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August 20, 2009

Katharine Carter
North Coast Regional Water Quality Control Board
5550 Skylane Blvd. Suite A
Santa Rosa, CA 95403

Re: Comments on *Public Review Draft, Staff Report for the Klamath River Total Maximum Daily Loads (TMDLs) and Action Plan Addressing Temperature, Dissolved Oxygen, Nutrient and Microcystin Impairments in California*

Dear Ms Carter,

The Quartz Valley Indian Community (QVIC) would like to thank the Regional Water Quality Control Board for all the time and effort that has gone into the development of the Klamath TMDL. A healthy Klamath River is necessary for proper ecological function of the cold-water fishery in the basin, the most valued cultural resource of the tribe.

Specifically in the Scott and Shasta River basin, due to the distance from the ocean, salmonid populations are extremely dependant on the Klamath River meeting the water quality objectives necessary for migration. It is for these reasons that the QVIC has a great interest in the development, implementation and hopeful attainment of the Klamath River TMDL.

We have reviewed the document and offer our comments in an effort to refine the specifics of the Klamath TMDL so that the goals of implementation will be reached. We thank you for this opportunity to provide you with our comments.

Sincerely,

Crystal Bowman
Environmental Director

INTRODUCTION/SUMMARY

The Public Review Draft, Staff Report for the Klamath River Total Maximum Daily Loads (TMDLs) and Action Plan Addressing Temperature, Dissolved Oxygen, Nutrient and Microcystin Impairments in California (*Public Draft TMDL)* was issued by the North Coast Regional Water Quality Control Board in June 2009.

The Quartz Valley Tribe has been engaged in the Klamath TMDL process since 2004, and has reviewed a long list of TMDL-related documents in that time, with the help of our consultants. The Agency Review Draft in July 2008 was previously reviewed and the Quartz Valley Tribe submitted comments in September 2008. For the most part it appears that Regional Board staff has incorporated the technical recommendations advanced by the tribe in September 2008; however, some previous comments are repeated here because they are not adequately addressed in the present document.

Overall the technical analysis presented in the Klamath TMDL is scientifically rigorous and provides a solid foundation for remediation of the river's pollution problems. We commend Regional Board Staff for their effort on the TMDL conceptual framework and technical analysis.

The Implementation Plan (Chapter 6 of the *Public Draft TMDL*), the most important part of the TMDL from a practical perspective, was released on June 30. Overall, we are cautiously optimistic – with some specific reservations – about this plan:

- The *Public Draft TMDL* would require PacifiCorp to propose an implementation plan for approval by the Regional Water Board that includes implementation measures, a timeline for implementation, measurable milestones, and a requirement to update the plan periodically. In our opinion, the only way that PacifiCorp can meet TMDL requirements (particularly for temperature) is to remove its California reservoirs.
- Irrigated agriculture in the California portion of the Lost River is included in the implementation plan, which is a positive step. Previously, Regional Board Staff was undecided whether Lost River would be included in the implementation plan.
- Strong protections for thermal refugia are proposed, including the prohibition of waste discharge (e.g. suction dredge mining) . We have included additional data for protection of critical thermal refuge habitat in the Scott River.
- The proposed watershed-wide protections for riparian shade and class III (ephemeral) streams concerning private land timber harvest are necessary and good.
- The proposed approach for developing a conditional waiver of waste discharge covering all activities for each National Forest in the Klamath Basin makes sense, but we withhold judgment until more details on the proposed waivers are available.
- The proposed Klamath River water quality accounting and tracking program referred to as "KlamTrack" (previously described as "pollutant trading") offers promise for cost-effective water quality improvements, <u>but only if</u> properly implemented. One shortcoming of the proposed KlamTrack Program is lack of specific mention of Tribes in the development of the program.

Reservations we have regarding the implementation plan are:

- Pollutant reductions in Oregon are key to the successful reduction of nutrient concentrations in California downstream, yet Oregon's authority to regulate non-point source discharges (i.e. irrigation tailwater return flow) is weak. We need to know more about the proposed development of a Management Agency Agreement (MAA) between USBR, USFWS and the Regional Water Board to implement the Lost River and Klamath River TMDLs, as well as the MOU between U.S. EPA, Oregon Department of Environmental Water Quality (ODEQ) and the Regional Water Board.
- There are disturbing developments within the State Water Resources Control Board (SWRCB 2009) with regard to a potential shift in oversight authority of U.S. Forest Service activities (QVIR 2009, included here as appendix A).
- Lack of regulation of water use by the SWRCB Water Rights Division (WRD) and other agencies with authority over streamflow flow remains a <u>huge</u> impediment to successful TMDL implementation.
- The proposed approach of continuing the status quo in the Shasta and Scott watersheds is unfortunate, given the acute water quality problems and slow pace of TMDL implementation there.
- Many aspects of the implementation plan look good on paper, such as requirements for farmers to develop water quality management plans, yet it remains to be seen how effective such efforts will actually be in practice.
- Overall, the implementation plan needs to be strengthened, and while maintaining reasonable flexibility for those engaged in good-faith efforts to comply, the plan should more explicit regarding how it will deal with those who would deliberately delay.

It is understandable that implementation of the TMDL will be adaptively managed. However, we request that any revisions made to the implementation plan or timeline be a transparent process with input from the various stakeholders. Likewise, stakeholder input is necessary in the development of polluter MOU's, waivers (i.e. timber, grazing, irrigated agriculture), KlamTrack, nonpoint and point source control trade-offs.

Timely implementation will be critical to the success of the TMDL. Many of the drivers of water problems (e.g. Shasta and Scott River flow depletion, the Klamath Hydroelectric Project, and Upper Klamath Basin agricultural pollution) were identified <u>decades</u> ago, yet positive action has been slow in coming. We strongly encourage the Regional Water Board to fast-track implementation, to the maximum extent possible, of these key problems.

The comments below are organized using the same chapter/section numbering system as the *Public Draft TMDL*. Since Work Group member Tribes have already submitted extensive comments in the past on various aspects of the technical TMDL, we focus the comments here primarily on the Implementation Plan (Chapter 6) and upon aspects of the technical analysis that have changed since the agency review draft.

