California coast coho ESU, including efforts by Federal and state fisheries agencies, and private landowners. These and other research efforts could provide critical information regarding coho salmon distribution and population abundance.

Section 10(a)(1)(B) incidental take permits may be issued to non-Federal entities to authorize take of listed species incidental to otherwise lawful activities. The types of activities potentially requiring a section 10(a)(1)(B) incidental take permit include the operation and funding of hatcheries and release of artificially propagated fish by the State, State or university research not receiving Federal authorization or funding, the implementation of state fishing regulations, and timber harvest activities on non-federal lands. Several industrial timber companies with substantial landownership within the boundaries of the Central California coast coho ESU are in the process of developing HCPs and incidental take permit applications for coho salmon. These HCPs are being developed as multi-species plans in conjunction with both NMFS and the FWS.

NMFS and FWS published in the Federal Register on July 1, 1994 *(59 FR 34272)*, a policy that NMFS shall identify, to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the ESA. The intent of this policy is to increase public awareness of the effect of this listing on proposed and ongoing activities within the species' range. NMFS thinks that, based on the best available information, the following actions will not result in a violation of section 9:

1. Possession of Central California Coast coho salmon acquired lawfully by permit issued by NMFS pursuant to section 10 of the ESA, or by the terms of an incidental take statement pursuant to section 7 of the ESA.

2. Federally approved projects that involve activities such as silviculture, grazing, mining, road construction, dam construction and operation, discharge of fill material, stream channelization or diversion for which consultation has been completed, and when such activity is conducted in accordance with any terms and conditions provided by NMFS in an incidental take statement accompanied by a biological opinion pursuant to Section 7 of the ESA.

3. Incidental catch of coho salmon by recreational anglers in freshwater streams, provided they are fishing legally under California fishing regulations (which must comply with a NMFS incidental take permit) and the coho salmon is returned immediately to the water using handling practices to minimize injury to the fish.

4. Diversion of water, provided a properly designed and functional fish screen (i.e. meets NMFS screen criteria) is in place to prevent entrainment of coho salmon and if resulting instream flow conditions do not adversely affect coho salmon.

5. Ongoing habitat restoration efforts that have been reviewed and approved by NMFS.

Activities that NMFS thinks could potentially harm coho salmon in the Central California Coast ESU and result in "take", include, but are not limited to:

1. Land-use activities that adversely affect coho salmon habitat (e.g. logging, grazing, farming, road construction) in riparian areas and areas susceptible to mass wasting and surface erosion.

2. Unauthorized destruction/alteration of the species' habitat, such as removal of large woody debris or riparian shade canopy, dredging, discharge of fill material, draining, ditching, diverting, blocking, or altering stream channels or surface or ground water flow.

3. Discharges or dumping of toxic chemicals or other pollutants (i.e., sewage, oil, and gasoline) into waters or riparian areas supporting the species.

4. Violation of discharge permits.

5. Pesticide applications in violation of label restrictions.

6. Interstate and foreign commerce of central California coast coho salmon (commerce across state lines and international boundaries) and import/export of central California coast coho salmon without prior obtainment of a threatened or endangered species permit.

7. Unauthorized collecting or handling of the species. Permits to conduct these activities are available for purposes of scientific research or to [*56148] enhance the propagation or survival of the species.

8. Introduction of non-native species likely to prey on salmon or displace them from their habitat.

This list is not exhaustive. It is intended to provide some examples of the types of activities that might be considered by the NMFS as constituting a "take" of Central California coast coho salmon under the ESA and its regulations. Questions regarding whether specific activities will constitute a violation of section 9, and general inquiries regarding prohibitions and permits, should be directed to NMFS (see ADDRESSES).

Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the ESA include recognition, recovery actions, Federal agency consultation requirements, and prohibitions on taking. Recognition through listing promotes public awareness and conservation actions by Federal, State, and local agencies, private organizations, and individuals.

Several protective and recovery efforts are underway to address problems contributing to the decline of the Central California coast coho salmon ESU. These include the listing of coho salmon south of San Francisco under CESA, the implementation of improved protective measures for timber harvest in watersheds south of San Francisco, and the development of a recovery plan for coho salmon south of San Francisco. Other important future efforts include development of the California Resources Agency's CSI, the development of several HCPs by industrial timber companies, and development of a Memorandum of Understanding (MOU) with Natural Resources Conservation Service (NRCS) and others.

As discussed under the listing determination, NMFS encourages the State to continue its work with the CSI to create a comprehensive conservation plan for coho salmon throughout California. NMFS thinks these cooperative conservation efforts wherein diverse stakeholders achieve both environmental and economic goals are essential components of recovery planning for coho salmon and other salmonids. Even after a final listing of the Central California coho salmon ESU, the CSI process can serve as an important forum to assist NMFS in the development of ESA 4(d) regulations for listed salmonids.

The California Forest Practices Act provides a process to list threatened or endangered species as "Sensitive Species," thereby requiring additional protection measures either throughout the species range or specific to individual watershed basins. This process could be employed to provide substantial conservation benefits for coho salmon in the central California coast ESU, where at present more than 90 percent of the land is in private ownership, and silviculture is a predominant land use activity. In response to the listing of the Central California coast salmon ESU, the CDF, State Water Resources Control Board, and CDFG, in cooperation with Federal agencies, could provide special emphasis to habitat areas containing listed coho salmon to promote their recovery.

NMFS will assess new scientific information as it becomes available and will continue to assess the degree to which ongoing Federal, state, and local conservation initiatives reduce the risks faced by coho salmon in the Central California coast coho salmon ESU. If these or future initiatives clearly ameliorate risk factors and demonstrate that the species is recovering, NMFS will reconsider the listing status. Information regarding the efficacy of conservation efforts and any new scientific data regarding the Central California Coast coho salmon ESU should be submitted to NMFS (see ADDRESSES).

NMFS intends to move rapidly during the next year to develop and implement a strategy to halt the decline and begin the recovery of coho salmon populations within the Central California coast coho salmon ESU. Because the vast majority of land in this ESU is in private ownership (ca. 90 percent), the key to protecting and recovering coho salmon in this ESU will be the implementation of conservation measures on private lands. Also, because coho salmon in this ESU are being listed as threatened, NMFS intends to take full advantage of section 4(d) of the ESA to define and authorize incidental take of coho salmon and its habitat in association with various land use activities on private lands. Key elements of the coho salmon conservation strategy that NMFS will pursue include:

1. Development of ESA 4(d) Rules-NMFS intends to pursue the development of one or more ESA 4(d) rules that will identify conservation measures and strategies for various non-federal land use sectors (e.g. timber harvest, agriculture, and grazing, etc.) and define acceptable levels of incidental take. NMFS thinks that the California Resources Agency's CSI can serve as a particularly useful forum for developing these conservation strategies, since a broad range of stakeholder groups participate in the CSI process. NMFS, therefore, encourages rapid progress by the participants in the CSI so that its work products can contribute to or be incorporated into a 4(d) rule that may define, with greater specificity, permissible activities and protect landowners from potential section 9 liabilities.

2. Development of Interim/Long-term Protective Strategies for Timber Harvest-NMFS will continue to work aggressively with the California Board of Forestry and CDF to develop guidelines for the development of Timber Harvest plans which do not result in the take of coho salmon, including harm to the species by degradation of its habitat. In addition, NMFS will work with the Bureau of Forestry, CDF, and landowners to develop protection strategies for coho salmon and its habitat throughout the ESU. These strategies may also reduce harm or incidental take of coho salmon as a result of modification to habitat. NMFS is hopeful that this type of protection plan can be incorporated into an ESA 4(d) rule which will address smaller landowners in this ESU.

3. Development of Multi-Species HCPs and ITPs-NMFS will continue to work with large industrial timber landowners within this ESU to develop HCPs which protect and conserve coho salmon and its habitat, while at the same time allowing landowners to conduct their economic activities with long-term certainty. NMFS will continue its commitment to work with the FWS to develop multi-species HCPs and issue multi-species ITPs. These efforts are important because large landowners control and manage a substantial portion of coho salmon habitat within the Central California coast coho salmon ESU.

4. Development and Implementation of an MOU with NRCS and others-NMFS will continue working with the Natural Resource Conservation Service, FWS, EPA, the State, local and private interests (e.g. The California Association of Resource Conservation Districts) to develop and implement a voluntary, watershed-based, locally driven program to assist the agricultural and grazing community in complying with Federal and State endangered species and water quality laws including protecting coho salmon and its habitat. Both technical and financial assistance will be made available to farmers in high-priority watersheds.

5. Ocean Harvest Management-NMFS expects that it will be necessary to continue the restrictions on coho [*56149] salmon harvest that have been in place since 1994 to protect listed and proposed coho salmon populations. At this time, NMFS does not think that further restrictions on the ocean chinook fisheries are needed to reduce ocean harvest impacts on coho salmon.

6. State-managed Fisheries and Hatcheries-NMFS intends to work with the State of California to evaluate its current fisheries management regulations and hatchery activities to ensure that impacts to coho salmon from in-river recreational fisheries and State managed hatchery practices are minimized. As necessary, NMFS will work with the State to amend its sportfishing regulations and provide incidental take authorization for recreational fisheries targeting other species of salmon, steelhead and trout. Similarly, NMFS will review and authorize appropriate hatchery practices.

7. Develop and Implement Recovery Plan-NMFS intends to establish a recovery team to develop a recovery plan for coho salmon once the final decisions on coho salmon status coastwide are completed by the agency in the coming months. In the interim, NMFS will continue to work with the State in its efforts to develop a recovery plan for coho salmon populations south of San Francisco where the species has been listed under the CESA.

Critical Habitat

Section 4(a)(3)(A) of the ESA requires that, to the extent prudent and determinable, critical habitat be designated concurrently with the listing of a species. NMFS has completed its analysis of the biological status of the Central California Coast coho salmon ESU, but has not completed the analysis necessary for the designation of critical habitat. NMFS has decided to proceed with the final listing determination now and to proceed with the designation of critical habitat in a separate rulemaking. Section 4(b)(6)(C)(ii) provides that, where critical habitat is not determinable at the time of final listing, NMFS may extend the period for designating critical habitat by not more than one additional year. Congress further stated in the 1982 amendments to the ESA, "where the biology relating to the status of the species is clear, it should not be denied the protection of the Act because of the inability of the Secretary to complete the work necessary to designate critical habitat." H. Rep. No. 567, 97th Cong., 2d Sess. 19 (1982). NMFS believes that this final listing determination is appropriate and necessary to protect the ESU and is consistent with congressional direction.

NMFS further concludes that critical habitat is not determinable at this time because information sufficient to perform the required analysis of the impacts of the designation is lacking. NMFS has solicited information necessary to designate critical habitat in its proposed rule *(60 FR 38011,* July 25, 1995) and will consider such information in the proposed designation. Specifically, designation requires a determination of those physical and biological features that are essential to the conservation of the species and which may require special management considerations or protection; it further requires the consideration of economic analysis of the impacts of the designation. These analyses have not yet been completed, and, therefore, critical habitat is not determinable at this time.

Classification

The 1982 amendments to the ESA in section 4(b)(1)(A) restrict the information that may be considered when assessing species for listing. Based on this limitation of criteria for a listing decision and the opinion in *Pacific Legal Foundation v. Andrus, 675 F. 2d 825* (6th Cir., 1981), NMFS has categorically excluded all ESA listing actions from the environmental assessment requirements of NEPA *(48 FR 4413;* February 6, 1984).

As noted in the Conference Report on the 1982 amendments to the ESA, economic considerations have no relevance to determinations regarding the status of the species. Therefore, the economic analysis requirements of the Regulatory Flexibility Act are not applicable to the listing process. Similarly, this final rule is exempt from review under E.O. 12866.

References

The complete citations for the references used in this document can be obtained by contacting Craig Wingert, NMFS (see ADDRESSES)

List of Subjects in 50 CFR Part 227

Endangered and threatened species, Exports, Imports, Marine mammals, Transportation.

Dated: October 24, 1996.

Gary Matlock,

Acting Assistant Administrator for Fisheries, National Marine Fisheries Service.

For the reasons set out in the preamble, 50 CFR part 227 is amended as follows:

PART 227--THREATENED FISH AND WILDLIFE

1. The authority citation of part 227 continues to read as follows:

Authority: *16 U.S.C. 1531* et seq.

2. In § 227.4, paragraph (h) is added to read as follows:

§ 227.4 -- Enumeration of threatened species.

* * * * *

(h) Central California coast coho salmon (Oncorhynchus kisutch).

3. Section 227.21 is revised to read as follows:

§ 227.21 -- Threatened salmon.

(a) Prohibitions. The prohibitions of section 9 of the ESA *(16 U.S.C. 1538)* relating to endangered species apply to the threatened species of salmon listed in § 227.4 (f), (g), and (h), except as provided in paragraph (b) of this section. These prohibitions shall become effective for the threatened species of salmon listed in § 227.4(h) on December 30, 1996.

(b) Exceptions. (1) The exceptions of section 10 of the Act *(16 U.S.C. 1539)* and other exceptions under the Act relating to endangered species, including regulations implementing such exceptions, also apply to the threatened species of salmon listed in § 227.4 (f), (g), and (h). This section supersedes other restrictions on the applicability of parts 217 and 222 of this chapter, including, but not limited to, the restrictions specified in §§ 217.2 and 222.22(a) of this chapter with respect to the species identified in 227.21(a).

(2) The prohibitions of paragraph (a) of this section relating to threatened species of salmon listed in § 227.4 (h) of this part do not apply to activities specified in an application for a permit for scientific purposes or to enhance the propagation or survival of the species provided that the application has been received by the Assistant Administrator by December 30, 1996. This exception ceases upon the Assistant Administrator's rejection of the application as insufficient, upon issuance or denial of a permit, or on May 31, 1997, whichever occurs earliest.

[FR Doc. 96-27887 Filed 10-25-96; 5:05 pm]

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(ii) *Provider or supplier not subject to additional requirements.* For a provider or supplier that is not subject to additional requirements, the effective date is the date of the provider's or supplier's initial request for participation if on that date the provider or supplier met all Federal requirements.

(2) *Special rule: Retroactive effective date.* If a provider or supplier meets the requirements of paragraphs (d)(1) and (d)(1)(i) or (d)(1)(ii) of this section, the effective date may be retroactive for up to one year to encompass dates on which the provider or supplier furnished, to a Medicare beneficiary, covered services for which it has not been paid.

4. Section 489.53 is amended to revise the heading of paragraph (b) and paragraphs (c)(1) and (c)(2) to read as follows:

§ 489.53 Termination by HCFA.

* * * * *

(b) *Termination of agreements with certain hospitals.* * * *

(c) *Notice of termination*—(1) *Timing: basic rule.* Except as provided in paragraph (c)(2) of this section, HCFA gives the provider notice of termination at least 15 days before the effective date of termination of the provider agreement.

(2) *Timing exceptions: Immediate jeopardy situations*—(i) *Hospital with emergency department.* If HCFA finds that a hospital with an emergency department is in violation of § 489.24, paragraphs (a) through (e), and HCFA determines that the violation poses immediate jeopardy to the health or safety of individuals who present themselves to the hospital for emergency services, HCFA—

(A) Gives the hospital a preliminary notice indicating that its provider agreement will be terminated in 23 days if it does not correct the identified deficiencies or refute the finding; and

(B) Gives a final notice of termination, and concurrent notice to the public, at least 2, but not more than 4, days before the effective date of termination of the provider agreement.

(ii) *Skilled nursing facilities (SNFs).* For an SNF with deficiencies that pose immediate jeopardy to the health or safety of residents, HCFA gives notice at least 2 days before the effective date of termination of the provider agreement.

* * * * *

PART 498—APPEALS PROCEDURES FOR DETERMINATIONS THAT AFFECT PARTICIPATION IN THE MEDICARE PROGRAM AND FOR DETERMINATIONS THAT AFFECT THE PARTICIPATION OF CERTAIN ICFs/MR AND CERTAIN NFs IN THE MEDICAID PROGRAM

E. Part 498 is amended as set forth below.

1. The authority citation for part 498 continues to read as follows:

Authority: Secs. 1102, and 1871 of the Social Security Act (42 U.S.C. 1302 and 1395hh).

2. Section 498.3 is amended to revise paragraph (a), republish the introductory text of paragraph (b) and add a paragraph (b)(14), revise the introductory text of paragraph (d) and add new paragraphs (d)(14) and (d)(15), to read as follows:

§ 498.3 Scope and applicability.

(a) *Scope.* This part sets forth procedures for reviewing initial determinations that HCFA makes with respect to the matters specified in paragraph (b) of this section, and that the OIG makes with respect to the matters specified in paragraph (c) of this section. It also specifies, in paragraph (d) of this section, administrative actions that are not subject to appeal under this part.

(b) *Initial determinations by HCFA.* HCFA makes initial determinations with respect to the following matters:

* * * * *

(14) The effective date of a Medicare provider agreement or supplier approval.

* * * * *

(d) *Administrative actions that are not initial determinations.* Administrative actions that are not initial determination (and therefore not subject to appeal under this part) include but are not limited to the following:

* * * * *

(14) The choice of alternative sanction or remedy to be imposed on a provider or supplier.

(15) A decision by the State survey agency as to when to conduct an initial survey of a prospective provider or supplier.

* * * * *

F. Technical correction.

§ 489.1 [Amended]

In § 489.11(c), the following changes are made:

a. At the end of paragraph (c)(1), the word "and" is added.

b. At the end of paragraph (c)(2), "; and" is removed and a period is inserted in its place.

(Catalog of Federal Domestic Assistance Program No. 93.773, Medicare—Hospital Insurance; Program No. 93.774, Medicare—Supplementary Medical Insurance; and Program No. 93.778, Medical Assistance.)

Dated: September 20, 1996.

Bruce C. Vladeck,

Administrator, Health Care Financing Administration.

Dated: December 27, 1996.

Donna E. Shalala,

Secretary.

[FR Doc. 97–21731 Filed 8–15–97; 8:45 am]

BILLING CODE 4120–01–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Parts 222 and 227

[Docket No. 960730210–7193–02; I.D. 050294D]

RIN 0648–XX65

Endangered and Threatened Species: Listing of Several Evolutionary Significant Units (ESUs) of West Coast Steelhead

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Final rule.

SUMMARY: On August 9, 1996, NMFS completed a comprehensive status review of west coast steelhead (*Oncorhynchus mykiss*, or *O. mykiss*) populations in Washington, Oregon, Idaho, and California, and identified 15 Evolutionarily Significant Units (ESUs) within this range. NMFS is now issuing a final rule to list two ESUs as endangered and three ESUs as threatened under the Endangered Species Act (ESA). The endangered steelhead ESUs are located in California (Southern California) and Washington (Upper Columbia River). The threatened steelhead ESUs are located in California (Central California Coast and South-Central California Coast) and Idaho, Washington, and Oregon (Snake River Basin). For the endangered ESUs, section 9(a) prohibitions will be effective 60 days from the publication of this final rule. For the threatened ESUs, NMFS will issue shortly protective regulations under section 4(d) of the ESA, which will apply section 9(a) prohibitions with certain exceptions.

NMFS has examined the relationship between hatchery and natural populations of steelhead in these ESUs, and has assessed whether any hatchery

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populations are essential for their recovery. Only the Wells Hatchery stock in the Upper Columbia River ESU is essential for recovery and included in this listing. Aside from the Wells Hatchery stock, only naturally spawned populations of steelhead (and their progeny) residing below long-term, naturally and man-made impassable barriers (i.e., dams) are listed in all five ESUs identified as threatened or endangered.

At this time, NMFS is listing only anadromous life forms of *O. mykiss*.

DATES: Effective October 17, 1997.

ADDRESSES: Protected Resources Division, NMFS, Northwest Region, 525 NE Oregon Street, Suite 500, Portland, OR 97232-2737.

FOR FURTHER INFORMATION CONTACT: Garth Griffin, 503-231-2005, Craig Wingert, 562-980-4021, or Joe Blum, 301-713-1401.

SUPPLEMENTARY INFORMATION:

Species Background

Oncorhynchus mykiss exhibit one of the most complex suites of life history traits of any salmonid species. *Oncorhynchus mykiss* may exhibit anadromy (meaning they migrate as juveniles from fresh water to the ocean, and then return to spawn in fresh water) or freshwater residency (meaning they reside their entire life in fresh water). Resident forms are usually referred to as "rainbow" or "redband" trout, while anadromous life forms are termed "steelhead." Few detailed studies have been conducted regarding the relationship between resident and anadromous *O. mykiss* and as a result, the relationship between these two life forms is poorly understood. Recently the scientific name for the biological species that includes both steelhead and rainbow trout was changed from *Salmo gairdneri* to *O. mykiss*. This change reflects the premise that all trouts from western North America share a common lineage with Pacific salmon.

Steelhead typically migrate to marine waters after spending 2 years in fresh water. They then reside in marine waters for typically 2 or 3 years prior to returning to their natal stream to spawn as 4-or 5-year-olds. Unlike Pacific salmon, steelhead are iteroparous, meaning they are capable of spawning more than once before they die. However, it is rare for steelhead to spawn more than twice before dying; most that do so are females. Steelhead adults typically spawn between December and June (Bell, 1990; Busby et al., 1996). Depending on water temperature, steelhead eggs may incubate in "redds" (nesting gravels) for 1.5 to 4 months before hatching as "alevins" (a larval life stage dependent on food stored in a yolk sac). Following yolk sac absorption, young juveniles or "fry" emerge from the gravel and begin actively feeding. Juveniles rear in fresh water from 1 to 4 years, then migrate to the ocean as "smolts."

Biologically, steelhead can be divided into two reproductive ecotypes, based on their state of sexual maturity at the time of river entry and the duration of their spawning migration. These two ecotypes are termed "stream maturing" and "ocean maturing." Stream maturing steelhead enter fresh water in a sexually immature condition and require several months to mature and spawn. Ocean maturing steelhead enter fresh water with well-developed gonads and spawn shortly after river entry. These two reproductive ecotypes are more commonly referred to by their season of freshwater entry (e.g., summer and winter steelhead).

Two major genetic groups or "subspecies" of steelhead occur on the west coast of the United States: a coastal group and an inland group, separated in the Fraser and Columbia River Basins approximately by the Cascade crest (Huzyk & Tsuyuki, 1974; Allendorf, 1975; Utter & Allendorf, 1977; Okazaki, 1984; Parkinson, 1984; Schreck et al., 1986; Reisenbichler et al., 1992). Behnke (1992) proposed to classify the coastal subspecies as *O. m. irideus* and the inland subspecies as *O. m. gairdneri*. These genetic groupings apply to both anadromous and non-anadromous forms of *O. mykiss*. Both coastal and inland steelhead occur in Washington and Oregon. California is thought to have only coastal steelhead while Idaho has only inland steelhead.

Historically, steelhead were distributed throughout the North Pacific Ocean from the Kamchatka Peninsula in Asia to the northern Baja Peninsula. Presently, the species distribution extends from the Kamchatka Peninsula, east and south along the Pacific coast of North America, to at least Malibu Creek in southern California. There are infrequent anecdotal reports of steelhead occurring as far south as the Santa Margarita River in San Diego County (McEwan & Jackson, 1996). Historically, steelhead likely inhabited most coastal streams in Washington, Oregon, and California as well as many inland streams in these states and Idaho. However, during this century, over 23 indigenous, naturally-reproducing stocks of steelhead are believed to have been extirpated, and many more are thought to be in decline in numerous coastal and inland streams in Washington, Oregon, Idaho, and California. Forty-three stocks have been identified by Nehlsen *et al.* (1991) as being at moderate or high risk of extinction.

Previous Federal ESA Actions Related to West Coast Steelhead

The history of petitions received regarding west coast steelhead is summarized in the proposed rule published on August 9, 1996 (61 FR 56138). The most comprehensive petition was submitted by Oregon Natural Resources Council and 15 co-petitioners on February 16, 1994. In response to this petition, NMFS assessed the best available scientific and commercial data, including technical information from Pacific Salmon Biological Technical Committees (PSBTCs) and interested parties in Washington, Oregon, Idaho, and California. The PSBTCs consisted primarily of scientists (from Federal, state, and local resource agencies, Indian tribes, industries, universities, professional societies, and public interest groups) possessing technical expertise relevant to steelhead and their habitats. A total of seven PSBTC meetings were held in the states of Washington, Oregon, Idaho, and California during the course of the west coast steelhead status review. NMFS also established a Biological Review Team (BRT), composed of staff from NMFS' Northwest and Southwest Fisheries Science Centers and Southwest Regional Office, as well as a representative of the National Biological Service, which conducted a coastwide status review for west coast steelhead (Busby et al., 1996).

Based on the results of the BRT report, and after considering other information and existing conservation measures, NMFS published a proposed listing determination (61 FR 56138, August 9, 1996) that identified 15 ESUs of steelhead in the states of Washington, Oregon, Idaho, and California. Ten of these ESUs were proposed for listing as threatened or endangered species, four were found not warranted for listing, and one was identified as a candidate for listing.

NMFS has now analyzed new information and public comments received in response to the August 9, 1996, proposed rule. NMFS' BRT has likewise analyzed this new information and has updated its conclusions accordingly (NMFS, 1997a). Copies of the BRT's updated conclusions, entitled "Status Review Update for West Coast Steelhead from Washington, Idaho, Oregon, and California," are available upon request (see ADDRESSEES). This final rule identifies five ESUs of west coast steelhead in the four states that currently warrant listing as threatened or endangered species under the ESA.

Summary of Comments Received in Response to the Proposed Rule

NMFS held 16 public hearings in California, Oregon, Idaho, and Washington to solicit comments on the proposed rule. One hundred and eighty-eight individuals presented testimony at the public hearings. During the 90-day public comment period, NMFS received 939 written comments on the proposed rule from Federal, state, and local government agencies, Indian tribes, non-governmental organizations, the scientific community, and other individuals. A number of comments addressed specific technical issues pertaining to a particular geographic region or *O. mykiss* population. These technical comments were considered by NMFS' BRT in its re-evaluation of ESU boundaries and status and are discussed in the updated Status Review document (NMFS, 1997a).

On July 1, 1994, NMFS, jointly with U.S. Fish and Wildlife Service (FWS), published a series of policies regarding listings under the ESA, including a policy for peer review of scientific data (59 FR 34270). In accordance with this policy, NMFS solicited 22 individuals to take part in a peer review of its west coast steelhead proposed rule. All individuals solicited are recognized experts in the field of steelhead biology and represent a broad range of interests, including Federal, state, and tribal resource managers, private industry consultants, and academia. Eight individuals took part in the peer review of this action; comments from peer reviewers were considered by NMFS' BRT and are summarized in the updated Status Review document (NMFS, 1997a).

A summary of comments received in response to the proposed rule is presented below.

Issue 1: Sufficiency and Accuracy of Scientific Information and Analysis

Comment: Numerous commenters disputed the sufficiency and accuracy of data which NMFS employed in its proposed rule to list ten steelhead ESUs as either threatened or endangered under the ESA. Several commenters urged NMFS to delay any ESA listing decisions for steelhead until additional scientific information is available concerning this species.

Response: Section 4(b)(1)(A) of the ESA requires that NMFS make its listing determinations solely on the basis of the best available scientific and commercial data after reviewing the status of the species. NMFS believes that information contained in the agency's status review (Busby *et al.*, 1996), together with more recent information obtained in response to the proposed rule (NMFS, 1997a), represent the best scientific information presently available for the steelhead ESUs addressed in this final rule. NMFS has conducted an exhaustive review of all available information relevant to the status of this species. NMFS has also solicited information and opinion from all interested parties, including peer reviewers as described above. If in the future new data become available to change these conclusions, NMFS will act accordingly.

Section 4(b)(6) of the ESA requires NMFS to publish a final determination whether a species warrants listing as threatened or endangered within 1 year from publishing a proposed determination. If such a final listing is not warranted, NMFS must withdraw the proposed regulation. In certain cases where NMFS concludes that substantial disagreement exists regarding the sufficiency or accuracy of available data relevant to its determinations, NMFS may extend this 1-year period by not more than 6 months for the purposes of soliciting additional data. (ESA § 4(b)(6)(B)(i)).

With respect to those steelhead ESUs addressed in this final rule, NMFS concludes no basis exists to delay final ESA listings. State resource agencies, peer reviewers, and other knowledgeable parties are in general agreement that steelhead stocks in these areas are at risk. As described in a separate Federal Register notice, however, NMFS has determined a 6-month extension is warranted for five remaining ESUs of west coast steelhead. These ESUs include the following: Lower Columbia River, Oregon Coast, Klamath Mountains Province, Northern California, and the Central Valley of California. For these particular ESUs, NMFS concludes that substantial disagreement exists regarding the sufficiency and accuracy of the data. Several efforts are underway that may resolve scientific disagreement regarding the sufficiency and accuracy of data relevant to these ESUs. NMFS has undertaken an intensive effort to analyze the data received during and after the comment period on the proposed ESUs from the States of Washington, Oregon, and California, as well as from peer reviewers. This work will include evaluating the Oregon Department of Fish and Wildlife (ODFW) models, analyzing population abundance trends where new data are available, and examining new genetic data relative to the relationship between winter and summer steelhead and between hatchery and wild fish. In light of these disagreements and the fact that more data are forthcoming, NMFS extends the final determination deadline for these ESUs for 6 months, until February 9, 1998.

Issue 2: Description and Status of Steelhead ESUs

Comment: A few commenters disputed NMFS' conclusions regarding the geographic boundaries for some of the ESUs and questioned NMFS' basis for determining these boundaries. Most of these comments pertained to the ESUs south of San Francisco Bay, suggesting particular river systems be excluded from listing due to historical or occasional absence of steelhead or rainbow trout.

Response: NMFS has published a policy describing how it will apply the ESA definition of "species" to anadromous salmonid species (56 FR 58612, November 20, 1991). More recently, NMFS and FWS published a joint policy, consistent with NMFS' policy, regarding the definition of "distinct population segments" (61 FR 4722, February 7, 1996). The earlier policy is more detailed and applies specifically to Pacific salmonids and, therefore, was used for this determination. This policy indicates that one or more naturally reproducing salmonid populations will be considered to be distinct and, hence, species under the ESA, if they represent an ESU of the biological species. To be considered an ESU, a population must satisfy two criteria: (1) It must be reproductively isolated from other population units of the same species; and (2) it must represent an important component in the evolutionary legacy of the biological species. The first criterion, reproductive isolation, need not be absolute but must have been strong enough to permit evolutionarily important differences to occur in different population units. The second criterion is met if the population contributes substantially to the ecological or genetic diversity of the species as a whole. Guidance on applying this policy is contained in a scientific paper entitled: "Pacific Salmon (*Oncorhynchus* spp.) and the Definition of 'Species' under the Endangered Species Act." It is also found in a NOAA Technical Memorandum: "Definition of 'Species' Under the Endangered Species Act: Application to Pacific Salmon" (Waples, 1991). A more detailed discussion of individual ESU boundaries is provided below under "Summary of Conclusions Regarding Listed ESUs."

Comment: Several commenters questioned NMFS' methodology for determining whether a given steelhead ESU warranted listing. In most cases, such commenters also expressed opinions regarding whether listing was warranted for a particular steelhead ESU. A few commenters provided substantive new information relevant to making risk assessments.

Response: Section 3 of the ESA defines the term "endangered species" as "any species which is in danger of extinction throughout all or a significant portion of its range." The term "threatened species" is defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." NMFS has identified a number of factors that should be considered in evaluating the level of risk faced by an ESU, including: (1) Absolute numbers of fish and their spatial and temporal distribution; (2) current abundance in relation to historical abundance and current carrying capacity of the habitat; (3) trends in abundance; (4) natural and human-influenced factors that cause variability in survival and abundance; (5) possible threats to genetic integrity (e.g., from strays or outplants from hatchery programs); and (6) recent events (e.g., a drought or changes in harvest management) that have predictable short-term consequences for abundance of the ESU. A more detailed discussion of status of individual ESUs is provided below under "Summary of Conclusions Regarding Listed ESUs."

Issue 3: Factors Contributing to the Decline of West Coast Steelhead

Comment: Many commenters identified factors they believe have contributed to the decline of west coast steelhead. Factors identified include overharvest by recreational fisheries, predation by pinnipeds and piscivorous fish species, effects of artificial propagation, and the deterioration or loss of freshwater and marine habitats.

Response: NMFS agrees that many factors, past and present, have contributed to the decline of west coast steelhead. NMFS also recognizes that natural environmental fluctuations have likely played a role in the species' recent declines. However, NMFS believes other human-induced impacts (e.g., incidental catch in certain fisheries, hatchery practices, and habitat modification) have played an equally significant role in this species' decline. Moreover, these human-induced impacts have likely reduced the species' resiliency to natural factors for decline such as drought, poor ocean conditions, and predation (NMFS, 1996a).

Since the time of this proposed listing, NMFS has published a report describing the impacts of California Sea Lions and Pacific Harbor Seals upon salmonids and on the coastal ecosystems of Washington, Oregon, and California (NMFS, 1997b). This report concludes that in certain cases where pinniped populations co-exist with depressed salmonid populations, salmon populations may experience severe impacts due to predation. An example of such a situation is Ballard Locks, WA, where sea lions are known to consume significant numbers of adult winter steelhead. This study further concludes that data regarding pinniped predation is quite limited and that substantial additional research is needed to fully address this issue. For additional information on this issue see the "Summary of Factors Affecting Steelhead" below.

Comment: One peer reviewer and several commenters stated that NMFS' assessment underestimated the significant influence of natural environmental fluctuations on salmonid populations. Several commenters stated that ocean conditions are one of the primary factors for decline. These commenters suggested that any listing activity should be postponed until the complete oceanographic cycle can be observed.

Response: Environmental changes in both marine and freshwater habitats can have important impacts on steelhead abundance. For example, a pattern of relatively high abundance in the mid-1980s followed by (often sharp) declines over the next decade occurred in steelhead populations from most geographic regions of the Pacific Northwest. This result is most plausibly explained by broad-scale changes in ocean productivity. Similarly, 6 to 8 years of drought in the late 1980s and early 1990s adversely affected many freshwater habitats for steelhead throughout the region. These natural phenomena put increasing pressure on natural populations already stressed by anthropogenic factors such as habitat degradation, blockage of migratory routes, and harvest (NMFS, 1996a).

Improvement of cyclic or episodic environmental conditions (for example, increases in ocean productivity or shifts from drought to wetter conditions) can help alleviate extinction risk to steelhead populations. However, NMFS cannot reliably predict future environmental conditions, making it unreasonable to assume improvements in abundance as a result of improvements in such conditions. Furthermore, steelhead and other species of Pacific salmon have evolved over the centuries with such cyclical environmental stresses. This species has persisted through time in the face of these conditions largely due to the presence of freshwater and estuarine refugia. As these refugia are altered and degraded, Pacific salmon species are more vulnerable to episodic events such as shifts in ocean productivity and drought cycles (NMFS, 1996a).

Issue 4: Consideration of Existing Conservation Measures

Comment: Several commenters argued that NMFS had not considered existing conservation programs designed to enhance steelhead stocks within a particular ESU. Some commenters provided specific information on some of these programs to NMFS concerning the efficacy of existing conservation plans.

Response: NMFS has reviewed existing conservation plans and measures relevant to the five ESUs addressed in this final rule and concludes that existing conservation efforts in these areas are not sufficient to preclude listing of individual ESUs at this time. Several of the plans addressed in comments show promise of ameliorating the risks facing steelhead. However, in most cases, measures described in comments have not been implemented or are in their early stages of implementation and have not yet demonstrated success. Some of these measures are also geographically limited to individual river basins or political subdivisions, thereby improving conditions for only a small portion of the entire ESU.

While existing conservation efforts and plans are not sufficient to preclude the need for listings at this time, they are nevertheless valuable for improving watershed health and restoring fishery resources. In those cases where well developed, reliable conservation plans exist, NMFS may choose to incorporate them into the recovery planning process. In the case of threatened species, NMFS also has flexibility under section 4(d) to tailor section 9 take regulations based on the contents of available conservation measures. NMFS fully intends to recognize local conservation efforts to the fullest extent possible. Endangered Species Act listing should not be viewed as the failure of such plans; rather, it should be viewed as a challenge to better coordinate existing conservation efforts to address the underlying problems of watershed degradation and species health.

Issue 5: Steelhead Biology and Ecology

Comment: Several commenters and a peer reviewer asserted that resident rainbow trout should be included in listed steelhead ESUs. Several commenters also stated that NMFS and FWS should address how the presence of rainbow trout populations may ameliorate risks facing anadromous populations within listed ESUs.

Response: In its August 9, 1996, proposed rule, NMFS stated that based on available genetic information, it was the consensus of NMFS scientists, as well as regional fishery biologists, that resident fish should generally be considered part of the steelhead ESUs. However, NMFS concluded that available data were inconclusive regarding the relationship of resident rainbow trout and steelhead. NMFS requested additional data in the proposed rule to clarify this relationship and determine if resident rainbow trout should be included in listed steelhead ESUs.

In response to this request for additional information, many groups and individuals expressed opinions regarding this issue. In most cases these opinions were not supported by new information that resolves existing uncertainty. Two state fishery management agencies (California Department of Fish and Game and Washington Department of Fish and Wildlife) and one peer reviewer provided comments and information supporting the inclusion of resident rainbow trout in listed steelhead ESUs. In general, these parties also felt that rainbow trout may serve as an important reservoir of genetic material for at risk steelhead stocks.

While conclusive evidence does not yet exist regarding the relationship of resident and anadromous *O. mykiss*, NMFS believes available evidence suggests that resident rainbow trout should be included in listed steelhead ESUs in certain cases. Such cases include: (1) Where resident *O. mykiss* have the opportunity to interbreed with anadromous fish below natural or man-made barriers; or (2) where resident fish of native lineage once had the ability to interbreed with anadromous fish but no longer do because they are currently above human-made barriers, and they are considered essential for recovery of the ESU. Whether resident fish that exist above any particular man-made barrier meet these criteria, must be reviewed on a case-by-case basis by NMFS. NMFS recognizes that there may be many such cases in California alone. Resident fish above long-standing natural barriers, and those that are derived from the introduction of non-native rainbow trout, would not be considered part of any ESU.

Several lines of evidence exist to support this conclusion. Under certain conditions, anadromous and resident *O. mykiss* are apparently capable not only of interbreeding, but also of having offspring that express the alternate life history form, that is, anadromous fish can produce nonanadromous offspring, and vice versa (Shapovalov and Taft, 1954; Burgner et al., 1992). Mullan et al. (1992) found evidence that in very cold streams, juvenile steelhead had difficulty attaining "mean threshold size for smoltification" and concluded that "[m]ost fish here [Methow River, WA] that do not emigrate downstream early in life are thermally-fated to a resident life history regardless of whether they were the progeny of anadromous or resident parents." Additionally, Shapovalov and Taft (1954) reported evidence of *O. mykiss* maturing in fresh water and spawning prior to their first ocean migration; this life history variation has also been found in cutthroat trout (*O. clarki*) and Atlantic salmon (*Salmo salar*).

NMFS believes resident fish can help buffer extinction risks to an anadromous population by mitigating depensatory effects in spawning populations (e.g., inability of spawning adults to find mates due to low population sizes), by providing offspring that migrate to the ocean and enter the breeding population of steelhead, and by providing a "reserve" gene pool in freshwater that may persist through times of unfavorable conditions for anadromous fish. In spite of these potential benefits, presence of resident populations is not a substitute for conservation of anadromous populations. A particular concern is isolation of resident populations by human-caused barriers to migration. This interrupts normal population dynamics and population genetic processes and can lead to loss of a genetically based trait (anadromy). As discussed in NMFS' "species identification" paper (Waples 1991), the potential loss of anadromy in distinct population segments may in and of itself warrant listing the species as a whole.

On February 7, 1996, FWS and NMFS adopted a joint policy to clarify their interpretation of the phrase "distinct population segment (DPS) of any species of vertebrate fish or wildlife" for the purposes of listing, delisting, and reclassifying species under the ESA (61 FR 4722). DPSs are "species" pursuant to section 3(15) of the ESA. Previously, NMFS had developed a policy for stocks of Pacific salmon where an ESU of a biological species is considered "distinct" (and hence a species) if it is substantially reproductively isolated from other conspecific population units, and it represents an important component in the evolutionary legacy of the species (November 20, 1991, 56 FR 58612). NMFS believes available data suggest that resident rainbow trout are in many cases part of steelhead ESUs. However, the FWS, which has ESA authority for resident fish, maintains that behavioral forms can be regarded as separate DPSs (e.g., western snowy plover) and that absent evidence suggesting resident rainbow trout need ESA protection, the FWS concludes that only the anadromous forms of each ESU should be listed under the ESA (DOI, 1997; FWS, 1997).

In its review of west coast steelhead, the NMFS BRT stated that rainbow trout and steelhead in the same area may share a common gene pool, at least over evolutionary time periods (NMFS, 1997a). The importance of any recovery action is measured in terms of its ability to recover the listed species in the foreseeable future. The FWS believes that steelhead recovery will not rely on the intermittent exchange of genetic material between resident and anadromous forms (FWS, 1997). As a result, without a clear demonstration of any risks to resident rainbow trout or the need to protect rainbow trout to recover steelhead in the foreseeable future, the FWS concludes that only the anadromous forms of *O. mykiss* should be included in the listed steelhead ESUs at this time (FWS 1997). Moreover, including resident forms of *O. mykiss* in any future listing action under the ESA would necessitate that the two forms combined meet the definition of an endangered or threatened species (FWS, 1997).

Summary of Factors Affecting the Species

Section 4(a)(1) of the ESA and the listing regulations (50 CFR part 424) set forth procedures for listing species. The Secretary of Commerce (Secretary) must determine, through the regulatory process, if a species is endangered or threatened based upon any one or a combination of the following factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors affecting its continued existence.

As noted earlier, NMFS received numerous comments regarding the relative importance of various factors contributing to the decline of west coast steelhead. Several recent documents describe in more detail the impacts of various factors contributing to the decline of steelhead and other salmonids (e.g., NMFS, 1997c). Relative to west coast steelhead, NMFS has prepared a supporting document that addresses the factors leading to the decline of this species entitled "Factors for Decline: A supplement to the notice of determination for west coast steelhead" (NMFS, 1996a). This report, available upon request (see ADDRESSES), concludes that all of the factors identified in section 4(a)(1) of the ESA have played a role in the decline of the species. The report identifies destruction and modification of habitat, overutilization for recreational purposes, and natural and human-made factors as being the primary reasons for the decline of west coast steelhead. The following discussion briefly summarizes findings regarding factors for decline across the range of west coast steelhead. While these factors have been treated here in general terms, it is important to underscore that impacts from certain factors are more acute for specific ESUs. For example, impacts from hydropower development are more pervasive for ESUs in the Upper Columbia River and Snake River ESUs than for some coastal ESUs.

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Steelhead on the west coast of the United States have experienced declines in abundance in the past several decades as a result of natural and human factors. Forestry, agriculture, mining, and urbanization have degraded, simplified, and fragmented habitat. Water diversions for agriculture, flood control, domestic, and hydropower purposes (especially in the Columbia River and Sacramento-San Joaquin Basins) have greatly reduced or eliminated historically accessible habitat. Studies estimate that during the last 200 years, the lower 48 states have lost approximately 53 percent of all wetlands and the majority of the rest are severely degraded (Dahl, 1990; Tiner, 1991). Washington and Oregon's wetlands are estimated to have diminished by one-third, while California has experienced a 91-percent loss of its wetland habitat (Dahl, 1990; Jensen *et al.*, 1990; Barbour *et al.*, 1991; Reynolds *et al.*, 1993). Loss of habitat complexity has also contributed to the decline of steelhead. For example, in national forests in Washington, there has been a 58-percent reduction in large, deep pools due to sedimentation and loss of pool-forming structures such as boulders and large wood (FEMAT, 1993). Similarly, in Oregon, the abundance of large, deep pools on private coastal lands has decreased by as much as 80 percent (FEMAT, 1993). Sedimentation from land use activities is recognized as a primary cause of habitat degradation in the range of west coast steelhead.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Steelhead support an important recreational fishery throughout their range. During periods of decreased habitat availability (e.g., drought conditions or summer low flow when fish are concentrated), the impacts of recreational fishing on native anadromous stocks may be heightened. NMFS has reviewed and evaluated the impacts of recreational fishing on west coast steelhead populations (NMFS, 1996a). Steelhead are not generally targeted in commercial fisheries. High seas driftnet fisheries in the past may have contributed slightly to a decline of this species in local areas, but could not be solely responsible for the large declines in abundance observed along most of the Pacific coast over the past several decades.

A particular problem occurs in the main stem of the Columbia River where listed steelhead from the Upper Columbia and Snake River Basin ESUs migrate at the same time and are subject to the same fisheries as unlisted, hatchery-produced steelhead, chinook and coho salmon. Incidental harvest mortality in mixed-stock sport and commercial fisheries may exceed 30 percent of listed populations.

C. Disease or Predation

Infectious disease is one of many factors that can influence adult and juvenile steelhead survival. Steelhead are exposed to numerous bacterial, protozoan, viral, and parasitic organisms in spawning and rearing areas, hatcheries, migratory routes, and the marine environments. Specific diseases such as bacterial kidney disease (BKD), ceratomyxosis, columnaris, Furunculosis, infectious hematopoietic necrosis (IHNV), redmouth and black spot disease, Erythrocytic Inclusion Body Syndrome (EIBS), and whirling disease among others are present and are known to affect steelhead and salmon (Rucker et al., 1953; Wood, 1979; Leek, 1987; Foott et al., 1994; Gould and Wedemeyer, undated). Very little current or historical information exists to quantify changes in infection levels and mortality rates attributable to these diseases for steelhead. However, studies have shown that native fish tend to be less susceptible to pathogens than hatchery-reared fish (Buchanon *et al.*, 1983; Sanders *et al.*, 1992).

Introductions of non-native species and habitat modifications have resulted in increased predator populations in numerous river systems, thereby increasing the level of predation experienced by salmonids. Predation by pinnipeds is also of concern in areas experiencing dwindling steelhead run sizes. However, salmon and marine mammals have coexisted for thousands of years and most investigators consider predation an insignificant contributing factor to the large declines observed in west coast steelhead populations.

D. Inadequacy of Existing Regulatory Mechanisms

1. Federal and State Forest Practices

The Northwest Forest Plan (NFP) is a Federal management policy with important benefits for steelhead. While the NFP covers a very large area, the overall effectiveness of the NFP in conserving steelhead is limited by the extent of Federal lands and the fact that Federal land ownership is not uniformly distributed in watersheds within the affected ESUs. The extent and distribution of Federal lands limits the NFP's ability to achieve its aquatic habitat restoration objectives at watershed and river basin scales and highlights the importance of complementary salmon habitat conservation measures on non-Federal lands within the subject ESUs. For example, there are no Federal lands managed under the NFP within the Central California, South-Central California, or Southern California ESUs.

On February 25, 1995, the U.S. Forest Service and Bureau of Land Management adopted Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in eastern Oregon and Washington, Idaho, and portions of California (known as PACFISH). The strategy was developed in response to significant declines in naturally-reproducing salmonid stocks, including steelhead, and widespread degradation of anadromous fish habitat throughout public lands in Idaho, Washington, Oregon, and California outside the range of the northern spotted owl. Like the NFP, PACFISH is an attempt to provide a consistent approach for maintaining and restoring aquatic and riparian habitat conditions which, in turn, are expected to promote the sustained natural production of anadromous fish. However, as with the NFP, PACFISH is limited by the extent of Federal lands and the fact that Federal land ownership is not uniformly distributed in watersheds within the affected ESUs. In the South-Central California and Southern California ESU, for example, Federal lands managed by the U.S. Forest Service represent less than 15–25 percent of each ESU. Moreover, much of these Federal lands are located in upper elevation areas above currently impassible barriers. Furthermore, PACFISH was designed to be a short-term land management/anadromous fish conservation strategy to halt habitat degradation and begin the restoration process until a long-term strategy could be adopted. Interagency PACFISH implementation reports from 1995 and 1996 indicate PACFISH has not been consistently implemented and has not achieved the level of conservation anticipated for the short-term. Additionally, because PACFISH was expected to be replaced within 18 months, it required only minimal levels of watershed analysis and restoration. The interim PACFISH strategy could be effective until summer 1998, when the Interior Columbia River basin Environmental Impact Statements replace it. In total, PACFISH would be in place for a period of approximately 42 months and its long-term limitations have already resulted in lost conservation opportunities for threatened and proposed anadromous fishes.

The California Department of Forestry and Fire Protection (CDF) enforces the State of California's forest practice rules (CFPRs) that are promulgated through the Board of Forestry (BOF). The CFPRs contain provisions that can be protective of steelhead if fully implemented. However, NMFS believes the CFPRs do not secure properly functioning riparian habitat. Specifically, the CFPRs do not adequately address large woody debris recruitment, streamside tree retention to maintain bank stability, and canopy retention standards that assure stream temperatures are properly functioning for all life stages of steelhead. The current process for approving Timber Harvest Plans (THPs) under the CFPRs does not include monitoring of timber harvest operations to determine whether a particular operation damaged habitat and, if so, how it might be mitigated in future THPs. The CFPR rule that permits salvage logging is also an area where better environmental review and monitoring could ensure better protection for steelhead. For these reasons, NMFS is working to improve the condition of riparian buffers in ongoing habitat conservation plan negotiations with private landowners.

The Washington Department of Natural Resources implements and enforces the State of Washington's forest practice rules (WFPRs) which are promulgated through the Forest Practices Board. These WFPRs contain provisions that can be protective of steelhead if fully implemented. This is possible given that the WFPR's are based on adaptive management of forest lands through watershed analysis, development of site-specific land management prescriptions, and monitoring. Watershed Analysis prescriptions can exceed WFPR minima for stream and riparian protection. However, NMFS believes the WFPRs, including watershed analysis, do not provide properly functioning riparian and instream habitats. Specifically, the base WFPRs do not adequately address large woody debris recruitment, tree retention to maintain stream bank integrity and channel networks within floodplains, and chronic and episodic inputs of coarse and fine sediment that maintain habitats that are properly functioning for all life stages of steelhead.

The majority of land area within the Snake River ESU (about 70 percent) is under Federal management; therefore, in most watersheds the State of Idaho's forest practice rules play a lesser role in forest management relative to Federal measures (i.e., PACFISH). Even so, NMFS believes that certain aspects of the State's forest practice rules do not avoid adverse effects to anadromous fish populations or their habitat. Specifically, current riparian buffer width requirements are inadequate, as well as rules which do not prohibit logging on unstable hillsides and landslide prone areas.

2. Dredge, Fill, and Inwater Construction Programs

The Army Corps of Engineers (COE) regulates removal/fill activities under section 404 of the Clean Water Act (CWA), which requires that the COE not permit a discharge that would "cause or contribute to significant degradation of the waters of the United States." One of the factors that must be considered in this determination is cumulative effects. However, the COE guidelines do not specify a methodology for assessing cumulative impacts or how much weight to assign them in decision-making. Furthermore, the COE does not have in place any process to address the additive effects of the continued development of waterfront, riverine, coastal, and wetland properties.

3. Water Quality Programs

The Federal CWA is intended to protect beneficial uses, including fishery resources. To date, implementation has not been effective in adequately protecting fishery resources, particularly with respect to non-point sources of pollution.

Section 303(d)(1) (C) and (D) of the CWA requires states to prepare Total Maximum Daily Loads (TMDLs) for all water bodies that do not meet State water quality standards. TMDLs are a method for quantitative assessment of environmental problems in a watershed and identifying pollution reductions needed to protect drinking water, aquatic life, recreation, and other use of rivers, lakes, and streams. TMDLs may address all pollution sources including point sources such as sewage or industrial plant discharges, and non-point discharges such as runoff from roads, farm fields, and forests.

The CWA gives state governments the primary responsibility for establishing TMDLs. However, EPA is required to do so if a state does not meet this responsibility. In California, as a result of recent litigation, the EPA has made a legal commitment guaranteeing that either EPA or the State of California will establish TMDLs, that identify pollution reduction targets, for 18 impaired river basins in northern California by the year 2007. The State of California has made a commitment to establish TMDLs for approximately half the 18 river basins by 2007. The EPA will develop TMDLs for the remaining basins and has also agreed to complete all TMDLs if the State fails to meet its commitment within the agreed upon time frame.

State agencies in Oregon are committed to completing TMDLs for coastal drainages within 4 years, and all impaired waters within 10 years. Similarly ambitious schedules are in place, or being developed for Washington and Idaho.

The ability of these TMDLs to protect steelhead should be significant in the long term; however, it will be difficult to develop them quickly in the short term and their efficacy in protecting steelhead habitat will be unknown for years to come.

4. Hatchery and Harvest Management

In the past, non-native steelhead stocks have been introduced as broodstock in hatcheries and widely transplanted in many coastal rivers and streams in California (Bryant, 1994; Busby et al., 1996; NMFS, 1997a). Because of problems associated with this practice, California Department of Fish and Game (CDFG) developed its

Salmon and Steelhead Stock Management Policy. This policy recognizes that such stock mixing is detrimental and seeks to maintain the genetic integrity of all identifiable stocks of salmon and steelhead in California, as well as minimize interactions between hatchery and natural populations. To protect the genetic integrity of salmon and steelhead stocks, this policy directs CDFG to evaluate each salmon and steelhead stream and classify it according to its probable genetic source and degree of integrity. This has not yet been accomplished by the State.

California's Steelhead Management Plan (or plan) was adopted and published in February 1996. The plan recognizes that restoration of California's steelhead populations requires a broad approach that emphasizes ecosystem restoration. The plan focuses on restoration of native and naturally produced steelhead stocks because of their importance in maintaining genetic and biological diversity and for their aesthetic values. The Steelhead Plan presents a historical account of the decline of California's steelhead populations, and identifies needed restoration measures both on a broad, programmatic scale and on a stream-specific scale. The Steelhead Plan identifies recent changes in the State's steelhead fishery management and regulations (e.g., steelhead trout catch report—restoration card (AB 2187), seasonal closures and zero bag limits for nearly all coastal streams from Santa Barbara County southward) and also identifies recommendations for further management changes to protect and conserve steelhead populations. These recommended changes include marking of all hatchery-produced steelhead in the State, implementation of an 8-inch minimum size limit for all anadromous waters in the State, and a reduction in the State-wide bag limit to one steelhead per day. CDFG has just recently begun implementation of some of the measures identified in this plan.

Hatchery programs and harvest management have strongly influenced steelhead populations in the Upper Columbia and Snake River Basin ESUs. Hatchery programs intended to compensate for habitat losses have masked declines in natural stocks and have created unrealistic expectations for fisheries. Collection of natural steelhead for broodstock and transfers of stocks within and between ESUs has detrimentally impacted some populations.

The three state agencies (Oregon Department of Fish and Wildlife, Washington Department of Fish and Game, and Idaho Department of Fish and Game) have adopted and are implementing natural salmonid policies designed to limit hatchery influences on natural, indigenous steelhead. Sport fisheries are based on marked, hatchery-produced steelhead, and sport fishing regulations are designed to protect wild fish. While some limits have been placed on hatchery production of anadromous salmonids, more careful management of current programs and scrutiny of proposed programs is necessary in order to minimize impacts on listed species.

E. Other Natural or Human-Made Factors Affecting Its Continued Existence

Natural climatic conditions have exacerbated the problems associated with degraded and altered riverine and estuarine habitats. Persistent drought conditions have reduced already limited spawning, rearing and migration habitat. Climatic conditions appear to have resulted in decreased ocean productivity which, during more productive periods, may help offset degraded freshwater habitat conditions (NMFS, 1996a).

In an attempt to mitigate the loss of habitat, extensive hatchery programs have been implemented throughout the range of steelhead on the West Coast. While some of these programs have succeeded in providing fishing opportunities, the impacts of these programs on native, naturally-reproducing stocks are not well understood. Competition, genetic introgression, and disease transmission resulting from hatchery introductions may significantly reduce the production and survival of native, naturally-reproducing steelhead. Collection of native steelhead for hatchery broodstock purposes often harms small or dwindling natural populations. Artificial propagation can play an important role in steelhead recovery through carefully controlled supplementation programs.

Summary of ESU Determinations

Below follows a summary of NMFS' ESU determinations for these species. A more detailed discussion of ESU determinations is presented in the "Status Review Update for West Coast Steelhead from Washington, Idaho, Oregon, and California" (NMFS, 1997a). Copies of this document are available upon request (see ADDRESSES).

(1) Central California Coast ESU

This coastal steelhead ESU occupies river basins from the Russian River, Sonoma County, CA, (inclusive) to Aptos Creek, Santa Cruz County, CA, (inclusive), and the drainages of San Francisco and San Pablo Bays eastward to the Napa River (inclusive), Napa County, CA. The Sacramento-San Joaquin River Basin of the Central Valley of California is excluded. Environmental features show a transition in this region from the northern redwood forest ecosystem to the more xeric southern chaparral and coastal scrub ecosystems. This area is characterized by very erosive soils in the coast range mountains; redwood forest is the dominant coastal vegetation for these drainages. Precipitation is lower here than in areas to the north, and elevated stream temperatures (greater than 20° C) are common in the summer. Coastal upwelling in this region is strong and consistent, resulting in a relatively productive nearshore marine environment.

NMFS has determined that no changes in the proposed boundaries of the Central California Coast ESU are warranted; however, the original written description of this ESU inadvertently left a gap between Soquel Creek and the Pajaro River. This ESU includes steelhead occupying the Russian River and all basins south to Aptos Creek but not including the Pajaro River Basin.

One peer reviewer questioned the basis for the location of the boundary between this ESU and the South-Central California Coast, effectively splitting the basins that flow into Monterey Bay. The ESU break between Aptos Creek and the Pajaro River is largely based on ecological differences of the river basins. The Pajaro River and river basins south of there drain an arid interior and end in broad coastal plains, whereas north of the Pajaro River, the river basins largely drain coastal mountains at the southern end of the natural range of the redwood forest. This boundary is also consistent with the southern limit of coho salmon, further suggesting a natural ecological break.

NMFS finds no biological basis to exclude steelhead from the basins of either San Francisco or San Pablo Bays from this ESU, as some commenters have suggested. The characteristics of hydrology, geology, and upper basin vegetation in the basins draining into San Francisco Bay and San Pablo Bay are more similar to those attributes of the coastal portion of this ESU than to the Central Valley ESU, although resource management activities and urbanization have altered much of the habitat. Life history characteristics of steelhead, such as period of emigration and spawning, are also consistent within this ESU.

Hatchery Populations Pertaining to This ESU

Hatchery populations considered part of this ESU include Big Creek Hatchery stock and San Lorenzo River Hatchery stock which is reared at the Big Creek hatchery. The basis for this conclusion is the minimal influence of releases of fish from outside of the ESU and the genetic similarity between these and other regional stocks. Furthermore, adult collection and spawning procedures practiced by the hatcheries (which include using naturally produced fish) have helped reduce selection for domestication and small population effects during the course of hatchery operations.

Hatchery populations not included in the listed ESU at this time include the Dry Creek stock at the Warm Springs hatchery. Information concerning this stock is sparse and therefore this stock's relationship to the entire ESU is uncertain. NMFS will continue to evaluate any new information concerning this stock in the future to determine if its inclusion is warranted.

