5/20/08 Bd Mtg. Item 7
Napa River TMDL
Deadline: 5/8/08 by 12 p.m.

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RECEIVED
MAY 8 2008
SWRCB EXECUTIVE

May 7, 2008

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

Re: Comment Letter - Napa River Sediment TMDL

Dear Ms. Townsend:

This office represents Living Rivers Council ("LRC"), a non-profit association, with respect to the proposed Basin Plan Amendment for the Napa River Sediment Total Maximum Daily Load ("TMDL"). I am writing to submit comments regarding the proposed TMDL on LRC's behalf. LRC objects to the State Water Resources Control Board's adoption of the proposed TMDL on grounds that the Board has not complied with California Environmental Quality Act ("CEQA"), the Clean Water Act or the Porter-Cologne Water Quality Act.

LRC previously submitted the following comments to San Francisco Bay Regional Water Quality Control Board regarding this proposed TMDL:

- August 15, 2006 comment letter from my office including Exhibits 1 through 32.
- Comment letter dated August 11, 2006 from Dr. Robert Curry submitted as Exhibit 1 to my August 15, 2006 comment letter.
- Comment letter dated August 11, 2006 from Dennis Jackson submitted as Exhibit 3 to my August 15, 2006 comment letter.
- Comment letter dated August 12, 2006 from Patrick Higgins submitted as Exhibit 5 to my August 15, 2006 comment letter.

These comments are still applicable and LRC requests that the State Water Resources Control Board ("State Board") consider them before deciding whether to adopt this proposed TMDL.

In addition, LRC's comments include:

- Comment letter dated April 24, 2008 from Dennis Jackson regarding the Napa River Sediment TMDL attached hereto as Exhibit 1;

- Comment letter dated January 28, 2001 from Dennis Jackson regarding the cumulative effects of water diversions in Napa County attached hereto as Exhibit 2;

- Judgement Granting Permanent Injunction entered in the action entitled *People of the State of California v Forni et. al.*, Napa Superior Court No. 31785 attached hereto as Exhibit 3;

- Comment letter dated May 6, 2008 from Patrick Higgins regarding the Napa River Sediment TMDL attached hereto as Exhibit 4;

- Comment letter dated April 2, 2008 from Patrick Higgins regarding the Division of Water Rights' *Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams* attached hereto as Exhibit 5;

- Comment letter dated May 7, 2008 from Dr. Robert Curry regarding the Napa River Sediment TMDL attached hereto as Exhibit 6.

1. Neither the Regional Board Nor the State Board Has Complied with the California Environmental Quality Act ("CEQA")

a. An EIR Equivalent Analysis of Impacts is Required.

The State Board is required to comply with CEQA in approving the TMDL. Where impacts of TMDL implementation may be significant, this means preparing a document that is equivalent to an Environmental Impact Report ("EIR"). *City of Arcadia v. State Water Resources Control Bd.* (2006) 135 Cal. App. 4th 1392, 1422-1423. Here, the Staff Report includes an environmental checklist that is functionally equivalent to a Negative Declaration. A EIR level analysis is required, however, because implementation of the TMDL may cause significant impacts.

The proposed TMDL implementation program regarding sediment discharges associated with vineyards specifies, in the "actions" section of Table 4.1, the "identification of specific erosion control measures needed to achieve performance standards ..." (See Resolution R2-2007-0011. Exhibit A, p. 1763.) The Staff Report and the "Sources and Performance Standards" section of Table 4.1 makes clear that these "erosion control measures" include the engineered drainage facilities that Napa County requires, pursuant to its Conservation Regulations, on new vineyards on slopes over 5% to reduce surface soil erosion.

These engineered drainage facilities often cause significant unintended adverse consequences to the environment, including concentrating runoff and increasing peak flows, which increase downstream sedimentation by causing channel incision and bank failures. Indeed, both Dr. Curry and Mr. Jackson have consistently found that the Erosion Control Plans and facilities approved for new vineyards by Napa County pursuant to its Conservation Regulations do not accurately evaluate or adequately mitigate potentially significant impacts associated with increases in runoff from projects approved pursuant to the Conservation Regulations. *See e.g.*, Exhibits 7 through 16 and 30 through 32 to my comment letter dated August 15, 2006 to the San Francisco Bay Regional Water Quality Control Board regarding this TMDL. As Dr. Curry explained in his overview critique of the Conservation Regulations in 2000:

> 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 its side tributaries. Exhibit 7 to Lippe Comment Letter dated August 15, 2006, p. 1.

Indeed, the cumulative contribution to increased runoff from the installation of engineered drainage facilities designed to bring new vineyards into compliance with the Napa County Conservation Regulations is cumulatively significant. As explained by Dr. Curry:

> The recommended structural drainage facilities such as culverts, lined ditches, and drainage channels as applied over large areas of Napa Valley will reduce sediment input from uplands but will exacerbate off-site channel and stream-bed erosion through increased yield of runoff. The public and the fish in the Napa River are directly impacted by the cumulative downstream impacts of increased frequency and duration of flood flows in the main river and its primary tributaries. The sediment addressed by the TMDL is also important but cumulative effects analyses must also include the changed flow characteristics. Exhibit 6 attached hereto, p. 3.

The Staff Report entirely fails to assess the impact of increases in peak flow as a result of the installation of these engineered drainage facilities.

The TMDL implementation program also incorporates the Division of Water Rights' appropriative permit program and its *Policy for Maintaining Instream Flows in Northern California Coastal Streams*. (See Table 5.2, Resolution R2-2007-0011. Exhibit A, p. 1768.) As described by Dennis Jackson, the Division of Water Rights' appropriative permit program causes significant adverse impacts to the beneficial uses of water in the Napa River watershed (see Exhibit 2 hereto) and as shown by Patrick Higgins (Exhibits 4 and 5 hereto), this state of affairs is expected to continue into the foreseeable future. For this reason, an EIR level analysis of this mechanism of impact is required.

b. The Staff Report Fails to Identify Mitigation Measures to Reduce Significant Impacts, and Fails to Discuss a Reasonable Range of Alternatives as Required by CEQA and Fails to Consider all Relevant Factors.

The comment letters by Curry, Jackson and Higgins provide detailed analyses of a number of mechanisms by which human activity adversely effects the beneficial uses of water in the Napa River watershed. Many of these mechanisms are directly related to sediment-caused impacts. These include, without limitation, increases in peak flows that increase downstream sedimentation by causing channel incision and bank failures; trapping of coarse sediment behind and passing fine sediments through dams; reductions in stream flow by impoundments and diversions, both legal and illegal; groundwater withdrawals from stream channel underflow, which exacerbates low flow effects of sediment deposition in channels and many others.

Yet, the Staff Report does not include any discussion of alternative regulatory approaches that would address these mechanisms of impact. In light of the substantial evidence presented by these commenters that the failure to include these regulatory approaches in the proposed TMDL will render it ineffective in achieving basin plan water quality standards and objectives, this failure represents a violation of CEQA's mandate that the Board prepare an EIR equivalent document that discusses a reasonable range of project alternatives. This also represents a failure to identify mitigation measures to reduce significant impacts identified by these commenters. In addition, this represents a failure to consider all relevant factors necessary to achieve the Clean Water Act's and Porter-Cologne Water Quality Act's goals of cleaning up the waters of the nation and the state.

Thank you for your attention to these comments.

Very truly yours,

Thomas N. Lippe

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Dennis Jackson - Hydrologist

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April 24, 2008
Tom Lippe
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Re: Napa River Sediment TMDL

Dear Mr. Lippe:

I am writing to submit additional comments regarding the Napa River Sediment TMDL. I also present evidence of chronic turbidity in Conn Creek near Angwin that may be adversely impacting rainbow trout upstream of Lake Hennessey.

Channel Incision

Channel incision, also known as downcutting, is when the river cuts into its bed and the channel becomes progressively deeper over time. The Stillwater Sciences Limiting Factors report (2002, page 42) identifies channel incision as a source of sediment.

> Incision, however, can also lead to destabilization of sediment rich banks and adjacent fans, resulting in an increased sediment load on the channel. Incision also causes flood flows to be confined within the incised banks, thereby increasing the likelihood of bed mobility.

Besides identifying channel incision as a source of sediment, the Stillwater Sciences report (2002) also links channel incision to a reduction in the quality of fish habit.

> Pervasive channel incision and habitat simplification have greatly reduced the quantity of habitat for spawning (gravel bars) and early juvenile rearing (riffle margins, side channels and sloughs), and greatly expanded habitat favored by introduced predator fish species (long deep pool-run habitat complexes). Channel incision and simplification appears to be the primary factor limiting salmon population.

The Napa River Sediment TMDL (pages 46-47) states that:

> Four significant categories of human caused sediment sources are: 1) grazing lands, 2) vineyards, 3) roads, and 4) erosion of the Napa River bed and banks. Sediment erosion process that relate to these sources are: a) sheetwash from land uses (grazing and vineyards); b) road related erosion (surface erosion, crossings, and landslides and gullies caused by roads); c) gullies and shallow landslides caused by land-uses that concentrate runoff (grazing, roads, and hillside vineyards); and d) **channel incision and associated bank erosion** (Figure 19). Channel incision has the **highest priority for treatment** because sediment from channel incision is produced locally therefore, it likely has a greater effect on fine sediment deposition at spawning sites in the Napa River, than distal sources. Also, of greater importance than its role in the sediment budget, as the Napa River incises, it obliterates the basic physical habitat structure of the river (expressed by a substantial reduction in quantity of gravels bars, riffle margins, side channels, and sloughs, and a

> disconnection of the channel from its flood plain). The resulting increase in the quantity of homogeneous long, deep pool-run habitats, favors native and introduced fishes that prey upon juvenile salmonids and has likely reduced chinook populations. Stillwater Sciences and Dietrich (2002) postulate that the restoration of natural and complex physical habitat is a necessary prerequisite to facilitate a self-sustaining run of chinook salmon. Restoration of natural bar-pool topography and floodplain connectivity may also be needed to protect other rare or threatened species, including California freshwater shrimp, that are distributed solely or primarily in the Napa River and lower tributary reaches. Additionally, streamside land uses and public works infrastructure also are threatened by the high rates of bank erosion associated with channel incision processes along the Napa River.
>
> Addressing the problem of channel incision in mainstem Napa River and the lower reaches of its tributaries will be the primary focus of the Napa River sediment TMDL. Substantial reductions in the amount of fine sediment input from land-uses in upland areas will also be needed to improve the quality of spawning and rearing habitat for salmon in the Napa River, and to protect spawning habitat for steelhead in its tributaries. Proposed reductions in sediment load are described in Chapter 5 (Allocations and Linkage Analysis).

Dams play a significant role in the channel incision process. The December 20, 2007 Staff Report observes that:

> Following completion of the *Napa River Basin Limiting Factors Analysis*, University of California, Berkeley, in partnership with the University of Florida and with the assistance of Napa County, developed a high-resolution digital topographic map to accurately map the locations and extent of channels and reservoirs throughout the Napa River watershed. Dietrich et al. (2004) identified over 1,000 dams within the watershed, over 400 of which are located on tributary channels that drain approximately 30 percent of the total land area (Map 1). These dams exert a significant influence on routing of physical products (water, heat, nutrients, sediment, and wood), and the movement of fish and aquatic wildlife through channels in the Napa River watershed7. **Because dams capture all of the coarse sediment delivered to channels above dams (and some of the fine sediment), it likely that dams are affecting or influencing the channel incision** and associated bank erosion that has been documented in the mainstem of the Napa River and along the lower reaches of its tributaries.

Channel incision directly delivers sediment to the stream channel and also reduces fish habitat complexity and leads to loss of riparian vegetation. Channel incision also lowers the ground water table near the channel which leads to a decrease in dry weather streamflow. The capture of sediment by dams is a significant cause of channel incision. Large dams that have sufficient storage capacity and the ability to control the rate of release can also contribute to channel incision and bank erosion via their storm water release policies and practices. The Napa River Sediment TMDL does not require a change in the operation of dams nor does it require the owners of dams to contribute in any way to the mitigation of channel incision.

The TMDL assumes that channel incision can be reversed by encouraging grant agencies to fund projects to reconfigure the geometry of the river. This approach does not address the imbalance between the disrupted sediment supply and the sediment transport capacity of the stream downstream of dams. In other words, the TMDL strives to correct the symptoms of channel incision but does not address some of the major underlying forces that cause channel incision.

It is common practice for large reservoirs to capture large flood peaks and then subsequently release the captured water at a rate approximating bankfull for an extended period. Release of stored flood waters at a rate near bankfull for an extended time saturates banks and leads to bank failure when the release rate is subsequently reduced. The practice of releasing stored flood water at rates approximating bankfull can also contribute to redd scour, one of the numeric targets specified in the TMDL. Therefore, I propose that the State Board require that a study be conducted to determine if flood control operations of any of the large reservoirs contributes to bank erosion and channel incision.

It should be recognized that owners of on-stream reservoirs are receiving benefits from the ownership of the on-stream reservoirs and so should be prepared to accept responsibility for environmental damage caused by the reservoirs. Therefore, I propose that ways be explored for the owners of on-stream reservoirs to take responsibility for the role that their reservoirs play in driving the channel incision process. It may be feasible to alter some dams to reduce their impact such as by providing a way for migrating fish to gain access to spawning and rearing areas upstream of the dam. One possible way for owners of on-stream reservoirs to take responsibility for their structures would be to contribute monetarily to a fund for stream habitat restoration and to monitor summer-fall streamflow. There may be other effective ways for the owners of on-stream reservoirs to contribute their fair share towards correcting environmental problems generated by the disruption of the sediment transport process and the blocking of salmonid migration to former spawning and rearing areas.

Low Flows

Natural dry-weather streamflow comes from groundwater. Groundwater can enter a stream channel through either the bed or the banks. Groundwater adjacent to a stream will enter the channel if the water table surface is higher than the water in the stream. The rate of flow of groundwater into the stream is proportional to the difference between the elevation of the water table and the elevation of the water in the stream. Channel incision increases the rate of flow of groundwater into the stream channel. The increased flow of groundwater into the incised stream channel will deplete the volume of groundwater available to supply dry-weather streamflow sooner than would be the case without the incision. The rate of flow into the channel will diminish as the water table surface declines. Therefore, channel incision is likely to result in lower flows during the latter part of the dry season than would have occurred without the incision.

Channel incision has the potential to lower the surface of the water table adjacent to the channel. Lowering the elevation of the water surface would decrease the flow of groundwater into the channel, particularly in the late summer. Incision induced lowering of the groundwater surface would also decrease the total near-surface groundwater supply available for pumping from wells and could exacerbate any decrease in streamflow caused by groundwater pumping.

Wells that are in close proximity to the river channel may draw water from the underflow of the river and would then require an appropriative water right. However, it is my understanding that the Division of Water Rights assumes that a well taps freely-percolating groundwater unless someone demonstrates a connection to the underflow of the river. It is my understanding that wells that tap freely-percolating groundwater do not require an appropriative water right unless the well is in an adjudicated basin. The Regional Board could collect the necessary data to determine if wells near the river were directly impacting streamflow and would therefore require an appropriative water right. However, the Regional Board is not presently collecting the data required to determine if any wells are tapping the underflow of the Napa River without an appropriative water right. This data collection effort should be done in concert with the monitoring of summer-fall streamflow as proposed in the TMDL and Basin Plan Amendment.

Lowering of the water table through incision may threaten the survival of plants within the riparian zone. Loss of riparian vegetation would diminish food supplies for juvenile salmonids. Loss of riparian vegetation would also increase stream water temperatures. Again, pumping may exacerbate the lowering of the groundwater table increasing the likelihood of loss of riparian plants.

Even though the Napa River is incising, local sediment deposition may occur in areas such as near the valley margin where the tributary gradient suddenly flattens or near the mouth of tributaries due to backwater from the river or in other locations. The local sediment deposition could be deep enough that a significant portion of the summer streamflow travels through the deposited material instead of on the surface of the streambed. It is even possible that the entire flow, during late summer or early fall, would seep into the sediment deposited on the bed under the right conditions.

Channel incision may have the potential to degrade the quality of low streamflows. The channel incision would cause a steeper groundwater surface gradient which may bring in groundwater from a greater distance from the channel, increasing the potential for a greater concentration of contamination by farm chemicals or other pollutants such as septic tank discharge. In addition, the dissolved oxygen content may be lower. Naturally occurring materials, such as boron or geo-chemicals, may also be a water quality hazard.

Another low-flow problem occurs in dry years with a cold spring. Many landowners protect crops from spring frosts by spraying water. The California Department of Water Resources was appointed the Frost Protection Watermaster for the Napa River. They have authority over pumping and streamflow from March 15 to May 15 each year. They have set 10 cfs as the minimum streamflow for fish and wildlife. This value may have been determined in the mid 1970's and has not been adjusted since then. The California Department of Water Resources uses the USGS stream gauge at Oak Knoll to set streamflow and pumping rates. I question whether the 10 cfs flow is sufficient to protect fish given the degraded condition of the channel.

The following excerpt is from my January 28, 2001 letter report to Tom Lippe describing the Cumulative Impacts to salmonids in the Napa River.

> The February 1972 report (Anderson, 1972) 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).

Department of Fish and Game documents demonstrate that water diversions and on-stream reservoirs have played a significant role in the decline of salmonids in the Napa River watershed. Many appropriative water rights have bypass flows that are lower than those recommended by studies conducted by the Department of Fish and Game.

Surface water diversions, groundwater pumping and the process of channel incision can all decrease the flow in the Napa River and its tributaries. The actions of the Division of Water Rights (SWRCB) and of the Watermaster (California Department of Water Resources) should be considered under the cumulative impact discussion of the CEQA analysis for the sediment TMDL.

On-stream reservoirs play an important roll in channel incision and therefore should actively participate in mitigating the environmental effects of their on-stream reservoirs. The Regional Board and State Board should develop a process that will allow the owners of on-stream reservoirs to either change the design of a reservoir to mitigate or reduce the environmental damage caused by the reservoir or to contribute monetarily to habitat restoration projects or find some other equitable way offset the problems created by the reservoirs.

The Basin Plan Amendment and TMDL propose to monitor summer and flow streamflow and to develop a, "…cooperative partnership to plan for a joint resolution of water supply concerns and fishery conservation concerns surface water diversions." Near-stream wells should be examined to determine if they are impacting streamflow either by directly tapping the underflow of a stream or by contributing to lowering the water table.

Chronic Turbidity

Chronic turbidity appears to be a problem on Conn Creek. On February 25, 2006 I observed elevated turbidity levels in Conn Creek near Angwin, see Figure 1. The photo was taken 6 days after the last recorded daily rainfall of 0.32", at the Angwin rain gauge. A total of 0.72 inches was recorded at the Angwin rain gauge between 2/17/2006 and 2/19/2006. Prior to 2/17/2006 there were 12 days with no recorded rainfall.

Figure 2 shows the daily average discharge recorded at the USGS Napa River near St Helena stream gauge from December 1, 2005 through February 26, 2006. The discharge, at the Napa River near St Helena gauge, on February 25, 2006 was 78 cfs, which is the median discharge for January through February over a 61 year period.

Trush (2002) has identified "chronic turbidity thresholds" for anadromous salmonid populations for each of the following flow conditions:

- mean daily average streamflow (23%-24%): NTU < 10
- winter base streamflow (10%): NTU < 25
- receding winter peak streamflow (5%): NTU <70
- winter peak streamflow (2.5%): NTU < 100.

The percentages in parentheses are water-discharge exceedence probabilities during the winter which is defined as October 1 through the following May 31. For example, winter base streamflow is exceeded only 10% of the time during winter (October 1 through May 31). Trush's chronic turbidity standard for winter base flow says that the turbidity of the winter base flow should be less than 25 NTU. Since the winter base flow has a water-discharge exceedence probability of 10%, the turbidity should exceed 25 NTU for no more than 10% of the time during the winter. The winter period is 243 days long so, 10% is 2.43 days. Therefore, the turbidity should not exceed 25 NTU for more than 2.43 days or 58 hours during the entire winter period from October 1 through May 31. If the turbidity exceeds 25 NTU for more than 2.43 days, salmonids are expected to suffer adverse impacts.

Table 1 shows the winter (October 1 through May 31) water discharge exceedence probabilities for the Napa River near St Helena and their respective "safe" levels of turbidity as formulated by Trush. The winter base streamflow (10% exceedence probability) for the Napa River near St Helena is 310 cfs and its associated safe turbidity is 25 NTU. The winter average flow for the Napa River near St Helena is 140 cfs and has an exceedence probability of 17.8% and an associated "safe" turbidity of 10 NTU. Trush's turbidity standards, listed above, imply that the winter average discharge has an exceedence probability of about 23% to 24%. However, Trush's work has focused on forested North Coast watersheds that have different hydrologic responses than the Napa River.

Table 1. Selected discharge exceedence probabilities for the Napa River near St Helena and their associated water discharge. The column labeled "Trush's Turbidity Standard" show the turbidity levels where the literature shows that salmonids begin to experience chronic adverse affects from turbidity.

	Exceedence Probability	USGS Napa River near St Helena Daily Discharge cfs	Trush's Turbidity Standard
Winter Peak Flow	2.5%	1,150	<100 NTU
Receding Winter Peak Flow	5.0%	640	<70 NTU
Winter Base Flow	10.0%	310	<25 NTU
Winter Average Flow	17.8%	140	<10 NTU
Jan-Feb Median Flow	26.2%	78	<10 NTU
Winter Median Flow	50.0%	22	<10 NTU

Figure 1. Chronic turbidity observed on Conn Creek near Angwin on February 25, 2006, 56 days after the last flood event recorded at the Napa River near St Helena stream gauge. Figure 2 shows the hydrograph for the Napa River near St Helena from December 1 through February 26, 2006. Assuming that the exceedence probability of the discharge in Conn Creek near Angwin, on 2/25/06, was similar to the exceedence probability of the discharge at the Napa River near St Helena gauge, the turbidity in Conn Creek should have been less than 10 NTU. . I did not measure the turbidity of Conn Creek when I photographed it on 2/25/2006 but water with a turbidity of 10 NTU (or less) is relatively clear and the water I observed and photographed was distinctly cloudy at the time the photo was taken. This location is upstream of Conn Dam and would NOT be subject to the sediment TMDL. The sediment TMDL would not protect the landlocked steelhead that are known to inhabit Conn Creek above Lake Hennessey from this chronic turbidity. In addition, this turbid water will degrade the City of Napa's municipal water supply.

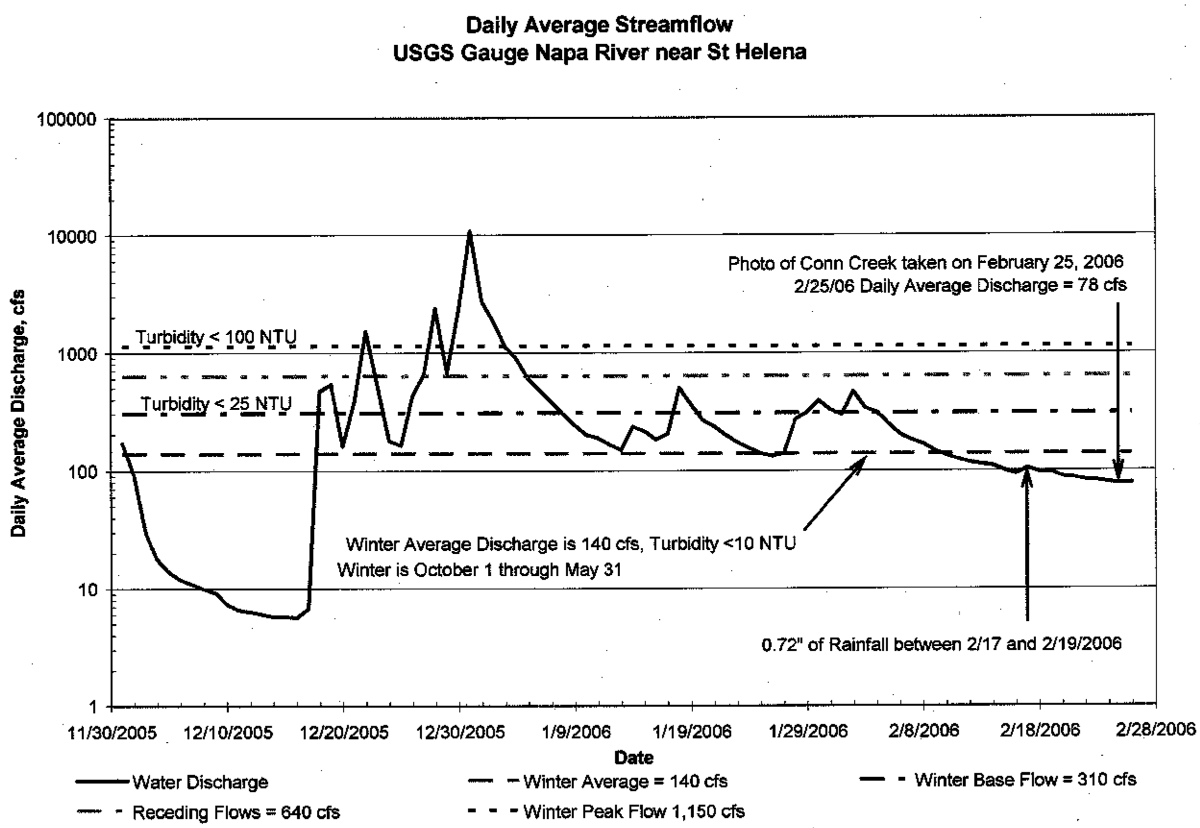

Figure 2. The daily average discharge recorded at the USGS Napa River near St Helena stream gauge from December 1, 2005 through February 26, 2006. No rain had fall between 2/19/06 and 2/25/06 when the photo in Figure 1, showing chronic turbidity in Conn Creek near Angwin, was taken. The discharge on February 25, 2006 was 78 cfs. The long-term (61 years) median discharge for January and February is 78 cfs. The Winter (Oct 1 through May 31) Average discharge, for the Napa River near St Helena, is 140 cfs. According to Trush, the turbidity associated with the Winter Average Discharge should be less than 10 NTU. Assuming that the discharge in Conn Creek near Angwin was close to its winter average on 2/25/2006 suggests that its turbidity should have been less than 10 NTU. I did not measure the turbidity of Conn Creek when I photographed it on 2/25/2006 but water with a turbidity of 10 NTU (or less) is relatively clear and the water I observed and photographed was distinctly cloudy. The dashed horizontal lines in Figure 2 show the flows corresponding to the winter exceedence probabilities in Table 1. These flow exceedence probabilities are associated with maximum chronic turbidity values. For example, a receding peak flow (flow exceedence probability of 5%) should have a turbidity value of less than 70 NTU in order to avoid chronic turbidity stress on salmonids.

The flow at the Napa River near St Helena gauge was 78 cfs (about 26% exceedence probability) on February 25, 2006 when the photo in Figure 1 was taken. Assuming that the discharge in Conn Creek near Angwin had a similar exceedence probability, a turbidity greater than 10 NTU would indicate chronic turbidity. I did not measure the turbidity of Conn Creek when I photographed it on 2/25/2006 but water with a turbidity of 10 NTU (or less) is relatively clear and the water I observed and photographed was distinctly cloudy.

Stillwater Sciences (Limiting Factors Analysis, 2002, Appendix A) attempted to evaluate turbidity in the Napa watershed by taking grab samples 0, 1, 3, and 9 days after storm peaks. Trush (2002) suggests that streams in good condition with respect to salmonid habitat will have turbidity greater than 25 NTU for no more than 10% of the winter (October 1, through May 31) or 2.43 days or 58 hours. Stillwater sampled storms in a dry year and only storms after January. Stillwater sampling schedule could easily have missed chronic turbidity during the storms they sampled. The sampling schedule employed by Stillwater would have caught extreme cases of chronic turbidity but not moderate cases. Moderate levels of chronic turbidity would adversely impact the growth rate of juvenile salmonids and decrease their probability of survival.