DETAILED COMMENTS

Chapter 1: Problem Statement

General Comments on Chapter 1

The background material on the Klamath Basin and changes in water quality caused by human uses is well researched and clearly stated. For example: “The conversion of wetlands to farmland and other land uses has exposed the nutrient and organic rich soils to oxidation, resulting in the release to the water column of nitrogen and phosphorus previously stored in the soil and wetland vegetation.” (p 1-14)

The *Public Draft TMDL* recognizes that streamflow must be considered, because of its profound impact on water quality, and describes clearly how human use has altered basin flow regimes. One deficiency in the plan is that water use discussions do not mention that groundwater withdrawal can reduce surface flows.

Relevant overlapping regulatory processes are clearly described, including Tribal Trust responsibilities: “The California Regional Water Board must consider federal Tribal Trust responsibilities in the Klamath River basin since TMDLs are subject to the approval of the U.S. EPA” (p 1-8). Discussions of Treaty Rights extend not just to fishing but also ceremonial uses of aquatic resources. The document specifically mentions the water quality authority of Tribes and cites all of the completed Tribal water quality plans. Discussions regarding the Klamath Hydroelectric Project (KHP) clearly define the reservoirs as water quality nuisances and note that a SWRCB letter stating that PacifiCorp has not provided evidence demonstrating that the company’s proposal to relicense the KHP will resolve the reservoirs’ water quality impacts and meet requirements for 401 Certification.

Chapter 2: Problem Statement

The problem statement is well-organized and presents a compelling description of Klamath River water quality problems and the various inter-related causal mechanisms. The first sentence in this chapter is indicative of the inclusive approach taken in the *Public Draft TMDL* to water quality problems:

> “In the Klamath River in California increased water temperatures, elevated nutrient levels, low dissolved oxygen concentrations, elevated pH, potential ammonia toxicity, increased incidence of fish disease, an abundance of aquatic plant growth - high Chlorophyll-a levels (both planktonic and periphytic algae), and high concentrations of potentially toxigenic blue-green algae, particularly in the impounded reaches, decrease the quality and quantity of suitable habitat for fish and aquatic life, and have disrupted traditional cultural uses of the river by resident Tribes. These conditions contribute to the non-attainment of beneficial uses, including the most sensitive beneficial uses: those associated with the cold water fishery (specifically the salmonid fishery) in California, and those related to cultural uses and practices.”

The TMDL solidly references its selection (U.S. EPA, 2003; Tetra Tech, 2006) of water quality parameters and numeric end-points indicative of pollution and takes an approach generally compatible with the *Water Quality Control Plan for the Hoopa Valley Indian Reservation* (HVTEPA, 2008). There is an impressive amount of detail on interaction of different water quality problems and their implications for fish health. This includes the recently discovered relationships between nutrient enrichment and the proliferation of the deadly pathogen *Ceratomyxa shasta*. Two flow charts (Figure 2.7, 2.8) demonstrate the analytical power of graphics in this draft. These figures present pathways for nutrient pollution, including toxigenic algae (Figure 2.7) and relationships of water temperature stress, river ecosystem response, fish physiological response and their impacts on beneficial uses (Figure 2.8)

The amount of data assimilated and interpreted by the *Draft Klamath TMDL* reflects the huge amount of effort put into the document. Many of the summary charts and maps are innovative and very powerful. Particularly useful examples of such include a temperature summary of Klamath River tributaries (Figure 2.14); a limnological profile of Iron Gate Reservoir (Figure 2.15) showing that areas having temperature and dissolved oxygen suitable for trout do not overlap; charts summarizing exceedance of D.O. (Figure 2.25 and 2.26) and pH (Figure 2.27); and a map of river reaches where fish kills have occurred (Figure 2.29).

<u>2.3.2.2 Suspended Algae Chlorophyll-a, Microcystis aeruginosa, and Microcystin Toxin</u>
Section 2.3.2.2 includes recent analyses by Kann and Corum (2009), showing quantitative relationships between chlorophyll, *Microcystis,* and microcystin (i.e. the probability of exceeding the microcystin target based on a given chlorophyll concentration). These analyses are a welcome addition, providing added support for the TMDL's in-reservoir chlorophyll targets. [**Note**: the final May version of the Kann and Corum (2009) report is available on the Karuk Tribe website, but this Public Draft TMDL cites an outdated January draft version.]

<u>2.5.3.4 Evidence of Water Quality Objective and Numeric Target Exceedances. Nutrients and Indicators of Nutrient-Related Impairment: Chlorophyll-a – Reservoirs</u>
While the discussions on page 2-60 notes that the chlorophyll-a target of 10 ug/L is exceeded at reservoir stations in California and Oregon, the text should also note that while the target is not exceeded in the Klamath River between Boyle and Copco Reservoirs, it is exceeded at the below Iron Gate Dam station and at I-5, indicating that Iron Gate Reservoir is releasing algae into the river below it.

The following statement on page 2-61 appears to have an erroneous citation: "The reservoirs also impact the river below Iron Gate by serving as a source of blue-green algae that continues to grow in backwater and slower sections within the river reaches below the dams (Kann and Asarian 2005)." This subject was not mentioned in the cited document. A more appropriate citation would be Kann and Corum (2009), already cited elsewhere in the *Public Draft TMDL*.

2.5.4 Blue-Green Algae and Microcystin Toxin

We could not find any mention in the *Public Draft TMDL* of the sampling that has been conducted on Klamath River aquatic fauna to assess the concentrations of microcystin in their tissues. This section of the *Public Draft TMDL* seems to be the most appropriate place for such a discussion, and it could be as simple as: "Bioaccumulation studies in 2007 showed accumulation of microcystin toxin in muscle and/or liver tissues of yellow perch, hatchery salmon, and freshwater mussels (Kann 2008, Mekebri et al. 2009)."