(2) South-Central California Coast ESU

This coastal steelhead ESU occupies rivers from the Pajaro River, located in Santa Cruz County, CA, (inclusive) to (but not including) the Santa Maria River, San Luis Obispo County, CA. Most rivers in this ESU drain the Santa Lucia Mountain Range, the southernmost unit of the California Coast Ranges. The climate is drier and warmer than in the north, which is reflected in the vegetational change from coniferous forest to chaparral and coastal scrub. Another biological transition at the north of this area is the southern limit of the distribution of coho salmon (*O. kisutch*). The mouths of many of the rivers and streams in this area are seasonally closed by sand berms that form during periods of low flow in the summer. The southern boundary of this ESU is near Point Conception, a well-known transition area for the distribution and abundance of marine flora and fauna.

NMFS has determined that no changes in the proposed boundaries of the South-Central California Coast ESU are warranted. See discussion of the Central California Coast ESU, above, regarding the break between Aptos Creek and the Pajaro River.

Hatchery Populations Pertaining to This ESU

Hatchery populations considered part of this ESU include Whale Rock Reservoir stock. Although this stock was established from a steelhead population that was trapped behind the Whale Rock Dam in the 1950s, it apparently retains an anadromous component. Juvenile steelhead are able to emigrate from Whale Rock Reservoir during high spill years, and anecdotal information indicates that some of these juveniles return as adults to the base of the dam 2 years later.

(3) Southern California ESU

This coastal steelhead ESU occupies rivers from the Santa Maria River, San Luis Obispo County, CA (inclusive) to the southern extent of the species' range. Available data indicate that Malibu Creek, Los Angeles County is the southernmost stream generally recognized as supporting a persistent, naturally spawning population of anadromous *O. mykiss* (Behnke, 1992; Burgner et al., 1992).

Migration and life history patterns of southern California steelhead depend more strongly on rainfall and streamflow than is the case for steelhead populations farther north (Moore, 1980; Titus et al., in press). River entry ranges from early November through June, with peaks in January and February. Spawning primarily begins in January and continues through early June, with peak spawning in February and March. Average rainfall is substantially lower and more variable in this ESU than regions to the north, resulting in increased duration of sand berms across the mouths of streams and rivers and, in some cases, complete dewatering of the marginal habitats. Environmental conditions in marginal habitats may be extreme (e.g., elevated water temperatures, droughts, floods, and fires) and presumably impose selective pressures on steelhead populations. Steelhead use of southern California streams and rivers with elevated temperatures suggests that populations within this ESU are able to withstand higher temperatures than those to the north. The relatively warm and productive waters of the Ventura River resulted in more rapid growth of juvenile steelhead than occurred in northerly populations (Moore, 1980; McEwan & Jackson, 1996). However, relatively little life history information exists for steelhead from this ESU.

In the proposed rule NMFS stated that this ESU presently extends to the southern extent of the species range which is currently thought to be Malibu Creek, Los Angeles County. Many comments were received regarding this issue; most supported placing the southern boundary of this ESU further south. NMFS has reviewed numerous references to steelhead occurring historically and recently in streams as far south as the U.S.-Mexico border. While available data indicate that steelhead may occasionally occur as far south as the Santa Margarita River, the relationship of these individuals to those populations occurring further north is poorly understood.

Based on available data, NMFS concludes that insufficient information exists to justify revision of the proposed southern boundary of this ESU.

Hatchery Populations Pertaining to This ESU

No hatchery production of steelhead currently occurs in this ESU.

(4) Upper Columbia River Basin ESU

This inland steelhead ESU occupies the Columbia River Basin upstream from the Yakima River, Washington, to the United States-Canada border. The geographic area occupied by this ESU forms part of the larger Columbia Basin Ecoregion (Omernik, 1987). The Wenatchee and Entiat Rivers are in the Northern Cascades Physiographic Province, and the Okanogan and Methow Rivers are in the Okanogan Highlands Physiographic Province. The geology of these provinces is somewhat similar and very complex, developed from marine invasions, volcanic deposits, and glaciation (Franklin & Dyrness, 1973). The river valleys in this region are deeply dissected and maintain low gradients except in extreme headwaters. The climate in this area includes extremes in temperatures and precipitation, with most precipitation falling in the mountains as snow. Streamflow in this area is provided by melting snowpack, groundwater, and runoff from alpine glaciers. Mullan *et al.* (1992) described this area as a harsh environment for fish and stated that "it should not be confused with more studied, benign, coastal streams of the Pacific Northwest."

Life history characteristics for Upper Columbia River Basin steelhead are similar to those of other inland steelhead ESUs; however, some of the oldest smolt ages for steelhead, up to 7 years, are reported from this ESU. This may be associated with the cold stream temperatures (Mullan *et al.*, 1992). Based on limited data available from adult fish, smolt age in this ESU is dominated by 2-year-olds. Steelhead from the Wenatchee and Entiat Rivers return to fresh water after 1 year in salt water, whereas Methow River steelhead are primarily two-ocean resident (Howell *et al.*, 1985).

In 1939, the construction of Grand Coulee Dam on the Columbia River blocked over 1,800 kilometers of river from access by anadromous [illegible] Mullan et al., 1992). In an effort to p[illegible]ve fish runs affected by Grand Coulee Dam, all anadromous fish migrating upstream were trapped at Rock Island Dam from 1939 through 1943 and either released to spawn in tributaries between Rock Island and Grand Coulee Dams or spawned in hatcheries and the offspring released in that area (Peven, 1990; Mullan *et al.*, 1992; Chapman *et al.*, 1994). Through this process, stocks of all anadromous salmonids, including steelhead, which were historically native to several separate subbasins above Rock Island Dam, were redistributed among tributaries in the Rock Island-Grand Coulee reach without regard to their origin. Exactly how this has affected stock composition of steelhead is unknown.

NMFS has determined that no changes in the boundaries of the Upper Columbia River ESU are warranted. No new information was received from peer reviewers or other commenters regarding the boundaries of this ESU.

Hatchery Populations Pertaining to This ESU

Hatchery populations considered part of this ESU include the Wells Hatchery stock of steelhead (Summer run). Although this stock represents a mixture of native populations, it probably retains the genetic resources of steelhead populations above Grand Coulee Dam that are now extinct from those native habitats. Operations at the Wells Hatchery have utilized large numbers of spawning adults (>500) and have incorporated some naturally spawning adults (10 percent of the total) into the broodstock each year, procedures which should help minimize the negative genetic effects of artificial propagation. Because of the incorporation of naturally-spawning adults into the hatchery broodstock and the large number of hatchery-propagated fish that spawn naturally, there is a close genetic resemblance between naturally spawning populations in the ESU and the Wells Hatchery stock that could be used for recovery purposes.

Hatchery populations not considered part of this ESU include the Skamania Hatchery stock (Summer run) because of its non-native heritage.

(5) Snake River Basin ESU

This inland steelhead ESU occupies the Snake River Basin of southeast Washington, northeast Oregon and Idaho. The Snake River flows through terrain that is warmer and drier on an annual basis than the upper Columbia Basin or other drainages to the north. Geologically, the land forms are older and much more eroded than most [illegible] steelhead habitat. The eastern portion of the basin flows out of the granitic geological unit known as the Idaho Batholith. The western Snake River Basin drains sedimentary and volcanic soils of the Blue Mountains complex. Collectively, the environmental factors of the Snake River Basin result in a river that is warmer and more turbid, with higher pH and alkalinity, than is found elsewhere in the range of inland steelhead.

Snake River Basin steelhead are summer steelhead, as are most inland steelhead, and have been classified into two groups, A-run and B-run, based on migration timing, ocean-age, and adult size. Snake River Basin steelhead enter fresh water from June to October and spawn in the following spring from March to May. A-run steelhead are thought to be predominately one-ocean, while B-run steelhead are thought to be two-ocean (IDFG, 1994). Snake River Basin steelhead usually smolt at age-2 or -3 years (Whitt, 1954; BPA, 1992; Hassemer, 1992).

NMFS concludes that no changes in the proposed boundaries of the Snake River Basin ESU are warranted. While several commenters stated that A- and B-run steelhead are distinctive and therefore warrant consideration as separate ESUs, no new scientific evidence was provided to support this. As one peer reviewer noted, the distinction between A- and B-run fish currently is made using either timing-based or length-based divisions of steelhead passing Bonneville Dam, on the mainstem Columbia River. Above Bonneville dam, run-timing separation is not observed, and the groups are separated based on ocean age and body size (IDFG, 1994). It is unclear if the life history and body size differences observed upstream are correlated with groups forming the bimodal migration observed at Bonneville dam. Furthermore, the relationship between patterns observed at the dams and the distribution of adults in spawning areas through the Snake River basin is not well understood. Based on the inability to clearly distinguish between A- and B-run steelhead once above Bonneville, NMFS concludes their division into separate ESUs is not warranted.

Hatchery Populations Pertaining to This ESU

Hatchery populations considered part of this ESU include Dworshak National Fish Hatchery (NFH) stock (Summer run); Imnaha River stock (Summer run); and Oxbow Hatchery stock (Summer run). Although the historical spawning and rearing habitat for the Dworshack Hatchery stock is not available to anadromous migrants (due to the construction of Dworshak Dam), this stock represents the only source of a genetically distinct component of the ESU. Furthermore, due to the absence of any introgression from other populations, the purity of this stock likely has been maintained. While some concern exists for potential domestication or genetic founder effects, hatchery records indicate that a minimum of a thousand adults have been used annually to perpetuate the stock, which would reduce the possibility of genetic drift leading to reduced genetic variation within the stock.

NMFS concludes that the Imnaha River Hatchery stock is part of the Snake River ESU. This stock was recently founded from an undiluted stock (with no previous history of non-native hatchery releases) for the purpose of preserving the native genetic resources of this area. Therefore, this stock represents an important component of the evolutionary legacy of this ESU.

Finally, NMFS concludes that the Oxbow Hatchery stock is part of the Snake River ESU. Although this stock has been under artificial propagation for several generations and has been propagated almost entirely from hatchery-derived adults, NMFS believes this stock represents the only source of a unique genetic resource and as such is important to preserve as part of the ESU.

Hatchery populations not considered part of the Snake River ESU include the Lyons Ferry stock (Summer run), Pahsimeroi Hatchery stock (Summer run), East Fork Salmon River Trap (Summer run), and Wallowa Hatchery stock (Summer run). The Lyons Ferry Hatchery stock is excluded primarily based on the use of steelhead from stocks that originated outside of this ESU. The Pahsimeroi Hatchery stock consists of a mixture of populations, all of which originate within the ESU; however, NMFS believes that because these populations came from ecologically-distinct regions throughout the Snake River Basin, the assemblage of these populations does not closely resemble any naturally spawning counterpart. In recent years, hatchery practices have focused on propagating this stock solely from hatchery derived adults. The East Fork Salmon River Trap consists of a mixture of Pahsimeroi and Dworshak Hatchery stocks which are not included in the ESU.

NMFS concludes that the Wallowa Hatchery stock is not included in this ESU. This stock was founded by collections of adults from lower Snake

River mainstem dams, and there is no clear consensus on which populations within the Snake River Basin were represented in the mixture. Also, populations not native to the Snake River (e.g., Skamania stock) have been incorporated into Wallowa Hatchery broodstock. Many of the reasons for not including this stock are similar to those given for the Pahsimeroi Hatchery stock.

Existing Conservation Efforts

Under section 4(b)(1)(A) of the ESA, the Secretary of Commerce is required to make listing determinations solely on the basis of the best scientific and commercial data available and after taking into account efforts being made to protect a species. During the status review for west coast steelhead, NMFS reviewed an array of protective efforts for steelhead and other salmonids, ranging in scope from regional strategies to local watershed initiatives. NMFS has summarized some of the major efforts in a document entitled "Steelhead Conservation Efforts: A Supplement to the Notice of Determination for West Coast Steelhead under the Endangered Species Act" (NMFS, 1996b). In addition, NMFS has compiled inventories of locally based, watershed conservation planning and restoration efforts for steelhead in the Central California, South-Central, and Southern California ESUs (NMFS, 1997d). These documents are available upon request (see ADDRESSES).

Despite numerous efforts to halt and reverse declining trends in west coast steelhead, it is clear that the status of many native, naturally-reproducing populations has continued to deteriorate. NMFS therefore believes it highly likely that past efforts and programs to address the conservation needs of these stocks are inadequate, including efforts to reduce mortalities and improve the survival of these stocks through all stages of their life cycle. Important factors include the loss of habitat, continued decline in the productivity of freshwater habitat for a wide variety of reasons, significant potential negative impacts from interactions with hatchery stocks, overfishing, and natural environmental variability.

NMFS recognizes that many of the ongoing Federal, state, and local protective efforts are likely to promote the conservation of steelhead and other salmonids. However, NMFS has also determined that, collectively, these efforts are not sufficient to achieve long-term conservation and recovery of steelhead at the scale of individual ESUs. There have been significant improvements in migration conditions in the Columbia River Basin as a result of NMFS' 1995 Biological Opinion on the operation of the Federal hydropower system. However, mainstem passage conditions are only one of many threats facing the species. NMFS believes most existing efforts lack some of the critical elements needed to provide a high degree of certainty that the efforts will be successful.

The best available scientific information on the biological status of the species supports a final listing of five steelhead ESUs under the ESA at this time. NMFS concludes that existing protective efforts are inadequate to alter the proposed determination of threatened or endangered for these five steelhead ESUs.

Status of Steelhead ESUs

Section 3 of the ESA defines the term "endangered species" as "any species which is in danger of extinction throughout all or a significant portion of its range." The term "threatened species" is defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Thompson (1991) suggested that conventional rules of thumb, analytical approaches, and simulations may all be useful in making this determination. In previous status reviews (e.g., Weitkamp *et al.*, 1995), NMFS has identified a number of factors that should be considered in evaluating the level of risk faced by an ESU, including: (1) Absolute numbers of fish and their spatial and temporal distribution; (2) current abundance in relation to historical abundance and current carrying capacity of the habitat; (3) trends in abundance; (4) natural and human-influenced factors that cause variability in survival and abundance; (5) possible threats to genetic integrity (e.g., from strays or outplants from hatchery programs); and (6) recent events (e.g., a drought or changes in harvest management) that have predictable short-term consequences for abundance of the ESU.

During the coastwide status review for steelhead, NMFS evaluated both quantitative and qualitative information to determine whether any proposed ESU is threatened or endangered according to the ESA. The types of information used in these assessments are described below, followed by a summary of results for each ESU.

Quantitative Assessments

A significant component of NMFS' status determination was analyses of abundance trend data. Principal data sources for these analyses were historical and recent run size estimates derived from dam and weir counts, stream surveys, and angler catch estimates. Of the 160 steelhead stocks on the west coast of the United States for which sufficient data existed, 118 (74 percent) exhibited declining trends in abundance, while the remaining 42 (26 percent) exhibited increasing trends in abundance. Sixty-five of the stock abundance trends analyzed were statistically significant. Of these, 57 (88 percent) indicated declining trends in abundance and the remaining 8 (12 percent) indicated increasing trends in abundance. NMFS' analysis assumes that catch trends reflect trends in overall population abundance. NMFS recognizes there are many problems with this assumption and, therefore, the index may not represent trends in the total population in a river basin. However, angler catch is the only information available for many steelhead populations, and changes in catch still provide a useful indication of trends in total population abundance. Furthermore, where alternate abundance data existed, NMFS used them in its risk analyses.

Analyses of steelhead abundance indicate that across the species' range, the majority of naturally reproducing steelhead stocks have exhibited long-term declines in abundance. The severity of declines in abundance tends to vary by geographic region. Based on historical and recent abundance estimates, stocks in the southern extent of the coastal steelhead range (i.e., California's Central Valley, South-Central and Southern California ESUs) appear to have declined significantly, with widespread stock extirpations. In several areas, a lack of accurate run size and trend data make estimating abundance difficult.

Qualitative Assessments

Although numerous studies have attempted to classify the status of steelhead populations on the west coast of the United States, problems exist in applying results of these studies to NMFS' ESA evaluations. A significant problem is that the definition of "stock" or "population" varies considerably in scale among studies, and sometimes among regions within a study. In several studies, identified units range in size from large river basins, to minor coastal streams and tributaries. Only two studies (Nehlsen *et al.*, 1991; Higgins *et al.*, 1992) used categories that relate to the ESA "threatened" or "endangered" status. Even these studies applied their own interpretations of these terms to individual stocks, not to broader geographic units such as those discussed here. Another significant problem in applying previously published studies to this evaluation is the manner in which stocks or populations were selected to be included in the review. Several studies did not evaluate stocks that were not perceived to be at risk, making it difficult to determine the proportion of stocks they considered to be at risk in any given area.

Nehlsen *et al.* (1991) considered salmon and steelhead stocks throughout Washington, Idaho, Oregon, and California and enumerated all stocks they found to be extinct or at risk of extinction. They considered 23 steelhead stocks to be extinct, one possibly extinct, 27 at high risk of extinction, 18 at moderate risk of extinction, and 30 of special concern. Steelhead stocks that do not appear in their summary were either not at risk of extinction or there was insufficient information to classify them. Washington Department of Fisheries et al. (1993) categorized all salmon and steelhead stocks in Washington on the basis of stock origin ("native," "non-native," "mixed," or "unknown"), production type ("wild," "composite," or "unknown") and status ("healthy," "depressed," "critical," or "unknown"). Of the 141 steelhead stocks identified in Washington, 36 were classified as healthy, 44 as critical, 10 as depressed, and 60 as unknown.

The following summaries draw on these quantitative and qualitative assessments to describe NMFS' conclusions regarding the status of each steelhead ESU. Furthermore, in these summaries, NMFS identifies those hatchery populations that are essential for the recovery of the ESU. An "essential" hatchery population is one that is currently vital to the success of recovery efforts for the ESU within which it occurs. In evaluating the importance of hatchery stocks for recovery, NMFS considers the relationship between the natural and hatchery populations and the degree of risk faced by the natural populations. A more detailed discussion of the status of these steelhead ESUs is presented in the "Status Review Update for West Coast Steelhead from Washington, Idaho, Oregon, and California" (NMFS, 1997a). Copies of this document are available upon request (see ADDRESSES).

(1) Central California Coast ESU

Only two estimates of historical (pre-1960s) abundance specific to this ESU are available: an average of about 500 adults in Waddell Creek in the 1930s and early 1940s (Shapovalov & Taft, 1954), and an estimate of 20,000 steelhead in the San Lorenzo River before 1965 (Johnson, 1964). In the mid-1960s, CDFG (1965) estimated 94,000 steelhead spawning in many rivers of this ESU, including 50,000 and 19,000 fish in the Russian and San Lorenzo Rivers, respectively. NMFS has comparable recent estimates for only the Russian (approximately 7,000 fish) and San Lorenzo (approximately 500 fish) Rivers. These estimates indicate that recent total abundance of steelhead in these two rivers is less than 15 percent of their abundance 30 years ago. Additional recent estimates for several other streams (Lagunitas Creek, Waddell Creek, Scott Creek, San Vincente Creek, Soquel Creek, and Aptos Creek) indicate individual run sizes are 500 fish or less. No recent estimates of total run size exist for this ESU. McEwan and Jackson (1996) noted that steelhead in most tributary streams in San Francisco and San Pablo Bays have been extirpated.

Additional information received in response to the proposed rule suggests that steelhead in this ESU may be exhibiting slight increases in abundance in recent years (NMFS, 1997a). Updated abundance data for the Russian and San Lorenzo Rivers indicate increasing run sizes over the past 2–3 years, but it is not possible to distinguish the relative proportions of hatchery and natural steelhead in those estimates. Additional data from a few smaller streams in the region also show general increases in juvenile abundance in recent years.

Presence/absence data available since the proposed rule show that in a subset of streams sampled in the central California coast region, most contain steelhead. This is in contrast to the pattern exhibited by coho, which are absent from many of those same streams. Those streams in which steelhead were not present are concentrated in the highly urbanized San Francisco Bay region. While there are several concerns with these data (e.g., uncertainty regarding origin of juveniles), NMFS believes it is generally a positive indicator that there is a relatively broad distribution of steelhead in smaller streams throughout the region.

In evaluating trends in productivity throughout the ESU, NMFS considered difficulties arising from the inability to separate out the effects of hatchery productivity from overall run size increases in recent years. The Russian and San Lorenzo Rivers have the highest steelhead productivity in the ESU, but it is likely that many of the fish are of hatchery origin (estimates in both streams range from 40–60 percent over the last 5 years).

After considering available information, NMFS concludes that steelhead in the Central California Coast ESU warrant listing as a threatened species—a change from its proposed status as endangered. Factors contributing to the present conclusion include new evidence for greater absolute numbers of steelhead in the larger rivers of the central California coast region and the possible increases in juvenile abundance over the last few years. In addition, the broad geographic distribution of steelhead throughout the region, as indicated by the presence/absence data, also convinced NMFS this ESU does not warrant an endangered listing at this time.

Hatchery Populations Essential for the Recovery of the ESU

NMFS concludes that the Big Creek and San Lorenzo River Hatchery stocks are not essential for recovery of this ESU. Current information indicates sufficient naturally spawning populations exist for recovery efforts. The significant degree of hatchery contribution to steelhead runs in the San Lorenzo River may require the use of this stock in recovery efforts in the future.

(2) South-Central California Coast ESU

Historical estimates of steelhead abundance are available for a few rivers in this region. In the mid-1960s, CDFG (1965) estimated a total of 27,750 steelhead spawning in this ESU. Recent estimates for those rivers where comparative abundance information is available show a substantial decline during the past 30 years. In contrast to the CDFG (1965) estimates, McEwan and Jackson (1996) reported runs ranging from 1,000 to 2,000 in the Pajaro River in the early 1960s, and Snider (1983) estimated escapement of about 3,200 steelhead for the Carmel River for the 1964–1975 period. No recent estimates for total run size exist for this ESU; however, recent run-size estimates are available for five rivers (Pajaro River, Salinas River, Carmel River, Little Sur River, and Big Sur River). The total of these estimates is less than 500 fish, compared with a total of 4,750 for the same rivers in 1965, which suggests a substantial decline for the entire ESU from 1965 levels.

Updated data on abundance and trends for steelhead in this ESU indicate slight increases in recent years. New data from the Carmel River show increases in adult and juvenile steelhead abundance over the past 2 to 5 years.

After weighing this new information, NMFS concludes that steelhead in the

South-Central California Coast warrant listing as a threatened species—a change from its proposed status as endangered. Reasons for this slightly more optimistic assessment include new abundance data indicating recent increases in adult and juvenile abundance in the Carmel River and several small coastal tributaries in the southern part of the region. In addition, risks to genetic integrity to steelhead in this ESU are relatively low because of low levels of hatchery stocking. (There are a few scattered reports of rainbow trout introductions from rivers outside the central California coast region.)

Hatchery Populations Essential for the Recovery of the ESU

NMFS concludes that the Whale Rock Reservoir Hatchery stock is not essential for recovery of this ESU. Current information indicates sufficient naturally spawning populations exist for recovery efforts. If in the future the status of steelhead in this ESU worsens, this stock may become essential for recovery efforts.

(3) Southern California ESU

Historically, steelhead occurred naturally south into Baja California. Estimates of historical (pre-1960s) abundance for several rivers in this ESU are available: Santa Ynez River, before 1950, 20,000 to 30,000 (Shapovalov & Taft, 1954; CDFG, 1982; Reavis, 1991; Titus *et al.*, in press); Ventura River, pre-1960, 4,000 to 6,000 (Clanton & Jarvis, 1946; CDFG, 1982; AFS, 1991; Hunt *et al.*, 1992; Henke, 1994; Titus *et al.*, in press); Santa Clara River, pre-1960, 7,000 to 9,000 (Moore, 1980; Comstock, 1992; Henke, 1994); Malibu Creek, pre-1960, 1,000 (Nehlsen *et al.*, 1991; Reavis, 1991). In the mid-1960s, CDFG (1965) estimated steelhead spawning populations for smaller tributaries in San Luis Obispo County as 20,000 fish; however, no estimates for streams further south were provided.

The present estimated total run size for 6 streams (Santa Ynez River, Gaviota Creek, Ventura River, Matilija Creek, Santa Clara River, Malibu Creek) in this ESU are summarized in Titus *et al.*, and each is less than 200 adults. Titus *et al.* concluded that populations have been extirpated from all streams south of Ventura County, with the exception of Malibu Creek in Los Angeles County. While there are no comprehensive stream surveys conducted for steelhead trout occurring in streams south of Malibu Creek, there continue to be anecdotal observations of steelhead in rivers as far south as the Santa Margarita River, San Diego County, in years of substantial rainfall (Barnhart, 1986, Higgins, 1991, McEwan & Jackson, 1996). Titus *et al.* (in press) cited extensive loss of steelhead habitat due to water development, including impassable dams and dewatering.

No time series of data are available within this ESU to estimate population trends. Titus *et al.* summarized information for steelhead populations based on historical and recent survey information. Of the populations south of San Francisco Bay (including part of the Central California Coast ESU) for which past and recent information was available, 20 percent had no discernable change, 45 percent had declined, and 35 percent were extinct. Percentages for the counties comprising this ESU show a very high percentage of declining and extinct populations.

The sustainability of steelhead populations in the Southern California ESU continues to be a major concern, evidenced by consistently low abundance estimates in all river basins. There are fairly good qualitative accounts of historical abundances of steelhead in this ESU, and recent adult counts are severely depressed relative to the past. The few new data that have become available since the proposed rule do not suggest any consistent pattern of change in steelhead abundance in this region.

NMFS concludes that the Southern California ESU is, as proposed, endangered. The primary reasons for concern about steelhead in this ESU are the widespread, dramatic declines in abundance relative to historical levels. Low abundance leads to increased risks due to demographic and genetic variability in small populations. In addition, NMFS believes the restricted spatial distribution of remaining populations places the ESU as a whole at risk because of reduced opportunities for recolonization of streams suffering local population extinctions. The main sources of the extensive population declines in steelhead in this ESU are similar to those described in the South-Central California Coast ESU. In addition, because of fire suppression practiced throughout the area, NMFS believes the effects of increased fire intensity and duration is likely to be a significant risk to the steelhead in this ESU.

Hatchery Populations Essential for the Recovery of the ESU

No hatchery production of steelhead currently occurs in this ESU.

(4) Upper Columbia River Basin ESU

Estimates of historical (pre-1960s) abundance specific to this ESU are available from fish counts at dams. Counts at Rock Island Dam from 1933 to 1959 averaged 2,600 to 3,700, suggesting a pre-fishery run size in excess of 5,000 adults for tributaries above Rock Island Dam (Chapman *et al.*, 1994). Runs may already have been depressed by lower Columbia River fisheries at this time. Recent five-year (1989–93) average natural escapements are available for two stock units: Wenatchee River, 800 steelhead, and Methow and Okanogan Rivers, 450 steelhead. Recent average total escapements for these stocks were 2,500 and 2,400, respectively. Average total run size at Priest Rapids Dam for the same period was approximately 9,600 adult steelhead.

Trends in total (natural and hatchery) adult escapement are available for the Wenatchee River (2.6 percent annual increase, 1962–1993) and the Methow and Okanogan Rivers combined (12 percent annual decline, 1982–93). These two stocks represent most of the escapement to natural spawning habitat within the range of the ESU; the Entiat River also has a small spawning run (WDF *et al.*, 1993).

Steelhead in the Upper Columbia River ESU continue to exhibit low abundances, both in absolute numbers and in relation to numbers of hatchery fish throughout the region. Data from this ESU include separate total and natural run sizes, allowing the separation of hatchery and natural fish abundance estimates for at least some areas in some years. Review of the most recent data indicates that natural steelhead abundance has declined or remained low and relatively constant in the major river basins in this ESU (Wenatchee, Methow, Okanogan) since the early 1990s. Estimates of natural production of steelhead in the ESU are well below replacement (approximately 0.3:1 adult replacement ratios estimated in the Wenatchee and Entiat Rivers.) These data indicate that natural steelhead populations in the Upper Columbia River Basin are not self-sustaining at the present time. The BRT also discussed anecdotal evidence that resident rainbow trout, which are in numerous streams throughout the region, contribute to anadromous run abundance. This phenomenon would reduce estimates of the natural steelhead replacement ratio.

The proportion of hatchery fish is high in these rivers (65–80 percent). In addition, substantial genetic mixing of populations within this ESU has occurred, both historically (as a result of the Grand Coulee Fish Maintenance Project) and more recently as a result of the Wells Hatchery program. Extensive mixing of hatchery stocks throughout this ESU, along with the reduced oppoi tunity for maintenance of locally adapted genetic lineages among different drainages, represents a considerable threat to steelhead in this region.

Based on the considerations above, NMFS concludes the Upper Columbia ESU is endangered, as proposed. In their comments on the proposed rule, Washington Department of Fish and Wildlife states its general concurrence with this conclusion (WDFW, 1997). The primary cause for concern for steelhead in this ESU are the extremely low estimates of adult replacement ratios. The dramatic declines in natural run sizes and the inability of naturally spawning steelhead adults to replace themselves suggest that if present trends continue, this ESU will not be viable. Habitat degradation, juvenile and adult mortality in the hydrosystem, and unfavorable environmental conditions in both marine and freshwater habitats have contributed to the declines and represent risk factors for the future. Harvest in lower river fisheries and genetic homogenization from composite broodstock collections are other factors that may contribute significantly to risk to the Upper Columbia ESU.

Hatchery Populations Essential for the Recovery of the ESU

NMFS concludes the Wells Hatchery stock including progeny is essential for recovery efforts in this ESU, and therefore should be listed. This conclusion is primarily based on very low estimates of the recruits per spawner ratio, which indicate that productivity of naturally spawning steelhead in this ESU is far below the replacement rate.

(5) Snake River Basin ESU

Prior to Ice Harbor Dam completion in 1962, there were no counts of Snake River Basin naturally spawned steelhead. However, Lewiston Dam counts during the period from 1949 to 1971 averaged about 40,000 steelhead per year in the Clearwater River, while the Ice Harbor Dam count in 1962 was 108,000, and averaged approximately 70,000 until 1970.

All steelhead in the Snake River Basin are summer steelhead, which for management purposes are divided into "A-run" and "B-run" steelhead. Each has several life history differences including spawning size, run timing, and habitat type. Although there is little information for most stocks within this ESU, there are recent run-size and/or escapement estimates for several stocks. Total recent-year average (1990–1994) escapement above Lower Granite Dam was approximately 71,000, with a natural component of 9,400 (7,000 A-run and 2,400 B-run). Run size estimates are available for only a few tributaries within the ESU, all with small populations.

Snake River Basin steelhead recently have suffered severe declines in abundance relative to historical levels. Low run sizes over the last ten years are most pronounced for naturally produced steelhead. In addition, average parr densities recently have dropped for both A-and B-run steelhead, resulting in many river basins in this region being characterized as critically underseeded relative to the carrying capacity of streams. Declines in abundance have been particularly serious for B-run steelhead, increasing the risk that some of the life history diversity may be lost from steelhead in this ESU. Recently obtained information indicates a record low smolt survival and ocean production for Snake River steelhead in 1992–94.

The proportion of hatchery steelhead in the Snake River Basin is very high for the ESU as a whole (over 80 percent hatchery fish passing Lower Granite Dam), yet hatchery fish are rare to nonexistent in several drainages in the region. In places where hatchery release sites are interspersed with naturally-spawning reaches, the potential for straying and introgression is high, resulting in a risk to the genetic integrity of some steelhead populations in this ESU. Hatchery/natural interactions that do occur for Snake River steelhead are of particular concern because many of the hatcheries use composite stocks that have been domesticated over a long period of time.

Based on this information, NMFS concludes that the Snake River ESU is threatened, as proposed. The primary indicator of risk to the ESU is declining abundance throughout the region. Demographic and genetic risks from small population sizes are likely to be important, because few natural steelhead are spread over a wide geographic area. In their comments on the proposed rule, the State of Idaho concurred with NMFS' assessment that steelhead stocks in this ESU are imperiled (State of Idaho, 1997). Steelhead in this ESU face risks similar to those in the Upper Columbia River ESU: Widespread habitat blockage from hydrosystem management and potentially deleterious genetic effects from straying and introgression from hatchery fish. The reduction in habitat capacity resulting from large dams such as the Hells Canyon dam complex and Dworshak Dam is somewhat mitigated by several river basins with fairly good production of natural steelhead runs.

Hatchery Populations Essential for the Recovery of the ESU

NMFS concludes that the hatchery stocks considered part of this ESU (Dworshak NFH stock, Imnaha Hatchery stock, and Oxbow Hatchery stock) are not currently essential for the recovery of the ESU. The Dworshak NFH stock and Oxbow Hatchery stock both represent the remnants of population(s) of steelhead that have been excluded from their historical spawning and rearing habitat by impassable dams. These stocks represent the only legacy for the reintroduction of native populations into these areas. If such reintroduction programs are undertaken, these stocks will likely be essential to the recovery of steelhead in these areas. Currently, naturally spawning steelhead populations in the Imnaha River are relatively healthy; however, if naturally spawning populations decline considerably in the future, this stock may become essential for recovery.

Listing Determination

Section 3 of the ESA defines an endangered species as any species in danger of extinction throughout all or a significant portion of its range, and a threatened species as any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Section 4(b)(1) of the ESA requires that the listing determination be based solely on the best scientific and commercial data available, after conducting a review of the status of the species and after taking into account those efforts, if any, being made to protect such species.

Based on results from its coastwide assessment, NMFS has determined that on the west coast of the United States, there are fifteen ESUs of steelhead that constitute "species" under the ESA. NMFS has determined that two ESUs of steelhead are currently endangered (Southern California and Upper Columbia River ESUs) and three ESUs are currently threatened (Central California Coast, South-Central California Coast, and Snake River Basin ESUs). The geographic boundaries (i.e., the watersheds within which the members of the ESU spend their freshwater residence) for these ESUs are described under "Summary of ESUs Determinations."

NMFS has examined the relationship between hatchery and natural populations of steelhead in these ESUs and has assessed whether any hatchery populations are essential for their recovery. While NMFS has concluded that several hatchery stocks are part of the ESU in which they occur, only the

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Wells Hatchery stock in the Upper Columbia River ESU is deemed essential for recovery at this time and therefore, included in this listing. Aside from the Wells Hatchery stock, only naturally spawned populations of steelhead (and their progeny) which are part of the biological ESU residing below long-term, naturally and man-made impassable barriers (i.e., dams) are listed in all five ESUs identified as threatened or endangered.

In some cases unlisted hatchery fish that are part of the ESU may not return to the hatchery but instead spawn naturally. In that event, the progeny of that naturally spawning hatchery fish is considered listed. This final rule includes in the listing determination those naturally spawned fish that have at least one parent that was derived from current ESU hatchery broodstock. In some cases these fish may be hybrids; that is, they may have one parent that is part of the biological ESU and one that is not. By listing these fish and extending to them the protections of the ESA, NMFS does not mean to imply that these hybrids are suitable for use in conservation. That decision would need to be made on a case-by-case basis.

NMFS' "Interim Policy on Artificial Propagation of Pacific Salmon Under the Endangered Species Act" (April 5, 1993, 58 FR 17573) provides guidance on the treatment of hatchery stocks in the event of a listing. Under this policy, "progeny of fish from the listed species that are propagated artificially are considered part of the listed species and are protected under the ESA." In accordance with this interim NMFS policy, all progeny of listed steelhead are themselves considered part of the listed species. Such progeny include those resulting from the mating of listed steelhead with non-listed hatchery stocks.

At this time, NMFS is listing only anadromous life forms of *O. mykiss*.

NMFS concludes the Wells Hatchery stock including progeny is essential for recovery efforts in this ESU, and therefore should be listed. This conclusion is primarily based on very low estimates of the recruits per spawner ratio, which indicate that productivity of naturally spawning steelhead in this ESU is far below the replacement rate. It is possible that in some years returns to this hatchery may exceed the number of returns necessary to produce the number of offspring NMFS considers advisable for release into this ESU. This surplus may therefore be, by definition, not essential for recovery efforts. In that case, hatchery operators may be faced with a choice between destroying the excess returns or using them for some other purpose. In making its decision today to include the Wells Hatchery stock as part of the listed population, NMFS does not intend to foreclose the possibility of using such excess returns to provide limited harvest opportunities consistent with the conservation of this ESU.

Prohibitions and Protective Measures

Section 9 of the ESA prohibits certain activities that directly or indirectly affect endangered species. These prohibitions apply to all individuals, organizations, and agencies subject to U.S. jurisdiction. Section 9 prohibitions apply automatically to endangered species; as described below, this is not the case for threatened species.

Section 4(d) of the ESA directs the Secretary to implement regulations "to provide for the conservation of [threatened] species," which may include extending any or all of the prohibitions of section 9 to threatened species. Section 9(a)(1)(g) also prohibits violations of protective regulations for threatened species implemented under section 4(d). NMFS will issue shortly protective regulations pursuant to section 4(d) for the Central California Coast, South-Central California Coast, and Snake River ESUs.

Section 7(a)(4) of the ESA requires that Federal agencies consult with NMFS on any actions likely to jeopardize the continued existence of a species proposed for listing and on actions likely to result in the destruction or adverse modification of proposed critical habitat. For listed species, section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or conduct are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with NMFS.

Examples of Federal actions likely to affect steelhead in the listed ESUs include authorized land management activities of the U.S. Forest Service and U.S. Bureau of Land Management, as well as operation of hydroelectric and storage projects of the Bureau of Reclamation and U.S. Army Corps of Engineers (COE). Such activities include timber sales and harvest, hydroelectric power generation, and flood control. Federal actions, including the COE section 404 permitting activities under the CWA, COE permitting activities under the River and Harbors Act, National Pollution Discharge Elimination System permits issued by the Environmental Protection Agency, highway projects authorized by the Federal Highway Administration, Federal Energy Regulatory Commission licenses for non-Federal development and operation of hydropower, and Federal salmon hatcheries, may also require consultation. These actions will likely be subject to ESA section 7 consultation requirements that may result in conditions designed to achieve the intended purpose of the project and avoid or reduce impacts to steelhead and its habitat within the range of the listed ESU. It is important to note that the current listing applies only to the anadromous form of *O. mykiss*; therefore, section 7 consultations will not address resident forms of *O. mykiss* at this time.

There are likely to be Federal actions ongoing in the range of the listed ESUs at the time these listings become effective. Therefore, NMFS will review all ongoing actions that may affect the listed species with Federal agencies and will complete formal or informal consultations, where requested or necessary, for such actions pursuant to ESA section 7(a)(2).

Sections 10(a)(1)(A) and 10(a)(1)(B) of the ESA provide NMFS with authority to grant exceptions to the ESA's "taking" prohibitions (see regulations at 50 CFR 222.22 through 222.24). Section 10(a)(1)(A) scientific research and enhancement permits may be issued to entities (Federal and non-Federal) conducting research that involves a directed take of listed species.

NMFS has issued section 10(a)(1)(A) research or enhancement of survival permits for other listed species (e.g., Snake River chinook salmon and Sacramento River winter-run chinook salmon) for a number of activities, including trapping and tagging, electroshocking to determine population presence and abundance, removal of fish from irrigation ditches, and collection of adult fish for artificial propagation programs. NMFS is aware of several sampling efforts for steelhead in the listed ESUs, including efforts by Federal and state fishery management agencies. These and other research efforts could provide critical information regarding steelhead distribution and population abundance.

Section 10(a)(1)(B) incidental take permits may be issued to non-Federal entities performing activities that may incidentally take listed species. The types of activities potentially requiring a section 10(a)(1)(B) incidental take permit include the operation and release of artificially propagated fish by state or privately operated and funded hatcheries, state or university research on species other than steelhead, not receiving Federal authorization or funding, the implementation of state fishing regulations, and timber harvest activities on non-Federal lands.

Take Guidance

NMFS and the FWS published in the Federal Register on July 1, 1994 (59 FR 34272), a policy that NMFS shall identify, to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the ESA. The intent of this policy is to increase public awareness of the effect of a listing on proposed and on-going activities within the species' range. NMFS believes that, based on the best available information, the following actions will not result in a violation of section 9: (1) Possession of steelhead from the listed ESUs acquired lawfully by permit issued by NMFS pursuant to section 10 of the ESA, or by the terms of an incidental take statement pursuant to section 7 of the ESA; and (2) Federally funded or approved projects that involve activities such as silviculture, grazing, mining, road construction, dam construction and operation, discharge of fill material, stream channelization or diversion for which a section 7 consultation has been completed, and when such an activity is conducted in accordance with any terms and conditions provided by NMFS in an incidental take statement accompanied by a biological opinion pursuant to section 7 of the ESA.

Activities that NMFS believes could potentially harm, injure or kill steelhead in the endangered listed ESUs and result in a violation of section 9 include, but are not limited to: (1) Land-use activities that adversely affect steelhead habitat in this ESU (e.g., logging, grazing, farming, road construction in riparian areas, and areas susceptible to mass wasting and surface erosion); (2) Destruction or alteration of steelhead habitat in the listed ESUs, such as removal of large woody debris and "sinker logs" or riparian shade canopy, dredging, discharge of fill material, draining, ditching, diverting, blocking, or altering stream channels or surface or ground water flow; (3) discharges or dumping of toxic chemicals or other pollutants (e.g., sewage, oil, gasoline) into waters or riparian areas supporting listed steelhead; (4) violation of discharge permits; (5) pesticide applications; (6) interstate and foreign commerce of steelhead from the listed ESUs and import/export of steelhead from listed ESUs without an ESA permit, unless the fish were harvested pursuant to legal exception; (7) collecting or handling of steelhead from ...ed ESUs. Permits to conduct these ...tivities are available for purposes of scientific research or to enhance the propagation or survival of the species; and (8) introduction of non-native species likely to prey on steelhead in these ESUs or displace them from their habitat. These lists are not exhaustive. They are intended to provide some examples of the types of activities that might or might not be considered by NMFS as constituting a take of west coast steelhead under the ESA and its regulations. Questions regarding whether specific activities will constitute a violation of this rule, and general inquiries regarding prohibitions and permits, should be directed to NMFS (see ADDRESSES).

Effective Date of Final Listing

Given the cultural, scientific, and recreational importance of this species, and the broad geographic range of these listings, NMFS recognizes that numerous parties may be affected by this listing. Therefore, to permit an orderly implementation of the consultation requirements and take prohibitions associated with this action, this final listing will take effect October 17, 1997.

Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the ESA include recognition, recovery actions, Federal agency consultation requirements, and prohibitions on taking. Recognition through listing promotes public awareness and conservation actions by Federal, state, and local agencies, private organizations, and individuals.

Several conservation efforts are underway that may help reverse the decline of west coast steelhead and other salmonids. These include the Northwest Forest Plan (on Federal lands within the range of the northern spotted owl), PACFISH (on all additional Federal lands with anadromous salmonid populations), Oregon's Coastal Salmon Restoration Initiative, Washington's Wild Stock Restoration Initiative, overlapping protections from California's listing of coho salmon stocks in California under both the Federal and State ESAs, implementation of California's Steelhead Management Plan, and NMFS' Proposed Recovery Plan for Snake River Salmon. NMFS is very encouraged by a number of these efforts and believes they have or may constitute significant strides in the efforts in the region to develop a scientifically well grounded conservation plan for these stocks. Other efforts, such as the Middle Colu...a River Habitat Conservation Plan... at various stages of development, but show promise of ameliorating risks facing listed steelhead ESUs. NMFS intends to support and work closely with these efforts—staff and resources permitting—in the belief that they can play an important role in the recovery planning process.

Based on information presented in this final rule, general conservation measures that could be implemented to help conserve the species are listed below. This list does not constitute NMFS' interpretation of a recovery plan under section 4(f) of the ESA.

1. Measures could be taken to promote land management practices that protect and restore steelhead habitat. Land management practices affecting steelhead habitat include timber harvest, road building, agriculture, livestock grazing, and urban development.

2. Evaluation of existing harvest regulations could identify any changes necessary to protect steelhead populations.

3. Artificial propagation programs could be required to incorporate practices that minimize impacts upon natural populations of steelhead.

4. Efforts could be made to ensure that existing and proposed dam facilities are designed and operated in a manner that will less adversely affect steelhead populations.

5. Water diversions could have adequate headgate and staff gauge structures installed to control and monitor water usage accurately. Water rights could be enforced to prevent irrigators from exceeding the amount of water to which they are legally entitled.

6. Irrigation diversions affecting downstream migrating steelhead trout could be screened. A thorough review of the impact of irrigation diversions on steelhead could be conducted.

NMFS recognizes that, to be successful, protective regulations and recovery programs for steelhead will need to be developed in the context of conserving aquatic ecosystem health. NMFS intends that Federal lands and Federal activities play a primary role in preserving listed populations and the ecosystems upon which they depend. However, throughout the range of all five ESUs listed, steelhead habitat occurs and can be affected by activities on state, tribal, or private land. Agricultural, timber, and urban management activities on nonFederal land could and should be conducted in a manner that minimizes adverse effects to steelhead habitat.

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NMFS encourages nonfederal landowners to assess the impacts of their actions on potentially threatened or endangered salmonids. In particular, NMFS encourages the establishment of watershed partnerships to promote conservation in accordance with ecosystem principles. These partnerships will be successful only if state, tribal, and local governments, landowner representatives, and Federal and nonFederal biologists all participate and share the goal of restoring steelhead to the watersheds.

Critical Habitat

Section 4(b)(6)(C) of the ESA requires that, to the extent prudent, critical habitat be designated concurrently with the listing of a species unless such critical habitat is not determinable at that time. While NMFS has completed its initial analysis of the biological status of steelhead populations from Washington, Oregon, Idaho, and California, it has not completed the analyses necessary for designating critical habitat. Therefore, critical habitat is not now determinable for these five listed steelhead ESUs. NMFS intends to develop and publish a critical habitat determination for west coast steelhead within one year from the publication of this notice.

Classification

The 1982 amendments to the ESA, in section 4(b)(1)(A), restrict the information that may be considered when assessing species for listing. Based on this limitation of criteria for a listing decision and the opinion in *Pacific Legal Foundation* v. *Andrus*, 675 F. 2d 825 (6th Cir. 1981), NMFS has categorically excluded all ESA listing actions from environmental assessment requirements of the National Environmental Policy Act (NEPA) under NOAA Administrative Order 216–6.

As noted in Conference Report on the 1982 amendments to the ESA, economic considerations have no relevance to determinations regarding the status of species. Therefore, the analytical requirements of the Regulatory Flexibility Act (RFA), 5 U.S.C. 601 *et seq.*, are not required. Similarly, this final rule is exempt from review under E.O. 12866.

At this time NMFS is not promulgating protective regulations pursuant to ESA section 4(d). In the future, prior to finalizing its 4(d) regulations for the threatened ESUs, NMFS will comply with all relevant NEPA and RFA requirements.

References

A complete list of all references cited herein is available upon request (see ADDRESSES).

List of Subjects

50 CFR Part 222

Administrative practice and procedure, Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

50 CFR Part 227

Endangered and threatened species, Exports, Imports, Marine mammals, Transportation.

Dated: August 11, 1997.

Rolland A. Schmitten,

Assistant Administrator for Fisheries, National Marine Fisheries Service.

For the reasons set forth in the preamble, 50 CFR parts 222 and 227 are amended as follows:

PART 222—ENDANGERED FISH OR WILDLIFE

1. The authority citation of part 222 continues to read as follows:

Authority: 16 U.S.C. 1531–1543; subpart D, § 222.32 also issued under 16 U.S.C. 1361 *et seq.*

2. In § 222.23, paragraph (a) is amended by revising the second sentence to read as follows:

§ 222.23 Permits for scientific purposes or to enhance the propagation or survival of the affected endangered species.

(a) * * * The species listed as endangered under either the Endangered Species Conservation Act of 1969 or the Endangered Species Act of 1973 and currently under the jurisdiction of the Secretary of Commerce are: Shortnose sturgeon (*Acipenser brevirostrum*); Totoaba (*Cynoscian macdonaldi*), Snake River sockeye salmon (*Oncorhynchusnerka*), Umpqua River cutthroat trout (*Oncorhynchus clarki clarki*); Southern California steelhead (*Oncorhynchus mykiss*), which includes all naturally spawned populations of steelhead (and their progeny) in streams from the Santa Maria River, San Luis Obispo County, California (inclusive) to Malibu Creek, Los Angeles County, California (inclusive); Upper Columbia River steelhead (*Oncorhynchus mykiss*), which includes the Wells Hatchery stock and all naturally spawned populations of steelhead (and their progeny) in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the United States-Canada Border; Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*); Western North Pacific (*Korean*) gray whale (*Eschrichtius robustus*), Blue whale (*Balaenoptera musculus*), Humpback whale (*Megaptera novaeangliae*), Bowhead whale (*Balaenamysticetus*), Right whales (*Eubalaena spp.*), Fin or finback whale (*Balaenoptera physalus*), Sei whale (*Balaenoptera borealis*), Sperm whale (*Physeter catodon*); Cochito (*Phocoena Sinus*), Chinese river dolphin (*Lipotes vexillifer*); Indus River dolphin (*Platanista minor*); Caribean monk seal (*Monachus tropicalis*) Hawaiian monk seal (*Monachus schauinslandi*); Mediterranean monk seal (*Monachus monachus*); Saimaa seal (*Phoca hispida saimensis*); Steller sea lion (*Eumetopias jubatus*), western population, which consists of Steller sea lions from breeding colonies located west of 144° W. long.; Leatherback sea turtle (*Dermochelys coriacea*), Pacific hawksbill sea turtle (*Eretmochelys imbricata bissa*), Atlantic hawksbill sea turtle (*Eretmochelys imbricata imbricata*), Atlantic ridley sea turtle (*Lepidochelys kempii*). * * *

* * * * *

PART 227—THREATENED FISH AND WILDLIFE

1. The authority citation for part 227 continues to read as follows:

Authority: 16 U.S.C. 1531–1543; subpart B, § 227.12 also issued under 16 U.S.C. 1361 *et seq.*

2. In § 227.4, paragraphs (j), (k), and (l) are added to read as follows:

§ 227.4 Enumeration of threatened species.

* * * * *

(j) Central California Coast steelhead (*Oncorhynchus mykiss*). Includes all naturally spawned populations of steelhead (and their progeny) in streams from the Russian River to Aptos Creek, Santa Cruz County, California (inclusive), and the drainages of San Francisco and San Pablo Bays eastward to the Napa River (inclusive), Napa County, California. Excludes the Sacramento-San Joaquin River Basin of the Central Valley of California;

(k) South-Central California Coast steelhead (*Oncorhynchus mykiss*). Includes all naturally spawned populations of steelhead (and their progeny) in streams from the Pajaro River (inclusive), located in Santa Cruz County, California, to (but not including) the Santa Maria River;

(l) Snake River Basin steelhead (*Oncorhynchus mykiss*). Includes all naturally spawned populations of steelhead (and their progeny) in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho.

[FR Doc. 97-21661 Filed 8-13-97; 9:14 am]

BILLING CODE 3510-22-P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 679

[Docket No. 970613138-7138-01; I.D. 081397A]

Fisheries of the Exclusive Economic Zone Off Alaska; Scallop Fishery; Closure in Registration Area Q

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Closure.

SUMMARY: NMFS is closing the scallop fishery in Registration Area Q (Bering Sea). This action is necessary to prevent exceeding the *Chionoecetes opilio* (*C. opilio*) Tanner crab bycatch limit (CBL) in this area.

DATES: Effective 1200 hrs, Alaska local time (A.l.t.), August 13, 1997, until 2400 hrs, A.l.t., June 30, 1998.

FOR FURTHER INFORMATION CONTACT: Andrew Smoker, 907-586-7228.

SUPPLEMENTARY INFORMATION: The scallop fishery in the exclusive economic zone off Alaska is managed by NMFS according to the Fishery Management Plan for the Scallop Fishery off Alaska (FMP) prepared by the North Pacific Fishery Management Council under authority of the Magnuson-Stevens Fishery Conservation and Management Act. Fishing for scallops is governed by regulations appearing at subpart F of 50 CFR part 600 and 50 CFR part 679. In accordance with § 679.62(b) the 1997 *C. opilio* CBL for Registration Area Q was established by the Final 1997-98 Harvest Specifications of Scallops (62 FR 34182, June 25, 1997) as 172,000 *C. opilio* crab.

The Administrator, Alaska Region, NMFS, has determined, in accordance with § 679.62(c), that the *C. opilio* CBL for Registration Area Q has been reached. Therefore, NMFS is prohibiting the taking and retention of scallops in Registration Area Q.

Classification

This action responds to the best available information recently obtained from the fishery. It must be implemented immediately to prevent overharvesting the 1997 CBL for Registration Area Q. Providing prior notice and an opportunity for public comment on this action is impracticable and contrary to public interest. The fleet has already taken the CBL for Registration Area Q. Further delay would only result in overharvest and disrupt the FMP's objective of allowing incidental catch to be retained throughout the year. NMFS finds for good cause that the implementation of this action cannot be delayed for 30 days. Accordingly, under 5 U.S.C. 553(d), a delay in the effective date is hereby waived.

This action is required by § 679.62 and is exempt from review under E.O. 12866.

Authority: 16 U.S.C. 1801 *et seq.*

Dated: August 13, 1997.

Gary C. Matlock,

Director, Office of Sustainable Fisheries, National Marine Fisheries Service.

[FR Doc. 97-21826 Filed 8-13-97; 2:40 pm]

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Habitat Conservation Division
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

November 10, 1997 F/SWO:RLW

Mr. Tom Furrer
Casa Grande High School
333 Casa Grande Road
Petaluma, CA 94954

Dear Mr. Furrer:

This letter is in response to your request for information about recent field inspections of Adobe Creek conducted by this office. On two occasions, in September and November of this year, members of our hydraulic engineering and biological staff inspected the creek and surrounding riparian habitat above the former Lafferty Ranch Diversion Structure.

These preliminary fisheries investigations were qualitative in nature, and thus no conclusive scientific information was yielded. However, the inspections did provide indications that there may be a remnant population of residualized steelhead trout, *Oncorynchus mickss*, in the upper reaches of Adobe Creek. This postulate is based on three pieces of evidence: 1) the historical and current accounts of the presence of steelhead in Adobe Creek, 2) two different eye-witness sitings of small fish, which appeared to be steelhead, in the pools above the former Lafferty Ranch diversion structure, 3) a videotape which shows swimming fish, most likely juvenile steelhead, in pools on upper Sonoma Mountain.

The visual sitings revealed the presence of several small fish in Adobe Creek - located in the deeper, small pools above the former diversion structure. These fish appeared to range from about 50 mm to 15cm in fork length. It was difficult to make a positive identification due to limited water visibility, abundant rocks which provided underwater refuge, and the fact that the fish were not physically captured for close examination. In order to properly identify and quantify these fish, it may be necessary to use electrofishing techniques. More study is necessary to make a species determination and population estimate. However, it is possible these fish are residualized steelhead trout.

Please feel free to contact me if I can answer more questions or be of further assistance.

Sincerely,

Richard L. Wantuck
National Marine Fisheries Service

EXHIBIT 2

EXHIBIT 3

Dennis Jackson

708 - 14th Avenue
Santa Cruz, CA 95062-4002
(831) 464-7580
djackson@cruzio.com

January 28, 2001

Tom Lippe
One Market Street Plaza
Steuart Street Tower, Sixteenth Floor
San Francisco, CA 94105

Tom,

You requested me to investigate if there are any cumulative impacts from the water diversions in Napa County. A search of the files in the Department of Fish and Game Region 3 office in Yountville, CA shows that there have been significant cumulative impacts from the hundreds of water diversions in the Napa River watershed. Based on the evidence presented below an Environmental Impact Report (EIR) should be required before any additional water rights are granted in the Napa River.

Physical Setting

Napa County, which is famous for its wine grapes, is about 40 miles northeast of San Francisco. The county occupies an area of about 758 square miles in the central Coast Range of California. The western portion of the county is drained by the Napa River, which flows through the Napa Valley and empties into San Pablo Bay. The Napa River drains about 420 square miles or 54% of Napa County, see Figure 1. The eastern portion of the county is drained by Putah Creek, a tributary of the Sacramento River. Suisun Creek and other small streams flow into San Pablo Bay and drain small portions of the southern county. The peaks in the surrounding mountains range from less than 1,000 feet to over 4,000 feet.

The climate of Napa County is characterized by warm, dry summers and cool, moist winters. Most precipitation falls as rain during the winter and early spring. Precipitation generally increases with elevation. A zone of high rainfall occurs in the mountains to the west of the Napa Valley. The eastern mountains are generally lower so receive somewhat less precipitation. The annual average precipitation during the water-year (October-September) at St. Helena is about 35 inches based on 48 years of record. The annual average precipitation during the water-year at Calistoga is about 39 inches based on 51 years of record. The lowest water-year rainfall recorded for these stations was about 14 inches and the maximum was about 69 inches.

The air temperature can dip below freezing occasionally. The average frost-free season in the Napa Valley is 250 days and runs from March 18 to November 22 (Faye, 1973). Frost has occurred as early as October 12 and as late as May 26. Frost that occurs during the period of March 15 to May 15 has the potential to seriously reduce the yield of the grape crop.

Cumulative Impacts of Water Diversions

A cumulative impact is the result of many similar projects whose individual impact on the environment may not be significant but when considered together they do have a significant effect. The water diversions in Napa County fit this description.

EXHIBIT 1

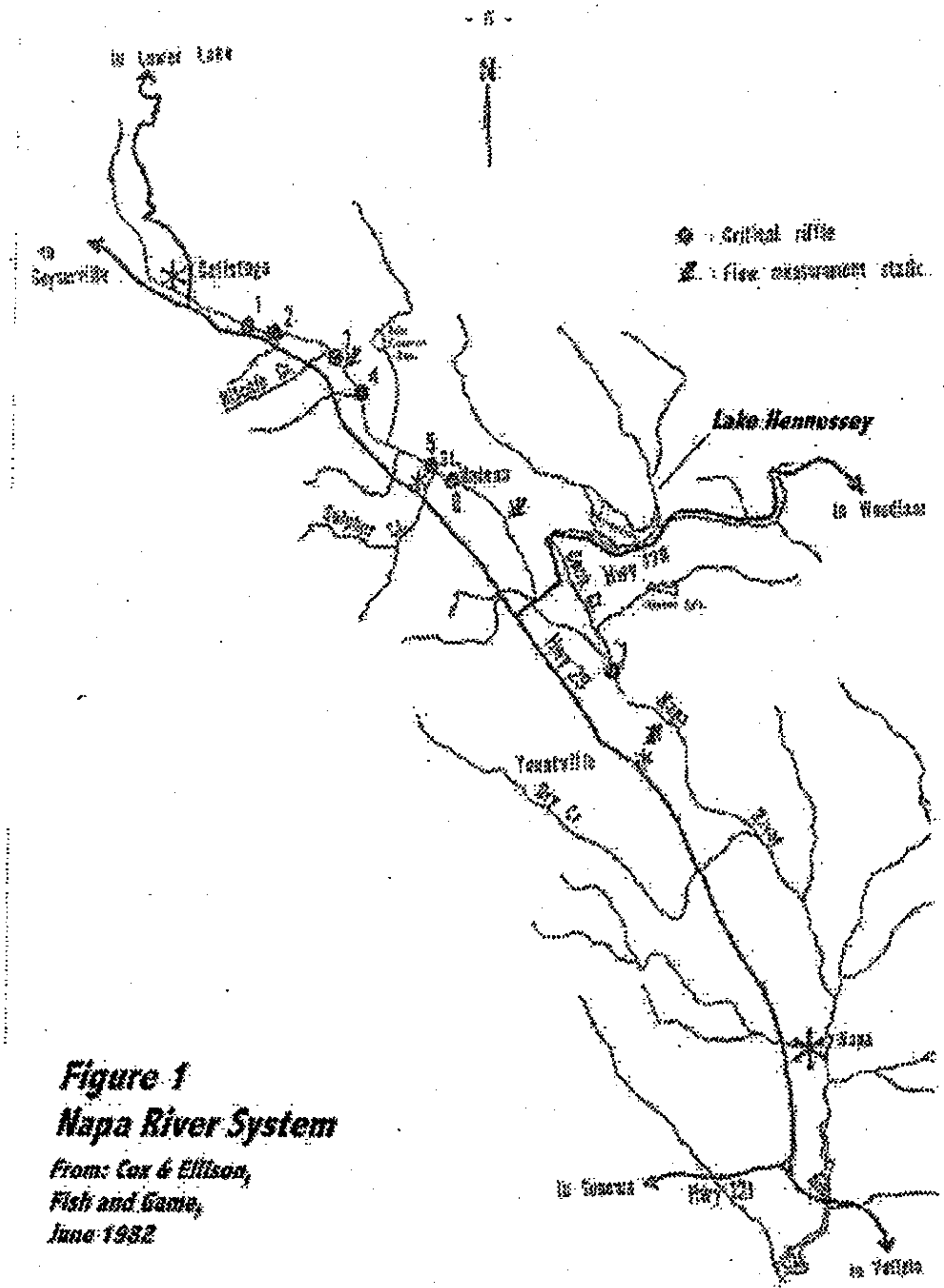

Figure 1
Napa River System

From: Cox & Ellison, Fish and Game, June 1982

In a later section of this report, the observations of Department of Fish and Game staff linking the decline of steelhead to the increase in the number of water rights are given. An outline of the various types of impacts from water diversions is given below.