Conn Creek drains into Lake Hennessey, one of the five large water supply reservoirs, and is therefore excluded from the sediment TMDL according to the Basin Plan Amendment. The location of the photo of Conn Creek near Angwin is upstream of Conn Dam and so would NOT be subject to the sediment TMDL. Therefore, the sediment TMDL would *not* protect the landlocked steelhead that are known to inhabit Conn Creek above Lake Hennessey (Leidy et al, 2005) from this chronic turbidity. In addition, this turbid water will degrade the City of Napa's municipal water supply. Clearly, the sediment TMDL must be applied to areas upstream of the water supply reservoirs in order to protect the beneficial uses of municipal supply and the landlocked steelhead.

In addition, the elevated level of turbidity in Conn Creek near Angwin should be seen as evidence of a chronic turbidity problem in other locations in the Napa River watershed because the geologic units upstream of where the photo in Figure 1 was taken also occur in areas not controlled by the large water supply reservoirs.

Sincerely,

Dennis Jackson

Dennis Jackson
Hydrologist

References:

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January 28, 2001

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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.

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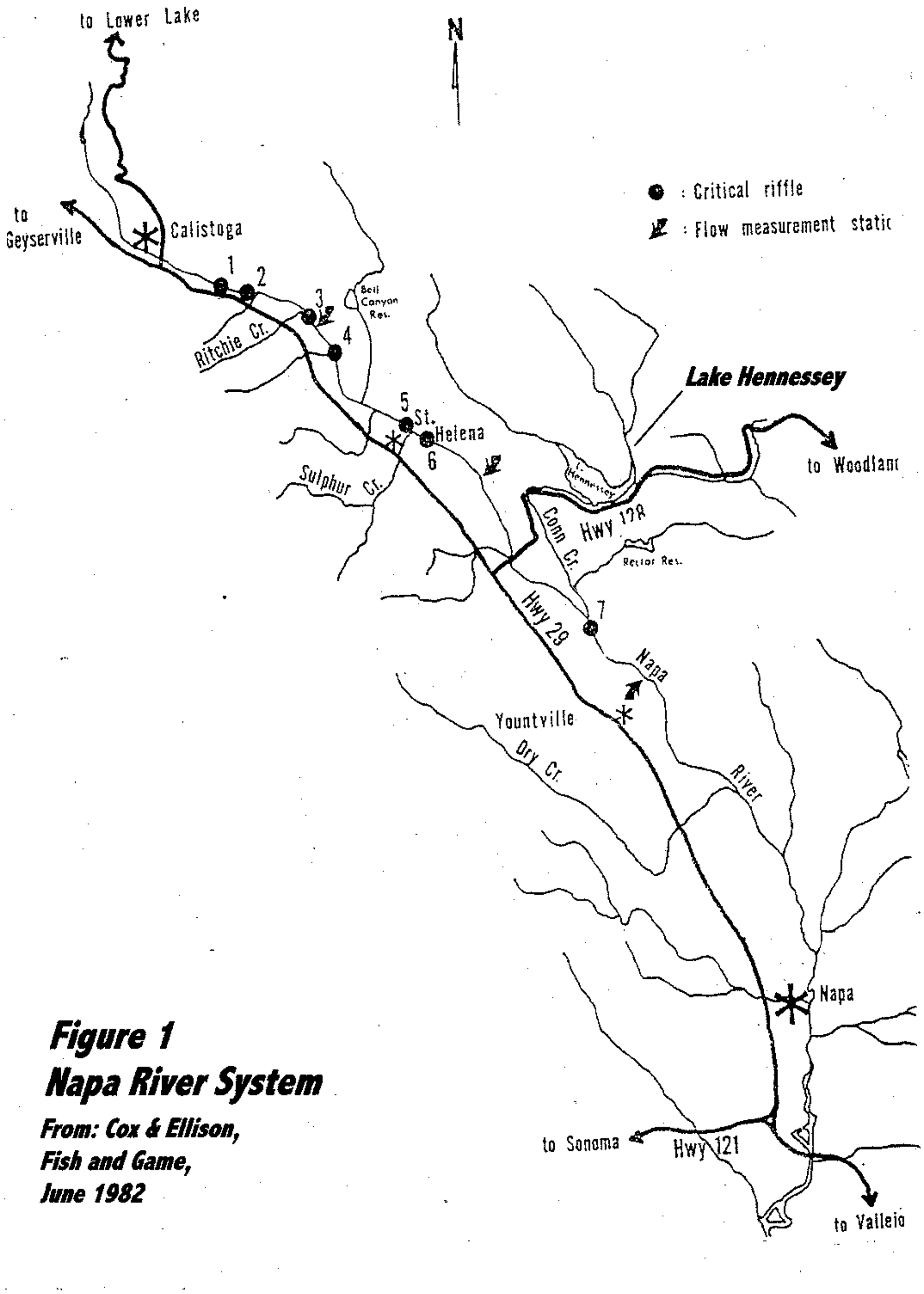

Figure 1
Napa River System

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

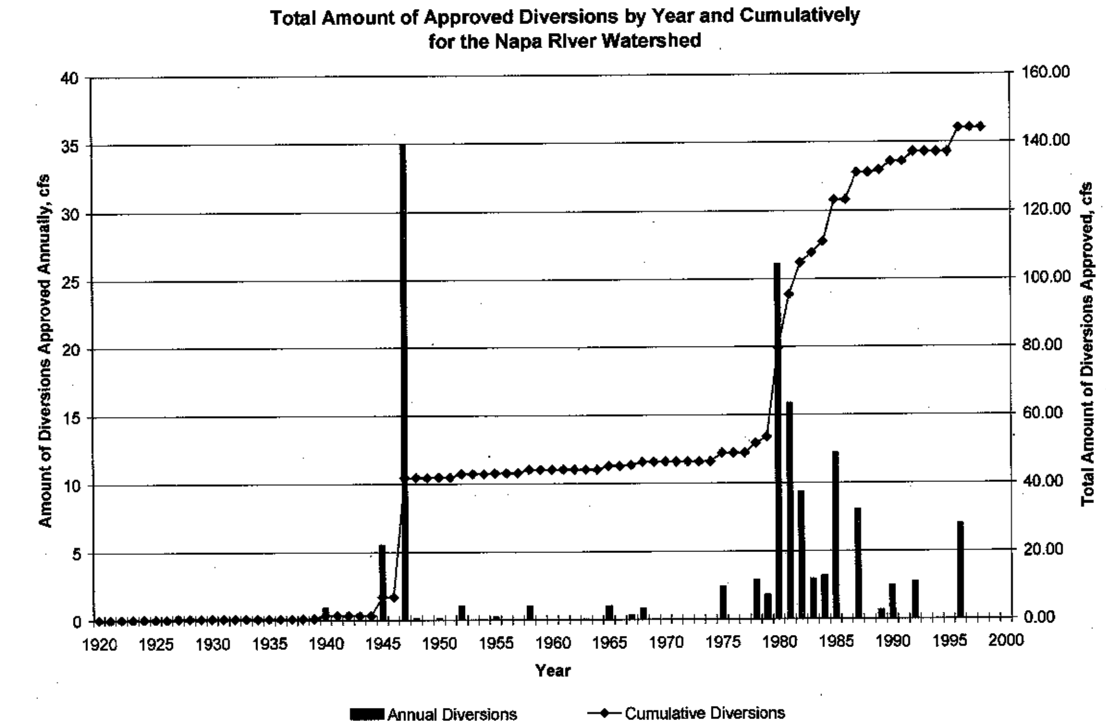

Figure 2. Total amount of direct diversions approved each year and cumulatively for the Napa River watershed.

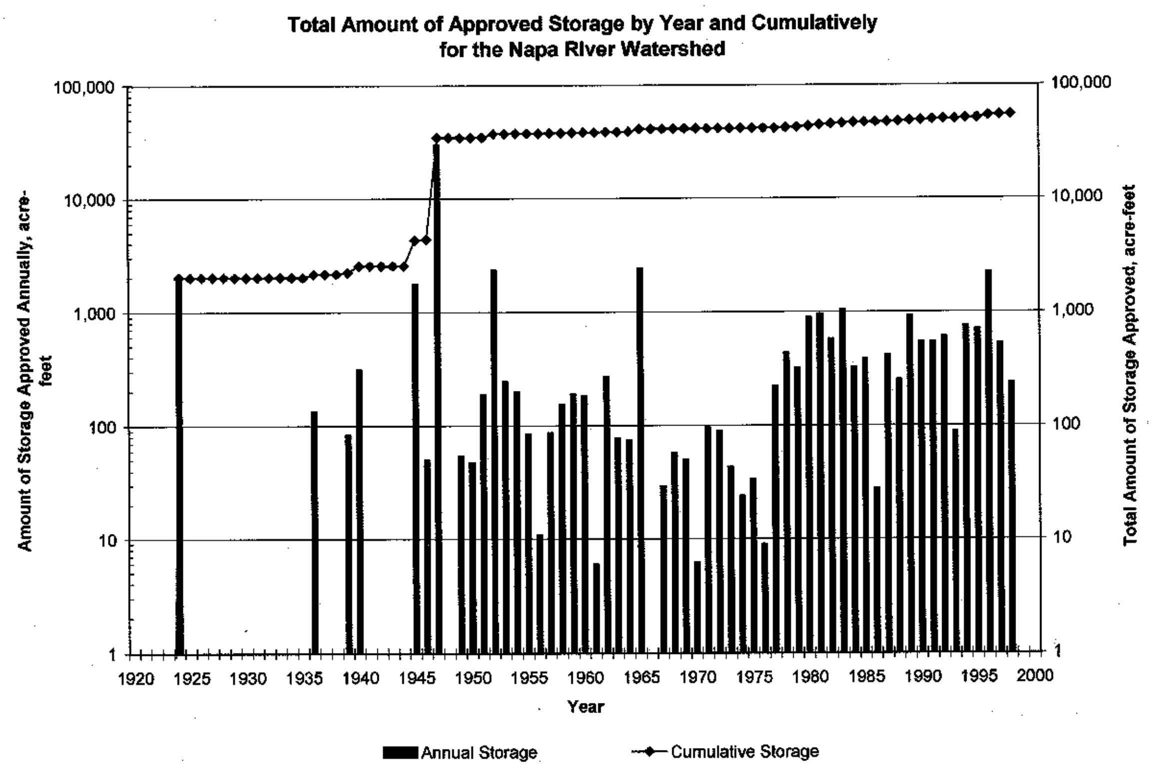

Figure 3. Total amount of storage approved each year and cumulatively in the Napa River watershed.

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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DEC 29 1976

ENDORSED

FILED DEC 29 1976

FLORENCE W. CUNNY, CLERK

BY L. E. MORGAN DEPUTY CLERK

Judg't. Entered

In Judgment Book 29, Page 199

Judgment Roll Filed DEC 29 1976

FLORENCE W. CUNNY, CLERK

By L. F. MORGAN Deputy

SUPERIOR COURT OF STATE OF CALIFORNIA

COUNTY OF NAPA

PEOPLE OF THE STATE OF CALIFORNIA ex rel., STATE WATER RESOURCES CONTROL BOARD,

Plaintiffs,

v.

ALFRED F. FORNI; THEODORE J. LAURENT; VIRGIL A. GALLERON; PAUL L. GALLERON; DONALD M. CAMPBELL; ZINFANDEL ASSOCIATES; PAUL C. JAEGER; FRED BEROLDO; RENA BEROLDO; CHARLES A. CARPY; CROSSE AND BLACKWELL VINTAGE CELLARS, INC. DOES ONE through TWENTY,

Defendants.

NO. 31785

JUDGMENT GRANTING PERMANENT INJUNCTION

Defendants Alfred F. Forni, Theodore J. Laurent, Virgil A. Galleron, Paul L. Galleron, Donald M. Campbell, Zinfandel Associates, Paul C. Jaeger, Fred Beroldo, Rena Beroldo, Charles A. Carpy and Crosse and Blackwell Vintage Cellars, Inc., have executed a Stipulation for Entry of Judgment Granting Permanent Injunction. Additional stipulations have been executed by Frank S. Emmolo and Cody C. Kirkham wherein said individuals have stipulated to their joinder as defendants in the above entitled action. Said stipulations have been filed with the Clerk of the Court upon application of plaintiff.

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Good cause appearing therefore:

IT IS HEREBY ORDERED, ADJUDGED AND DECREED that Frank S. Emmolo and Cody C. Kirkham shall be joined as defendants herein and shall be entitled to the benefits and responsibilities of this Judgment in accordance with its terms, insofar as the land described in the attachments to their stipulations is concerned;

IT IS HEREBY FURTHER ORDERED, ADJUDGED AND DECREED that defendants, their agents, officers, employees, servants, successors in interest, assignees, subsidiary or parent corporations and all persons acting in concert or conspiracy with them, shall not henceforth divert water from the Napa River during the Napa Valley frost season -- March 15 to May 15 of each year -- except in accordance with the following definitions, findings and operational provisions which the Court adopts as its own:

I. DEFINITIONS

A. Allotment is each defendant's proportionate share of available water supply which a watermaster appointed by the plaintiff State Water Resources Control Board determines in accordance with paragraph III, Sub. 9 infra, that each defendant has a right to divert for frost protection purposes during any 24-hour period commencing at midnight.

B. Ample streamflow is a condition when the available water supply is great enough to allow all direct diverters to pump at the full capacity of their river pumps throughout a frost and to allow storage replenishment diverters, including nonriparians having appropriative rights to pump at the full capacity of their pumps continuously. The streamflow is considered to be ample when it exceeds 78

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cubic feet per second (cfs) measured at the USGS gaging station near Napa, Oak Knoll Road, (hereinafter, USGS gage) or when it would exceed that amount in the absence of any diversions by upstream diverters. The figure 78 cfs shall, if necessary, be adjusted yearly by the watermaster and shall depend upon total riparian pumping capacity for frost protection purposes.

C. Available water supply is that portion of the water flowing in Napa River over and above the amount necessary for the protection of fish in the Napa River. The watermaster will be guided by the requirement of 10 cfs for fish protection in the Napa River superior in priority to appropriative rights and correlative with riparian rights.

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D. Direct diverters are those defendants and other diverters who pump directly from Napa River onto vineyards for frost protection rather than pumping first into a reservoir of reasonable size, and if only part of their vineyard is so protected, they are direct diverters so far as the part so protected is concerned.

E. Full natural flow is the sum of the measured flow of the Napa River at the USGS gage and diversions being made concurrently by diverters upstream from the gage.

F. Napa River is that portion of the main stem of the Napa River between the uppermost and lower most diversion points inclusive of all frost season diverters.

G. Reservoir of reasonable size is a reservoir with capacity of approximately 50,000 gallons or more per acre of vineyards under sprinklers. A reservoir of less capacity may be considered reasonable at the discretion of the watermaster, who shall take into consideration (1) the extent of any supplemental water supply that may be available and (2) whether the capacity of the river pump is sufficiently low per acre of vineyard to have an insignificant effect on the ability of other diverters to pump their allotment.

H. Riparian land is the land of frost season diverters, including defendants, determined on an interim basis to be riparian to Napa River by the watermaster for the purpose of allocating water in 1976. Any land considered to be riparian during the 1976 frost season shall continue to be so considered unless a title search indicates otherwise. For other land, not included in the 1976 program or in a decree or order of a Court in a water adjudication proceeding, the watermaster will use county assessor's parcel maps and conduct a field survey of each new participating vineyard to determine riparian status.

I. <u>Storage replenishment diverters</u> are those defendants and other diverters who pump water from Napa River, to replenish water stored in reservoirs of reasonable size prior to March 15, where both initially stored water and replenishment water is for later use on vineyards for frost protection.

II. FINDINGS

A. Many of the vineyardists in Napa Valley are dependent on diversion of water from the Napa River for sprinkling to prevent frost damage to their vineyards during the season from about March 15 to May 15.

B. The streamflow available in the Napa River is at times insufficient to fulfill all direct diversion requirements and is occasionally insufficient to permit all frost protection storage reservoirs to be replenished after a frost by continuous pumping from Napa River.

C. Appropriative water rights administered by the State Water Resources Control Board are conditioned so that diversion of water after March 15 of each year is permitted only so long as the diverter is participating in a water distribution program to assure protection to prior rights.

D. Section 1051.5 of the Water Code authorizes the Board to conduct trial distribution of water in accordance with agreements.

E. The proper enforcement of this Judgment requires that both the instantaneous rate of discharge and the cumulative total volume of water pumped by each pump be measured.

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III. OPERATIONAL PROVISIONS

1. A watermaster appointed by the plaintiff State Water Resources Control Board (hereinafter "the Board") will determine allotments to the defendants and will control the amount, the rate, and times of pumping of defendants.

2. The defendants shall abide by the instructions given to them by the watermaster.

3. All reservoirs must be filled and ready for use by March 15, unless additional time for filling is allowed by the watermaster.

4. All defendants will inform the watermaster of the name, address, and phone number of the person responsible for operating the frost protection system.

5. Meters shall be installed on each discharge line capable of measuring both the instantaneous pumping rate and the cumulative total volume of water pumped. The meters shall be installed and operable by March 15, 1977 unless additional time is granted by the watermaster. All other diverters shall be required by the watermaster to provide metering devices appropriate to their diversion methods.

6. The defendants shall reimburse the Board for a proportional share of the Board's actual expenses in providing the watermaster for the period March 15 to May 15, of each year. The expenses of the Board charged to each defendant shall be apportioned according to the proportion each defendant's acreage under sprinklers bears to the total acreage of all defendants and all participants in any yearly trial distribution program conducted by the Board.

7. Knowledge of the following facts is essential to the success of the distribution program:

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a. Number of acres to be frost protected by each defendant.

b. Capacity of reservoir.

c. Capacity of river pump.

Each defendant shall inform the watermaster of these facts by February 15, 1977 and thereafter inform him of any changes.

8. Each defendant shall grant the watermaster reasonable right of access across the defendant's property and the right to inspect and measure pump capacities, acreages, reservoir storage levels, and diversion and sprinkler systems for the purpose of enforcing this judgment.

9. The watermaster will allot the available water supply when it is less than ample to the defendants, correlatively in proportion to total riparian acreage under sprinklers limited by pump diversion capacities. The watermaster will estimate the available water supply for allotments from gaging station data. Other data, such as channel storage, may be considered by the watermaster in estimating available water supply for allotments. Appropriators having nonriparian vineyards will be allowed to pump for this land only when streamflow is in excess of riparian direct diverters' and riparian storage replenishment diverters' requirements including replenishment of reservoirs serving riparian lands.

10. During less than ample streamflow conditions, the watermaster will inform each storage replenishment diverter and each direct diverter of the period of time during which the allotment can be pumped. Without interfering with the needs of storage replenishment diverters, the watermaster will prescribe pumping hours for storage replenishment diverters within the period of each day when these diversions will, insofar as possible, conflict least with direct diverter requirements.

11. Each direct diverter agrees to divert only his allotment when full natural flow is less than ample, and only when his system is equipped with a main control valve near the pump discharge and individual valves on each sprinkler line which provide the capability of reducing the rate of diversion in increments shown opposite the name of the direct diverter in Appendix "A" attached to this Judgment.

12. Unused allotments shall be considered as an increase in the available water supply for all other diverters i accordance with the priorities of the various rights.

13. To conserve water and prevent waste, the watermaster may at times allow diversion of water outside the normal pumping period established to carry out the terms of this Judgment, provided that such diversion will not deprive other diverters of their allotment.

14. Compliance by defendants with the instructions from the watermaster will be determined by taking readings of the meter on the discharge line of the pump or by any other reasonable method of determining the amount or rate of pumping.

15. Minor deviations by defendants from the pumping instructions given them by the watermaster shall be adjusted as promptly as possible.

16. Willful diversion by defendants of water not alloted them by the watermaster will be prima facie evidence of violation of the terms of this Judgment and the terms of any water right permit or license authorizing the diversion. A violation of the terms of this Judgment shall be cause for revocation of any permit or license issued for frost protection and shall be considered to constitute an unreasonable method of diversion within the meaning of Article X, Section 2

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of the California Constitution and Sections 100, 101 and 275 of the Water Code.

IT IS HEREBY FURTHER ORDERED, ADJUDGED AND DECREED that in the event of a violation of the terms of this Judgment, the watermaster shall have the authority to apply to the Superior Court of Napa County for appropriate relief including an order prohibiting any further violation of the terms of this ..greement.

IT IS HEREBY FURTHER ORDERED, ADJUDGED AND DECREED that at the end of each frost season, the watermaster shall prepare a report summarizing any trial distribution program conducted by the Board and shall make available to all defendants all factual data collected.

IT IS HEREBY FURTHER ORDERED, ADJUDGED AND DECREED that defendants Charles A. Carpy and Crosse and Blackwell Vintage Cellars shall forthwith make proper application to plaintiff for permit to divert and store Napa River water in reservoirs for frost protection purposes.

IT IS HEREBY FURTHER ORDERED, ADJUDGED AND DECREED that experience gained during each season shall be drawn on at the end of each frost season to develop refinements leading eventually to a comprehensive control program for all Napa Valley vineyardists dependent on the Napa River and its tributaries for frost protection. This Court shall retain jurisdiction in this case to order modification of its Judgment so as to incorporate refinements based upon experience gained during each frost season.

IT IS HEREBY FURTHER ORDERED, ADJUDGED AND DECRRED that except as expressly provided herein nothing in this Judgment shall be deemed to modify or preempt any term or condition of any water right entitlement.

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IT IS HEREBY FURTHER ORDERED, ADJUDGED AND DECREED that each party herein, shall bear his own costs of suit.

DATED: 12-29-, 1976.

THOMAS KONGSGAARD
JUDGE OF THE SUPERIOR COURT

Napa Superior Court No. 31785.

Patrick Higgins
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May 6, 2008

Mr. Thomas Lippe
Attorney at Law
329 Bryant Street, Suite 3D
San Francisco, CA 94107

Re: Final Napa River Watershed Sediment TMDL and Habitat Enhancement Plan

Dear Mr. Lippe,

I have reviewed the San Francisco Bay Regional Water Quality Control Board staff's final *Napa River Watershed Sediment TMDL and Habitat Enhancement Plan* (Napolitano et al., 2007) and the related proposed *Basin Plan* (SFBRWQCB, 2005) amendment. Unfortunately, I do not see appropriate response to my previous comments provided for you during *Napa River TMDL* development (Higgins, 2006, 2007) or to comments and recommendations of hydrologist Dennis Jackson (2006) or Dr. Robert Curry (2006).

Major problems in the final *Napa River TMDL* and *Basin Plan* amendment include:

- Implementation will be largely driven by voluntary actions,
- No recommendation or guidelines are set forth for limiting development or preventing increased road density to enable restoration of natural hydrologic function and flow regimes,
- Decreased base flows due to altered watershed hydrology are already negatively impacting steelhead and chinook salmon (including sedimentation of spawning beds) and continuing development will exacerbate these impacts,
- Failure to deal adequately with increased peak flow issues insures that bank erosion will continue, confounding successful TMDL implementation,
- Monitoring is restricted to spawning gravel permeability and scour depth of the stream bed gravels, which will be insufficient to gauge recovery, while more standard measures such as sediment grab samples, cross sections and longitudinal profiles, and turbidity are ignored,
- Site specific mitigations and implementation of Best Management Practices are the main tools for achieving Napa TMDL objectives, but cumulative watershed effects will likely confound success, and
- Areas above dams are exempt under the Napa TMDL despite the ability of sediment to pass through reservoirs and the need to protect remnant land-locked steelhead populations that still spawn in upper tributaries.

I have attached comments (Higgins, 2008) I recently prepared for the Redwood Chapter of the Sierra Club on the *Policy for Maintaining Instream Flows in Northern California Coastal Streams* (SWRCB WRD, 2007). In Table 5.2 the *Napa River TMDL* states that the State Water Resources Control Board Water Rights Division will "establish guidelines to maintain in-stream flow to protect salmonids," but the *Policy* fails in this regard for the reasons stated in the attached comments.

Appendices to the *North Coast Instream Flow Policy* (Stetson Engineers, 2007) document major cumulative effects contributions from legal and illegal diversions that also compound sedimentation problems. They note that there are hundreds of diversions in the Napa River watershed and that more than half are unpermitted. Peer reviewers of the *Policy*, such as Band (2008), explained how downstream interactions of numerous diversions cause problems for salmonid spawning and I provide explanatory excerpts below (Higgins, 2008):

> "Band (2008) described numerous cumulative watershed effects likely from the interaction of diversions, even if all were operating in accordance with minimum base flows (MBF). 'The cumulative impacts of water diversions from all areas of the drainage network require consideration of the network as an entity, and not just the sum of all individual reaches.'
>
> While each diversion might only capture less than 5% of the 1.5 recurrence interval flow at one location, Band (2008) calculated the interaction between diversions in the stream system could increase to 28% downstream. He sees the necessity of increasing model parameters "to analyze the impacts of sequential dependencies of reach conditions as they will not be randomly distributed."
>
> If interactions of multiple diversions are not factored into consideration, Band (2008) predicts "perturbations to the downstream hydraulic geometry, as well as bed sediment grain size, and seasonal variations in bed composition." Of specific concern to Band (2008) is fine sediment delivery from early storms in streams where flow is depleted: 'the first few increased flows of the year may flush fine grained sediment, perhaps without mobilizing coarser grain sizes, which may accumulate in reaches where discharge is drawn down.' These reaches might be ones used for spawning."

The interaction of early season diversions in various Napa River tributaries likely combine to deplete flow and cause fine sediment deposition in Chinook salmon redds in the mainstem reaches. This is another example of cumulative effects overlooked by the *Napa River TMDL* and yet another deficiency with regard to compliance with CEQA.

Conclusion

As noted above, many of the points raised in my initial comments remain unaddressed. The final report demonstrates that the SFBRWQCB staff continues to interpret their responsibility for the *Napa River TMDL* and *Basin Plan* amendment narrowly, which makes it unlikely that actions will prevent sediment pollution and allow restoration of Pacific salmon species in a timely fashion. Monitoring is insufficient in temporal and spatial extent to provide a feed back mechanism for meaningful enforcement through use of Waste Discharge Requirements, upon which the *Napa River TMDL* and *Basin Plan* extensively rely.

Sincerely,

Patrick Higgins

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April 2, 2008

Karen Niiya
Senior Water Resource Control Engineer
Permitting Section Division of Water Rights
State Water Resources Control Board
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Sacramento, CA 95812-2000

Re: Comments on *Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams*

Dear Ms. Niiya,

I have reviewed the *Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams* on behalf of the Redwood Chapter of the Sierra Club and provide comments on their behalf below. In addition to commenting specifically on the proposed *Policy*, I provide information on the status of Pacific salmon species in northern California, climatic cycles that affect salmon abundance, and on the interplay of cumulative watershed effects caused by land use management and those caused by diversion. I also provide case studies of several northern California watersheds where water diversion is limiting Pacific salmon, including ones outside the area defined by the *Policy*.

I have read the *Draft Policy* and read peer review comments from Dr. Lawrence Band (2008), Dr. Margaret Lang (2008), Dr. Robert Gearheart (2008), Dr. Charles Burt (2008), and Dr. Thomas McMahon (2008). In addition I read or reviewed McBain and Trush and Trout Unlimited (MTTU, 2000), California Department of Fish and Game and National Marine Fisheries Service (2002) guidelines for central California coastal streams and Appendices to the *Policy* (Stetson Engineering, 2007a; 2007b; R2 Consulting, 2007a; 2007b; 2007c). Although I find the *Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams* to have substantial technical merit, much more action is needed on regulation of water use to prevent the further decline of Pacific salmon stocks and the likelihood of stock extinctions.

Qualifications

With regard to 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). Although I am not a hydrologist, I have considerable expertise in the area of water use and its effect on Pacific salmon.

Since 1994 I have been the project manager for 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 a number that fall within the targeted area of the *Policy*.