In discussing how best to collect samples to assess the potential public health threats posed by blue-green algae, it is noted that "Few samples have been taken in near shore backwater areas where scums have been frequently reported and photographed." (p. 2-62) Due to a recently-released report, this statement is now outdated and should be replaced with the following language: "Prior to 2008, few samples had been taken in near shore backwater areas where scums have been frequently reported and photographed. In 2008, however, the Karuk Tribe began collecting samples in these areas. These samples frequently show high levels of *Microcystis* even when mid-channel samples did not (Kann and Corum 2009)."

2.5.5 Evidence of Water Quality Objective and Numeric Target Exceedances: Dissolved Oxygen

Data in Figure 2-26 showing frequency of dissolved oxygen saturation less than 85% is credited to the U.S. Fish and Wildlife Service, but this dataset also includes data from the Karuk and Yurok Tribes, and should be cited accordingly.

Chapter 3: Analytical Approach

General Comments on Chapter 3

This section clearly describes the methods and tools used in the development of the TMDL.

3.2 Modeling Approach

The *Public Draft TMDL* includes outputs from updated water quality model simulations. Previous version of the model outputs presented in last year's Agency Review Draft (i.e. see Figures 2.9 and 2.10 in that document) included the following patterns that in our opinion appear to be erroneous:

- N and P concentrations remain relatively constant between Iron Gate Dam and the estuary under natural conditions (they should decrease due to dilution and natural river purification processes).
- Natural N concentrations are higher than currently measured N concentrations.

These patterns are no longer present in the new outputs of the *Public Draft TMDL* (Figures Figure 2.16 and 2.17), indicating that revised boundary conditions (model inputs) for the Shasta, Scott, Salmon, and Trinity Rivers have improved the model's performance.

We have not yet been able to examine the most recent model outputs in detail. We expect (though reserve the right to be pleasantly surprised) that when we do obtain and examine the model outputs, they will show that while model performance has improved due to improved boundary conditions, the model will continue to under-represent nutrient reduction in free-flowing river reaches (an issue that Work Group members have been bringing to the attention of the TMDL team for several years now). That said, it is our opinion that on the whole, the model is robust enough to serve its intended purposes in the TMDL (i.e. setting load allocations). It is abundantly clear that the current nutrient concentrations in the river are far higher than natural background and that substantial reductions are necessary to restore water quality.

3.2.2.3 TMDL Compliance: Temperature Compliance in California (TCT1 and TCT2)

It is our understanding based on previous inter-agency/inter-Tribal meetings that in the natural conditions (T1BSR) and the temperature compliance in California (TCT1 and TCT2) model scenarios, the small tributaries between Iron Gate Dam and the Klamath River estuary had their temperatures reduced by 2˚C; however, this is not mentioned in this section of the TMDL, nor is there any presentation in Chapter 4 of modeling results indicating what effect this 2˚C decrease had on mainstem temperatures.

We discussed this issue with Regional Board Staff on August 6, 2009, and staff confirmed that the 2˚C reduction was included, but had essentially no effect on mainstem Klamath temperatures. The TMDL text in Chapter 3 should be amended to mention the 2˚C reduction, and at least briefly mention the results in Chapter 4.

Chapter 4: Pollutant Source Analysis:

General Comments on Chapter 4

This chapter is well researched, scientifically solid, and contains useful illustrations (e.g. the conceptual source loading diagrams) that make subjects easily understandable. The sources of pollution in all areas of the Klamath Basin are clearly described, including the Klamath Hydroelectric Project reservoirs, and the data that show levels of pollution are displayed in easy-to-read charts. The introductory paragraph that explains why the Klamath was known as the "river of renewal" succinctly describes the current problem: "source loads have overwhelmed the historic renewal capabilities of the Klamath, leading to its impaired status. The intent of the source analysis is to assess how and what loading scenarios will allow the river once again be restored through its own unique renewal capabilities."

4.1.1 Pollutant Source Categories

This section recognizes and clearly describes the interplay of sediment contributions in Klamath River tributary watersheds and the resulting impacts on water temperature and nutrients. This may obviate the need to develop a separate sediment TMDL; thus, implementation to reduce the risk of cumulative watershed effects can begin immediately (rather than waiting for a new sediment TMDL) with the goal of protecting and restoring critical salmonid cold water refugia. The recognition of the importance of refugia, and the description of how they work synergistically within the larger river system to support cold water fisheries, reflects cutting-edge understanding of Klamath River ecology and is in accordance with U.S. EPA (2003) guidance on Pacific salmon, temperature and TMDL development.

4.1.2 Natural Background

This section provides useful geologic background information that explains the Klamath River's lack of buffer capacity and; therefore, its susceptibility to nutrient pollution. We generally agree with the information presented in this section and with its conclusion that:

> "These natural background heat, nutrient, and organic matter loads to the Klamath River underscore the very limited capacity of the river to assimilate anthropogenic pollutant sources, and the necessity for establishing load allocations that will result in attainment of water quality standards." (p. 4-5)

In the discussion regarding historically high ambient air temperatures, it would be good to add a note regarding the historical status of thermal refugia. Prior to widespread logging and agricultural development, which have increased sediment levels, reduced stream canopy, and depleted streamflow, there were likely a greater abundance of high-quality cool-water refugia due to more (and colder) water in tributaries and greater connection with hyporheic flow in the mainstem. U.S. EPA (2003) states that this was generally true for most large rivers in the Pacific Northwest:

> "Alluvial floodplains with a high level of groundwater exchange historically provided high quality habitat that served as cold water refugia during the summer for large rivers in the Columbia River basin and other rivers of the Pacific Northwest. These alluvial reaches are interspersed between bedrock canyons and are like beads on a string along the river continuum. Today, most of the alluvial floodplains are either flooded by dams, altered through diking and channelization, or lack sufficient water to function as refugia."

While much of the length of the Klamath River does flow through canyons, there are many small alluvial features (i.e. gravel bars) in those canyon reaches that should provide some hyporheic flow, particularly in historical conditions prior to the clogging of gravel pore spaces by fine sediments. In addition, there are some significant alluvial valleys including Seiad Valley, Scott Valley, and the areas now impounded under Keno, Copco, and J.C. Boyle Reservoirs.

Snyder (1931) made the following observation related to water temperature that suggests hyporheic connection at some locations in the 1920's:

> "One may at times find a difference of two degrees between the water flowing along the north and south banks where the river is not more than 250 feet across, and where there are neither springs nor tributaries to affect it."