The direct impact of a water diversion depends on:

- the time of year of the diversion
- the amount of the diversion
- the method of the diversion

Water diversions can also create indirect impacts.

1. Time of Year of the Diversion

   A. Summer and Early Fall Diversions

   Diversions in the summer and fall can directly impact riparian plants, fish and other aquatic organisms. The impacts can be:

   a. significant reduction in water volume including drying up a section of stream

   b. increase in water temperature

   c. decrease in water available to riparian plant communities

   B. Late Fall, Winter and Spring Diversions

   Diversions in the winter and spring have the potential to disrupt the sediment transport processes of a stream. Streams transport water and sediment. Streams in the Napa River watershed tend to have a gravel or cobble bed. Coarse sediment (gravel and cobble) is an important component of the physical structure of a stream. Gravel and cobble also play important roles in the life cycle of fish and organisms that fish eat. Coarse sediment is moved only during significant storm events.

   The impacts can be:

   a. Capture of flood peaks by reservoirs – this can reduce the number of storms capable of transporting coarse sediment each year. The cumulative off-site impacts of this process can be significant.

   b. Capture of flood peaks may have significant biological impact in late fall or early winter. Salmonids wait in the ocean until they detect an increase in stream flow. The increase in flow draws anadromous fish upstream to their spawning area. A decrease in these early events could delay the upstream migration of salmonids. In addition, the salmon that are attracted upstream may encounter barriers to upstream migration caused by the decreased flows.

   c. Capture, in reservoirs, of bedload carried by flood discharges. This may potentially result in erosion immediately downstream of the reservoir. This process can potentially lead to the creation of an armor layer or the exposure of bedrock or clay layers. A channel bed of bedrock or clay has a significantly lower habitat value. The channel may also continue to incise. Channel incision can create barriers to fish passage. Channel incision can also endanger pipeline crossings and bridges.

   d. Improperly screened diversions can suck young migrating fish out of the stream.

2. Amount of Diversion

   A. Large diversions can cause a local change in stream flow direction, which can confuse young migrating fish.

   B. Large diversions can interfere with the sediment transport process.

   C. Large diversions can increase water temperature.

   D. Large diversions could potentially cause a portion of the stream to dry up.

3. Method of Diversion

   A. On-stream reservoirs have the greatest potential impacts. They capture bedload (coarse sediment) and flood peaks. This can result in erosion and coarsening of the bed just downstream of the reservoir. Channel incision can threaten social infrastructure such as pipelines and bridges.

   B. Diversions to a reservoir. This type of diversion structure (weir or low dam) can be a migration barrier to fish. The diversion structure, if not properly screened, can also suck young migrating fish into the reservoir. A large diversion can change the direction of streamflow and confuse young migrating fish.

4. Indirect Impacts

   A. Appropriative water rights can lead to an increase in the total area devoted to agricultural production. An increase in cultivation will probably come from conversion of oak woodland or other types of plant communities.

   B. Cultivation of steep areas which may result in accelerated erosion.

   C. An increase in diversions from tributaries to the Napa River may result in a decrease in recharge of the groundwater aquifers in the Napa River Valley. The US Geological Survey (1970's report) estimated that up to about half the annual recharge to groundwater in the Napa Valley came from the tributaries. This could potentially decrease water levels in the Napa Valley resulting in greater energy expenditures to withdraw water.

   D. Lack of enforcement of the terms of water diversion permits could result in significant environmental impacts. The large number of diversions in Napa County and in California force the Division of Water Rights to rely on members of the public to point out diverters who are not in compliance with the terms of their permits. Often, complaints are only filed when an upstream user is effecting a downstream user. Serious environmental damage may be done by the time a complaint is filed.

Life History of Steelhead

Since steelhead are one of the species most effected by water diversions a review of their life cycle and requirements is in order. The requirements and life cycle information given here is taken from *Fish Bulletin No. 98, The Life Histories of the Steelhead Rainbow Trout (Salmo gairdneri gairdneri) and Silver Salmon (Oncorhynchus kisutch) with Special Reference to Waddell Creek, CA and Recommendations Regarding Their Management,* by Leo Shapovalov and Alan Taft, 1954, State of California, Department of Fish and Game.

Waddell Creek is a small coastal drainage near Santa Cruz California. It drains a portion of Big Basin Redwood State Park. Like most small coastal California streams, the mouth of Waddell Creek usually closes in the summer.

Shapovalov and Taft studied the steelhead and silver salmon of Waddell Creek from 1933 to 1942. They captured fish migrating upstream and downstream at a weir a short distance above the upstream limit of tidal influence. They measured the length of all the fish captured and took scale samples from most of the fish. Scales morphology gives information about the age and spawning history of the fish.

Steelhead migrate upstream, spawn and return to the ocean. The spawned eggs develop in the gravel where they were deposited. Young steelhead emerge from the gravel and live in the stream for one or more years before going to sea. The cycle is then repeated after the steelhead remain at sea for a year or more. Steelhead can live to be seven years old but the vast majority dies after five years of age. Most steelhead spawn once, but a very few were observed to have spawned four times in the Waddell Creek study.

At each stage of their life cycle, the majority of steelhead exhibit one behavior but a handful act differently. For example, the majority of the juvenile downstream migration occurs from March through June, but a significant number of fish were still migrating downstream through August. A small number of steelhead were captured in the downstream trap in every month of the year. Fish that are one or two years old dominate the March through May downstream migration. Fish less than one year old dominate the June through September period of downstream migration. Fish older than one year dominate the smaller winter downstream migration of juveniles.

Adults have been observed to migrate upstream in all months in Waddell Creek. However, the majority of the upstream migration occurred between mid-November and the beginning of February.

To complete their life cycle, steelhead require the following environmental conditions. In the early winter, a sustained increase in streamflow is required to attract the adults to leave the ocean and move into the river. The flow must be high enough to allow free passage of the adults upstream. The flow must be of sufficient duration to allow the fish to reach their spawning grounds. This requirement means that the flow in the tributaries must also be high enough to provide a sufficient depth for the adults to navigate all the riffles and the entrance to the tributary from the main river. Sufficient flow must continue long enough to allow adults to move out to sea once they have spawned. The water must also be of high quality and be have the proper temperature range. The material on the surface of the streambed must be in the proper size range and have good permeability to aerate buried eggs and remove waste from the gravels.

Water Diversions in Napa County

More than 1,345 applications have been filed to divert water from streams in Napa County. The total number of actual diversions in Napa County is unknown since riparian users are not required to file for rights and there may be some unauthorized diversions. It appears that the SWRCB record of applications filed in the Napa River is incomplete. In February 1972, Fish and Game protested 26 applications, 22 on the main Napa River and 4 on tributaries. A search of the SWRCB list of applications failed to find 10 of the applications, 8 on the Napa River and 2 on tributaries. It is unknown whether these applications were withdrawn, denied or approved. These "missing" applications point out that the SWRCB system may be faulty and thus may contribute to them underestimating the total diversions and storage in the watershed.

At least 858 permits have been issued for Napa County streams. Of these, at least 484 permits have been approved in the Napa River watershed. Figures 2 and 3 show the amount of direct diversion and storage authorized annually in the Napa River watershed. Table 1 summarizes the water rights information by decade, starting in 1937. The water right for Conn Creek (Lake Hennessey) was approved in 1947 and permits the diversion of 35 cfs and storage of 30,500 ac-ft.

Fish and Game began documenting the decline of salmon and steelhead in the mid-1960's. By 1967, a total of about 46 cfs of diversions and about 41,600 ac-ft of storage had been approved. There was little change through the 1970's. Then, a large increase in the diversions (82 cfs) and storage (5,400 ac-ft) were approved in the early 1980's. The 1990's brought another large increase in the amount of approved storage (7,200 ac-ft) and a 13 cfs increase in diversions.

Table 1. Approved Napa River water rights by decade, with and without the Conn Creek water right. Conn Creek Dam was approved in 1947. The Conn Creek water right allows the direct diversion of 35 cfs and storage of 30,500 ac-ft.

Year	All Napa River Diversions cfs	All Napa River Storage ac-ft	Diversions w/o Conn Dam cfs	Storage w/o Conn Dam ac-ft
1937	0.36	2,136	0.36	2,136
1947	42	34,958	7	4,458
1957	43	38,236	8	7,736
1967	46	41,643	11	11,143
1977	49	42,280	14	11,780
1987	131	47,678	96	17,178
1997	144	54,867	109	24,367

Table 2. Summary of the 32 state regulated dams in the Napa River watershed. The information is shown by tributary stream.

Stream	Storage Capacity acre-ft	Drainage Area sq. mi.	Reservoir Area acres
Bell	2,530	5.53	76
Carneros	378	0.55	33
Conn	36,499	68.98	941
Huichica	80	0.20	6
Milliken	3,366	10.67	114
Napa	1,116	6.84	101
Soda	92	0.65	12
Tulucay	244	1.39	54
Kimball	344	3.44	14
Totals	44,649	98.25	1,351

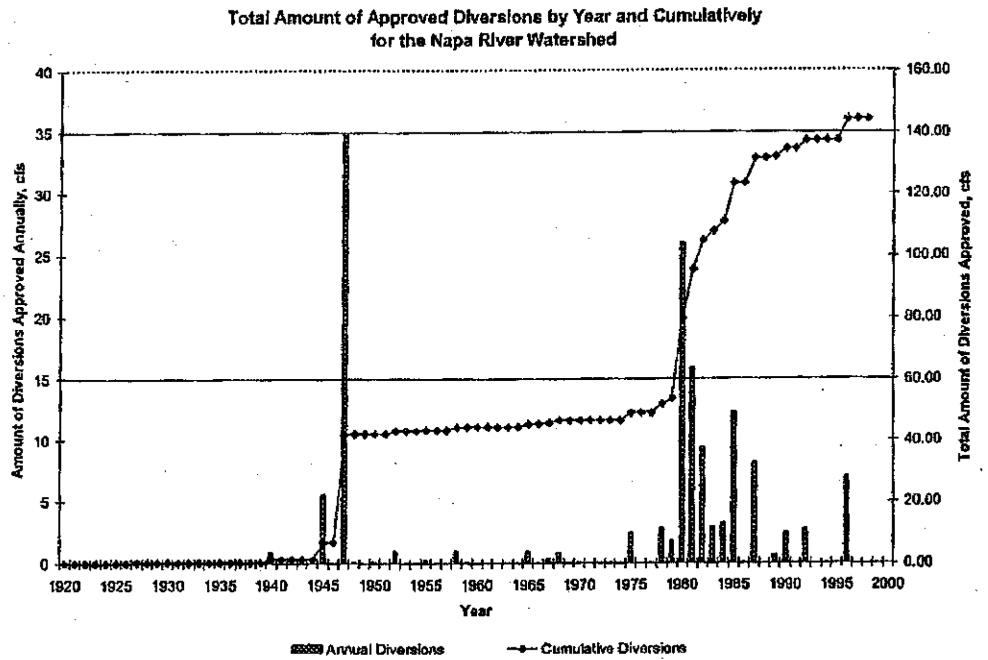

Figure 2. Total amount of direct diversions approved each year and cumulatively for the Napa River watershed.

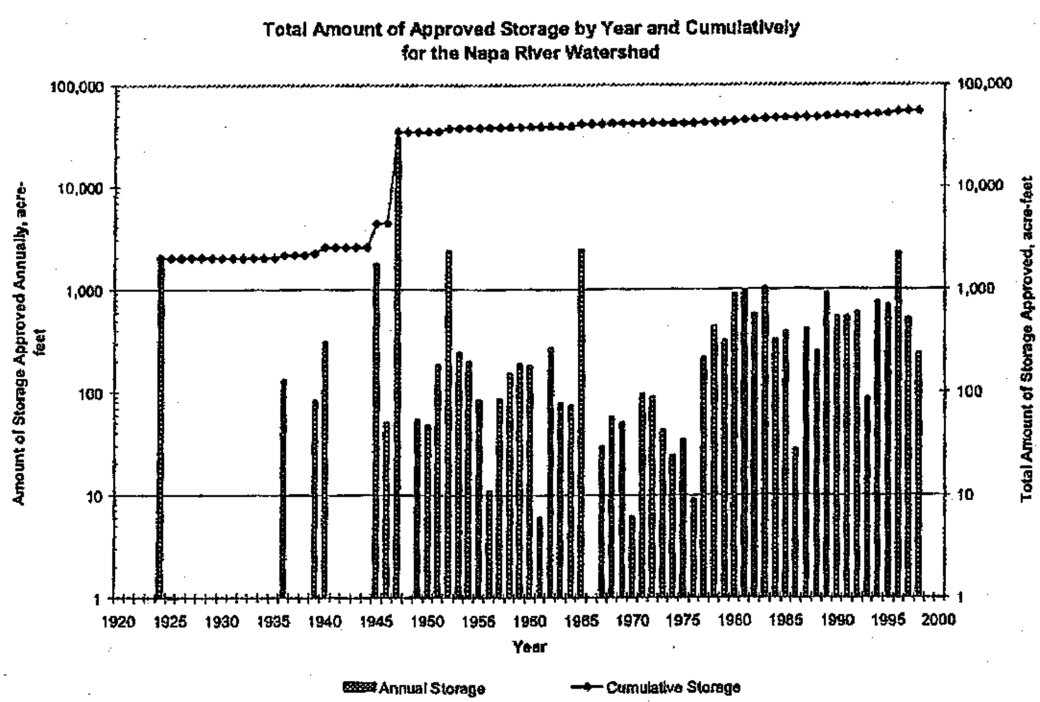

Figure 3. Total amount of storage approved each year and cumulatively in the Napa River watershed.

Dams in the Napa Watershed

There are 52 dams large enough to be regulated by the Division of Dam Safety in Napa County (DWR Bulletin 17). Thirty-two of these dams are on streams in the Napa River system. Eighteen of the dams are in the Putah Creek drainage and two of them are on streams that flow to Suisun Bay. The largest diversion (30,500 acre-feet) is the Conn Creek Dam, which has been operated by the City of Napa since 1946.

Table 2 summarizes some of the data available about the 32 state regulated dams in the Napa River watershed. These structures are complete barriers to fish passage. Thus, they prevent steelhead from the spawning and nursery areas upstream of the structures. Conn Creek dam (Lake Hennessey) controls the runoff of 54 square miles of the watershed. The other large dams control about 29 square miles of the watershed.

A review of the revised contour maps (1987) for Napa County shows that there are about 150 small reservoirs upstream of the USGS stream gauge near St. Helena. SWRCB records show that 73 permits have been granted for storage upstream of the USGS stream gauge near St. Helena. Thus, there appears to be the possibility that some of the reservoirs upstream of the St. Helena stream gauge may not have a permit. When a similar situation was investigated on the Navarro River, it was discovered that several of the reservoirs visible on aerial photos were built without benefit of proper water rights. If there are unpermitted reservoirs and perhaps diversions in the Napa River watershed, the SWRCB may underestimate the cumulative impact of additional water rights applications.

Department of Fish and Game Documents the Decline of Napa River Steelhead

The Department of Fish and Game (DFG) files document the decline of steelhead. Fish and Game staff consistently list water diversions as being the most important factor limiting production of steelhead in the Napa River. For example, John Robinson, a DFG Fishery Biologist wrote the following on February 18, 1963.

> *The Napa River Drainage supports an important steelhead run. It can be assumed that all of the tributaries of the Napa River that have sufficient runoff during the winter months support adult steelhead spawning. The main limiting factor of the steelhead production in the drainage is adequate nursery areas. With the increasing water development in the drainage, the nursery areas are disappearing fast. A report by C. K. Fisher entitled, "The 1954-55 Steelhead Fisheries in Region 3 Streams Based on Angler Census Conducted by Wildlife Protection Officers", gives an indication of the importance of the drainage. The report states that the Napa River drainage has 41.3 miles of stream used for winter steelhead fishing....*

Young steelhead remain in fresh water streams for one to two years before migrating to the ocean. "Therefore, providing of good quality water-year-around in these nursery areas is extremely important." (Greenwald, 1963).

As of 1963, there were, "Approximately 192 miles of the Napa River presently remain as nursery and spawning areas for steelhead, 79 miles of stream have been blocked by dam construction." (Greenwald, 1963).

A US Bureau of Sport Fisheries and Wildlife Memorandum, dated October 21, 1968, reports on surveys of the Napa River system they conducted in cooperation with DFG in 1966. Their study measured the amount of spawning and nursery areas, in miles, for steelhead and rainbow trout in the Napa River system. The results were compared to values from 1920. The following is a quote from the cover letter for the study noting the decline of steelhead numbers and the elimination of the silver salmon run.

> *Important factors which have limited or are limiting fish populations of the drainage include blockage or degradation of tributary streams, dewatering of tributary streams during critical summer months, intermittent natural flows, and pollution of the river by municipal and industrial wastes.*

These and possibly other more subtle factors have limited, reduced or eliminated fish populations. For instance, the annual run of steelhead trout has been reduced from an estimated 8,000 fish to about 1,000 fish and a silver salmon run of an estimated 4,000 fish has been eliminated.

The connection between water diversions and the decline in steelhead is amplified on pages 2 and 3 of the October 1968 US Bureau of Sport Fisheries and Wildlife Memorandum.

Spawning areas suitable for salmonids are located in the upper Napa River and in most tributary streams. Most important reductions in historical spawning habitat have been the result of construction of dams or diversion structures on tributary streams, e.g., Conn Dam on Conn Creek. Lesser reductions also have occurred through degradation of gravels.

Historically, nursery areas for salmonids are thought to have been distributed throughout the drainage including significant portions of the estuary. At present, salmonid fish populations are being maintained in the upper reaches of the river, in tributaries, in areas around springs and seeps, and possibly in the upper-most reach of the estuary. Major reduction or degradation of the nursery areas is attributed to diversion of water from the river and tributaries by means of dams or streamside pumps, water pollution, partial or complete removal of riparian vegetation.

Steelhead trout of the Napa drainage appear to be stabilized or possibly increasing slightly after a period of rapid decline in the late 1940's and early 1950's. The availability of suitable nursery areas during late summer limit steelhead trout populations and any rapid ecological change in the system could severely reduce or eliminate the remaining population.

The number of water rights permits issued in the Napa River drainage between 1945 and 1950 exceeded the number of water rights issued prior to 1945. Between 1950 and 1955, the number of water rights permits issued in the Napa River drainage had doubled again (SWCRB data).

The 1966 US Bureau of Sport Fisheries and Wildlife study of the Napa River shows that in 1966 there were 200 miles of spawning habitat and 179 miles of nursery habitat available. In 1920, there were 263 miles of spawning habitat and 262 miles of nursery habitat.

DFG sampled juvenile steelhead populations at 15 sites in the Napa River and its major tributaries between July 18 and October 1 of 1969. Based on the sampling data DFG estimated that the total standing crop of juvenile steelhead for the Napa River drainage system ranged from 116,400 to 192,800 fish. The resulting adult run was estimated to be 1,160 to 1,930 adult fish using a 1% survival rate.

The 1969 juvenile steelhead population estimate included estimates for the number of juveniles in several tributaries. The study estimated that Dry Creek supported a juvenile steelhead population of 24,300 to 53,400 fish in 1969. A 1983 population-study of Dry Creek showed that the juvenile steelhead population was 1,172 fish. The 1983 juvenile steelhead population is 4.8% of the lower estimate from 1969, a dramatic decline in a 15 year period.

DFG again expressed their concern about the impacts of water diversions on the steelhead population in the Napa River in a February 1972 report addressing 25 water right applications.

We are concerned that the valuable fish and wildlife resources of the Napa River drainage will be greatly diminished as a result of the expansion of vineyards and the concomitant increased diversion of water for irrigation and frost protection. The relatively recent, but increasing use of water for vineyard frost protection represents a significant threat to the future survival of the river's fishery resources - - particularly the steelhead resource.

Excessive diversion during the spring months for frost protection could reduce streamflows to levels that interrupt the downstream migration of juvenile steelhead and strand fish with subsequent high losses. Sections of the river and tributary streams, particularly in dry years, may even be dewatered with catastrophic impact on fish and wildlife resources.

Uncontrolled manipulations of natural flow patterns resulting from extensive drainage-wide diversions could upset "biological clocks." Juvenile steelhead may be stimulated by alteration of the spring flow pattern to migrate earlier or later in the season than under natural conditions to the potential detriment of the resource. Resident fish species may be stimulated to spawn under poor environmental conditions with subsequent high mortality of eggs or young.

Sufficient surface flow is required in the river and tributaries during the winter season to provide for the upstream migration of adult steelhead, spawning and the return migration of adults to the ocean. Diversions of water to off-stream storage during dry winters could interrupt this migration and spawning.

Extreme reduction in flow during the summer and fall months has degraded the value of the mainstem river as steelhead nursery habitat by greatly reducing physical habitat and lowering water quality. Waste discharges are not effectively diluted due to low flows - - further degrading water quality.

The February 1972 report addressing the 25 water rights applications recommended minimum bypass flows on the mainstem of the Napa River for each season. A minimum flow of 15 cfs or the natural flow was set for the period of November 15 to February 29. A subsequent study found this "totally inadequate for the maintenance of a healthy steelhead run in the Napa River." (Cox and Ellison, 1982).

Cox and Ellison studied 7 critical riffles (see Figure 1) in the late 1970's. They reported their findings in June 1982. Their study showed that 58 cfs was needed in the Napa River below Sulphur Creek to provide steelhead passage over the critical riffles. Upstream of Sulphur Creek they found a flow of 50 cfs was required for passage. The minimum flow amount set in the February 1972 report is about one-fourth of the amount determined to be the minimum required for passage. Unfortunately, the inadequate minimum winter flows have been written into at least 38 water rights agreements on the Napa River (DWR Bulletin 216, 1982).

Cox and Ellison observe that:

The environmental factor most important to the successful completion of the steelhead life cycle is sufficient water flow. Sufficient flow is needed for steelhead to ascend the river to their spawning grounds; sufficient flow is needed over the spawning gravels for completion of the spawning act; sufficient flow is needed to provide oxygen to the eggs and fry in the gravel; sufficient flow is needed for the downstream migration of both adults and juveniles to the ocean. Most critical of these needs in the Napa River at the present time is sufficient flow for the upstream spawning migration and the maintenance of nursery habitat in the summer and fall.

The prime agricultural land of the Napa Valley requires a tremendous amount of water during the summer for irrigation and heat control, during the spring for frost control, and during the winter for refilling off-stream storage ponds. The source of much of this water is the Napa River. Domestic and municipal diversions also take substantial amounts from the Napa River drainage. As a result, the cumulative, unregulated demand for water is so great it appears possible for even winter flows to be entirely diverted in some years.

DFG created a "Napa River Management Plan" in about 1982 or 1983. The document is not dated but its references indicate that it was written after February 1982 but prior to the juvenile steelhead sampling during the summer of 1983. The Management Plan describes the Napa River, notes the dramatic decline in steelhead, sets a management objective, lays out a plan to gather more information, and proposes to rear juvenile steelhead to offset the loss of nursery habitat. The Management Plan states,

The single most important impact has resulted from the cumulatively large diversions of surface waters for frost protection and irrigation. In all likelihood, there is currently no unappropriated surface water in the summer and fall in the Napa River system. There may be excess water in the winter; unfortunately, irrigation and frost protection are not necessary then.

To better utilize excess winter water, many storage facilities have been built. The major impoundments, built for storage of municipal water, have been constructed at the expense of anadromous resources. Almost without exception, large dams built in the Napa Valley are blocking anadromous fish runs. The most obvious example is Conn Dam on Conn Creek, which impounds Lake Hennessey on Conn Creek. Built in 1946, Conn Dam blocks steelhead access to approximately 24 km (15 miles) of spawning and nursery habitat (Ellison, 1982).

The Management Plan goes on to state,

Another impact from agricultural development and urbanization in the Napa Valley has been the destruction of riparian vegetation. Riparian vegetation is often removed because it shades out grapevines and harbors insect vectors of diseases that affect grapes. On the main stem of the Napa River, there is currently insufficient shading from riparian growth to maintain summer/fall water temperatures in an acceptable range for salmonids.

A more recent problem stemming from agricultural practices is the increasing conversion of wooded hillside acreage to vineyards. This clearing of forested lands results in higher and more rapid peak runoff in drainages during storm events. The basic hydrology of the entire river system changes in response to these higher peak flows. This is manifest in a greater tendency of the river to undercut its banks and increase its meanderings. The resulting loss of adjacent agricultural lands provides the incentives for sometimes extensive flood control projects that are all too often insensitive to fish and wildlife resource values. This has been an historic problem in the City of Napa, and we have in the past only narrowly avoided the approval of projects that would channelize major portions of the Napa River.

The net results of the previously mentioned problems have been the elimination or degradation of SH (steelhead) nursery and summer/fall holdover habitat in the Napa River system. The carrying capacity of this system is determined by the amount of nursery habitat remaining during the critical summer/fall low flow period. Population estimates made during this period should give a good relative indication of overall population trends in the drainage on a yearly basis.

In 1978, a hearing was held to determine if the City of Napa violated the terms of the Permit 6960 for the Conn Creek Dam. Jones and Garland prepared a report summarizing DFG's position for the hearing. Permit 6960 allows the direct diversion of 35 cfs between November 1 and May 1 into Lake Hennessey for storage of 30,500 acre-feet per annum. Surface flows were to be measured above and below the dam and 10 cfs was to be released during the diversion period. All inflow into the reservoir was to be released between May and October. The Jones and Garland report states that DFG apparently was not invited to participate in the water application procedure. "As such, the permit terms do not reflect specific measures to protect or mitigate pre-project fish and wildlife values." Table 2 of the Jones and Garland report shows the mean number of days, by month, which the Conn Creek project was in violation of the terms of Permit 6960. The table shows that violations occurred in every month of the year and that violations occurred almost daily in October, November and December. The almost constant failure to release 10 cfs during the late fall and early winter would significantly reduce the high flow events in the Napa River, relative to pre-project conditions, that are responsible for attracting returning salmonids.

Jones and Garland go on to state:

The Department of Fish and Game believes that the project by itself or in conjunction with other appropriations has reduced or modified streamflows to the detriment of fishery resources.

Conn Dam was constructed without a fish ladder. Consequently, steelhead are deprived of 17 miles of the best spawning and rearing habitat in the drainage. Reduction of fish habitat downstream resulting from encroachment of vegetation is, in part, due to modification of streamflows by the project. We believe that the project, with reduced flows during the upstream migration and spawning period, has had an adverse affect upon steelhead populations using Conn Creek. Much of the *upstream migration that normally followed periods of heavy storm runoff has been eliminated. Without adequate runoff, attraction and physical transport of the adult fish is questionable.*

The report goes on to discuss the fact that salmonids need an adequate amount of water through out the year to complete their life cycle. This report also demonstrates that the failure to enforce the conditions of a permit can result in significant environmental impacts. It took 30 years for a hearing to be held to determine if the City of Napa was in violation of its water rights permit.

Another example of enforcement problems is the City of Saint Helena's abandoned dam on York Creek. In 1993, the Napa Superior Court ordered the City of Saint Helena to remove the abandoned dam. The dam had not been in use for 20 years and had filled with silt. The dam is a complete barrier to upstream salmonid migration. The City has not yet complied with the Superior Court Order (John Emig, personal communication).

On December 29, 1976, the Superior Court of Napa County granted a permanent injunction regarding diversions from the Napa River for frost protection. The court order established allotments for frost protection apportioned by a watermaster. The court order also recognized the 10-cfs flow for fish protection in the Napa River as having a superior right to appropriative rights and correlative with riparian rights. The court order also authorized the watermaster to adjust the allotment system on a yearly basis. Unfortunately, the court institutionalized a flow that Cox and Ellison's 1982 flow study shows is inadequate.

The Department of Water Resources Bulletin 216, *Inventory of Instream Flow Requirements Related to Stream Diversions,* was published in December of 1982. It lists 86 water rights permits with instream flow requirements in the Napa River drainage system. Another 23 are listed in the Napa County portion of the Putah Creek drainage. The actual number of permits with instream flow requirements is probably higher, since Bulletin 216 has not been updated in the last 18 years. Enforcement of these instream flow requirements is questionable at best. The case of the Conn Creek Dam illustrates that the existence of a permit term does not guarantee compliance with the term. In addition, as understanding of the natural world increases, it is not unusual to find that the real requirement of a species are actually different from what they were thought to be in the past. For example, when DFG requested minimum flow requirements for the Napa River in the early 1970's they may not of been aware of the type of study required to properly determine the minimum flow to provide passage over critical riffles. Thus, bypass requirements on water rights permits may not be adequate, by themselves, to prevent significant impacts to threatened species such as steelhead.

Cumulative Impacts of Water Diversions in Napa County

The Department of Fish and Game (DFG) files reveal a concern about the decline of the steelhead population in the Napa River watershed. By 1968, the silver salmon (Coho) population was eliminated from the Napa River system. Both steelhead and silver salmon (Coho) have legal status. The DFG documents reviewed link the decline of these two species of salmonids to water rights developments.

However, the DFG files may not have told the full story. It is possible that water right development has also impacted amphibians (frogs and salamanders), plants and other components of the biological community in and adjacent to the streams in the Napa River watershed.

When considering the impacts from water right development it is important to remember the indirect effects of the development. For example, a vineyard owner may have cleared a portion of the riparian corridor to remove host plants for the sharpshooter that is responsible for the spread of Pierce's disease. The clearing of the riparian corridor could potentially increase the summertime water temperature to the lethal range for steelhead. The clearing may also have impacted various plant or animal species with special legal status. The vineyard owner may not have developed a vineyard if a water right was not first granted.

If a water right is not obtained then a property owner may choose not to engage in agricultural activities that would result in the loss of habitat, increase in erosion, use of chemicals any other actions that might significantly (and cumulatively) impact the environment.

Fully Appropriated Streams in Napa County

The State Water Resources Control Board Water Right Order 98-08 Exhibit A listed streams that have been declared *fully appropriated*, subject to certain conditions including time of year, in past State Board decisions.

The Napa County streams listed in Table 3 are fully appropriated during the summer months. This is an indication that there is probably insufficient water in these streams to provide optimum steelhead nursery habitat.

Table 3. Fully Appropriated Streams in Napa County.

Decision No.	Stream	Tributary	Season	Critical Reach
0760	Bell Creek	Napa River	4/15 – 11/15	from the confluence of Bell Canyon and the Napa River upstream (1)
0798	Unnamed Spring	Conn Creek	7/15 – 9/30 (f)	from the confluence of Conn Creek and Lake Hennessey upstream (1)
0869 96-002	Putah Creek	Yolo Bypass	1/1/ - 12/31 (c)	from Monticello Dam upstream (1)
0960	Aetna Creek	Swartz Creek	5/1 – 10/31	from the confluence of Aetna and Swartz Creek upstream (1)
1307 1021	Pope Creek	Putah Creek	6/1 – 10/31	from the confluence of Pope Creek and Putah Creek upstream (1)
1404	Napa River	San Pablo Bay	5/15 – 10/31	at Trancas St upstream (1)
1546	Adams Creek	Eticuera Creek	6/1 – 11/30	from the confluence of Adams Creek and Eticuera Creek upstream (1)
1594	Sacramento-San Joaquin Delta	Delta above Collinsville	6/15 – 8/31	from Delta upstream (1)

(1) Including all tributaries where hydraulic continuity exists.

(c) Applications to appropriate water above Monticello Dam in Lake and Napa counties will not be processed by the State Water Resources Control Board without first determining the availability of water under Condition 12 Settlement Agreement dated March 10, 1995.

(f) When Application 10990 (City of Napa) puts the maximum water to beneficial use, Conn Creek will be fully appropriated from November 1 through May 1.

Information Required to Evaluate Additional Water Rights Applications

Migration Flows

Cox and Ellison (DFG) studied the flow required to allow upstream migrating steelhead to negotiate seven critical riffles on the mainstem Napa River in the late 1970's and early 1980's. They determined that a flow of 58 cfs near the St. Helena stream gauging station was sufficient for the adults to move upstream. However, they did not investigate whether the flow in the tributaries was sufficient to allow adults to move upstream when the flow at the gauge was 58 cfs. This is a critical piece of information that needs to be ascertained. In addition, the 1981 study of mainstem riffle passage needs to be repeated. After 20 years, it is likely that the riverbed has changed enough that the depth to discharge relationship has changed at some or all of the riffles studied by DFG in the 1981 Cox and Ellison report. For example, the USGS records for the gauging station near St. Helena show that the 1996 channel capacity is about 25% less than it was in during 1978 - 1983 when Cox and Ellison did their study. Note that the discharge is no longer measured at the St. Helena gauge.

Flow also has to be sufficient for the adults that have spawned to return to the ocean. The Waddell Creek study showed that most of the adults migrated downstream from March through mid-July. A few steelhead migrated downstream into September. A few adult steelhead were captured migrating downstream in December.

If Napa River steelhead behave like the steelhead of Waddell Creek, passage flows should be provided as late as mid-June to allow adults to return to the ocean. So, information is needed about the passage condition of the tributaries and mainstem from mid-November to mid-June.

Water Temperature

Water temperature is another key environmental factor for steelhead and silver salmon. The optimum temperature range for steelhead is about 62.5 ^{0}F to 66.2 ^{0}F. The lower lethal temperature is 32 ^{0}F and the upper lethal temperature ranges from 69.8 ^{0}F to 80.6 ^{0}F, depending on the authority quoted. The range in lethal temperature is partly caused by the fact that higher temperatures stress the fish and, if exposed to them long enough the fish eventually dies. Steelhead can survive short-term exposure to high water temperatures. About half the steelhead exposed to 75^0 F water die.

Temperature requirements vary with type of activity. Spawning is best when water temperatures are 39-49 ^{0}F. Incubation of eggs is best when the temperature if 50 ^{0}F. Rearing is best when the temperature is about 66 ^{0}F. Upstream migration stops when water temperatures begin to exceed 70 ^{0}F.

Water diversions can effect water temperature. Diversions in spring and summer reduce the flow (mass) and hence lower the amount of thermal energy (sunlight) that can be absorbed by the water before the temperature is increased.

Water diversions can also indirectly increase water temperature, since the agricultural activity supported by the water diversion could lead to the removal of stream-side trees that shade the stream. Trees that shade the stream reduce the amount of solar radiation reaching the stream surface.

Water temperature in Mendocino and Sonoma County streams typically experience the maximum temperature in late July. The maximum daily water temperature of these streams in June and July is often near or above the upper lethal temperature for steelhead. Sustained high summer water temperatures can wipe out the juvenile steelhead population of a stream, or at least the portion of the stream affected by the high water temperatures. The juvenile steelhead population is composed of recently spawned fish and fish spawned during the prior year.

The SWRCB should study the effect of diversions on water temperature from May through September. The range of daily temperatures may also be an important measure of the thermal stress on fish.

Fine Sediment

Salmon and steelhead require gravel for spawning. However, fine sediment deposited on the streambed adversely impacts steelhead spawning, egg development, escape cover and the availability of food. Water rights development can effect the amount of fine sediment transported by the stream network. Reservoirs can capture the gravel and cobble being transported in (or into) the stream network. Gravel and cobble is moved along the bed of the stream by the force of the water moving downhill and so is termed *bedload.* By capturing the bedload, reservoirs interrupt the sediment transport process that shapes the streambed. Downstream of a reservoir, the bedload-free stream uses its extra energy to erode the streambed, thereby introducing additional fine sediment into the channel. This could lead to a change in the composition of the streambed below the diversion.

Reservoirs placed on steep swales can also prevent new bedload from moving into the stream network. Debris flows, a thick mixture of soil and rock with a little water, are an important mechanism for delivering coarse material to the stream network. Debris flows typically originate in ephemeral watercourses with slope of more than 20%. The cumulative impact of many small reservoirs intercepting bedload may be having a significant effect on the composition of the bed material of the Napa River and its tributaries. Therefore, the SWRCB should study the relationship between diversions/reservoirs and the composition of bed material prior to issuing any further water rights.

Water development can also indirectly increase the amount of fine sediment in the stream network because of the change in land use practices associated with the developed water supply.

Steelhead Food Supply

Steelhead mostly eat macroinvertebrates. The Waddell Creek study indicates that steelhead may prefer caddisflies. The types of caddisflies require cool clean water and a streambed that is largely free of fine sediment to flourish. The types of macroinvertebrates favored by steelhead are sensitive to pollution. Activities that increase fine sediment, water temperature or pollution levels or significantly decrease streamflow will adversely impact macroinvertebrates. A systematic study of the macroinvertebrates population in the tributary streams of the Napa River is needed to fully understand the condition of the steelhead habitat The SWRCB should undertake a study of the relationship between macroinvertebrate populations and diversions in the Napa watershed.

Summary

The impacts from any given water diversion may be small, but when all the water rights in the Napa River watershed are considered the cumulative impact on steelhead and other species of fish and wildlife are significant. The documents reviewed for this report show a clear link between the increase in the number of water rights permits issued and the elimination of salmon and the decline of steelhead in the Napa River. Several of the water rights granted use on-stream reservoirs to divert the permitted water. These reservoirs deny anadromous fish access to the channel upstream of the reservoir. Therefore, these types of reservoirs directly reduce the amount of spawning area and nursery habitat available to steelhead. Cumulatively, the loss of spawning and nursery habitat in the Napa River system has been very significant.

These types of impacts can apply to small reservoirs as well as large reservoirs such as Lake Hennessey on Conn Creek. In addition, the total number of diversions has reduced the stream flow at critical times of the year. In fact, the Napa River and its hydraulically connected tributaries have been declared fully appropriated during the summer. This indicates that, in many years, there is probably not enough water to meet the needs of diverters and juvenile steelhead.

On stream reservoirs also capture bedload and typically result in channel incision below the dam. This can lead to coarsening of the bed material immediately below the dam and in deposition of fine material downstream. These effects can lead to a further loss of spawning and nursery habitat below the dam as well as the habitat lost above the dam.

During the early spring frost season, the demand for water for frost protection is so great that adjudication was required to ensure enough water would be available to all diverters. The court order imposing the adjudication reserved a minimum flow for fish and wildlife but this flow was later demonstrated to be insufficient for fish migration. This inadequate minimum flow has been institutionalized in a large number of water rights permits, thereby ensuring continuing negative impacts to steelhead.

Inadequate enforcement of water rights is also an environmental impact. A significant number of reservoirs were constructed without the benefit of legal water rights in the Navarro River drainage. The extent of illegal reservoir construction in Napa County is unknown. Illegal reservoirs or direct diversions make it unlikely that the Division of Water Rights can properly assess the environmental impacts of additional diversions since the true amount of existing diversions is not known.

Indirect effects from the approval of water rights are also significantly impacting the environment in Napa County. The recent expansion of hillside vineyards would not be possible without appropriative water rights. Significant acreage of oak woodland has been recently lost to the creation of hillside vineyards. Hillside vineyards are also a significant source of sediment and increased storm runoff, which further degrade steelhead spawning and nursery habitat.

An Environmental Impact Report is clearly required before the SWRCB can issue any additional water rights in the Napa River watershed. The EIR should include studies on the following issues.

- The minimum flow required for adult steelhead migration in the main river and its tributaries.
- The flow required for out-migration of juvenile steelhead.
- Effect of diversions on water temperature.
- Effect of diversions on the composition of bed material. This should include reservoirs on steep swales that may be capturing debris flows.
- The condition of the macroinvertebrate populations.

Sincerely,

Dennis Jackson

Dennis Jackson

Hydrologist

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EXHIBIT 4

WATERSHED SYSTEMS

NAPA VALLEY HILLSIDE VINEYARDS

CUMULATIVE EFFECTS OF CONVERSION OF UPLAND WOODLANDS AND CHAPARRAL TO VINEYARDS

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DECEMBER 24, 2000

EXHIBIT 2

EVALUATION OF CURRENT NAPA COUNTY REGULATIONS

CUMULATIVE EFFECTS OF UPLAND VINEYARD CONVERSIONS

PROBLEM STATEMENT

Misapplication of fundamental principles of soil science and hydrology has lead to a dangerous loss of upland infiltration capacity in the upland areas of Napa Valley that were formerly oak woodlands, chaparral and mixed conifer woodlands. Continued approval of conversions of native vegetation and undisturbed natural soil units to vineyards will likely lead to increases in downstream flood hazards and sediment yields. The sediments that accumulate in channels of the Napa River and its primary tributaries are not all derived from vineyards themselves, but also from channel erosion associated with increased runoff associated with hillside development. I have been asked to evaluate Erosion Control Plans for conversion to vineyards that have already been approved by the Napa County Planning Department pursuant to the Napa County Hillside Ordinance. These are also known as Conservation Regulations at Napa County Code Chapter 18, Section 108.

The approach of the Napa County ordinances is fundamentally incorrect and cannot protect either public health and safety or long-term land productivity. The existing ordinances seem to assume that by attempting to capture sediments from upland vineyard conversion areas; downstream cumulative effects are reduced to insignificance. This is not correct. Increased upland sediment yields, while important, are less hazardous to Napa Valley than are the changes in runoff timing, volumes, and rates. Increased runoff does have cumulative downstream effects through changes in rates of runoff and frequency of runoff events of a given magnitude. These changes are likely to be a significant factor in changing sediment loads in the main Napa River through changes in stability of side its tributaries.

The application of erosion control principles as a potential mitigation for all downstream cumulative effects of runoff change is misguided. Effects of vineyard conversion on hillside sediment yield and water runoff are largely independent of each other. It is probable that well-intentioned evaluation of the effects of potential hillside vineyard conversions without testing and monitoring of actual practices will result in incorrect hypotheses about how conversion of natural lands to tilled vineyards will behave. There can be no land management without land monitoring. The underlying principles that seem to guide the current Napa County Ordinance are not applicable and appropriate for evaluating the actual hydrologic effects of upland conversion to vineyards in the Napa area on slopes or hilltops.

Critical to proper cumulative effects evaluation is an understanding of the infiltration capacity of a site before and after vineyard conversion. Use of generalized regional soil characteristics to predict effects of conversion is shown to yield an incorrect model of the actual changes that occur during the preparation and planting of vineyards. Models of soil response that are derived from observations by the US Department of Agriculture for agricultural lands do not accommodate either the actual soil characteristics of Napa area uplands or the deep tilling and local stone removal that accompanies modern vineyard planting or replanting These models derived from the Modified Universal Soil Loss Equation (MUSLE) are what the consultants for the conversion plans used as the bases of their analyses.

Routine application of the MUSLE without accommodation of the unique Napa Valley soil characteristics that give rise to the inherent extremely valuable substrate for wine grape production, leads to errors that are now being multiplied throughout the Napa appellations. For example, the simple error that assumes, based on agricultural soil loss principles, that the steeper the slope, the greater the risk of soil losses and increased runoff, is fundamentally false for the eastern side of the Napa Valley uplands and for parts of the western side. In fact, slopes less than 30 percent have higher sediment and water yields than do those of greater than 30 percent, simply because the less steep slopes retain the clay-rich volcanic soils that are simultaneously more valuable for premium grape production and are more susceptible to decreased infiltration capacity when disturbed and are therefore more hazardous for conversion.

FIELD INVESTIGATIONS

During 1999 three vineyard conversion sites were visited for close inspection of field hydrologic and erosion control conditions. These sites were those for which erosion control plans had been developed and approved by Napa County. Added erosion control plans submitted and approved in the spring and summer of 2000 were reviewed and those sites were reviewed on aerial photos and overflights. Two overflights of the whole of the Napa Valley new vineyard conversion areas were made specifically to evaluate the magnitude of the conversion efforts and the characteristics of the sites being converted, to establish the representativeness of the sites and conditions of more detailed on-the-ground investigations.

Field investigations of hillside vineyard conversions were made on December 29, 1999 at Pahlmeyer Vineyards west-sloping and ridgetop development sites that were cleared and prepared for planting in 1999. This site is tributary to Milliken Reservoir and upper Milliken Creek, and was considered as representative of east-side headwater vineyard conversion conditions in oak woodland and mixed chaparral on Sonoma Volcanic series soils. Based on subsequent overflights (of early 2000 and 8/10/00), this site is believed to be representative of soil-hydrologic conditions on over 50% of the new Napa Valley upland vineyard sites. Chateau Potelle in the Mt. Veeder area on the west side was also inspected at sites already converted, at sites to be converted, and at sites of prior vineyards in the process of redevelopment. The Ch. Potelle conditions of mixed oak-madrone and conifer woodlands on rhyolite tuff parent materials may represent about 30 percent of the conversion sites of the last 5 years. Vineyard Properties West on and near the Hopper Creek headwaters were field inspected as a site that represents a mixed Franciscan metamorphic and volcanic parent material site in the west central fault zone portion of Napa Valley that had gone undeveloped for vineyards because of long-recognized poor quality grape production conditions but is now being developed in small parcels on steeper lands by persons for whom grape quality may be less important than appellation. This substrate characteristic includes landslides, erodable soils, and mixed hardwood and conifer native vegetation, and probably represents less than 15% of new vineyard development sites. Other new vineyard development in the southern part of Napa Valley and the Carneros area in oak grassland lower-gradient sites represent 10 percent or less of new hillside vineyards. These southern sites were reviewed from the air and through their erosion control plans and published soil maps but not with on-site soil investigations. The general findings and conclusions of this present report do not include opinions about low-gradient southern Napa County oak-grassland sites.

Additional field investigations were conducted in 1999 along the Napa River and its tributaries to inspect channel conditions, status of erosion and deposition, bank stability, present and past gauging sites, and stream substrate conditions. These investigations extended from the Napa/Lake County Line (Montesol Ranch) to the City of Napa and included observation of soil characteristics, evidence of gullying or rilling that would indicate need for erosion control on uplands, and evidences for increases in runoff in minor ephemeral channels. Soil drainage characteristics in Napa Valley floor alluvial soils were not inspected for this study effort but this author is familiar with them based on past work for established vineyards.

FINDINGS OF FIELD INVESTIGATIONS

Basic findings of field work were clear and rather straightforward. Vineyard development on uplands where natural vegetation is removed and where Napa County Erosion Control ordinance conditions are followed and approved by the County markedly decrease the capacity of the soil and the watersheds to absorb and retain rainfall. This is precisely the opposite of the predictions of the Napa NRCS/RCD upon which the Erosion Control Ordinance was justified[1].

Field investigations in December, 1999, showed that undisturbed soils under native vegetation, even where fire-maintained, had very much greater porosity and infiltration capacity than did the same sites after conversion to vineyards. Vineyard conversion does not emulate agricultural field conditions for which soil management models are developed. In all sites inspected in the Napa region, it was found that the deep raking and tilling of modern mechanized vineyard preparation brought high-clay-content subsoils to the surface, stripped off the protective and beneficial near-surface stone layers, and destroyed the one-to-three foot porous and permeable surface soil structure.

Napa County soil mapping was conducted from 1965 through 1973 and represents conditions as they existed in 1974[2]. The upland areas were at that time classed as rangelands and used for range, wildlife and recreation. The mapping scale and accuracy was appropriate for that land use, but not for later conversion to vineyards or other uses. In general, stone content was not originally delimited in the upland mapping units. For the Pahlmeyer site, the old maps show the Forward gravelly-loam as the primary soil unit which is defined as loamy soils developed on volcanic rocks (see Appendix A - Soil Descriptions).

Stone content is critical to soil hydrology. The loam and especially the clay-loam sites have soils that contract in the summer as they dry out. The stones in the soil profile do not contract, so a void space is left around each rock. Grass roots and percolating water need those spaces to move into when it starts to rain in the fall. As the soils become saturated they expand but the previous season's grass and shrub roots continue to provide avenues for infiltration of rainfall. Thus, the infiltration capacity of rocky expansive clay-rich soils is much greater than that of a simple clay-rich soil. Where stones remain throughout the soil profile, rainfall is carried down through the soil into cracks in the bedrock and it recharges the groundwater.. Where stones are absent on sloping clay-rich soils, rainfall runs off over the soil surface and removes the soil over geologic time. Where stones are removed, slopes will rill and gullies will form to remove that soil and expose bedrock to direct infiltration. It is a very simply balance and all natural slopes in Napa County are adjusted to the steepness and infiltration capacity necessary to accommodate the natural rainfall that has occurred historically. You cannot change the slope hydrologic characteristics without simultaneously changing the rainfall. Such change is not possible.

[1] A theoretical modeling study was conducted by the USDS-NRCS Napa Field Office and the County RCD in 1998-99, comparing east and west side development based on agricultural soil management concepts and models: Haas, Julie, January 2000, *Napa River Watershed Hillside Development Runoff and Erosion Study*, Napa RCD.

[2] Lambert, G, J. Kashiwagi, B. Hansen, P. Gale and A. Endo, 1978, Soil Survey of Napa County: USDA Soil Conservation Service and UC Ag. Experiment Station. Published on-line at http://www.ca.nrcs.usda.gov/mira/NapaSS/main.html.

By comparing the development of rills on newly exposed vineyards, the yield of sediment to the small catchments required under the Ordinance, and the runoff volumes associated with fall, 1999, small storms as evidenced by overflow of the sediment catchment basins, we were able to estimate the downstream offsite effects of conversion of hillside sites to vineyards. Although some allowance must be made for the "maturing" of new vineyards through time and the reestablishment of vertical permeability through no-till management of cover erosion-control crops, the real long-term damage is done through the deep tilling. The hourly precipitation record from Atlas Peak was used for this field analysis.

Hundreds of thousands of years of slow downward movement of clay particles derived from volcanic ash inputs to all the Napa Valley hillside soils, as well as from the varied parent soil materials, is undone in a few days of modern site preparation for vineyards. Those segregated clays are brought again to the surface and mixed in the soil column, creating a substrate for planting that is only able to absorb 10 to 50 percent of the normal and usual seasonal rainfall peak events. To add insult to injury, the larger stones and small boulders that have, over hundreds of millennia, accumulated as a lag deposit near the surface through several geologic processes, including ground freezing during 10's of thousands of years of much colder weather in past geologic time, and that now serve to create seasonal voids and surface protection, are often deliberately removed from the soil in the mistaken belief that they may impair fertility or management options for vineyards. In clay-rich parts of southern France these stones are deliberately worked into the soil to prepare new sustainable vineyards, while here we deliberately reduce tilth and soil moisture holding capacity and increase soil erodibility by removing them.

By comparing the observed reductions in soil moisture holding capacity and capacity to allow water infiltration with the actual historical record of precipitation in and around the Napa Valley, it is a straightforward and simple exercise to determine how hillside vineyard conversion will affect runoff. Determining how that increased runoff will erode and transport soil is somewhat more complicated and is the focus of erosion control plans, but by observing and monitoring the existing Napa County upland conversion sites, theoretical erosion models can be calibrated and the volumes of sediment to be derived from the vineyards themselves can be determined. Monitoring is not difficult. Maintaining and removing sediment from the small sediment basins required under the County Ordinance is a necessary part of vineyard management. It is but one more step to calculate the volume of that sediment and not too much more difficult to determine the overflow of runoff from those basins to calculate increased water yield. Again, one cannot manage without monitoring.

The increased runoff volumes themselves can be expected to erode banks and beds of tributary channels and to entrain in-channel sediment that will then be deposited in the lower-gradient reaches of those tributaries or in the main-stem of the Napa River. This we see happening in some sites, such as lower Hopper Creek below and within Vineyard Properties West. Construction of reservoirs may have counteracted or slowed this cumulative downstream offsite effect, but if and when those sediment traps fill, we will again see a reversal of channel stability. Below new on-channel tributary reservoirs today, we see channel erosion and net downstream cumulative hydrologic effects. Reservoirs trap coarse sediment that is needed by the tributaries to maintain their erosional energy balance. By trapping coarse sediment, we increase bank and bed erosion downstream. Fine sediments carried from tributaries below vineyard conversion sites may be ultimately sluiced through the Napa River to be deposited in the tidal marsh. But those sediments reduce spawning gravel function and rearing habitat as they pass to San Francisco Bay. And once they get into the tidal marshlands, they decrease the ability of those sites to transport water and sediment and thus increase backwater effects in the lower River, possibly increasing flooding in Napa. While we cannot pick up a handful of sand and silt from the Napa River bed today and establish where it came from, we can note that today's steelhead populations are but 20% of those of the 1950's and 1960's and that such declines can be explained by observed reduction in spawning and rearing habitats.

NAPA SOIL CHARACTERISTCS - EAST VS WEST SIDE

Eastside upland soils derived from both volcanic parent materials and from more recent additions of volcanic ash were found to be those with the greatest changes accompanying conversion to vineyards. Our field investigations showed that soils under chaparral or mixed oak and chaparral were able to absorb on the order of 12 inches of intense short-period precipitation without generating overland flow. Stony subsoils can allow percolation of that accumulated 12 inches of precipitation in a week or less so that natural upland areas can accommodate even the extreme precipitation events recorded in the Napa area, including several 12-inch rainy periods in a single season. This determination is based on surface and subsurface soil characteristics in the sites of native vegetation, and on the evidences or lack thereof for rill, gully, and sheetwash erosion. Soil types were mapped on the old maps as Forward gravelly loam and Bressa-Dibble complex.

This means that surface runoff is minimized under natural soil and vegetation conditions and that the geomorphic development of a drainage network does not need to accommodate frequent surface runoff by developing a denser headwater tributary network. Because broad areas are able to absorb all the precipitation that falls in almost all years, groundwater is recharged readily into fractured permeable volcanic rocks, water tables are not perched, and springs and seeps will flow in lower canyons through dry periods as well as wet. The primary upland drainage network is probably developed after major fire followed by El Niño type winters when temporarily hydrophobic soils reduce infiltration and increase the ratio of runoff to rainfall.

A particular characteristic of many eastside soils is that the ***less*** steep the slope, the higher the clay content, and the greater the post-conversion erosion hazard under contemporary conversion techniques. Slopes over 30 to 40 percent have largely been stripped of their residual clay-rich soils, or they may never have developed there. Such sites are characterized by exposed surface bedrock and residual stones with moderately high infiltration capacity and little soil moisture holding capacity. The Napa County Erosion Control Ordinance requires assessment and mitigation on sites that are less erodable while ignoring those that are more erodable. This reversal of standard theory is not seen on the west-side watersheds.

Eastside soils with higher silt-clay subsoils were observed to loose 60 to 70 percent of their capacity to absorb regularly occurring intense rainfall after initial conversion to vineyard. What this means practically is that an east-side site that could absorb the maximum-intensity cumulative 1-week rainfall that might occur only once every hundred years or longer, will now become saturated and generate runoff every average year. This means, roughly, that surface erosion may occur 100 times more frequently.

As the following figure (1) illustrates, there is a 10 percent chance that a rainfall of 1-inch will fall in any given day in late January of any year along the east side of Napa Valley. There is almost a 5% chance that a 2-inch daily rainfall will fall in any given winter day, but there is virtually no chance (less than 1 percent) that an 8-inch daily rainfall will occur. The natural shape of hillsides in Napa Valley and the drainage networks that develop naturally to drain them, are delicately adjusted to the natural characteristics of rainfall and runoff that occur under native vegetation on native soils. When these are changed, the slope equilibrium, or fluvial geomorphology of the hillsides must change to respond to the new conditions. We found that natural slopes of less than 30 percent gradient could accommodate an initial 6 to 8 inches of daily rainfall without surface saturation and runoff while those converted to vineyard immediately adjacent on the Pahlmeyer site generated runoff, rilling, and completely filled and overflowed the County-required detention ponds with the first 1 to 2 inches of fall rainfall in 1999[3].

Looked at another way, Figure 2 shows the extreme values recorded historically through the year and the average daily values for two Napa Valley long-term climate stations. Daily precipitation that exceeds 6 inches (the minimal capacity of natural ridge-top soils) is very rare, but those that exceed One and one-half to 2 inches (the capacity of the converted lands) are very common. At both Calistoga and Angwin there have been an average of 13 days per year with precipitation greater than 1 inch in the 52-years of records since 1948. At Calistoga there was one day only (2/17/86) with precipitation greater than 6 inches (8.10 inches) for 52 years of record. Thus we can expect that the converted lands will yield runoff that exceeds the preconversion values by a substantial amount about 13 times a year, and that this excess will exceed runoff from unconverted natural lands at least 1200 days per century [one event in 52 years on natural lands versus 13 events per year on converted lands]. This is even more than a hundred-fold increase. All statistics are taken from Western Regional Climate Center sources at http://www.wrcc.dri.edu/cgi-bin/.