The California Department of Forestry (CDF) funded KRIS projects in the Mattole, Ten Mile, Noyo, Big and Gualala rivers as part of the North Coast Watershed Assessment Planning effort. The Sonoma County Water Agency (SCWA) also funded regional KRIS projects (IFR, 2003), including ones for the Garcia, Russian and Navarro rivers and tributaries of the Pacific Ocean and San Francisco Bay in Marin and Sonoma Counties. I am submitting a DVD including all KRIS projects for the geographic area covered by the *Policy*.

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. 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 field experience as a field biologist in the South Fork Trinity, Klamath, Eel, Navarro, Mattole and Garcia rivers as well as smaller coastal streams from Humboldt Bay to San Diego County.

Overview

The *Policy for Maintaining Instream Flows in Northern California Coastal Streams* (*Policy*) (SWRCB WRD, In Review) was created in response to California Assembly Bill 2121, which requires the State Water Resources Control Board (SWRCB) Water Rights Division (WRD) to adopt principles and guidelines for maintaining instream flows in coastal streams from the Mattole River to Marin County and in coastal streams entering northern San Pablo Bay (Figure 1). Much of the *Policy* is derived from a California Department of Fish and Game (CDFG) and National Marine Fisheries Service (NMFS) central California coast water supply paper (CDFG and NMFS, 2002). The *Policy* proposes to:

1) Restrict new appropriative rights for diversion of surface water to October 1 to March 15,
2) Establish minimum bypass flows,
3) Set cumulative diversion limits, and
4) Discontinue permitting dams on Class I and II streams.

The *Policy* also calls for universal screening of new diversions, construction of fish passage facilities, non-native species control and riparian restoration. Appropriate monitoring parameters are identified in the Policy and the adaptive management strategy is theoretically sound (Band, 2008; McMahon, 2008).

Unfortunately, the *Policy* will only be narrowly applied to new appropriative water right applications in a restricted geographic area and does not deal with other aspects of long recognized water supply problems. Shortcomings of the approach include:

- No action to assess summer and fall flows, when the most critical flow shortages for juvenile salmonid rearing are known to occur,
- No recognition of changes in stream channels and watershed hydrology due to land use nor the implications for salmonid suitability or surface water supply,
- Applies only to new diversions seeking appropriative water rights and does not discuss potential problems due unlimited riparian water rights that could be exercised at any time,

Figure 1. North Coast area defined by the *Policy* to which the statutes defined therein will be applied. It does not cover the Klamath or Eel River basins that have greater need of water rights reform and greater potential for salmon and steelhead recovery.

- Insufficient consideration of ground water extraction despite known linkage to diminished surface flow and carrying for Pacific salmon species regionally,
- Enforcement discussion shows the WRD refuses to enforce water law and to provide a disincentive for unpermitted water use, creating an epidemic problem of illegal diversions, and
- The *Policy* recommends recognizing Watershed Groups that are comprised of diverters and envisions transfer of many SWRCB WRD responsibilities to such local extraction interests.

Although AB 2121 has forced publication of this *Policy*, there seems to be a great deal of reluctance on behalf of the SWRCB WRD to fully engage in this effort as indicated by the tone of the report, a lack of willingness to set limits on diversion and to enforce CA Water Code § 1052, 1055, 1243, and 1375. Also the geographic area of the *Policy* does not cover some northern California watersheds with greater need for water rights reform for Pacific salmon species protection, such as the Scott, Shasta and Eel Rivers. Consequently, the *Policy* is not likely to recover coho salmon, Chinook salmon and steelhead in northern California.

Policy Framework

The SWRCB WRD has been working on this *Policy* for more than a decade (R2 Consultants, 2007a) and there is a great deal of merit in the theoretical basis for its minimum base flow and maximum cumulative diversion calculation. Dr. Lawrence Band (2008) summed limitations and benefits of the *Policy*:

> "The documents provided for review contain a set of references to the limited time and budget available for data collection and analysis, and present very limited field sampling at one specific time, with flow records drawn from different periods of time. Given these limitations, the approach adopted in the proposed policy, to provide more conservative restrictions on in-stream water use at the regional level, is a sound strategy."

There are, however, some instances where the *Policy* strays from a sound scientific basis and potential major data gaps will likely confound the application of the system. The five elements of the *Policy* framework are listed below with observations of peer reviewers and my own comments.

1. *"Water diversions shall be seasonally limited to periods in which instream flows are naturally high to prevent adverse effects to fish and fish habitat."*

In fact, the only limitation on water diversions would be on new appropriative water rights applicants and no study or action is envisioned for extraction from April through October, when flows are severely limiting for juvenile salmonid rearing. Dr. Thomas McMahon (2008) cautions that the entire exercise will be confounded due to this deficiency:

> "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."

The Policy gives little or no scientific defense of its choice of October 1 versus December 15 as the start up of the winter water diversion:

> "Although the DFG-NMFS Draft Guidelines recommended a season of diversion from December 15 through March 31, an earlier diversion season start date is still protective of fishery resources when minimum instream flows and natural flow variability are maintained. This policy limits new water diversions in the policy area to a diversion season beginning on October 1 and ending on March 31 of the succeeding year."

Band (2008) points out that "the recommended limits of October 1 to March 31 is a compromise between the two other options (all year diversions and December 15-March 31), but places the beginning of the diversion season at the beginning of flow increases and Chinook migration in most years." Dr. Margaret Lang concurred and recommended the later start date: "The December 15 start date is much more likely to prevent water diversion during the extreme low flows present before the onset of consistent rainfall." She notes that numerous years there is little runoff on the first major storms of the season, as soil pores and the groundwater matrix soak up most early rainfall.

2. *"Water shall be diverted only when stream flows are higher than the minimum instream flows needed for fish spawning and passage."*

Peer reviewers (Lang, 2008; McMahon, 2008) suggest that impacts on rearing salmonids need equal consideration with those on migrating and spawning adults. Steelhead juveniles typically spend two years in freshwater (Barnhart, 1989) and coho salmon spend a full year feeding before migrating to the ocean (Groot and Margolis, 1991). Dr. Lang (2008) points out that factors such as "food availability, food delivery from upstream, and hiding cover, that are also important and not well characterized" by modeling exercises and cites Harvey et al. (2006) as demonstrating differences in growth rates of juvenile salmonids between diverted and undiverted streams.

Again there is no mention of limiting diversion from April through October, no limit proposed for riparian diversions that do not require off-stream storage, nor restrictions on ground water extraction to actually maintain and restore flows for salmon and steelhead, even if the *Policy* were enacted (Band, 2008; Gearheart, 2008).

3. *The maximum rate at which water is diverted in a watershed shall not adversely affect the natural flow variability needed for maintaining adequate channel structure and habitat for fish.*

This policy requires calculation of minimum base flow (MBF) and maximum cumulative diversion (MCD), but lack of recent or historic flow data and problems with application of models confound accurate estimates (Lang, 2008). Even if the MBF and MCD were accurately calculated, they do not properly account for interactions between diversions. Synergy between diversions in multiple tributaries will cause unintended consequences on flows, fish passage and alteration of substrate quality in downstream reaches that need to be more fully considered (Band, 2008; Gearheart, 2008).

4. *Construction or permitting of new on-stream dams shall be restricted. When allowed, on-stream dams shall be constructed and permitted in a manner that does not adversely affect fish and their habitat.*

Although future permit activities may restrict the construction of new dams, there are 1771 illegal dams already constructed within the geographic area covered by the *Policy* (Stetson Engineers, 2007a) (Figure 3) for which permits are being considered. Avoiding cumulative effects from thousands of impoundments, many of which are on Class I streams that contain salmonids, will not be possible without widespread enforcement action to remove a significant number of these illegal dams.

Several peer reviewers express reservations about damming and diversion of small headwater tributaries (Band, 2008; McMahon, 2008). Band (2008) notes a high risk of cumulative effects despite mitigations proposed for such projects in the *Policy*. 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."

5. *The cumulative effects of water diversions on instream flows needed for the protection of fish and their habitat shall be considered and minimized.*

The *Policy* does not properly deal with cumulative effects of diversions (Gearheart, 2008; Band, 2008) nor those associated with long term changes to streams and watershed hydrology due to land use that effect surface and ground water availability (see Cumulative Effects). Gearheart expressed the following concern:

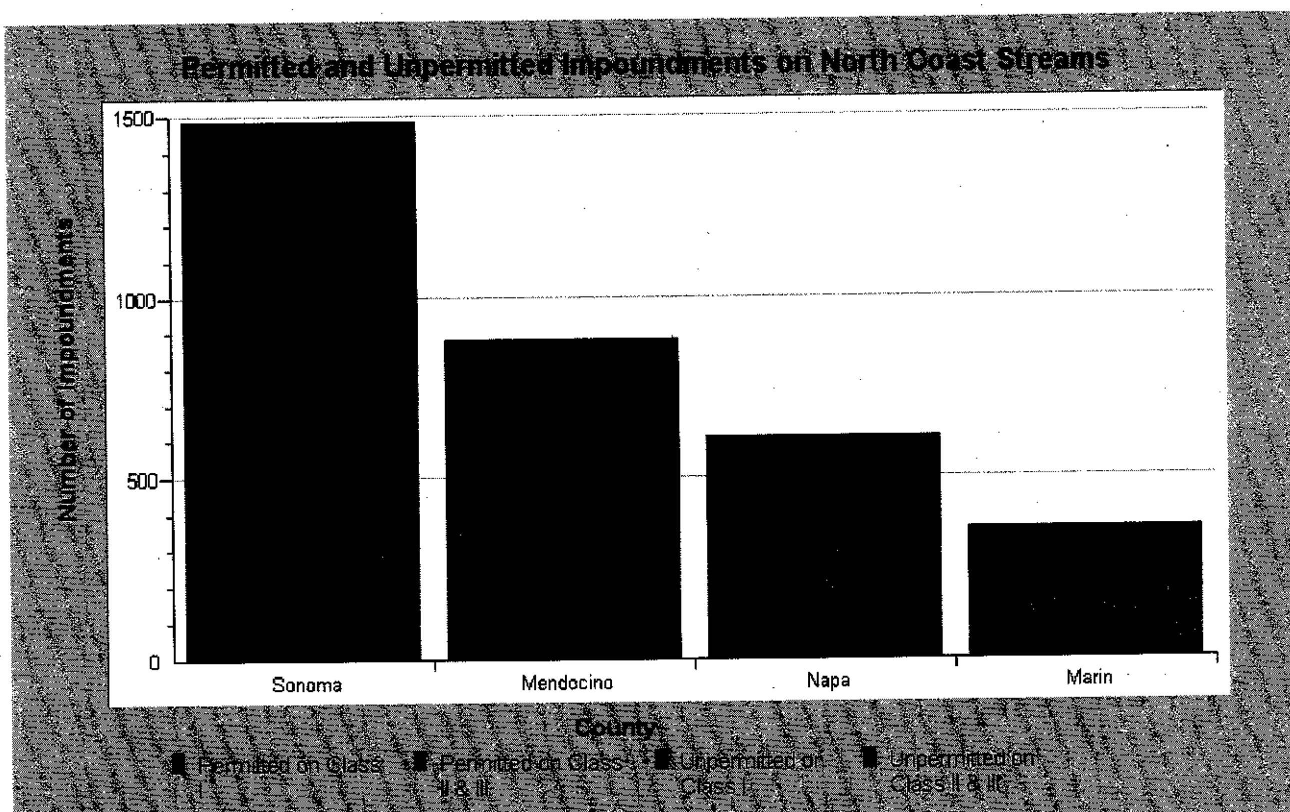

Figure 2. The number of permitted and unpermitted impoundments within the geographic area covered by the *Policy* is displayed above with illegal diversion impoundments outnumbering legal ones. Data from Stetson Engineers (2007a).

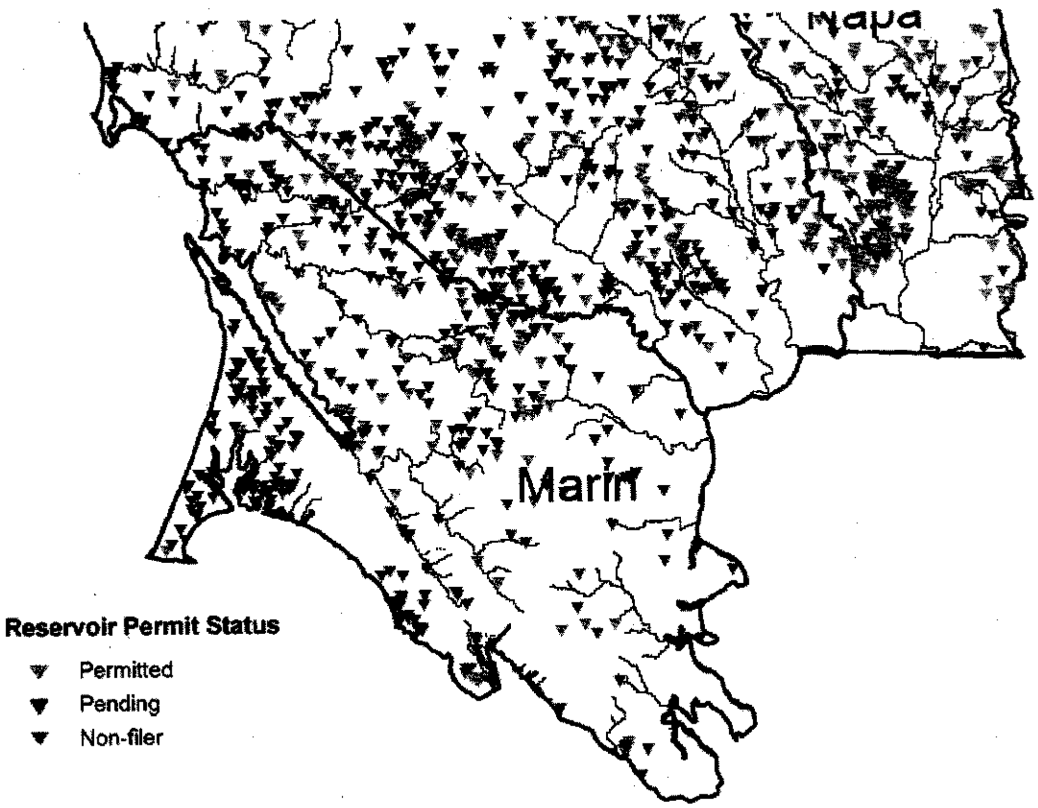

Figure 3. The number of Marin County, southern Sonoma and Napa County diversion impoundments displayed above demonstrate the challenge that an appropriative right water applicant faces in inventorying quantities diverted. Stetson Engineers (2007a) Figure A-3.

> "It appears to me as one evaluates the cumulative effect of scalping 5% of the peak as the storm hydrograph precedes down stream the reduction in the total flow reduces and the delay time (1/2 day recession -flow restricted) increases."

Band (2008) suggests that flow depletion below stream convergence points will magnify fluctuations. This in turn will cause depositions of fine sediment and other undesirable channel changes that could affect spawning salmon and steelhead downstream (see Cumulative Effects).

Minimum Base Flow (MBF) and Maximum Cumulative Diversion (MCD): The Policy hinges on relatively accurate estimate of MBF and MCD. Although the scientific basis for calculation of these statistics is theoretically sound, accurate calculation is confounded by lack of historic records and problems with model simulations.

The *Policy* defines the MBF as "the minimum instantaneous flow rate of water that must be moving past the point of diversion (POD) before water may be diverted" and recommends 60% of the mean annual unimpaired flow (0.60 Q_m) as needed for flows and fish passage in watersheds greater than 290 square miles either at the point of diversion, or at the upper limit of anadromy. Lang (2007) states that 68% (0.68 Q_m) is actually needed for protection of fisheries resources and also points out that there may be substantial error in calculation of mean annual unimpaired flow because there are very sparse gauge data, often with periods of record of less than 10 years. Lang (2008) cautions additionally that model generated mean flow estimates may have significant error:

> "Scaling by watershed area and mean annual precipitation works reasonably well for peak and major storm flows dominated by the rainfall generated runoff (assuming the storm influences at nearby gauged sites are consistently similar to the watershed of interest) but at lower flows, more subtle factors such as watershed geology, slopes, ground cover, soil thickness, etc. influence the stream flow. The mean annual flow is as much a function of storm flows as low flows that do not generally correlate as well to drainage area."

The maximum cumulative diversion (MCD) is defined in the policy as "the largest value that the sum of the rates of diversion of all diversions upstream of a specific location in the watershed can be in order to maintain adequate peak stream flows. The maximum cumulative diversion criterion is equal to five percent of the 1.5-year instantaneous peak flow."

Lang (2008) recommended against the use of MCD in the Policy:

> "The analysis by R2 Resources (2007) and Stetson Engineers, Inc (2007) clearly shows that maximum cumulative diversion limits set as volumes failed to meet the stated criteria of providing for channel maintenance flows. Stating the criteria as a volume would not meet objectives of the policy."

Lang (2008) is joined by most other peer reviewers (Band, 2008; Gearheart, 2008; McMahon, 2008) in calling for additional data collection to better establish flow regime targets.

Water Availability Analysis: Before the SWRCB WRD can issue a permit for an appropriative water right, it must demonstrate that there is "unappropriated water available to supply the applicant" (CA Water Code § 1375) and that sufficient water for remains for "recreation and the preservation and enhancement of fish and wildlife resources" (CA Water Code § 1243). A multi-party regional assessment is laid out as part of the *Policy* plan, but it also envisions a great deal of information being contributed by permit applicants and permit holders (see Watershed Groups).

The *Policy* section entitled Data Submissions (4.1.1.1) repeatedly refers to public domain spreadsheets and programs. The issue is not whether data analysis and models are done using public or private software, but whether the raw data are made available and the computer codes for models are made available so that results can be fully audited. Any revision of the *Policy* should have clear language that specifies full raw data availability and model transparency.

Water Supply Reports and Instream Flow Analysis Required of Applicants: The *Policy* provides the following description of study requirements facing new applicants:

> "This policy requires a water right applicant to conduct a water availability analysis that includes (1) a Water Supply Report that quantifies the amount of water remaining instream after senior rights are accounted for, and (2) an Instream Flow Analysis that evaluates the effects of the proposed project, in combination with existing diversions, on instream flows needed for fishery resources protection."

The water supply report is *not* required to describe flow conditions in the stream or determine surplus availability for April through November. Applicants are asked, however, to hire consultants to make a case that there is surplus water available in winter. This will not only be expensive, the consultants may actually be unable to determine the amount of cumulative diversion without an extensive survey because of unregistered riparian rights, pre-1914 water rights and those that have been established illegally (Figure 3). They will also be forced to use models and simulated data that produce considerable error (Lang, 2008) as discussed above.

Effectiveness Monitoring: Most peer reviewers stress that extensive field data needed on an on-going basis to support adaptive management, or the implementation of the *Policy* will be seriously flawed (Lang, 2008; Band, 2008, Gearheart, 2008; McMahon, 2008). The tone of the *Policy* on this topic, however, is very disappointing and shows little commitment on behalf of the WRD with every passage in this section using *may* not will: "The State Water Board *may* develop and implement a policy effectiveness monitoring program."

Enforcement: The SWRCB WRD has clear authority to regulate water extraction and to penalize those who appropriate water without a permit:

> "Pursuant to Water Code section 1052, an unauthorized diversion or use of water is a trespass against the State subject to a maximum civil liability of $500 per each day of unauthorized diversion or use of water. Water Code section 1055, subdivision (a), provides that the Executive Director of the State Water Board may issue an Administrative Civil Liability (ACL) complaint."

The problem is the WRD's near absolute refusal to enforce the law. Stetson Engineering (2007a) lists 1771 unpermitted diversions in the North Coast region as defined by this project (Figure 2). They note the potential need to remove 1569 structures, but also note that 519 unpermitted structures now have pending permit applications. The pattern of non-enforcement is clear in a number of basins (Figure 3) and I have documented similar problems in northern California case studies below both inside and outside the *Policy* area (i.e. Napa, Navarro, Russian, Gualala, Scott, and Shasta).

The WRD has also been derelict in its duty with regard to CA Water Code § 1243 and 1375, which require that they protect recreation, fish and wildlife and that they establish a surplus before issuing permits, respectively. The WRD has failed to comply with these laws by simply not supplying permits other than after ponds and diversions have been illegally constructed. This has caused not only a loss of fish habitat but also treasured recreational opportunities enjoyed by past generations, such as swimming at the Scout Camp on the Wheatfield Fork of the Gualala or at Hendy Woods on the lower mainstem Navarro River.

Instead of active enforcement, the WRD relies on mechanisms like self-enforcement, whereby permit holders self-report violations, and on complaints from citizens. I know several individuals who have filed hundreds of complaints over several decades with the WRD and have had few resolved as a result (Bob Baiocchi; Stan Griffin, personal communication).

The reluctance to enforce the law is evident in the following passage from the Policy:

> "Every violation deserves an appropriate enforcement response. Because resources may be limited, however, the State Water Board will balance the need to complete its non-enforcement tasks with the need to address violations. It must also balance the importance or impact of each potential enforcement action with the cost of that action. Informal enforcement actions, described below, have been the most frequently used enforcement response. *Such informal actions will continue to be part of this policy for low priority violations.*"

Figure 4. Navarro River at Hendy Woods State Redwood Park is so flow depleted that only a stagnant pool not suitable for human contact remains. The mainstem Navarro was formerly rearing habitat for juvenile steelhead (Kimsey, 1952) and a major recreational draw during the hot days of summer and fall. CA Water Code § 1243 is clearly not being upheld in this basin. Photo by Pat Higgins from KRIS Navarro. September 21, 2001.

Some of the WRD criteria for prioritization include any violations:

- On Class I or Class II streams,
- That threaten or cause a take of endangered species,
- That constitute waste, unreasonable use, or unreasonable method of use,
- That illegally take water in a fully appropriated stream system, or
- That injure a prior right holder.

Despite pages of text on enforcement, there is no specific plan mentioned for decommissioning dams that are high priority. Almost all dams in the region effect at-risk salmonids and 308 illegal impoundments are on Class I streams (Figure 2) (Stetson Engineering, 2007 a). The Sierra Club (Pennington et al., 2008) points out that allowing diverters to avoid permit fees and costs of compliance offers them an unfair business advantage as well.

Informal Enforcement: "The purpose of an informal enforcement action is to quickly bring a violation to the water diverter's attention and to give the diverter an opportunity to voluntarily correct the violation and return to compliance as soon as possible." While quickly and voluntarily correcting violations is desirable, as one reads further into the *Policy*, deficiencies become apparent. Informal enforcement may only mean that WRD staff calls or emails the violator and then creates a file as a record of contact.

Penalties: The lack of willingness to enforce extends into the realm of use of fines as a disincentive:

> "The ability to pay administrative civil liability is limited by diverter's revenues and assets. In some cases, it is in the public interest for the diverter to continue in business and bring operations into compliance. If there is strong evidence that administrative civil liability would result in widespread hardship to the *service population* or undue hardship to the diverter, it may be reduced on the grounds of ability to pay."

I have added emphasis to the term "service population" above because it shows the inherent bias of the WRD for diverters (their clients) as opposed to protection of public trust. They also express a willingness to skip the enforcement phase, if the diverters just agree to pay for cooperative management:

"Accordingly, flexibility should be provided to groups of diverters who endeavor to work together to allow for cost sharing, real-time operation of water diversions, and implementation of mitigation measures."

Watershed Groups: The *Policy* proposes to use watershed groups to fund studies, assess flow availability, and mitigate all problems related to diversions. A watershed group is defined as follows:

"A watershed group is a group of diverters in a watershed who enter into a formal agreement to effectively manage the water resources of a watershed by maximizing the beneficial use of water while protecting the environment and public trust resources."

Any watershed group formed by special interests that does not include public participation is unacceptable. Consultants working for water diverters would protect vested interests and the quality of science would not likely be as unbiased or equal to that collected by government scientists who have public trust responsibility.

The *Policy* defines further the role these watershed groups would play:

"The watershed group shall provide the technical information necessary for the State Water Board to determine water availability, satisfy the requirements of CEQA (if applicable), evaluate the potential impacts of water appropriation on public trust resources, make decisions on whether and how to approve pending water right applications for diverters in the watershed group, and make decisions on whether to approve the watershed group's proposed watershed management plan."

In other words, they want to turn their job and that of other State agencies over to local diverters. There are numerous streams in northwestern California that are already so over-subscribed they are dry in summer and fall. Many of the diversions may be unpermitted or constructed illegally and have permit applications pending. This strategy is not going to do anything for public trust and fish and it is likely illegal.

Cumulative Watershed Effects

The California Environmental Policy Act (CEQA) requires that cumulative effects be considered and defines them as "indirect or secondary effects that are reasonably foreseeable and caused by a project, but occur at a different time or place." The *Policy* is subject to CEQA yet fails to meet its requirements in considering cumulative watershed effects. Discussions of this topic are parsed below into 1) discussion of cumulative effects from networks of diversion on downstream reaches, and 2) on how all the watersheds under consideration are cumulatively effected by land use. The emphasis in the latter discussion is on changes in stream channel form and watershed hydrology that effect surface water availability.

Water Use Related Cumulative Effects: Band (2008) described numerous cumulative watershed effects likely from the interaction of diversions, even if all were operating in accordance with minimum base flows (MBF).

"The cumulative impacts of water diversions from all areas of the drainage network requires consideration of the network as an entity, and not just the sum of all individual reaches."

While each diversion might only capture less than 5% of the 1.5 recurrence interval flow at one location, Band (2008) calculated the interaction between diversions in the stream system could increase to 28% downstream. He sees the necessity of increasing model parameters "to analyze the impacts of sequential dependencies of reach conditions as they will not be randomly distributed."

If interactions of multiple diversions are not factored into consideration, Band (2008) predicts "perturbations to the downstream hydraulic geometry, as well as bed sediment grain size, and seasonal variations in bed composition." Of specific concern to Band (2008) is fine sediment delivery from early storms in streams where flow is depleted: "the first few increased flows of the year may flush fine grained sediment, perhaps without mobilizing coarser grain sizes, which may accumulate in reaches where discharge is drawn down." These reaches might be ones used for spawning.

Band (2008) and Gearheart (2008) expressed concern about cumulative effects potential associated with dams on ephemeral streams (Class III). These headwater swales may constitute 50% of a watershed's area and "the vast majority of coarse grained material delivered to larger streams with salmonid habitat are generated from small, headwater catchments" (Band, 2008). Figure 2 above shows permitted and unpermitted impoundments and there are 1357 permitted impoundments in the Policy's area of interest and another 1771 unpermitted ones (Stetson Engineering, 2007a). Therefore, there is significant likelihood of advanced cumulative effects from interactions of releases from diversions.

Stetson Engineering (2007a) estimates that the capacity of illegal impoundments in the North Coast watershed region, as defined by the Policy, is 48,515 acre feet and that 3,234 surface acres of reservoirs now submerge former stream reaches or headwaters. These impoundments in turn are ideal habitat for bull frogs, which decimate native amphibian populations. They are often stocked with warmwater game fish that escape into water bodies below and may predate upon salmonids or displace them through competition (Higgins et al., 1992).

Ground water is not considered in the *Policy*, yet over-extraction is known to contribute to diminished water quality and greatly reduced fish habitat in many streams within the region (see Case Studies). Peer reviewers (Band, 2008; Gearheart, 2008; McMahon, 2008) point out that no real water budget can be calculated without knowing the influence of ground water withdrawals. The Department of Water Resources, a separate State agency, has oversight over ground water withdrawal, but all well logs are treated as proprietary and restriction of ground water use is uncommon.

Potential additional water withdrawal under riparian water rights is another flow-related cumulative effect. Riparian rights are those where water is extracted for use on lands that directly boarder the stream and any owner of a parcel immediately adjacent to a water course has the right to take water for domestic and agricultural use at any time unless specific deed restrictions are stated in the title to the land. Riparian rights do not require a permit from the WRD. Although the WRD requests that riparian water users file a statement of diversion and use, there is no penalty for not complying and few are filed.