4.2.2 Pollutant Source Area Loads: Copco 1 and 2 and Iron Gate Reservoirs

This section includes a good discussion of how Iron Gate and Copco Reservoirs affect nutrient dynamics, but we have several suggestions for improving it.

This section repeatedly refers to May 2004 – May 2005 data from Kann and Asarian (2007), when in fact the data are from May 2005 – May 2006 (this appears to be due to a typographical error in the TetraTech (2008) nutrient dynamics memorandum).

Locations requiring correction in section 4.2.2.2 include the caption of Table 4.3 ("May 2004 – May 2005" should be replaced with "May 2005 – May 2006") and the contents of Table 4.5 (all instances of "2004 – 2005" should be replaced with "2005-2006 May to May").

It should be noted that the data presented from the Asarian and Kann (2009) report are preliminary results, and are subject to revision. It is our understanding that the final numbers will be only slightly different (i.e. within ±1-2%), not enough to affect any conclusions drawn from the data. Hopefully, the Asarian and Kann (2009) report will be completed soon and the final results can be included in the final version of TMDL.

In discussing internal nutrient loading, it is stated on page 4-17 that "High pH at the sediment surface may cause release of adsorbed phosphorus from sediments, with or without agitation of sediments." This sentence should be a candidate for deletion since it may not be relevant to Copco and Iron Gate Reservoirs. In deep portions of the reservoirs, pH *is not* high at the sediment-water interface, it is close to 7 (see figure 11 from Kann and Asarian 2007). pH *is* probably (no data exists) high in the margins of the reservoirs where depths are shallow enough for algal photosynthesis to elevate pH. In such cases, however, the water would not be anoxic and we do not know whether high pHs would cause the release of phosphorus from sediments in the presence of oxygen (if yes, then the sentence should stay in; if not, then the sentence should be removed).

We are unclear what is meant by the statement "The ~30% export is likely a high estimate because the TMDL model retention does not account for the nitrogen exported downstream within living algal biomass from algae growing within the reservoir and taking up nitrogen from the water column." (p. 4-19). Is this an artifact of how retention is calculated from the model outputs? If so, is there a better way to calculate it, or is it an inherent characteristic of the model? And, if so, what are its implications for interpreting model outputs?

4.2.3 Pollutant Source Area Loads: Iron Gate Hatchery

There appears to be an error in the flow data presented on page 4-21 for various locations associated with Iron Gate Hatchery operations. The calculations used to convert units from millions of gallons per day (mgd) to cubic feet per second (cfs) appear to be erroneous, and the cfs numbers require correction. For example, it is erroneously stated that “Average flows through the hatchery system are 16.1 million gallons per day (mgd) (1494.6 cubic feet per second [cfs])”, where the correct number should be 25 cfs (calculation: 16.1 mgd * 1.55 cfs/mgd = 25 cfs).

4.2.4.1 Pollutant Source Area Loads: Shasta and Scott River Temperature
A sentence or a small table should be added to indicate how unimpaired flows in the Shasta River compare with current flows. This information is an important product of the TMDL analysis not previously provided, so it should be included somewhere in the TMDL document.

The x-axis for Figure 4.17 “Comparison of estimated daily average Scott River Temperature conditions to estimated daily average Klamath River conditions.” is erroneous (discussions with Regional Water Board staff on 8/6/2009 confirmed this) and needs to be corrected.

Reducing the number of graphs in this section would make the document shorter and clearer. We suggest that staff consider combining the two Scott River Figures 4.10 and 4.11 together into a single figure with three lines (likewise, Shasta River Figures 13 and 14 could be combined).

Cumulative Temperature Effects of Tributary Inputs and Absence of Impoundments
The fall, 2008 Agency Review Draft of the Klamath TMDL included a summary section in Chapter 4 titled “Cumulative Temperature Effects of Tributary Inputs and Absence of Impoundments”; however, this section does not appear in this *Public Draft TMDL*.

The earlier section contained very important information, and should be re-included in the final TMDL.

The Klamath TMDL modeling effort has provided excellent information regarding the differences in water temperatures between existing and natural conditions, but some key conclusions resulting from the model outputs should be presented in a more clear and comprehensive fashion. The old Figures 4.21, 4.22, and 4.23 from the Agency Review Draft present some very important information regarding the consequences of Regional Water Board staff’s decision not to require full restoration of flows in the Shasta and Scott Rivers as part of the Klamath TMDL. Because the CA Compliance scenario (used to set the pollutant allocations in Chapter 5) does not require restoration of full natural flows in the Shasta and Scott, maximum temperatures in the Klamath River will still be 1-2˚C warmer than natural in mid-summer (Figure 1). The model results presented in old Figures 4.21, 4.22, and 4.23 show that natural flows in the Shasta and Scott are not necessary to result in near-natural (i.e. <1˚C difference) temperature conditions during the fall chinook spawning (i.e. September-October); the Klamath TMDL’s required mitigation of thermal impacts from the reservoirs (e.g. by dam removal) will be sufficient in that regard.

Two points touched on in the previous paragraph should be made clearer in the TMDL text:

- Dam removal will result in near-natural temperatures for fall chinook spawning.