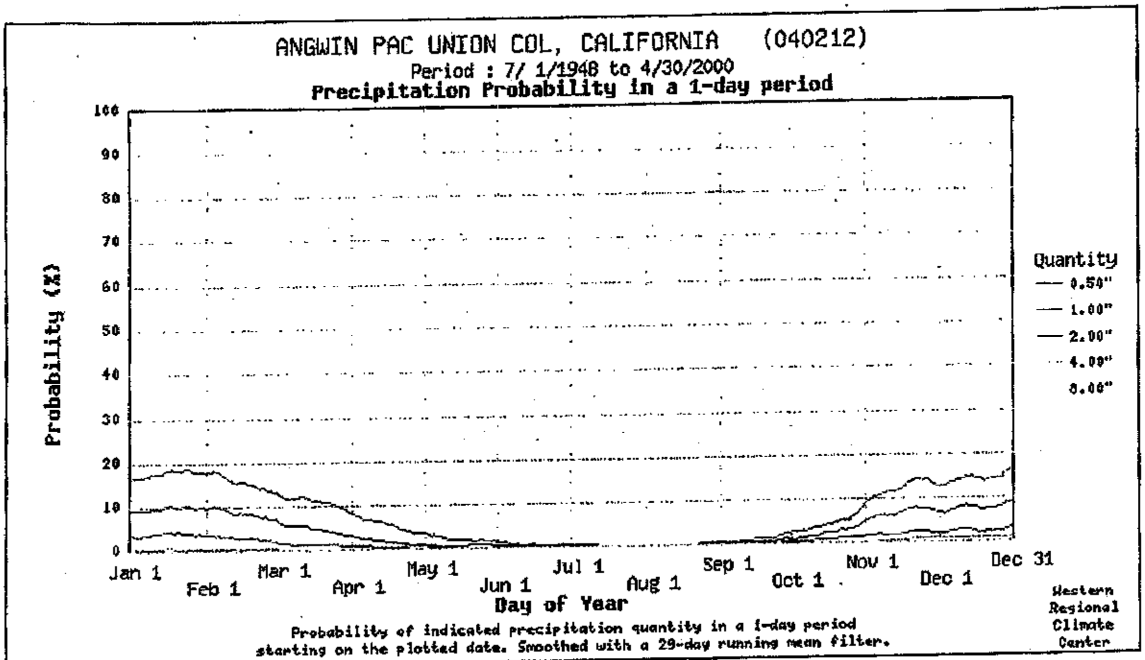

Figure 1 - East-side Napa Valley 24-hour precipitation probability

[3] Based on Atlas Peak hourly precipitation record. Pahlmeyer's on-site record was not available to us.

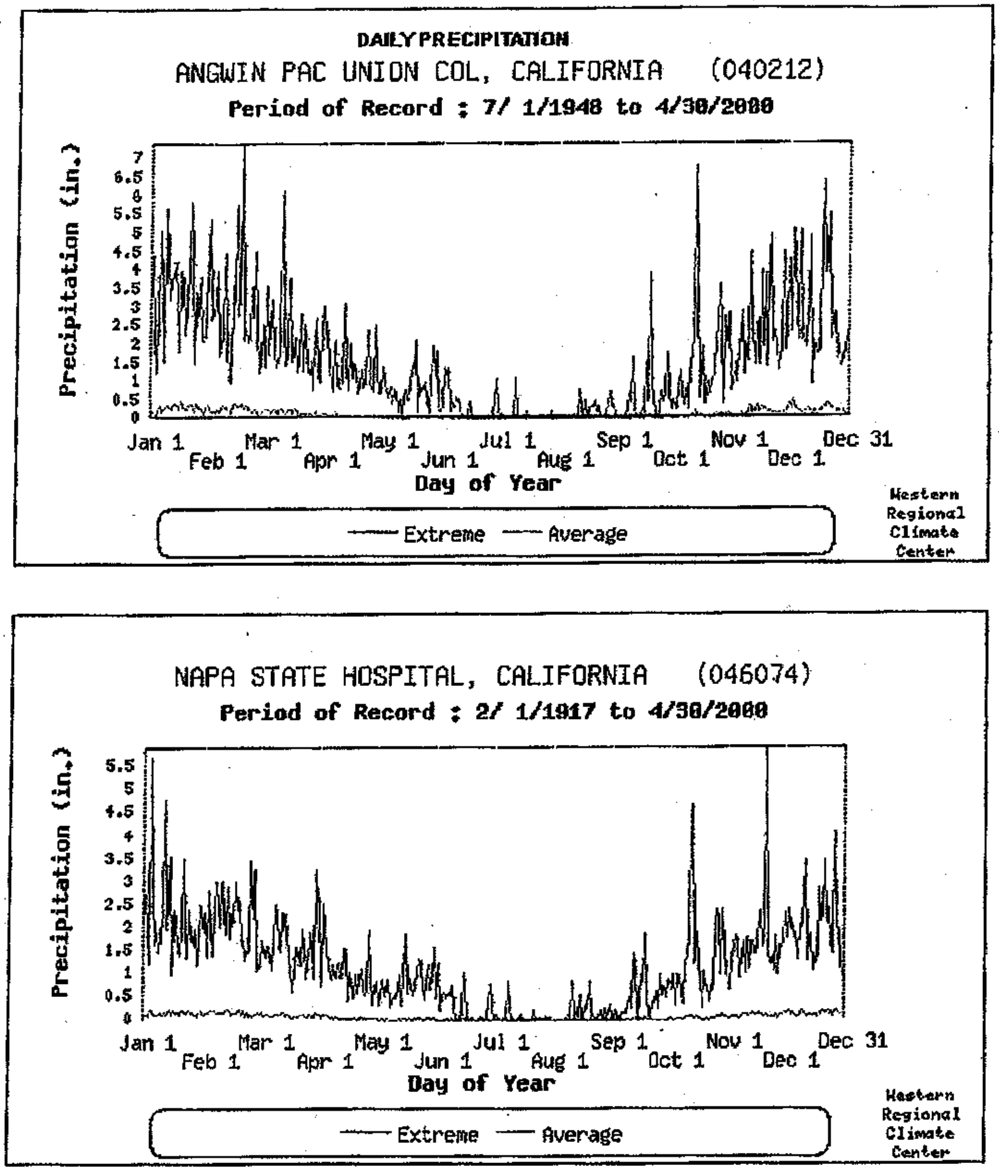

Figure 2: Means and Extremes for period of record at Angwin and Napa

Westside conditions are much more varied because both substrates and vegetation are more varied than are seen on the east side. Soil mapping on the hillside vineyard areas of Napa Valley is not adequate for detailed evaluation of runoff-generating characterstics. Napa County soil survey mapping is generally not suitable for evaluating vineyard conversion risks for non-alluvial soils above the valley floor. Soil mapping by the Soil Conservation Service and, later, by the Natural Resources Conservation Service has concentrated on the soil characteristics in the top two feet of agriculturally significant soil materials[4]. Soil mapping is not generally done to

[4] See "Napa County Soil Hydrologic Groups" map from the Soil Survey Geographic Database (SSURGO), Napa County RCD.

the degree or refinement necessary for hillside land conversions. Ongoing conversions for vineyards thoroughly change the mapped soil characteristics (see next Section on need for EIR analyses).

The Napa Valley floor vineyard lands are generally mapped to what is called an Order 2 mapping level. Because the conversions on these lands took place a century or more ago and these alluvial-substrate soils are relatively flat lying and are either well drained or have long had augmented drainage facilities, erosion is not generally a problem. The Order 2 maps are quite accurate and detailed, as is appropriate for very valuable crops. The hillsides around the Napa Valley, however, are only mapped at 4th Order reconnaissance level in forests or, at best, 3rd Order levels (see Appendix B for discussion of this mapping standard). Those lesser standards were appropriate for the open range and recreational uses of the hillsides in the 1960's. New syntheses of those older survey maps (see http://www.ca.nrcs.usda.gov/mlra/NapaSS/) come with a caveat on each map that states:

Due to complex features of the landscape and map scale limitation accuracy, on-site field inspections should be conducted with staff from the Natural Resources Conservation Service or professional soil scientists to verify soil mapping unit characteristics..

Thus, hillside soil maps in Napa County include lumped complexes or associations of undifferentiated soil types that cannot be mapped separately at a scale of 1:24,000. Under westside woodlands, these soils are largely interpreted from aerial photographs and often cannot be resolved to land units under about 40 acres. Further, soils on hillsides are generally defined as slope phases of an upland or better-developed soil that may be found at one site. This mapping convention means that soils mapped on hillslopes of greater than 15 percent are generalized and imprecise. This is particularly troublesome in Napa County where hilltop soils may be derived from volcanic ash with much clay content while hillside soils below those sites are developed on unrelated bedrock. This is one fundamental reason that slope steepness is a poor predictor of erodibility in parts of Napa County.

Soil characteristics including content of stones are very important attributes to predict erosion potential. Stone content is a primary characteristic of the erodibility estimate developed in the Modified Universal Soil Loss Equation as part of its **K** factor. This equation is the basis for both the runoff models that were developed by the Napa County RCD and for the calculations of sediment basin sizes produced by the agricultural engineering consultants who prepare some of the Erosion Control Plans for the County. But stones also have significant effects on the overall function of soil; particularly where high shrink-swell characteristics are inherited from volcanic-ash derived clay minerals (see previous discussion). Long millennia of trial and error in southern Europe have taught the great import of maintaining a surface lag or coating of stones to protect underlying soils from rainsplash and rill erosion. Soil moisture levels are maintained under stone cover, planting is easily effected through stone cover, tilling is unnecessary, and weed control need is minimized. Stones within the soil column do not contract during the dry summer months when clay-rich soils are shrinking, and thus passageways are established along the boundaries of the stones that can readily accommodate infiltration and root growth with the first intense fall or early winter rains. Various stone mulching methods are effective.

The Napa County erosion control ordinances emphasize cover crop plantings of perennial grasses to effect the same kind erosion control. But grasses compete with vines for late summer soil water, are much less effective with initial infiltration capacity for the first winter rains, and do less to increase deep permeability in clay-rich soils. Where native stones are not present in a natural soil profile, as in parts of the west side, perennial grass cover-cropping may be a sound alternative.

To evaluate the ability of a site to develop a stone cover, the stone content of the soil mantle must be assessed. This usually requires a series of representative deep soil pits that are carefully logged. This information is not generally part of a routine agricultural soil survey because larger stones do not contribute to the conventional productivity of the site. But they are very important for soil erosion resistance and enhanced infiltration capacity.

West side soils, as evaluated on Mt. Veeder on the Chateau Potelle site, have less clay-rich subsoils than do east-side sites. Bedrock is closer to the surface, more fractured, and soils are not as subject to summer shrinkage. Less antecedent rainfall is necessary to saturate observed west-side soils so headwater stream and gully density is greater than on the east-side. Management of vineyard conversion sites on Mt. Veeder and similar sites around Mt. Veeder requires drainage infrastructure and larger sediment detention basins for a given vineyard area. At Ch. Potelle, we observed that old vineyards that had been regraded and replanted were able to absorb about two-thirds less rainfall than the undisturbed forest-floor sites immediately adjacent could absorb[5]. Newly converted lands, with slightly higher clay contents than those of the old vineyard lands, could absorb about one-fourth of the precipitation of "undisturbed" naturally vegetated lands. While this reduction in infiltration capacity and resulting increase in runoff is substantially less than we observed on the east-side, it is still significant. It still demonstrates that the modeling that was a basis for the Napa County Erosion Control Ordinance is incorrect.

Most significantly, it is not simply the size of the sediment retention basins that should be at issue, but it is the shape and volume of runoff basins that should be the focus of the ordinance. A sediment basin can also be designed to capture runoff. At all observed sites in Napa County we noted that sediment basins had filled rapidly with runoff and had overflowed with only about 3 inches of rainfall in the fall of 1999. Bathtub rings of fine sediment at the elevation of overflow indicated that suspended sediment-bearing water had overflowed the detention basins.

The capacities of those basins were designed, in the observed east (Pahlmeyer) and west (Ch Potelle) Napa Valley sites, to accommodate 50-year return period sediment yield. That is, they were supposed to be designed to capture most sediment that could be generated in a major storm that would be expected once every 50 years. We found that the calculated sediment yields may have been accurate for the published soil information for the pre-conversion conditions, but were inadequate for the post-conversion conditions with drainage infrastructure. But most alarming was the fact that no accommodation was made to capture the increased runoff of water and suspended sediment. The ponds were sized assuming that all waterborne sediment somehow had time to settle out in a small circular basin, and that the "excess" water could be discharged downslope without further concerns.

[5] Two-inch, 24-hour rainfall event, which can be expected several times in an average year. These estimates are based on field-derived estimates of soil pore volumes and soil density assessed in late December.

Erosion blankets, jute netting, straw-bales, filter fabric, and geotextiles were placed in many instances on the outflow channels below the sediment basins, but these did not extend far downslope or carry to the natural watercourses. They protected the integrity of the sediment basins themselves but not the watersheds below them, where the increased runoff was concentrated. Thus, the sediment basins served to control some of the coarse sediment coming from the conversion sites but, by so doing, increased the erosion offsite below the new vineyards. For a hilltop site like Pahlmeyer, this left a long exposed series of rills and channels to erode into Millikin reservoir. For a hillside site like Ch. Potelle, the tributary creeks were immediately below and adjacent to the vineyard plantings and were protected with riparian buffers, thus relying on root cohesion in those buffers to minimize in-channel erosion and subsequent reentrainment of sediment due to "hungry water" that now flows in volumes in excess of those before conversion. Reduction in offsite cumulative damage is therefore completely dependent on a continuous healthy riparian corridor between the vineyard sites and the Napa River tributaries. Where highways are adjacent to the creeks and the corridor is compromised, as for example Redwood Road and along Dry Creek, that rapid excess runoff simply satisfies its sediment needs by eroding downstream. The offsite effect of increase runoff volumes is independent of east or west side locations except where tributary streams pass through erodable materials, landslides, and oversteepened stream bank areas downstream. The Dry Creek and Redwood Creek canyons in their lower reaches are examples of tributaries that are susceptible to increased downstream erosion associated with increased upstream water yield.

The foothills east of Mt. Veeder west of Yountville contain a Franciscan greywacke (sandstone) that is easily eroded and that appears to be highly fractured by local faulting. This is the site of the Vineyard Properties West developments inspected near the headwaters of Hopper Creek. These are also sites where downstream impacts of upstream changes in runoff were most readily apparent. Tributary stream channels are incised, often deeply, and banks are unstable (for example, Hopper Creek from its very headwater to Yountville). As streams incise, landslides and small slumps occur, further increasing the rate of sediment discharge to those streams. Vineyard development increases water yield faster than it increases sediment yield, so the runoff is "hungry" or sediment-deprived. That sediment carrying capacity is almost immediately met by local bed and bank erosion in the stream channels, as is seen in Redwood, Dry, and Hopper Creeks. While vineyards are not the only sources of that increased runoff, they contribute to the downstream cumulative hydrologic effects, and should be evaluated in that context.

At Vineyard Properties West we noted clear evidence of recent streambed and bank erosion and marked (2 meter) stream incision of middle and upper Hopper Creek that could only be attributed to land clearing and vineyard conversion. Coarse gravel and sand fractions of that eroded stream bed were apparently captured in a local reservoir that was seen to have reduced storage capacity, while fine-grained sediments passed through that residual reservoir and entered the lower creek and passed down into the Napa River.

ONGOING AND NEEDED FUTURE WORK

Further work is in progress that evaluates the existing streamflow record for the tributaries and the main stem of the Napa River. This work is specifically focused on detection of the signatures of cumulative hydrologic effects and the separation of those stream flow change signals from many sources of background noise caused by channel clearing, alteration, precipitation-intensity changes, etc.

Napa County would have to conduct such data-intensive work to assess cumulative offsite hydrologic impacts of hillslope vineyard conversions.

SOIL DESCRIPTIONS - APPENDIX A

Bressa series (Map units: 112, 113, 114, 115)

The Bressa series consists of well drained soils on uplands. Slope is 5 to 75 percent. Elevation is 400 to 2,000 feet. These soils formed in material weathered from sandstone and shale. The plant cover is mostly annual grasses and scattered oaks. The mean annual precipitation is 25 to 35 inches. The mean annual air temperature is 62° to 64° F. Summers are hot and dry, and winters are cool and moist. The frost-free season is 220 to 260 days.

In a representative profile the surface layer is pale brown, slightly acid silt loam 10 inches thick. The subsoil is light yellowish brown and yellowish brown, slightly acid and medium acid silty clay loam 23 inches thick. Weathered, soft sandstone is at a depth of 33 inches.

Permeability is moderately slow. The effective rooting depth is 30 to 40 inches, and the available water capacity is 4 to 6 inches.

Bressa soils are used mostly for range. Some areas near Lake Berryessa are used for recreation.

Representative profile of Bressa silt loam, in an area of Bressa-Dibble complex, 30 to 50 percent slopes, 1 mile north on Gordon Valley Road from intersection with Wooden Valley cross road, about 100 feet north on road from cattle guard, and 150 feet east of road on hillside, NE¼SW¼ sec. 19 (projected), T. 6 N., R. 2 W.:

A11-0 to 4 inches, pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; slightly acid (pH 6.5); clear smooth boundary.

A12-4 to 10 inches, pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; slightly acid (pH 6.5); clear smooth boundary.

B1t-10 to 15 inches, light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; many fine tubular and interstitial pores; few thin clay films on peds and lining pores slightly acid (pH 6.5) ; clear smooth boundary.

B2t-15 to 23 inches, yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and few coarse roots; many fine tubular and interstitial pores; many moderately thick clay films on peds, lining pores, and as bridges; medium acid (pH 5.6) ; gradual smooth boundary.

B3t-23 to 33 inches, yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine tubular and interstitial pores; many moderately thick clay films on peds, lining pores, and as bridges; medium acid (pH 5.6); gradual irregular boundary.

Cr-33 to 37 inches, soft weathered sandstone and some soil material.

APPENDIX B - SOIL MAPPING STANDARDS APPLICABLE TO NAPA VALLEY AND ENVIRONS

As stated in the Soil Survey Manual [6]:

> Third-order surveys are made for land uses that do not require precise knowledge of small areas or detailed soils information. Such survey areas are usually dominated by a single land use and have few subordinate uses. The information can be used in planning for range, forest, recreational areas, and in community planning.
>
> Field procedures permit plotting of most soil boundaries by observation and interpretation of remotely sensed data. Boundaries are verified by some field observations. The soils are identified by traversing representative areas and applying the information to like areas. Some additional observations and transects are made for verification. Map units include associations, complexes, consociations, and undifferentiated groups. Components of map units are phases of soil series, taxa above the series, or they are miscellaneous areas. Delineations have a minimum size of about 1.6 to 16 hectares (4 to 40 acres), depending on the survey objectives and complexity of the landscapes. Contrasting inclusions vary in size and amount within the limits permitted by the kind of map unit used. Base map scale is generally 1:20,000 to 1:63,360, depending on the complexity of the soil pattern and intended use of the maps.

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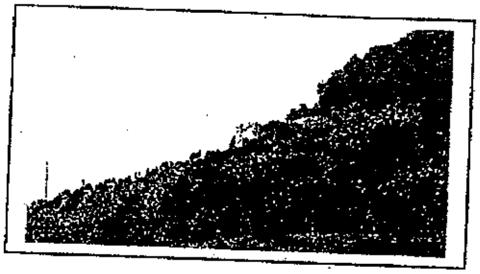
[6] (USDA, 1993, http://www.statlab.iastate.edu/soils/ssm/gen_cont.html)

EXHIBIT 5

Expert Witness Report:
Cumulative Impacts on Fisheries Resources from Intensive Viticulture Practices in Napa County, CA



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February 1, 2001

EXHIBIT 3

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Expert Witness Report: Cumulative Impacts on Fisheries Resources from Intensive Viticulture Practices in Napa County, CA

1.0 INTRODUCTION

1.1 Background

The culture of wine grapes in the Napa River watershed of Napa County California has been going on since approximately 1836. However modern viticulture started in the 1960's with advent of the "boutique wineries" (Conaway 2000). The financial success of these wineries along with the cultural cachet of owning a wine label stimulated rapid growth of the industry with an increasing number of applications for permits to clear land and appropriate water for irrigation. Coincident with this growth there has been a deterioration of water quality in the Napa River. Water quality testing in the Napa River during the 1990s by San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) showed that the river had excessive levels of suspended sediments, nutrients and bacteria. In 1998, the California EPA classified the Napa River as an, "Impaired River" under Section 303(d) of the Clean Water Act. Coincident with the increase in viticulture and the decline in water quality, fisheries resources in the Napa River have also been in decline.

1.2 Objectives

This report summarizes fisheries resource, water quality and riparian habitat issues in the Napa River with the objective of characterizing cumulative impacts on steelhead resulting from vineyard cultivation practices.

1.3 Organization

The report starts with a general characterization of fisheries resources in the Napa River along with the history of the decline of the salmon and steelhead resources. This is followed with a brief overview of the Federal and State fisheries resource management and regulatory issues governing salmon and steelhead, and places these regulations in the context of public agencies and private sector development projects. The next section discusses direct, indirect, cumulative and synergistic impacts on steelhead and the need for an integrated, watershed based approach to steelhead habitat conservation and restoration to comply with the National Marine Fisheries Service 4(d) rule for protection of critical habitat. The report concludes with a set of recommendations for watershed based planning, along with fisheries, riparian habitat and water quality monitoring.

1.4 Sources of Information

This report is based on information obtained from numerous sources including:

- Personal observations and photographs made on September 12, 2000
- A review of documents listed in the literature cited section
- Discussions with Dennis McEwin of CDFG
- Discussion and data analysis by R. Robert Curry
- Discussions and data analysis by Dr. Dennis Jackson
- Discussions with Mr. Mike Napolitano of the SFBRWQCB
- Blake, Phillip. 2000. Napa County Resource Conservation District, Napa, California

1.5 Qualifications

Robert Abbott is the President and sole owner of the environmental consulting company Strategic Environmental Consulting Inc. (SEC Inc.) based in San Rafael California. His business practice is almost exclusively in the area of fisheries and natural resource planning. He obtained my Masters Degree and Ph. D. in Fisheries Science from the University of Washington, College of Fisheries, and has been continuously employed throughout the world in fisheries related activities since 1967. He was formerly an adjunct professor and research scientist at San Francisco State University. He has been actively engaged in fisheries research and consulting in the San Francisco Bay area since 1991, working on salmon and steelhead management planning projects throughout Northern California. His resume, a list of references, and a selected list of projects is attached at the end of this report.

Robert Coats is Principal and sole proprietor of the environmental consulting firm Hydroikos Associates in San Rafael California. He has a Ph.D. in Wildland Resource Science from the University of California at Berkeley, with 25 years of professional experience in environmental restoration and the assessment of land use impacts on water quality. His experience includes independent research on nitrogen transport in rivers and streams. His resume, list of publications and list of project experience is attached at the end of this report.

2.0 FISHERIES RESOURCES OF THE NAPA RIVER

The Napa River watershed is host to a wide variety of native and exotic species of fish. The most important is rainbow trout-steelhead. The following account addresses the main species, a brief overview of their life cycle, habitat requirements and population decline.

2.1 Rainbow Trout-Steelhead

Excluding the Sacramento-San Juaquin River system, the Napa River is the most important rainbow trout-steelhead production stream feeding into San Francisco Bay (CDFG 1963). Steelhead and rainbow trout are common names for an the genetically identical but behaviorally different forms of the same species *(Oncorhynchus mykiss).* Steelhead is the anadromous form for this species that involves spawning in freshwater and rearing in the ocean. Rainbow trout is the form that remains in freshwater throughout their life cycle (Busby et al. 1996). Juvenile rainbow trout and juvenile steelhead cannot be differentiated by visual inspection. There appears to be substantial gene flow between these different life history patterns. Their behavior and eventual size at reproduction distinguishes steelhead from rainbow trout. For purposes of simplicity, the terminology, "steelhead" will be used throughout this report. Steelhead, are the most phylogentically and ecologically complex of the salmonids (Busby et al. 1996). There are numerous genetic groupings or populations along the Pacific Coast from Baja California to Alaska. Recent genetic research has led to the division of California Steelhead into several Evolutionarily Significant Units (ESU). Steelhead found in streams draining into San Francisco Bay and San Pablo Bay are included in the Central California Coastal Steelhead ESU.

In California most steelhead spawn from December through April (McEwan 1996). Adults move upstream during rain events and seek out areas with suitable gravel and dig nests, or redds, where the eggs are deposited after fertilization by one or more males. Spawning areas suitable for salmonids are located in the upper Napa River and most of its tributary streams (CDFG 1968). The hatch rate depends on many factors including temperature, silt, and disturbances. After hatching the sac fry spend a few weeks in the gravel interstices and then swim up and start actively feeding after absorption of the yolk sack. The fry tend to move to the margins of the streams and feed on aquatic insects. As they grow the juvenile steelhead move to riffles and stream bank undercuts. As they get larger they move into the deeper pools. Steelhead may migrate to sea in their first year, but most spend one to two years in fresh water and one to two years in the ocean. Some return after a year, but most return after two to three years. Some survive their first spawning and return to spawn in subsequent years. Large adults may weigh up to 30 lbs. (Miller and Lea 1972).

Population Status – In the late 1960s, CDFG estimated that were approximately 230,000 juvenile steelhead spread throughout the Napa River watershed. This juvenile population resulted in approximately 6,000 – 8,000 fish returning adults (USFWS 1968, Anderson 1972). By 1972 the run had decreased to only about 1200-1900 returning adults. By the late 1990s the number of returning adults had dropped to a few hundred (Napolitano personal communication). There are many reasons cited for the decline of the population including:

- Suitable summer carryover habitat
- Diversions that reduce or eliminate flows in the spring and summer
- Dams blocking access to upstream spawning and rearing habitat
- Low DO in the lower reaches of the river due to fertilizer and sewage discharge
- Sedimentation in spawning habitat
- Pollution – point and non-point
- Loss of riparian canopy

(USFWS 1968, Anderson 1972, Whyte al. 1992).

2.2 Chinook Salmon

Chinook salmon (*Oncorhynchus tshawytscha*) are regularly reported to enter the Napa River but in only small numbers (Claesgens 1988). Angler observations recorded chinook salmon in the lower Napa River in November 1983. Salmon were seen jumping at the Zinfandel fish ladder and 2 fish were seen to make it upstream using the fish ladder. Small numbers of Chinook (1 to 2 fish) were observed in upper Napa river at Bale Lane, Maple Lane and Dunaweal Lane. In the upper reaches of the river, salmon redds were observed above Sulphur Creek (CDFG 1983).

It is believed that most are strays from the Sacramento-San Joaquin River Chinook stocks. CDFG regularly releases large numbers of chinook salmon in the lower Sacramento River Delta near Rio Vista. In addition thousands of chinook salmon are raised in net pens in San Francisco Bay near Tiburon, and released when they are large enough to avoid to most common predators.

These pen-reared salmon have a very high survival rate but may have some difficulty in finding their way back to their stream of origin (McGowan personal communication).

2.3 Coho Salmon

The Napa River used to support a run of coho or silver salmon (*Oncorhynchus kisutch*). The adult spawning run used to be between 1,000 and 2,000 fish a year but that run ceased to exist some years ago (Anderson 1972). The Central California coho ESU was listed by the State of California as threatened in 1995 and then Federally listed in 1996 (CDFG 2000).

2.4 Sacramento Splittail

The Sacramento splittail (*Pogonichthys macrolepidontus*) is a large native minnow found primarily in the Sacramento-San Joaquin River system but is also found in the Napa River at least 6 miles (10 km) up stream from San Pablo Bay (Sommer et al. 1997). The United States Fish and Wildlife Service (USFWS) listed Splittail as "Threatened" in 1999. The listing has been successfully challenged in Federal Court by state water contractors, but the status of the Sacramento Splittail population is being carefully monitored because of its status as an indicator species.

2.5 Other Native Species

California Roach – The California roach (*Hesperoleucus symmeticus*) is a native member of the minnow family found throughout northern California streams. They seldom grow much larger than 4" in length (McGinnis 1984). They can survive in isolated pools of water where the temperature gets so high, and dissolved oxygen (DO) gets so low that most other fish succumb. They are an important part of the coastal stream food web in that the juveniles feed mostly on aquatic insect larvae, and adults primarily feed on algae. Juvenile California roach are also a prey item for larger steelhead. Electro fishing surveys by CDFG regularly indicate the roach as one of the most abundant fish in the Napa River (Montoya 1988).

Threespined Stickleback – The threespined stickleback (*Gasterosteus aculeatus*) is also a native species of California streams. It primarily feeds on insect larvae and small crustaceans along the edge of streams. It also can withstand very high temperatures and low DO better than steelhead. The spins provide protection from juvenile steelhead (McGinnis 1984).

Sculpin – There are 7 species of small freshwater sculpin (*Cottus sp.*) found in California streams (McGinnis 1984). Sculpin are regularly found in the Napa River and made up 10% of the population sampled in 1988 (Montoya 1988).

Sacramento Sucker – The Sacramento sucker (*Catostomus occidentalis*) is a native species that can get up to over a foot long. They are very common in the Napa River making up approximately 10% of the fish found in the main stem of the river (Montoya 1988).

Sacramento Squawfish – The Sacramento squawfish (*Ptychocheilus grandis*) is a native species commonly found in the Napa River. Squawfish made up approximately 17% of the catch in a 1988 survey (Montoya 1988). Squawfish are a major predator of steelhead.

Eels – Native species of eels are also found in the Napa River watershed but there are no records as to the species (Montoya 1988).

Sturgeon – Large sturgeon were formerly caught in the lower reaches of the Napa River by recreational fishermen (Whyte et al. 1992). Though sturgeon are not a listed species, they are a species of special concern because of their economic importance, their vulnerability to environmental perturbations and very long time to reach sexual maturity.

Freshwater Shrimp – The Federally listed California freshwater shrimp (*Syncaris pacifica*) is found in pools along undercut banks in 3 Napa River tributaries: Garnett Creek, Huichica Creek and the upper Napa River (Whyte et al. 1992).

2.6 Exotic Species

Many exotic species have been introduced into California waters over the last 100 years. Some of these species are now commonly found in the Napa River. Many of them make up an important element of the recreational fishery that used to occur up and down the river.

- Striped Bass (*Morone saxatilis*)
- Small Mouth Bass (*Micropterus dolomieui*)
- White Catfish (*Ictalurus catus*)
- Brown Bullhead (*Ictalurus nebulosus*)

- Green Sunfish (*Lepomis cyanellus*)
- Carp (*Cyprinus carpio*)

The most important of these is the striped bass that was the basis of an important recreational fishery until the river was closed to all fishing. White catfish, and small mouthed bass are steelhead predators. Warm, slow moving water preferentially benefits these species enabling them to occupy what was formerly steelhead habitat. Slow moving water enables these ambush predators to take up territorial and prey on juvenile steelhead and smolts as they move downstream towards San Pablo Bay. CDFG is reevaluating its striped bass restoration program since stripped bass are such a formidable predator on steelhead and salmon.

3.0 REGULATORY STATUS

Fisheries resources throughout North America have been seriously challenged by anthropogenic factors for nearly two centuries and numerous species have gone from unbelievable abundance to extinction in less than 150 years. Some species of fish that only a few decades ago were significant parts of local and state economies are now so reduced in abundance that commercial exploitation has all but ceased. Many rivers that once supported robust recreational fisheries are now closed, as is the case with the Napa River. As a result, there has been a flurry of state and Federal legislation to protect, and wherever possible restore, these species and their habitat. The following sections summarize the main regulatory and restoration initiatives that are applicable to fisheries resources in the Napa River watershed.

3.1 Endangered Species Act

The Central California Coast steelhead ESU was listed by the National Marine Fisheries Service (NMFS) as "Threatened" on August 18, 1997. The San Pablo Bay Hydrologic Unit including the Napa River was listed as containing "Critical Habitat" for steelhead on February 16, 2000 (Federal Register Vol. 65 No. 32). The Final Rule for governing "Take" of steelhead was promulgated on July 10, 2000 (Federal Register 2000 b). This Final Rule is commonly referred to as the 4(d) rule for conservation of the species. A key element of this measure is the prohibition of "Take". The National Marine Fisheries Service (NMFS) has taken a very broad and encompassing approach to "Take" and habitat conservation to conserve steelhead. Actions that are "likely" to injure or kill steelhead and trigger enforcement actions include:

- Collecting, illegal harvest, harassing

- Diverting water through unscreened diversions
- Blockage of the streambed used for spawning
- Discharge of toxic substances
- Blocking fish passage through impassable culverts or dams
- Water withdrawals that impact spawning or rearing habitat
- Diversions that result in excessive temperature or temperature fluctuation
- Destruction of the riparian canopy
- Land-use such as farming, urban development that adversely affect steelhead habitat
- Disturbance of spawning gravel
- Pesticide and herbicide applications that affect the biological requirements of steelhead
- Introduction of non-native species
- Habitat alterations that promoted the development of predator populations

The NMFS requires all individuals, organizations and local government entities that are engaged in projects that may cause a "Take" to seek a permit or shape their activities so as to not result in a "Take". Particular emphasis is placed on encouraging local government agencies to come up with restoration plans such as watershed wide management planning activities.

The 4(d) rule is presently being challenged by a consortium of fisheries and environmental advocacy groups as being too lenient on the planning actions of local government entities, which they believe will inevitably result in the further degradation of essential steelhead habitat and the decline of the species.

3.2 California Salmon and Steelhead Restoration Legislation

Restoration of the steelhead is mandated by The Salmon, Steelhead Trout, and Anadromous Fisheries Act of 1988 (SB 2261) of 1988. The emphasis is on restoration of natural population. In 1996 CDFG published the Steelhead Restoration and Management Plan for California (Plan) (McEwan and Jackson 1996). Though the Napa River is not specifically mentioned in the Plan it is in fact covered by the Plan (McEwan personal communication).

3.3 SFBRQCB Impaired River Listing

The San Francisco Bay Regional Water Quality Control Board (SFBRQCB) has listed the Napa River and its tributaries as impaired by excess sediment supply, nutrient loading, and bacterial pollution under Section 303(d) of the Clean Water Act. Accordingly the SFBRWQCB is legally required to develop a Total Maximum Daily Load allocation (TMDL) for each of the listed pollutants. The SFBRWQCB recently initiated a $275,000, two-year study of the pollution problems in order to determine the sources of pollutants and to develop a plan to restore the aquatic health of the Napa River. Sediment specific concerns include:

- Prolonged periods of high turbidity
- Flooding and streambed aggradation
- Sediment accumulation in the gravel interstices reducing aquatic insect productivity
- Fine sediment accumulation that smothers eggs and sac fry

Other SFBRWQCB concerns are:

- Low summertime flows
- Loss of habitat complexity
- Cumulative and synergistic impacts such as raising temperature and less food availability

3.4 CDFG Fishing Regulations

The Napa River is closed to all fishing in the main stem and tributaries upstream from Calistoga and in the main stem of the river from Calistoga to the Trancas Bridge in the City of Napa to protect native runs of steelhead. The reach of the river below the Trancas Bridge is considered tidewater.

4.0 DIRECT, INDIRECT, CUMULATIVE AND SYNERGISTIC IMPACTS

A direct adverse impact is an action that harms or directly kills a fish such as poaching. Direct impacts also include being sucked into the intake of an unscreened vineyard diversion pump. An example of an indirect effect is the release of relatively small amounts of partially treated domestic waste into the Napa River. The waste would not kill the steelhead directly, but the resulting low dissolved oxygen (DO) as a result of chemical oxygen demand and biological oxygen demand would kill the steelhead. There are 6 waste water treatment facilities on the Napa River that release waste into the river at different times of the year (USACOE 1994). An example of a cumulative impact is the increasing number of dams and diversions that reduce Napa River instream flows. An example of an adverse synergistic impact is where several harmful but not lethal direct or indirect impacts result in a significant mortality. The loss of riparian cover results in an increase in water temperature. It also results in less food (insects) being dropped into the river. The increased temperature due to the loss of the shade, increases the rate of metabolism and demand for food, resulting in starvation. Compound this with loss of aquatic insects in the river due to pesticides and sedimentation and the result is debilitated fish that are vulnerable to disease and predators. The following section describes a number of significant direct and cumulative impacts on steelhead, water quality and their critical riparian habitat in the Napa River watershed that are a direct result of the conversion of land to vineyard cultivation in Napa County.

4.1 Instream Flows

The single most important habitat requirement for steelhead is water. However the Napa River has only a very limited amount of water most of the year. The flows tend to be low in the summer months. The river has many intermittent flow tributaries that run only in the months from October to about May (See Figure 1). The largest tributaries are Redwood Creek, Dry Creek, Sulphur Creek, Conn Creek, Soda Creek, Napa Creek, Milliken Creek. Minimum flow requirements, or what must pass downstream after all agricultural diversions, are often not met during the frost season (Whyte et al. 1992).

Figure 1 Soda Creek September 2000

Steelhead as individuals and as a population cannot live without adequate amounts of high quality water. Dewatering a part of the Napa River for even a few seconds will result in the death of all the fish in that reach. Dewatering of Napa River reaches, resulting in a dry streambed and no-flow conditions such as illustrated in Figure 1, can occur in the spring time when there is increased demand for water by vineyards in order to protect the vines from frost (CDFG 1991). Sufficient water flow is needed for steelhead to ascend the river to their spawning grounds and spawn. Steady flows is required to provide oxygen for the developing eggs, to prevent siltation of the eggs and transport food organisms for fry and juveniles. Finally, downstream migration of adults and juveniles depends on minimum flows to pass over barriers.

Minimum flow-bypass conditions above and below Sulphur Creek have been set by the Department of fish and game in order to safeguard fish migrations and habitat (See table 1). Though these flow rates are quoted and referred to in various documents, they have not been scientifically tested to determine their inadequacy. The competition between fisheries and agriculture for water will increase as more land is put into cultivation. (Whyte et al. 1992).

Period	Flow rates below Sulphur Creek (cfs)	Flow rates above Sulphur Creek
Nov 1 to Nov 14	18 or n.f.	10 or n.f.
Nov 15 to Mar 31	58 or n.f.	50 or n.f.
April	38 or n.f.	21 or n.f.
May	19 or n.f.	12 or n.f.
June 1 to Oct 31	3 or n.f.	1.5 or n.f.

n.f. = natural flow

Table 1. CDFG minimum flows at Sulphur Creek

Conversion of oak woodlands to vineyards requires consumptive use of water from the river or groundwater. The Department of Water Resources (DWR) has continued to issue permits to build dams and divert water without benefit of an objective scientific understanding of the Napa River flow regime or groundwater resources (Drs. Robert Curry and Dennis Jackson 2000). Figure 2 shows the cumulative storage and diversion of the Napa River and its tributaries.

Figure 3 shows where the Napa River stopped flowing at the Oakville Bridge on September 12. 2000.

This figure clearly reflects a pattern of cumulative diversion of water from the Napa River Watershed. The number of permits issued is also increasing. Figure 3 shows a generally increasing trend in the issuance of water permits over the last 80 years with a peak in the late 1950s which corresponds to the extirpation of the coho salmon run and a big peak in the 1990s which corresponds to the more recent dramatic decline in the steelhead run.

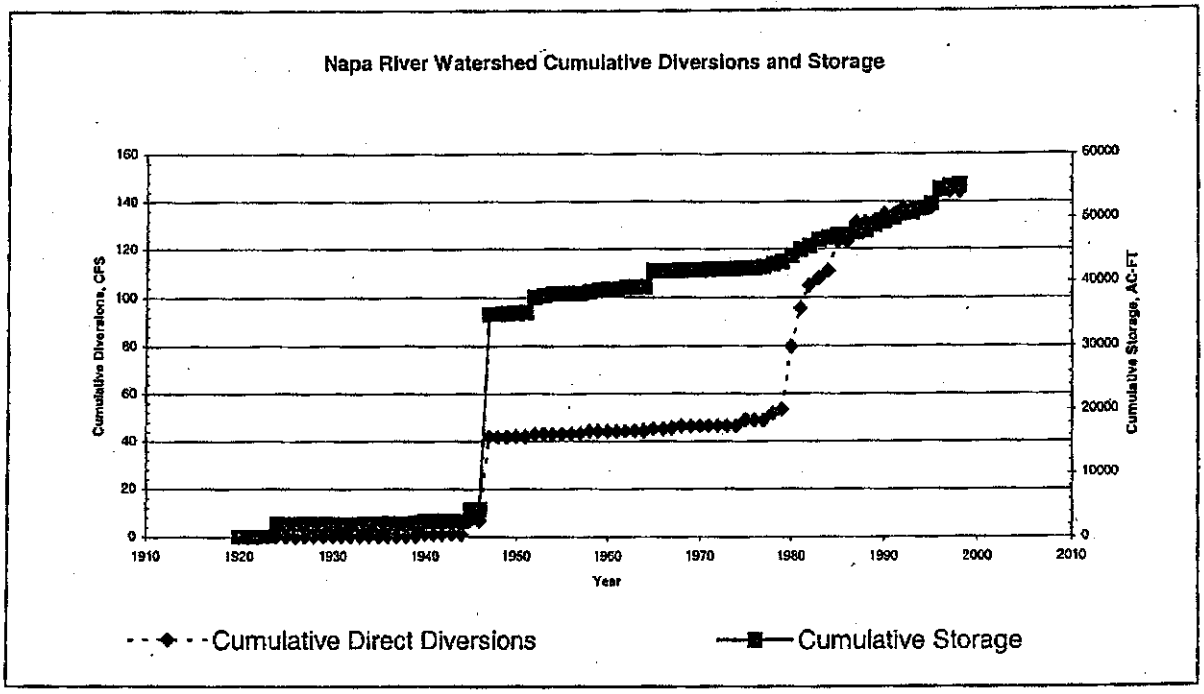

Figure 2. Cumulative storage and diversions. (Adapted from Robert Curry 2000)

This figure clearly reflects a patten of cumulative diversions of water from the Napa River watershed. The absolute number of permits is also increasing. Figure 3 shows a generally increasing trend in the issuance of water permits over the last 80 years, with peaks in the late 1950's, corresponding to the extirpation of the coho salmon run, and from the late 1970s through the 1990's corresponding to the more recent drastic decline in the steelhead run.

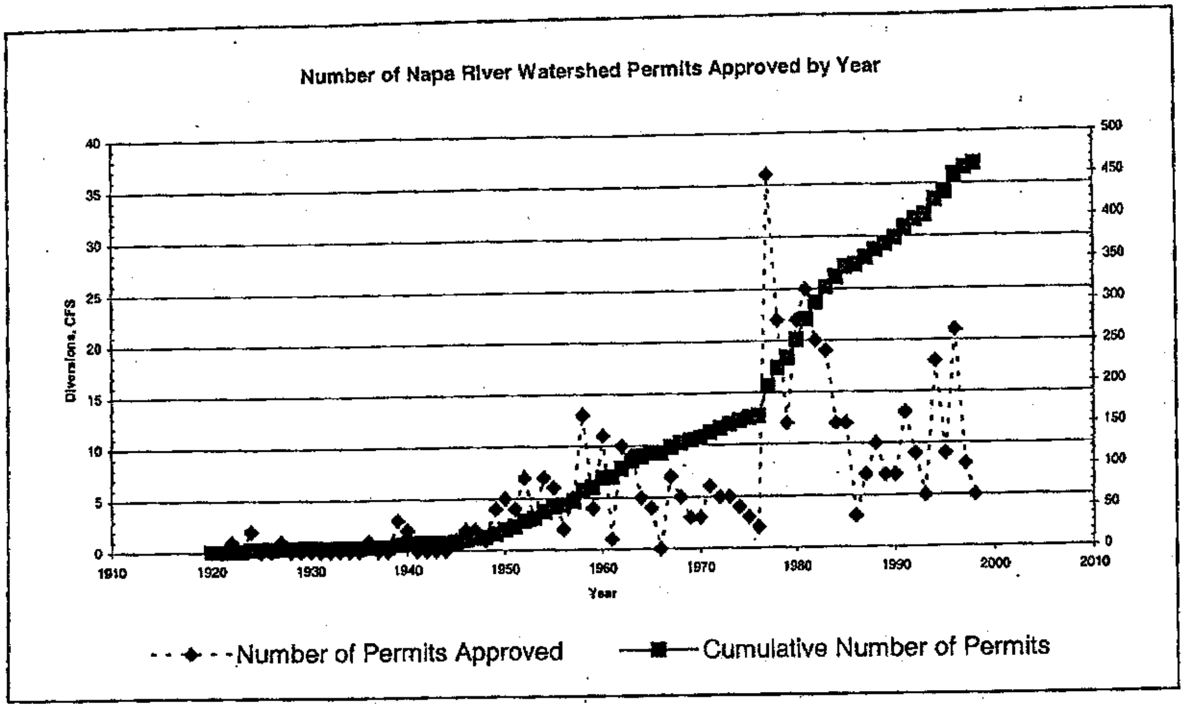

Figure 3. Historical trends in the numbers of permits issued and the cumulative CFS appropriated from Curry 2000.

There is no available evidence that permits have been issued based on assuring minimum flows at all times of the year. The very few gages operating on the river may not indicate the true impact of cumulative diversions such as the dewatering of many reaches of the river such as that observed at the Oak Knoll Bridge on Napa River on September 12, 2000 (Figure 4). Even very brief periods of near dewatering can result in mass mortalities of adult and juvenile steelhead and their eggs due to low levels of oxygen.

Figure 4. Zero flow at Oak Knoll Ave. Bridge September 12, 2000

The available evidence suggests that cumulative storage and diversions have reduced instream flows to the point where there is inadequate water for steelhead spawning, rearing and migration and that this problem will become worse as more land is converted to vineyards.

Low flows result in higher temperatures, and the creation of habitat for juvenile steelhead predators such as small mouth bass. Low flows can also result in stranding fish and fish eggs.

4.2 Stream Bank Stability

Much of the Napa River is narrowly confined by riprapped banks resulting in scouring of the bottom, and riverbanks of adjacent areas that do not have riprap during floods. As a result, the confined streambed is deeply incised and the banks of many unprotected areas tend to be highly eroded, exposing the roots of trees. Trees tend to fall over as they became progressively more undercut. Roadside fences have also collapsed. Figure 5 shows exposed tree roots, a fallen tree and a collapsed fence immediately downstream of the Yountville Cross Road. This kind of erosion is a result of high-energy flows being tightly confined to a narrow channel.

Figure 5. Deeply incised streambed and eroded banks result in high sediment loads and poor conditions for spawning steelhead

4.3 Suspended Sediments

Suspended sediment is one of the most challenging water quality issues in the Napa River. Fine particles of sediment remain suspended in the water column and drop out when the velocity of flow drops. Bed load sediment stays on the bottom and is only mobilized with there are storm events. Suspended sediment particles transport heavy metals, agricultural chemicals and excess nutrients to the aquatic environment, seriously impacting fish and wildlife. Bed load sediment fills the interstices between the gravel in the riverbed, preventing the movement of water between the rock, reducing aquatic insect habitat, and making the area unsuitable for steelhead spawning. In 1992, sediment in the Napa River covered spawning gravels and pools, reducing habitat diversity and adversely affecting food supply (Hill et al., 1992). In 1997, suspended solids ranged from 1.5 to 6.7 mg/L in the Napa River. Maximum suspended solids occurred in winter and spring, coinciding with heavy runoff. The "Impaired River" listing for the Napa River by the SFBRWQCB identified suspended sediments as one of the main factors impairing water quality. Suspended sediments have their origin from many sources including:

- Natural stream bank erosion
- Construction activities
- Logging operations
- Agriculture

The rapid expansion of vineyard acreage in the Napa Valley watershed has left large amounts of land denuded of vegetation that would normally trap water and reduce the rate of runoff (Curry 2000). Bare land can be found throughout the watershed (fig. 6 - 8).

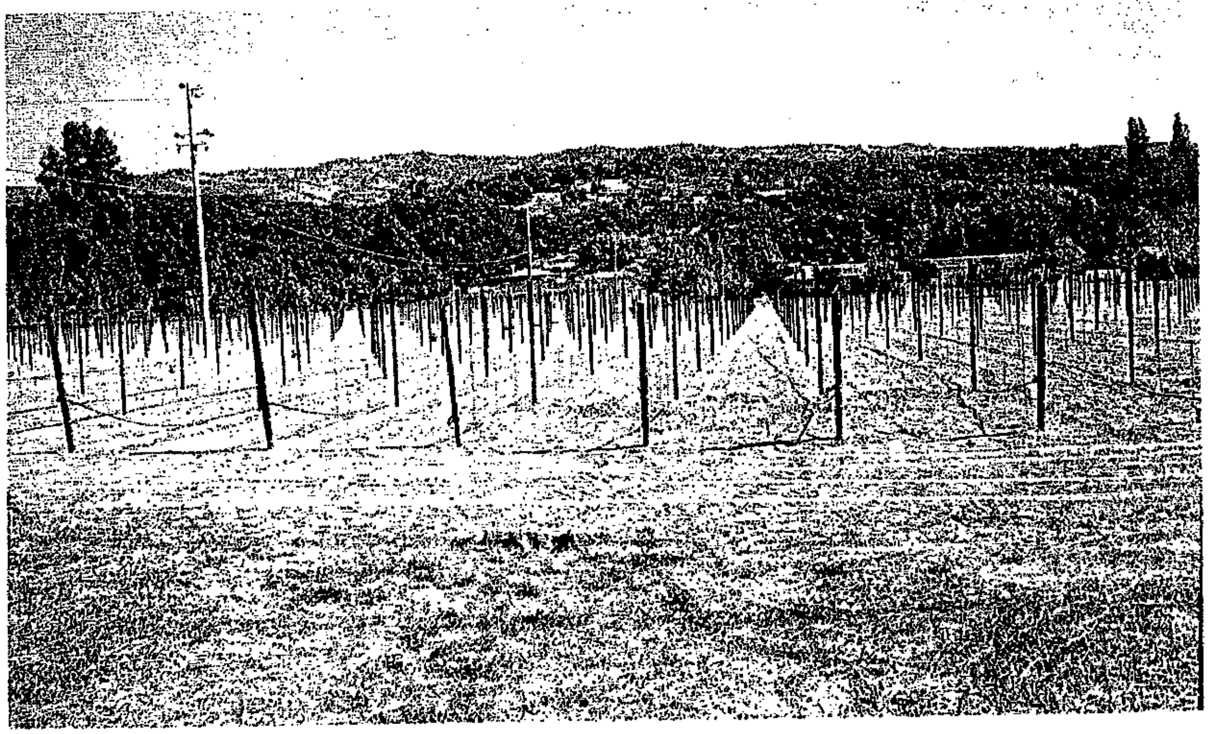

Figure 6 New vineyards result in exposed soils that contribute to sediment problems in the Napa River

Erosion from construction activities can also contribute to excess sedimentation in the river. Figure 7 shows a large amount of loose dirt at the site of a culvert construction project on Soda Creek. The dirt will be washed down the dry creek bed with the first rain event and be deposited in slower moving areas of the main river. New vineyards inevitably result in the construction of roads adding to the overall matrix of cumulative impacts to the riparian corridor and aquatic habitat of listed species of fish.

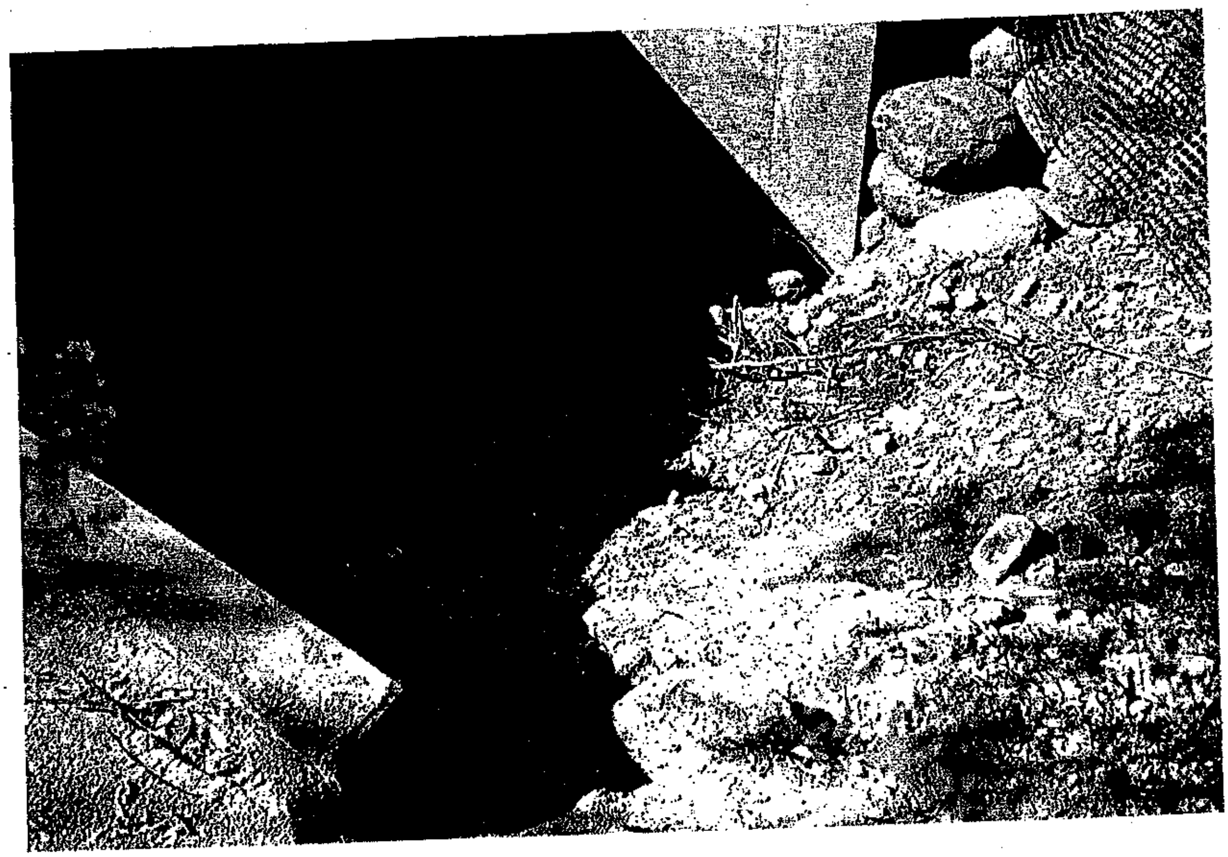

Figure 7. Construction activities result in sediments being washed into the Napa River.

The construction of vineyards on steep hillsides with extensive areas of exposed ground as can be seen in figures 8 and 9, dramatically affect the runoff timing, volumes and rate (Curry 2000).

Figure 8. Vineyard practices on steep hillsides result in large areas of exposed soil and accelerated erosion during storm events

Abnormally high runoff rates decrease the volume of water slowly percolating through the soil that is needed to recharge the tributaries and main stem of the Napa River in the summer and early fall. It is the lack of water in the tributaries in these months that most severely impacts species like steelhead that need water year around.

Figure 9. Clearing oak and pine forest habitat for vineyards results in the loss of water retaining ground cover

4.4 Agricultural Chemicals

The widespread use of agricultural chemicals such as fertilizers and pesticides may have adversely affected steelhead and other aquatic species. Planned increases in vineyard acreage will constitute an additional cumulative impact.

4.4.1 Pesticides

The agricultural chemicals used on grapes in Napa County include fertilizers, herbicides, fungicides, insecticides, and chemicals added to the pesticides as dispersants or carriers. In 1998, about 100 tons of pesticides and associated additives (not including sulfur) were used on grapes in Napa County. The ecological effects of these chemicals varies widely, depending on the persistence, mobility, bioconcentration factor, and toxicity to fish, zooplankton, and other organisms. Due to human health concerns, the use of some pesticides–notably the nematocide gas methyl bromide–has been reduced in recent years, but the use of other pesticides, such as Glyphosate and Diquat has increased.

Table 2 summarizes the use of pesticides on grapes in Napa County, for 1996-1998 (Pesticide Action Network, 2000). Excluding sulfur, the gross weight of the chemicals listed in the table accounts for 97.5 percent of the mass of pesticides and associated chemicals used on grapes in Napa County in 1998. The chemicals were rated using two data base sources to rank their relative persistence, mobility, and toxicity (1= high, 3= low). The sources used were the Pesticide Action Network (PAN) and ExToxNet data bases(http://www.pesticideinfo.org/ and http://ace.orst.edu/info/extoxnet/pips/ghindex.html). Mobility is rated as mobility in solution; many pesticides bind to soil particles to some degree, and can be mobilized by soil erosion, and transported with suspended sediment.

More detailed information is contained in the Excel files that accompany this report. The file PesticideAttribs.xls includes all the information in Table 2, along with relative toxicity rated separately for fish and zooplankton, a relative bioaccumulation factor, the general application of the chemical, and additional human health information provided by PAN. The file Napa.grapes.bymonth98.xls shows the use of pesticides and related chemicals by month, in 1998. The information in these tables suggests some pesticides that might be of concern in the Napa River:

Simazine–This herbicide is rated low in toxicity to both fish and zooplankton. It is moderately persistent. However, it is used in large amounts (about 13,000 lbs/yr.), primarily during the wet season.

Oryzalin–This herbicide is also used in large amounts, (10,000 lbs in 1998), mostly during the wet season. It is rated as highly toxic to both fish and zooplankton, moderately mobile, and of low to moderate persistence.

Table 2. Summary of principal pesticides used in Napa Valley

PESTICIDE USE ON GRAPES IN NAPA COUNTY
(Pesticide Action Network)

Pesticide Name (Gross lbs per year)	1996	1997	1998	Persistence	Mobility	Toxicity to fish
Sulfur	2,399,555	2,484,804	2,361,987			3
Glyphosate, isopropylamine salt	24,437	30,592	57,814	2	3	3
Methyl bromide	145,467	170,077	19,702	2	2	2
Mancozeb	3,119	2,824	14,714	3		2
Simazine	16,362	13,685	12,719	2	3	3
Sodium tetrathiocarbonate	14,635	7,028	11,844			3
Oxyethylene	12,353	9,369	10,557			3
Oryzalin	3,739	14,195	10,151	2-3	2	1
Iprodione	2,936	3,249	9,429	2	3	2
Oxyfluorfen	7,992	13,854	9,088	2	3	1
Copper hydroxide	5,173	2,710	6,408	1	3	
Myclobutanil	2,789	2,784	4,171	3	3	3
Propylene glycol	4,770	3,602	4,059	3	1	3
Alkylaryl poly(oxyethylene) glycol	1,500	1,179	3,972			
Petroleum oil, unclassified	180	424	3,645			
Copper oxychloride sulfate	1,334	68	3,015			
Cyprodinil	0	0	2,877			
Potassium bicarbonate	0	0	2,667			
Manganese sulfate	314	189	2,021			
Potash soap	1,169	1,868	1,764			
Triflumizole	994	1,074	1,688			
Benomyl	655	1,392	1,671	1	3	1
Dicofol	788	1,370	1,438	2	3	1
Lime-sulfur	1,222	2,217	1,321			
Modified phthalic glycerol resin	981	788	1,232	3	1	3
Oleic acid	1,425	1,080	1,218	3	3	3
Paraquat dichloride	511	729	1,177	1	3	2
Azoxystrobin	0	9	753			
Fenarimol	527	466	566			
Dimethoate	907	582	512	3	1	2
Propargite	258	1,157	490		3	2
Fenbutatin-oxide	158	608	477	2	3	1
Isopropyl alcohol	734	380	417			
Carbaryl	487	477	411	3	3	2
Napropamide	2,372	822	397	2		2
Norflurazon	413	314	378	2	3	
Silicone-polyether copolymer	68	77	329			
Diquat dibromide	31	44	312	1	3	3
Poly-l-para-menthene	122	111	304			
Dicloran	42	0	288	2	3	

Oxyfluorfen–This pesticide is heavily used in the wet season (>9,000 lbs in 1998). It is highly toxic to fish and zooplankton, tends to bioconcentrate, and is moderately persistent.