Band (2008) mentions tailwater as a major issue needing consideration by the WRD as a potential effect. Agricultural waste water may have elevated temperature and nutrients and its impact is recognized as substantial on the Shasta River (NCRWQCB, 2006a).

Upland Cumulative Effects and Surface Water Supply: Cumulative effects in northern California watersheds related to logging and associated road networks are well studied (Ligon et al., 1999; Dunne et al., 2001; Collison et al., 2003). Although much of the geographic area defined by the *Policy* is now in agricultural production, virtually all the watersheds have been logged at least historically. All of those logged after WW II have extensive road networks that alter watershed hydrology (Jones and Grant, 1996). 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).

Most of the streams within the *Policy* area are listed for sediment impairment on the SWRCB 303d list and targeted for remediation under the Clean Water Act TMDL program. A huge amount of sediment recognized as polluting north coast rivers is moving downstream in waves. The level of aggradation can be up to 25 feet (i.e. South Fork Trinity) (PWA, 1994) and high sediment yield has caused dozens of regional streams, such as those of the Lower Klamath (Voight and Gale, 1998), to lose surface flow even when there is no diversion (Figure 5).

The *Policy* needs to consider the question of water supply in a stream environment that is profoundly changed by cumulative effects. Increased flood peaks and excess sediment transport in North Coast rivers have caused a loss of pool habitat, an increased width to depth ratio, reduced large wood, and overall diminishment of salmon and steelhead habitat. Because the streams have become wider and shallower, they are more subject to warming (Poole and Berman, 2000). (The *Policy* skips the discussion of cumulative effects due to April-October flow depletion on stream temperatures by concerning itself only with the October-March time period.) The North Coast Regional Water Quality Control Board (NCRWQCB, 2006a) found that flow depletion in the Shasta River was contributing to temperature pollution and NRC (2004) found the same relationship on the Scott River (see Case Studies).

Anderson Creek in the Navarro River basin might serve as an example. When an early water right was granted for 2 cubic feet per second (cfs), pools were likely frequent with some 6-8 feet deep (CDFG, 1969), and the effect of the withdrawal was likely minimal. The stream has experienced substantial cumulative effects and pools are now infrequent and maximum pool depth is often 4 feet or less; *the effects on fish of the historically permitted quantity of water may now be significant*. Add to the equation decreased baseflows due to high road densities, recent logging and development and one can understand why streams are running dry and fish are going without water. All of these are factors that the *Policy* needs to consider in order to meet CEQA requirements and to determine water availability that truly reflects the needs of fish.

Cumulative effects should also be recognized as compromising recreational opportunities. Not only do north coast rivers lack sufficient flow for recreation, flow depletion and aggradation now cause stagnation that fosters toxic algae. Although the South Fork Eel River is not in the *Policy* area, it none the less serves as a regional example. Generations of Californians have vacationed on the South Fork Eel at Richardson's Grove Redwood State Park or at Benbow Lake, but toxic blue-green algae species now make surface water contact during low flows ill-advised. There have been several accounts in the local press of dogs dying after ingesting SF Eel River water. Rural development in the Eel River watershed has fostered a similar pattern of unpermitted water use as in *Policy* area basins, that when combined with aggradation, leads to major loss of recreational opportunities.

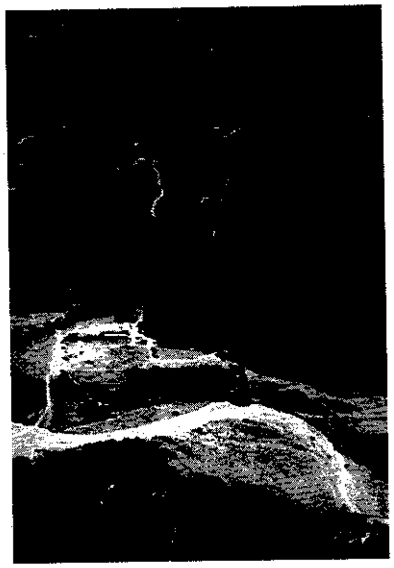

Figure 5. Lower Terwer Creek running underground in late fall 1990. High sediment yield related to watershed disturbance has caused massive aggradation. The stream loses surface flow in late summer and fall yet there is no diversion upstream. Photo by Paat Higgins from KRIS Klamath-Trinity Version 3.0. September 1991.

Case Studies

There are a number of watersheds in northwestern California that have flow levels that limit salmonid production and case studies are provided below for areas both inside and outside the geographic area covered by the *Policy*. Many of my reports are provided on the DVD that is being filed with these comments so that WRD can get more detailed information from them.

Napa River: I am intimately familiar with the Napa River watershed from having commented (Higgins, 2006a) on the *Napa River Sediment TMDL* (SFBWQCB, 2006) and on several proposed vineyard conversions (Higgins, 2006b; 2007). The diminishment of flow from historic levels is most clearly seen through examining what would have been coho salmon habitat. USFWS (1968) estimated the historic coho population in the Napa River at 2000-4000 fish. Coho prefer reaches with a gradient of less than <2% and suitable water temperature, with juveniles spending one year in freshwater. Figure 6 illustrates where coho are likely to have ranged in the middle Napa River watershed. The majority of low gradient mainstem and tributary reaches were found to be dry (Figure 7) or stagnant in 2001 by Stillwater and Dietrich (2002). Figure 8 is taken from Stetson Engineers (2007a) and shows the number of permitted and unpermitted diversions in the lower Napa River, including Carneros Creek. Stetson Engineers (2007a) noted that 43% of winter flow in Carneros Creek is likely diverted.

While Napa River coho are extinct, steelhead are still present, although there is a homogeneous disturbance in the watershed because of urbanization, timber harvest, vineyard development, dams for municipal water supply and changes in the stream channel. Steelhead are blocked from 30% of the Eastside of the watershed by large municipal water supply dams, the mainstem Napa River is now either dry or unsuitable for steelhead rearing, and Westside tributaries sustain steelhead in isolated pools. Stillwater and Dietrich (2002) noted that steelhead juveniles stranded in isolated pools lost weight during summer due to lack of insect drift delivered not being delivered by flows. Given the precipitous decline in steelhead habitat, it is my professional opinion that their population is likely dropping significantly. Chinook salmon still return to the Napa River, but their population is small and also at risk of loss.

My *Napa River TMDL* comments (Higgins, 2006a) conclude that sediment and flow problems cannot be remedied without limiting watershed disturbance and that temperature and fish problems cannot be remedied without additional flows:

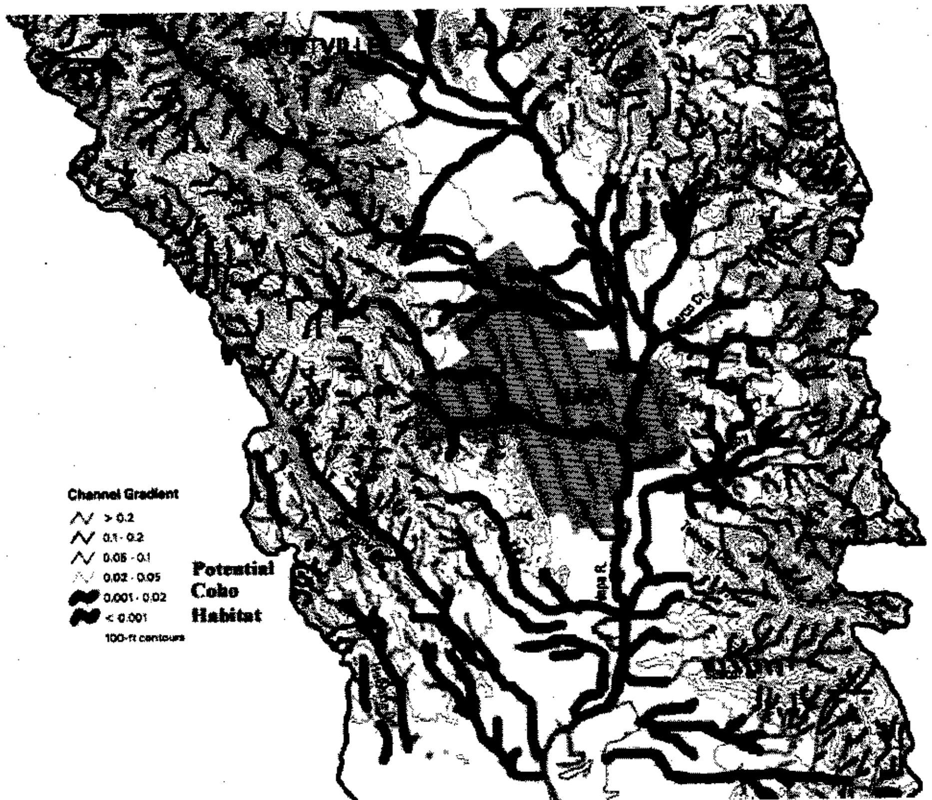

Figure 6. Stream gradient map of the Napa River is overlain with dark green on reaches with gradient less than 2% (0.02) to show likely range of coho salmon prior to human disturbance. Map 6 from Stillwater and Dietrich (2002).

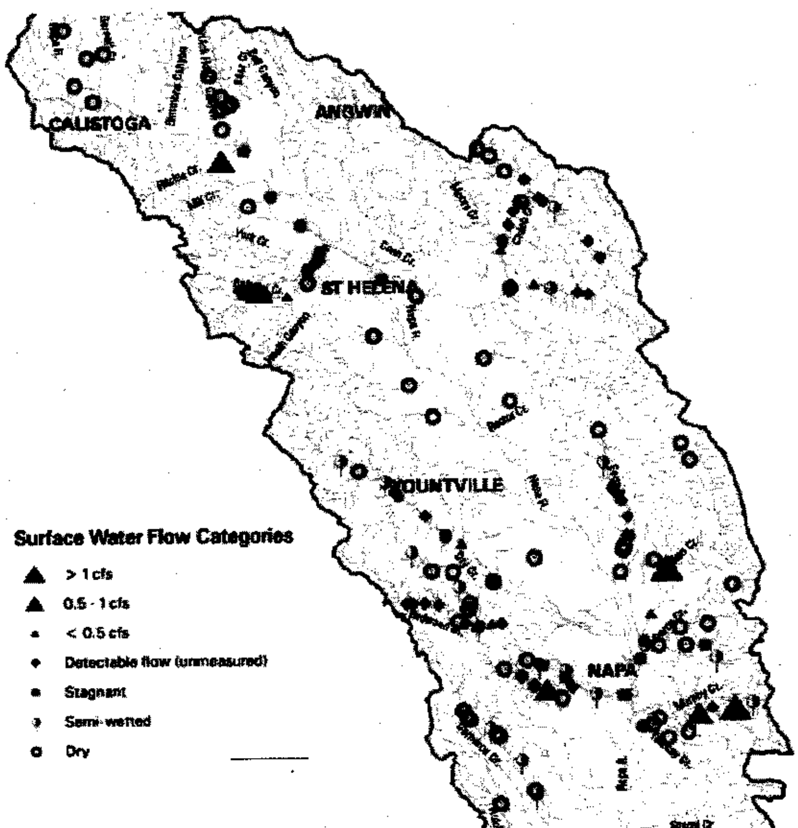

Figure 7. Symbols on this Napa River map indicate that reaches likely formerly inhabited by coho now lack surface flow or are stagnant. Taken from Stillwater and Dietrich (2002) where it appears as Map 13.

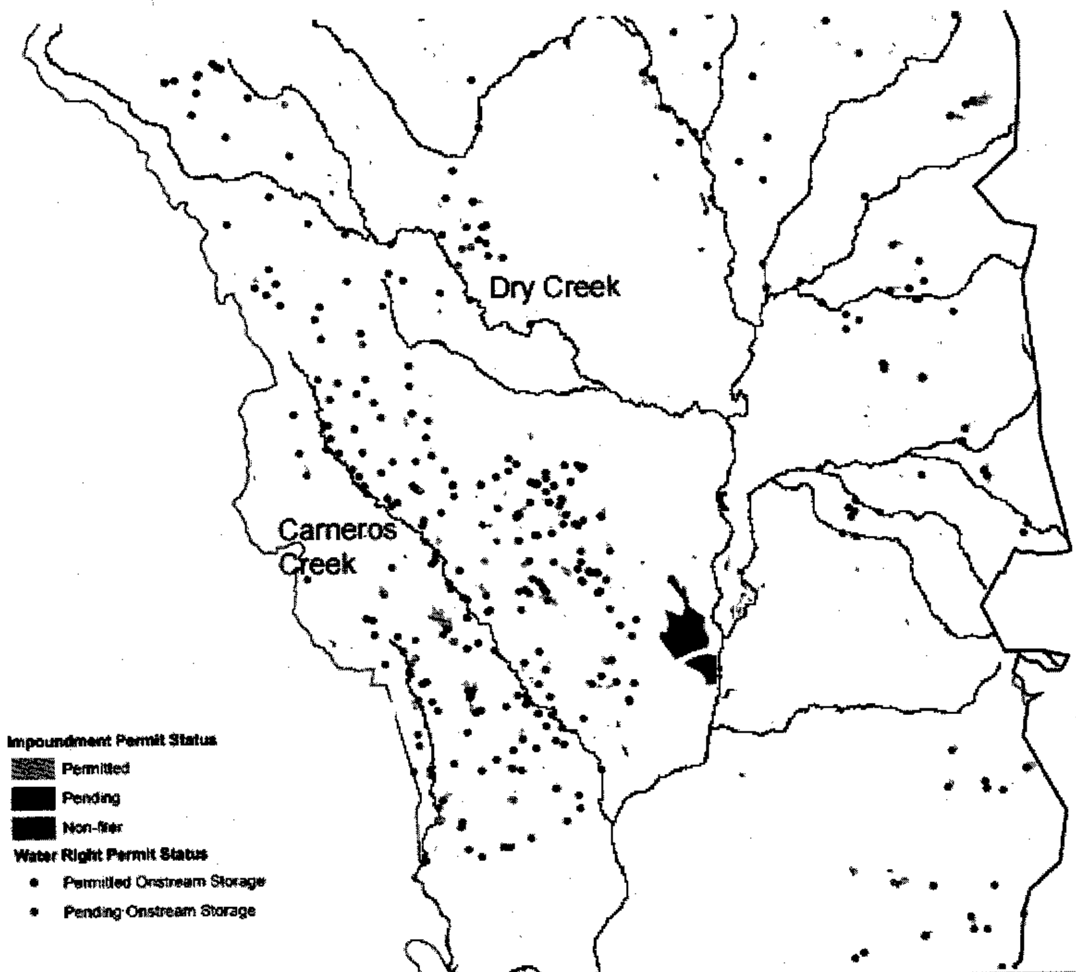

Figure 8. Diversions and impoundments in the lower Napa River basin in Huachuca, Carneros and Dry creeks at left. Impoundments include both those permitted and unpermitted. Stetson Engineers (2007a).

> "The State Water Resources Control Board Water Rights Division has the authority to install stream gages where ever necessary to insure protection of public trust, water quality and water rights. The TMDL should make explicit reference to reaches affected by low flows and call on the SWRCB WRD to take appropriate monitoring and enforcement actions."

Navarro River: I am familiar with the Navarro River having worked in the basin as a CDFG seasonal aid in 1972, commented on proposed timber harvests in Rancheria Creek and Indian Creek in 1993-1994, and more recently helped complete the KRIS Navarro project (IFR, 2003a). The WRD is intimately familiar with the Navarro River as documented in previous comments on regional flow policy by Friends of the Navarro River Watershed (Hall, 2006) and the Sierra Club (2006).

In 1994 the Sierra Club Legal Defense Fund (Volcker, 1994) filed a water rights complaint with the SWRCB WRD for failing to adequately address instream flow needs under the Public Trust Doctrine in the Navarro River basin. In the complaint, Volker (1994) stated that:

> "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."

Volcker's (1994) assertion that the Navarro loses surface flow was correct at the time and the condition is still chronic in summer (Figure 9). In processing the complaint, the WRD (SWRCB, 1998) found 121 illegal impoundments (Figure 10), none of which were removed and many of which have now applied for permits (Pennington et al., 2008). The SWRCB (1998) declined to take public trust protection action:

> "The SWRCB could initiate a public trust action in the watershed. However, the cause of the anadromous fish decline may be principally due to factors other than flow, and there is not adequate information available regarding the flow needs of the fishery in the summer. Consequently, the Division recommends that a public trust action should not be initiated at this time. If the complainants, DFG, or some other entity develops adequate information regarding the summer flow needs of the anadromous fishery, this recommendation can be reevaluated."

Illegal diversions of two types for Mendocino County watersheds are shown in Figure 11, which is taken from Stetson Engineers (2007a). The Navarro River appears at left with a combination of regulatory dams, diversions that do not impound water, and illegal impoundments.

Russian River: I am familiar with the Russian River due to work on a KRIS Russian database (IFR, 2003a) and from having provided comments on the Bohemian Grove NTMP (Higgins, 2007b).

As one of the centers of the booming wine industry, the Russian River is one of the most heavily diverted streams in northwestern California, as indicated by the prevalence of unpermitted diversions (Figure 11). Major tributaries lose surface flow during summer and early fall (Figure 12) and significant numbers of large pumps have been installed to tap ground water, some immediately adjacent to the river (Figure 13). The Sierra Club (2006) documented problems with over-diversion and widespread illegal water use in Maacama Creek causing severe damage to public trust.

Coho salmon are increasingly rare in the Russian River, but still known to occur in some tributary sub-basins. Figure 14 shows the existing appropriative rights and those proposed for all tributaries known to have harbored coho salmon in the past. Coho were present in Green Valley Creek all three years of CDFG surveys from 2000-2002, but present in Dutch Bill Creek only one year in that period. While there is only one permit on Green Valley Creek, there were 17 applications as of 2001 and Dutch Bill had 7 water rights permitted, but an additional 10 in the application process. Figure 15 shows identified illegal water withdrawal specifically on these streams (Stetson Engineers, 2007a). Legal and illegal diversions pose significant risk to the last streams where coho still persist in the Russian River.

California Department of Fish and Game habitat typing surveys of Green Valley Creek and Dutch Bill Creek show that both streams lose surface flow in some reaches (Figure 15). Pool frequency is also low relative to the CDFG (2004) target of 40% as optimal for salmonids and coho juveniles are known to require pools for freshwater rearing (Reeves et al., 1988). Additional permitted extraction of surface water is likely to both raise water temperatures and decrease depth and cover for juvenile coho salmon. The extent of dry habitats suggests that both streams are fully or possibly over-allocated and that coho habitat is already significantly diminished.

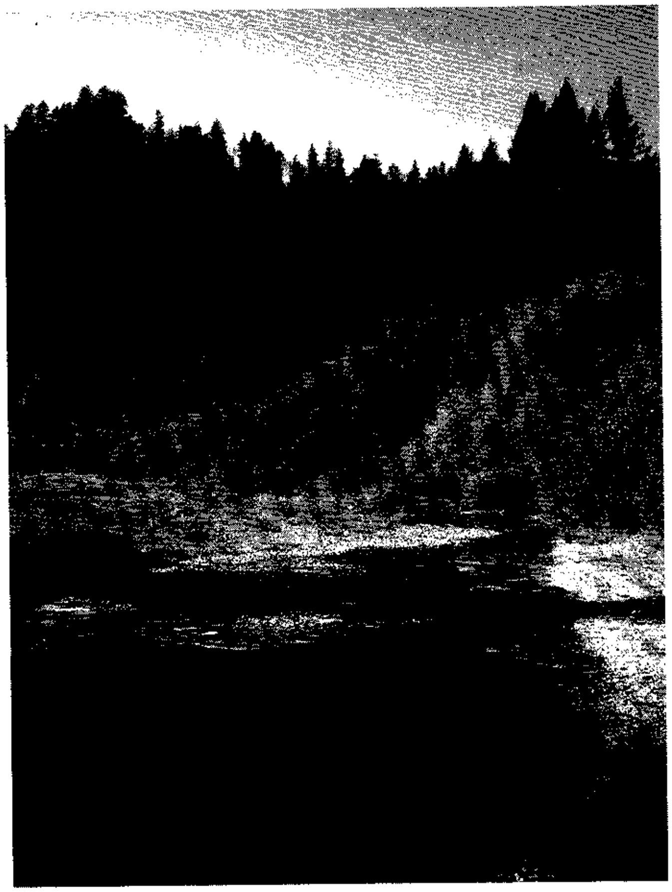

Figure 9. The lower mainstem Navarro River near Flume Gulch is shown at left during low flow conditions on September 21, 2001. The USGS flow gauge indicated that the average flow on this day was 1.1 cubic feet per second. The algae on the margins of the stream indicate stagnation and no fish were present at the time of observation. Photo from KRIS Navarro by Pat Higgins.

Kimsey (1952) sampled this exact location in August 12, 1962 and found steelhead trout of two age classes (young-of-year, 1+) and a flow of 15 cfs during what was an average water year.

U.C. Davis (Johnson et al., 2002) found only seven suckers in many miles of Navarro stream surveys indicating that even this hardy species is disappearing.

Figure 10. Aerial photo of agricultural development in the Navarro River basin circa 1998 shows ten ponds of different types typical of water storage. Vineyard development and aggradation has almost completely eliminated salmonid summer rearing habitat. Photo from KRIS Navarro.

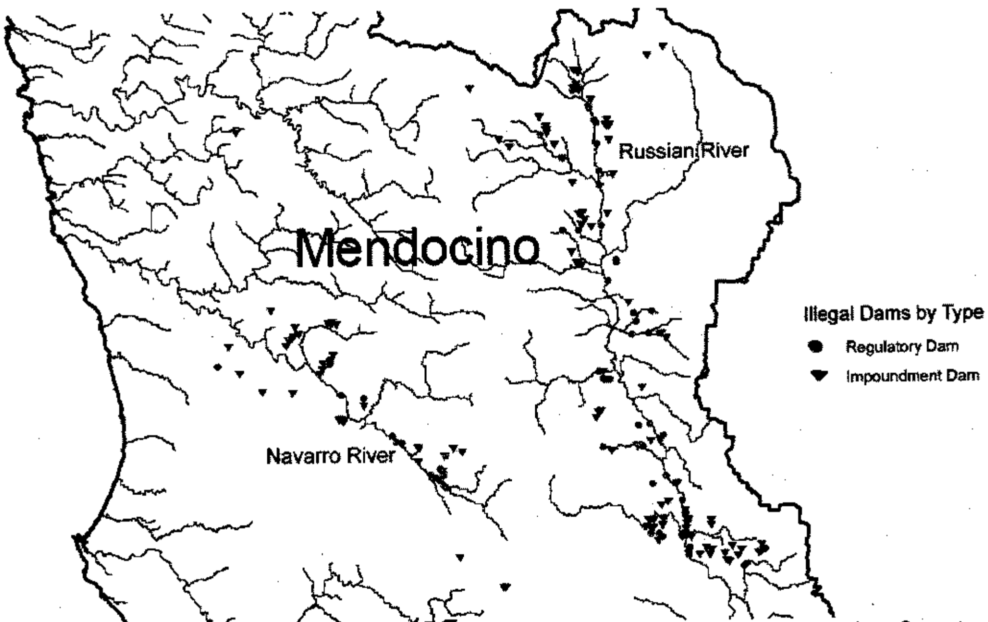

Figure 11. Locations of unpermitted diversion dams of two types in central Mendocino County with the Navarro at left and upper Russian River at right. Regulatory dams are diversions with no impoundments. From Stetson Engineering (2007a).

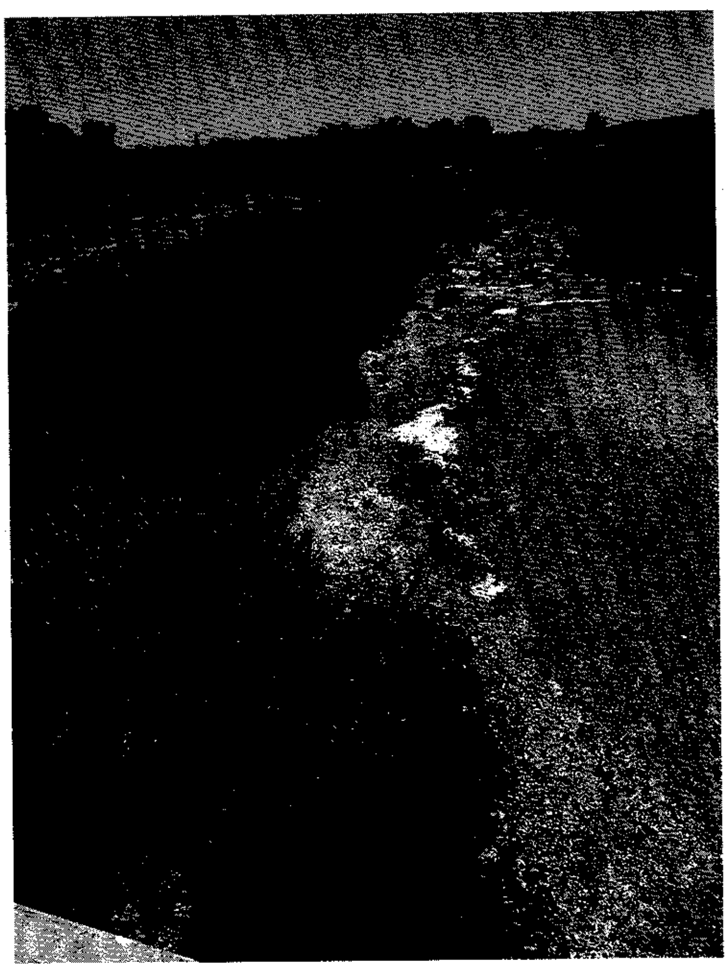

Figure 12. Looking downstream at the dry stream bed of the West Fork Russian River off the Eastside Road Bridge. The riparian vegetation lining both banks and extending back on the terrace at right is a result of a bioengineering project by Evan Engber. While trees have been successfully re-established to protect adjacent property and to stabilize channel conditions, over-diversion causes loss of flows. Photo by Patrick Higgins from KRIS Russian. July 13, 2003.

Figure 13. Large ground water pump appears right of center in the riparian zone of the Russian River looking west off East Side Road north of Hopland. KRIS Russian. Photo by Patrick Higgins. July 15, 2003.