- Restoration of natural flows in the Shasta and Scott are required to restore mainstem Klamath summer temperatures for juvenile salmon growth and survival, and the TMDL does not require such restoration of full natural flows

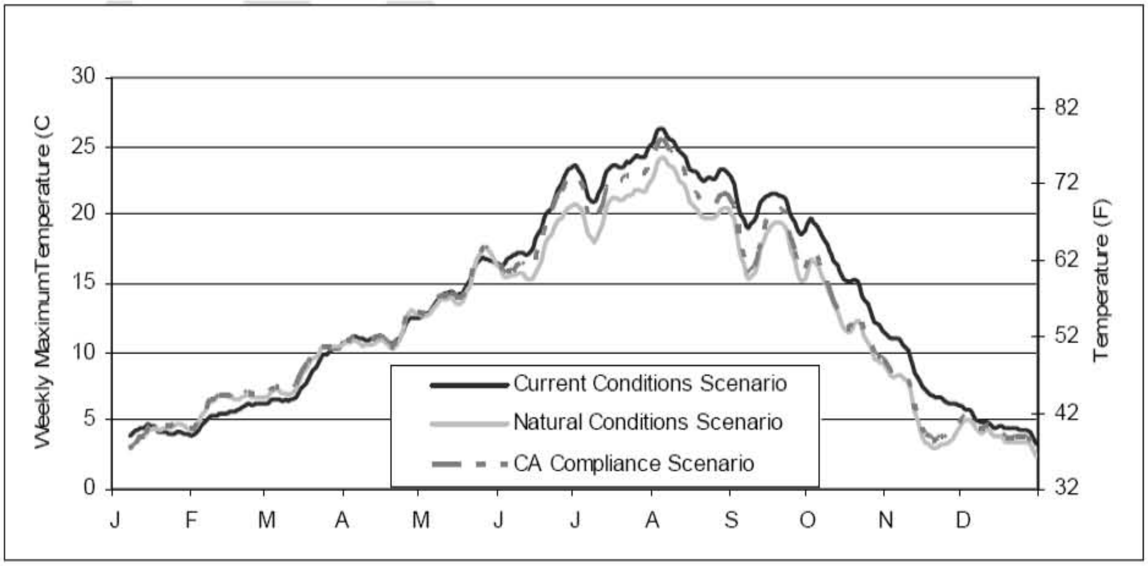

Figure 1. Klamath River 7-day average of daily maximum temperatures downstream of Scott River (Figure 4.23 from the Agency Review Draft of Klamath TMDL)

Chapter 5: Klamath River TMDLs – Allocations and Numeric Targets

General comments on Chapter 5
This chapter presents pollutant load allocations and numeric targets. The pollutant load allocations are well supported, with one exception, noted below, and, if properly implemented, should result in substantial protection and restoration of beneficial uses.

5.1 Introduction
The new table 5.1 in the *Public Draft TMDL* summarizes all of the numeric targets and allocations, a nice addition since the Agency Review Draft, but we are confused by one of the targets included in it: "Microcystis aeruginosa cell density < 50% of the blue-green algae biomass, or < 20,000 cells/L (which ever is lower)" (p 5-2). We agree that the *Microcystis aeruginosa* cell density < 20,000 cells/L is an excellent target, but the *Microcystis aeruginosa* cell density <50% of the blue-green algae biomass it is unnecessary and not supported. For example, if the total blue-green algae biomass is very low, then it should not matter if *Microcystis aeruginosa* is 50% of the total -- because the total amount of *Microcystis aeruginosa* would still be very low. Public health risks are driven by the concentration of *Microcystis aeruginosa* cells and microcystin toxin, not the relative percent of the blue-green algae biomass that is *Microcystis aeruginosa*. We suggest a revised target of simply "*Microcystis aeruginosa* cell density < 20,000 cells/L".

This is the only place in the entire TMDL that we can find any mention of a 50% target, so we suspect that its inclusion in Table 5.1 may have been unintended.

All other targets listed in Table 5.1 are justified and we support them.

Klamath Hydroelectric Project (sections 5.3.2 and 5.2.3)
The *Public Draft TMDL* now includes an additional allocation (required load reduction) to the Klamath Hydroelectric Project reservoirs in California (Iron Gate and Copco Reservoirs) that was not part of the Agency Review Draft. The quiescent waters of the reservoirs facilitate blue-green algal blooms, causing predictable exceedances of chlorophyll and *Microcystis*/microcystin targets even when assuming estimated natural background nutrient concentrations for reservoir inflows. In contrast, there are no predicted violations of the chlorophyll and *Microcystis*/microcystin targets with estimated natural background nutrient concentrations with the reservoirs absent. Thus, the *Public Draft TMDL* now includes an allocation requiring PacifiCorp to reduce upstream nutrient loads to an amount that will not cause predicted exceedances of chlorophyll and *Microcystis*/microcystin targets.

We agree it is reasonable to require PacifiCorp to reduce nutrients to compensate for the fact that the physical characteristics of the reservoirs create the conditions favorable for blue-green algal blooms. The required reductions are equivalent to 10% of current conditions for total phosphorus and 12% for total nitrogen (Table 1).

Table 1. Comparisons of annual total nitrogen and total phosphorus loads at Stateline under various scenarios, compared with the reductions required from PacifiCorp. Percentages are calculated based on information presented in the TMDL.

				PacifiCorp Allocation (Required Reduction)			
Nutrient	**Existing Condition (lbs)**	**Natural Baseline Condition (lbs)**	**Oregon TMDL Compliance (lbs)**	**(Lbs)**	**(% Existing Condition)**	**(% Natural Baseline Condition)**	**(% Oregon TMDL Compliance)**
Phosphorus	722,659	105,538	113,210	74,569	10%	71%	66%
Nitrogen	3,040,279	1,128,968	1,471,629	379,975	12%	34%	26%

We present the reductions in this form to provide some context.

While these reductions are substantial relative to natural conditions, they are small (10 to 12%) relative to current conditions. It is important to understand that if PacifiCorp were able to successfully implement upstream actions to reduce nutrient loads by the required amount, but if other major efforts to reduce nutrient loads were not also successful, then PacifiCorp's reductions alone would not be sufficient to prevent blue-green algal blooms in the reservoirs.

Thus, an argument could be made that PacifiCorp's allocation is not sufficiently restrictive and that if PacifiCorp wants to keep its reservoirs in place, then the TMDL should require PacifiCorp to reduce nutrients down to levels where blue-green algal blooms would not occur in its reservoirs -- regardless of the actions of other upstream entities. This is probably a moot point, however, because, in our opinion, there is no way for PacifiCorp to meet its temperature allocations other than through dam removal. Thus, the magnitude of PacifiCorp's required nutrient reductions is only of minor importance, and the amount currently proposed in the TMDL would appear reasonable.