Diazinon and Chlorpyrifos–These organophosphate insecticides are not heavily used on grapes in Napa Co., relative to other pesticides. In 1998, 112 lbs of Chlorpyrifos and 75 lbs of Diazinon were used, much of it in early spring. These compounds, however, have been implicated in zooplankton toxicity in urban creeks around San Francisco Bay (Katznelson and Mumley, 1997), and in agricultural runoff from the San Joaquin Valley (Kuivala and Foe, 1995). At low (sublethal) concentrations, Diazinon interferes with the olfactory sense of salmonids, disrupting their homing ability (Scholz, et al., 2000) The only sample analyzed for Diazinon from the Napa River did not detect it above the Method Detection Limit of 30 nanograms/liter (parts per trillion) (Katznelson and Mumley, 1997). The source of most the Diazinon in urban runoff around the Bay Area is thought to be residential gardens (SF Bay Regional Water Quality Control Board Staff, 2000).

The data on pesticide use on grapes in Napa Co. are detailed, but there is a notable dearth of data on pesticides in surface water. A search of the EPA's STORET data base turned up one "hit", for Simazine in Huichica Creek (0.1 ug/l) in 1993. Part of the reason for the lack of data may be that many of the laboratory methods in use – especially screening techniques for "total chlorinated hydrocarbons" or "total organophosphates"-- do a poor job of measuring low levels of pesticides. The Method Detection Limit (the minimum concentration that can be measured with a given method) for Diazinon stated by some of the commercial laboratories (2 ug/l) is 4 times the LC_{50} for *Ceriodaphnia dubia*, and 50 times the California Department of Fish and Game recommended 4-day average water quality criterion. The U.S. Geological Survey is studying the concentrations of pesticides in agricultural runoff around the U.S., including the Sacramento and San Joaquin Valleys. The pesticide MDLs for the laboratory that they use are typically 0.02 to 0.001 times the MDLs for commercial laboratories (U.S. Geological Survey, 1999)

In 1989, a draft EIR was prepared for the "Napa County Winery Definition Ordinance (LSA, 1989). It included a water quality assessment (Water Engineering and Technology, 1989). We understand that this is the document that previously provided CEQA compliance for vineyard expansion. The draft included projections of agricultural chemical use in Napa County in the year 2010. Comparing the projections with the amounts used in 1998 (from Table 3) shows the following:

Pesticide Type	Projected for 2010 (lbs)	Used in 1998 (lbs)
Glyphosate	16,250	58,000
Other Herbicides	19,510	34,700
Fungicides	32,510	63,600
Insecticides	81,270	13,300
Fumigants	287,710	31,600

Table 3. Summary of projected and actual pesticide use for selected classes of pesticide

Clearly the projections for pesticide use were seriously in error; herbicide and fungicide use is far higher than expected; insecticide and fumigant use is far lower. The latter difference is due largely to reduction in use of methyl bromide.

4.4.2 Nitrogen and Eutrophication

Excess loading of dissolved nitrogen–usually nitrate (NO_3^-) or ammonium (NH_4^+) to waterways can stimulate algae growth. Changes in the species composition of algae may directly affect the aquatic food chain; respiration and decay of the algae may also contribute to the Biochemical Oxygen Demand (BOD) in the water, and reduce dissolved oxygen (DO). The Napa River is "303(d) listed" for nutrients, under the Clean Water Act, and the Regional Water Quality Control Board is committed to developing a Total Maximum Daily Load (TMDL) allocation for the river. The Regional Board's staff report on the Napa river (Whyte, et al., 1992) reported low DO concentrations in the river at St. Helena (1985), and 15 samples with nitrate concentrations >30 mg/l, but we have been unable to locate the data. The ratios of nitrogen to phosphorus in water samples from the river suggest that nitrogen is probably the limiting nutrient in the upper river; it is generally thought to be the limiting nutrient in estuaries. Figure 10 shows a dense mat of algae in the Napa River during the summer, near the Oak Knoll Bridge.

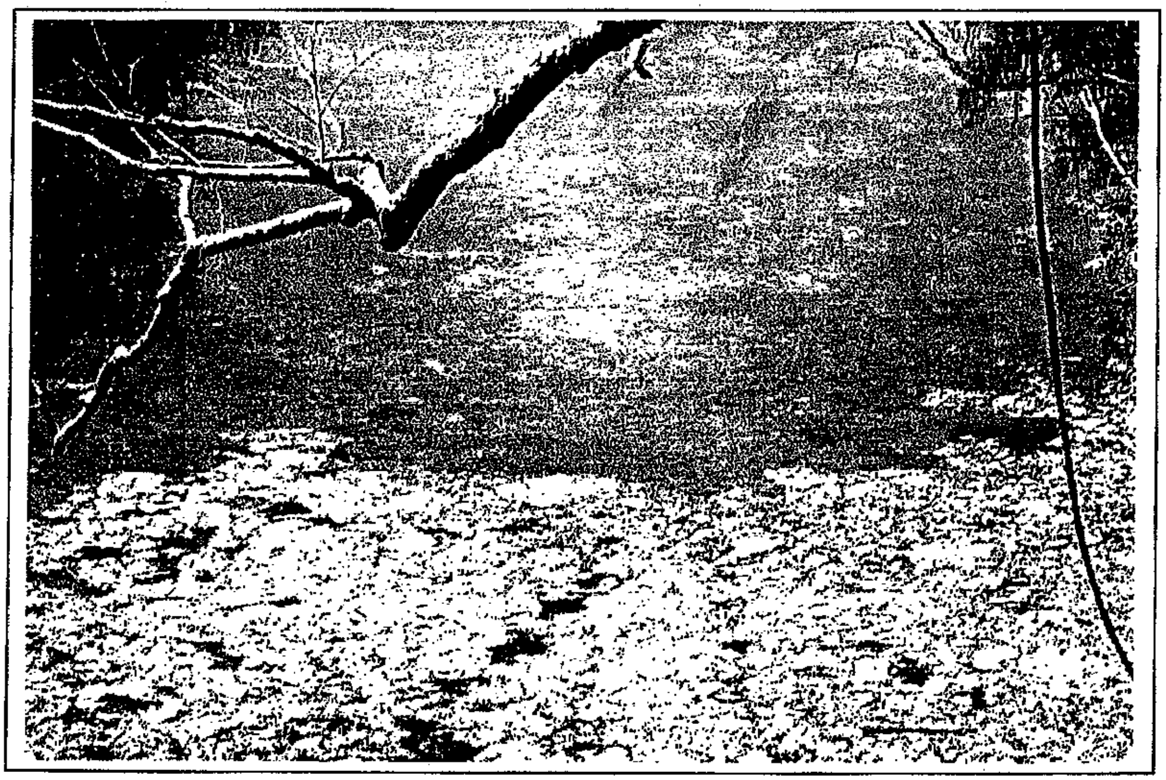

Figure 10. Dense algae mat near Oak Knoll Bridge

There are two primary anthopogenic sources of excess nitrogen in the Napa River: treated wastewater and fertilizer. Treated wastewater is discharged at Calistoga, St. Helena, Yountville, and in the lower (estuarine) reach of the Napa River. The waste discharge permits for the upstream plants allow discharge only during high natural runoff, when a dilution of at least 10:1 at Calistoga, and 50:1 at St. Helena, can be achieved. Historically the discharge of treated effluent downstream from Napa has had a major impact on the lower river, especially during droughts. Aside from nutrient loading, effluent discharge has resulted in low DO and high counts of coliform bacteria (Napa River Surface Runoff Management Plan-208, 1977). Since the drought of the mid-1970s, expansion of the treatment plant has improved water quality in the lower river.

Treated wastewater also includes winery effluent. The wineries are not allowed to discharge treated wastewater directly to streams; instead, they treat their process waste-water on-site and allow the effluent to infiltrate and percolate to groundwater.

The treated winery effluent average nitrate-nitrogen concentration was estimated by Water Engineering and Technology (1989) to be 4.4 mg/l, but reached a maximum of 37 mg/l for one winery. The total groundwater load of nitrate-nitrogen contributed by winery effluent in 1989 was estimated to the 635 kg/month during the crushing season (Water Engineering and Technology, 1989).

The extent to which treated effluent could reach surface water by lateral subsurface flow is not known. In some cases, the treated process water is used for irrigation. Since the season of maximum production of effluent (the fall) is not a time of high evapotranspiration, some of the effluent may run off and enter surface waters during fall storms. Groundwater that does not directly emerge as surface flow may be eventually be pumped for irrigation or frost control, and thus become surface water. Additional work is needed on the fate and impacts of groundwater nitrate in the Napa Valley.

Fertilizer use on grapes may be a significant source of nitrate-nitrogen in the Napa Valley. Grape vines produce best if the available nitrogen is limited, so nitrogen fertilizers are not applied in large quantities. In fact, the nitrogen concentration in treated wastewater is sometimes too high to permit its use for irrigating mature grape vines (Phil Blake, Napa Co. RCD., pers. comm.). If nitrogen is applied, it is usually to young vines, when vegetative growth is important. It is often applied through a drip irrigation system ("fertigation"), or directly at the base of the young plants as calcium nitrate.

The County now has an ordinance requiring cover crops under grapes on slopes > 5%. These include legumes and annual grasses and native perennial grasses. Cover crops will help to conserve nitrogen on site, and reduce its runoff to surface water. The total estimated annual fertilizer use on grapes in Napa County was estimated by Water Engineering and Technology (1989) at 4,140 tons (3704 metric tonnes), but the content of this fertilizer is not given. A thorough assessment of the potential impacts of fertilizer use on grapes must take into account the nitrogen content of the fertilizer, the soil characteristics and total area over which it is applied, and the season of application. Although it may turn out that treated wastewater and use of nitrogen fertilizer on lawns and golf courses in the Napa Valley are important sources of nitrogen in surface waters of the Napa Valley, the existing data do not support a conclusion that fertilizer use on grapes is of no significance.

In evaluating the nitrogen loading problem in the Napa River, we obtained the available concentration data from the EPA STORET system. Nitrate data were available for the gage near St. Helena from 1952-88, and for the gage near Napa from 1966-92. For both gages, we plotted concentration vs. time, and concentration vs. mean daily discharge. Figures 11 and 12 show the plots for the St. Helena gage, and Figures 13 and 14 for the Napa gage.

The plots of concentration vs. time show large annual fluctuations, with high values during winter and spring, and low values during the summer. At St. Helena, there appears to be an upward trend during the 1960's and a slight downward trend in the maximum values after about 1968. This may be due to improved wastewater treatment, or limitations on dry-weather discharge. For that gage, no relationship between discharge and concentration is apparent. For the Napa gage, no time trend can be seen in the data, but there is a positive relationship between concentration and discharge. At very high discharge, however, (>12,000 l/sec) there seems to be a dilution effect. The discharge-concentration relationship is consistent with a surface water or point source for nitrate-nitrogen, rather than a groundwater source, but does not allow us to separate the relative contributions of fertilizer and treated wastewater. Using a regression of concentration vs. discharge, we estimated the mean annual nitrat-nitrogen load at the Napa gage (1966-1992) to be 324 metric tones.

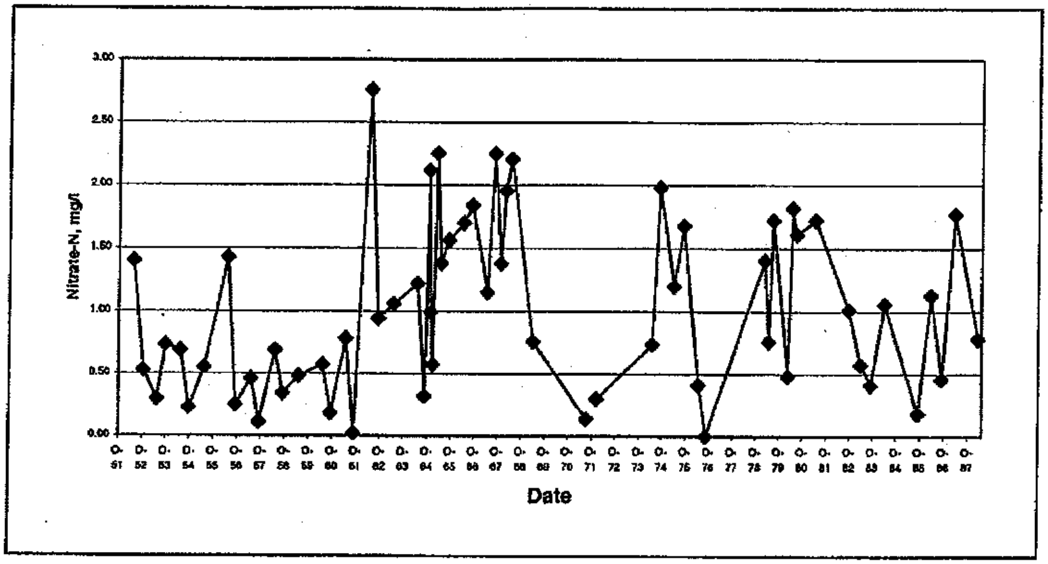

Figure 11 Nitrate-N, Napa River near St. Helena

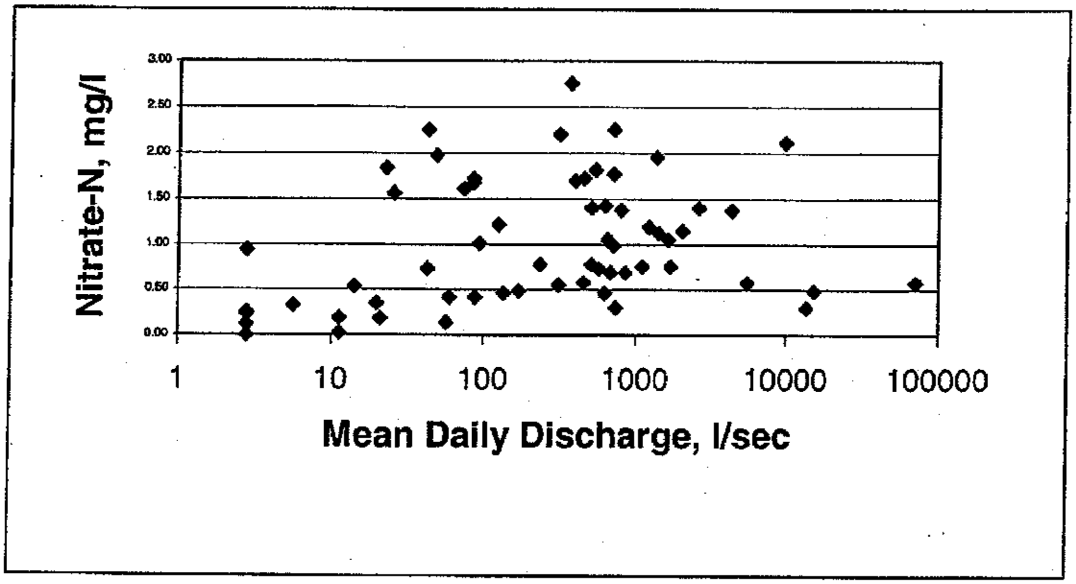

Figure 12. Nitrate-N, Napa River near St. Helena

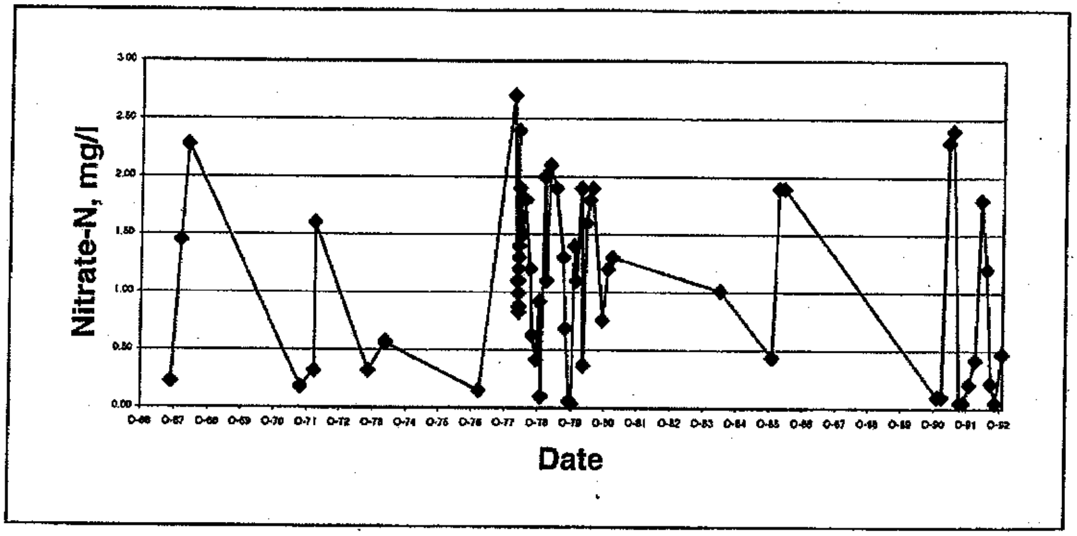

Figure 13. Nitrate-N, Napa River near Napa

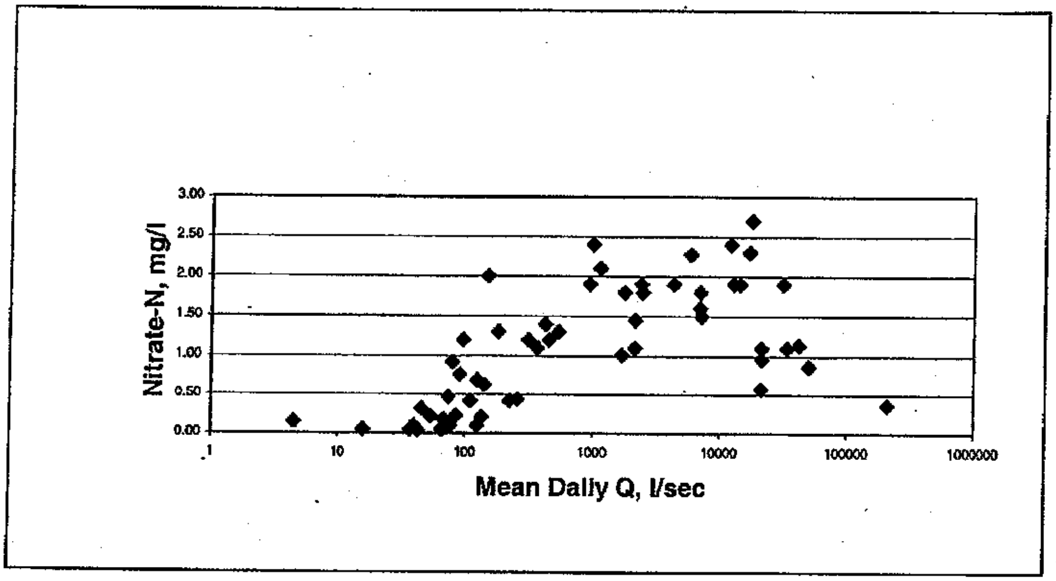

Figure 14. Nitrate-N, Napa River near Napa 1967-1992

4.4.2 Recommendations for Future Work on Water Quality

In general, there are two possible approaches to assessing the impacts of agricultural chemicals on water quality in the Napa River. The first is to look at the interaction of the soil-vegetation system with the applied chemicals, on a scale of field plots. One good way to do this is with a model such as GLEAMS, which couples soil hydrology with soil chemistry, and can model the transport of nutrients and pesticides through the soil (Zacharias and Heatwole1994). The second approach is to sample the river and measure concentrations of the water quality constituents in question. A sampling program would need to take account of seasonal and discharge variations, and use chemical methods appropriate for measuring low concentrations. Both approaches would require a substantial commitment of funds.

Additional evaluation of the importance of nitrogen loading in the Napa River should also include measurements of DO in the river, from Calistoga to the estuary, along with measurements of organic and inorganic nitrogen. In the lower (estuarine) section, this should include vertical profiles. Isotopic techniques are available for separating the wastewater and fertilizer contributions of nitrogen, if nitrogen loading turns out to be a major factor in the decline of water quality in the River.

4.5 Riparian Cover

Napa Valleys agricultural development and urbanization has resulted in several adverse impacts: Clearing of riparian vegetation as it shades out grape vines and harbors insect vectors of disease has resulted in insufficient shading of streams and increasing water temperatures to unsuitable levels for salmonids (Elison 1982).

5.0 CONCLUSIONS

1. There is an abundance of compelling evidence that the Napa River is being severely impacted by agricultural activities in the watershed that are individually and cumulatively adversely impacting fisheries resources. Some of the main pieces of evidence include:

- The extirpations of the coho salmon run
- The reductions of the steelhead run from approximately 8,000 to a few hundred today
- The listing of the river as impaired by the SFBRWQCB
- Photographic evidence of egregious stream bank erosion
- Photographic evidence of no-flow in sections of the river below Sulphur Creek
- Documented continuing increase in the number of diversions
- Documented continuing increase in the number of dams and reservoirs
- Documented use of large amounts of persistent, bioacumulative and very toxic pesticides
- Documented high levels of nitrogen due to agriculture

- Documented eutrophication, algae blooms and low D.O. in many parts of the river

2. Cumulative and synergistic impacts are resulting in the destruction of critical habit for the listed steelhead population in the Napa River and its tributaries. Examples of cumulative impacts include:

- Removal of riparian vegetation results in less food, warmer water
- Each new acre of vineyard incrementally results in:
- Less rainfall retention
- More soil erosion and more sediment entering the river
- More nutrients entering the river
- More pesticides entering the river
- More water withdrawn to prevent frost control
- An additional appropriation of river and groundwater
- Construction derived sediment is additive to vineyard derived sediment

3. There is no scientific basis for allocating water consistent with the regulatory community's need to conserve and restore the fisheries resources of the Napa River.

4. The hydrologic monitoring system is inadequate for monitoring and managing minimum flows to protect fisheries resources throughout the Napa River watershed.

6.0 RECOMMENDATIONS

There is an urgent need to initiate a comprehensive monitoring program on the Napa River and its tributaries that include monitoring of fisheries resources, habitat, water quality, and water quantity monitoring. A strong science based monitoring program can become the foundation stone of a community based watershed wide habitat restoration program. But the first step has to be monitoring. The results of the monitoring program will become the basis for scientific analysis, and stakeholder agreement on what needs to be done to restore fisheries resources. The following section briefly discusses the main elements of a systematic monitoring program that would lead to restoration planning.

6.1 Fisheries Monitoring

Fisheries monitoring must include all life stages in representative reaches of the river. There needs to be a good estimate of the numbers of spawning adults, juveniles and smolts. Fisheries monitoring needs to be conducted on many reaches and many miles of the river every year for at least ten year to truly understand the fisheries resources and limiting factors in each reach. The monitoring program will need substantial funding, the assistance of many volunteers and the cooperation of many landowners.

6.2 Water Quality Monitoring

It is imperative to implement a long term systematic water quality monitoring program including; temperature, DO, pH, suspended sediments, pesticides, BOD, COD, coliforms, and nutrients such as nitrates and phosphates. The monitoring must be continuous to cover every week of the years and all reaches of the river. Water quality monitoring should also include the study of the algae in the river.

6.3 Riparian Habitat Monitoring

Riparian habitat monitoring needs to be done in conjunction with fisheries and water quality monitoring. The amount of tree cover over a stream is generally directly correlated with the habitat quality of the river. Tree cover provides water cooling shade, and indirectly provides food, habitat complexity and protection from human interference. Many species other than fish utilize the riparian corridor. There is also a need to quantify the amount of good quality spawning gravel, and pool-and-riffle rearing habitat. This would include the quantification of the abundance of aquatic invertebrates that make up a very important element in the fisheries food web. Habitat monitoring should also include habitat complexity such as undercut banks, and woody debris.

6.4 Water Quantity Monitoring

Surface water and groundwater abundance, distribution and interaction are poorly understood because of a lack of adequate monitoring data. There needs to be a USGS monitoring station along many more reaches of the main stem and in each of the 10 main tributaries. Monitoring needs to focus on minimum flows and not peak flows. All diversions need to be monitored to make sure that fish are not being killed directly or indirectly. There are indications that there are many non-permitted reservoirs (Jackson personal communication). There needs to be a comprehensive study of water usage and how to balance diversions, groundwater extraction and minimum instream flows throughout the entire watershed.

6.5 Revaluation of the Existing Environmental Impact Assessment and Permiting Process

Permits continue to be issued in spite of an abundance of evidence that the aquatic environment has been progressively damaged over the last 50 years, and species listed under the ESA have been "Taken". Issuing new permits without consultation with the NMFS will be clearly in violation of the critical habitat listing for steelhead under the 4(d) rules issued in 2000. The misapplication of erosion control principles and the dereliction of county responsibility to assess cumulative impacts and protect the aquatic environment is counter to the intent and purpose of the California Environmental Quality Act. We strongly recommend that all City, County and State agencies operating within the Napa River watershed revaluate their planning ordinances and customary practices in order to stop further degradation of fisheries habitat.

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RESUME

ROBERT (BUD) ABBOTT, Ph. D.

Fisheries
Aquatic Resource Planning
Adaptive Management Planning
Underwater Explosive Impacts
Natural Resource Modeling
Essential Fish Habitat Assessments
Dam Assessment and Removal
Bioacoustics of Fish

BIOGRAPHICAL SKETCH

Dr. Abbott is a fisheries expert with over 30 years of experience in the assessment of fisheries and aquatic resource information for government agencies and the private sector. He is an experienced manager of large teams of scientists and field technicians in designing monitoring programs, collecting field data, computer data entry, modeling based on field data, and the analysis of model outputs and databases. He is an authority on Sacramento-San Joaquin River Delta, and San Francisco Bay fisheries issues. He is an expert in threatened and endangered species of fish, dam removal permits, underwater explosive impacts on fish and aquatic pest control.

EDUCATION

Ph.D.; University of Washington; Fisheries; 1973
M.S.; University of Washington; Fisheries; 1970
B.S.; California Western University; Biology; 1964

Fisheries

Expert in all aspects of fisheries science, management and the fishing industry. He earned his Doctorate at the University of Washington College of Fisheries and prepared his dissertation on the bioacoustics of salmon and trout. Most of his fisheries experience in the last 10 years has been directed towards managing fisheries resources through the application of natural resource simulation models and the assessment of impacts on fisheries resources for NEPA/CEQA compliance. Recent field experience includes field sampling for juvenile fish in the San Francisco Bay estuary under a contract with the San Francisco State University.

California Central Valley Aquatic Ecosystem

Worked on fisheries ecology projects in the Sacramento and San Joaquin Rivers for the last seven years. Recent experience includes technical review of the CALFED Ecosystem Restoration Program Plan (ERPP), CALFED American River Task Force Restoration team, the San Joaquin River Group regulatory hearing technical team and the CALFED North Bay Restoration team. He assisted in preparation of the first draft for the CALFED EIR/EIS Affected Environment and the Aquatic Resources Impacts Assessment chapters. Project experience includes, work on the Moklumne, Tuolumne, San Joaquin- Sacramento Rivers and Marin County streams.

Simulation Models and Statistics
Directed teams in the development, refinement, calibration, and application of a variety of computer simulation models for the assessment and management of fisheries resources including CPOPx, Clark Fork River Ecosystem Model and ELOFIN. On the Steering Committee of the Bay-Delta Modeling Forum where he chaired a regional workshop of the application of simulation models to project impacts from dam removal.

EIR/EIS
Participated in various elements of the NEPA/CEQA process including; public participation programs, Biological Assessments, Assessment of the Affected Environment, Environmental Assessments (EA) Direct Impact Assessments, and Cumulative Impact Assessments. Assisted in the preparation of the Environmental Assessment (EA) for the Alexandria WasteWater Treatment Plant, Phase II in Egypt. He was part of the EIR/EIS team for the American Falls Reservoir Management plan funded by the US Bureau of Reclamation in Idaho. He also coordinated document preparation and provided technical review for a gas powered power plant EIR for the Oregon Energy Commission. He has also assisted in the preparation of the draft Affected Environment relative to the Vernalis Adaptive Management Plan (VAMP) EIR.

CHAMP/IPMP
Worked with the Arnold Palmer Golf Management Corporation to prepare a chemical application management plan and integrated pest management plan for the Presidio Golf Course. Duties included development of a characterization of the physical and ecological setting, design of an environmental quality monitoring program, the preparation of an acceptable list of chemicals, and designing a pest threshold criteria methodology. California Pesticide Control Advisory License # AA01245

Underwater Blasting Impacts
Prepared an environmental impact assessment for California Department of Transportation (CALTRANS) on the impact of a large underwater blasting project on salmon, herring and fish eggs. Responsibilities involved review of agency databases for relevant data, assessment of blast modeling results and the design of a comprehensive mitigation plan.

Coastal Zone Management Planning
Assisted in the development of a coastal zone management plan for the Republic of Kiribati and the Sultanate of Oman under USAID and ADB funded programs. He led workshops of government and public participation programs, lagoon management plans, and preserves for coastal fisheries restorations programs. He worked on urban river and estuary clean up programs in the Philippines, Malaysia, Indonesia, and Thailand.

Fisheries Business
Involved in many aspects of the world fishing industry including; an assessment of the feasibility of starting a new anchovy based fish meal/oil production facility in California, and he advised on methods to control unauthorized high seas trans-shipments of high value tuna. He was a commercial tuna fisherman in California, and Hawaii.

International Work Experience
Worked for many international institutions including; Asian Development Bank, World Bank, USAID and the U.S. Peace Corps. He worked in the Sultanate of Oman, Burma, Thailand, Chile, Nigeria, Egypt, Kiribati, Malaysia, Indonesia, Tuvalu, and the Philippines. Project experience includes, fisheries development, environmental planning, institution strengthening, training programs, coastal zone planning, environmental information management, and natural resource assessment.

Recent Special Training Programs
Endangered Species Act and Water Resources Issues, UC Davis 200
Aquatic Weed School UC Davis 1999
GCSA Leadership Training Program, U. C. Davis 1998
Dam Planning and Engineering Projects, Univ. Wisconsin 1998
IPM, U. C. Davis 1998
Toxicology and Risk Assessment, U.C. California at Berkeley, 1997
PSMJ Project Management Training, 4 day intensive training 1997
Stream Restoration for salmon and steelhead 1996

EMPLOYMENT HISTORY

1998-Present	Strategic Environmental	Principal
1996-1998	EA Engineering, Science and Technology, Lafayette, CA	Sr. Scientist
1990-1995	BioSystems Analysis, Inc. Tiburon, CA	Sr. Fisheries Scientist
1988-1990	AquaSeed California, Inc. Sausalito, CA	President
1986-1988	Aquatic Farms Rangoon, Burma	Prawn Fisheries Specialist
1983-1986	RDA International Muscat, Oman	Chief of Party
1982	World Bank Washington D.C.	Training Consultant
1980-1982	Oceanic Institute Makapuu, HI	Manager, Finfish Program
1974-1979	Pisces International Kailua-Kona, HI	Licensed skipper/Vessel Owner commercial and charter fishing

PARTIAL LIST OF CLIENTS AND PRIME CONTRACTORS

National

EA Engineering, Science, and Technology
McLaren/Hart
Fountaingrove Parkway
Adams Broadwell & Joseph
San Francisco State University
Parsons Brinckerhoff
Arnold Palmer Golf Management
Animal Damage Management
URS Greiner Woodward Clyde
Technical Advisory Services for Attorneys (TASA)
National Fish and Wildlife Foundation
Bookman-Edmonston
San Joaquin River Group
BioSystems Analysis
East Bay Municipal Utility District
National Marine Fisheries Service
EDAW
Oceanic Institute
Fisheries Research Institute
Stillwater Sciences
CalFed

International

Asian Development Bank- Tuvalu, Kiribati
Agency for International Development (USAID) Kiribati, Oman
World Bank Washington D. C. - Oman
Aquatic Farms - Burma
AquaSeed Corp -Turkey
Unicord - Thailand
Island Science - Indonesia, Malaysia, Thailand, Philippines
Swan Foundation - Norway
Metcalf & Eddy International/USAID - Egypt

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Robert Coats, Ph.D.

Dr. Coats has 25 years of experience focusing on the hydrologic and ecological effects of land management on aquatic ecosystems. This work has concentrated in two areas: wetlands and forested watersheds. In both areas, he has drawn on his background in hydrology, ecology, and soil science. His long-term research interests are focused on nitrogen cycling and biogeochemistry at the watershed level.

Dr. Coats' work with wetlands has included the design of numerous wetland restoration and enhancement projects; analysis and testimony as an expert witness in cases involving wetland jurisdiction and spread of contamination in wetlands; and preparation of habitat management plans for endangered wetland plants.

In the area of forested watersheds, his experience includes research on the effects of land disturbance on water quality; evaluation of the effects of silvicultural activities on both site quality and water quality; review of proposed timber harvest plans and National Forest plans; reclamation and hydrologic aspects of strip mining; evaluating the hydrologic and water quality effects of hydropower projects; and developing monitoring programs and habitat conservation strategies for two Habitat Conservation Plans (pursuant to the Endangered Species Act) in north coastal California.

He has worked on two projects in Latin America, and speaks Spanish.

Much of Dr. Coats' work has involved management of large projects involving major resource conflicts and institutional complexity. In addition to project management, Dr. Coats' experience includes personnel management and directing a professional development program.

Education

Ph.D.,	Wildland Resource Science, specializing in watershed management and water quality, University of California School of Forestry and Conservation, Berkeley, and Division of Environmental Studies, Davis, 1975
M.S.,	Forestry, specializing in soils and plant ecology, University of Minnesota, 1967
B.S.,	Forestry, University of California School of Forestry, Berkeley, 1965

Awards

1978-1979	Rockefeller Foundation Fellowship in Environmental Affairs
1969-1971	The National Science Foundation Traineeship
1965	Faculty Citation, University of California School of Forestry

Professional Experience

1999-present	Principal, sole proprietor, Hydroikos Associates
1997-1999	Senior Scientist, Stillwater Ecosystem, Watershed & Riverine Sciences, Inc. Berkeley, CA
1986-1997	Principal, Philip Williams & Associates, Ltd., San Francisco, CA
1983-1986	Senior Associate, Philip Williams & Associates, San Francisco, CA
1982	Visiting Lecturer, Department of Soil and Plant Biology, University of California, Berkeley
1978-1983	Staff Scientist, The John Muir Institute, Berkeley, CA
1974-1978	Teaching Associate, Department of Conservation and Resource Studies University of California, Berkeley
1972-1974	Research Associate, University of California, Davis.

Professional Affiliations

American Geophysical Union
American Association for the Advancement of Science
California Forest Soils Council
Environmental Management Editorial Board
Society for Ecological Restoration
Society of Wetland Scientists
The Tahoe Research Group, U.C. Davis
Watershed Management Council (Board of Directors)

Selected Publications

Coats, R. N. and C. R. Goldman. 2001. Patterns of nitrogen transport in streams of the Lake Tahoe Basin, California-Nevada. *Water Resources Research* 37(2):405-416.

Coats, R. N. and M. Powell. 2000. Hydropower, timber management and eutrophication in the North Umpqua River Basin. Watershed Management Council Networker 9(2): 1, 4-6.

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Coats, R. N., P. Baker and C. R. Goldman. 1998. Soil type, land disturbance and streamwater nitrate in three watersheds of the Lake Tahoe Basin. Poster at Ninth North American Forest

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Coats, R.N., 1999. Evaporation, Evapotranspiration. In: *Encyclopedia of Environmental Science*. D. E. Alexander and R. W. Fairbridge, (eds.) p. 240. Kluwer Academic Publishers, London.

Coats, R.N., 1999. The Riparian Zone. In: *Encyclopedia of Environmental Science*. D. E. Alexander and R. W. Fairbridge, (eds.) p. 517. Kluwer Academic Publishers, London.

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Coats, R.N., and C.R. Goldman, 1993. Nitrate transport in subalpine streams, Lake Tahoe Basin, California-Nevada, USA. Supplementary Issue No. 2:17-21, *Applied Geochemistry*, Presented at the Second International Symposium on Environmental Geochemistry, Uppsala, Sweden, September, 1991.

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EXHIBIT 6

Fish Bypass Flows for Coastal Watersheds

A Review of Proposed Approaches for
the State Water Resources Control Board

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With Technical Assistance From
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Bay-Delta Modeling Forum

June 12, 2000

EXHIBIT 4

1. Introduction

In the Russian River watershed increasing pressure to develop hillside agriculture (especially vineyards) has led to a proliferation of water rights applications for diversions from headwater streams, which support federally listed coho salmon or steelhead, or support larger streams that do. Similar conditions occur in other coastal watersheds. The State Water Resources Control Board (SWRCB) is presently wrestling with the issue of how to condition permits for water rights to protect ecological resources, a task made difficult by the lack of information on the physical and ecological functioning of these channels, and their influence on downstream channels. For example, proposed methods for determining minimum instream flows in these streams have been developed using stream gauge data - all of which are from larger channels downstream, where scale differences lead to a very different hydrology. Similarly, the need for streamside protection zones along these headwater channels is not widely recognized, because most guidance has been developed for larger channels. In any case, existing institutions are poorly suited to regulating activities that impact these streams. The State Board can decide how much water (if any) should be diverted but has limited authority to regulate land use changes that influence runoff and erosion rates. Similarly, the Department of Fish and Game can put conditions on activities within the stream itself, but has limited authority beyond the stream banks. Land-use decisions are made at the county level, with varying levels of scientific analysis and political concerns influencing decisions. The most advanced county-level ordinance in the region is the Napa County Conservation ordinance, which is now under review in part because of concerns over its effectiveness in addressing the effects of multiple headwater impacts. Moreover, there is presently no mechanism for taking cumulative effects into account. The SWRCB has proposed analyzing cumulative hydrologic changes from numerous headwater diversions at the upstream point used by anadromous fishes, but this limit is changing in many streams as human-made barriers (such as culverts) are corrected as part of watershed restoration programs.

This review is intended to provide the SWRCB with guidance regarding minor water rights applications on streams in coastal watersheds, with particular focus on the Russian River basin. Many of these streams support coho salmon or steelhead rainbow trout, which are listed as threatened under the federal Endangered Species Act (ESA). Although there is general agreement that there is little if any water available for diversion in the dry season, frequent winter flooding in the Russian River basin supports the view that water could be diverted in some winter months without harmfully affecting instream flows required by salmon, steelhead, and other public trust resources. The SWRCB staff has developed an approach that, when embodied into permit conditions, is designed to allow for a "negative declaration" under the California Environmental Quality Act (CEQA) for diversions from small coastal steams; that is, a finding that exercise of a new permit will not have a significant effect on the environment. In other words, the conditions of each permit are supposed to be strict enough so that the diversion will not have negative effect on salmon, steelhead, or other significant aquatic life, either individually or cumulatively. Such findings have been made for several water rights applications in the basin of the Navarro River (SWRCB 1998), which supports coho and steelhead, and the SWRCB staff proposes to use the same approach in the basin of the Russian River, which also supports both species (SWRCB 1997).

The approach has been controversial, however, and has been criticized by the National Marine Fisheries Service (NMFS), Trout Unlimited (TU), the California Sports Fishing Protection Alliance (CALSPA), and others. This caused the SWRCB staff to seek review of the approach by qualified experts acceptable to the various parties, and the authors of this review were selected. The SWRCB also secured the services of the Executive Director of the Bay-Delta Modeling Forum, of which the SWRCB is an institutional member, to act as staff for the review. As part of the review, the SWRCB staff conducted a workshop, on 31 January 2000, in which the SWRCB staff approach and alternatives suggested by NMFS and TU were presented. The California Department of Fish and Game, CALSPA, and engineers from two private firms who frequently represent applicants for water rights, Wagner & Bonsignore and Napa Valley Vineyard Engineering, also participated in the workshop and provided comments.

In this review, we do not recommend a definitive method for determining what flows should be left in each stream to the SWRCB staff and interested parties. Instead, we give our views on topics raised in the workshop and related issues, give suggestions for improved formulation of permit conditions instream flow standards that are well suited for adaptive management, and recommend an approach to apply within the context of adaptive management.

2. General comments on instream flow standards:
Scientific uncertainty and Adaptive Management:

The implications of uncertainty for public policy and environmental management have been a topic of discussion in the scientific literature for some time (e.g. Holling 1978), but particularly in the last decade (e.g., Ludwig et al. 1993; Hilborn and Peterman 1995; Mangel et al. 1996; Chrisentsen et al. 1996; Francis and Shotton 1997; Healey 1997). The discussions have concerned environmental management generally, and management of fisheries or fish populations in particular, and have been motivated by rampant management failure: many stocks of commercially important fish have recently collapsed (Thompson 1993; Horwood 1993), and many runs of Pacific salmon and steelhead are either extinct or in trouble (Nehlsen et al. 1991; Stanley et al. 1996; Mills et al. 1997; Brown et al. 1994; Yoshiyama et al. 2000).

Briefly stated, it is now generally recognized among professionals that management of wild living resources involves such large amounts of uncertainty that (1) management actions are experiments and should be treated as such, and (2) irreversible actions should be avoided. This point of view is embodied in the widely advocated approach of "adaptive management" (e.g., Holling 1978; Walters 1986; Volkman and McConnaha 1993; Healey and Hennessey 1994; Healey 1997, Williams 1998). In 1996, we joined others in declaring that "currently no scientifically defensible method exists for defining the instream flows needed to protect particular species of fish or ecosystems," and in calling for the application of adaptive management to the problem of setting instream flow standards (Castleberry et al. 1996), with a focus on flows below existing dams. We made three basic recommendations:

First, conservative (i.e., protective) interim standards should be set based on whatever information is available, but with explicit recognition of its deficiencies. The standards should prescribe a reasonable annual hydrograph as well as minimum flows. Such standards should try to satisfy the objective of conserving fishery resources, the first principle of adaptive management (Lee and Lawrence 1986).

Second, a monitoring program should be established and should be of adequate quality to permit the interim standards to serve as experiments. Active manipulation of flows, including temporary imposition of flows expected to be harmful, may be necessary for the same purpose. This element embodies the adaptive management principles that management programs should be experiments and that information should both motivate and result from management actions. Often, it also will be necessary to fund ancillary scientific work to allow more robust interpretation of monitoring results.

Third, an effective procedure must be established whereby the interim standards can be revised in light of new information. Interim commitments of water that are in practice irrevocable must be avoided.

Here, we expand on these ideas, particularly as they relate to diversions from small streams.

The fact of relevant scientific uncertainty is perhaps best illustrated by recent developments in stream ecology. The role of high flows in structuring food webs in streams like those under consideration here has been elucidated only in the past decade (Wootton et al. 1996). Understanding of the substantial ecological importance of subsurface (hyporheic) flow, which is affected by the frequency with which stream sediments are mobilized, has also developed rapidly over the same period (Jones and Mulholland 2000). Although a great deal is known about salmonids and about stream ecosystems, these examples show that we should expect more surprises, and not assume that our current understanding is sufficient to support permanent decisions regarding management of streams.[1]

In adaptive management, uncertainty is acknowledged, management actions are recognized as experiments, and developing new information is an explicit management objective that can justify actions that may be sub-optimal in terms of other objectives. Deliberate manipulation of the system is required when there is otherwise little variation in the factor of management concern. For example, an adaptive approach to evaluating flows in a regulated stream with fairly constant flows would require a deliberate change in management; it is impossible to learn much about the relation between flow and public trust benefits in a stream if the flow does not vary. In other situations, an adaptive approach may not require deliberate manipulation of the system in question. Delta outflow in the spring, for example, varies naturally much more from year to year than it could from any plausible deliberate manipulation of outflows. The key in such situations is to describe the conceptual model upon which management is based as explicitly and quantitatively as possible so that the rationale for the standards can be formulated as testable hypotheses, and to establish a monitoring program by which the hypotheses can be tested.

---

[1] The great complexity of ecosystems and the practical impossibility of accurately measuring many relevant aspects of them explains the apparent paradox that scientists know a great deal about ecosystems but remain unable to make good specific predictions about how they will behave in response to small or intermediate perturbations. See Healey (1997) for a good discussion of this point.

Thus, adaptive management of instream flows may or may not require deliberate, experimental manipulation of flows, depending on the amount of variation that occurs in flows regardless of management. Generally, there will be large variation in flows within and between years in Russian River tributaries and in other California coastal streams. However, to depend on natural variation in flow for management "experiments" increases the risk that results will be confounded by other variables. For example, water quality might be better in high-flow years, so that benefits of improved water quality could be mistakenly interpreted as results of some hypothesized flow-habitat relationship. In any event, the rationale for the instream flow standards or permit conditions must be made clear, so that it can be tested against new information.

This can best be done if objectives and conditions or standards are stated in terms of explicitly biological criteria, with a method specified to convert these into hydrological terms. This allows the condition or standard to be articulated as a testable hypothesis or set of hypotheses. In the present context, for example, a winter flow standard or by-pass condition might be stated as a flow that allows enough spawning to occur to saturate the rearing capacity of the stream, stated quantitatively as enough flow to allow spawning to occur in 75% of the potential spawning habitat in the stream. To make this criterion operational it could be translated, based on some explicitly stated reasoning or evidence, as some particular value on the flow duration curve or some other parameter of the flow data. The standard or condition now involves two hypotheses, one harder to test than the other, but both at least conceptually testable. The more easily testable hypothesis would be that the selected flow criterion actually does allow for spawning in 75% of the potentially available habitat. The more difficult hypothesis would be that 75% of the potential spawning habitat will provide the desired level of biological protection, say lack of harm to listed species. The conceptual model in this case would be density-dependent effects such that spawning on 75% of the potential spawning habitat would saturate the rearing capacity of the stream, so that making more spawning habitat available would not result in greater production of juveniles or returning adults. In any event, the reasoning behind the standard or condition should be spelled out, so that is possible to specify the kind of information that would justify a change.

Under adaptive management, in other words, management decisions should *invite* change, by emphasizing uncertainty, by making clear what kind of new information would justify a change in the management action, and by requiring monitoring that can provide the relevant information. We emphasize this to clarify the difference between adaptive and traditional management, in which management actions typically are designed to be durable, and the reasoning given for the decision may be deliberately vague to further that end. Formulations such as "Careful consideration of all the evidence leads to the conclusion that a by-pass standard of X cfs best balances the competing needs for water," without further elaboration, are incompatible with adaptive management.

Similarly, the large scientific uncertainty regarding instream flows means standards or conditions must be based on explicit conceptual models and formulated as testable hypotheses. To depend on consensus of technical experts for the parties or stakeholders in a given situation, without these elements, may be convenient for decision-makers but damaging to the resource. Consensus on conceptual models and testable hypotheses would be very useful, but if the technical experts cannot articulate their recommendations in this way, the consensus is most likely based on non-scientific considerations, and as noted by Mangel et al.(1993) this approach has often failed:

> We believe that a principal reason for the routine overexploitation of resources is that the scientific community often fails to differentiate between science and policy, that is, to separate fact and value judgements. For example, scientists are often expected to reach "consensus" amid considerable scientific uncertainty about cause and effect. Instead of telling policy makers that they cannot accurately predict the consequences of alternative management strategies, scientists allow themselves to be forced into negotiated agreement. As a result, decision makers (usually not scientists themselves) are often not fully aware of the uncertainties and cannot be help fully accountable for the consequences of their actions.
>
> The International Whaling Commission, for example, asks its Scientific Committee to recommend catch quotas. Available information is often insufficient to determine catch levels that can be sustained, and many Scientific Committee members have different views about what should be done in the face of uncertainty; some believe that, when there is uncertainty, the benefit of the doubt should be afforded to the industry while others believe that it should be afforded to the resource. Instead of reporting the uncertainty and the possible consequences of this uncertainty to the Commission, the Committee generally has sought a "scientific consensus" that represents a middle ground. In hindsight, the consequence of attempting to reach a consensus is clear: one stock after another of the world's large whales have been driven to economic and near biological extinction.

In the current context, uncertainty in estimates of flows in small, ungaged streams is a major problem. The SWRCB has tried to address this problem through development of a rainfall-runoff model for the Russian River watershed, but the accuracy of this or any other model is fundamentally constrained by the scarcity of data on rainfall and runoff, which can be highly variable spatially in coastal watersheds. We make recommendations for addressing this problem below.

Other Types of Uncertainty and Other Factors to Consider:

Experience with fisheries management has demonstrated that uncertainty regarding non-scientific factors also needs to be taken into account for effective management, and doubtless the same is true for management of diversions from streams. Most obviously, uncertainty regarding compliance with permit conditions must be taken into account,[2] and the SWRCB should avoid allocating water to uses that would suffer seriously in dry years when permit conditions would limit diversions, unless it can assure compliance with the conditions. Uncertainty regarding future diversions under riparian rights, or expansions of diversions under appropriative rights, should be taken into account in such situations. Stated differently, effective management needs to take human motivation into account (Ludwig et al. 1993). In many situations, including the approach

[2] We appreciate the frank comments by Wagner and Bonsignore and Napa Valley Vineyard Engineering on this point.

under review, uncertainty about existing diversions under riparian or pre-1914 rights will be important, as will illegal diversions. Similarly, the SWRCB needs to consider the indirect effects of water allocations on streams. For example, if a small diversion from a headwater stream makes possible a use that will be accessed through the winter by a dirt road, then sediment from the road may have a greater effect on the stream than the diversion itself. Simply depending on other agencies to control such effects puts the puts the public trust at undue risk. Effective management needs to deal with the world as it is, not as it is supposed to be, and not as it is bounded by agency jurisdictions.

Limitations on Adaptive Management for Minor Water Rights Applications:

Water rights granted for vineyard development or other capital-intensive activities are for practical purposes irrevocable and their environmental effects should be evaluated in that light. This reduces the applicability of adaptive management to the process under review. Nevertheless, adaptive management still has a role, because much of the concern about the minor water rights applications involves cumulative impacts, so that future modification of the process for evaluating individual permits, in light of new information, can still be effective. However, the practical irrevocability of such allocations of water creates a greater need for caution than would otherwise be the case.

The practicality of effective monitoring of the efficacy of conditions on minor water rights permits also limits the applicability of adaptive management in such cases. Effective monitoring is almost always expensive, and the cost per unit of water diverted will be particularly high for small diversions. It seems to us that this difficulty can best be overcome by monitoring the effectiveness of permit conditions on a sample of diversions, with some method for spreading the cost over all diversions. Requiring inadequate monitoring of all diversions would be a waste of resources.

The need to protect high flows and flow variability:

The importance of maintaining high flows and flow variability seemed to be recognized by all parties at the workshop. We agree. There has been a spate of recent articles that emphasize the importance of variation in flow in rivers for creating and maintaining aquatic and riparian habitat and ecosystems (e.g., Ligon et al. 1995, Power 1995, Reeves et al. 1995, Sparks 1995, Power et al. 1996, Stanford et al. 1996, Wootton et al. 1996, Richter et al. 1997, Nilsson et al. 1997). As stated in the abstract of Power et al. (1996):

> Responses of rivers and river ecosystems to dams are complex and varied, as they depend on local sediment supplies, geomorphic constraints, climate, dam structure and operation, and key attributes of the biota. Therefore, "one-size-fits-all" prescriptions cannot substitute for local knowledge in developing prescriptions for dam structure and operation to protect local biodiversity. *One general principle is self-evident: that biodiversity is best protected in rivers where physical regimes are the most natural. A sufficiently natural regime of flow variation is particularly crucial for river biota and food webs.* We review our research and that of others to illustrate the ecological importance of alternating periods of low and high flow, of periodic bed scour, and of floodplain inundation and dewatering. The fluctuations regulate both the life cycles of river biota and species interactions in the food webs that sustain them. Even if the focus

of biodiversity conservation efforts is on a target species rather than whole ecosystems, a food web perspective is necessary, because populations of any species depend critically on how their resources, prey, and potential predators also respond to environmental change. ... (Emphasis added.)

Brian Richter and his colleagues at the Nature Conservancy have developed an approach to evaluating instream flows from this point of view (Richter et al. 1996, 1997, 1998), although they acknowledge that the approach only provides a "first cut" that should be implemented in the context of adaptive management. The approach involves comparing up to 33 statistics developed from observed or simulated daily flow records for "project" and "no project" conditions, to develop and "index of hydrologic alteration," or IHA. A computer program to perform the analysis is available. The approach is strictly empirical, however.

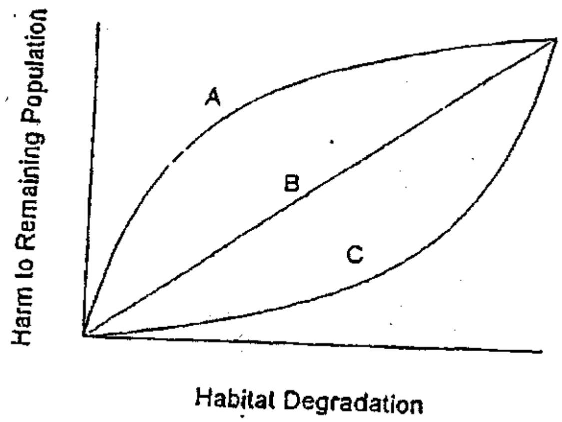
Issues of Spatial Scale:

Issues of spatial scale are important in several aspects of the problem under consideration, as emphasized by TU. As one example, flows that provide adequate depth for migration of adult salmonids or for spawning become less frequent as the drainage area decreases. As another example, the flow in a stream reflects the integrated effects of rainfall over the basin, which may be highly variable if area of the basin covers more than a few square miles, so flow in the lower reaches is less variable than flow in the smaller tributaries. Therefore, applying hydrological generalizations developed from gage data to headwater streams is perilous, since gages typically are located in the lower reaches of stream systems.

At another level, there is ordinarily a need to balance instream and consumptive uses of water.[3] This balancing needs to be conducted at an appropriate spatial scale, however, if it is to be effective. Any such balancing in Russian River tributaries, for example, must place in the balance the amount of habitat that is blocked by Warm Springs Dam or otherwise degraded. This will create equity concerns on the part of water rights applicants on less modified streams, but meeting these concerns at the expense of the remaining habitat is a recipe for environmental disaster.

The equity concern just described raises an important question: how should we regard the incremental effect of additional habitat degradation in an already degraded system? The figure below shows three conceptual alternatives: Curve A reflects the idea that if an environment is already highly degraded, then a little more damage won't hurt much. Curve B shows a linear relationship, in which the harm to remaining members of a population does not depend on the general level of degradation, while Curve C reflects the idea that a high level of degradation makes any remaining habitat even more important. Of course, these curves grossly simplify a highly complex situation, but in our experience people do tend to evaluate evidence in terms of such simple conceptual models, so it useful to make them explicit.

[3] Our impression is that where federally listed species are involved, the balancing has already been done by Congress, but this point may still be relevant for tributaries too small to support salmon and steelhead.



For the situation at hand, we think that Curve C is most appropriate, although it should be regarded as a rebuttable presumption. In other words, the burden should be on applicants to show that Curve C is not appropriate. One reason for this is the essentially irrevocable nature of appropriative water rights, which makes the effects of choosing the wrong curve asymmetrical. For example, if Curve A really is the correct conceptual model, then acting as if Curve C is correct and denying a permit will result in temporary economic loss, since the water could be allocated after Curve A is shown to be appropriate. On the other hand, if Curve C is correct, then the consequences of issuing permits on the assumption that Curve A is correct will be serious and cause permanent harm to the population. This kind of asymmetry of effects, together with the scientific and other types of uncertainty described above, is the basis of the "precautionary principle" for fisheries management (Cameron and Abouchar 1991; Hilborn and Peterman 1996; Gordon and Munro 1996; Richards and Maguire 1998).

Legal barriers to rational water management:

California water law is a curious patchwork that has evolved in response to changing conditions in the state. Although it is possible to understand how the law came to be as it is, the law is nevertheless ill-suited for coping with the difficult allocation problems now facing the state. To scientists such as ourselves, for example, the different legal treatment of surface water and groundwater is fundamentally irrational and seriously compromises the state's ability to deal with its water problems. This is true at the state-wide scale at which we are currently advising CALFED, and it is also true at the scale of minor tributaries of the Russian River. The Public

Trust Doctrine provides the SWRCB with a powerful tool for accommodating appropriative water rights with protection of the public trust. However, demand in an area may be supplied partly by surface water diverted under riparian rights, partly by surface water diverted under appropriative rights, partly by "small domestic" certificates,[4] and partly by pumping of groundwater that is non-jurisdictional but is hydrologically linked to the surface streams. In such cases, developing rational and equitable conditions to impose on the exercise of appropriative rights is a task that we do not envy. The SWRCB is, in effect, working with one foot and one hand tied behind its back. Especially given the presence of listed species in a basin, the inability of the state to control effectively all water use within a basin means that even greater caution should be exercised regarding water use that the SWRCB can control than might otherwise be the case.

Existing unauthorized diversions:

The presence of many unauthorized diversions, some of long standing, creates a dilemma for the SWRCB. On the one hand, effective government depends upon the consent of the governed, and taking too strong a position against people who honestly do not realize that they need a permit for their diversions is likely to be counterproductive. On the other hand, taking too weak a position invites non-compliance, and deals with the problem at the expense of the public trust. We are not confident that there is a good resolution to this dilemma, but a vigorous program to identify unauthorized diversions and bring them into the water rights process would be an important step in the right direction. If the problem is ignored it will only get worse.

3. General comments on approaches discussed:

The SWRCB staff is attempting to develop an approach that, when embodied into permit conditions, will allow for a finding that the project in question will not have a significant effect on the environment. Under the ESA, harm to listed species is by definition a significant effect, so for the Russian River basin the approach must also allow for a finding that the project will not harm coho salmon or steelhead. Given the depressed condition of the populations of salmon and steelhead in the basin and the our limited knowledge of these fish and the ecosystems that support them, a finding of "no harm" can only mean that there is an acceptably low risk of a significant effect on the environment or harm to listed species. Reasonable people can differ in their assessment of what is an acceptable risk of harm. We emphasize, however, that given the condition of the stocks, the "reasonable range" of assessments includes the view that the Russian River and its tributaries are already over-appropriated, that existing diversions should be cut back, and that no new diversions should be allowed.

Although the condition of coho and steelhead populations the Russian River basin and elsewhere in California justifies particular attention to the effects of water diversions on these species, it bears emphasizing that the need for protection does not end with anadromous fish. In regions with Mediterranean climates, much of the drainage network is composed of intermittent headwater streams that flow seasonally. These channels support a distinct biota that has received

[4] Individual small domestic diversions can adversely affect very small tributaries even when they are not abused, and we suspect that abuse is not uncommon. Small domestic diversions also raise serious concerns regarding cumulative impacts. We think § 1228 et seq. of the Water Code should be reconsidered.

little attention, but deserves protection in its own right.[5] The seasonal streams may be particularly important for the breeding by amphibians (especially frogs), which are declining worldwide.

Such channels also convey water, sediment, organisms, organic litter, and large woody debris to perennial reaches downstream. As noted in Welsh et al. (2000), at the conclusion of a discussion of the critical role of large woody debris for pool formation:

> … In a natural stream with intact riparian forests, a large proportion of these logs would enter streams from the highest channels in the stream network … during large storm events (Sedell et al. 1998). Because they provide large woody debris and a variety of sediment types, headwater or first-order stream channels strongly influence the type and quality of downstream fish habitat (Sedell et al. 1998). Stated succinctly, "Reaches that are themselves inhospitable to salmonids may contribute to the maintenance of salmonid populations downstream" (G. Reeves in Reid 1998).

The ecological linkages between small headwater streams and the larger streams farther down the watershed mirrors the cumulative impact problem with minor diversions. Just as small headwater streams combine to form the larger streams that support anadromous fish, so many small diversions, which individually may be inconsequential, can combine to contribute substantially to the degradation of the stream system as a whole.