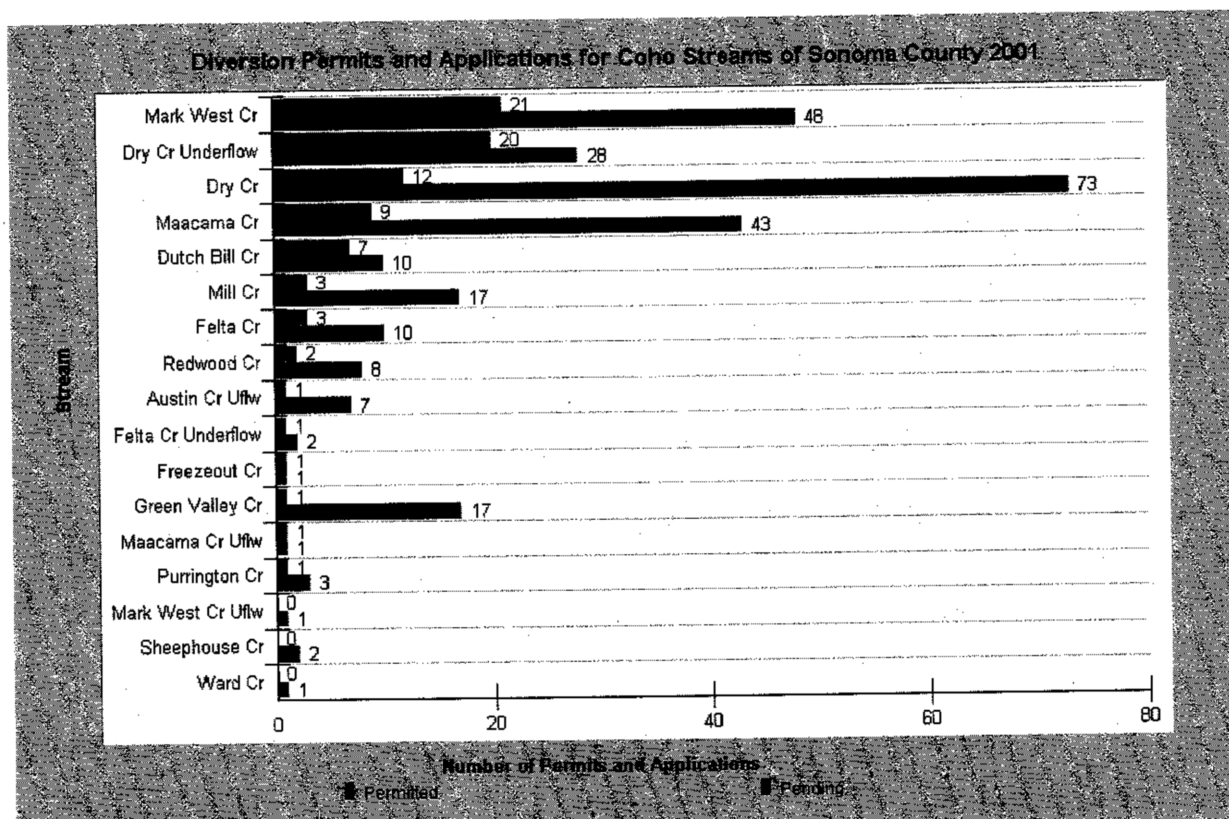

Figure 14. This chart displays the number of approved permits for appropriative water rights and those submitted for approval in Russian River tributaries known to have harbored coho salmon, including Green Valley Creek and Dutch Bill Creek. Data from the SWRCB WRD. March 2001. Chart from KRIS Russian.

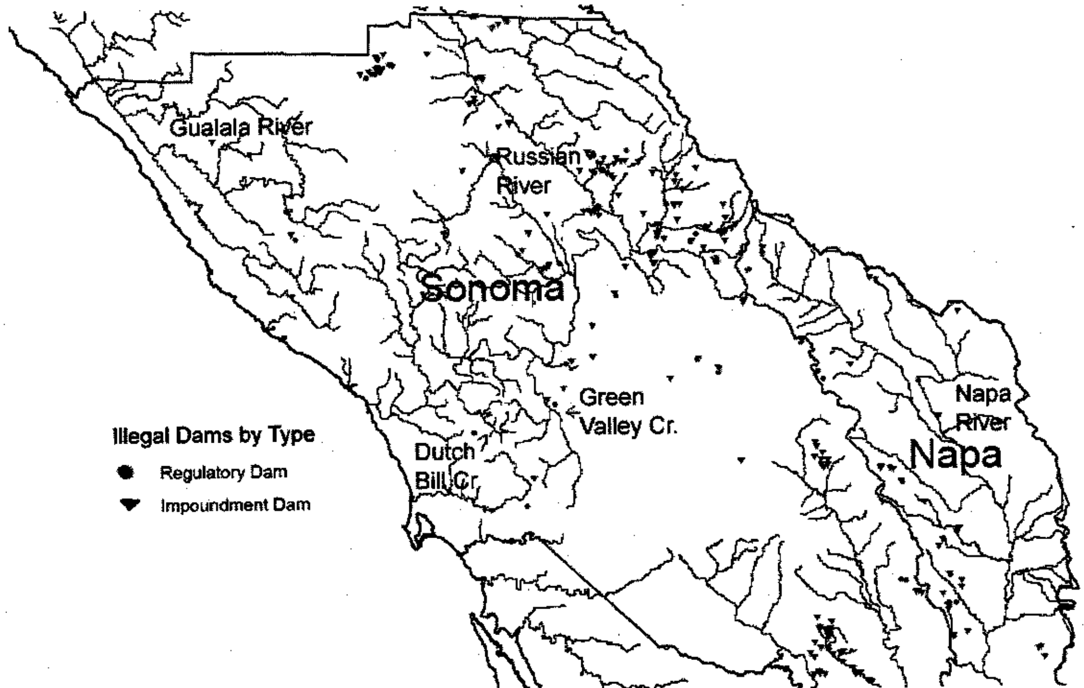

Figure 15. This map shows the locations of unpermitted diversion dams of two types in southern Sonoma and Napa counties, including lower Russian River tributaries Green Valley and Dutch Bill Creeks, which have recently harbored coho. Regulatory dams are diversions with no impoundments. From Stetson Engineering (2007a).

Sonoma Creek: My familiarity with Sonoma Creek is primarily due to my participation in the KRIS East Marin-Sonoma database project. Similar types of evidence are available to those used to demonstrate problems on the Russian River above. Habitat typing data (Figure 16) from upper Sonoma Creek indicates that reaches downstream of the headwaters go dry in summer. The cause of this loss of surface flow might be partially related to aggradation, but is still a sign that surface water availability has been diminished and that fish habitat is currently compromised. Figure 17 shows the dry bed of Carriger Creek, a tributary of Sonoma Creek, with what appears to be a large diversion pipe upstream. While Sonoma Creek itself has some problems with unpermitted diversion (Figure 18), diversion in the Tolay Creek basin indicates major illegal over-appropriation. It is likely that steelhead in Tolay Creek are at a very low level, if they persist at all.

Gualala River: I am familiar with the Gualala River from having worked on the KRIS Gualala database (IFR, 2003), completed a literature search and data assessment (Higgins, 1997), and commented on several proposed vineyard conversions (Higgins, 2003; 2004a, 2004b).

The Gualala River lies within southern Mendocino and northwestern Sonoma counties. It is recognized as impaired with regard to sediment (NCRWQCB, 2004) and has major problems with loss of surface flow and high water temperature (IFR, 2003b). CDFG (2001) characterized coho salmon in the Gualala River as "extirpated or nearly so."

The following passage from KRIS Gualala (IFR, 2003b) characterizes SWRCB WRD prior actions in the North Fork:

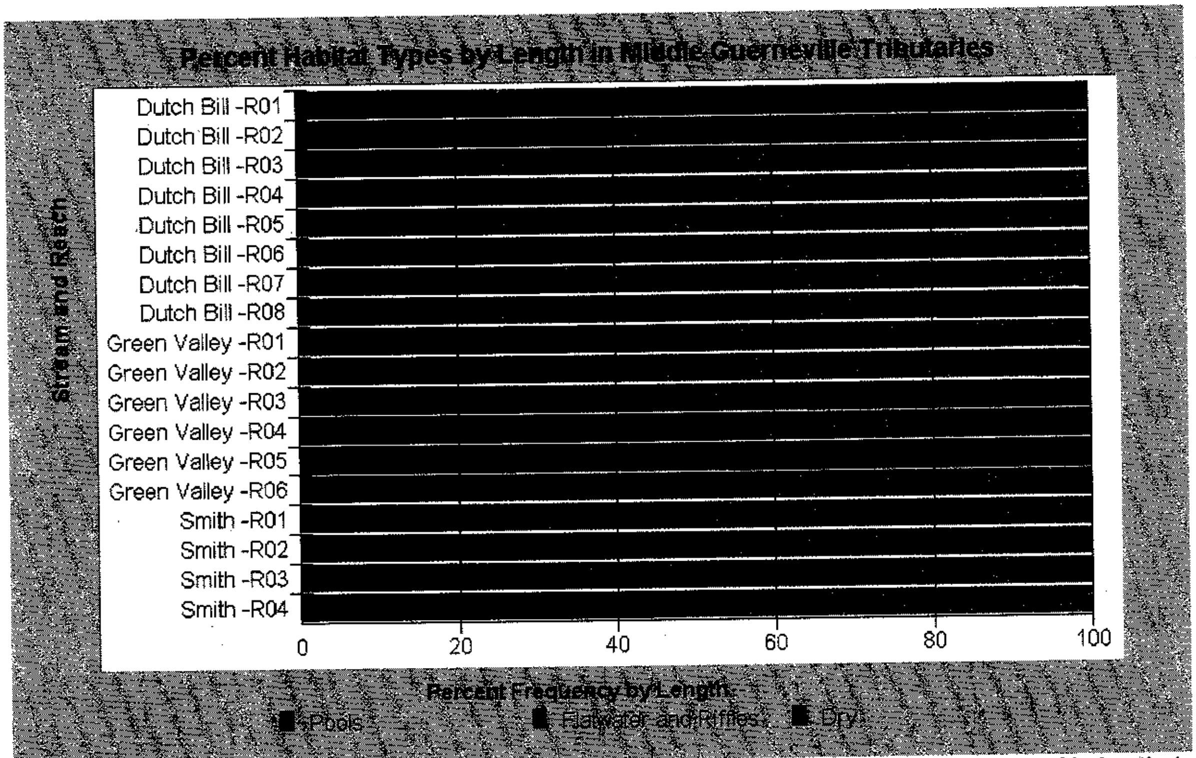

Figure 15. This chart shows CDFG habitat typing data for three lower Russian River tributaries. Notice that Dutch Bill and Green Valley Creek have significant dry reaches. Data from CDFG chart from KRIS Russian.

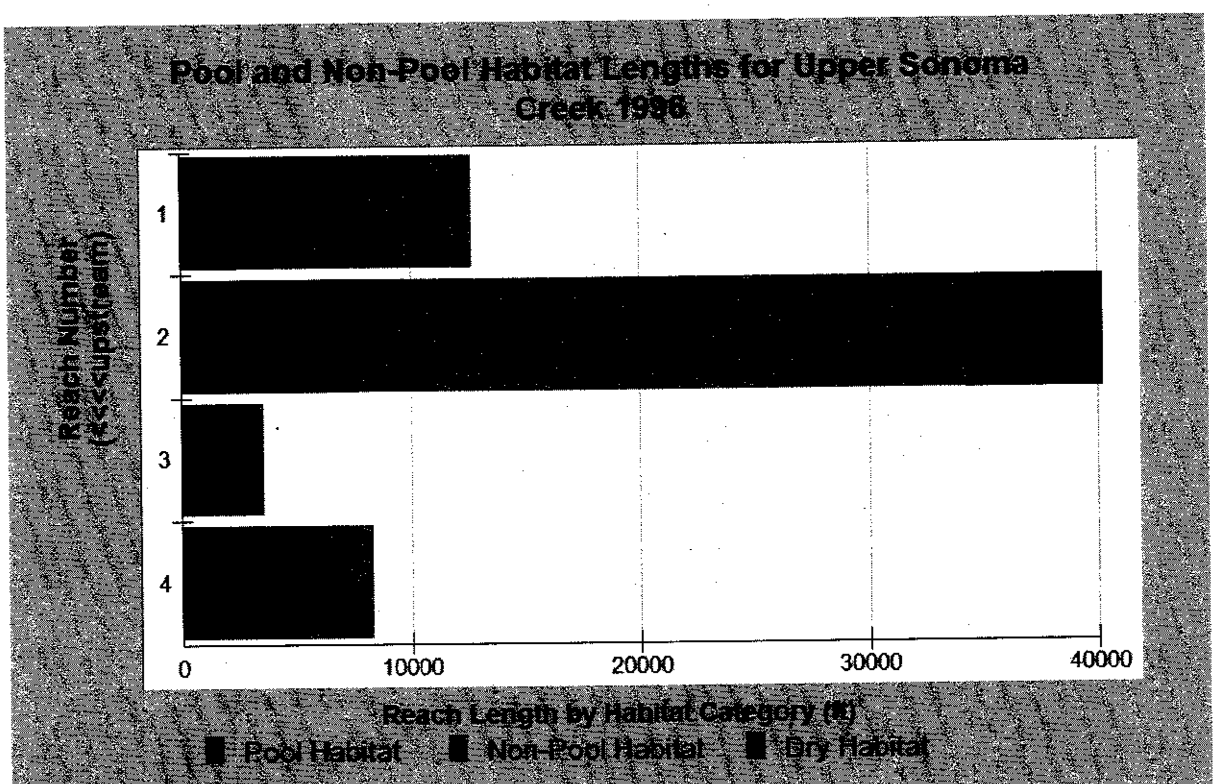

Figure 16. This chart shows Sonoma Creek Ecology Center habitat typing data for upper Sonoma Creek. The pool frequency is lower than optimal for salmonids (CDFG, 2004) and there are significant dry reaches. From KRIS East-Marin Sonoma.

Figure 17. This photo shows Carriger Creek, a tributary of Sonoma Creek, with a dry stream bed and what appears to be a large diversion pipe along cutbank upstream. From KRIS East-Marin Sonoma.

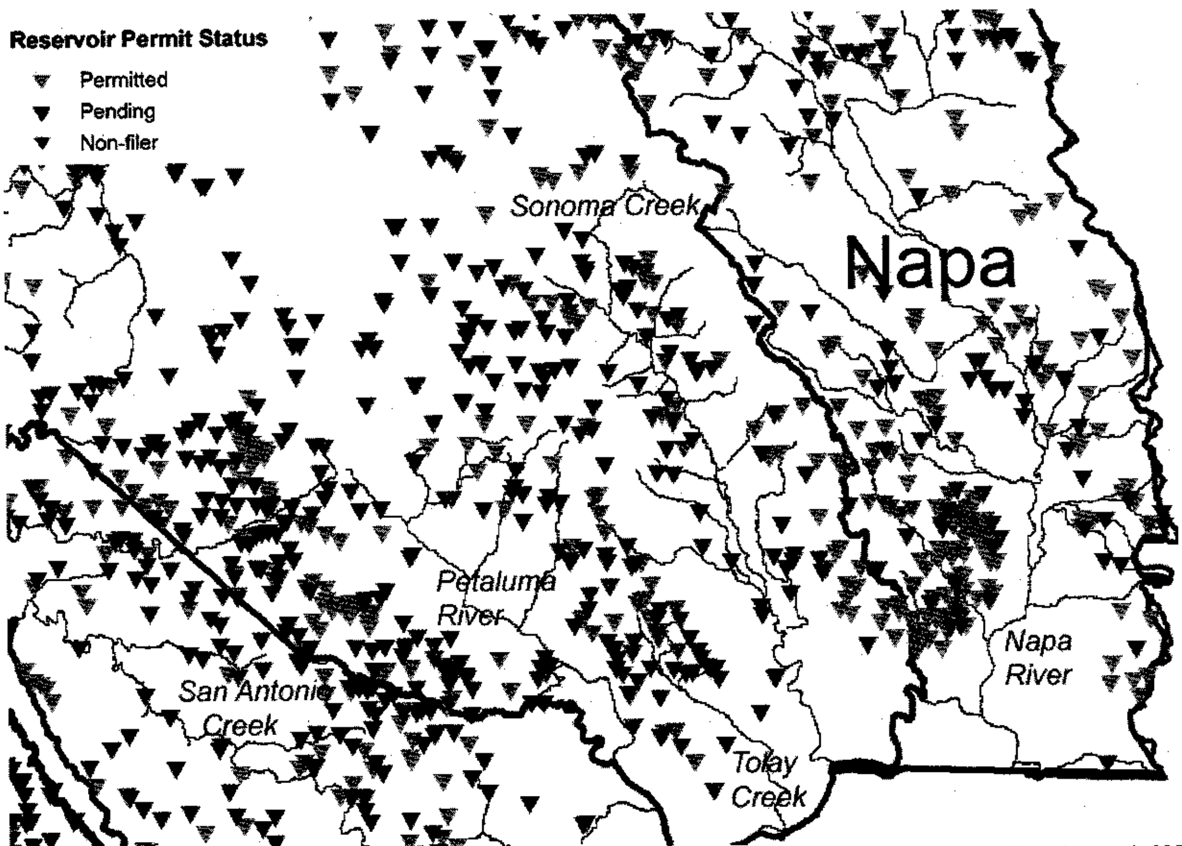

Figure 18. Locations of unpermitted diversion dams of two types, non-filers (brown) and pending (green). While there are many legal and illegal diversions on Sonoma Creek, cumulative effects risk is much greater in Tolay Creek, a much smaller basin, where there are 29 unpermitted diversions. From Stetson Engineering (2007a).

"The California Department of Fish and Game (Hunter, 1996) expressed concern about the diversion of the North Fork Gualala by the North Gualala Water Company, citing reduction in fish habitat if minimum stream flows were not retained. The State Water Resources Control Board (1999) prohibited diversion of surface water when the North Fork dropped below four cubic feet per second (cfs), then in August 2000, ruled that this order applied to two NGWC groundwater wells (SWRCB, 2000). This decision recognizes the importance of North Fork flows to the lower mainstem Gualala as well."

The Gualala River combination of aggradation and increased water use due to vineyard expansion has created an expanding problem with stream reaches in this basin losing surface flow (Figure 19), including the lower mainstem, Wheatfield Fork, South Fork, Buckeye Creek and Rockpile Creek (Higgins, 2003; 2004). Habitat typing surveys by CDFG (2001), as part of the North Coast Watershed Assessment Program, found mainstem reaches going dry (Figure 20) where they maintained surface flow during the 1976-77 drought (Boccione and Rowser, 1977). Although rainfall in 1976-77 was only 16.0 inches, total rainfall in 2001 was 24.6 inches, yet flows in 1976-77 were 12.5 cfs and all major tributaries contributed surface flow. This indicates a major decrease in water yield and water supply.

The extensive loss of surface flows in the Gualala River represents a major threat to the continuing survival of steelhead, which are still a major part of the local tourist-based economy.

Figure 19. The Wheatfield Fork, just upstream of its convergence with the South Fork, ran underground in 2001. Although the aggradation of the Wheatfield Fork is a factor contributing to lack of surface flows, water diversion for several vineyards and rural residential use exacerbate the problem. Photo by Pat Higgins from KRIS Gualala database.

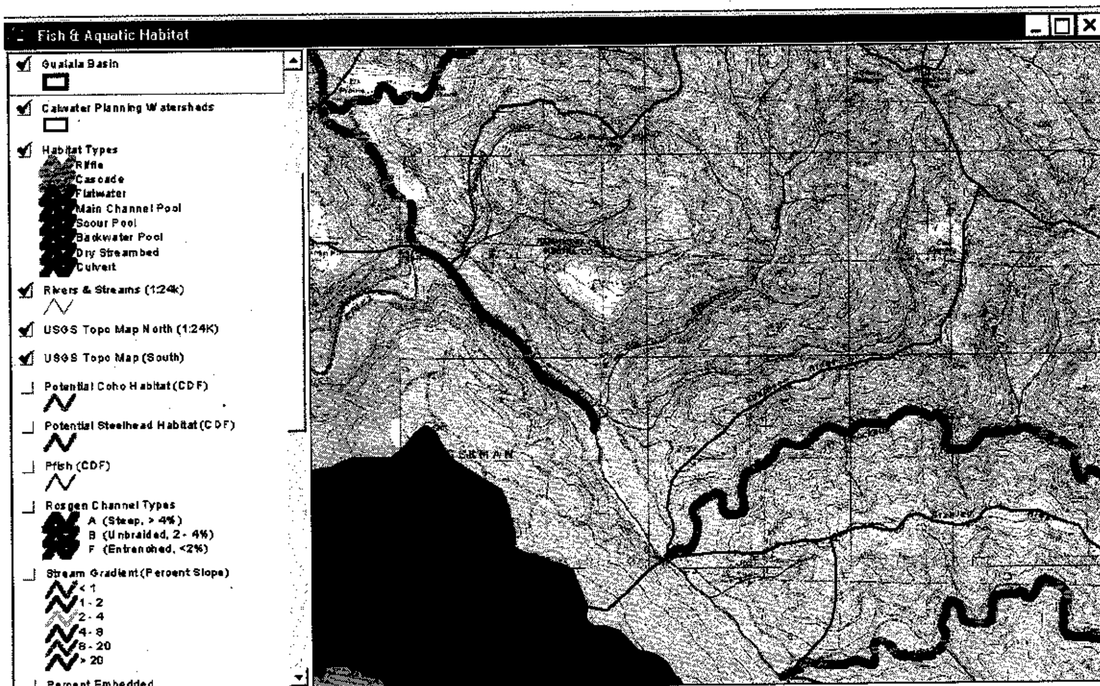

Figure 20. CDFG habitat typing of the Gualala River in 2001 shows the lower mainstem Gualala River below Big Pepperwood Creek ran underground for an extensive reach. Lower Rockpile Creek also lost surface flows in more than a quarter mile. KRIS Gualala and Higgins (2003).

West Marin Tributaries: Salmon, Americano, Stemple and Walker creeks all have agricultural water extraction that both compromises water quality and limits habitat for steelhead and coho salmon. Figure 21 shows a close up of these West Marin tributaries with all impoundments, 1) permitted, 2) those with applications pending, and 3) illegal diversions with no contact from the operator. The epidemic problem of over diversion and potential for cumulative effects is self-evident.

All these West Marin tributaries have extensive agricultural land use, mostly by dairies. Cattle may deposit fecal material directly into streams or it may enter as a result of overland flow. Grazing takes place up to stream banks leaving no riparian buffer capacity (Figure 22). Lack of canopy also promotes stream warming and flow depletion contributes promotion of both increased water temperatures and nutrient pollution.

Charts from KRIS West-Marin Sonoma (IFR, 2003a) show the degree of water quality impairment due to the cumulative effects of agricultural activity and flow depletion. Salmon Creek is the most northerly of tributaries considered, entering the Pacific Ocean north of Bodega Bay. Figure 23 shows dissolved oxygen (DO) values from several stations sampled by CDFG on Salmon Creek that are indicative of nutrient pollution. Super-saturated DO of greater than 10 mg/l at Highway 1 is linked to very high biological activity of algae blooms that thrive in the stagnant, nutrient-rich waters. Minimum DO levels at the Bodega location approached the recognized lethal limit for salmonids of 3.8 mg/l (WDOE, 2002). While D.O. is super-saturated during daylight hours due to photosynthesis, D.O. becomes depressed as algae respire at night or as algae dies off.

Merritt and Smith Consulting (1996) studied Americano Creek for the City of Santa Rosa. Figure 24 shows flow measurements indicating that surface flow near Garicke Road (Station E-6) was not present from April until November 1988 and from May-September 1989. Flow depletion also contributes to major pollution problems similar to those in neighboring creeks. Stemple Creek shows another symptom of nutrient pollution, high pH (Figure 25). A pH value of over 9.5 is directly lethal to rainbow trout (Wilkie and Wood, 1995).

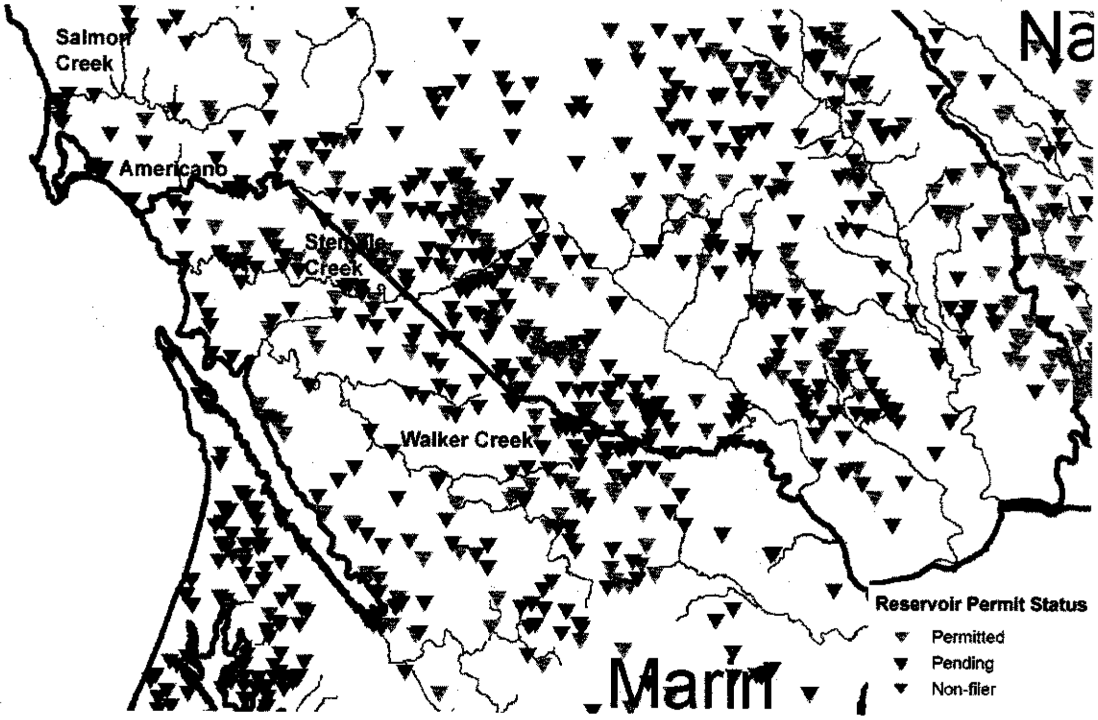

Figure 21. This map shows a zoom of the same type as Figure 2 with close up of West Marin County creek diversion impoundments that are permitted, have permits pending or are unpermitted (Non-filer). There is an obvious huge cumulative effects problem with diversion and water use. From Stetson Engineers (2007a).

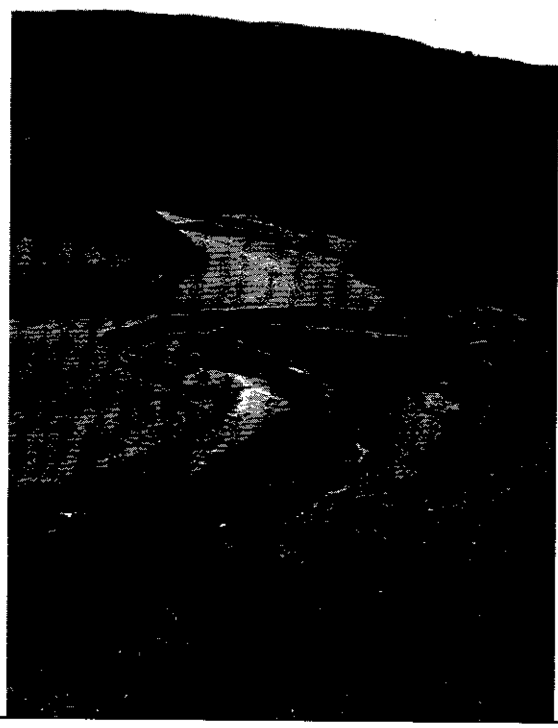

Figure 22. The photo at left shows the lower mainstem of Walker Creek with very poor fish habitat as a result of livestock grazing and flow depletion. The shallow, wide stream channel and lack of riparian vegetation makes the stream subject to warming. Photo from KRIS West Marin-Sonoma.

Creel census data from 1949-1974 indicate that hundreds of adult steelhead were harvested in some years and adult coho were present in the catch (Kelley, 1976). Kelley (1976) interviewed long time residents and anglers, who said that the coho salmon run in Walker Creek was much more robust prior to 1950.