The "compliance lens" for D.O. and temperature within the reservoirs water column is of concern for meeting beneficial uses of the cold-water fishery. This is essentially a thermal and oxygen refuge for salmonid passage to the upper basin. Thermal refuges are providing critical habitat today, and found to be used historically in the TMDL temperature and oxygen analysis. However, cumulative effects to the salmonid resource have exacerbated the need for thermal refuges. One example is the thermal refuge usage on the Scott River, tributary to the Klamath, where tributaries are not accessible due to cumulative effects disconnecting access from the mainstem Scott. Thermal refuges are often unnaturally high in density, surrounded by warm water, both being stressful on fish which can lead to the increased spread of certain diseases (ich, columnaris). Fish isolated in refuge pockets are also more easily predated on. It should also be expected that the compliance lens would expand and contract over a 24-hour period as do refuges in the basin, this poses complications for compliance monitoring in such large reservoirs. The only way to ensure safe passage through the reservoir is to meet the water quality objectives of the *Basin Plan* throughout the reservoirs.

Other important allocations and targets for the reservoirs remain the same as they were in the Agency Review Draft, and we support them:

- No reservoir-caused temperature increases allowed
- Zero nutrient loading from reservoir bottom sediments

Chapter 6: Implementation Plan

General comments on Chapter 6

Many aspects of the implementation plan look good on paper, such as its requirements for farmers to develop water quality management plans, yet it remains to be seen how effective these efforts will actually be in practice. Overall, the implementation plan should be stronger and, while maintaining reasonable flexibility for those engaged in good-faith efforts to comply, the plan should be more explicit about how it will prevent unwarranted delay on the part of non-compliers.

Timely implementation will be critical to the success of the TMDL. Many of the drivers of water problems (e.g. Shasta and Scott River flow depletion, the Klamath Hydroelectric Project, and Upper Klamath Basin agricultural pollution) were identified decades ago, yet positive action has been too slow taking place.

We strongly encourage the Regional Water Board to fast-track implementation of solutions to these key problems to the absolute extent possible.

6.1.1 Basin-Wide TMDL Implementation

This section of the Public Draft TMDL correctly identifies the main actions required to restore the water quality of the Klamath River:

- Reduction of point and nonpoint source nutrient loads in Oregon and California;
- Protection of thermal refugia; and
- Addressing water quality impacts from the Klamath Hydroelectric Project.

6.1.3 Nonpoint Source Land Use Activities and Controls

Tables 6.1 and 6.2 provide a useful summary of the regulatory mechanisms proposed for dealing with nonpoint sources of pollution. One suggestion for improvement would be to speed up the timeline for the waiver/WDRs for irrigated agriculture from 2012 to an earlier date. Irrigated agriculture is one of the largest contributors to nutrient-related Klamath River water quality problems. The sooner implementation begins the better.

6.2 Implementation of Allocations and Targets – Stateline

Reducing nutrient inputs from the Upper Klamath Basin is a key issue in successful implementation of the Klamath River TMDL. The challenge is daunting given the weak laws governing water quality protection in Oregon. We encourage the Regional Board to exert strong pressure on upstream dischargers and regulatory agencies, to increase the chances of the program's success.

6.4 Implementation of Allocations and Targets - Tributaries and Coordination with Existing Klamath River Tributary TMDLs

6.4.3 Lost River

We support the concept of the development of a Management Agency Agreement (MAA) between the Regional Board, U.S. Bureau of Reclamation, and the U.S. Fish and Wildlife Service. We question, however, the necessity for the MAA to include an action item to "Complete a water quality study to characterize the seasonal and annual nutrient and organic matter loading through the KIP and refuges."(p. 6-21).

The technical analyses conducted in the development of the Lost River TMDL have already provided this. If not, then what was the purpose of the Lost River TMDL?

The only thing accomplished by conducting yet another study would be a delay in water quality restoration. What is needed, in fact, are detailed work plans for the types of project that would be most effective in cleaning up water quality pollution in the Lost River basin, the prioritization of projects, and implementation of the highest priority projects.

As noted in previous comments by QVIC (2007) and Yurok Tribe (2009), the Lost River and Lower Klamath Lake ecosystems have been profoundly diminished and degraded over the past century. A major component of the water quality problems of these areas is not just nutrient pollution, but also channelization, diking, and simplification -- the loss of connection between stream channels and wetlands. This lack of habitat complexity reduces the ability of wetlands and riparian vegetation to serve as nutrient sinks.

If TMDL implementation in the Lost River and Lower Klamath Lake is to succeed the continuing trend of habitat degradation and channel simplification must be reversed. Reductions in nutrient inputs, alone, will not be sufficient to restore ecosystem function. The Problem Statement in Chapter 2 contains some discussion on this topic (see Degraded Channel Habitat Integrity on page 2-35), but its discussion in the Implementation Plan in Chapter 6 is inadequate

We encourage Regional Board staff to lay out a more bold restoration vision in the Implementation Plan, even if the Board lacks the clear authority to guarantee its outcomes.

The Klamath TMDL should call for a plan to restore water storage and water filtration capacity to Lower Klamath Lake as a means of decreasing nutrient loads to the Klamath River and improving water supply. Historically, Lower Klamath Lake not only stored substantial quantities of Klamath River water but also likely removed huge amounts of nutrients with its extensive marsh system. We recommend consideration of increasing the size of Lower Klamath Lake, since much of the former lake bed is in public ownership, and using it to store and remove nutrients from Lost River water that are currently being flushed into Keno Reservoir and the mainstem Klamath River.

Shasta and Scott Rivers (sections 6.4.4 and 6.4.5)
Flow problems in the Scott and Shasta Rivers will confound Klamath TMDL implementation success. Not only is the ecosystem function of these tributaries compromised, but substantial cold water volumes which historically contributed to the mainstem have been lost. In their place we now have hot, nutrient rich irrigation tailwater. U.S. Geologic Survey flow records for both basins for June through August (Figures 2 and 3) show that both are dropping below 10 cubic feet per second and well below their historic norms. These reduced flow levels are creating extremely poor water quality and a collapse of fish carrying capacity. Flow records indicate the Shasta is steadily going dry.

The lack of action under the Shasta and Scott River TMDLs, despite their approval and adoption into the Basin Plan does not bode well for the future of Klamath TMDL implementation.