In some cases seasonal streams are even used directly by anadromous fish. For example, Trush (1991) observed that steelhead trout may ascend seasonal streams during winter freshets, spawn, and descend before flows drop below the minimum level for adult passage Their eggs hatch and the alevins emerge and migrate downstream in the spring before the channel dries up. Some juvenile chinook salmon in the Sacramento drainage also use seasonal tributaries for rearing habitat, and the same may be true of steelhead and coho salmon in the coastal streams.

Although most consideration has been given to steelhead and coho adults and to flows needed for spawning, winter habitat for juveniles is a major factor limiting recruitment for coho in coastal streams in Oregon (Nickelson et al. 1992) and British Columbia (McMahon and Hartman 1989; Hartman et al. 1996). The importance of winter habitat for juveniles in California is poorly understood but it clearly deserves more attention than it has received.

Finally, It seems to us that applying a single, "one size fits all" approach to instream flow standards for Russian River tributaries and other headwater streams in coastal watersheds is ill advised. The more general the approach, the more margin for error is required to support a finding of no significant effect. At the least, a distinction should be made between diversions from perennial streams or seasonal streams that carry continuous flow for part of the rainy season in most years, on one hand, and ephemeral streams or swales that flow only during or shortly after storms on the other. We discuss these separately below.

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[5] See Gasith and Resh (1999) and Welsh et al. (2000) for recent reviews.

4. Proposed conditions on diversions from perennial or seasonal streams:
Summary of proposals:

The SWRCB staff proposed standard conditions that include three restrictions on diversions: (1) the season of diversion is restricted to December 15 to March 31; (2) the maximum rate of diversion is restricted, as determined on a case-by-case basis; and (3) diversions must allow a by-pass flow of 60% of the estimated mean annual unimpaired flow at the site. SWRCB permit terms in the Navarro watershed also include the provision that water diverted under claim of riparian rights not be used in the same area as water diverted under the permit, and we understand that this fourth constraint would apply elsewhere as well. NMFS agrees with the general form of the SWRCB staff proposal and the proposed season of diversion, but maintains that the by-pass standard should be the February median daily unimpaired flow, and that total diversions from a stream be limited to 20% of the 20% exceedence flow. TU also finds the basic form of the staff proposal and the season of diversion acceptable, but proposed that the by-pass flow be the 10% exceedence flow (90th percentile) daily unimpaired flow, that by-pass flows allow a minimum passage depth of 0.8 to 1.0 ft, and that total diversions from a stream not advance the recession of storm hydrographs to the by-pass flow by more than 0.5 to 2 days, depending on the size of the watershed. Wagner and Bonsignore and Napa Valley Vineyard Engineering also found the basic form of the staff recommendation acceptable, although impractical and overly burdensome in some specifics. At the workshop, there seemed to be convergence of opinion toward the general limit to total diversions proposed by NMFS.[6] In summary, there is agreement regarding the basic approach, but differences regarding several of the specifics of its implementation.

We are not persuaded that it is wise to issue any new permits until effective recovery programs for coho salmon and steelhead are in place, but with that caveat we also find the general form of the approach acceptable, and agree that a hydrologically-based approach is reasonable provided that the hydrological criteria are explicitly linked to biological criteria by testable hypotheses. The form of the NMFS proposal for limiting total diversions seems reasonable, although we have not evaluated the specific criterion that NMFS has proposed. Effective implementation of this approach would require knowledge of all existing legal and illegal diversions, however, for which data are largely lacking at present. We also agree with NMFS that negative declarations are inappropriate for proposals for impoundments on perennial or seasonal streams. Such impoundments are likely to have a significant effect on the environment, even if conditions requiring by-pass flows are made part of the permit. Apart from concerns regarding compliance with by-pass requirements, such impoundments will drown stream habitat that has ecological value even if it does not support fish, and will effect other stream habitat by interfering with the migration of organisms and downstream movement of sediment and organic matter as well as water. We also agree with TU that a separate minimum depth criterion may be necessary, particularly for smaller streams.

SWRCB staff proposal for by-pass standards:

The 60% mean annual flow by-pass flow proposed by the SWRCB staff is based largely several PHABSIM studies that indicate that 60% of the mean annual flow will provide 80% of "weighted usable area" (WUA) for coho and steelhead spawning. During the workshop, the SWRCB staff clarified that their proposed by-pass flow is intended to allow for substantial

[6] This approach is detailed in pp. 28-29 in NMFS (2000).

spawning, and not just to provide holding habitat between high flow events during which spawning might take place.

In form, this recommendation is close to what we think is needed. That is, there is a biological objective, and the approach is based on a conceptual model (which underlies PHABSIM) that can easily be formulated as testable hypotheses. We cannot endorse this standard, however, for several reasons, some of them raised in comments by NMFS and TU. A first reason concerns scale effects: some minimum depth is required for adult passage and spawning, but the depth provided by some fixed percentage of the mean annual flow will decrease with the watershed area. Accordingly, applying the results of studies on relatively larger streams to smaller ones is dubious. A second reason concerns the uncertainty associated with the results of any method for estimating spawning habitat, and the presumed dome-shaped relation between flow and spawning habitat in a given stream. Even if PHABSIM results involved relatively little uncertainty, small underestimates of the flow that would produce 80% of maximum spawning habitat could produce relatively large reductions in the actual spawning habitat, particularly because the flow-habitat curves tend to be steeper to the left of the selected point.[7] In other words, the SWRCB staff approach does not provide an appropriate margin for error.

More seriously, the uncertainty in the results of PHABSIM studies is very large. PHABSIM is based on the premises that habitat value of a point in a stream can be described in terms of the depth, water velocity, and the substrate, and that the area of a reach of stream with given values of depth, velocity and substrate can be estimated using hydraulic models. The descriptions are based on "preference" or "suitability" curves that vary between 0 and 1 as a function of depth, velocity, and substrate, using different curves for different life stages. The hydraulic modeling is normally done with one-dimensional models, which describe the stream in terms of a set of transects, as was the case with the studies cited. Problems with PHABSIM using one-dimensional hydraulic modeling are described by Williams (1996) and Kondolf et al. (in press, attached as an appendix), and references cited therein. Briefly, there is a good deal of uncertainty in model results at the transects, and much more uncertainty from extending results at the transects to the rest of the stream. In terms of spawning, there is a clear additional problem with the conceptual model underlying PHABSIM: salmonids select spawning sites partially in terms of "hyporheic" or subsurface flow, so depth, velocity and substrate do not adequately describe spawning habitat.

In short, we believe that the PHABSIM studies cited by the SWRCB staff report do not provide an appropriate basis for by-pass conditions or flow standards, so the 60% criterion is essentially arbitrary. This does not mean that the 60% criterion is necessarily wrong, but rather that it lacks a suitable proximate rationale against which it could be judged. It seemed to us, however, that the discussions in the workshop and in the NMFS comments (p. 16) raised serious questions about the adequacy of the 60% criterion to avoid harm to spawning by steelhead and coho salmon, especially in smaller tributaries.

Finally, as noted above, we are concerned about the uncertainty in estimates of mean annual flow (or estimates of any point on the flow-duration curve) from the streamflow simulation model, that is proposed for use as part of the SWRCB staff approach. Probably a good deal of

[7] See Figure 4.1-2 in Attachment B to SWRCB (1997) for an example.

this uncertainty is unavoidable; precipitation in mountainous areas is highly variable temporally and spatially, and gages tend to be concentrated in more populated areas at lower elevation and relief. Measurements of stream flow from gage data are more accurate than estimates of areally-averaged precipitation, but 95% confidence intervals for flow measurements at gages are probably about +/- 5%, so even with measured data there is some uncertainty. Although we are not rainfall-runoff experts and have not carefully reviewed the model, it also seems to us that uncertainty in the estimates will increase as the size of the basin under consideration decreases, so the tests of the model presented in the SWRCB's 1997 Russian River Watershed Staff Report (errors of 7.6 and 10.3%) most likely underestimate the errors that should be expected when the model is applied to smaller areas.[8]

NMFS Proposal:

The February-median flow by-pass standard proposed by NMFS is based on two considerations: that more flow (within some limit) provides more spawning habitat, on the one hand, and that the flow must be sustained for a considerable period for the spawning to be successful, on the other. NMFS finds that the February-median flow is an easily defined criterion that reasonably balances these considerations, or in other words that the median February flow approximates the flow that will maximize the habitat in which coho salmon and steelhead can successfully spawn. NMFS also assumes that maximizing the effective spawning habitat will maximize production of steelhead and coho salmon (i.e., survival of juveniles is not strongly density-dependent, at least given current population levels). These assumptions can easily be cast as hypotheses, so the NMFS proposal is consistent with the form that we recommend. The first hypothesis, that the February median flow approximates the flow that maximizes effective spawning habitat, would be much easier to test than the second.

The NMFS criterion is more conservative than the 60% of mean annual flow standard proposed by SWRCB staff, and as noted above a more conservative approach is appropriate. Given the status of salmon and steelhead in the Russian River basin, and the absence of a realistic recovery plan, it is reasonable to maintain maximum spawning habitat in tributaries that do or could support these fishes, until good evidence is developed to show that less spawning habitat is required. This is particularly appropriate for an approach that is intended to allow for use of negative declarations under CEQA,.

NMFS also proposes that the cumulative diversion at any point on a stream not exceed 20% of the "winter 20% exceedence flow," following a procedure outlined at p. 28 in their comments, for which "winter" means December 15 to March 15. As noted above, there seemed to be convergence towards this approach in discussion at the workshop, and with the caveat noted

[8] We are also concerned by the statement at the end of Section 5 in Attachment A of the Staff Report that the model results were more variable when it was used with rainfall and runoff data for the same period (e.g., 1961-1981 for Macama Creek). We are not sure we that understand this statement, but it raises questions in our minds about the model testing. We also do not understand why the model tends to shift peaks in the average weekly flow data forward in time, especially later in the year (Figures 5 and 6 in Attachment A to SWRCB 1997) but this raises more questions. It seems to us that the model is really more of an empirical model than a physically-based model, and that explicitly empirical regression models might do as well or better for the intended use.

above it seems reasonable to us, although we have not done independent analyses of the specific criterion. Presumably NMFS agrees with the SWRCB staff that the maximum rate for individual diversions should be determined on a case by case basis.

Trout Unlimited Proposal:

The proposal by Trout Unlimited (TU) is also described in terms of hydrology, although two of the three criteria proposed are explicitly linked to biology. As described in the 1/10/00 letter from Bill Trush to Jerry Johns, TU proposes that:

(1) "No streamflow between December 15 and March 31 should be diverted below a stage height equivalent to the 10% daily average flow exceedence (p) on an unimpaired daily average flow duration curve."

(2) By-pass flows should allow a minimum passage depth of 0.8 to 1.0 ft (which will be more restrictive than (1) in smaller watersheds).

(3) In any stream, diversions should not advance the recession of storm hydrographs to the base flow determined (1) or (2) by more than 0.5 to 2 days, depending on the size of the watershed.

According to Trush's letter of 1/10/00, criterion 1 is "...associated with an hydraulic break in the channel's hydraulic geometry and is readily identified in the field as a morphologically distinct inner channel." This is also described as the "active channel" in the McBain and Trush commentary of 3/12/98, identifiable by "(1) the lower limit of rooted mature white alders, (2) the crest of an abrupt berm along the outer margin of bars, and (3) a bench of finer alluvium along glide and riffle margins." The commentary also summarizes observations regarding use of the active channel by steelhead from Trush's graduate research (Trush 1991). Criterion (2), regarding depth of flow, would be converted to a specific discharge by means of a relationship between depth and drainage area that Trush is developing under a contract with NMFS.

A basic difficulty with the TU proposal is that criteria (1) and (2) are based upon observations that have not been described in the peer- reviewed literature, and have not been subjected to ordinary professional scrutiny. We have reviewed materials provided to us by Trush (Trush 1991, Trush undated) and find that they would not persuade a skeptical reader that there is a morphologically distinct inner channel that is corresponds to the area occupied by the 10% exceedence flow in his study area, Elder Creek. Such an inner-channel may well exist, but the evidence for it has not yet been presented effectively.. In any event, the generality of Trush's Elder Creek observations would need to be established before they would provide a reasonable basis for regulation.[9]

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[9] The active channel shelf feature identified reported by McBain and Trush (1998) and Trush (1991) has been reported from other river systems in the peer-reviewed literature. As noted in Trush (1991), Osterkamp and Hedman (1977:256) described the active channel shelf as:

> ...a short-term geomorphic feature subject to change by prevailing discharges. The upper limit is defined by a break in the relatively steep bank slope of the active channel to a more gently sloping

TU's third criterion raises an important point that should be considered before a specific total limit on diversions in the form proposed by NMFS is adopted; diversions will reduce the duration of flows greater than the by-pass standard, as well as the magnitude of such flows. With a small enough storm, a diversion could remove a flow pulse entirely, so the criterion as proposed may not be workable, but we think this point should be evaluated in some quantitative way, for example by use of the IHA software (Richter et al. 1996; 1997), as well as by visual evaluation of "with project" and "without project" hydrographs.[10]

5. **Proposed Impoundments on ephemeral streams or swales:**

For the reasons described above, the SWRCB staff should use caution and judgement in approving impoundments on ephemeral streams,[11] but in many situations this may be acceptable,

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surface beyond the channel edge. The break in slope normally coincides with the lower limit of permanent vegetation so that the two features, individually or in combination, define the active channel reference level.

While the features appear to be the same, the frequencies of inundation are reported to be rather different. From a study of channel geometry at 70 gauging stations on mostly intermittent or ephemeral streams in the semi-arid western US, Hedman and Osterkamp (1982:3-4) reported these relations between the active channel and flow regime:

> At most perennial and intermittent streams the active channel level is exposed between 75 and 94 percent of the time. The active-channel level of many ephemeral streams may be exposed more than 99 percent of the time. The stage corresponding to mean discharge of most perennial streams approximates that of the active-channel level ... but is lower than the active channel level of the highly ephemeral stream channels...

In the (perennial) Passage Creek drainage basin in Virginia, Hupp and Osterkamp (1986) found that the active channel shelf was inundated between 5-25% of the time, and supported a riparian-shrub forest.

Thus, while the association of the active channel feature with the 10% exceedence level in north coastal California channels proposed by Trush is plausible, results in the published literature suggest considerable variation in the percentage of time that the active channel shelf is inundated. Scale issues are important. As shown by Hupp (1986), as one goes headward along a drainage, features like the floodplain and then the active channel shelf disappear completely. Thus, the relevance of the 'active channel' in headwater streams needs to be confirmed before being adopted as a basis for establishing instream flows there. At the least, the applicability of the return periods and exceedence levels observed on larger channels to headwater channels is questionable. As Trush (1991) pointed out, "The case study of Elder Creek main channel morphology and steelhead spawning ecology has a sample size of one. Conclusions derived from monitoring and hypothesis testing cannot be statistically extrapolated to other drainage's or to tributaries within the Elder Creek Watershed" (p. 72).

Kondolf and Williams have observed the active channel shelf feature on many coastal California streams, but in some cases it was clearly the result of deposition of debris flow material brought in by steep tributaries. It is not clear to us why such deposits should be related to any particular point on a flow-duration curve, rather than the particular conditions existing just after the debris flow.

[10] People tend to underestimate differences represented by a pair of sloping lines because the normal distance between the lines is much easier to see than the more significant vertical and horizontal distances.
[11] We recognize that the SWRCB does not have jurisdiction over impoundments that capture "diffuse surface waters."

and in some cases it may be necessary to allow storage from diversions from larger seasonal or perennial streams. We agree with the suggestion made by CDFG during the workshop that there must be a limit to the percentage of a watershed controlled by impoundments, although there remains the question from which point to calculate this percentage. Clearly, 100% of the watershed above each impoundment will be so controlled, and the percentage will decrease moving downstream from each dam, unless there is a confluence with a more heavily regulated stream. Probably there is no rigid formula that will make sense in all cases. One possible approach would be to specify the limit in terms of a percentage of the watershed of first order streams, with recognition that there will be areas, for example swales that drain directly into second or higher order streams, to which this formula would not sensibly apply. The effects of these impoundments on high flows downstream should also be taken into account in estimates of total diversions and limits on cumulative diversions.

We recommend that impoundments only be permitted under negative declarations only when "fill and spill" operation is acceptable, so that permit compliance issues are minimized.[12] More flexibility regarding the season of diversion may also be appropriate for such cases, so that the effects of different diversions can be distributed temporally.

Additionally, we recommend a requirement that impoundments be emptied annually, for two reasons. The first and most important reason is that perennial ponds provide habitat for exotic species such as bullfrogs. The danger from these exotics far outweighs any incidental or opportunistic use of such ponds by native species, including listed natives. Secondly, a requirement that ponds be emptied will greatly facilitate compliance monitoring; a pond will either be effectively empty before the allowed season of diversion, or it will not.

6. **Minimum level of analysis:**

Even with conservative bypass standards, field investigations will always be necessary to provide the information necessary for a Negative Declaration. More importantly, the SWRCB can learn whether its permit conditions adequately protect public trust resources only if it has information regarding current conditions to which future conditions can be compared. We recommend that one set of field investigations be used for both purposes. We have reviewed the negative declarations prepared for several Navarro River and Russian River applications, and find that the level of analysis is less than is needed. Although any rigid formula for field investigations is likely to be burdensome for some cases and inadequate for others, we think a typical field investigation probably should include the following:

Reconnaissance survey: After inspecting topographic maps and recent aerial photography,[13] SWRCB staff or DFG staff should walk the channel from the project site downstream to the confluence with a substantially larger stream (unless the diversion is directly from a stream known to be easily accessible to salmonids) to detect and evaluate unusual conditions that call for special

[12] For example, we are concerned about compliance problems with by-pass conditions such as those proposed for Application No. 29711, because it appears that inflow to the impoundment will be much less than capacity in dry years, when the need for the water will be greatest.

[13] Aerial photography is readily available from commercial sources, and applicants should be required to submit images of the project area and the affected reach of stream as part of the application.

treatment. For example, a waterfall that partially blocks fish migration may make upstream diversions even of high flows problematic, since the high flows may be needed to allow passage over the barrier. We realize that securing access may be a problem, but this burden can be placed on the applicant. We do not see how a finding of no significant impact can be made if the affected reach of stream cannot be inspected.

Photodocumentation: Channel conditions should be recorded by photographs showing both typical and unusual conditions. The photographs should be annotated using notes made during the reconnaissance or other field visits.

Discharge measurements: SWRCB or CDFG staff should measure the discharge in the stream whenever they visit a project site. Even one or a few discharge measurements can provide an important check on calculated estimates of flow. If the discharge is less than about 3/4th to 1 cfs the measurement should be make using a portable flume; if it is larger, current meters should be used. Measurements made between storms during the season of diversion will be most valuable, and if possible field visits should be scheduled to allow for them.

Channel characteristics: SWRCB staff should characterize the channel geometry near the project site and downstream. This should include sketched channel transects, with dimensions estimated using a staff or tape, measurements of slope[14], and estimates of channel roughness. These should be used to estimate stage over a range of discharges, to provide a check on the plausibility of calculated estimates of flow at the site, and to provide a baseline description of the channel to allow for future assessments.[15] If there are sites such as bridges that provide convenient sites for future measurements that can show incision or aggradation, then more care should be taken in depicting the transect accurately at these sites. Channel substrate should be described, using quantitative methods such as pebble counts (Kondolf 1997) where they are appropriate..

Vegetation: Vegetation in the project area, especially riparian vegetation, should be characterized and common species should be listed. Exposed roots or drowned trees that reflect channel incision or aggradation should be recorded, as should stands of even-age riparian trees, the elevation of flood scars on riparian trees, or other features that provide evidence regarding stream processes.

Characterization of aquatic fauna: Perennial stream should be examined at least twice, once in late summer at minimum flow and once in winter when spawning salmonids are likely to be present. Seasonal streams should be examined in late winter or early spring. The wetness or dryness of the year should be taken into account.[16] Direct sampling of fish (e.g., electrofishing) should be used if possible; at the least observations should be made of the presence or absence of

[14] Adequate measurements of slope can be with a hand level in steeper streams (say >2% slope), but an auto level should be used for streams with lower slopes; the slope should be measured over a distance of at least 10 channel widths.

[15] Problems with simple before/after comparisons, described in Schmitt and Osenberg (1996), need to be kept firmly in mind, but probably there is no practical way to avoid them in the present context.

[16] Ideally, streams should be inspected twice in both wet and dry years. As an alternative, appropriately sized streams in the same area could be inspected in a space for time substitution.

fish (species if possible), presence of redds, or other evidence of fish using the steam. Presence of amphibians (adults and larvae) should also be noted. Invertebrate communities should be characterized using CDFG's rapid bioassessment procedure or some other procedure that identifies the abundances of major aquatic taxa. It is important that careful, standardized notes be taken at each note, preferably on a special form.

The success of field investigations depends critically upon the skill, experience and attitude of the investigator. No methodology, procedures, checklists or forms to fill out can substitute for the ability to "read" streams and associated landforms. Similar skills are required to assess whether the proposed diversion as constrained by the by-pass conditions makes economic sense, or whether there will be an unacceptably large motivation to cheat. Essentially this means that to be successful, the SWRCB must be able to maintain competent staff and provide for their continuing education.

In the negative declaration, the analysis of the amount of water available at the site should be reported in enough detail (probably in an appendix) to allow others to repeat the calculations, and should describe the assumptions of the method used and how well the assumptions are met at the site in question. Put differently, in order that the assumptions of the method be testable, the method used needs to be described well enough that it can be checked against discharge measurements in the stream, should such measurements be made in the future. In any event, the main body of the study should include an assessment of the likely accuracy of the reported estimates, and field conditions should be used to check the plausibility of the estimates.[17] The analysis should also include a discussion of the availability of water during severe drought as well as of a typical dry year, since the project is most likely to have a significant effect on the environment during severe droughts, and uncertainty regarding compliance with permit conditions will also be greatest.

7. Comments on monitoring and research:

Estimates of the flows that should be expected in ungaged tributaries is a major source of uncertainty that could be reduced substantially by a well-designed monitoring and research program. Developing the design for such a program is beyond the scope of this review, and should involve knowledgeable people for agencies such as the USGS, NRCS, DWR, and county or local agencies, as well as academics. The SWRCB should take the initiative in promoting the design and implementation of such a program, and it should be willing to exercise its power to re-

[17] We are concerned about the methods used in the Navarro River basin negative declarations to estimate the amount of water available at the project sites. Without data, no method will be very accurate, so it is appropriate to use a simple method. Making reasonable estimates with such methods requires considerable skill knowledge and experience with the region in question, to guide selection of parameters for the model; simply plugging in numbers for a table can lead to gross errors. It is also important that the method not be biased. The initial studies refer to the Rational Method, which is intended to predict peak flows. It is not clear to us what method was used for estimating average annual flows. Unfortunately, such methods for predicting peak flows are intended for sizing culverts or similar applications where the harm from underestimates is much greater than the harm from overestimates, so the methods are biased high. For estimating the amount of water available for appropriation, or the amount that will be left in the stream, a bias in the opposite sense is appropriate.

open existing permits to add conditions needed for implementing the program. Future permits should include requirements for collecting and reporting precipitation and flow data, although the specific requirements should be tailored to individual cases.[18]

Since making assessments of the availability of water for proposed projects is a routine part of the SWRCB's work, however, the SWRCB should have strong in-house expertise in this area. Based on the SWRCB documents that we have reviewed, this expertise is currently lacking. Therefore, we recommend that the SWRCB create a staff position at a sufficiently high level to attract an individual with demonstrated knowledge and experience in this area. This person would also represent the SWRCB in the development of the coordinated monitoring and research program described above, and participate actively in its implementation.

As with hydrological uncertainty, research and monitoring intended to address the biological uncertainties involved in assessments of the effects of water diversions should be coordinated with other efforts, if this is possible. A better understanding of the biology of coho salmon, steelhead, and the coastal streams that support them is also needed to address important issues regarding timber harvest, for example, and this understanding could best be developed by a coordinated effort. Again, scientists from various agencies and from universities should to be involved, but the SWRCB can and should work for the creation of such a coordinated program.

Four biological topics stand out as requiring particular attention for testing the hypotheses implicit in the NMFS approach to conditioning permits and for reducing uncertainty about the environmental effects of diversions with such conditions: the use of streams by coho salmon and steelhead as spawning habitat; the nature of density-dependent mortality among juvenile salmon and steelhead; the use of streams as winter rearing habitat by these fishes, and characterization of ecosystems in seasonal or small perennial streams.

Trush's (1991) observations of steelhead spawning in Elder Creek, combined with geomorphically informed attention to channel conditions, exemplify the kind of work that is needed regarding spawning habitat. These need to be repeated in other streams, however, particularly because there is now greater awareness of the importance of hyporheic flow as an aspect of salmonid spawning habitat.

Observational studies are also needed of the use of winter rearing habitat by juvenile coho and steelhead. Studies of winter habitat use by salmonids in other areas should provide conceptual models and hypotheses to be tested in coastal California, but streams here are typically warmer in the winter and this should be taken into account. Winter habitat as been identified as a factor limiting survival of juvenile coho, so this topic overlaps with the general issue of density-dependent mortality among juvenile salmon and steelhead. This is a difficult issue but strong density-dependent mortality in the fry life stage has been demonstrated in anadromous brown trout (Elliott 1994), so the assumed lack of strong density-dependent mortality underlying the NMFS proposal needs to be examined carefully.

[18] A fee to help cover costs of the monitoring program could be substituted for data collection in some cases, especially in areas for which other data are available.

Studies of the ecosystems of seasonal and small perennial streams should be guided by the conceptual models and hypotheses that are already in the literature (e.g., Gasith and Resh (1999) and Welsh et al. (2000)), but there is also a basic need for simply characterizing the biota.

8. Summary and Recommendations

1. There is substantial uncertainty regarding the conditions needed to allow recovery of coho salmon and steelhead populations in coastal watersheds in California, and regarding the flow regime needed to maintain ecosystems in small headwater streams. There is also substantial uncertainty in estimates of the expected flow in streams at project sites, and about the actual effectiveness of mitigation measures prescribed by water right permits.

2. The historical decline and current status of coho salmon and steelhead populations, the pervasive modification of aquatic habitats in coastal watersheds in California, the unknown cumulative effects of legal and illegal diversions, and the scarcity of basic data on headwater streams are sufficient reasons to justify deferring approval of any new water rights, particularly in the Russian River watershed, until information is developed that shows that the diversions can be conditioned to avoid unacceptable risk of harm to listed species or other public trust resources.

3. If SWRCB feels obligated to approve diversions from seasonal or perennial streams using negative declarations, despite incomplete knowledge of both local and cumulative impacts of the diversions, we suggest using the NMFS approach, with the addition of a separate depth criterion for smaller streams that are used by anadromous fishes, and with consideration of the effects of diversions on the duration of high flows. In doing this, the SWRCB should confront uncertainty and pursue adaptive management by:

- Basing by-pass standards and flow requirements on clearly defined objectives;
- Using biological and hydrological criteria that can expressed as testable hypotheses;
- Requiring a monitoring program that can test the hypotheses; and
- Modifying standards in light of new information.

4. Impoundments should not be approved on seasonal or perennial streams using negative declarations. Impoundments should be approved on ephemeral streams using negative declarations only where a "fill and spill" approach is acceptable, and the impoundments should be emptied annually to control exotic species, especially bullfrogs.

5. The SWRCB should work with other state, federal and local agencies and academic institutions to promote improved hydrological and biological data collection and research to reduce the uncertainties identified above, and to test the hypotheses underlying management decisions and permit conditions. The SWRCB should develop a process whereby monitoring that is intensive enough to be effective can be focused on selected sites. The SWRCB should develop greater in-house expertise in estimating flow at the sites of proposed projects.

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Attachment 1
to
Fish Bypass Flows for Coastal Watersheds

A review of proposed approaches for the State Water Resources Control Board
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Measuring and Modeling the Hydraulic Environment for Assessing Instream Flows

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Abstract

Detailed measurements of depth and velocity in natural channels, although rare, show that the velocity fields are complex and irregular even in streams with moderate gradients and gravel substrates. This complexity poses a challenge for instream flow studies, most of which use PHABSIM, a set of computer models that combine the results of hydraulic modeling, estimates of channel substrate or cover, and habitat suitability criteria to compute weighted usable area (WUA), an index of habitat. Some recent studies have replaced the transect-based one-dimensional (1-D) hydraulic modeling in PHABSIM with 2-D models that allow better definition of the depth and velocity fields in the modeled stream reach. The accuracy of the estimates as a function of channel geometry and data collection effort remains unclear, however, as does the utility of the estimates for evaluating instream flow needs. Here we review the assumptions, accuracy and precision of hydraulic modeling and of the measurements that provide input data for the models, and consider some implications of the consequent limitations of hydraulic modeling for describing fish habitat and assessing instream flows. Highly accurate hydraulic modeling seems unfeasible for streams with complex channel geometry, and in any event practical hydraulic modeling cannot resolve flow patterns at the short length scales at which fish often respond to the hydraulic environment. Information on depth, velocity, and substrate is important for assessing instream flows, but information developed from hydraulic models should be treated with great caution and is not a substitute for biological understanding.

Detailed measurements of depth and velocity in natural channels are rare, but those that do exist show that the velocity fields are complex and irregular, often with significant cross-stream components (Dietrich and Smith 1983, Petit 1987, Whiting and Dietrich 1991; Larsen 1995; Whiting 1997). This complexity in the flow patterns in natural channels poses a challenge for methods of assessing instream flows that depend upon hydraulic modeling, such as the Physical Habitat Simulation Model (PHABSIM).

PHABSIM consists of a set of computer models that combine hydraulic and biological models to evaluate the habitat value of a reach of stream for a given fish species and life stage. The weighted sum of calculated habitat values for the reach is expressed as "weighted usable area" (WUA), which is taken to represent the "living space" available for the organism; water quality and temperature are evaluated separately. PHABSIM is widely used in North America as a tool to quantify the biological effects of alternations in flow regimes or the relative habitat benefits of different flow release regimes from reservoirs (Reiser et al. 1989), and has increasingly been applied overseas as well, either directly or in modified form (Jowett 1989; Pouilly et al. 1995). PHABSIM has even been used to evaluate the instream flow needs of blue ducks (*Hymenolaimus malacorhynchos*), which forage for invertebrates in steep, boulder-bedded upland streams of New Zealand (Collier and Wakelin 1996). However, the hydraulic and biological aspects of PHABSIM have also been the subject of continuing criticism (e.g., Marthur et al. 1985; Shrivell 1986, 1994; Osborne et al. 1988; Gan and McMahon 1990; Elliott 1994; Castleberry et al. 1996; Ghanem et al. 1996; Heggenes 1996; Williams 1996; Lamouroux et al. 1998).

In this paper, we consider the adequacy of hydraulic models in general, and PHABSIM in particular, for making predictions of the depth and velocity fields in natural rivers that are useful for assessing instream flows. We begin with data from the literature that demonstrate the complexity of the depth and velocity fields in natural steams. We then consider the sampling and measurement problems associated with developing data for modeling the flow fields in natural channels, or for describing the flow fields empirically . We next consider modeling approaches, given practical restrictions on data collection. Finally, we consider some biological aspects of the problem, and offer some recommendations. We confine ourselves to the problem of estimating the habitat value of a stream for a single species and life stage of fish, although we recognize the inadequacy of that perspective for real environmental protection. We do not consider recently reported hydrologically-based methods for assessing instream flow regimes (Richter et al. 1996, Richter et al. 1997); these appear promising, but do not explicitly link physical characteristics of channels to flows or biological habitats.

Depth and Velocity Fields in Natural Streams

The data of Whiting and Dietrich (1991) illustrate the complexity of patterns in natural channels. They took detailed measurements on Solfatara Creek, a 5-m-wide gravel bed stream, draining 62 km^2 in Yellowstone National Park, Wyoming. The 20 m-long study reach was located downstream of a bend, where the creek flows over and around a mid-channel bar; the substrate is coarse sand to medium gravel, and the average channel slope is 0.001 (Figure 1). Measurements were made at about one-third bankfull stage, using an array of small current meters suspended from a portable wooden bridge, across eleven cross sections spaced 2 m apart.

Although the stream appears relatively tranquil at this discharge, the velocity field is quite complex (Figure 2), displaying large variations vertically and horizontally within a given section, as well as between closely spaced sections. The large variation in channel form and velocity distributions from one section to the next, despite the close spacing of the sections, illustrates the spatial sampling problems inherent in any transect-based methods for evaluating instream flows. Results would vary substantially depending on the precise location of transects. Spatial sampling problems would be even more severe in steeper streams with larger substrate.

The measured velocity fields show that vertical velocity profiles often deviate substantially from the logarithmic profile commonly assumed (Figure 2), as has been noted elsewhere (e.g., Dingman 1989, Beebe 1996); in particular, the highest velocities are sometimes near the bed (e.g., cross sections 1 and 2). This implies that measurements of velocity at 0.6 depth may give only an approximation of the true column velocity. To illustrate this point, we obtained data for eight of the sections or transects shown in Figure 2 (not all data are available because of a storage media failure) and compared the vertically averaged velocity computed from measurements spaced 5 cm or less apart with the velocity at 0.6 depth (Figure 3). The velocity at 0.6 depth overestimates the vertically averaged velocity in most cases (the median difference is about +6%), but underestimates the vertically averaged velocity by almost 60% at some verticals in Section 10, where the flow deepens after passing over a mid-channel bar. In steep streams with large roughness elements, flow patterns would be even more complex. It may be possible to model the spatially averaged vertical velocity gradient in such streams (Wiberg and Smith 1991), but only if the stream is straight and the roughness elements are distributed approximately randomly, i.e., not organized into bars. These conditions are fairly restrictive, and as is often noted in discussions of instream flows, fish do not live in averages.

Details of the flow can vary in important ways even where general patterns are similar. This is illustrated in Sections 1-4, which have approximately the same shape and general lateral distributions of velocity, with higher velocity in the deeper part of the channel. Yet, the velocity gradients are quite different in Sections 1 and 2 compared to Sections 3 and 4. At Sections 1 and 2, the vertical gradient is almost nonexistent near the outside of the bend, but then becomes very steep under the high velocity core, which is near the bottom. Such steep gradients do not occur at Sections 3 and 4. If velocity gradients are important for fish, as indicated by the literature (e.g., Jenkins 1969; Bachman 1984; Heggenes 1994, 1996), then such differences would be important, but would remain undetected without detailed measurements of velocity and bed topography.

Note that the change in channel shape with distance downstream forces significant changes in the velocity field, termed convective accelerations. This has implications for modeling, because one-dimensional (1-D) models ignore convective accelerations.

Velocity Measurement in Streams:

For each cross section or transect measured at Solfatara Creek, Whiting and Dietrich took an average of 160 point velocity measurements, each a time-average over two minutes, requiring 8-10 hours to complete. In most practical applications, it is not possible to spend 8-10 hours per transect to measure velocity. PHABSIM procedures are typically modeled after the standard procedures of the US Geological Survey for measuring velocity in discharge measurements near stream gauges, described in Rantz et al. (1982).

Velocity is measured at 20-30 stations across the channel by wading or from a cable or bridge, using a Price AA current meter or the smaller mini current meter, consisting of cups that spin around a vertical axis in response to moving water. For depths less than 0.8 m, velocity is measured at 0.6 depth (i.e., 40% of the vertical distance from the bed to the water surface), which is assumed to reflect the mean column velocity. In deeper flow, the average of measurements at 0.8 depth and 0.2 depth is taken as reflecting the mean column velocity. The mean column velocities for each point are multiplied by the measured water depth and by the width of the vertical slice of the cross section represented by this measurement, to obtain the discharge for that vertical slice. The discharges for the individual "verticals" are summed to obtain the total discharge past the cross section.

To obtain a good measurement of flow, the hydrographer measures the stream by wading when possible, selecting the cross section with the most uniform flow conditions available on the channel, i.e., with flow lines that are parallel and that do not vary downstream. The hydrographer will often "improve the [measurement] cross section by removing rocks and debris within the section and in the reach of channel immediately upstream and downstream from the section," or by constructing "... temporary dikes to eliminate slack water...", all in an effort to transform flow conditions in the irregular natural channel into more uniform flow conditions (Rantz et al. 1982). Each measurement is rated as excellent, good, fair, or poor, with assumed error margins of 3%, 5%, 8%, or >8%, respectively, assigned based on the hydrographer's judgement (Rantz et al. 1982).

Ratings of "excellent" are uncommon in natural streams, despite the hydrographer's freedom to select the most uniform reach available and to modify channel geometry. The reaches selected for discharge measurements are probably not the preferred habitats for fish, or at least they are not typically the sites where anglers would look for fish. In essence, the hydrographer seeks the reach of channel that most closely resembles a canal. Highly irregular channels with shallow marginal areas, back eddies, still water, or boulder beds, which may be important as fish habitats, are sites that a hydrographer would avoid for flow measurement (unless the stream offered nothing better) because the resulting measurement would be poor.

Sources of Error in Measurements

Errors in point measurement of depth are usually small. At some locations the depth of flowing water can fluctuate by several centimeters at constant discharge, but this can be detected by reasonably careful observation of the section. Errors in estimating the average depth of a vertical are most likely to be sampling errors, especially when the cross section is irregularly shaped or the substrate is coarse. These conditions should be obvious, especially when measurements are made by wading, and with reasonable care a good estimate should be possible.

Potential sources of error in velocity measurements include the inherent limits of accuracy of the meter in registering downstream current velocity, temporal variations in velocity at a point, vertical and cross sectional components of velocity, and sampling errors within each vertical. Instrument errors associated with measuring unidirectional flow with Price meters are relatively minor; in the controlled environment of a tow tank, Carter and Anderson (1963) found that Price meters register within 0.6% of the actual downstream velocity. However, these meters were in excellent condition; poorly maintained meters, or meters clogged with sediment or organic debris, would not perform so well.

Replicate discharge measurements in rivers using Price and Ott current meters (a screw-type meter) were found to differ by up to 2.8% in total discharge (Carter and Anderson 1963). Agreement between the two meters seems acceptable, although the actual differences in point velocity measurements not reported. However, PHABSIM studies often use Marsh-McBirney current meters, which use the distribution of pressure around a rounded sensor to estimate velocity. This is conceptually attractive, and Marsh-McBirney meters can provide instantaneous or time-averaged readings of velocity. Manufacturer's specifications for the Marsh-McBirney meter state the accuracy as +/- 2% of reading, with a +/- 0.05 ft/s offset. Although one Marsh-McBirney meter performed well in initial tests by the US Geological Survey (Fulford et al. 1994), subsequent tests with a number of meters showed variable performance, under- and over-registering low velocities (Janice Fulford, US Geological Survey, pers. comm. 1998). In our experience the meters can be unstable and require frequent calibration, and after informal field comparisons with a Price current meter we are skeptical of data collected with Marsh-McBirney meters.

The vertical and cross-channel components of velocity are not well captured in the standard US Geological Survey flow measurement. The Price AA meter does not measure flow direction. Although any cross-channel flow can be accounted for using the hydrographer's estimate of the angle of approach, the existence of cross-channel flow at a vertical indicates a complex flow structure, so that one or two measurements may give a poor estimate of the spatially averaged velocity in the vertical. The Price meter is also affected by vertical velocity components in steep, turbulent channels but cannot measure them separately from the downstream components (Townsend and Blust 1960, Linsley et al. 1982). The velocities recorded in such channels may be greater than the true downstream velocities (Marchand et al. 1984). A modified Price meter that has solid cups composed of a polycarbonate polymer (The PAA meter) initially appeared to be less affected by vertical velocity components than the standard AA meter with stainless steel cups (Marchand et al. 1984), but subsequent experience has shown the polymer cups less accurate than the original stainless steel cups (R. Jarrett, U.S. Geological Survey, pers. comm. 1998).

There can be considerable temporal variation in velocity at a point in a stream, particularly one with a rough bed. The standard US Geological Survey approach is to take the velocity measurement over at least 40 seconds. Carter and Anderson (1963) took measurements continuously for an hour in 23 different rivers, at four different depths. They recorded data every 15 seconds, which allowed them to calculate the deviations of velocity measured over shorter intervals around the one-hour average (Figure 4). Although there are some problems with these data, they show that sampling errors are still significant at 40 seconds. Errors are also greater near the bed, where "focal point" velocity measurements are often made. Thus, the 40-second rule reflects a compromise between the gain in accuracy from averaging over a longer period and the cost of the additional time required. However, this compromise was developed for discharge measurements, where random errors in individual measurements tend to average out over the transect. In PHABSIM, measurements are not averaged over the transect, and it is not clear that the same compromise is appropriate. Moreover, the data are from reaches selected for discharge measurements, and greater temporal variation should be expected in reaches with more complex geometry.

Spatial sampling errors within each vertical will depend on the complexity of the flow field. In canal-like sections, the spatial sampling errors are small enough to allow good or excellent discharge measurements. In a complex flow field, however, even for a relatively tranquil stream such as that illustrated in Figures 1 and 2, the spatial sampling errors in estimating the average velocity of a vertical from one or two velocity measurements can be substantial.

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Commonly, the discharge during a PHABSIM study is assumed to be known from a nearby gage, and if the total flow calculated by summing the individual PHABSIM measurements differs from the "known" discharge, the individual velocity measurements are adjusted by "velocity adjustment factors," which are percentage changes applied equally to all the measurements across the channel (Milhous et al. 1984). Although this adjustment may account for systematic errors, it does nothing to change the distribution of sampling and measurement errors across the channel.

In summary, instrument errors with well-maintained and properly used Price or Ott current meters are likely to be small, relative to temporal and spatial sampling errors. Figure 4 provides some guidance regarding temporal sampling errors. Although the figure probably underestimates the magnitude of the errors for transects with complex flow patterns, a similar decrease in the sampling error with increased measurement time can be expected. With standard methods, spatial sampling errors are probably as large or larger than temporal sampling errors. Herschy (1978) provides for a more detailed discussion of measurement errors at sites selected for discharge measurements, and gives "rules of thumb" for estimating 95% confidence intervals around measurements at such sites (Table 1). Unfortunately, there have been too few detailed studies of the flow field in natural channels to allow quantitative generalizations about measurement errors in channel reaches more typical of those to which PHABSIM is applied, rather than those selected by hydrographers for discharge measurements. For the conditions of most instream flow studies, however, we believe that the errors in estimating the average velocity of verticals by the standard methods will be large enough to affect ultimate results, so the ordinary scientific practice of estimating errors by appropriate repetitive measurements should be followed.

Modeling Flow in Natural Streams:

One-dimensional models:

One-dimensional (1-D) models typically treat the river as a series of cross sections, for each of which a stage and cross-sectionally averaged velocity are computed based on hydraulic principles, the channel form, and calculated values of stage and velocity at downstream cross sections. Probably the best-known 1-D model is HEC-2, or HEC-RAS, which is widely used for predicting flood levels. WSP, a similar 1-D gradually varied flow model, is an option for modeling stage in PHABSIM (Milhous et al. 1984).

One-dimensional models typically assume that the channel is straight, with all flow perpendicular to the cross section, and that flow is either "uniform" or "gradually varied". Uniform flow does not change in the downstream direction, and therefore has a vertical velocity profile that reflects a balance between the acceleration of gravity and the resistance of the channel bed. These conditions can occur in canals, but generally not in natural streams. "Gradually varied" flow occurs where channel topography and roughness change only slowly along the channel, so that convective accelerations can be ignored.

These are large assumptions, and while reasonable approximations of river stage are routinely obtained with these models if they are used with adequate skill and professional judgement, by definition they can provide only cross-sectionally averaged velocity. Moreover, gradually-varied flow models are commonly used for predicting flood stage during high flows. During such high flows, variations in the bed topography may be relatively less important; for example, hydrologists speak of riffles being "drowned out" at bankfull stage and higher. Whiting (1997) has shown that convective accelerations are less important at higher flows in Solfatara Creek. Instream flow assessments, however, are typically concerned with the lower magnitude flows in which fish spend most of their time. These flows are too low to modify the bed, so they occupy a channel geometry inherited from past high flows. Downstream changes in channel geometry that are small relative to high flows may be large relative to low flows, as when low flow spills over a longitudinal bar, so that the assumption of gradually varied flow is violated, as noted by Osborne et al. (1988). As a result, a model that gives reasonable estimates of stage in a channel at high flows may fail to do so at low flows.

PHABSIM is concerned with the distribution of velocity and depth across the channel, so the hydraulic models in PHABSIM divide the cross section into vertical slices (cells) either centered on or between point measurements of velocity (much as is done in the USGS discharge measurements). The vertical cells are analyzed separately, using either a regression analysis of measurements of velocity in the cell at different stages, or a back-calculation of Manning's n from a single velocity measurement (Milhous et al. 1989). The latter approach has been properly criticized by Shirvell (1986), and more recently by Ghanem et al. (1996), who point out that the cells are no longer tied to one another through hydrodynamic principles. On this account, Ghanem et al.(1998) describe the velocity modeling in PHABSIM as "zero-dimensional". With the single measurement approach, the Manning's roughness factor is used to calculate velocity and discharge for each cell at other discharges, but the individual cell discharges are adjusted to equal the modeled flow, so the roughness factor is really a weighting factor rather than a true roughness coefficient. With the multiple measurement approach, there is a problem with obtaining the required three velocities for verticals near the bank, which may be dry at the lower measured discharges (Ghanem et al. 1996).

Errors associated with the PHABSIM approach to distributing velocity across channels were investigated by Bartz (1990), as part of a broader assessment of PHABSIM, using data from the US Fish and Wildlife Service for three streams spanning a flow range of two orders of magnitude. For each stream, he calibrated different PHABSIM hydraulic models to data at three flows, and for each vertical compared the measured and modeled velocities. The averages and standard deviations of the differences are substantial, as illustrated by data for the medium-sized stream (Figure 5): mean errors ranged from 4.6% to 12.8% and standard deviations ranged from 29.6% to 42.7%. Results for the small and large stream are similar.

Two-dimensional Models:

Two-dimensional (2-D) models are increasingly being used for instream flow studies (e.g., LeClerc et al.1995, Ghanem et al. 1996). Two-dimensional models require the simultaneous solution of a system of governing equations, typically including relationships (expressed as differential equations) for conservation of fluid mass, conservation of downstream fluid momentum, and conservation of cross-stream fluid momentum. To simplify these relationships, certain approximations are assumed, yielding the "shallow water equations". These 2-D velocity models give only vertically-integrated velocities, but show the variation in cross-stream direction as well as in the downstream direction.

These models retain the convective acceleration terms neglected by 1-D models, but require more detailed descriptions of channel geometry, and the accuracy of the modeled results depends upon the accuracy and spatial resolution of the measurements (Leclerc et al. 1995, Ghanem et al. 1996). For example, Leclerc et al. (1995) constructed a computer representation of the bed of a large stream by measuring the bed elevation with one measurement for every 50 to 400 m^2, so their results are necessarily generalized accordingly.

However, with detailed specification of the channel bed topography and planform, more sophisticated modeling may not be necessary. One-dimensional models are not all the same, and in some settings 1-D models can be as accurate for simulating vertically integrated velocity fields as a 2-D approach. Dietrich (1987) modeled flow in Muddy Creek, Wyoming, for geomorphic purposes, with a 1-D approach that explicitly accounted for the effect of channel curvature, and predicted the distribution of velocity across the transects. Larsen (1995) applied the same 1-D approach, and compared observed velocity patterns on two gravel-and-cobble-bedded meandering rivers. He showed that, with good bed topography as input, the 1-D model performed as well as more sophisticated models. However, understanding the appropriateness and limitations of a model seems critical. For example, it is unlikely that the excellent results achieved by Dietrich (1987) and Larsen (1995) could be achieved in a straight channel with irregular bed topography, such as the reach of Solfatara Creek studied by Whiting and Dietrich (1991), for which a 2-D model that accounted for convective accelerations would be more appropriate.

Statistical Hydraulic Models

Following a suggestion by Dingman (1989), Lamouroux et al. (1995) developed an empirical model that predicts the statistical distribution of hydraulic variables (such as velocity and water depth) for reaches with intermediate and large roughness elements, for which they believe the conventional deterministic models are ineffective. The model predicts the distributions of the hydraulic variables over an entire reach based on inputs of discharge, mean width and depth, and roughness. Lamouroux et al. (1998) coupled this hydraulic model with multivariate habitat use models to estimate the habitat value of a reach as a function of discharge. The need for validation is perhaps more obvious with such straightforwardly empirical models, which is a virtue.

Model Validation:

Models by nature involve simplifications of reality, and model predictions always involve some error. For hydraulic modeling of fish habitat, the errors can arise from measurement errors, from model errors, or from sampling errors. With the standard 1-D versions of PHABSIM, one should ask how accurately depth and velocity were measured at the selected points on the transects, how well the model predicts depth and velocity at the selected points at other discharges, how well the selected points represent the verticals or cells, and how well the selected transects represent the stream.

In practical applications, it is important that the likely errors in model predications be estimated. This is typically done by "model validation," in which model predictions are compared with measured data different from those used to develop or calibrate the model. (Oreskes et al. (1994) have pointed out that this is not really validation, but we will use this common term for the process.) Lamouroux et al. (1995) present graphical comparisons of measured and predicted velocity distributions, although they acknowledge that their procedure is not strictly correct. Aceituno and Hampton (1988) compared the distributions of point measurements of depth and velocity separately with comparable distributions from PHABSIM verticals, but did not consider their joint distributions or estimates of WUA. Unfortunately, these examples are exceptions. Typically, validation is not even discussed, although validation for PHABSIM predictions seems particularly important; PHABSIM offers users a wide variety of options that can produce a wide range of results, so there is a danger that options may be selected consciously or unconsciously to produce a desired result (Bartz 1990; Gan and McMahon 1990).

The proper form of the validation will depend on the conceptual model underlying the PHABSIM modeling. As originally developed, the conceptual model for PHABSIM assumed that data from the transects applied half-way up or down stream to the next transect (Bovee 1982; Thomas and Bovee 1993). In other words, the stream is divided into horizontal cells, each of which is represented by measurements at one point on the transect. With this conceptual model, validation could simply involve measuring the depth, velocity and substrate at random points in the study reach at various discharges, and comparing these with the values assigned to the point by PHABSIM. It is important that the validation include the habitat variables and not just WUA, so that "correct" estimates of WUA that result from offsetting errors are revealed.

Recently, some PHABSIM users have used a different conceptual model in which transect data are treated as samples, stratified by habitat types, rather than as representing specific areas of the channel (e.g., CDFG 1991). The details of the validation would then depend on the details of the sampling scheme, but the basic process remains the same; model predictions of the joint distributions of depth, velocity, and substrate must be compared with independent data. Provided that transect sites are selected randomly, they would provide an unbiased estimate of conditions in the study reach, so that models could be validated at the transects, and the streamwise spatial sampling errors could be estimated separately using statistical methods such as bootstrapping (Williams 1996). Since the PHABSIM hydraulic models cannot be calibrated for the more turbulent areas of many streams, however, the condition of randomly located transects is difficult to meet in PHABSIM studies, and validating the model with data from randomly located points seems more appropriate. As with any statistic developed by sampling, estimates of WUA should be reported with standard errors or confidence intervals, so that decision makers are informed of the uncertainty associated with the estimates (Castleberry et al. 1996).

Application of Models to Aquatic Habitat

Since our discussion of habitat models is in the context of their application to evaluating habitat for a particular species and life stage of fish, the most relevant question is whether such models can capture aspects of the hydraulic environment that are most important to the organism in question. In some cases, the answer is clearly no. For example, chinook salmon select spawning sites on the basis of subsurface flow, as well as depth, velocity, and substrate (Healey 1991, Vyverberg et al. 1997), so a model that does not address subsurface flow will be seriously incomplete in its evaluation of habitat for spawning chinook salmon.

More generally, we argue that fish often respond to features in their hydraulic environments such as velocity gradients over small length scales. For example, trout may hold in the flow separation zone downstream of a boulder, as described for a Pennsylvania stream by Bachman (1984, p. 9):

> Typically, foraging sites were in front of submerged rocks, or on top of but on the downward-sloping rear surface of a rock. From there the fish had an unobstructed view of oncoming drift. While a wild brown trout was in such a site, its tail beat frequency was minimal, indicating that little effort was required to maintain a stationary position even though the current only millimeters overhead was as high as 60 to 70 cm/second. Most brown trout could be found in one of several such sites

day after day, and it was not uncommon to find a fish using many of the same sites for three consecutive years.

Contrast the precise positioning of this trout in the hydraulic environment (within millimeters of a steep vertical velocity gradient) with the detail that can be resolved in hydraulic models. Even with 2-Dflow models, the resolution is scaled by flow depths (Ghanem et al. 1996), and cannot account for vertical velocity gradients. The best that can be done is to patch on some estimated average velocity gradient, and as should be evident from Figure 2, this would give only a crude approximation. Accordingly, there is a discontinuity in the spatial scale at which it seems feasible to model the hydraulic environment, and the spatial scales at which fishes often respond to it. This seems particularly true for fishes that hold near steep velocity gradients, such as near the bed of the stream, boulders, or logs.

At best, practical modeling of the hydraulic environment for determining instream flows involves estimating the distributions or joint distributions of depth and velocity over sizable areas. Where the channel conditions are sufficiently uniform that this can be done with reasonable accuracy, this information would obviously be useful for thinking about the effects of discharge on fish habitat. If such information can be developed by mapping (Collings 1972) or by an empirical approach (Lamouroux 1995) it will be similarly useful. However, values of hydraulic variables averaged over sizable areas should not be confused with the local values to which fish and other organisms often respond (Railsback 1999; Bult et al. 1999). To combine hydraulic model results, which are accurate only on a coarse scale, with habitat preference or suitability data collected on a much finer scale, raises troubling questions about meaning. PHABSIM estimates of weighted usable area result, in effect, from multiplying biological apples by hydraulic oranges.

Railsback (1999) proposes dealing with this problem of scale mismatch by developing suitability data from observations in cells with a spatial scale comparable to the resolution of the hydraulic modeling. This raises another set of problems. If the cells are small then occupancy of each cell may be affected by occupancy of adjacent cells, as wells as by hydraulic factors, and collection of enough hydraulic data for modeling any sizable length of stream will be difficult and expensive. If the cells are large, then describing the cell by a single index for depth, velocity, and index is dubious, and the biological meaning of weighted usable area is compromised.

Conclusions

Flow fields in natural channels are complex, and it is not feasible to model this complexity for any length of channel at the finer length scales to which fish often respond. We believe that a more modest approach to using hydraulic models for instream flow assessments is appropriate. In many streams, 2-D modeling may produce reasonable estimates of the amount of habitat with given combinations of depth and average velocity, and in other streams this can probably be estimated empirically. This is important information that any of us would want to use if we were charged with making decisions about instream flows, if it can be obtained without taking up too much of the available funding.

We suggest, however, that it is prudent to leave the hydraulic and biological inquiries as separate and distinct tasks, in part because this helps avoid the appearance of models providing answers, rather than aids to thought. We suspect that the best way to evaluate the importance of hydrologic conditions for a particular fish is to have a good understanding of the way that the fish uses the hydraulic environment, the kind of understanding that is developed by careful observational studies such as Jenkins (1969), Bachman (1984), or Nielsen (1992), and especially from long-term studies such as those on Carnation Creek in British Columbia (Hartman et al. 1995), or Brows Beck in England (Elliott 1994).

Such evaluations involve use of professional judgement in considering data from hydraulic modeling or mapping, and can be criticized as subjective. However, modeling gives only an illusion of objectivity. Modeling always involves simplifying assumptions. Therefore, judgement goes into deciding just what and how to model, and good judgement requires knowledge of both the model and the thing being modeled. Models are not a substitute for knowledge and experience. Whether a model is good or bad depends upon the purpose to which it is put. For simulating depth and velocity, different models are appropriate for different kinds of channels and for different scales of resolution. However, all models have limitations. For simulating a particular reach of stream, the proper use of any model requires consideration of the statistical problems arising from sampling and measurement errors, and appropriate validation.

Acknowledgements

We thank Peter Whiting for providing us with the Solfatera Creek data and photograph, and Nicolas Lamouroux, Robert Jarrett, and Janice Fulford for helpful discussions of various topics.

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EXHIBIT 7

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DRAFT

Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams

(An update of the May 22, 2000 Guidelines)

California Department of Fish and Game

and the

National Marine Fisheries Service

June 17, 2002

(Errata note, dated 8-19-02)

California Department of Fish and Game
1416 Ninth Street
Sacramento, California 95814

National Marine Fisheries Service
Southwest Region
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National Marine Fisheries Service

777 Sonoma Avenue, Room 325

Santa Rosa, California 95404

June 17, 2002

Mr. Ed Anton, Chief
State Water Resources Control Board
P.O. Box 2000
Sacramento, California 95812

Dear Mr. Anton:

In May 2000, DFG and NMFS distributed draft guidelines for maintaining instream flows to protect fisheries resources downstream of water diversions in mid-California coastal streams. These guidelines provided bypass flow recommendations and measures for protecting natural hydrographs that were reviewed and supported by peer review (Moyle et al. 2000). Previously permitted on-stream reservoirs have limited the ability of the SWRCB to use the guideline component concerned with avoiding cumulative impacts. Subsequent analysis and discussions by SWRCB, DFG, and NMFS staff have resulted in an alternative approach for conserving natural hydrographs and assessing cumulative impacts of multiple water projects. This method, which has been adopted by SWRCB staff, involves computation of a Cumulative Flow Impairment Index (CFII).

Although DFG, NMFS, and SWRCB environmental staff are in agreement on the application of this new method, there has been no clear written description of this procedure. Furthermore, the relationship of this procedure to DFG/NMFS guidelines for water diversions has been unstated. For that reason, we have updated DFG/NMFS May 22, 2000 guidelines to include use of the CFII method for conserving natural stream hydrographs and addressing the issue of cumulative impacts. Enclosed are six copies of these updated draft guidelines.

We greatly appreciate the efforts of SWRCB staff in helping to develop components of these guidelines. We look forward to continued opportunities for the State Water Resources Control Board and our agencies to cooperate in the conservation of listed species. If you have any questions or comments concerning the guidelines, contact Dr. William Hearn (NMFS) at (707) 575-6062 or Ms. Linda Hanson (DFG) at (707) 944-5562.

Sincerely,

Mr. James Bybee
NMFS Habitat Manager
Northern California

Mr. Robert W. Floerke, Regional Manager
Department of Fish & Game
Central Coast Region

TABLE OF CONTENTS

ERRATA

These guidelines were initially distributed to the California State Water Resources Control Board on June 17, 2002. Copies were then widely distributed to interested parties. A minor error and inconsistency in the guidelines was subsequently detected. For clarification the following error and intended correction is noted:

On page 7, in paragraph 2 under Section II-B-Item 5 (Protection of the Natural Hydrograph and Avoidance of Cumulative Impacts), Line 16 and Line 18 incorrectly provide a season of October 1 to March 31 for computations of unimpaired runoff. Consistent with Appendix A, the correct season for computation of unimpaired runoff is December 15 to March 31.