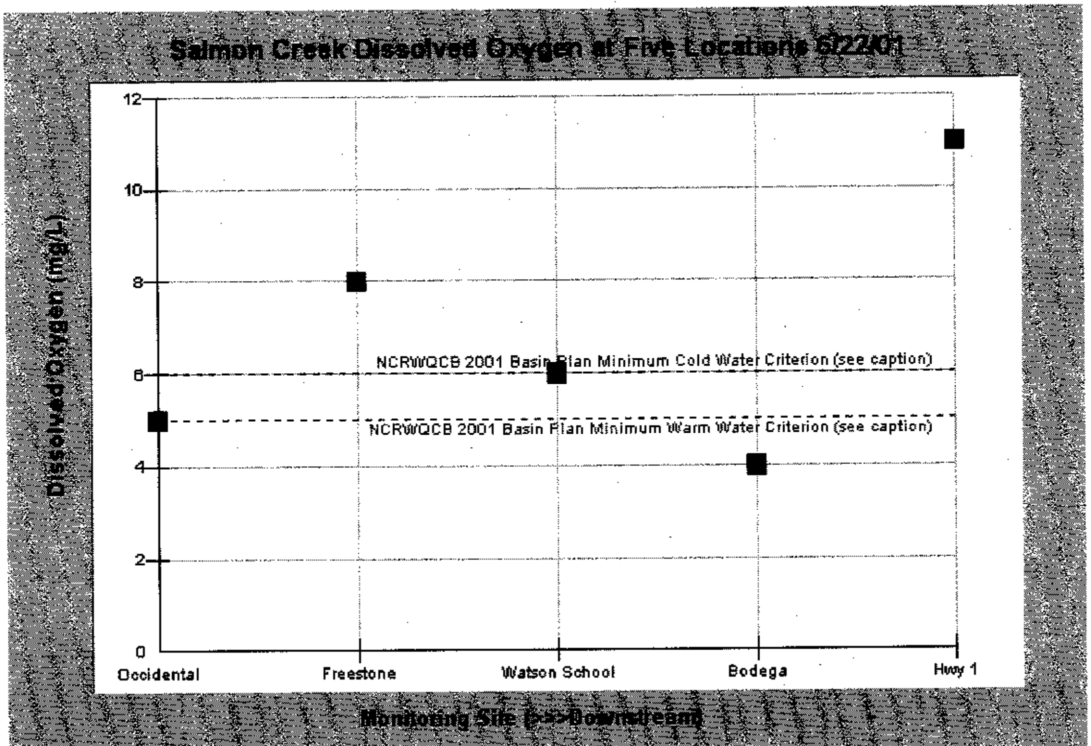

Figure 23. Dissolved oxygen at five stations (going downstream from left to right) in Salmon Creek. The high dissolved oxygen at Highway 1 is consistent with elevated pH values indicating photosynthetic activity characteristic of nutrient pollution. D.O. sags would occur at night. These data were collected by the North Coast Regional Water Quality Control Board as a part of the Surface Water Ambient Monitoring Program (SWAMP). June 22, 2001. From KRIS West Marin-Sonoma.

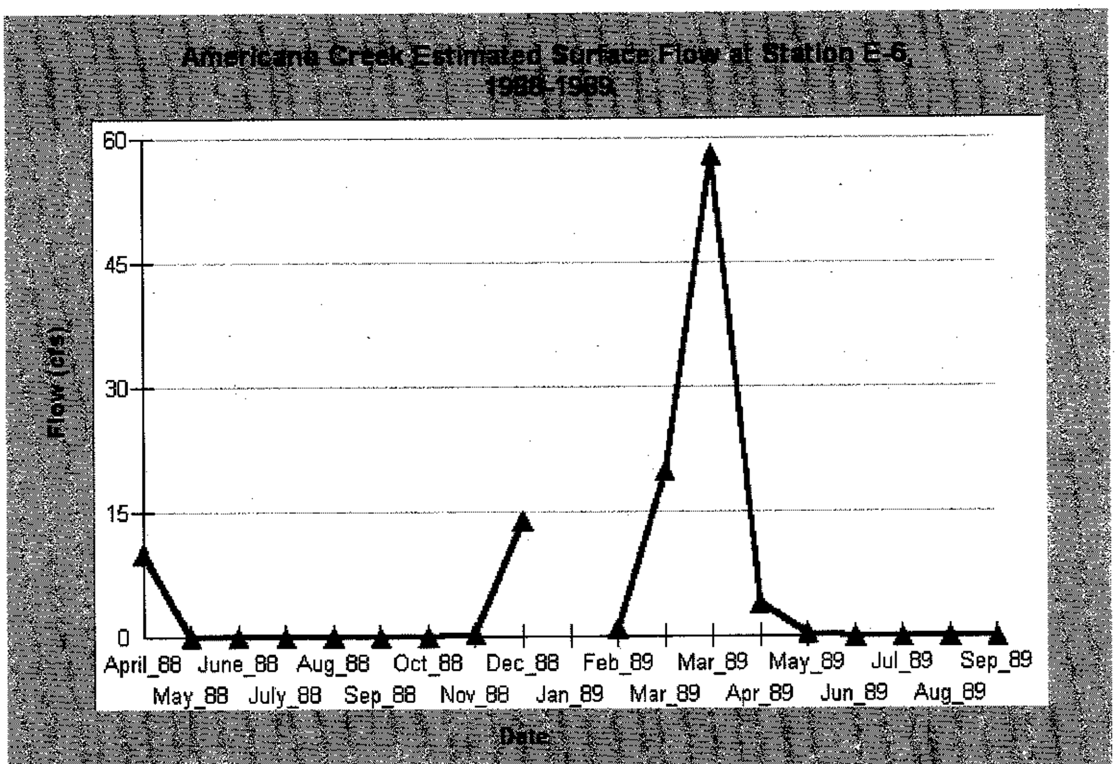

Figure 24. Surface flow was estimated approximately once monthly near Garicke Road (Station E-6) in Americano Creek from 1988-1989. Flow was not present after April in 1988 until November 1988 and from May-September 1989. Data from Merritt Smith Consulting for the City of Santa Rosa and U.S. Army Corps of Engineers. KRIS West Marin-Sonoma.

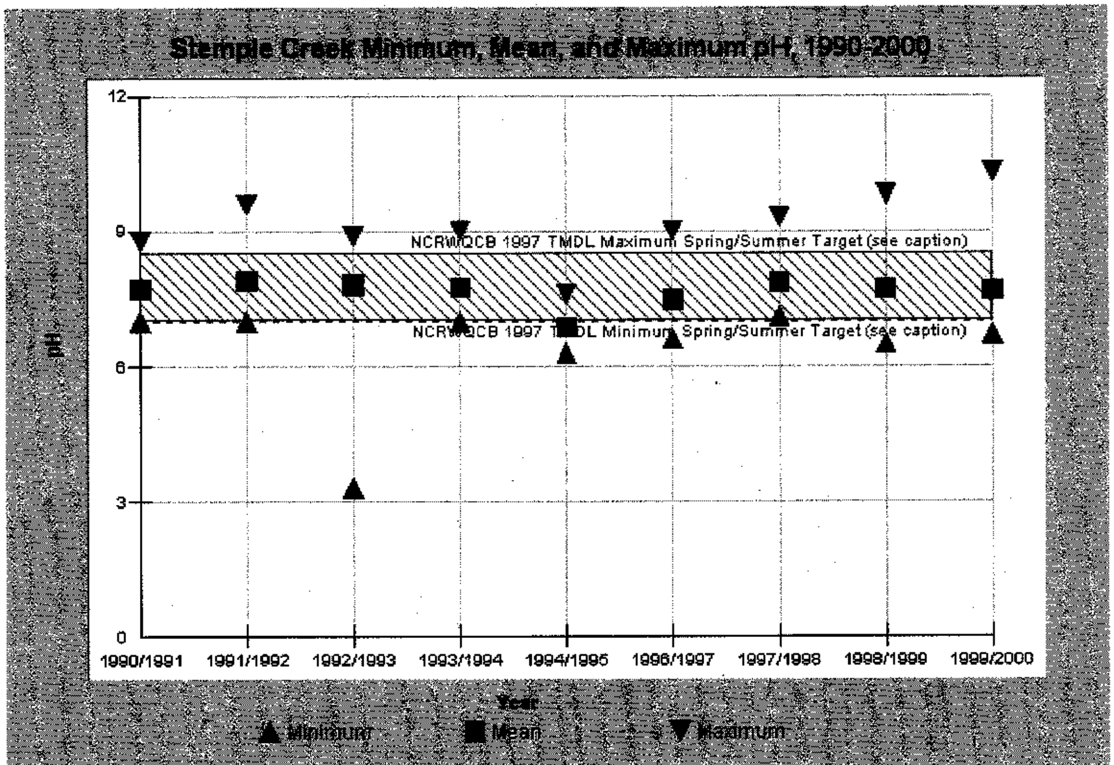

Figure 25. The pH of Stemple Creek exceeded stressful or lethal for salmonids (>9.5) as a result of nutrient enrichment from cattle waste in combination with flow depletion. Data from CDFG and chart from KRIS West Marin-Sonoma.

Walker Creek had coho salmon historically (Figure 26) but flow depletion and nutrient pollution have contributed to their disappearance. Kelly (1976) used electrofishing and netting for the Marin Municipal Water District sponsored studies that found coho, abundant Pacific lamprey juveniles and steelhead juveniles of all age classes in Walker Creek. Flows now annually fall to near 5 cfs or less from July through September (Figure 27). Reduced flow and grazing impacts have resulted in water quality problems similar to previously discussed tributaries related to nutrient pollution.

<u>Scott River</u>: Although the Scott River is not within the *Policy* area, it has very well recognized water quality and fisheries problems related to surface and ground water extraction (NRC, 2004). I am intimately familiar with this basin from helping with restoration planning (Kier Associates, 1991), restoration evaluation (Kier Associates, 1999), building three versions of KRIS databases, and four years of work on Scott River issues for the Klamath Basin Tribal Water Quality Work Group. Several papers on the Scott, Shasta and Klamath TMDLs are posted on their website and WRD can easily access documents on the Internet at www.klamathwaterquality.com.

I draw below from previous comments on the *Scott TMDL* (Higgins, 2006c) that are on the DVD with regional KRIS projects filed with these comments. The principal findings were as follows:

1. Flows have been decreased by ground water extraction,
2. Flows have declined to far below those required by the Scott River adjudication and often cause stream reaches and tributaries to go dry,
3. Low flow exacerbates water temperature problems, and
4. Flow and temperature problems combine with sediment to severely limit productivity of salmon and steelhead populations.

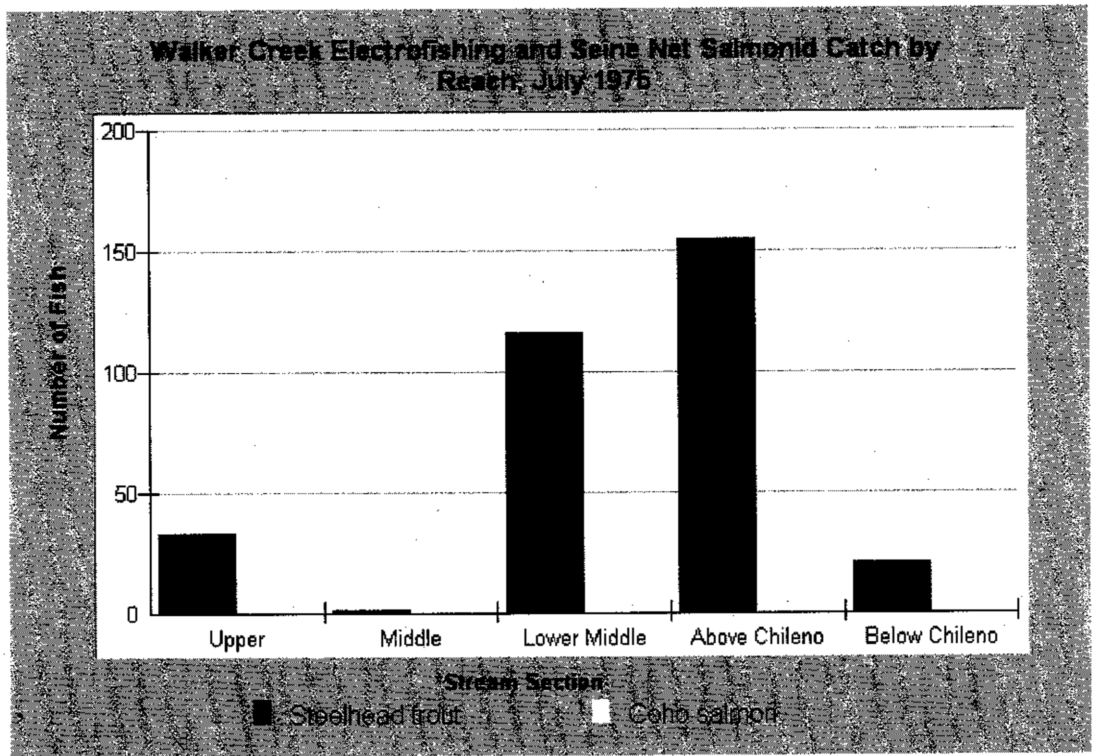

Figure 26. Fish sampling in Walker Creek in 1975 found coho salmon and numerous steelhead. Kelly (1976).

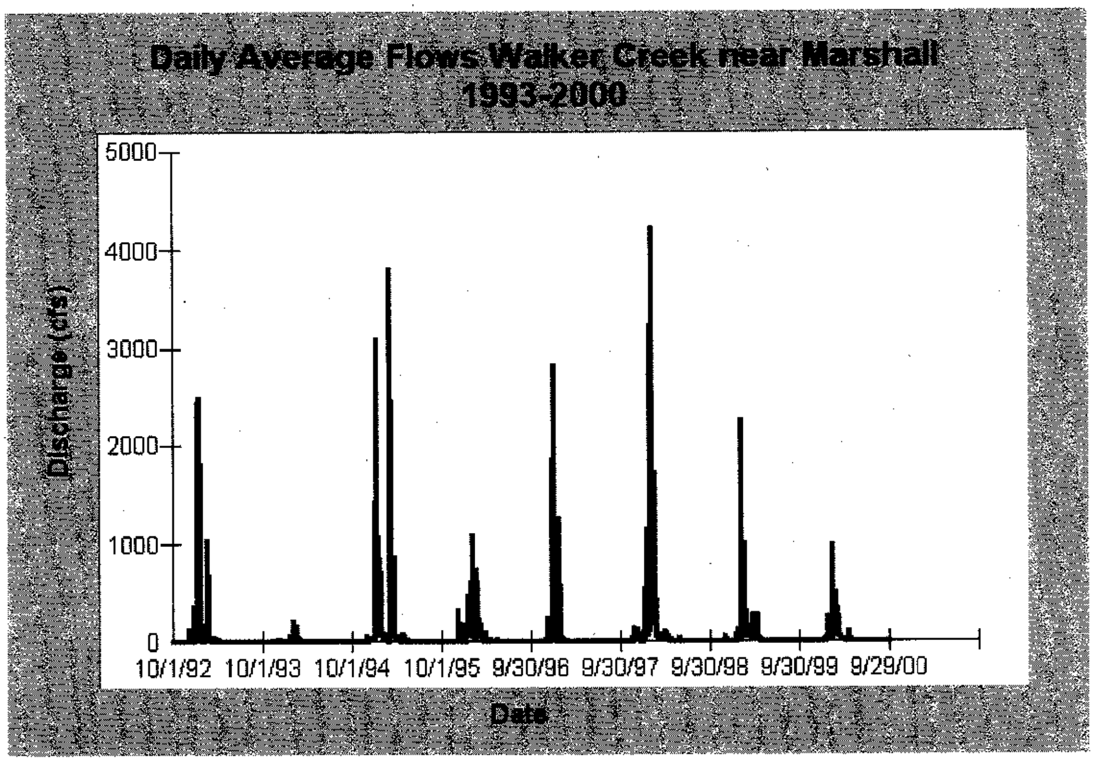

Figure 27. Flows in Walker Creek, tributary of Tomales Bay, dropped to 5 cfs or less on average annually according to USGS flow gauge records. Chart from KRIS West Marin-Sonoma.

The Scott River channel and many of its major tributaries are dried up annually, in violation of CDFG code 5937 (Figure 28 & 29), severely limiting rearing habitat for salmonids. Although the Scott River is adjudicated (SWRCB, 1980), flow levels fall below those required for months of the year (Figure 30). This causes major reductions in habitat quality in the lower Scott River, which formerly served as a summer refugia for juvenile salmonids.

The *Long Range Plan for the Klamath River Basin Conservation Area Fishery Restoration Program* (Kier Assoc., 1991) noted that ground water pumping in the Scott River valley depleted surface flows because of interconnections between surface and ground water. The Scott River has experienced major declines in surface flows coincident with installation of ground water pumps beginning in the 1970's. Pumps continue to be installed through NRCS and EQIP funding (Figure 31) and drops in ground water levels are becoming evident (Figure 32). The chart suggests that while annual maximum levels have remained relatively constant over time, annual minimum levels have declined since 1965, although they fluctuate with precipitation.

The National Research Council (2004) makes a clear case that flow depletion is at the root of temperature problems in the Scott River. As flows drop, transit time for water increases allowing an opportunity for stream warming. A thermal infrared radar (TIR) image of Shackleford Creek (Figure 33) was taken by Watershed Associates (2003) as part of the Scott River TMDL and shows dramatic effects of flow depletion on water temperature. Shackleford Creek is cool enough for juvenile salmonid rearing above points of diversion, then warms rapidly as its flow is depleted. Flow resumes below the major tributary Mill Creek, warms again as flow is reduced by irrigation until surface flows are lost, just upstream of the convergence with the Scott River.

Fall chinook salmon from the Scott River are an important component of the Klamath River run that supports ocean, sport and Native American fishing. Scott River fall chinook returns plummeted in 2004 and 2005 to the lowest level on record for two years in a row (Figure 34). Even after prolonged drought from 1986-1992 Scott River fall chinook returns ranged from 3000-5000 adults annually.

A major potential problem for chinook salmon is that they are stranded in the lowest reaches of the Scott River due to continuing stock water activities and other illegal diversions after October 1 (Figure 30). The fish are forced to spawn in lower reaches of the Scott River (Figure 35) where decomposed granitic sand levels are very high, which threatens egg survival as sand is transported during winter storms.

The SWRCB WRD needs to make the Scott River a priority for enforcement. Fall chinook are collapsing and coho salmon only have one strong year class of three, indicating a high risk of extinction. Immediate action is appropriate given the change in weather and flow patterns expected with a change of the Pacific Decadal Oscillation (PDO) expected sometime from 2015 to 2025 (Collision et al., 2003) and with longer term drought cycles expected with global warming (see Climate Cycles and Change).

<u>Shasta River</u>: My experience on the Shasta River parallels that described for the Scott River and my TMDL comments (Higgins, 2006d) also serve as the source for information below. The Shasta River Adjudication (CDPW, 1932) does not require a minimum flow level similar to the Scott River Adjudication (CSWRCB, 1980) and average daily flows can fall to near 20 cfs (Figure 36), which has major consequences for elevated stream temperatures (NRC, 2004). Lack of coordination of irrigation operations may sometimes cause flows to fall below the listed average and present an even greater challenge for fish survival. Dwinnell Reservoir (Figure 37) blocks the headwaters of the Shasta River and is a major source of pollution itself (NCRWQCB/UCD, 2005). Major tributaries like Parks Creek (Figure 38) and the Little Shasta River lose surface flows for several months a year.

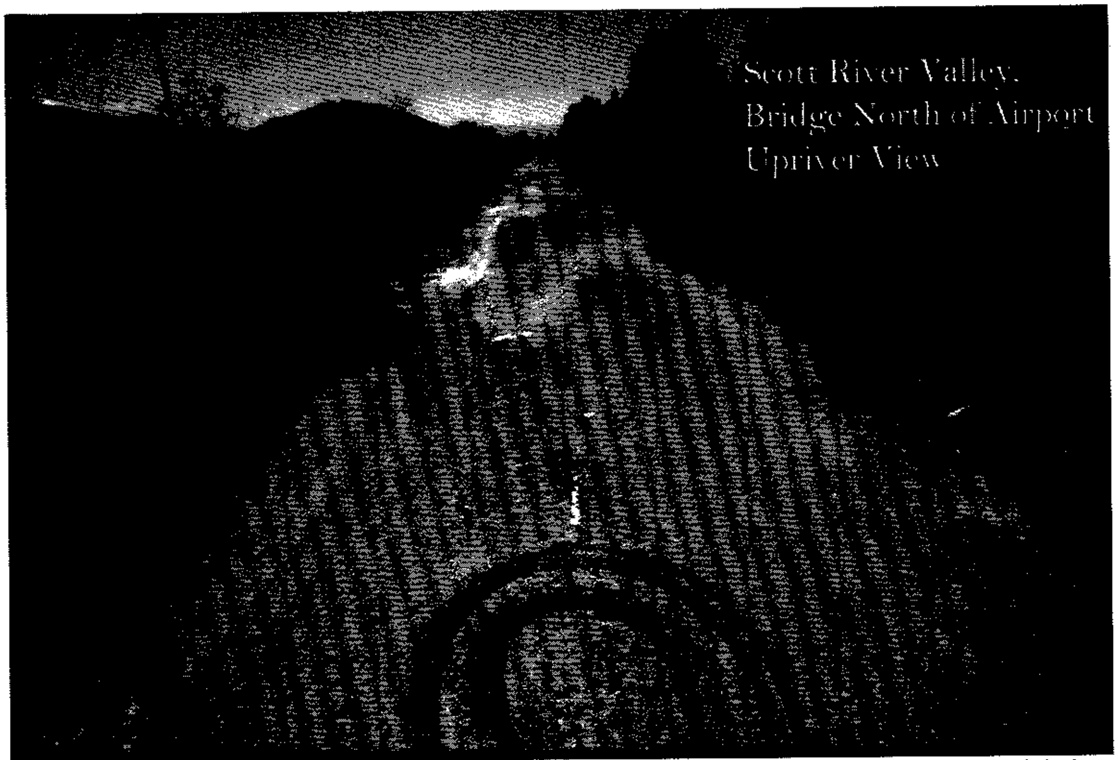

Figure 28. The dry bed of the Scott River in a reach near the airport looking upstream. This is a violation of CDFG Code 5937. Photo from KRIS Klamath-Trinity V 3.0 taken by Michael Hentz. 2002.

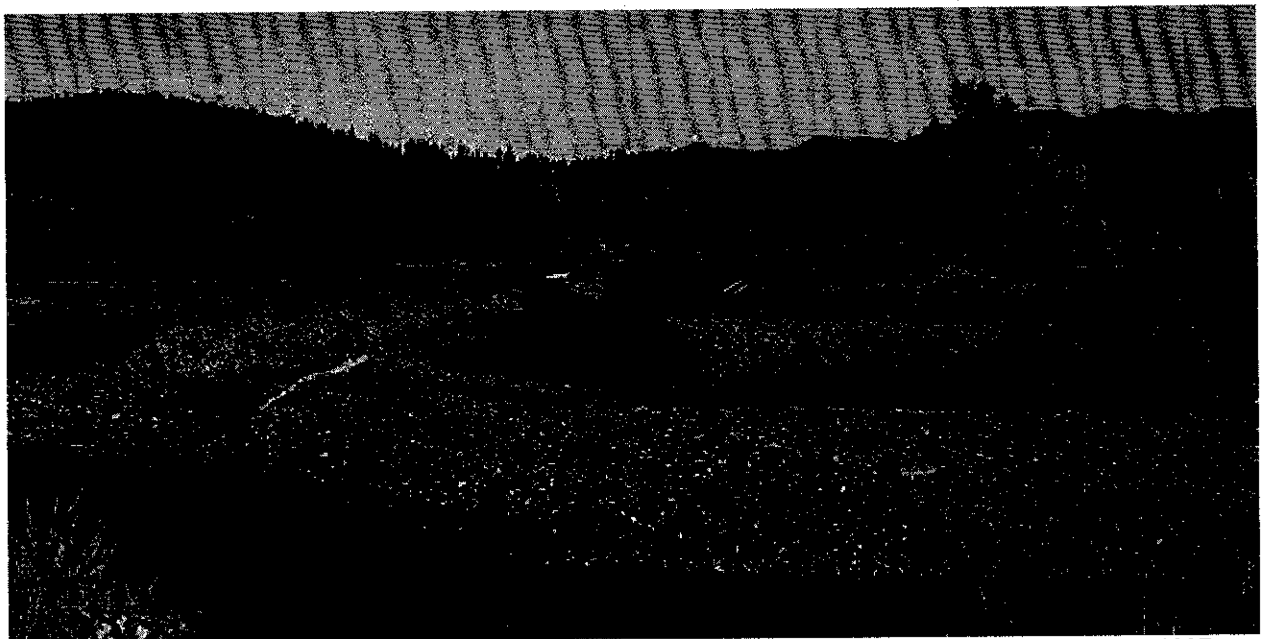

Figure 29. Shackleford Creek is shown here running dry at its convergence with Scott River in August 1997. The creek has coho and chinook salmon and steelhead trout, but diversions dry it up annually during summer and fall. This is also in violation of CDFG Code 5937. Photo by Pat Higgins from KRIS V 3.0.

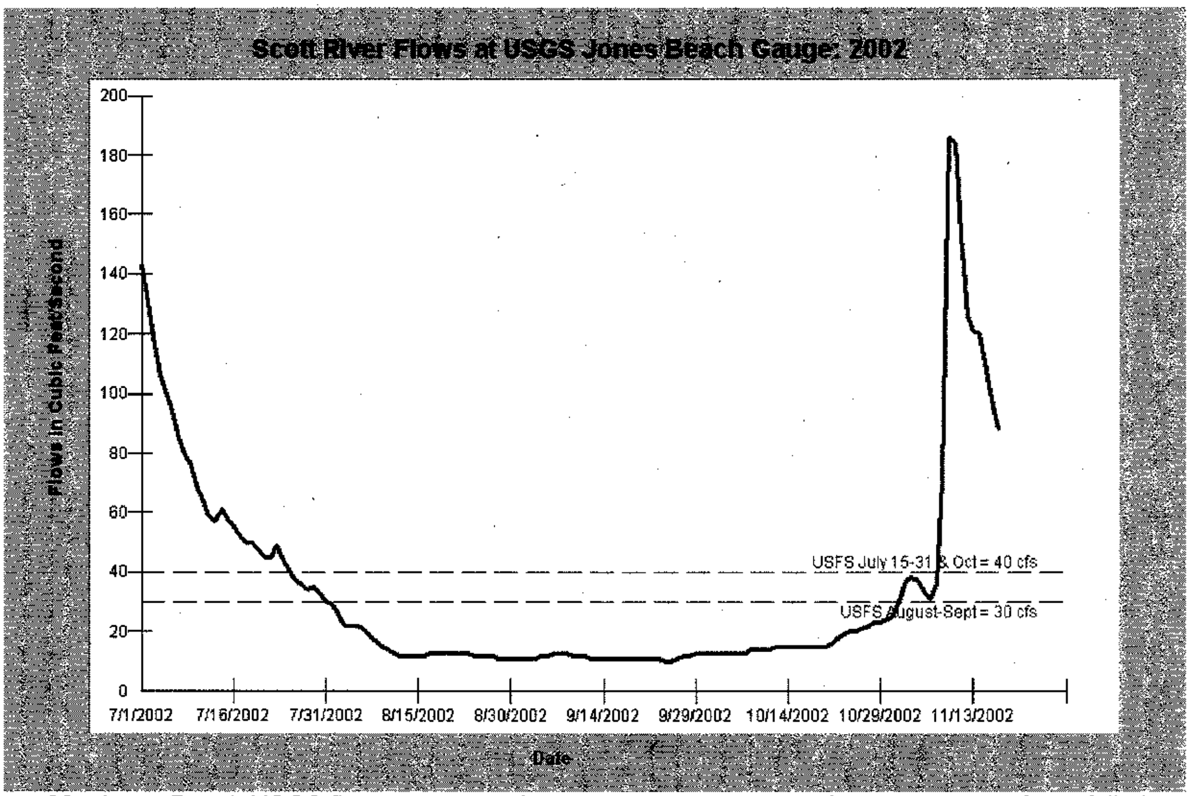

Figure 30. Jones Beach USGS flow gauge data from the irrigation season of 2002 show that flows failed to meet adjudicated levels for the USFS and flows needed for fish migration, spawning and rearing in August, September and October. Reference lines are those from the SWRCB (1980) adjudication.