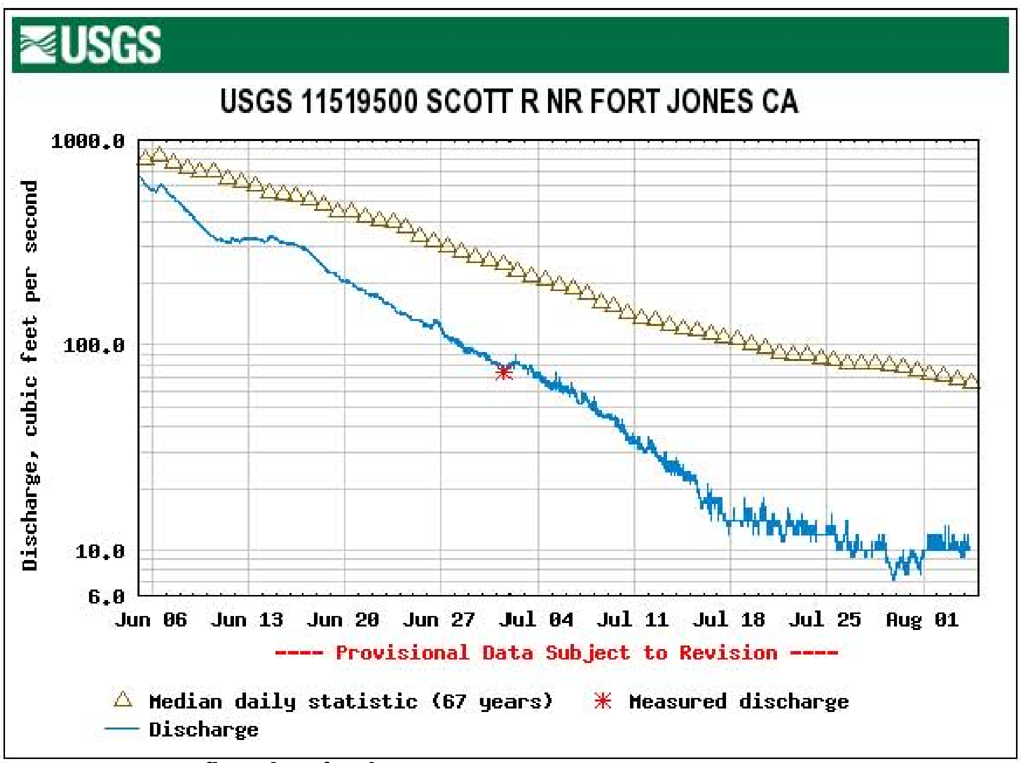

Figure 2. USGS flow data for the Scott River in summer 2009.

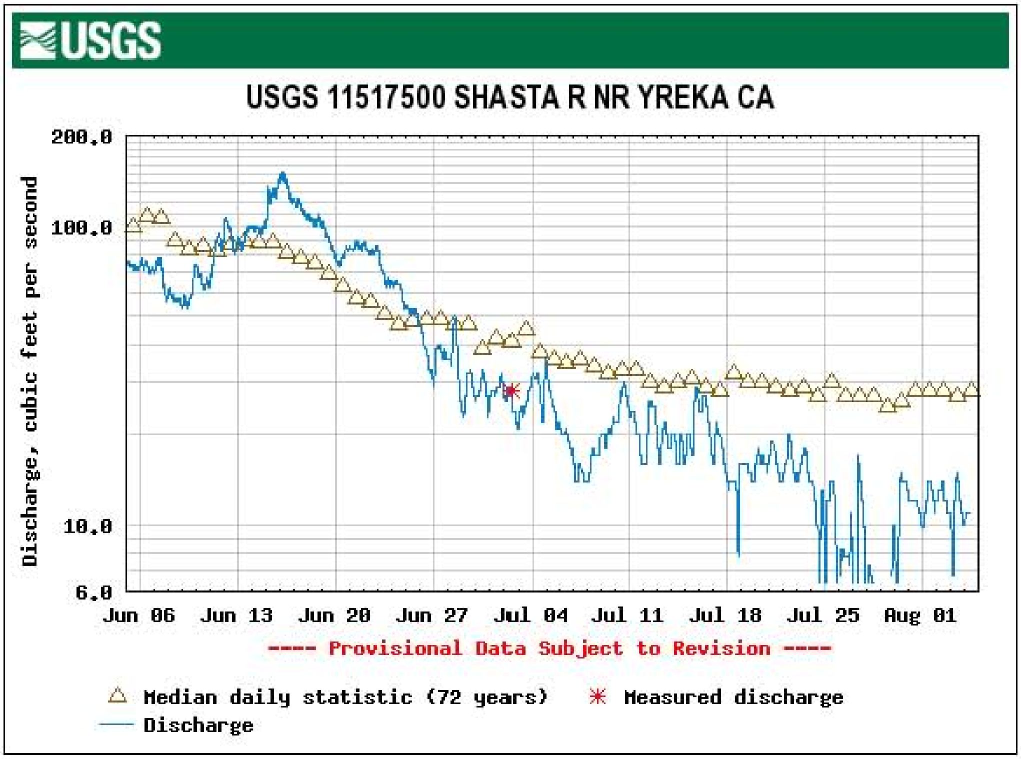

Figure 3. USGS flow data for the Shasta River in summer 2009.

There needs to be immediate action by the SWRCB water rights division to ensure that adjudicated flow levels are met on the Scott and Shasta Rivers. The Department of Fish and Game appears to have lost any stomach for fish protection and enforcement in these two basins in its attempt to win support for its proposed Incidental Take Permit (ITP) for coho salmon for agricultural activities (ESA 2008a, 2008b) under the California Endangered Species Act (CESA). The National Marine Fisheries Service has failed to take action despite virtual dewatering of ESA-listed coho salmon habitat in both basins.

Regarding the Scott River, the Draft TMDL notes that “Attainment of the Klamath River temperature TMDL, and associated temperature standards, requires that this study move forward and that appropriate management practices are implemented following the study in order to ensure adequate flow in the Scott River.” But there has been no effective action to restore Scott River flows.