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Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams

1. INTRODUCTION

The California Department of Fish and Game (DFG) and the National Marine Fisheries Service (NMFS) jointly developed draft guidelines for diverting water from central-coastal watersheds in California. Those guidelines, which were dated May 22, 2000, were developed in response to concern that current practices for issuing water rights were not adequate to protect and recover anadromous salmonids in coastal watersheds. These watersheds are often highly regulated, extensively developed and subject to significant levels of impairment. Depletion and storage of stream flows have significantly altered natural hydrological cycles and adversely affected aquatic habitats and resources. Reduced flows also interrupt invertebrate drift, disrupt channel dynamics, increase deposition of fine sediments, inhibit recruitment of spawning gravels, and promote encroachment of riparian and non-endemic vegetation into spawning and rearing areas.

The May 22, 2000 guidelines were developed pursuant to respective agency mandates and missions to protect and restore anadromous salmonids and their habitats. These guidelines provide standard recommended protective terms and conditions to be followed in the absence of site-specific, biological, and hydrologic assessments. The guidelines call for limiting new water right permits to diversions during the winter period (December 15-March 31) when stream flows are generally high. Minimum bypass flows and cumulative maximum rates of diversion are recommended to ensure that streams are adequately protected from new winter diversions. The guidelines also recommend that, except for limited circumstances, storage ponds should be constructed off-stream, rather than on-stream. Water diversions should also be screened using NMFS or DFG screening criteria, and fish passage facilities should be provided where appropriate.

The May 22, 2000 guidelines recommended that conservation of the natural hydrograph and avoidance of significant cumulative impacts could be accomplished by limiting the cumulative maximum rate of diversion from a watershed. The recommended cumulative maximum rate of diversion is equivalent to 15% of the "winter 20% exceedence flow" at the point of diversion. Following its distribution, the State Water Resources Control Board (SWRCB) staff stated that the DFG/NMFS guideline element for protecting the natural hydrograph and limiting cumulative impacts to salmonids was impractical, because many existing, legal storage ponds store 100% of a stream's runoff while they are filling. Therefore, on-stream ponds inherently exceed any maximum rate of diversion, at least temporarily. Rather than adopt a quantitative procedure to address this problem, SWRCB proposed an alternative approach for protecting the natural hydrograph and limiting cumulative impacts of numerous diversions. That alternative approach, described in SWRCB (2001), limits cumulative impacts and conserves the natural hydrograph by limiting the maximum cumulative volume of water that can be diverted in a watershed. Similar to the maximum rate of diversion, this maximum cumulative volume guideline is recommended for projects for which there has been insufficient site-specific, biological assessment of instream flow needs to protect fisheries. DFG and NMFS accept the reasonableness of this alternative "cumulative volume" approach to limiting cumulative impacts. Therefore, this update of the May 22, 2000 guidelines provides a technical description of the calculations required for this alternative method (see Appendix A). This update also reflects a minor change to the May 22, 2000 guidelines by noting that protecting spawning habitat for salmonids is largely achieved through conservation of the natural hydrograph. Except for these two changes, this update of the DFG/NMFS guidelines for maintaining instream flows in Mid-California coastal streams is unchanged from the May 22, 2000 draft guidelines.

These guidelines are recommended for use by permitting agencies, planning agencies and water resource development interests when taking proposed actions that would divert or act to reduce stream flows in California's mid-coastal watersheds containing anadromous salmonids. These guidelines do not constitute a final agency action for purposes of the National Environmental Policy Act or the California Environmental Quality Act. Nor do these guidelines define, or authorize take for purposes of State or Federal Endangered Species Acts. Rather, the guidelines are intended to preserve a level of flow that ensures that anadromous salmonids will not be adversely impacted by diversions. Altering stream flows outside these guidelines may impact salmonids by: blocking and/or delaying migration; reducing usable habitat; impacting habitat quality; stranding fish; entraining fish into poorly screened or unscreened diversions; and increased juvenile mortality resulting from increased water temperatures.

These joint guidelines are organized in two parts. The first, (*Terms and Conditions to be Incorporated into Water Rights Permits for Small Diversions)* consists of specific terms and conditions to be incorporated into water rights permits, issued by the State Water Resources Control Board (SWRCB) for small diversions where adequate site-specific biological data are not available. The guidelines were developed based on the biology and ecology of anadromous salmonids and their habitat requirements. The second part of these guidelines (*Implementation and Effectiveness Monitoring*) is programmatic in nature, addressing watershed-level initiatives necessary to ensure that the standards and protocols are consistent with conserving salmonids and their habitats.

The following guidelines are not developed for use in areas outside of the identified mid-coastal region. NMFS and DFG may develop similar guidelines for other regions of California in the future. Those guidelines should be based on anadromous salmonid habitat requirements, hydrologic characteristics, and other specific factors for those

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areas.

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II. TERMS AND CONDITIONS TO BE INCORPORATED INTO WATER RIGHTS PERMITS FOR SMALL DIVERSIONS

1. Diversions > 3 cfs or > 200 acre-feet

For diversions larger than 3 cfs or greater than 200 acre-feet from streams in watersheds that currently or historically contained anadromous salmonids, water right permit applicants must consult with the NMFS and DFG to plan and conduct a site specific study for the purpose of determining appropriate flow related terms and conditions to be incorporated into the permitted water right. The study plan should include, at a minimum, the following:

1) A habitat based stream needs assessment that incorporates habitat, species, and life history criteria specific to each diverted stream or stream reach;

2) An evaluation of the existing level of impairment (diversion) and limiting factors for salmonid restoration based upon habitat, species, and life history specific criteria for each diverted stream or stream reach;

3) A specific proposal to provide periodic channel maintenance and flushing flows that are representative of the natural hydrograph; and

4) A plan to monitor the effectiveness of stipulated flows and procedures for making subsequent modifications, if necessary.

2. Small Diversions <3 cfs and <200 acre-feet

1) Geographic Limitations

For small diversions less than or equal to 3 cfs and less than or equal to 200 acre-feet, default guidelines have been developed for coastal watersheds from the Mattole River to San Francisco, and for coastal streams entering northern San Pablo Bay. This area generally includes streams within California's Mendocino, Sonoma, Marin, and Napa Counties, as well as a few coastal streams in Humboldt County south of the Eel River. The default guidelines are based on the hydrology and life history requirements of resident anadromous salmonids in this area. For streams within this area, the default guidelines may be incorporated into the terms and conditions of a permitted water right, in lieu of results from site-specific biological studies.

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For coastal streams north of the Mattole River or coastal watersheds to the south of San Francisco, DFG and NMFS have yet to develop detailed default guidelines for maintaining stream flows to protect fisheries resources downstream from water diversions. However, until such guidelines are developed, these agencies recommend that, in the absence of site-specific studies, in watersheds north of the Mattole River or south of San Francisco: 1) the diversion season for new water rights permits should be limited to the period of seasonal "high-flows", 2) additional on-stream reservoirs should not be constructed or permitted unless consistent with the exemptions provisions described below, 3) sufficient minimum bypass flows should be maintained to protect fisheries resources, 4) the cumulative maximum rate of withdrawal should be limited to maintain a near natural hydrograph and avoid cumulative impacts, 5) adequate passage and protection measures must be provided to facilitate instream movements of fishes and avoid entrainment in diversion intakes, and 6) the applicant should describe the project specific mechanism(s) that adequately ensure compliance with diversion limits. For coastal watersheds north of the Mattole River or south of San Francisco, default guidelines for the bounds of the diversion season, minimum bypass flows, and cumulative maximum rates of withdrawal have yet to be determined. Until detailed guidelines are available for diversions in these watersheds, applicants seeking diversion permits for those areas should consult with DFG and NMFS for stream flow recommendations.

2) Seasonal Limits on Additional Diversions:

The diversion season will be limited to the period December 15 to March 31. From April 1 to December 14 instantaneous inflow to the point of diversion must equal the instantaneous outflow to downstream reaches past the point of diversion.

Justification: In its water rights proceedings for the Russian River, Navarro River, and Napa River watersheds, the SWRCB has found that new water diversions should be confined to the period December 15 to March 31. This period is the time of highest winter flow and the time when water withdrawals would be least likely to adversely affect fisheries resources. Additional water withdrawals between April 1 and mid-May may adversely affect anadromous salmonids, because flows generally subside during that time, and juveniles typically emigrate during the higher flow events in that period. Additional water withdrawals between May 1 and October 1 may adversely affect salmonids, because rainfall in north-central coastal streams is minimal during that period, and diversions during that time would probably reduce the availability of already limited habitat for juvenile salmonids. Additional water withdrawals between September 1 and December 15 may unnecessarily affect salmonids, because that is a time when flows are relatively low, and high flows are infrequent and sporadic.

3) No Additional Permitting of Small On-stream Reservoirs:

Water diversion projects requiring new permits should avoid construction or maintenance of on-stream dams and reservoirs, including existing unpermitted storage ponds. Thus, storage must be to an off-stream reservoir. Exceptions are provided for special circumstances involving Class III streams as defined by 14 CCR 916, riparian management regulations for protecting watercourses and lake protection zones (see Exemptions below).

Justification: On-stream reservoirs should be prohibited, because they 1) eliminate, within the reservoir footprint, free-flowing stream habitat that may either support listed salmonids or the production of riffle-dwelling aquatic invertebrates that serve as food sources for downstream fishes (Corrarino and Brusven 1983; Resh and Rosenberg 1984; Keup 1988), 2) eliminate or reduce the magnitude and frequency of naturally occurring intermediate and high flows necessary for natural channel maintenance processes, 3) trap coarse bedload material and impede bedload transport, 4) act as barriers to migrating fishes, and 5) provide habitat for non-native aquatic species (*e.g.*, bullfrogs).

4) Maintenance of Minimum Bypass Flows:

Provide bypass flow regimes that adequately protect salmonids and aquatic resources in reaches downstream from the point of diversion. The determination of the bypass flow's adequacy can be based on site specific biological investigations conducted in consultation with NMFS and DFG, or in the absence of site-specific data, it would be not less than the estimated unimpaired February median flow at the point of diversion.

Justification: The unimpaired February median flow guideline is based partly on the observation that (at relatively low to moderate flows) available spawning and incubation habitat is generally positively correlated with discharge, but that naturally higher flows must be sustained for a substantial period of time in order to have "effective spawning and incubation habitat". The February median flow is a conservatively high

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bypass flow because it conserves "typical" winter flows to which native fishes are adapted. February is generally the wettest month in the 4-county area, and therefore the long-term February median flow is a hydrologic metric that permits diversions only during the higher flows of winter. This is appropriate given uncertainties regarding site specific flow needs for numerous aquatic biological processes (including both invertebrate and vertebrate production). However, it must be recognized that a minimum bypass flow equivalent to the February median does not protect all stream functions including channel maintenance flows, migratory flows in headwaters, and in many small watersheds, spawning flows for salmonids. To protect these latter functions it is necessary to protect the natural hydrograph as described in Item 5 below. The unimpaired February median flow can be estimated using a modification of the SWRCB Stream Simulation model for the Russian River Watershed Region or comparable hydrologic analytical techniques.

5) Protection of the Natural Hydrograph and Avoidance of Cumulative Impacts:

The diversion will be operated with a maximum rate of withdrawal that preserves a natural hydrograph with no appreciable diminishment (<5%) in the frequency and magnitude of unimpaired high flows necessary for channel maintenance (e.g., unimpaired flows with a recurrence interval of 1.5 or 2 years). The diversion will also not appreciably reduce the frequency and magnitude of unimpaired moderate and high flows (*e.g.*, flows higher than median February) used by migrating and spawning fishes in small streams. Unless there is compelling site-specific biological and hydrologic information indicating that additional water can be diverted without adversely impacting anadromous salmonids, diversions should not be permitted or otherwise sanctioned if 1) the cumulative maximum rate of instantaneous withdrawal at the point of diversion exceeds a flow rate equivalent to 15% of the estimated "winter 20% exceedence flow" OR 2) the total cumulative volume of water to be diverted from the stream at historical points of anadromy exceeds 10% of the unimpaired runoff between October 1 and March 31 during normal water years. For projects contributing to a cumulative diversion of 5 to 10% of the normal unimpaired runoff between October 1 and March 31, hydrologic analysis must demonstrate that the project will not cause or exacerbate significant adverse cumulative effects to migration and spawning flows for salmonids. The "winter 20% exceedence flow" is the 20% exceedence value of the stream's daily average flow duration curve for the period December 15 to March 31. Cumulative reduction refers to the effects of this and other permitted or licensed projects as well as diversions under riparian rights.

Justification: Natural, periodic, intermediate and high flows should be maintained downstream of diversion sites (Barinaga 1996; Poff et al. 1997). High flows are essential for 1) cleansing fine sediments from coarse substrates, 2) removing encroaching vegetation and contributing to the deposition of instream woody cover, and 3) serving as cues for and facilitating the migratory movements of fishes. Protection of intermediate and high flows during winter months must be accomplished through an assessment of cumulative impacts and placing limits on the cumulative rate of instantaneous water withdrawals from the stream, or on the total volume of water diverted. A discussion of the need for and rationale for limiting cumulative maximum instantaneous withdrawals to a portion of the "winter 20% exceedence flow" in northern coastal California streams is provided in NMFS (2000). Procedures for assessing cumulative impacts of water diversions based on the cumulative total volume of diverted water are described in Addendum A.

6) <u>Fish Passage and Protection Measures</u>:

The potential effect of stream flow diversions on upstream and downstream movements of anadromous salmonids must be addressed. If anadromous salmonids have the likely potential to ascend the stream to the point of diversion, then adequate passage facilities and screening at the diversion intake must be provided. Screening must be in accordance with NMFS and DFG's screening criteria.

Justification: Diversion structures and instream reservoirs may block fishes from reaching their natal spawning areas. Diversion structures also have the potential to entrain fishes, with resulting mortality.

7) **<u>Special circumstances allowing onstream reservoirs</u>:**

If a proposed diversion is located 1) in a stream reach where fishes or non-fish aquatic species were not historically present upstream, <u>and</u> 2) where the project could not contribute to a <u>cumulative</u> reduction of more than 10% of the natural instantaneous flow in any reach where fish are at least seasonally present, <u>and</u> 3) where the project would not cause the dewatering of any fishless stream reach supporting non-fish aquatic species, then no stream flow or fish passage protection measures are required. By cumulative reduction we refer to the effects of this and other permitted or licensed projects as well as diversions under riparian rights. For diversion sites meeting the above three criteria, on-stream reservoirs

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may be permitted.

Justification: The need for the above instream flow and fish protection measures is dependent upon the quality of the stream at the diversion site. Instream diversions and on-stream reservoirs on a limited number of ephemeral headwater streams naturally without fish or other aquatic species (*i.e.*, Class 3 streams, under 14 CCR 916) will not significantly impact fisheries resources, if the flows of streams with fishes (*i.e.*, Class 1 streams, under 14 CCR 916) are not reduced by more than10% from unimpaired levels. Exemptions under the above criteria will enable water users to develop small on-stream reservoirs while ensuring that stream reaches containing fishes (either year-round or seasonally) will not have additional on-stream dams or stream flows reduced more than 10% from unimpaired levels. Stream reaches containing aquatic species without fishes (*i.e,* Class 2 streams, under 14 CCR 916), will not be dewatered. These exemptions are consistent with allocating water for beneficial uses and protecting fishery resources.

8) Quantify All Water Rights of Applicant

To facilitate assessment of stream diversion impacts to fisheries, the applicant must identify all other basis of rights (appropriative, riparian, adobe, pre-1914), in streams potentially affected by the proposed diversion.

Justification: The determinations of maximum rate of withdrawal and potential impacts of cumulative withdrawals require information concerning all water withdrawals within the impacted watershed. Records concerning existing water rights are limited. Applicants seeking additional appropriative rights should provide known information concerning their diversion activities within the affected watershed.

9) Compliance and Monitoring Measures:

Prior to issuance of permit, the applicant must identify, to the satisfaction of NMFS, DFG, and the SWRCB the mechanism(s) that assure that the bypass flows will be maintained and rates of diversion will not be exceeded at the project. The applicant will provide a description of mechanism(s) for assuring bypass flows and rates of diversion to the SWRCB. The SWRCB will provide this information to NMFS and DFG for review and comment. Diversion projects will provide DFG personnel access to all points of diversion and places of use for the purpose of conducting routine and or random monitoring and compliance inspections.

However, the responsibility for ensuring compliance and enforcement of water rights issued by the SWRCB and/or any other permit or regulatory instrument that approves or allows water diversion or causes reduction in stream flows, rests with that permitting agency.

Justification: In order to protect anadromous salmonid habitat, mechanisms must be provided to ensure that bypass flows and constraints on diversion rates are maintained. Mechanisms to verify compliance with permit conditions may vary and be dependent on site-specific conditions. The determination of the specific mechanisms for assuring compliance with the diversion guidelines is the responsibility of the applicant and subject to approval by NMFS, DFG, and SWRCB.

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III COMPLIANCE AND EFFECTIVENESS MONITORING

Inherent in the application of this, as well as any other, instream flow standard setting technique is the need for effectiveness monitoring to address and corroborate assumptions used in developing the flow standard. In addition, a prerequisite for reasonable flow allocation and habitat protection, is an accounting of existing diversions and enforcement of unpermitted diversions. It is essential, if instream resources are to be protected and over-allocation is to be avoided, that an accurate evaluation of all existing diversions be conducted prior to the issuance of any new water rights permits. Therefore, DFG and NMFS recommend the following initiatives:

1) Program to Verify Effectiveness and Refine the Flow Standard as Necessary

The SWRCB, DFG, and NMFS will cooperate in the development and implementation of an evaluation plan to monitor the effectiveness of flow standards being applied in the water rights process. This program should include specific monitoring activities to determine whether the standard provides a consistent and protective level of salmonid habitat conservation for streams of various size, order, elevation and geomorphic characteristics. The effectiveness monitoring program should also contain a protocol for making any refinements to the flow standard, as necessary to mitigate adverse affects on anadromous salmonid resources and their habitats.

2) Compliance and Enforcement Program

A compliance and enforcement program should be developed. This program should include flow gaging and routine, random compliance inspections. This program should be focused on a watershed approach and include the installation of stream flow gaging and recording devices at key locations within each stream basin for determining compliance with bypass flow requirements and current level of impairment. In addition, a separate schedule for routine, random compliance inspections should be developed for each watershed, based upon the level of impairment and sensitivity of anadromous salmonid habitat. As part of this program the SWRCB should require applicants to develop and implement measures that will ensure compliance with the bypass terms. The plans should specify measuring and recording devices and bypass facilities to be installed, the criteria for operation of the reservoir, and other measures that will be taken by the applicant to confirm compliance with permit terms. DFG and NMFS encouragė water rights permit applicants to install "passive" bypass facilities (*i.e.*, facilities that will automatically bypass flows without any action by the permittee) whenever feasible. The plan should also include a measure for documenting that facilities have been installed and are being maintained.

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3) Preventing Stream Over-Allocation

In order to prevent the over-allocation of anadromous salmonid streams by new diversions and to identify those streams currently over-allocated, it is necessary to document actual and potential levels of impairment. Prior to issuance of any new water rights the SWRCB should provide an evaluation and comprehensive accounting of all diversions currently in place including a disclosure of all basis of right in effect on the stream to be diverted and quantify the total maximum volume and maximum rate of withdrawal possible at any given time including rights not fully and/or currently exercised. The results of this evaluation should be compared on a month by month basis to the estimated unimpaired hydrograph to ensure that sufficient flow remains in the stream to provide a sufficient minimum bypass flow to protect salmonids in downstream reaches. Further, that the maximum cumulative rate of withdrawal from proposed and existing diversions will not appreciably diminish the natural hydrograph (<5%) in the frequency and magnitude of unimpaired high flows necessary for channel maintenance and will not appreciably reduce the frequency and magnitude of unimpaired moderate and high flows (*e.g.*, flows higher than median February) used by migrating and spawning fishes.

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Addendum A

Procedures for assessing cumulative impacts of water diversions based on the cumulative total volume of diverted water

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Procedures for assessing cumulative impacts of water diversions based on the cumulative total volume of diverted water

Determination of water availability:

Before issuing any new Water Rights permits, the State Water Resources Control Board (SWRCB) must first determine whether water is available for diversion. This determination is achieved through a Water Availability Analysis (WAA). Among other things, the WAA must estimate expected unimpaired stream flow (the natural flow without diversions) at the diversion site. In addition, it must then consider the water that has already been allocated to existing water rights holders (both riparian and senior appropriative) and the water that is required for the protection of public trust resources.

Requirements for resource protection based on potential cumulative impacts:

Minimum bypass flows must be maintained to ensure that threatened and endangered salmonid species are protected. At the same time, additional mechanisms must be employed to conserve intermediate and high flows (*i.e.*, maintaining a near natural hydrograph) so that other life history requirements of these species are met (see guidelines section for justification).

In the central coastal counties (Napa, Marin, Sonoma, and Mendocino), near natural hydrographs can be preserved by 1) limiting cumulative maximum instantaneous rates of withdrawal consistent with the DFG and NMFS guidelines (*i.e.*, 15% of the "winter 20% exceedence flow"), or 2) by limiting the cumulative volume of water diverted from the watershed. The guidelines section of this document addresses preserving the natural hydrograph using the "maximum instantaneous rate of withdrawal" approach. This addendum describes an alternative "volumetric" cumulative impact assessment method based on the total volume of water being diverted.

An analysis of site-specific flow requirements of anadromous salmonids in many western streams indicates that in small watersheds the optimal flows for spawning are variable, and often higher than the long-term, unimpaired February median flow (Hatfield and Bruce 2000). Hydrologic analysis indicates that adequate spawning flows, and near natural hydrographs, are generally maintained when the natural volume of winter runoff is impaired (*i.e.*, reduced) by less than 10% (SWRCB unpublished data). Spawning habitat for anadromous salmonids can be adversely affected by diverting more than 10% of winter runoff. Cumulative diversions of even 5 to 10% of annual runoff can also impact spawning habitats if the diversions reduce stream flows to minimum levels for several days during critical spawning periods in early winter.

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Determining the Cumulative Flow Impairment Index (CFII):

To evaluate the potential cumulative effects of water diversions using a "volumetric" approach, the volume of water that is naturally available must be compared with the total volume of water that is, or can be, legally diverted from the watershed through existing water rights. The potential level of impairment to stream flow caused by these cumulative diversions can be evaluated by calculating the Cumulative Flow Impairment Index (CFII), as follows:

$$\text{CFII} = \frac{\text{Cumulative Diverted Volume (CDV)}}{\text{Estimated Unimpaired Runoff (EUR)}}$$

where,

CDV = potential volume of water diverted under all bases of right between October 1 and March 31 in a normal water year (in AF)

EUR = estimated volume of surface flow in the stream passing the point of interest between December 15 and March 31 in a normal water year (in AF)

Calculating the Cumulative Diverted Volume portion of the equation (Impaired flow):

The Cumulative Diverted Volume (CDV) is the volume of water diverted under all water rights potentially affecting the stream flow at a given Point of Interest (Points of Interest are discussed in more detail below). An October 1 to March 31 season is used to calculate the CDV because it reflects the season of diversion for many existing permits. Therefore, use of the CDV season facilitates a more accurate assessment of the cumulative effect of authorized diversions upon flows within a watershed. Calculations of the CDV must include all existing legal diversions (including pre-1914 rights, riparian rights, small domestic and stockpond registrations, and other appropriative rights) together with the proposed project under consideration for a new water right. The computation of CDV is done for average (*i.e.*, normal) water years.

If a portion of the direct or riparian diversion is highly unlikely to occur during most or all of the CDV season, then that portion of the volume of riparian or direct diversion may be discounted when computing the CDV. This is appropriate in situations with year-round water rights that are typically not exercised during the winter months (*e.g.*, when irrigation of a particular crop does not occur during wet winter months). However, riparian diversions for frost protection must be included when calculating CDV. All computations

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of CDV must be accompanied by a list of the diversions used in the calculation. The list must also include: 1) the season of diversion, 2) the potential maximum instantaneous rate of diversion, 3) the potential maximum volume of diversion, 4) the existing water rights excluded from the computations, and 5) any other assumptions related to the calculations for each diversion listed.

Calculating the Estimated Unimpaired Runoff portion of the equation (Unimpaired flow):

The Estimated Unimpaired Runoff (EUR) is calculated for the high flow (winter) season from December 15 to March 31. This season represents the period during which it is assumed that some water may still be available for diversion without additional environmental impact. All computations must be done using standard hydrologic techniques that may include prorating known gauge data, application of precipitation runoff models, or other accepted methods. Calculations of EUR (unimpaired flow) will be accompanied with descriptions of computational methods, input data, data sources, and assumptions sufficient for reviewers to fully understand and replicate the results. As with the CDV, these computations are done for average (*i.e.*, normal) water years.

Locations requiring CFII calculations for a project:

A CFII is typically calculated for several Points of Interest (POI's) within the watershed. Generally a POI is calculated at the Point of Diversion (POD) and then again for points immediately downstream at each confluence of a major intervening tributary between the project site and the mainstem of coastal rivers. In the case of small mainstem coastal streams (*e.g.*, Sonoma Creek), points of interest extend to the stream's estuary.

The location of the Points of Interest requiring CFII values will be determined by DFG and NMFS staff. To ensure consistency, POI's will be provided directly by NMFS and DFG to SWRCB staff for dissemination to Applicants, their consultants, and other interested parties.

Level of potential cumulative impact based on the CFII calculations:

The level of impairment identified by the CFII will determine the likely study effort needed to address the significance of cumulative impacts of the new water right project.

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- If the CFII is greater than 10%, then there is a reasonable likelihood of significant cumulative impacts. When the CFII is greater than 10%, site specific studies will be required to assess impacts and the water right permit Applicant is referred to NMFS and DFG for the scoping of site-specific fisheries studies to assess these impacts.

- When the CFII is between 5 and 10%, the Applicant must provide additional hydrologic analysis documenting the estimated effects of cumulative diversions on the stream hydrograph at the POI's during three representative normal and two representative dry years. If the natural hydrograph is appreciably impaired during the migratory and spawning period of anadromous salmonid species, additional site specific study may be warranted.

- If the CFII is less than 5%, there is little chance of significant cumulative impacts due to the diversion and the project does not require additional studies to assess these impacts.

Scope and purpose of site specific studies:

Site-specific studies prompted by a CFII greater than 10% (or when there is an appreciable impairment of the hydrograph on projects with CFII between 5-10%) are performed to establish terms and conditions that ensure that habitats for anadromous salmonids are not further degraded. For most projects, three issues need to be addressed:

1) What are the cumulative effects of this and other projects on channel maintenance (flushing) flows needed to protect geomorphological processes downstream from the project site? Does the project under consideration contribute to a significant adverse effect on flushing flows needed to maintain the stream channel and avoid exacerbating stream sedimentation? Does the project affect the timing of the opening or closure of estuarine mouths with sand bars?

2) What minimum bypass flow and maximum instantaneous rate of withdrawal are needed for the project to protect spawning habitat for anadromous salmonids downstream from the project site?

3) What minimum bypass flow and maximum instantaneous rate of withdrawal are needed for the project to facilitate migratory movements of anadromous salmonids downstream from the diversion site(s)?

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The Applicant should consult with NMFS and DFG concerning the scope and methods of site-specific studies to address these issues. Performance of site-specific studies does not guarantee that stream flow terms and conditions will be consistent with an economically viable project.

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EXHIBIT 8

Dennis Jackson - Hydrologist
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July 31, 2003

Stephen Velyvis
Law Offices of Thomas N. Lippe
329 Bryant Street, Suite 3D
San Francisco, CA 94107

re: CFII for Napa Valley Country Club Diversion, Application NO A031358

Dear Stephen Velyvis,

The Cumulative Flow Impairment Index (CFII) is calculated by dividing the "face value" of the water rights within the subject watershed, prorated to the "demand season", by the winter season flow. At a May 1, 2003 workshop, the National Marine Fisheries Service (NMFS) set the "demand season" to the period October 1 through March 31 and the winter flow season to December 15 through March 31.

The Table 1 lists the water rights in the Sarco Creek drainage. The Table 1 also shows the demand prorated to the October 1 to March 31 demand season. The direct diversion of 3 cfs for Arcadia Vineyards, Application S008874, has no defined diversion seasons listed in the State Water Resources Control Board's database. A conversation with Mary Lisa of the Division of Water Rights revealed that S008874 was a statement of riparian use with a maximum diversion rate of 4,160 gallons per minute (9.27 cfs) and a total maximum diversion of 20 acre-feet per year. The total demand, including the 30 acre-feet requested under A031358, for the October 1 through March 31 period for Sarco Creek is 408.8 acre-feet.

The average annual winter season flow for Sarco Creek, from December 15 through March 31, was estimated from neighboring USGS gaging station records. Sarco Creek lies between the Milliken Creek and Tulacay watersheds. Sarco Creek joins Milliken Creek just upstream of its confluence with the Napa River. The Milliken Creek watershed is adjacent to and north of the Sarco Creek watershed. The Tulucay Creek watershed is adjacent to and lies to the south of Sarco Creek.

Table 2 summarizes the USGS station information, including the average total discharge from 12/15 through 3/31. Table 2 also gives the total water rights as of July 2000 for both the Tulucay and Milliken Creek watersheds.

Table 3 gives the total winter discharge (12/15 through 3/31) for the water-years 1971 to 1983. The total winter discharge, for the Milliken and Tulucay gaging stations, was calculated from the daily discharge values obtained from the USGS web site.

Table 2 shows that Milliken Creek has a 24% higher winter discharge (12/15 through 3/31) per square mile than Tulucay Creek. The Milliken Creek unit-winter-discharge (Ac-ft per square mile) is 764.2 Ac-Ft/sq-mi. The Tulacay Creek unit-winter-discharge is 616.3 Ac-Ft/sq-mi. The higher winter discharge per square mile of Milliken Creek is due to the fact that the Milliken Creek watershed extends up a ridge on

Table 1. Water Rights for Sarco Creek as of July 2000.

Total Demand for the October 1 to March 31 period = 408.8 Acre-Feet

Application #	Permit #	Permit Date	License #	License Date	Primary Contact Owner	Max. Direct Diversion	Maximum Storage And Annual Use Acre-Feet	Diversion Season	Direct Diversion Prorated to Demand Season Acre-Feet	Diversion to Storage Prorated to Demand Season Acre-Feet
A024456A	17238A	4/17/1985	13152	5/24/1995	ARCADIA VINEYARDS LLC		41	11-1 to 5-15		31.54
A024647	16868	3/28/1977	11308	2/1/1983	GORDON M PHILLIPS		1.6	11-1 to 3-1		1.60
A024994	17226	3/30/1978	11558	6/1/1984	JOHN A VAN HOFWEGEN		1.5	11-1 to 4-1		1.49
A026918	18634	12/3/1982	12241	2/9/1988	HAROLD G NICKEL		33	11-1 to 5-15		25.38
A027026	18490	4/21/1982	13245	5/24/1996	TIMOTHY DARRIN 1986 TRUST		4.7	10-1 to 5-15		3.76
A027151	18572	8/25/1982			JERRY LINSTAD		10	11-1 to 3-15		10.00
A027834	19092	1/24/1984	12711	3/22/1991	JOHN A VAN HOFWEGEN		3	11-1 to 4-1		2.98
A029017	20314	3/17/1989			NAPA VALLEY COUNTRY CLUB		98	9-1 to 6-1		64.97
A030303	20811	11/6/1995			NAPA VALLEY COUNTRY CLUB		189	9-1 to 6-1		125.31
A030753					TERRENCE A BORGE		20	12-15 to 3-31		20.00
C001144			1144	2/13/1980	MONTICELLO MINING, MILLING & MFG		4.6	11-1 to 5-1		3.81
S012480					LOUISE DUNLAP	1000 GPD	0	1-1 to 12-31	0.003	0
S014389					JERRY LINSTAD		10	6-1 to 10-31	0	2.04
A026649	18684	12/29/1982			EST OF PETER A GASSER		45	11-1 to 5-30	0	32.14
S008874					ARCADIA VINEYARDS LLC	3 CFS	0		20	0
A020451	13604	7/3/1962	8175	6/5/1967	BAPTIST GENERAL CONFERENCE FOUNDATION		8	11-1 to 5-1		6.63
A022533	15259	1/6/1967	8980	2/11/1969	BAPTIST GENERAL CONFERENCE FOUNDATION		1.5	11-1 to 5-1		1.24
D030864R			442R	6/8/1999	JAMES HUNTINGTON		6	11-1 to 5-14		4.64
A017315	10909	10/23/1957	6168	2/15/1961	VICTOR E CHIARELLA		20	11-15 to 5-1		16.29
D31354R				9/5/2002	Dale Miller		5	12-1 to 4-1		4.96
A031358					NAPA VALLEY COUNTRY CLUB		30	12-15 to 3-31		30
						Totals =	531.9		20.003	388.78

Table 2. Summary of the USGS gaging station records used to estimate the average winter discharge for Sarco Creek.

Station name:	Milliken C Nr Napa	Tulucay C At Napa Ca	Sarco Creek
Station number:	11458100	11458350	
latitude (ddmmss)	382019	381709	
longitude (dddmmss)	1221606	1221629	
drainage area (square miles)	17.3	12.6	8.19
Begin Record	10/1/1970	10/1/1971	
End Record	9/30/1983	9/30/1983	
Years of Record	13	12	
Total 12/15 through 3/31 Discharge, Ac-Ft	13,221	7,765	
Unit Winter Discharge per Sq-mile, Ac-Ft/Sq-mi	764.2	616.3	
Diversion to Storage, Ac-Ft	3,855.4	403.5	408.8
Direct Diversion, cfs	11.976	0.526	
Highest Point, feet above sea level	2,627	1,686	1,877
Estimated Winter Discharge for Sarco Creek, Ac-Ft			**5,050**

Table 3. The total winter discharge (12/15 through 3/31) for the Milliken and Tulucay gaging stations. The totals are based on the daily discharge record obtained from the USGS web site.

Water Year	Milliken Creek Total Winter Discharge Acre-Feet	Tulucay Creek Total Winter Discharge Acre-Feet
1971	6,142	
1972	1,663	961
1973	23,631	11,199
1974	15,024	6,339
1975	12,538	5,046
1976	654	190
1977	321	160
1978	20,409	10,977
1979	6,621	7,499
1980	20,723	13,483
1981	1,644	1,995
1982	28,205	16,236
1983	34,304	19,099
No. Years	13	12
Average	13,221	7,765

the flank of Atlas Peak. The ridge which extends down from Atlas Peak to form the watershed divide of Milliken Creek has an elevation of 2,627 feet. This ridge is 940 higher than any point in the Tulucay watershed and 750 feet higher than any point in the Sarco Creek watershed. In general, locations with higher elevations receive more rainfall. Table 2 also shows that the highest elevation in the Tulucay watershed is only 191 feet lower than the highest elevation in the Sarco Creek watershed. Therefore, it appears reasonable to assume that the average annual rainfall of the Sarco and Tulucay watersheds are similar.

The average winter discharge for the Milliken Creek stream gage is24% higher than the average winter discharge for the Tulucay gage, even though the City of Napa operates a water supply reservoir upstream of the gage with a 2,000 Ac-ft water right. The unimpaired average winter discharge for Milliken Creek would be higher than the winter discharge reported by the USGS stream gage.

An estimate of the degree of impairment can be obtained for the Milliken and Tulucay Creek gaging stations by using the data in Table 2 to calculate the CFII for each gage. This is only a rough calculation intended as a guide for deciding on how to best estimate the average winter flow in Sarco Creek, therefore, no attempt is made to adjust the demand (water rights) listed in Table 2 to the October 1 through March 31 period.

The CFII for Milliken Creek = (3,855 Ac-ft diversion)/(13,221 Ac-ft discharge) = 29%.

The CFII for Tulucay Creek = (403 Ac-ft diversion)/(7,765 Ac-ft discharge) = 5.2%

The CFII of 29% for Milliken Creek shows that the winter discharge has been significantly impaired. Therefore, it would be inappropriate to use the winter discharge data from Milliken Creek to estimate the winter discharge for Sarco Creek. On the other hand, the rough CFII for Tulucay Creek is just over 5% indicating that the winter discharge of Tulucay Creek might be somewhat impaired. However, the winter discharge record for Tulucay Creek is much less impaired than the winter discharge record for Milliken Creek. Given the lower level of impairment and the approximate equality of the elevation of the highest point in the watershed it appears that the unit-winter-discharge (Ac-ft/sq-mi) for Tulucay Creek will provide a reasonable estimate of the unit-winter-discharge for Sarco Creek.

The unit-winter-discharge for Tulucay Creek is 616.3 Ac-ft/sq-mi. The watershed area of Sarco Creek is 8.19 square-miles. Multiplying 616.3 Ac-ft/sq-mi by 8.19 sq-mi yields an estimate of **5,050 Ac-ft** for the total average winter discharge (12/15 through 3/31) from Sarco Creek.

The CFII is the Demand/Winter Discharge. So, the CFII = 408.8/5,050 = 8.09%. Values of the CFII that fall between 5% and 10% indicate that a more detailed analysis is needed according to the Division of Water Rights staff report entitled: **Assessing Site Specific and Cumulative Impacts on Anadromous Fishery Resources in Coastal Watersheds in Northern California January 23, 2001.**

The above CFII calculation includes the 30 acre-feet requested by the Napa Valley Country Club under A031358. The CFII without including the diversion proposed under A031358 is 7.5% = 378.8/5050. This indicates that there already is a potential for cumulative impacts in the Sarco watershed without even considering the diversion proposed under A031358.

Sincerely Yours,

Dennis Jackson

Dennis Jackson
Hydrologist

EXHIBIT 9

((

State Water Resources Control Board
Division of Water Rights
Staff Report

Assessing Site Specific and Cumulative Impacts on
Anadromous Fishery Resources in Coastal Watersheds in Northern California
January 23, 2001

Listed below are several factors that are to be evaluated when determining if water development projects have the potential to cause significant effects to the anadromous fishery in Northern California coastal watersheds. These factors will be evaluated for both proposed diversions and existing unauthorized diversions seeking water right permits. The importance of these factors are discussed in detail in reports prepared by State Water Resources Control Board (SWRCB) staff (1) and the National Marine Fisheries Service (NMFS) (2). These factors are to be applied to minor projects as defined by the California Water Code section 1348. (An application not in excess of 3 cfs by direct diversion or in excess of 200 acre feet of storage is considered a minor project). The area specifically evaluated for these factors was the Coastal watersheds (including those tributary San Francisco and San Pablo Bays in the counties of Mendocino, Sonoma, Marin and Napa. These factors with appropriate modification could be applied to areas coastal south of these counties with additional information from State and Federal Fishery agencies.

Migration Barriers

Onstream reservoirs have the potential to block fish passage and negatively affect stream processes needed to maintain healthy habitats for salmonids (e.g., gravel recruitment). The California Department of Fish and Game (DFG) and the NMFS suggest that no existing, unauthorized onstream reservoirs should be permitted and no approvals should be granted for new onstream reservoirs (3). Division staff believes that any project that has blocked or proposes to block spawning migration routes has the potential of causing significant adverse effects on anadromous fishery resources. In order for the Division to continue processing proposed projects that block anadromous fishery migration routes preparation of a detailed environmental review will be required as part of the initial study. The review will either a.) demonstrate that the project will not have a significant adverse effect upon the fishery; or, b.) if there is a significant adverse effect on the fishery. If significant effects are likely, then an Environmental Impact Report (EIR) will be required and the SWRCB will adopt a statement of overriding consideration for those effects that cannot be mitigated and the project is approved. The applicant will be responsible for all costs associated with the preparation of the EIR. The Division will continue to encourage applicants to design their projects for offstream storage.

In most cases existing, unauthorized diversions that block spawning migration routes will require extensive modification to allow for fish migration or they may be required to be removed. During the permit review process, existing unauthorized diversions that have the potential to cause adverse impacts to the anadromous fishery will be treated the same as new proposed onstream projects. Existing permitted conditions (i.e. current environmental conditions that result from the legally permitted aspects of existing projects) will typically be used for the CEQA baseline for evaluation of impacts of the project. If existing unauthorized projects have caused significant environmental impacts from this baseline, the preparation of an EIR will typically be required if the project proponent wishes to proceed with the water rights process. (The SWRCB has allowed some exceptions under CEQA for ongoing projects that have not expanded water use since 1973 when CEQA was amended to apply to private projects.

Season of Diversion

The 1997 Russian River Staff Report (1) proposed a season of diversion, of December 15 to March 31, based primarily upon hydrologic analysis and life stage evaluation of the anadromous fish species present to avoid adverse environmental impacts. The DFG and NMFS have concurred with this proposed restriction on the season of diversion (3). The peer review of the SWRCB proposal agreed that the season of 12/15 to 3/31 is appropriate for avoiding significant effects on salmonid species (4). Division staff recommends that the restricted season of diversion of December 15 to March 31 be used to prevent further effects on salmonid species during the critical spring, summer, and fall months. The season of diversion for coastal stream projects south of San Francisco Bay will be modified to reflect the run-off patterns and the life stages of anadromous fish in these areas. This modification will be done after contacting the State and federal fishery agencies for their recommendations.

DFG and NMFS recommend that the instantaneous inflow at the point of diversion equal instantaneous outflow to downstream reaches past the point of diversion outside of the diversion season (3). Under the State's water right process, water projects are typically allowed to regulated water for up to 30 days before it is considered storage, thus allowing projects to modify peak flows outside the storage season without violating their water right permit. This 30-day average regulation of flow is a concern for the fishery agencies. Their objectives are to require the natural flow of the stream to be bypassed as it occurs, and for this flow to not be modified by the project outside of the season of diversion and storage. Also, the project should be required to bypass all the flow that occurs during the season of diversion once the project has appropriated the amount authorized. For small impoundment's, this would require flow bypass facilities sized to bypass the instantaneous flows. Instantaneous flows can be quite large and sizing bypass facilities to accommodate such flows can be difficult and in some cases infeasible. Division staff agrees that bypassing flows as they occur is the preferable method of operation for new water rights to the extent this is feasible. However, the Division will evaluate the need for this condition for individual water right applications including existing unauthorized diversions. For existing projects, diversion facilities may have to be retrofit to accommodate these concerns.

During the diversion season, the fishery agencies request that the rate of diversion also be limited. The maximum rate of diversion for direct diversion projects is specified in the water right permit. However, this maximum rate often reflects an average over a period of days. SWRCB standard term 27 allows the averaging of the rate of diversions over 7 days for domestic use, 14 days for hydroelectric power and 30 days for all others uses provided such averaging would not interfere with other rights or conditions protecting instream beneficial uses. The fishery agencies would like standard term 27 to be used only when necessary. In addition, instantaneous maximum diversion rate for off stream storage should be used for off-stream storage projects (see standard permit term 5j).

Bypass Flow

Bypass stream flows for the protection of fish and fish habitat have been proposed by the SWRCB (1), NMFS (2) and Mcbain and Trush (6). These proposals were evaluated by a Peer Review Group during 2000 at the request of the SWRCB (4). Due to the uncertainty of setting bypass flows, the Peer Review group recommended using the unimpaired February median flow to establish a bypass flow instead of the 60% of the average annual flow described in the Russian River Report (1) or the 70% of the 1.5-year annual maximum flood event presented by Trout Unlimited (6). The February median flow is often twice that of the 60% of the average annual unimpaired flow, but does vary from watershed to watershed especially in central and south coastal watershed. Division staff believes that even with a higher bypass requirement, sufficient water is typically available for appropriation during the diversion season in many areas. Division staff now recommends using the February median as the bypass flow where needed to protect fish habitat or provide appropriate contributions to fish habitat downstream.

For areas high in the watershed, substantially removed from anadromous fish locations and sustainable habitat for other fish species, the bypass requirements will be based on protection of riparian habitat areas rather than fish habitat.

In small perennial streams where anadromous fish are continuously present, a depth criterion may be appropriate where the median February flow does not provide adequate habitat to protect anadromous fish directly below the point of diversion. Environmental Unit staff or environmental consultant, in cooperation with DFG staff, will be responsible for the determination of when a depth criteria is applicable and for determining the instream flow required to achieve the depth criteria. A determination of the flow requirement will be made utilizing field survey by qualified biologists in cooperation with DFG and NMFS staff.

Cumulative Effects

In order to make a finding of no significant impact to fishery resources; there should be no significant alteration of the natural hydrology of the stream in normal and wetter years. The DFG/NMFS guidelines suggest that a diversion should be operated with a maximum rate of withdrawal that preserves the natural hydrograph with no appreciable diminishment (<5%) in the frequency and magnitude of unimpaired high flows necessary for channel maintenance (e.g., unimpaired flows with the recurrence interval of 1.5 to 2 years) (3).

To avoid significant cumulative impacts, DFG and NMFS guidelines suggest that the cumulative maximum rate of instantaneous withdrawal at the point of diversion not exceed a flow rate equivalent to 15% of the estimated winter 20% exceedence flow for direct diversion and diversion to offstream storage (3). If the project exceeds these criteria both DFG and NMFS suggest a comprehensive evaluation of the possible effects upon fishery resources be completed. These evaluations typically would take the form of instream flow studies, hydrologic analysis and possibly an EIR.

The existence of authorized onstream storage facilities within a watershed makes the use of the NMFS criteria for the evaluation of cumulative effects impractical. NMFS has indicated that their objective is to protect peak and intermediate flows and preserve the general shape of the natural hydrograph. Subsequently, the SWRCB, DFG and NMFS have been evaluating alternatives to the NMFS criteria that achieve a similar level of protection.

Division staff has been using a graphical comparison of the unimpaired hydrograph and the impaired hydrograph, which incorporates all known diversions within a watershed. This comparison was used to determine the percentage of the reduction of steam flows in the affected watershed. This requires a judgement determination of what percentage of change constitutes a potential significant effect.

Upon further review of alternatives, Division staff has proposed a method to facilitate the evaluation of the cumulative effects of all known projects plus the proposed project. The recommended method incorporates the evaluation of the percentage of reduction of the hydrograph from existing and proposed water development projects during the season of October 1 through March 31 of typical normal water years. In several discussions with NMFS staff, the Division provided a sensitivity analysis of the comparison between the DFG and NMFS recommendation of 15% of the estimated winter 20% exceedance flow and several alternatives. The results of these comparisons suggest that 15% of the 20% exceedence of the winter flow period is closely related to 10% of the average unimpaired runoff that occurs during the winter period of December 15 to March 31.

The Division's approach was developed to make the analysis as simple as possible, but not to compromise NMFS objectives for the cumulative analysis. The Division will provide the information to DFG and NMFS in the water availability analysis for each project under consideration. The water availability analysis will also be incorporated into the CEQA document. The CEQA document will then be circulated for review and comment to DFG and NMFS, as well as all other interested parties.

The initial water availability analysis should identify all of the known and foreseeable future projects that are diverting or plan to divert water from the watershed in question during the winter storage season. The analysis should develop a percentage comparison of the diversions and the unimpaired conditions to determine if the natural variations of the hydrograph are maintained.

The determination of the percentage of the reduction of instream flows takes into consideration all of the impairments that are known to the SWRCB within the watershed in question. The unimpaired runoff will be calculated using the best available information. Staff has been using the rational runoff method or the regional regression method or combinations of both. The Peer Review group summarized several comments received regarding the methods used by the Division to calculate unimpaired runoff and expressed concerns over the use of the rational runoff method (4). The Division has contacted U.S. Geological Survey (USGS) to determine if there is a more acceptable method to calculate unimpaired runoff. Initially USGS also agreed with the Peer Review Group but did not offer a solution. The Division is attempting to develop a contract to have USGS measure the runoff in small unimpaired watershed(s) and compare the results to calculated runoff using the method describe above. USGS has indicated that this may take one to two years once the contract is in place. Optimistically the data will show a direct relationship between the calculation and the actual measured flows. In addition, The SWRCB staff is working with USGS to improve the methods used to estimate river flows where there are no gauging stations.

The first step in the process of calculating the percent reduction of instream flows is to determine the average unimpaired runoff for the period of October 1 to March 31 at the location where anadromous fish are typically present downstream of the proposed project. The Environmental Specialist assigned to the application or the environmental consultant will provide the location of anadromous fishery spawning in cooperation with DFG staff. This will be based on the best professional judgement and data to reflect the existing conditions to the extent these conditions are affected by legally permitted projects. The effects of existing unauthorized projects will be subtracted to determine the upstream range of anadromy. The downstream area of significant anadromous fish spawning will also be evaluated and the percent of natural flow impairment for this area of the watershed will also be calculated.

The next step is to determine the percentage of the reduction of instream flow at these locations from existing and the proposed water development projects upstream, during the same period of time (October 1 to March 31). If the percentage of the reduction of instream flows exceeds 10% of the estimated average winter season unimpaired runoff, the cumulative impact to the anadromous fishery will be considered potentially significant and further environmental evaluation will be required.

If the cumulative percentage of reduction of instream flow is less than 5%, then no further cumulative analysis of instream flow is required. If the percentage is between 5% and 10%, a more detailed analysis is required to demonstrate the effects of the project on the natural hydrograph. This will require a graphic display of the effects of all existing and pending diversions for three representative normal years. This display will be for the period October 1 to March 31 for the areas (1) representing the typical upstream range of anadromous fish downstream of the proposed project and (2) the lower range of important fish spawning. The hydrographic display will show the estimated winter daily flows for the years selected under unimpaired and impaired conditions. This will require staff to make reasonable assumptions related to how existing and proposed projects will likely operate. These assumptions will be clearly summarized in the analysis. For reference purposes, the analysis will also show the February median flows and the annual 10% exceedence flows. These hydrographic displays will be used by the environmental staff to determine if peak flows are protected and that the general shape of the natural hydrograph is preserved. These hydrographs will also be included in the environmental document that is prepared. In addition, hydrographs for two representative dry water years (lower quartile years) will be prepared and sent to the NMFS staff for their review. It is anticipated that during wet years there will be less than significant effect upon the natural hydrograph from diversions that total less than 10% of the average water year runoff

If the reduction of instream flow for normal years is more than 10% of the average unimpaired flow, then the cumulative effects will be considered potentially significant. If the applicant wishes to continue with the proposed project, then they will be responsible to demonstrate to the Division that the proposed project will have a less than significant effect upon the environment or document the extent of these impacts. This will likely require comprehensive fishery and hydrologic analysis. If the analysis indicates a potential for significant environmental impacts then an EIR will be prepared at the applicant's expense, which incorporates the supporting studies and documentation and recommend mitigation measures where feasible.

Key Reference Documents

1. State Water Resources Control Board, Division of Water Rights. 1997. *Staff Report Russian River Watershed.* August 15, 1997.
2. National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 2000 *Additional Staff Analysis of: The State Water Resources Control Board (SWRCB) Staff Report on Proposed Actions to be Taken on Pending Water Right Applications Within the Russian River Watershed (SWRCB document dated August 15. 1997) and Recommended Guidelines for Protecting Instream Flows for Anadromous Salmonids in Tributaries of the Russian River.* (Draft) January 10, 2000.
3. California Department of Fish and Game and the National Marine Fisheries Service. 2000 *Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams.* (Draft) May 22, 2000.
4. Moyle, Peter B., Kondolf, Mathias G. with technical assistance from Williams, John G. 2000. *Fish Bypass Flows for Coastal Watersheds, A Review of Proposed Approaches for the State Water Resources Control Board.* June 12, 2000.
5. McBain and Trush and Trout Unlimited. 2000. *Allocating Stream flows to Protect and Recover Threatened Salmon and Steelhead Populations in the Russian River and other North Coast Rivers of California.* (Draft) July 10, 2000.
6. McBain and Trush. 1999. *Commentary on the SWRCB Staff Protocol for Water Allocations in the Russian River and Other North Coastal Rivers.* May 4, 1999

EXHIBIT 10

State of California

Memorandum

Date: July 25, 2003

To : Mr. Edward C. Anton, Chief
Division of Water Rights
State Water Resources Control Board
Post Office Box 2000
Sacramento, CA 95812
Fax: (916) 341-5400

Attention Mitchell Moody

From : Robert W. Floerke, Regional Manager **COPY - Original signed by Robert W. Floerke**
Department of Fish and Game – Central Coast Region, Post Office Box 47, Yountville, California 94599

Subject: Protest of Water Application (WA) 31358 of Napa Valley Country Club to Divert and Store Water From Two Unnamed Tributaries to an Unnamed Stream, Tributary to Sarco Creek, Thence Milliken Creek, Thence the Napa River, Thence San Pablo Bay in Napa County

The Department of Fish and Game's (DFG) interest in this application is based on its status as trustee agency for fish and wildlife resources in California. DFG's right to protest is based on Water Code Section 1330 and other associated provisions of law.

Basis of Protest

DFG is concerned that the proposed project may result in direct and cumulative adverse impacts to the resources of the unnamed streams and the Napa River watershed by reducing flows which are needed to maintain riparian and fish rearing habitat within the drainage. Diversions also have the potential to reduce water quality and quantity during the migratory and spawning season for salmonid fish and manipulation of the flows may contribute to the decline of salmonids and other native species of fish and amphibians. The demands of this project may also contribute to diminishing the frequency and magnitude of high flows needed for channel maintenance. Finally, the cumulative diversion rate within the basin may reduce riparian and wetland habitat values within the watershed.

The Napa River and its tributaries, including Sarco and Milliken creeks, support populations of native fish including steelhead trout (*Oncorhynchus mykiss*) listed as "threatened" under the Federal Endangered Species Act (FESA). Native plants and other wildlife species are also supported by these streams. Altering the flow regime may cause adverse changes in habitat and could ultimately alter species composition.

Project Description

WA 31358 proposes to divert water from three Points of Diversion (PODs). POD #3 and POD #4 are each 15 acre-feet (af) onstream reservoirs. In addition to reservoir inflow at PODs #3 and #4, additional water will be diverted to these reservoirs by pumping from POD #5, an offset well downstream of PODs #3 and #4 on an unnamed stream tributary to Sarco Creek. The application gives the rate of diversion from POD #5 as 1.0 cubic feet per second (cfs).

The purposes of use include irrigation of the existing golf course, recreation, fire protection and aesthetic purposes with a diversion season of December 15 to March 31 of the following year. The place of use is an existing 90-acre golf course. There are currently two existing water right permits, with a total of 287 af of permitted storage, for this same 90-acre place of use. The notice, but not the application, refers to rediversion between the reservoirs proposed in this application and those permitted previously (WA 29017 and WA 30303). However, the notice states that water will not be moved between the proposed reservoirs and the existing reservoirs during the diversion season. The application includes a claim of other appropriative rights under the previous permits, and a review of the applications for those permits also show claims for riparian rights and overlying rights to groundwater. There is no information concerning the amount of water claimed under either of these two rights provided in this notice. DFG requests clarification from the applicant and State Water Resources Control Board (SWRCB) in regards to: 1) the rediversion of water between the proposed and existing reservoirs; 2) the methods used to ensure that water rediverted to the existing reservoirs after March 15 (the end of the diversion season) will not be replaced by out-of-season inflow to the two proposed onstream reservoirs; 3) the amount of water claimed under riparian right; 4) the amount of water used through groundwater pumping; 5) the need for another 30 acre-feet per annum (afa) if the golf course is not expanding; 6) an explanation as to why the current application will not result in prohibited "piecemealing" under the California Environmental Quality Act (CEQA) considering that the permit issued in 1995 for the same place of use received a Negative Declaration and made no mention of future water needs; and 7) the availability of recycled water from the Napa Sanitation District as an alternative to diverting surface water. Water Code Section 13551 prohibits the use of water suitable for potable domestic use if recycled water is available.

Protest Dismissal Terms

Protest Dismissal Terms, if adopted as enforceable conditions of the water right permit, are intended to mitigate adverse impacts to fisheries and wildlife resources. Based on the information provided by the applicant, a site-specific study for the purpose of determining appropriate flow-related terms and conditions is needed. The study plan should include, at a minimum, the following:

1. A hydrologic study to determine if the production of water within the watershed is sufficient to provide the quantity of

water requested without having significant adverse impacts to aquatic and riparian resources of the subject streams or downstream reaches. The study shall identify all other basis of water rights in the watershed potentially affected by the proposed diversions.

2. An evaluation of the site-specific and cumulative impacts of the proposed quantity and rate of diversion on the unnamed tributaries, Sarco Creek, Milliken Creek, the Napa River and their resources. The evaluation of cumulative impacts must include consideration of all other diversions within the watershed, including any diversions under riparian water rights.

3. A specific proposal to ensure minimum flows in the unnamed tributaries, Sarco Creek, Milliken Creek, and the Napa River for maintenance of aquatic habitat, fish, and wildlife. The starting point for determining the minimum bypass flow shall be the estimated unimpaired long-term February median flow at the points of diversion. The proposed season of withdrawal for these diversions coincides with the migration and spawning of adult salmonid fish and the incubation of their newly deposited eggs. A minimum flow proposal must indicate measures to prevent impacts to adult fish and their incubating or newly emerging offspring.

4. An assessment of the impacts of the proposed diversions on channel-forming flows with a specific proposal to provide periodic channel maintenance and flushing flows that are representative of the natural hydrograph.

6. A plan to monitor compliance, the effectiveness of the stipulated flows, and procedures for making subsequent modifications, if necessary.

In addition to the flow-related assessment discussed above, surveys for the presence of listed plant and animal species must be conducted for those areas within the place of use, place of storage, and those areas affected by the diversion of water at the PODs.

When the results of these studies are provided to DFG, appropriate mitigation measures and protest dismissal terms shall be determined. Depending on the outcome of these studies, dismissal terms for the diversions may include, but are not limited to:

1. The diversions, under all basis of right, shall be limited to December 15 through March 31 of the following year.

2. From April 1 to December 14, all natural flow shall be bypassed around the PODs.

3. Under all basis of right, a maximum of 317 af shall be used annually.

4. DFG is opposed to any project that impedes either upstream or downstream passage of fisheries resources. Any device or contrivance which prevents, impedes, or tends to prevent or impede the passage of fish upstream or downstream shall not be accepted as a means to divert or store water.

5. During the diversion season, a flow around or through the points of diversion shall be bypassed which will be of sufficient quantity and quality to allow upstream and downstream fish passage and to maintain in good condition any fisheries resources that would exist in downstream reaches under unimpaired flows. Determination of the bypass flow can be based on site-specific biological investigations conducted in consultation with DFG and National Marine Fisheries Service (NMFS) staffs. In the absence of site-specific information, the minimum bypass flows shall not be less than the estimated unimpaired long-term median flow for the wettest month.

6. The bypass will be a passive system that is designed to only divert flow when the terms of the SWRCB permit will be met. Outside the diversion season and at low flows, water will automatically bypass the diversion points.

7. The cumulative maximum instantaneous rate of diversion shall be limited to 15 percent of the 20 percent winter exceedence flow at the PODs.

8. Permittee shall submit plans on specifications of all diversion facilities to the Chief of Division of Water Rights for approval prior to diverting.

9. If warranted, the applicant shall develop a mitigation plan aimed at replacing lost plant, fish, and/or wildlife resources including, but not limited to, species or habitats listed in the California Natural Diversity Database. This plan will include a survey which quantifies losses of resources that have occurred or will occur as a result of this project. Plans will specify measures taken to offset impacts to resources and outline specific mitigation and monitoring programs.