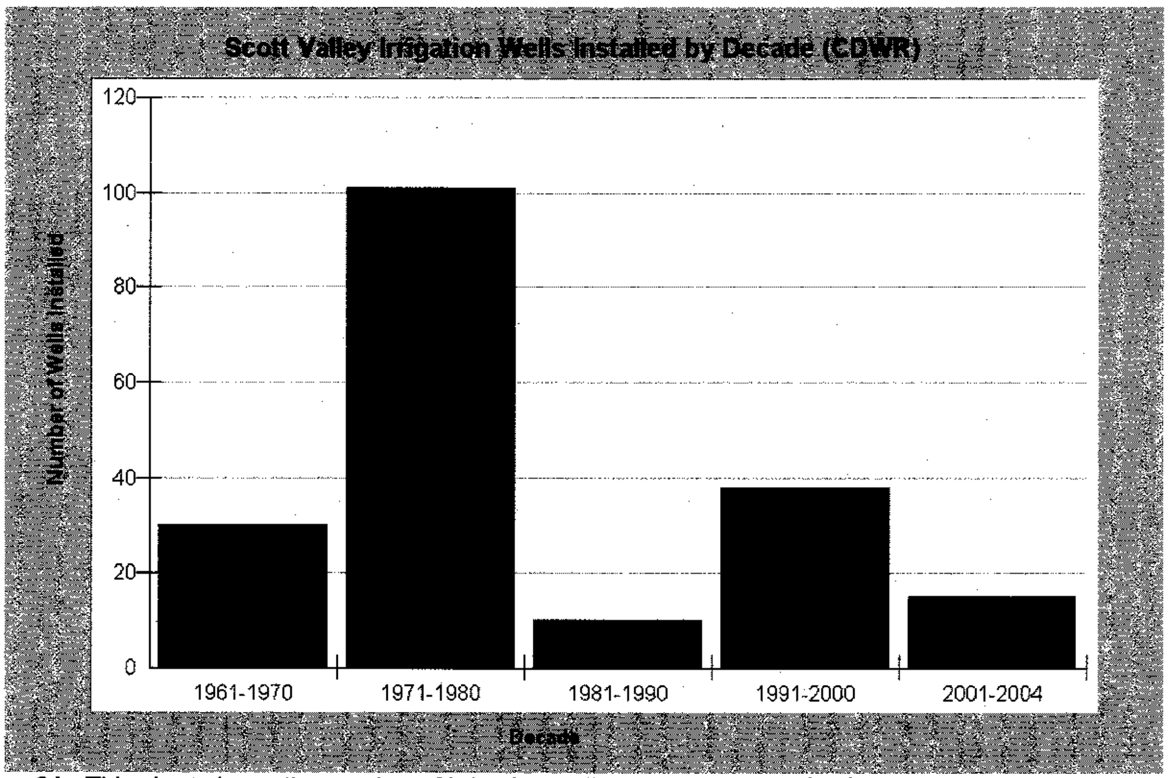

Figure 31. This chart shows the number of irrigation wells recorded by the California Department of Water Resources. Data may be only partial as not all parties installing wells file with DWR.

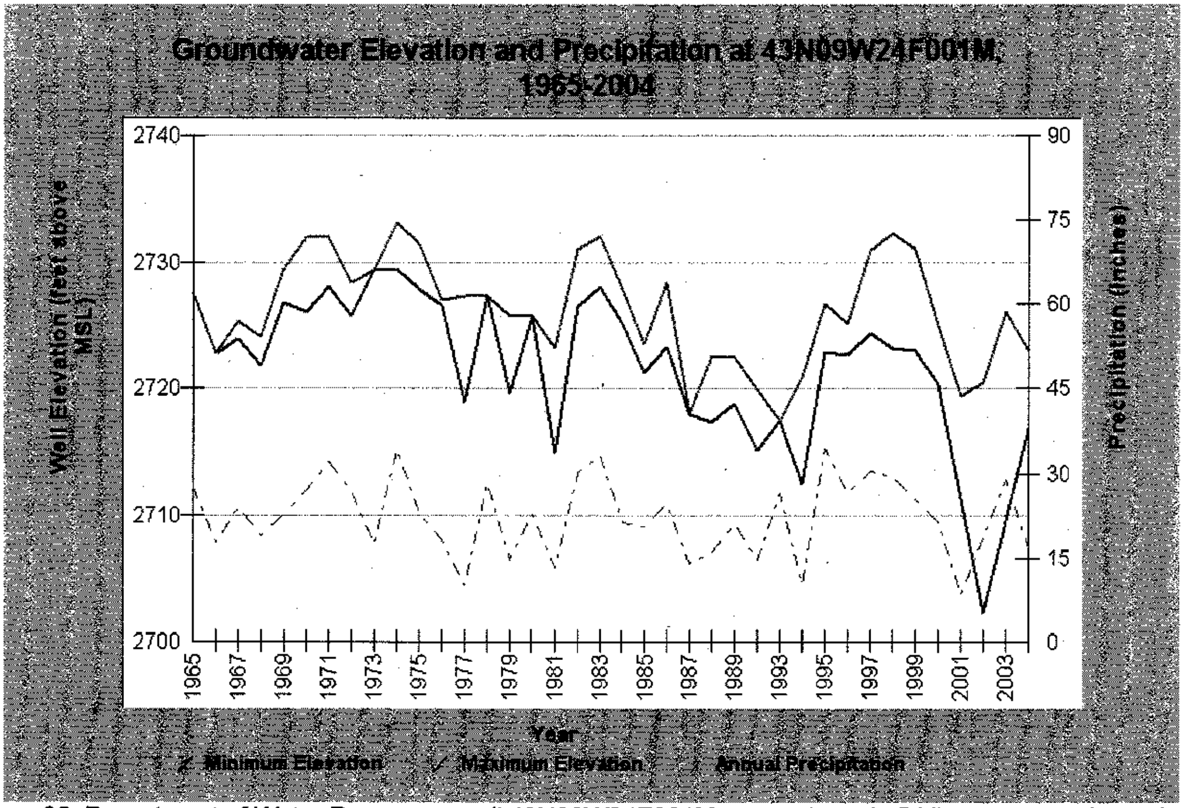

Figure 32. Department of Water Resources well 43N09W24F001M, approximately 5 kilometers south-southeast of Fort Jones, for the years 1965-2004. Minimum elevation declines are likely indicative of ground water depletion. From QVIC (2006).

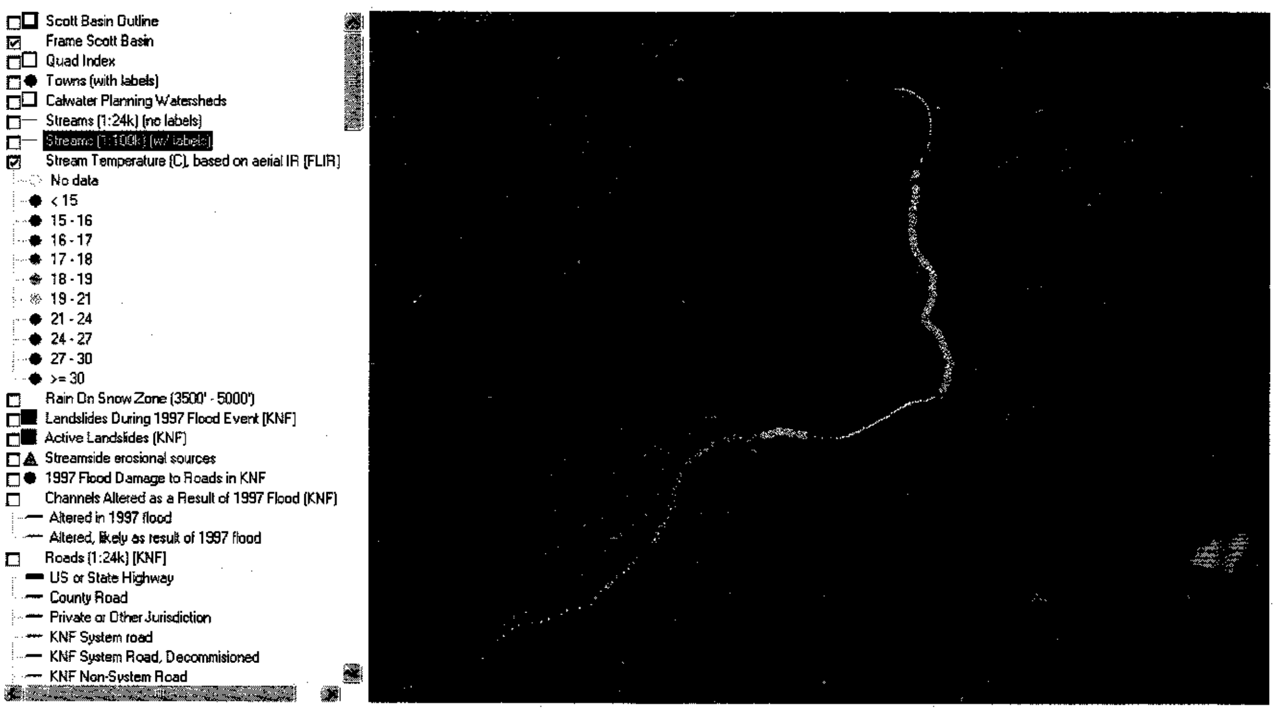

Figure 33. This map shows summary data of Scott River Thermal Infrared Radar (TIR) surveys for Shackleford Creek. Note that water temperature warms in a downstream direction as flow is depleted. Reaches with no temperature coded color are dry, indicating loss of surface flow in violation of CDFG Code 5937 and over-diversion in violation of SWRCB Codes 1243, and 1375. Data from Watershed Sciences (2003).

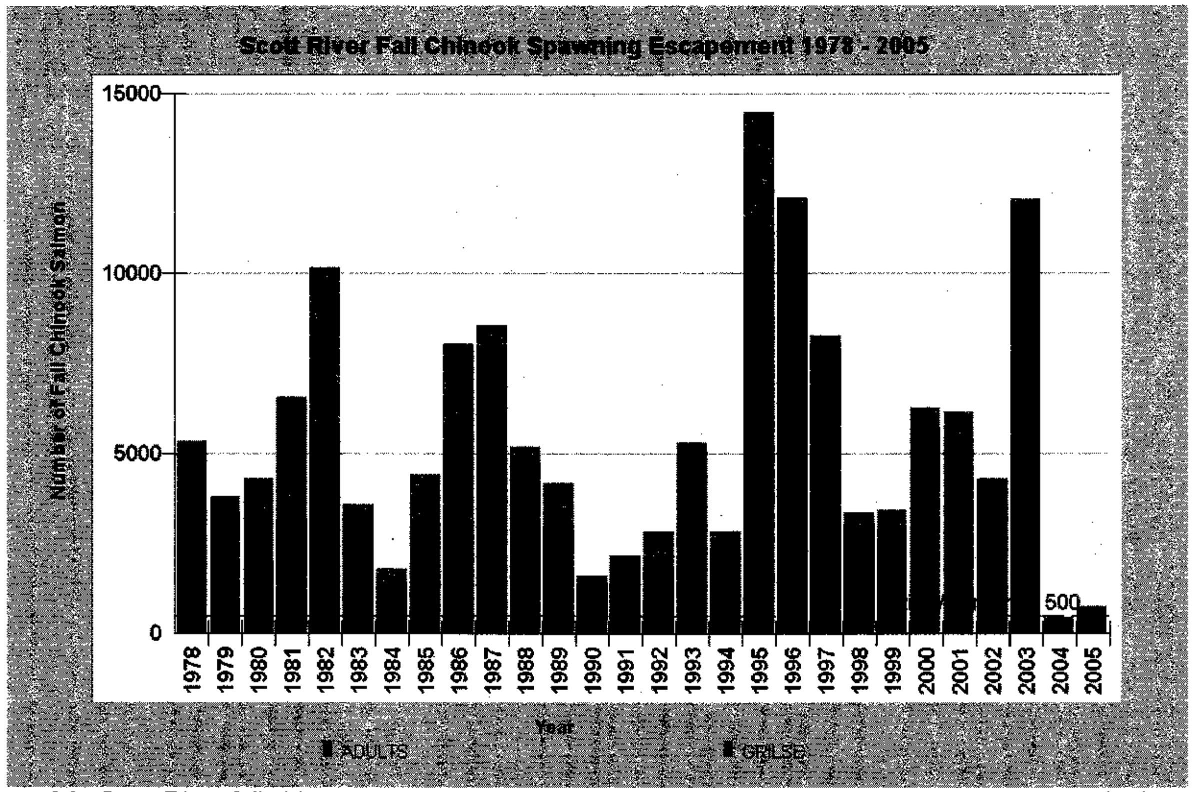

Figure 34. Scott River fall chinook spawning runs from 1978 to 2005 shows both 2004 and 2005 as the lowest years on record. Summer and fall flow conditions were near all time lows for preceding 2004-05 brood years (2001-2002). Data from CDFG.

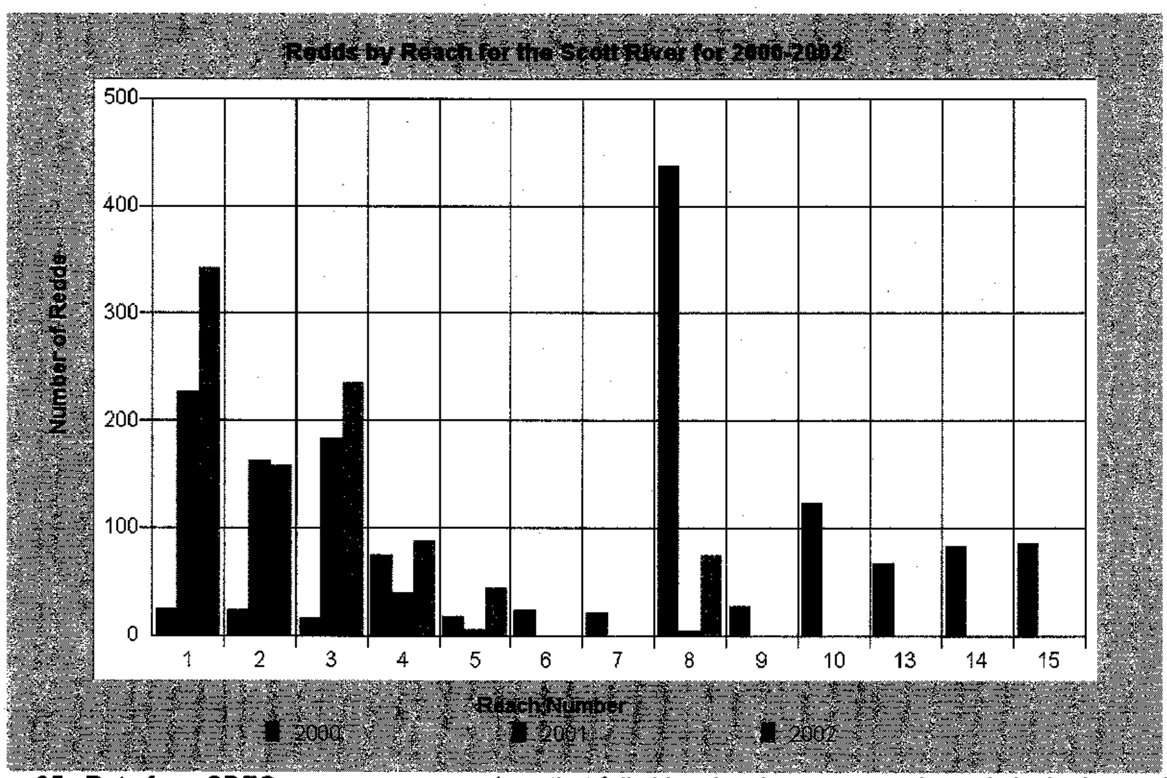

Figure 35. Data from CDFG spawner surveys show that fall chinook salmon spawned mostly in the lowest five reaches of the Scott River in 2001 and 2002, where eggs may be vulnerable due to potential for bed load movement or transport of decomposed granitic sands. Low flows in fall prevent salmon disbursement to upstream reaches where gravel conditions are superior and chances of egg survival greater. KRIS V 3.0.

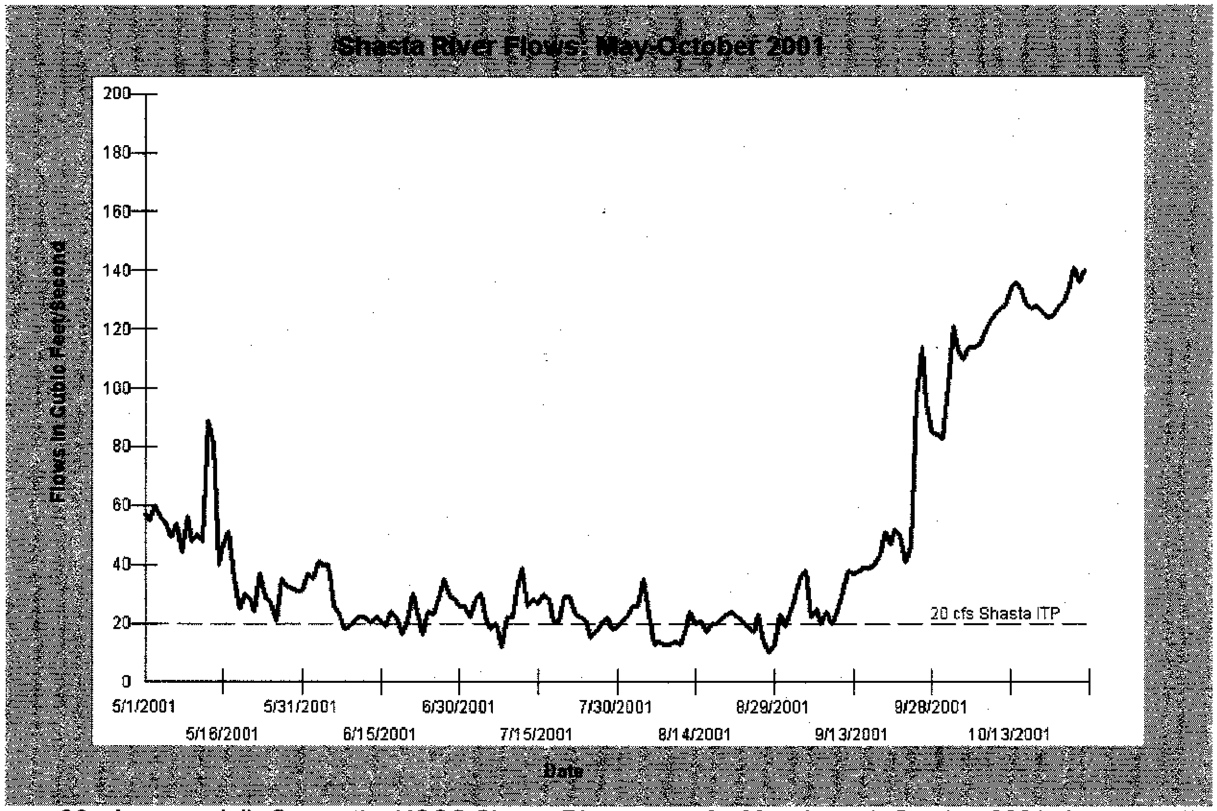

Figure 36. Average daily flow at the USGS Shasta River gauge for May through October 2001 shows a pattern of extremely low flows with many days falling below 20 cubic feet per second. This contributes to temperature problems as less water mass warms easily and agricultural runoff back to the river is hot.

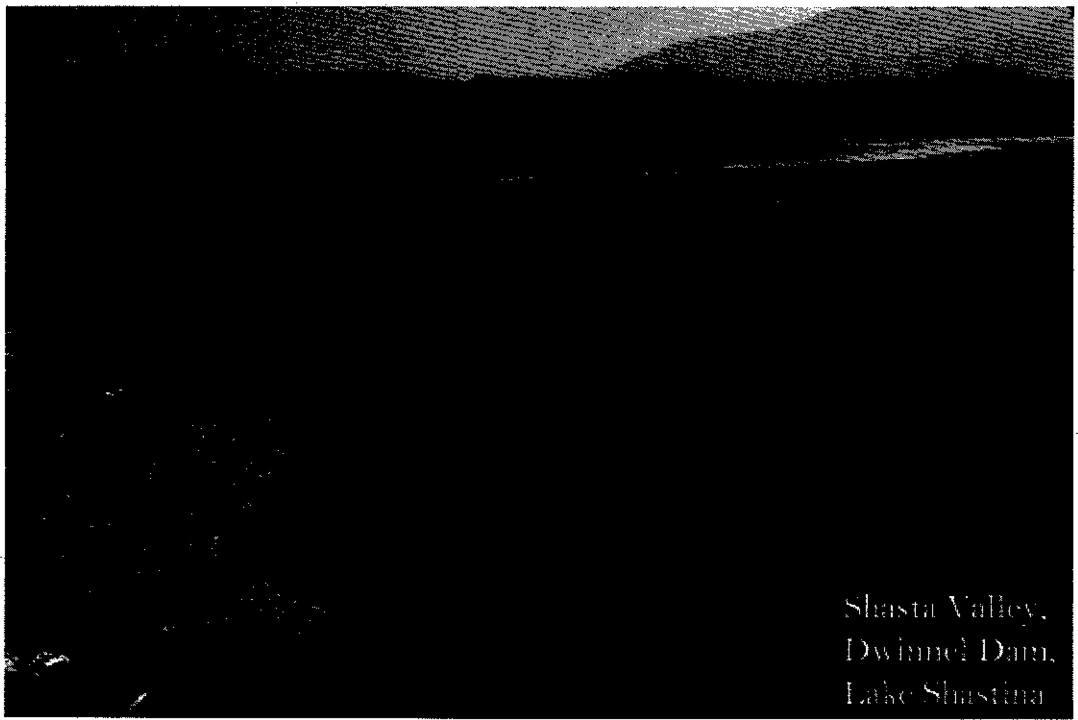

Figure 37. Dwinnell Reservoir looking southeast off the dam with water levels at less than full pool in 2002. Long retention time and exposure to sunlight trigger algae blooms and nutrient pollution. Water releases from this reservoir are restricted to avoid adding to water pollution downstream. It has blocked downstream flow since 1928 in violation of CDFG 5937. Photo from KRIS V 3.0 by Michael Hentz.

Figure 38. Parks Creek is shown here below the diversion to Dwinnell Reservoir with surface flows almost completely depleted. This not only shuts off cool water that could buffer high Shasta River water temperatures. Winter flows are also diverted blocking adult fish passage and blocking spawning gravel recruitment to the mainstem Shasta River. Photo by Michael Hentz.

Mack (1958) measured flow in Big Springs Creek of 103 cfs, which is very similar to the measurements taken by the California Department of Public Works (1925) for the Shasta River Adjudication (CDPW, 1932). This spring source was at optimal temperatures for salmonid rearing and the California Department of Water Resources (1981) found that Big Springs Creek had the highest spawning use of any Shasta River reach or tributary. Kier Associates (1999) noted that the spring feeding Big Springs had been depleted due to ground water pumping to less than 20 cfs.

Major increases in diversion of surface and groundwater have changed the temperature regime of the Shasta River. Thermal infrared radar (TIR) imagery captured by Watershed Sciences (2003) illustrates how flow depletion affects Big Springs Creek and Shasta River water temperature (Figure 39). The image shows water temperatures below 20° C only immediately downstream of Big Springs Lake, but warming to 21.7° C (Watershed Sciences, 2003), which is stressful for salmonids (U.S. EPA, 2003). The NCRWQCB (2006b) recommends that flows increases at Big Springs to at least 50 cfs to restore water quality.

The Shasta River and Scott River will also be where new private Watermaster service will be pioneered. The service has been ineffective in protecting instream flows in these basins (Kier Associates, 1991; 1999). The cost of DWR Watermaster service is born by the water users and it has been rising in recent years. Recent legislation now allows the water users to hire private contractors to render the same service. Questions have been raised as to whether a private contractor working for the water users can be expected to elevate public trust interests over those of his clients.

The NRC (2004) asked for consideration of removal of Dwinnell Dam in order to restore fish passage and increase flows. Models of snow fall changes resulting from global warming indicate that only Mt. Shasta's snow pack will increase, which makes the Shasta River one of the best places to maintain salmonids in the Klamath Basin in the face of climate change.

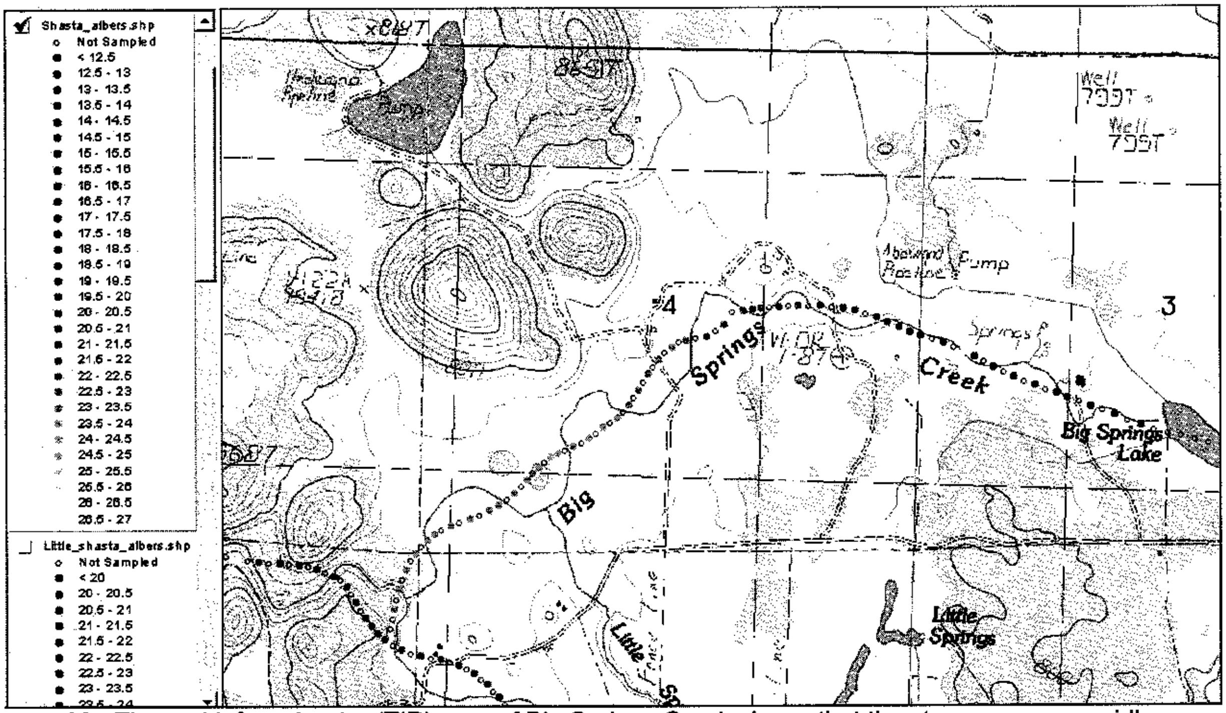

Figure 39. Thermal infrared radar (TIR) map of Big Springs Creek shows that the stream warms rapidly as a result of diversion and now is too warm for optimal salmonid rearing within a distance of less than three miles. Data from Watershed Sciences (2003) provided as GIS by NCRWQCB staff.

Climatic Cycles and Climate Change

The majority of the peer reviewers of the *Policy* (Lang, 2008; Gearheart, 2008; Band, 2008; McMahon; 2008) stated that SWRCB WRD needed to factor climate change into their planning. As mentioned above, NRC (2004) asserts that the Shasta River has the greatest restoration potential in the Klamath Basin in the face of global warming. Oscillations of climatic cycles will likely accentuate drought, which will act in concert with increased water demand from a growing population (Stetson Engineering, 2007b). While study of climate change is still progressing, shorter term cycles of rainfall and ocean productivity are now well recognized (Hare, 1998).