10. If warranted, an erosion and runoff control plan shall be developed. This plan shall outline measures aimed at alleviating sediment delivery into tributaries and the Napa River basin. This plan shall include:

a. All major grading operations and/or other project related activity that may promote erosion and sediment delivery into affected streams shall be confined to June 15 through October 15.

b. The establishment of buffer zones along any riparian corridor of the affected project site. Removal of existing riparian vegetation or other disruptive work shall not occur within said buffer zone.

c. Erosion control for all exposed areas susceptible to erosion including seeding, mulching, tree planting, slope contouring, and other erosion protection measures shall be included in this plan.

11. If unforeseen problems cause significant adverse impacts to fish and/or wildlife resources or as further data are accumulated for analysis, the applicant may be required to remediate the situation to the satisfaction of DFG.

12. Permittee shall allow reasonable access for DFG personnel to monitor compliance.

Should the applicant agree to the foregoing terms, DFG will dismiss this protest. All or some of these terms may be subject to adjustment or cancellation should facts warranting such action come to light in the future.

NOTICE TO APPLICANT: A Streambed Alteration Agreement (SAA) pursuant to Fish and Game Code Section 1603 may be required prior to any work, including water diversion, within the stream zone. This agreement process will be administered through the Central Coast Region Office in Yountville and can be initiated by contacting the Streambed Alteration Section at (707) 944-5520. Work cannot be initiated until an SAA is executed.

If you have any questions or concerns, please contact Ms. Linda Hanson, Staff Environmental Scientist, at (707) 944-5562; or Mr. Carl Wilcox, Habitat Conservation Manager, at (707) 944-5525; or by writing to DFG at the above address.

cc: See Next Page

cc: Napa Valley Country Club
c/o Drew L. Aspegren
Napa Valley Vineyard Engineering
176 Main Street
St. Helena, CA 94574

Dr. William Hearn
Dr. Stacy Li
NOAA Fisheries
777 Sonoma Avenue, Room 325
Santa Rosa, CA 95404

Mr. Steven Herrera
Division of Water Rights
State Water Resources Control Board
Post Office Box 2000
Sacramento, CA 95812-2000

e✉: Department of Fish and Game

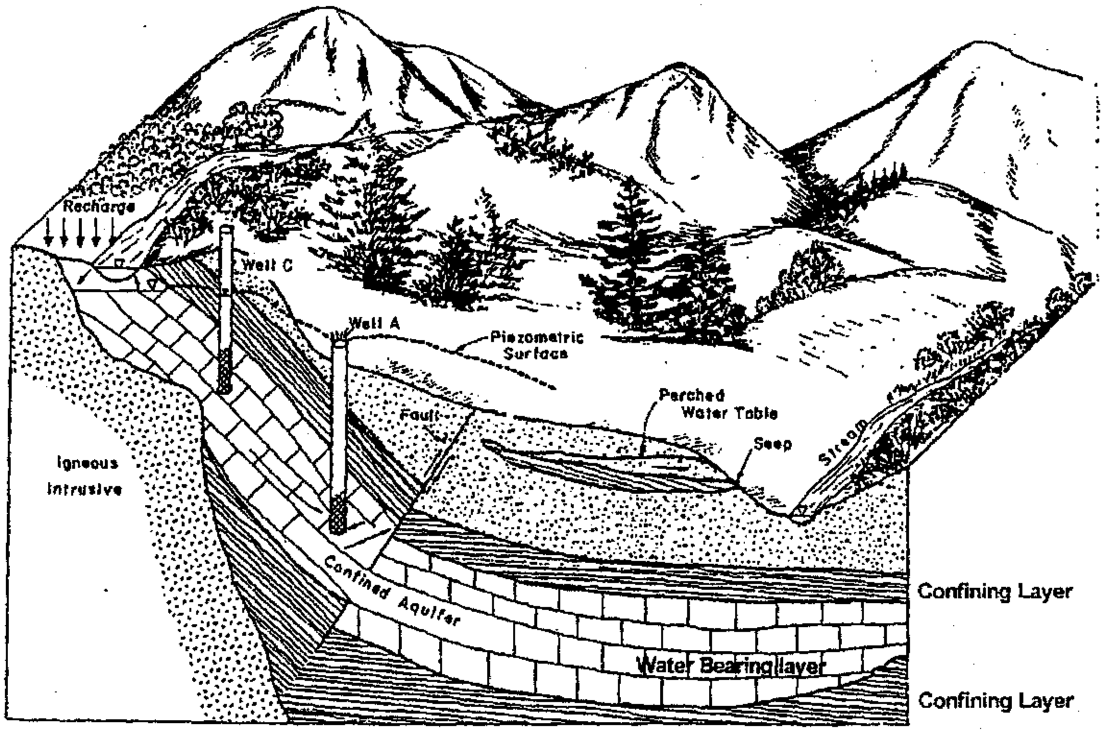
H. Branch, N. Murray (Legal)

J. Emig, L. Hanson (CCR)

LH/pm

EXHIBIT 11

Evaluation of Groundwater Impacts from the Proposed Palmaz Winery



For: The Law Offices of Thomas Lippe
1 Market Plaza, #16
Stewart Tower, 16th Floor
San Francisco, California 94105

By: *HSI* Hydrologic Systems
433 Town Center, Suite 503
Corte Madera, CA 94925

February 8, 2001

EXHIBIT 1

Services provided pursuant to this Agreement are intended solely for the use and benefit of

The Law Offices of Thomas Lippe

No other person or entity shall be entitled to rely on the services, opinions, recommendations, plans or specifications provided pursuant to this agreement without the express written consent of Hydrologic Systems, 433 Town Center, Suite 503, Corte Madera, California 94425.

Setting

The Palmaz Winery is a new facility that will be located east of the city of Napa California. The proposed location is situated along the west facing foothills of the Howell Range (Figure 1a). The site is located at the eastern end of Hagen Road along an unnamed tributary to Sarco Creek, and lies within the Milliken-Sarco-Tulucay (MST) groundwater basin of the Napa Valley.

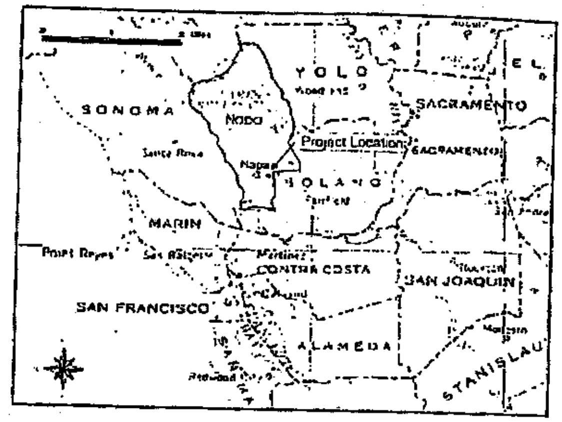


Figure 1a Location Map

Winery

The winery is a new 35,000 gal/yr facility that will be utilizing grapes grown on site and those from a neighboring vineyard under the same ownership. The winery/vineyard complex consists of 9 parcels totaling 560 acres. The winery itself will be located on a single 130-acre parcel, with the remaining 8 parcels (430 acres) being developed for vineyards. The 8-parcel vineyard development has been submitted to the planning department as a separate project.

The winery will be located in a constructed underground cave that will be excavated to develop a 50,000 square foot work and storage area. Other wineries in the 50,000 square foot size range typically have production capacities averaging 200,000 gal/year. Given average utilization, a 35,000 gal/year winery, would typically require approximately 12,000 square feet of work and storage area.

The main portion of the winery will be located underground, but above ground facilities will consist of a 61-space parking area, a wastewater treatment system consisting of open ponds, a 126,000 gallon water tank, and access roads. Approximately 15,000 cubic yards of spoil will be generated from excavating the cave. This material will be used for road construction at the winery, and fill on the applicant's adjoining property.

The anticipated future water demand for the facility is 800 gallons/day (gpd). An existing water source is capable of supplying 345 gpd. A 126,000 gallon tank will be installed for water storage, with a 325,800+ gallon emergency reservoir to be built on site. Domestic waste of 400 gpd will be discharged to a septic tank with leach field.

Winery waste process water is estimated to be an average of 1,380 gpd with a peak of 4,800 gpd during the estimated 60 day crush cycle. Process wastewater will be discharged to 2 aerated settling ponds that will be 150' long by 75' wide, each with a capacity of 425,000 gallons. Accumulated water from the settling ponds will be used for irrigation in the vineyard.

On September 29, 1999, Palmaz Vineyards applied for a Napa County Use Permit (#99128-UP) for the winery facility. The use permit requires that all conditions of the Napa County Groundwater Ordinance (Napa County Code Title 13.15) be fulfilled. This ordinance requires that any new or improved groundwater pumping system demonstrate that the new or improved facility will not impact the beneficial long-term use of the groundwater resource.

Groundwater

The sole source of water to the winery will be pumped groundwater. The Milliken Sarco Tulucay (MST) aquifer is the principal water-bearing formation underlying the project site. This aquifer, occupying approximately 15 square miles, is a highly variable and complex formation that has historically supported moderate to low yielding wells. Flow within the aquifer is generally westward, from the Howell Mountains toward the Napa River. Geologically the MST aquifer is primarily composed of two classes of material, moderately permeable pumice and ash flow tuffs, and volcanically derived material of very low permeability that confine the tuffs locally (Johnson 1977). These confining layers act as impermeable seals, limiting the amount of local precipitation that can percolate down and recharge the water bearing pumice layers. This type of aquifer is referred to as a confined aquifer, because it is confined between impermeable layers that exist above and below the water bearing layers. Figure 1b is a schematic of a typical confined aquifer.

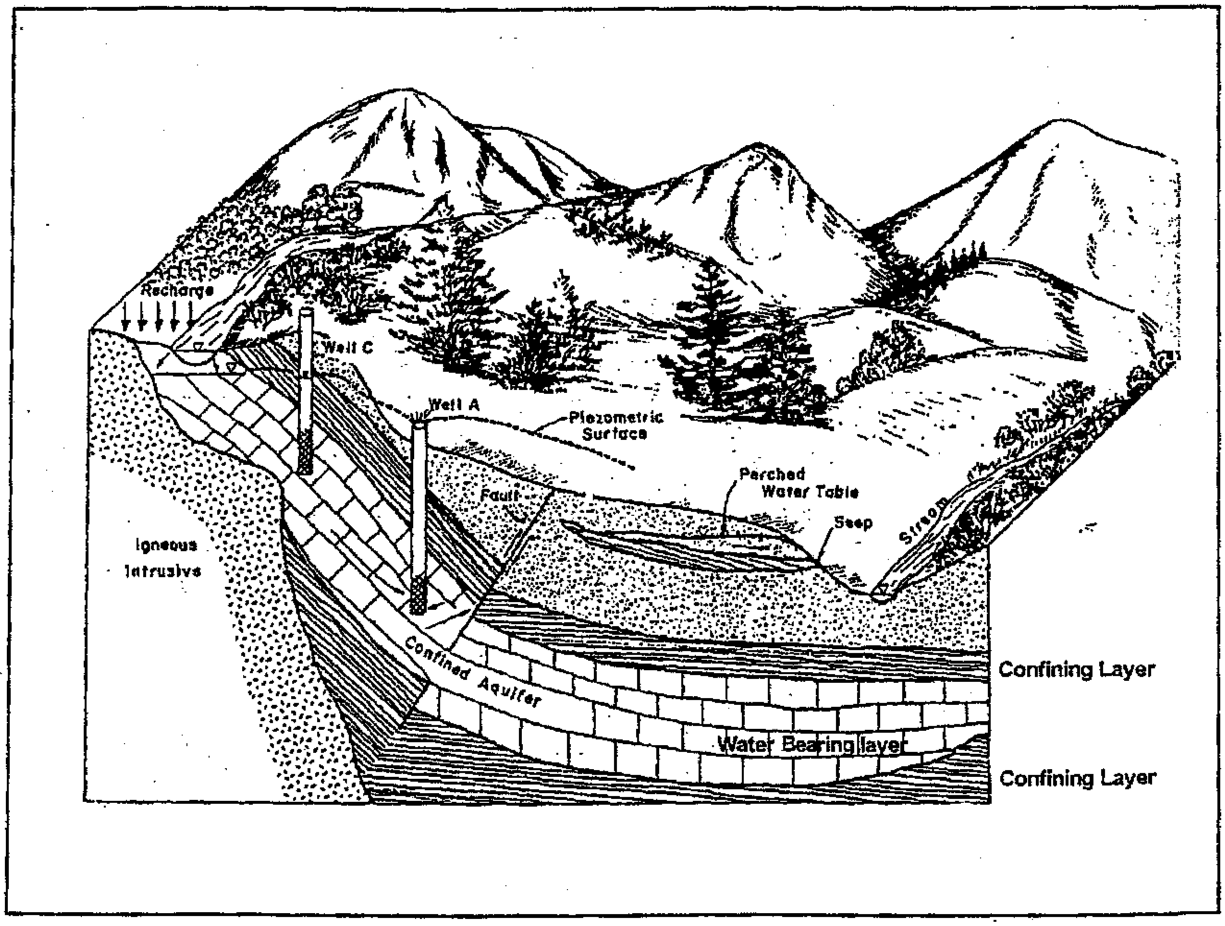
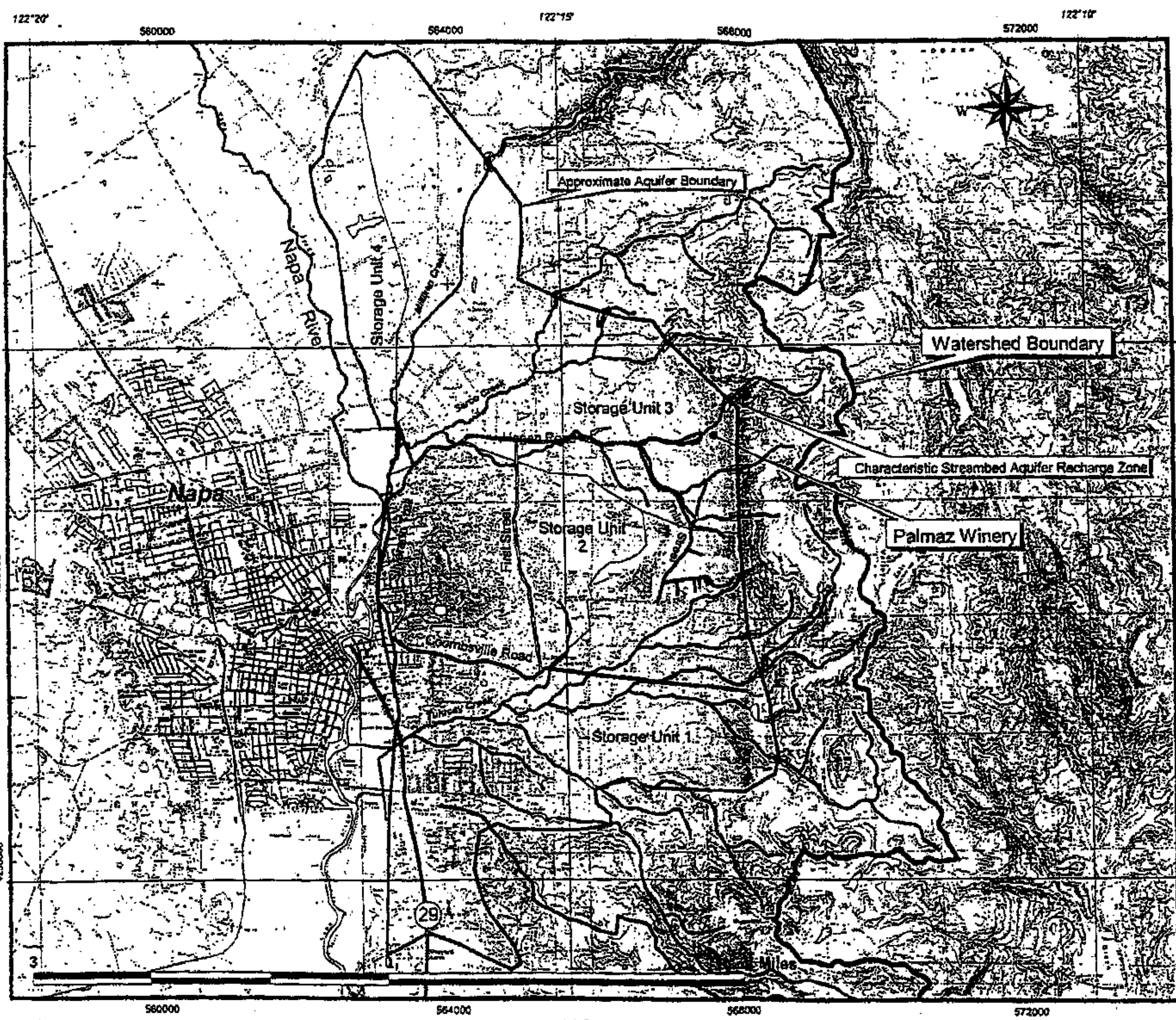


Figure 1b Schematic of Typical Confined Aquifer

The primary recharge to this local aquifer is from percolation through streambeds that cut through the porous water bearing layers where those layers intersect the ground surface. This occurs primarily along discrete sections of the eastern border of the aquifer (Figure 2). Thus, there are very few areas where groundwater recharge can occur. The Palmaz Winery is located along one of the few streams where this recharge is possible.

Several groundwater studies have been conducted in the Napa Basin. Three of these studies provide pertinent information on the MST aquifer and its geology. In 1960, Kunkel and Upson developed a detailed study of the geology and groundwater resources of the Napa Valley (Kunkel and Upson, 1960). In that report, Kunkel describes the confined nature of the MST aquifer and provides a brief description of some of the early wells. One of the earliest documented wells that they were able to find (#06N03W31N1) was drilled in 1910. This well was described as artesian, which is a well that is free flowing at the ground surface. This is common in a confined aquifer, because the impermeable layer over the surface of the aquifer acts as a cap causing the underlying water to be pressurized. In 1910, this well was able to freely flow into a tank 40 feet above the ground surface. If the amount of water flowing into the aquifer is equal to the amount of water that is withdrawn, these artesian characteristics will be maintained. When the groundwater withdrawal exceeds the recharge, the pressure between the confining layers will decrease, and the wells will loose their artesian characteristics and require pumping to remain active. Kunkel and Upson reported that by 1960, this well was no longer free flowing at the ground surface. The Kunkel report also showed a strong discontinuity in groundwater levels between the North Napa Valley Aquifer and the MST aquifer. This discontinuity would imply that a barrier exists along the edge of the MST aquifer and that little water exchange occurs between the two formations.



Legend

Subareas Of The MST Aquifer

- Storage Area 1
- Storage Area 2
- Storage Area 3
- Storage Area 4
- Watershed Boundary
- Lakes and Ponds
- Rivers and Creeks
- Zone Where Streambed Infiltration Recharges the Aquifer

Figure 2

MST Aquifer and Eastern Watershed Delineation

Evaluation Of Surface and Groundwater Impacts From The Proposed Palmaz Winery

HSI Hydrologic Systems, Corte Madera, California

In 1977, the USGS initiated a detailed study of the MST aquifer. This report (Johnson, 1977), developed in cooperation with the Napa County Flood Control and Water Conservation District, initiated a focused study of the MST aquifer to determine its flow characteristics and usable storage capacity. In this study, the MST aquifer was divided into 4 storage areas (Figure 3). The usable storage and existing pumping rate for each area was calculated. The Palmaz Winery is located in storage unit Number 3. This storage unit has a surface area of 3,584 acres, representing 36% of the MST aquifer. Johnson found that the 1975 pumping rate of 2,000 acre-feet (ac-ft) per year was greater than the recharge rate for the aquifer. This 2,000 ac-ft pumping rate is approximately equal to 0.5 acre-foot of pumped water per acre of land within the storage area. It was found that pumping at this rate was not sustainable, and was producing a water-level decline of approximately 1.5 ft/year.

The Johnson study primarily focused on the pumping and aquifer conditions that existed in the 1965 to 1975 period. The report noted that groundwater levels, specifically in Storage Area 3, were in decline and the 2,000 ac-ft/yr pumped from that area could not be maintained. Johnson did report that the MST aquifer as a whole (Storage Areas 1 through 4) could support the 3,000 ac-ft/year that was observed during the study period. If the 3,000 ac-ft/yr were divided over the 9,910 acres surface area of the MST aquifer, that pumping rate would represent a 0.30 ac-ft/yr per acre discharge rate. The report did not identify a maximum sustainable pumping rate for the aquifer.

To better understand what rate of pumping could be sustained, Napa County has hired the USGS to develop another study of the MST aquifer. That study, titled "Geohydrologic Framework and Hydrologic Budget of the Lower Milliken-Sarco-Tulucay Creeks Area of Napa California", is presently underway, and scheduled to be completed in September 2001. An understanding of the water budget of the aquifer is crucial to determining how much pumped water can be sustainably withdrawn from the aquifer.

Due to the limited number of areas where the aquifer can be recharged, and the historic decline in water levels, the MST aquifer has been declared a "groundwater deficient area" by the Napa County Conservation Development and Planning Department (Napa 1999). The county has acknowledged that excessive local groundwater pumping can exceed the capacity for the aquifer to recharge and replenish the volumes that are withdrawn. If groundwater pumping exceeds the recharge capacity then local well levels will continue to decline and shallow wells would be at risk of going dry.

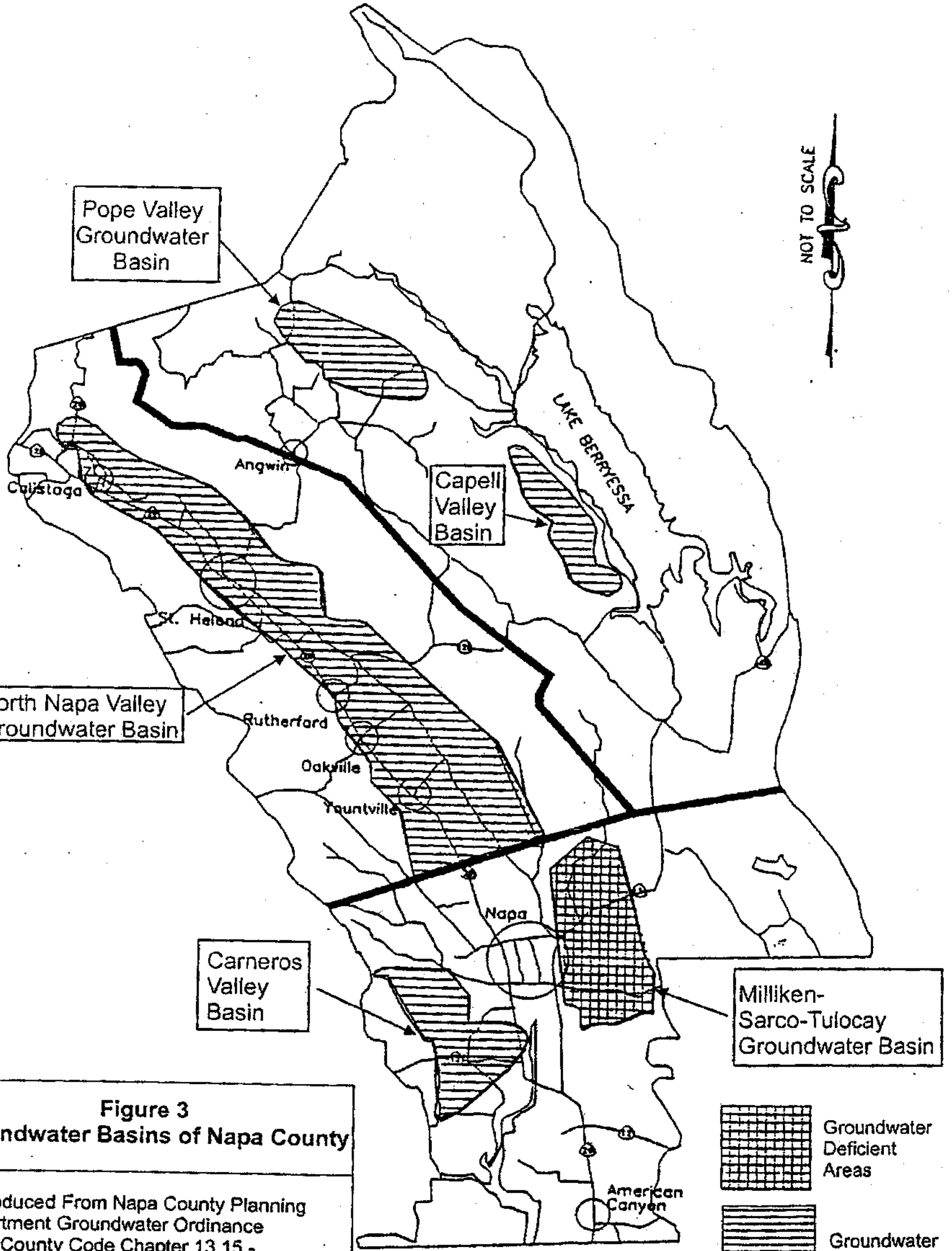


Figure 3
Groundwater Basins of Napa County

Reproduced From Napa County Planning Department Groundwater Ordinance Napa County Code Chapter 13.15 - Groundwater Conservation

Condition of the Aquifer

There is anecdotal and documentary evidence that the Milliken-Sarco-Tulucay aquifer is being overdrawn by groundwater pumping. In addition to the 1977 USGS study, which reported that pumping rates in the 1965-1975 period were already exceeding the ability of the aquifer to recharge, information from local landowners indicates that many of their wells have gone dry in the 1980 to 2000 period. The Stefanki's of Barrol Lane have had to increase the depth of their well 3 times during this period due to falling groundwater levels. The original well on their property was drilled to 100-feet. When the well went dry in 1983, the depth was increased to 130 feet; in 1987 it went dry again and was deepened to 200 feet. When again in 2000 it went dry, it was deepened to 530 feet (Stefanki 2000). There are not a large number of continuously monitored wells in the MST aquifer with a long-term record. From the available data in the MST aquifer, 3 wells were identified as having a period of record with enough detail to document long-term groundwater trends. These wells and their monitoring periods are shown in Table 1.

Table 1 – Monitoring Wells in the MST Aquifer

Well No.	Data Source	Period of Record	Span of Record
06N03W31H	DWR[1]	1949 - 1978	29 years
06N03W31N-01M	DWR	1949 - 1998	49 years
05N03W05M-01M	DWR	1937 - 1974	37 years

1 California Department of Water Resources

Review of the data for these wells indicates that there has been a steady decline in the groundwater table. A graph of the recorded aquifer level for each well is provided in Figures 4 through 6. As can be seen in each figure, the groundwater levels have been dropping consistently since the late 1940's. The period for these well records is long enough to show that the decline is not due to temporary climatic changes. They are indicative of an aquifer that is being overdrawn under the existing level of pumping.

Phase I and Phase II Water Availability Analysis

Starting in September of 1999, Napa County required that a groundwater permit be obtained for any new or improved groundwater pumping system within the MST aquifer. As part of the permit, applicants must prove that any new pumping system will not adversely affect the aquifer. Proof was provided by performing a Water Availability Analysis (WAA). The WAA is a set of procedures that were developed by the Napa County Flood Control and Resource Conservation District to insure that new wells would not impact the aquifer. The WAA consists of a phased approach to determine if new or improved pumping systems will affect the aquifer. Phase I basically compares the proposed pumping rate to a permissible pumping rate of 1 ac-ft/yr for each acre of land on the valley floor, and 0.5 ac-ft/yr of acre of land on the hillslope areas. Thus, a 15-acre parcel that contains 10 acres overlaying the aquifer and 5 acres located upslope of the aquifer would be allowed to withdraw (10x1.0 + 5x0.5) or 12.5 ac-ft/yr from the aquifer.

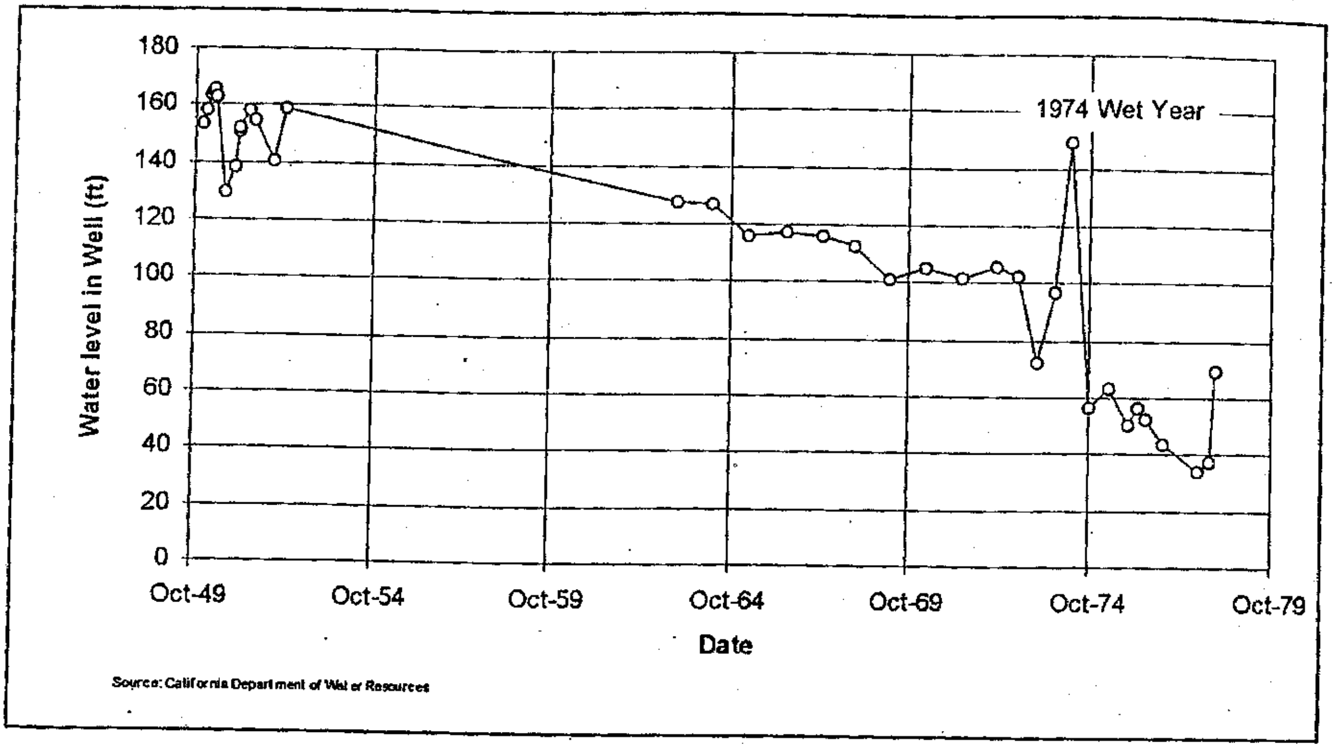


Figure 4 Groundwater Well 06N03W31H-01M

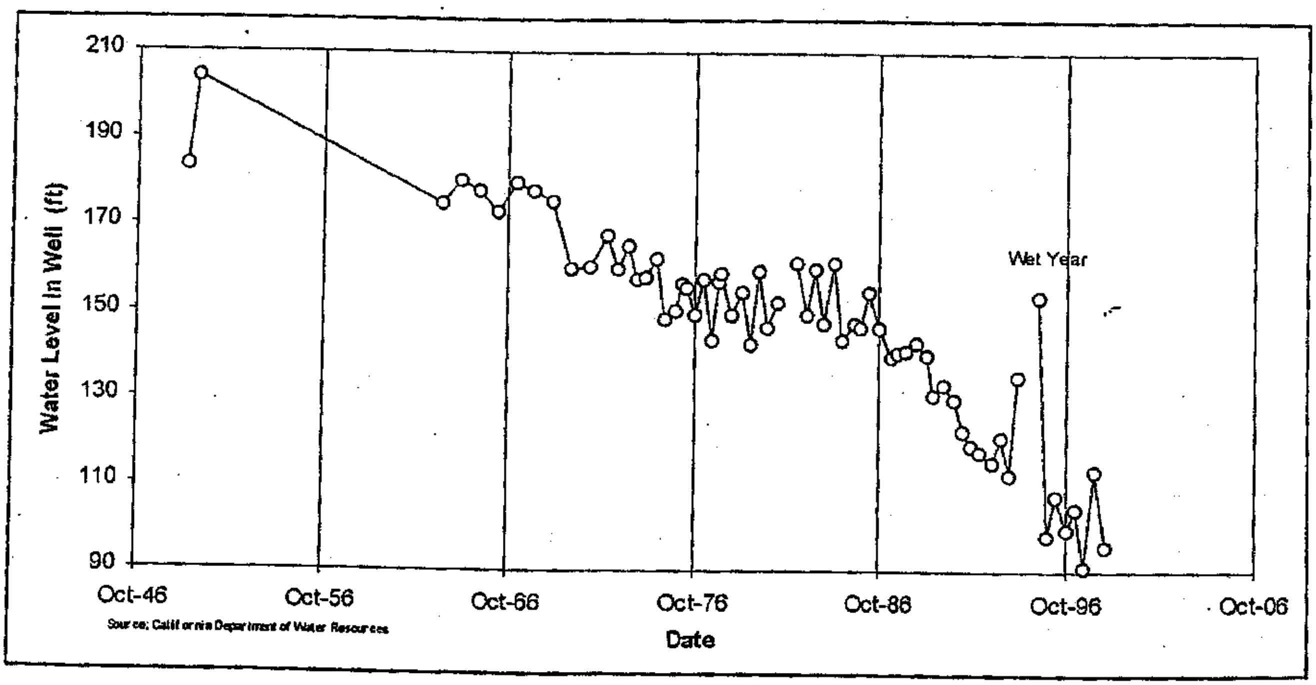


Figure 5 Groundwater Well 05N03W05M-01M

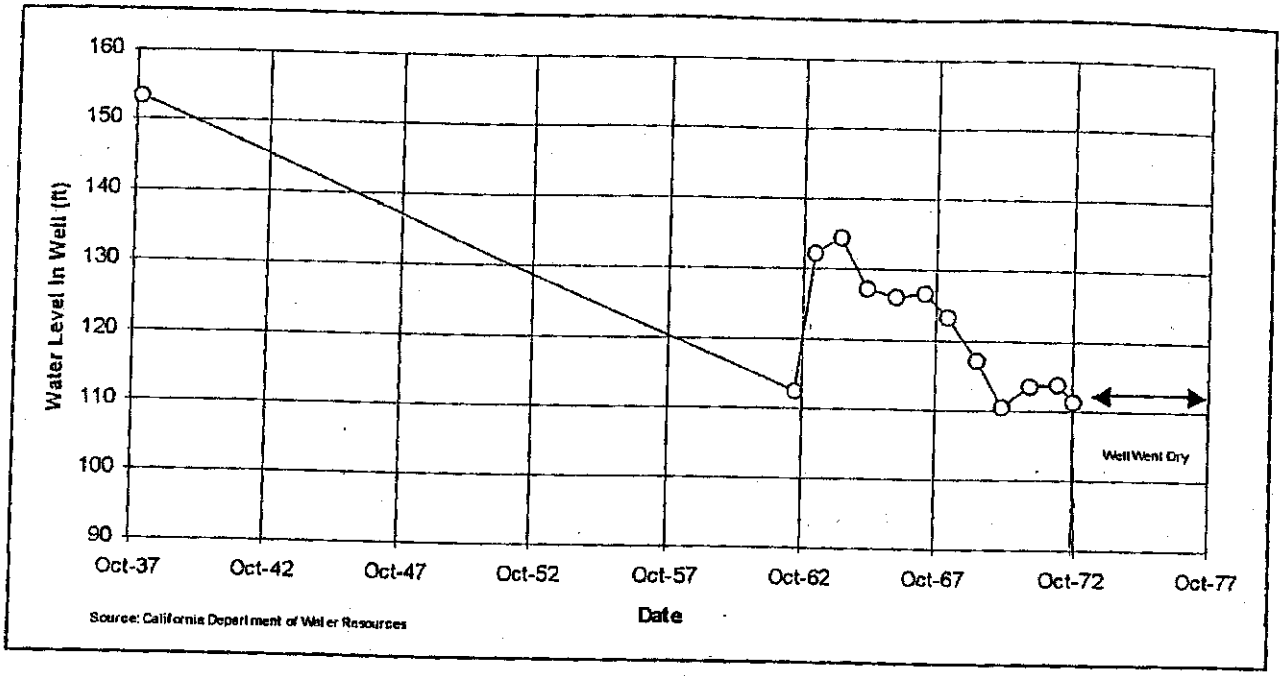


Figure 6 Groundwater Well 06N03W31N-01M

If a proposed project requires more pumped water than is allowed in the Phase I evaluation, a Phase II analysis is to be conducted. The Phase I and Phase II Water Availability Analysis for the Palmaz Winery was evaluated. After careful review of the information and analysis provided in the Phase I and Phase II analysis, it was determined that the two analyses are inadequate as a basis for concluding that the project will have no significant impact on the groundwater in the Milliken-Sarco-Tulucay (MST) basin. This inadequacy stems from two elements: 1) both the Phase I and Phase II criteria are inappropriate and technically flawed, and 2) in executing the Phase II procedure, the Plamaz Winery did not sufficiently monitor adjacent wells surrounding the winery. Details of these two elements are described below.

1. The Phase I Water Availability Analysis assigns an allowable pumping rate in ac-ft/yr, based on an assumption of the safe yield of the entire aquifer. A portion of this safe yield is then applied to each parcel overlying the aquifer based on the area of the parcel. The WAA allows for pumping of 1.0 ac-ft/yr per acre of land overlying the MST aquifer.

   The allowable safe yield of the MST aquifer is loosely based on information obtained from studies of the North Napa Valley Aquifer. This aquifer is located north and west of the MST aquifer, and is the primary aquifer for the Napa Valley. This is a large (and due to differences in geology) a much more productive aquifer than the MST.aquifer.

According to the Napa County Public Works department, the assumed safe yield for the North Napa Valley Aquifer from Napa to St. Helena is 10,000 acre-ft/yr (Personal Communication Nathan Vallaz). The Bureau of Reclamation has also agreed that this number would be a safe yield for the north aquifer (USBR 1972). Given that there are 30,000 acres overlying the aquifer, the 10,000 ac-ft safe yield would provide for 0.3 ac-ft/yr for each acre of land that overlays the aquifer. If 0.3 ac-ft/year is the sustainable rate for the much more productive North Valley Aquifer, it is unrealistic to set an allowable pumping criteria of 1.0 ac-ft/year per acre rate for land above the MST aquifer. Since the MST aquifer has been shown to have a lower capacity than the North Napa Aquifer, the 1 acre-foot/yr per acre is exceedingly high. Johnson (1977) showed that a pumping rate of 2,000 ac-ft/yr from the Milliken & Sarco basin (Unit 3), where the proposed Palmaz Winery is to be located, was not sustainable. This 2,000 ac-ft/year represents 0.5 ac-ft/year per acre, and was found to be greater than the aquifer can deliver. Thus, the safe yield from the aquifer below the project site is less than 0.5 ac-ft/yr per acre, not the 1.0 ac-ft/yr per acre that the county is allowing in the Phase I Water Availability Analysis. The sustainable rate will most likely be less than the 0.3 ac-ft/yr per acre of land that was shown to be the maximum sustainable rate for the North Napa Valley Aquifer.

2. The Phase I Water Availability Analysis also allows pumping of 0.5 ac-foot/yr per acre for hillslope areas that do not directly overlay the aquifer. It is not understood why credit for pumping water from the aquifer is allowed for lands owned outside the boundaries of the aquifer. In the county's analysis of the MST aquifer, they distribute all of the available groundwater to the land directly above the aquifer. From this analysis, they arrived at a 1.0 ac-ft/yr per acre safe pumping rate. If that same fixed safe yield is applied to a larger area, the per-acre allowable pumping rate should be reduced. In the Phase I of the WAA, the county does not reduce the allowable pumping rate for the area overlying the aquifer; they keep that distribution the same, and then permit an additional 0.5 ac-ft/year per acre for land not overlying the aquifer. Computed this way, all of the pumping that is allowed for the hillslope areas will be in excess of the safe aquifer capacity.

   The Palmaz Winery parcel consists of 130 acres, 66 of which overlay the water deficient MST aquifer, and 64 acres are on the hillslopes above the aquifer. Using the Phase I water availability criteria, the winery can pump 66x1.0 + 64x0.5 = 98 ac-ft/yr from the MST aquifer. If this were to be limited to the sustainable delivery rate for the North Napa Aquifer of 0.3 ac-ft/yr for the land that overlays the aquifer, and no pumping credit for land that does not overlay the aquifer, the allowable pumping rate would be 66x0.3 = 19.8 ac-ft/yr.

   The pumping rate requested by the Palmaz Winery is 51.7 ac-ft/yr. This is 2 ½ times the likely sustainable rate of 19.8 ac-ft/yr. It must also be remembered that the 19.8 ac-ft/yr was derived from the 0.3 ac-ft/yr criteria that was computed for the North Napa Aquifer, a much more robust and plentiful formation than is the MST aquifer, so the 19.8 ac-ft/yr is probably on the high end of the sustainable yield.

3. The Napa County Phase II protocol was implemented for the proposed well (Peterson 2000). The Phase II Water Availability Analysis consisted of performing a pump test on the well at the Palmaz Vineyards property, and monitoring neighboring wells. During this test, 2 wells

on the Miller property, one well on the Cash property and one well on the Darrin property were supposed to be monitored. The 2 wells on the Miller property were not monitored. Instead, an open unused well near the property line was used. The condition of this well is not known, and therefore, its response may not be indicative of the active well used by the Millers. The Cash well was also not monitored as required in the test procedures. The Darrin well was monitored. The results of the test showed a 1.5-foot maximum drawdown in the Palmaz Pumping well and a net rise in the Palmaz Winery office well that was being monitored. This increase of water level in the winery office well during the pumping test was not explained. The water level in the Darrin observation well fluctuated through a range of 25 feet before and during the test. This was probably caused by cycling of the Darrin pump during the test. It is not understood why the Darrin well would drop 25 feet when the Palmaz well (only 500 feet away) was only showing a 1.5-foot drop. Before this response can be understood, the following information is needed:

- information on the pumping rate of the Darrin well during the Palmaz test
- the drilled diameters, depths, and casing information from both wells
- geologic information to determine if both wells were drawing water from the same aquifer layer

With the Cash property well not monitored, the two Miller property wells not monitored, the unknown condition of the open well on the Miller property that was monitored, and without additional information to explain the dramatic difference in response from the Darrin and Palmaz wells, an analysis of aquifer impact from this pump test cannot be made.

4. The protocol for the Napa County Phase II Water Availability Analysis specifies developing a well drawdown test to determine if the proposed pumping operation will impact the water levels in neighboring wells. A pumping test is typically conducted over a 24 to 48 hour period. During this period, the well in question is pumped, and the surrounding wells are monitored for any change in water level. This test will provide information on specific capacity of the aquifer (the ability to deliver the water to the well) and relative short-term drawdown on neighboring wells, but does not provide any information on long term capacity of the aquifer to sustain this level of pumping or maintain groundwater levels. An analysis of long-term sustainability of an aquifer to yield water requires a detailed water budget of the aquifer. The Phase II protocol, whether implemented correctly or not, will not provide any meaningful information on long-term impacts to the water levels in the aquifer.

The Napa Flood Control and Water Conservation District has entered into a joint funding agreement with the U.S. Geological Survey to develop a detailed study of the aquifer in the Milliken-Sarco-Tulucay Creeks area of Napa. This study will provide detailed information that is necessary to better understand the groundwater supply that can be drawn from this aquifer. As stated in the proposal summary, one of the main problems for the aquifer is that increased ground water pumping has resulted in water-level declines throughout the area (USGS 1999). The proposal goes on further to describe their approach to develop a water budget for the aquifer. Development of a water budget for the aquifer can provide information on actual water availability that can be used in a Phase I Water Availability Analysis.

Conclusion

After review of the available data, and the condition of the aquifer, it is very likely that groundwater pumping at the Palmaz Winery will impact the existing water levels for other landowners. The Phase I and Phase II Water Availability Analyses that are required by the County are flawed with respect to their being able to determine impacts from groundwater pumping. As a result, the information provided to date has not been adequate to determine that a "no impact" condition will result from the proposed pumping. Existing historic information on water levels in the MST aquifer indicate that the capacity of the aquifer has already been exceeded. Any additional pumping from the aquifer is likely to have impacts on existing wells. The following items summarize the elements described in the preceding paragraphs.

- The MST aquifer is a degraded resource that is being impacted by existing pumping. The water levels in the aquifer are presently declining. The USGS has determined that the aquifer was not capable of sustaining the pumping rates that were observed in the 1965-1975 period. It is not likely that the rate of pumping has decreased, given the continual decline in water levels. Additional pumping from this aquifer will likely worsen this condition.

- The Phase I Water Availability Analysis as implemented by the county is likely overestimating the water availability of the MST aquifer by 300 to 400%. The procedure uses criteria developed from studies on the North Napa Aquifer, which is has a much greater capacity, and is not representative of the MST aquifer.

- The Phase II Water Availability Analysis as implemented by the county utilizes a standard engineering procedure to predict short-term changes in groundwater level, and therefore should not be used to predict long-term impacts.

- The Napa Flood Control and Water Conservation District recognizes that a problem exists in the MST aquifer and has contracted with the U.S. Geological Survey to develop a detailed study of the aquifer and its water supply characteristics. This study should provide necessary information that can be used in the Phase I Water Availability Analysis. Without the information from this study, any increase in pumping in excess of what is presently being pumped may adversely affect the aquifer.

Additional items of concern related to surface water impacts:

- The Palmaz Winery is located along one of the streambed recharge points for the MST aquifer. By pumping in this location, groundwater levels under the creek adjacent to the project will likely decrease, resulting in an increase in infiltration from the creek, and lower water levels in the creek. Under a worst-case scenario, pumping at this location has the potential to completely dewater the creek. This can have significant impacts to stream morphology and aquatic wildlife in the stream. Further analysis of these potential impacts would require a biological analysis of the creek.

- The winery access road was regraded within the stream setback zone. Destruction of the vegetation along the stream corridor can result in increased runoff and erosion in the stream. Erosion in the stream can adversely affect aquatic habitat and invertebrates that inhabit the streambed. Further analysis of these potential impacts would require a biological analysis of the creek.

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EXHIBIT 12

California Coastal Salmon and Steelhead
Current Stream Habitat Distribution Table

Table to be used with DeLorme Topo Quads, Bibliography, and Contacts & Expertise list

(Streams listed from north to south)

Stream [1]/*Tributary* (RM=river mile)	Species / Run	Upper Limit of Run [2] (RM=river mile)	Sources References / Pers. comm.	Comments	Survey Dates [3]
Chinook Salmon - California Coastal ESU ***Coho Salmon - Central California Coast ESU*** ***Steelhead - Northern California Coast Steelhead ESU***					
Napa County					
Napa River T3N, R4W, Sec. 14	CHIN COH SH	RM-30 RM-? RM-49.0	Fisher	Survey: reported that during the 1954-55 winter SH anglers spent 1,500 angler days for 400 adult SH.	1959
			Emig	Field note: reported that a CHIN was seen in the Napa River near Yountville on November 7th. Bill Jong reported one COH seen in the river (an unusual observation, it may have been a stray).	1983
			Gray	Gillnetting: in the lower river, found 1 chinook salmon in October.	1989
South Slough T4N, R4W, Sec. 34	?	RM-?		Connects China Slough and Napa River, no salmonids observed.	
China Slough T4N, R4W, Sec. 33	?	RM-?		Trib to South Slough on east side Connects Napa Slough and Napa River on the west side.	
Napa Slough T4N, R4W, Sec. 18	?	RM-?		Border of Sonoma and Napa Counties.	

Devils Slough T4N, R4W, Sec. 20	?	RM-?		No salmonids.	
American Canyon Creek T4N, R4W, Sec. 27	None	RM-0	Edwards	Personal observations: the stream becomes dry every summer.	2001
Hudeman Slough T4N, R4W, Sec. ?	SH	RM-0.5	CDFG	Resource map: tributary to the Napa River. SH use this stream for migration to Huichica Creek.	1979
Huichica Creek T4N, R4W, Sec. 7	SH	RM-8.3	Ellison, Eng and Carnine Edwards	Survey: found juvenile SH numerous in pools, 10/100 feet in July. Personal Observation: SH present up to the falls at 8.3 miles, fresh water shrimp present ½ mile above Hwy 12.	1980 1995/96
Fagan Creek T4N, R4W, Sec. 9	None	RM-0	Edwards	Personal observation: No fish, some water present where none was present before because the city of Napa has developed a water treatment plant in the area.	2001
Carneros Creek T4N, R4W, Swc. 4	SH	RM- 9.0	Elwell Edwards Emig	Survey: no fish seen on the survey in November, but a small run of SH do use this stream for spawning purposes during the winter months. Personal observation: no fish seen. Personal observation: there is a SH run in Carneros Creek.	1958 1996 2001
Suscol Creek T5N, R4W, Sec. 34	SH	RM-0.6	Edwards	Personal observation: there was a small SH population up to a barrier jam.	1996
Tulucay Creek T5N, R4W, Sec. 14	SH	RM-3.9	Emig Edwards	Survey: found one salmonid in July. Personal observation: have seen SH in the stream up to Murphy Creek.	1992 1996
Spencer Creek T5N, R3W, Sec. 7	None	Rm- 0	Edwards	Personal observation: the stream dries up in the summer.	1995/96
Murphy Creek T5N, R3W, Sec. 7	SH	RM-1.4	Emig Edwards	Survey: found SH present in July below the Coomsville Rd. bridge. Personal observation: SH were seen at the foot of the mountain.	1992 1995/96

Napa Creek T5N, R4W, Sec.?	SH	RM-2.0	Edwards	Personal observation: SH have been seen up to the tributaries.	1994/95
Browns Valley Creek T5N, R4W, Sec. 4	SH	RM-0.5	Edwards	Personal observation: SH use the stream to the falls 20/25 feet high.	1992/93
Redwood Creek T5N, R4W, Sec. 4	SH	RM- 8.2	Cherr and Griffin Edwards	Stream inventory: SH use this stream. Personal observation: have seen SH up to 8.2 miles.	1979 1995
Pickle Canyon Creek T6N, R5W, Sec. 25	SH	RM-2-0	Edwards.	Survey: found juvenile SH present in numbers of 30/100 feet of stream.	1995
Milliken Canyon Creek T6N, R4W, Sec. 2	SH RT	RM-6.6 RM-2.0	Fisher Montoya Edwards	Survey: The City of Napa maintains a reservoir called Milliken Reservoir. RT occupy 2 miles of stream above the reservoir up to a 40 foot falls. Survey: in July, juvenile SH use the stream below the reservoir. Personal observation: found RT present below the reservoir in a ½ mile section, between a 25 foot falls and the reservoir.	1959 1987 1995
Sarco Creek T6N, R4W, Sec. 2	SH	RM- 0.6	Edwards	Personal observation: a small SH population up to the barrier jam.	1996
Soda Creek T6N, R4W, Sec. 3	SH	RM- 2.4	Edwards Emig	Personal observation: SH were seen up to the 15 foot falls. Personal observation: a fish ladder has been constructed on the stream at the Silverado Trail crossing.	1996 2001
Dry Creek T6N, R4W, Sec. 4	SH	RM- 13.0	Nelson and Finlayson Emig	Survey: found juvenile SH present in the upper 8 miles of the 13 miles of stream in August. Electrofished: fish population survey in September and October. Estimated the juvenile population at 18,172 fish.	1973 1983
Montgomery Creek T7N, R5W, Sec. 32	SH	RM-?	Holstine Emig	Survey: no fish seen in December. Personal information: SH were present in the stream.	1975 2001

Hopper Creek T7N, R5W, Sec. 35	SH	RM- 6.0	CDFG	Resource map: some SH activity during the winter period.	1979
Bale Slough T7N, R5W, Sec. ?	SH	RM-1.3	CDFG	Resource map: SH use Bale Slough up to Bear Canyon Creek.	1997
Bear Canyon Creek T7N, R5W, Sec. 17	SH RT	RM- 0.5 RM-?	CDFG	Resource map: some SH, but the stream becomes nearly dry during the summer period. There is a dam on the Francis Ford Copela Estate that stops all SH. There may be RT upstream of this dam.	1997
Conn Creek T7N, R4W, Sec. 31	SH RT	RM-7.5 RM-?	Gray Jones	Electrofished: found RT present near Linda Falls/ Angwin Fire Station in the headwater. Personal observations: SH ascend the stream during the winter and rear in about ½ mile of the stream when the City of Napa released water from Hennessey Reservoir.	1988 1997
Rector Creek T7N, R5W, Sec. 25	SH RT	RM- 1.8 RM- 1.0	Jones and Edwards	Personal observation: SH migrate upstream to the dam, however in the summer the stream becomes dry. RT use the stream above the reservoir for a distance of 1.0 miles.	1975
Chiles Creek T7N, R4W, Sec. 31	RT	RM-4.0	Curtis Fisher	Field note: found RT present up to 3 inches in length in July. Survey: found RT present in the mid or flowing portions of the stream in August.	1945 1956
Moore Creek T8N, R4W, Sec. 30	RT	RM-4.5	Gray	Electrofished: found 30 RT present in 400 feet of stream, 0.4 miles downstream of the wooden Bridge (location?).	1988
Sulphur Creek T8N, R5W, Sec. 30	SH	RM- 3.8	Edwards	Personal observation: SH use this drainage, a gravel operation exists on the stream.	1994
Heath Canyon Creek T7N, R6W, Sec. 1	SH	RM-1.2	Edwards	Personal observation: information from the Napa County Land Trust. Also see CDFG Water Rights files.	1997

York Creek T8N, R6W, Sec. 25	SH	RM-2.5	Edwards	Personal observation: Frank Gray and Jack Edwards electrofished near the reservoir finding juvenile SH . The court ordered the City of St. Helena to remove the dam which has never been done as of 2001.	2001
Bell Canyon Creek T8N, R6W, Sec. 23	SH RT	RM- 2.0 RM-2.0	Nokes Thompson and Michaels	Memo: The City of St. Helena constructed a dam and reservoir on this stream in 1958. Survey: found 2 miles of RT habitat with numbers of 50-100/100 feet of stream in June.	1967 1969
Mill Creek T8N, R6W, Sec. 14	?	RM-?		Needs to be surveyed.	
Ritchey Creek T8N, R6W, Sec. 10	SH	RM-2.5	Emig	Personal observation: a six foot falls is located at the mouth of this stream however, SH use the stream to 2.5 miles upstream.	1984
Dutch Henry Creek T8N, R6W, Sec. 10	SH	RM-4.5	Elwell	Survey: found 4.5 miles of fair to poor spawning and nursery area in November.	1958
Biter Creek T8N, R6W, Sec. 2	?	RM-?		A stream survey is needed.	
Simmons Canyon T8N, R6W, Sec. 6	None	RM-0	Edwards	Personal observation: dry during July , August and September.	1996
Cyrus Creek T9N, R7W, Sec. 6	RT	RM- 1.3	CDFG	Maps: indicate SH presence and area of use.	1984
Garnett Creek T9N, R7W, Sec. 36	SH	RM- 3.0	Emig	Personal observation: found juvenile SH present in 3.0 miles in July. CDFG planted SH in this stream in 1986. This stream has fresh water shrimp in it.	1984
Jerrico Creek T9N, R7W, Sec. 36	SH RT	RM- 0.5 RM-?	Emig and Garland	SH and RT also found freshwater shrimp in the lower elevations.	1984

Kimball Canyon Creek T9N, R7W, Sec. 35	SH	RM-4.0	Allen	Survey: headawater of the Napa River, only periodic use by SH. Survey in mid May.	1957
Sacramento River tributaries					
Suisun Valley Creek T6N, R3W, Sec. 5	SH	RM- 3.6	Edwards	Personal observation: tributary to Chadborn Slough hence Sacramento River, SH use this stream up to lake Curry.	1995
Wooden Valley Creek T6N, R3W, Sec. 25	SH	RM-3.2	Edwards	Personal information: checked SH anglers.	1976/77
White Creek T6N, R3W, Sec. 15	RT	RM- 1.0	Edwards	Personal observation: steep in lower reach, an old hatchery was located on this stream at the lake, (currently it is unused), Lou Allen is the land owner.	1995
Putah Creek T10N, R5W, Sec. 55	RT	RM- 5.3	Jones and Edwards	Personal observation: Putah Creek is a tributrary to the Sacramento River, entering Napa County at the county line with Yolo County at Monticello Dam, Lake Berryessa. RT use the reservoir year round providing a fishery. Upstream, Putah Creek is used by RT for spawning migrations and to a limited extent for rearing purposes, 5.3 miles of stream are within Napa County, above this is an additional 25 miles of stream used by migratory RT in Lake County (see Lake County for this upper portion).	2001
Wragg Canyon T7N, R3W, Sec. 2	RT	RM- 2.8	CDFG	Resource maps.	1979.
Capell Creek T8N, R3W, Sec. 30	RT	RM-1.0	Snyder and Grass	Personal observation: blew up a barrier on this stream in 1993.	1993
Quarry Canyon T8N, R3W, Sec. 18	RT	RM- 0.4	Edwards	Personal observation: caught poachers with over limits.	1995

Pope Creek T9N, R4W, Sec. 17	RT	RM- 10.4	Edwards and Jones	Personal observations: mostly warm water in the summer but RT from Lake Berryessa use this stream during the winter for spawning migrations.	1985
Trout Creek T9N, R4W, Sec. ?	RT	RM- 4.9	CDFG	Resource maps: CDFG personnel indicate RT use this stream.	1985
Maxwell Creek T9N, R4W, Sec. 18	RT	RM- 8.0	Edwards	Personal observation: and CDFG resource map.	1984
Hardin Creek T9N, R5W, Sec. 25	RT	RM- 6.1	Edwards	Personal observation: limited RT use, only potholes in the summer.	1985
Burton Creek T9N, R5W, Sec. 25	RT	RM- 6.0	Edwards and Jones	Personal observation: only limited RT use.	1979/85
Swartz Creek T9N, R6W, Sec. 1	RT	RM- 2.5	Edwards	Personal observation: RT up to the 10 foot high falls.	1985
James Creek T10N, R6W, Sec. 35	RT	RM- 3.0	Cherr and Griffin	Resource map: RT use this stream for 3.0 miles.	1979
Butts Creek T10N, R5W, Sec. 23	RT	RM-6.2	Cherr and Griffin	Resource map: indicates RT use of this stream.	1979
Putah Creek Tributaries North of Lake Berryessa					
Eticuera Creek T10N, R4W, Sec. 22	RT	RM- 15.2	Cherr and Griffin	Stream inventory: and CDFG resource map. A northern tributary to Lake Berryessa, dry during the summer months, but a limited number of RT from Lake Berryessa use the drainage during the winter months for spawning purposes. Further surveys are needed.	1979
Adams Creek T10N, R4W, Sec. 22	RT	RM- 3.2	Cherr and Griffin	Stream inventory: RT are expected up to a four foot high dam.	1979

Nevada Creek T10N, R4W, Sec. 22	?	RM-?		No information: the stream appears to be substantial (7 miles) on the CDFG resource map. This stream needs to be surveyed.	
Zim Zim Creek T11N, R4W, Sec. 34	?	RM-?	CDFG	Resource map: this stream is dry each summer, however the map indicates a substantial stream of some 6.2 miles. A stream survey is needed.	
See Lake County for the headwater portion of Putah Creek.					