The Pacific Decadal Oscillation (PDO) cycle causes major shifts in ocean productivity from favorable to unfavorable for salmon approximately every 25 years off the coast of California, Oregon and Washington (Hare et al., 1999). Good ocean conditions are linked to wetter weather cycles and prevailed from 1900-1925 and 1950-1975 and returned to favorable again in 1995 (Collison et al., 2003). Poor ocean productivity and dry on-land cycles from 1925-1950 and 1976-1995 created very adverse conditions for salmon, particularly coho. The wet climatic cycle from 1950 to 1975 included the 1955 and 1964 floods. As the PDO cycle shifted, the 1976-1977 drought combined with highly aggraded stream beds to create a freshwater habitat bottleneck. Poor upwelling in the ocean also reduced growth and survival. Coho salmon populations on the California coast from Santa Cruz to Mendocino plummeted and many have never recovered (Figure 40).

The PDO influence is also evident in the Shasta River fall Chinook spawning returns (Figure 41). The highest return of 80,000 adults was just after Dwinnell Reservoir was built, despite being in a less productive ocean and climatic cycle (1925-1950). Even with access to less spawning habitat, runs in the 1960's exceeded 30,000 fall Chinook. The lowest ebb of the Shasta came during an extended drought from 1986-1992, when adult returns dropped to as low as 500 fish. Hopefully the WRD and DWR will get more water back in the Shasta River before the PDO switches in 2015-2025.

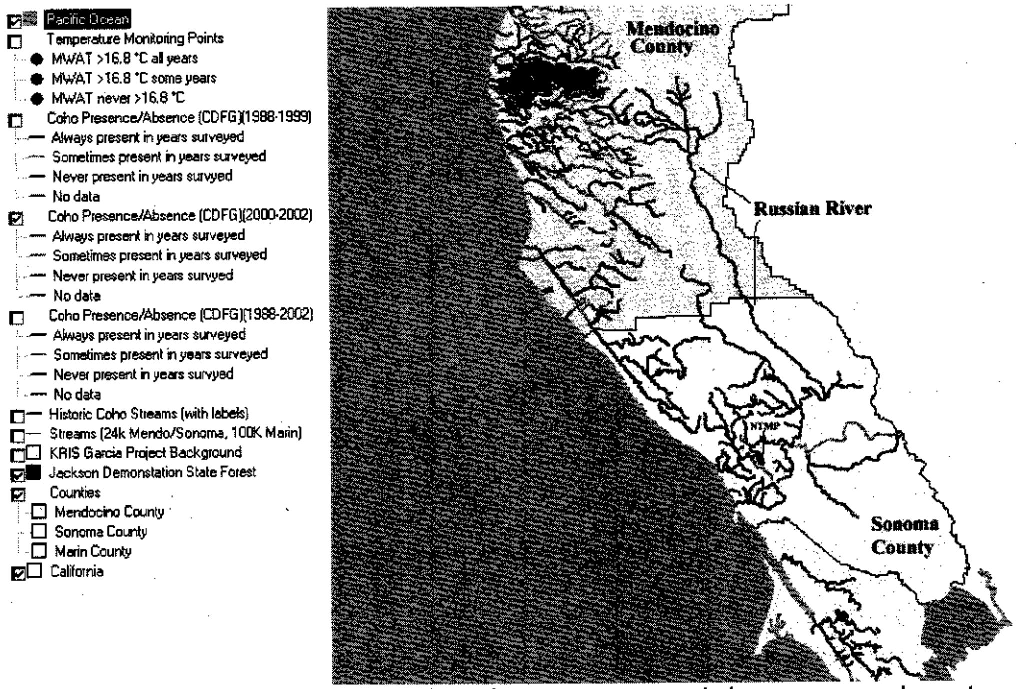

Figure 40. CDFG northern California coho salmon presence and absence maps show streams as green, if coho were always present, yellow if present in at least one year and red if absent in all three years from 2000-2002. Remaining populations are mostly near the coast within the redwood ecosystem and associated with more intact forests patches in coastal Marin County and around Jackson Demonstration State Forest. KRIS Russian.

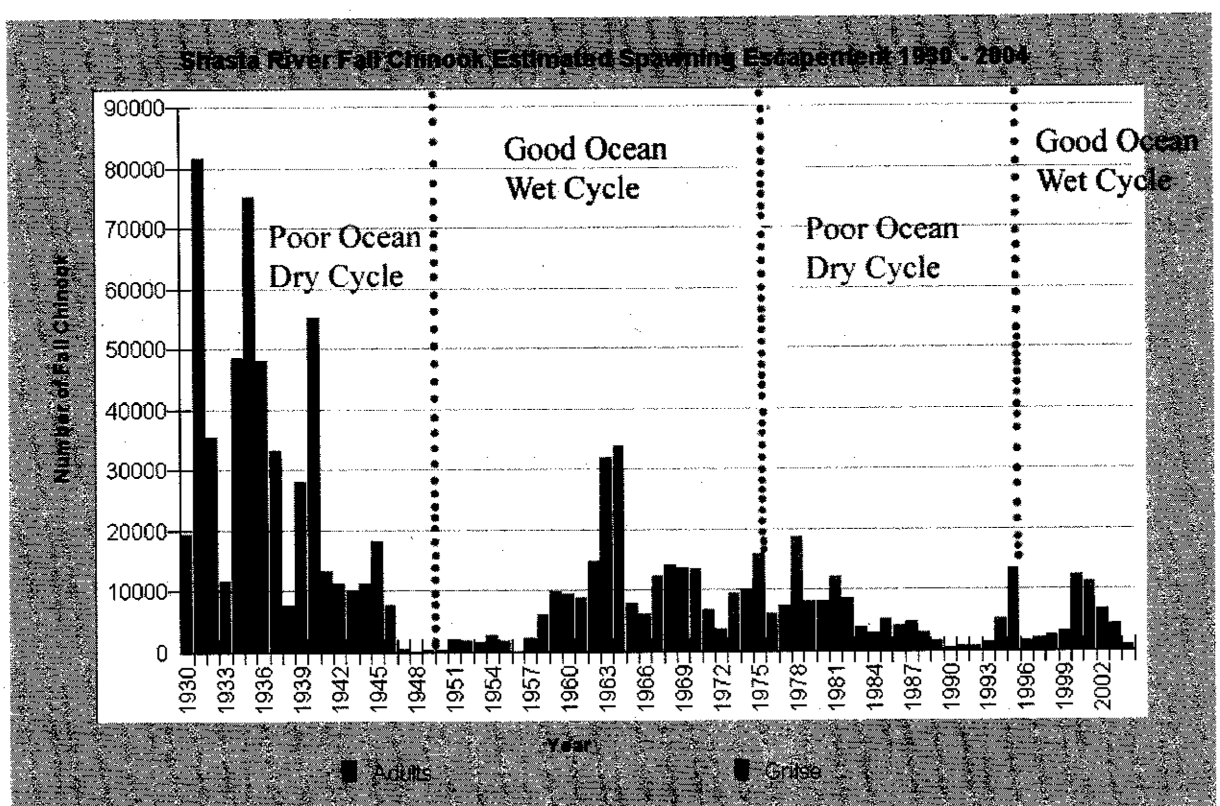

Figure 41. The CDFG Shasta Rack counts show fall Chinook returns from 1930 to 2004 with the PDO cycles overlaid. Returns fluctuate with climate and ocean cycles but the long term trend is down as a result of continuing loss and degradation of freshwater habitat. From Higgins (2006c) and KRIS V 3.0.

Restricted Geographic Scope Misses Basins With Greater Need

The *Policy* implementation is restricted to coastal watershed from the Mattole River south to San Francisco Bay (Figure 1) and does not include either the Klamath or the Eel River basins, which have enormous fisheries potential, more wildlands, and arguably greater need for help resolving flow issues.

The Shasta and Scott river basins are both recognized as water quality impaired to the degree that fisheries resources are compromised. CDFG is currently attempting to issue Incidental Take Permits (ITP) under the California Endangered Species Act for agricultural operations in these watersheds (CDFG, 2006a; 2006b). Lack of flows is confounding coho recovery under both State and federal ESA and, similarly, over-diversion is thwarting attainment of water quality standards under recently completed Scott and Shasta TMDLs (NCRWQCB, 2006a; 2006b). Despite the critical need for resolution of water supply issues, SWRCB WRD involvement is not apparent in either the ITP process or TMDL Implementation. California Department of Water Resources (DWR) staff have taken a similarly passive role in management of groundwater, which is directly linked to surface water supply problems in both basins. DWR has also failed to provide effective Watermaster Service and a new law permits the privatization of the service, which poses a potentially substantial impediment for insuring public trust oversight.

Timely action to restore flow and improve water quality in the Scott and Shasta Rivers could get the best return on investment for the WRD, if fish production is the index. The Shasta River has recently produced more than 10,000 adult Chinook salmon (Figure 41) and still has a run of coho salmon. Similarly, a restored Scott River could produce 10,000 fall chinook and viable populations of coho and steelhead as well. As NRC (2004) points out, increasing flow in the Shasta River would decrease water temperature. Functional Scott and Shasta River canyons would once again revitalize the rearing capacity of the both rivers for steelhead.

The Klamath River is recognized as being in crisis with regard to water quality and fish disease (Nichols and Foott, 2004) and the potential cumulative benefit of restoring flows and cold water from the Scott and Shasta Rivers should not be overlooked. Currently the Shasta and Scott contribute very little flow in summer to the mainstem Klamath River and what water they do contribute is warm and high in nutrients. McIntosh and Li (1998) used forward looking infra-red radar (FLIR) to examine water temperatures of the Klamath River. Figure 42 shows the FLIR image of the convergence with Shasta River water temperatures exceeding 29° C (84° F) and the Klamath River itself above lethal limits for salmonids. This influence is the opposite of the historic role the Shasta River played in moderating Klamath River water temperatures and nutrient loads.

The Eel River once had hundreds of thousands of salmon and steelhead, yet even the mainstem has gone dry in recent years just above Fernbridge in late summer. Flow depletion due to Pillsbury Dam reduces mainstem habitat, but the South Fork Eel is now also flow depleted. The latter has become so stagnant in recent years that blue green algae has proliferated that is toxic to dogs and makes recreational use impossible. Dozens of formerly productive tributaries for fisheries now run dry in summer and early fall. Because the Eel River watershed remains largely unpopulated and wild land, it has a great deal more chance for recovery than urbanizing watersheds or those with extensive agricultural activity.

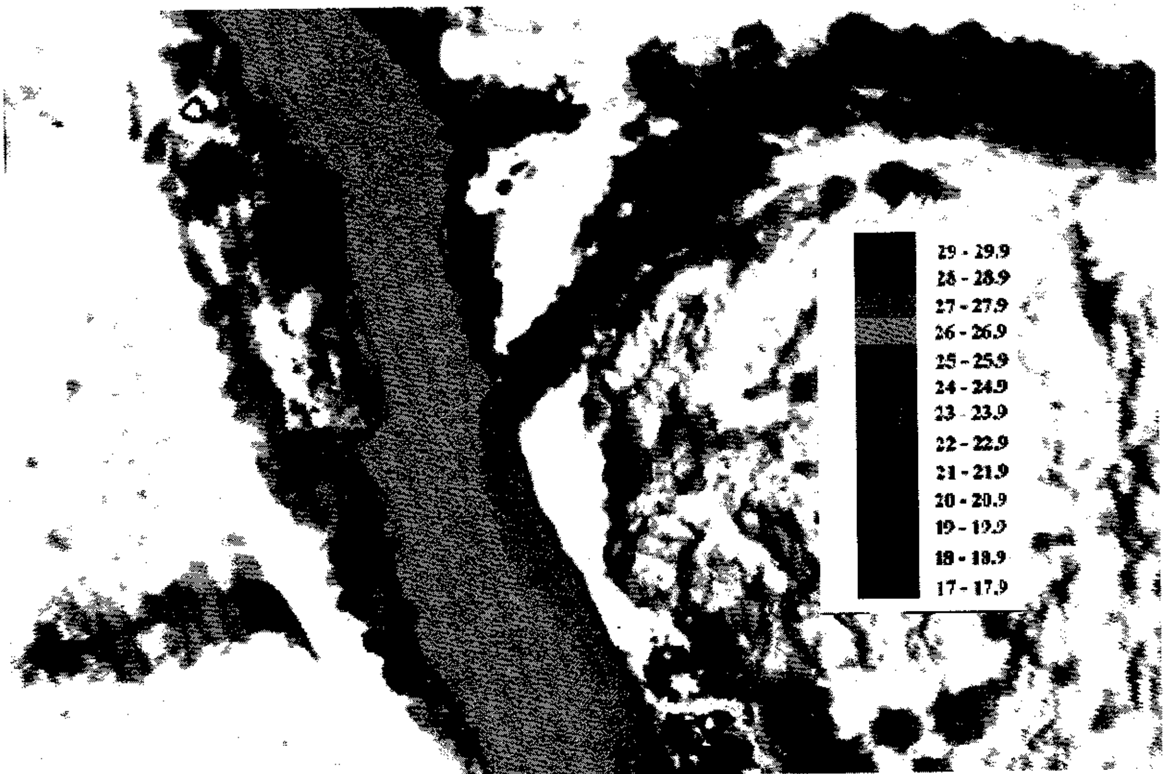

Figure 42. Thermal Forward Looking Infrared Radar Image (FLIR) showing the confluence of the Klamath River (flowing from the top of the image to the bottom of the image) and the Shasta River (flowing right to left in the image). The Shasta River is approximately 29 degrees C, which is well above lethal to salmonids. A warm water plume is observed in the Klamath River below. From McIntosh and Li (1998).

Monitoring, Data Management and Adaptive Management

Monitoring: The *Policy* calculation of protective base flows and water availability rely on fragmentary historical flow data and flawed synthetic data and "additional data collection on small stream hydrology and fish usage is needed to verify these relationships" (Lang, 2008). A major problem is that all monitoring envisioned is on winter flows (October-March) when surplus water is theoretically available, not on April-September flows that are known to be limiting fisheries.

There is a need for year around data collection in small and large streams throughout the region, with the priority identification of stream reaches where surface flows are lacking but where historically there was carrying capacity for salmon and steelhead. Band (2008) suggests gages "with real-time capability, likely co-funded with the USGS to take advantage of the National Water Information System (NWIS) real-time discharge system."

McMahon (2008) recommends installation of inexpensive stage height and temperature sensors (www.trutrack.com) that can be purchased inexpensively ($200) and are easy to install. He also recommends that monitoring be focused on key salmon and steelhead reaches (biological hotspots). Band (2008) pointed out the necessity of monitoring for *Policy* implementation:

> "Monitoring and management of the finite water resource network calls for the development of a more advanced sensor network to monitor stream temperature, turbidity, suspended sediment transport in addition to flow. The State of California should be in the position to develop and implement this type of network in collaboration with federal agencies and the university system."

In other words, to fully deal with the questions of cumulative effects of water diversion and water supply, many similar data elements are needed to those of other processes like the Clean Water Act (TMDL), Endangered Species Act (ITP) and the National Forest Management Act. The SWRCB WRD needs to co-participate with other agencies so that multiple objectives of different processes can be met and the WRD benefits from corollary data collected by its partners.

The SWRCB WRD shows little technical capacity, other than that provided by consultants, and no track record of extensive field data collection. There is no commitment to a schedule for monitoring and the effectiveness monitoring section of the Policy shows bureaucratic reluctance. DWR shows a similar lack of capacity with regard to ground water monitoring and regulation. Consequently, the State should solicit emergency help from the U.S. Geological Survey to assess water supply and surplus availability (see Conclusion for discussion on the need to re-organize WRD and DWR).

<u>Data Management</u>: Regardless of how data collection and agency coordination are structured, there needs to be a common database for sharing results, trend monitoring and implementation of adaptive management. KRIS projects submitted with these comments supply a great deal of useful data, including GIS information The SWRCB Water Rights Division should consider using this tool, already subsidized with over $1 million in public money, especially since the KRIS software allows easy cost-effective updating capacity for trend monitoring.

If *Policy* implementation involves partnerships with private parties or groups, all raw data, computer codes for models and other related information must be available to the scientific community and to the public in electronic form. Without full transparency, no model or study output is scientifically valid (Collison et al., 2003) and history shows that public trust resources, such as salmon and steelhead, cannot be fully protected without the ability of the public to participate in oversight.

Band (2008) envisions using the data collected in the field to increase the predictive capacity of the flow model:

> "An integrated GIS-spatial watershed model that incorporates natural runoff production, stream routing and all water diversions and return flows should be developed......As part of an adaptive management approach, the modeling system would provide a formal set of expectations of different water resources policies in the watersheds."

<u>Adaptive Management</u>: 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."

Dr. Carl Walters (1997) is credited with having coined the term adaptive management and has followed 25 case studies of riparian and coastal ecosystem restoration projects around the world, but found "only seven of these have resulted in relatively large-scale management experiments, and only two of these experiments would be considered well planned in terms of statistical design." He notes that too little change in anthropogenic stressors is carried out in most cases so that natural variation are not distinguishable from project effects.

"Various reasons have been offered for low success rates in implementing adaptive management, mainly having to do with cost and institutional barriers" (Walters, 1997).

The cost of monitoring associated with *Policy* implementation is not estimated nor are sources of funding identified. The institutional barriers that might impede successful adaptive management are well described above. The attempt to pass of monitoring costs to diverters (watershed groups) in exchange for their helping shape water management is unacceptable. The WRD needs to calculate staffing costs and define a partnership structure with other agencies that will satisfy data needs for adaptive management.

If 500 or 1,000 illegal dams are removed, we would have the potential to make a difference on the problem and would also frame an interesting and valid adaptive management exercise.

Instead of adaptive management, the SWRCB WRD has been exhibiting what NRC (2004) terms deferred action:

> "In the deferred-action approach, management methods are not changed until ecosystems are fully understood (Walters and Hillborn, 1978; Walters and Holling, 1990; Wilhere, 2002). 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."

Conclusion

When one studies Appendix E (Stetson Engineering, 2007a), it becomes apparent that Dr. Bob Gearheart's (2008) characterization of his experience with water rights in the Upper Klamath in Oregon apply to the *Policy* area: "water rights were 1) over allocated, 2) unmeasured, and 3) mostly unregulated." Implicit in the *Draft Policy* is that there is surplus water in North Coast streams in the geographic area in question. An accurate inventory of water resources might find that many or most streams are fully allocated, given changes in watershed hydrology and channel morphology in conjunction with existing levels of diversion and groundwater use. When the geographic extent and severity of the problem is fully assessed, one can see that Pacific salmon species will not thrive or even survive into the future without profound change in California water policy and management.

Recommendations: If the *Policy* goes forward under current agency framework:

- Only consider diversions after December 15.
- WRD works with USGS to set up gauges for year around flow measurement region wide, share all data in the public domain.
- No additional permits issued by WRD for streams that formerly supported juvenile salmonid rearing but now are dry for any period of the year and were not historically intermittent.
- Conduct full inventory of all water extraction on the ground in cooperation with USGS, including riparian rights, pre-1914 and illegal diversions within one year.
- Stop post-permitting of illegal diversions and make fines sufficient to be a disincentive.
- Work cooperatively w/ CDFG using 5937 and get flows back. Don't reign in the wardens.
- DWR needs to work with USGS on collection of ground water data and more actively manage the resource and data needs to be made public.

- DWR should re-establish Watermaster Service so that it is done by a government agency not a private party due to public trust protection needs and provide more effective service.
- WDR, DWR, CDFG and NOAA Fisheries need to create a participatory data management system that has all data for the region, including spatial data, and can be used for adaptive management.

In light of over-diversion, critical shortages of water for fish, inexorably rising demand for water, and the rampant lawlessness of both surface and ground water diversion, it is clear that we have a regional crisis. The data and the case studies above show that there is a complete dereliction of duty by the WRD and a similar lapse in management of ground water by DWR.

In fact, much more profound reform is likely necessary, although there will be considerable opposition from agricultural interests and intransigent bureaucracies involved. What is really necessary is:

1) Change California Water Law to make riparian diversions require a permit,
2) Have Legislature request Attorney General investigation into lack of enforcement of SWRCB codes (1052, 1055, 1243, and 1375), including illegal extraction of ground water that is connected to surface water (i.e. Big Springs, Shasta River)
3) Consolidate surface water and ground water management and Watermaster Service under one State agency that has public trust as its over-riding objective, such as CDFG or Cal EPA.
4) Integrate planning with TMDL (Regional Boards), ESA/CESA (CDFG, NMFS), watershed restoration efforts (NRCS/NGO's), and NFMA and Northwest Forest Plan (U.S. Forest Service/Bureau of Land Management) implementation to pool resources and all agencies and processes targeting Pacific salmon recovery.

Given the institutional incapacity of both the SWRCB WRD and DWR, it is hard to recommend either as a future lead agency under which water management would be carried out, and it is time to consider shifting authority. Regardless of how bureaucratic responsibility might be reallocated, the new management perspective must hold public trust protection as a priority and allow water extraction only when it does not harm fisheries and water quality. Also under any scenario the USGS is needed immediately to lead data collection and analysis.

Urgent action is needed in reform of water management to avoid a wave of Pacific salmon stock losses due to climate change and recognized shifts in climatic regimes, such as the Pacific Decadal Oscillation (PDO) cycle (Hare et al., 1999). That means substantially improved freshwater habitat conditions by 2015-2025. It is time for State agencies to uphold the law, to begin cooperative work to remediate over-diversion of surface and groundwater, and to not only prevent fish stock extinctions, but to aim for restoration that provide a harvestable surplus of fish. Restoration of recreational beneficial uses will improve regional quality of life. Healthier rivers will also contribute to economic development related to tourism.

I would be happy to discuss any aspect of my comments with your staff.

Sincerely,

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Watershed Systems
Hydrology - Geology - Soil Science

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May 7, 2008

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Dear Mr. Lippe,

You have asked that I address the specific hydrologic and sediment issues that may be associated with program implementation for the **Napa River Watershed Sediment TMDL and Habitat Enhancement Plan.** These are the issues that are the focus of pp 93-120 in the Staff Report for current version of the proposed Napa River TMDL. I had not noticed that the checklist format and abbreviated discussion of impacts of the implementation program itself did not really address the environmental impact of the proposed actions. That section of the staff report conveys an impression that the Napa County regulations that govern land use conversions to vineyards in the hillside areas of Napa County will meet the goals of the TMDL with State Board oversight as proposed in the TMDL implementation plan.

However, my prior extensive reports and analyses of specific conversion projects in Napa County have all demonstrated that you cannot simultaneously reduce sediment yield with engineering structures and flow routing while maintaining or reducing peak flow runoff. The belief that the proposed TMDLs will meet or exceed water quality standards when implementation of the TMDL must rely on land use regulations that are not within the control of the Regional Board needs to be reconsidered. In my opinion, it may be possible to implement the TMDL and meet its goals with local control, but that has not been demonstrated to date and the bulk of the evidence suggests that in the specific case of Napa County, there is an entire land-use engineering industry that has not been able to deal with impacts of peak flow increases associated with land conversions.

The source-area erosion control technology promoted by the consultant community in Napa County is good and seems to be improving through time. But the engineering solutions for headwater source-area sediment yield reduction and/or local capture of sediments almost invariably result in greater off-site, downstream, concentration of runoff that then leads to bank and streambed erosion to balance sediment load with the increased stream power. It seems that recommendations for more and larger-capacity on-site runoff detention are largely ignored in favor of reduced sediment concentration in that runoff.

This is understandable. It is more expensive in terms of money and land resources to capture and recharge the volumes of water that are yielded with a land use conversion from native vegetation to vineyard than it is to control sediment yield. The consulting reports done for Napa County to meet their Erosion Control Ordinance requirements almost always utilize the Natural Resource Conservation Service's older Soil Conservation Service map soil unit characteristics as the basis for calculating comparative before- and after- yields of sediment and water that are to result from a proposed land conversion. By using the broad scale map unit soil descriptions for the sites as they existed in the 1960's and 1970's before conversion, consultants are able to show to the satisfaction of Napa County Planning staff and its Rural Conservation District that a proposed conversion will either not increase runoff at all, while capturing sediment, or will not have a significant environmental impact on the channels or watercourses of the conversion site.

As I have repeatedly pointed out to Napa County in my reviews of Erosion Control Plans, most vineyard conversions significantly change the hydrologic characteristics of the soil substrate in the new vineyard areas. The single most important factor in this change is the removal of surface stones and/or deep-ripping of soils on hillsides. Either of these common vineyard preparation activities changes the porosity and permeability of surface soils, sometimes in ways that increase runoff for a given high-intensity storm event. When these changes are coupled with constructed lined drainage ditches, culverts, and other erosion control structures, the net result is an increased rate of runoff for higher intensity storms.

What is critical for the proposed TMDL is an appreciation the fact that most of the deleterious land use activities that affect water quality do so only infrequently. The average year's rainfall is not a significant geomorphic agent of erosion. The mean annual channel flood does not significantly alter the banks and bed of that channel. It is the 15-30 year interval intensity-duration rainfall events that wipe our fisheries, erode channel banks, move gravel bars, and flood the surrounding country side. A cover-crop of grasses planted in a vineyard to compensate for leafless vines that have replaced native chaparral cannot emulate the pre-conversion hydrologic characteristics.

Despite the great and sincere research efforts that went into this TMDL, the significant differences in impacts of conversion of stony east-side Napa Valley chaparral-covered hillsides to vineyard are not the same as those when oaks and other trees are cleared from some geologic substrates on the west side or southern foothills of the County. Until and unless the County Planners can demonstrate that they understand how to balance both sediment yield and water yield to minimize offsite, downstream impacts, the "checklist" included in the Staff Report on pp. 100-101 dealing with hydrology and water quality cannot be considered accurate.

For example: Section VII: Would the Project – c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion of siltation on- or off-site?

Yes, most certainly! Yet "less than significant impact" is checked. Presumably, "of" siltation is a typographic error and should be "or" siltation. The *project* is the *action* of the TMDL to implement its requirements through continued use of Napa County Erosion Control Plans. Yet we have repeatedly shown that these plans underestimate off-site channel erosion and often underestimate on-site erosion for geomorphically-significant expected storm events.

Part d asks: d) Would the Project: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

Again "less than significant impact" is checked. Yet the existing practice of the Erosion Control Plans approved by Napa County to recommend engineered drains and extensive collector systems to prevent on-site erosion in the vineyards and their vineyard roads does in-fact speed and concentrate runoff that is then discharged off-site into tributary ephemeral and intermittent stream courses from which it is carried to the Napa River.

The fact that "reasonably foreseeable compliance projects'" are listed to include earthmoving and minor construction does not address the environmental impact of these "foreseeable compliance projects". We are told, [Section VIII, part c] *Specific projects involving earthmoving or construction activities to comply with requirements derived from the proposed Basin Plan amendment are reasonably foreseeable. Such projects could affect existing drainage patterns. However, to meet proposed Basin Plan amendment allocations, they would be designed to reduce overall soil erosion, not increase it. Nevertheless, temporary earthmoving operations could result in short-term, limited erosion. These specific compliance projects would be subject to the review and/or approval of the Water Board, which would require implementation of routine and standard erosion control best management practices and proper construction site management. In addition, construction projects over one acre in size would require a general construction National Pollutant Discharge Elimination System permit and implementation of a storm water pollution prevention plan. Therefore, the Basin Plan amendment would not result in substantial erosion, and its impacts would be less-than significant.* [Staff Report, pp 113-114]

But the reduction of soil erosion does not offset increased off-site peak flow increases. You can reduce soil erosion on the hillslope while simultaneously increasing it along the channels downstream. These are difficult issues to resolve and require very thorough and continuing diligence. This is the nexus of a cumulative hydrologic effect. The recommended structural drainage facilities such as culverts, lined ditches, and drainage channels as applied over large areas of Napa Valley will reduce sediment input from uplands but will exacerbate off-site channel and stream-bed erosion through increased yield of runoff. The public and the fish in the Napa River are directly impacted by the cumulative downstream impacts of increased frequency and duration of flood flows in the main river and its primary tributaries. The sediment addressed by the TMDL is also important but cumulative effects analyses must also include the changed flow characteristics.

Respectfully Submitted:

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