6.5.1.1 Riparian Shade Allocations and Targets (Watershed-Wide)
We support the protections for riparian vegetation proposed in this section.

6.5.2 Watershed-wide Prohibition on the Discharge of Excess Sediment
We support the proposed watershed-wide prohibition on the discharge of excess sediment applying to all sediment sources in the Klamath River not regulated under a Regional Water Board adopted WDR or waiver.

6.5.3.1 Implementation Measures to Protect Thermal Refugia: Flow
We strongly support the language in section 6.5.3.1 that Regional Water Board staff “will work with other state and federal agencies and tribes to identify and eliminate illegal diversions in the Klamath River basin in California” and “recommend that the State

Water Board staff issuing water rights permits to divert surface water in the Klamath River basin in California consider the impact of increased diversions on tributaries that provide thermal refugia." (p. 6-28)

6.5.3.1 Prohibition of Discharge in and Around Known Thermal Refugia in the Klamath River Basin

We fully support the proposed protections for thermal refugia, including the prohibition of waste discharge (e.g. suction dredge mining) in the mainstem Klamath River and in the lower sections of tributaries whose lower reaches serve as refugia. The maps and lists of specific refugia locations are also helpful in making this proposal understandable.

Only thermal refugia habitat on the mainstem Klamath is documented in the Appendices of the TMDL. USFS Klamath National Forest, QV tribe and Northern California Resource Center have been collecting thermal refugia data in the Scott since 2004. A comprehensive map of all identified locations in the lower 21 miles of the Scott is attached to be included for protection.

Also to be noted and included for protection is a reach of approximately 5 miles that during the summer serves as a thermal refuge to salmonids in the mainstem Scott River. This has been documented in studies conducted by USFS, NCRC and QV tribe since 2004. Salmonid densities are significantly higher throughout this reach. The temperature drop over this stretch of the Scott River was first noted in the '03 TIR and again in the '06 TIR conducted by Water Sciences. The Klamath TMDL lists Boulder, Kelsey and Canyon Creeks as important refugia for salmonids; but in fact, the entire 5-mile stretch (Boulder Creek to Townsend Gulch) is critical habitat during the summer rearing bottleneck. I have attached the following reports describing the fish usage in this thermal refuge reach: Maurer 2006, 2007 and 2008.

Clarification of the thermal refugia definition: Chapter 6-28 states, "Thermal refugia are typically identified as areas of cool water created by inflowing tributaries, springs, seeps or through upwelling hypoheric flow and groundwater in an otherwise warm stream channel." Summer rearing studies in the Scott River indicate that not all cool-water inflows necessarily offer fish refuge due to site specific and ambient water quality conditions. The statement in the TMDL, Chapter 6 should read something like: "Thermal refugia are typically identified as areas of cool water created by inflowing tributaries, springs, seeps or through upwelling hypoheric flow and groundwater in an otherwise warm stream channel *offering refuge habitat to cold-water fish/aquatic species."*

It seems that the effects (settling distance) of sediment associated with suction dredging would be dependant on flow? Where does the ~300ft number come from? Moreover, at what flow does it settle out at 300ft? No citation is listed in the Klamath TMDL Implementation Plan as to how this number for protection was determined. Please provide some scientific support for this determination.

Tributaries should have pollution protection to the upper most identified location of summer rearing and/or spawning anadromy, not just the lower 3000 ft. By protecting only the lower 3000 ft, you could unintentionally inflict overcrowding and increase competition if pollution is 'allowed' and occurs above 3,000 ft.

6.5.4 Road Construction and Maintenance

We support the actions proposed in this section to regulate construction and maintenance of private, county, and State roads.

6.5.5 Grazing

We support the *Public Draft TMDL's* requirement that: "...any party conducting grazing activities in the Klamath River basin must select and implement management practices that control sediment sources, protect and maintain riparian functions, and address discharges of nutrients and organic matter." (p. 6-38), and that "To control discharges of nutrients and organic matter from animal waste deposited to surface waters, Regional Water Board staff recommend including, as a condition of eligibility for general WDRs or a waiver, that responsible parties implement measures to limit livestock access to the stream channel." (p. 6-39).

In combination with low flows, nutrient loading from cattle waste can promote eutrophication and elevate pHs that can be directly stressful to fish or that can promote the production of highly toxic dissolved ammonia. While we recognize that with proper management it is possible to allow cattle limited access to stream channels and not cause ecological harm, such protective practices are, however, difficult to achieve. Large sums of public money have been used to construct riparian fencing in the Klamath Basin yet there is little enforcement and monitoring to ensure that the fencing is maintained and effective, and that riparian vegetation is actually re-generating. It may prove more effective to simply mandate that cattle be completely excluded from stream channels, rather than to "limit" access.

The proposal to require ranch management plans is good, and it contains common-sense provisions such as allowing landowners to cooperate on group plans, and to modify and adapt existing plans to fit TMDL requirements.

Under sub-section 6.5.5.1 title: "Responsible parties" conducting grazing activities in Klamath Basin. It should state more clearly if a permit or lease is given to a rancher for grazing on another private landowners property exactly who is responsible for implementing the BMP's, meeting water quality objectives and for compliance oversight. And what data will be made public.

6.5.6 Irrigated Agriculture

We support the Public Draft TMDL's proposal to require the development and implementation of water quality management plans to control sediment, nutrient, and temperature effects rising from irrigated agriculture. We also support the proposal for developing a Klamath River basin-wide conditional waiver of WDRs and/or general WDRs for irrigated agriculture. We request that any group compliance programs be transparent, have enforcement oversight, be open to stakeholder input during the drafting of the WDR and that results will be shared.

The implementation plan should be strengthened by requiring on-farm treatment of all agricultural wastewater or tailwater throughout the Klamath Basin. The use of constructed wetland catchments would increase percolation to groundwater, reduce adverse warm water impacts and strip nutrients that would otherwise reach streams. Wastewater can also be retained in small catchments and pumped as a source of nutrient rich water for reuse in irrigation, as has already been demonstrated on some Shasta River ranch lands.

6.5.7 Timber Harvest (on Private Lands)

With regard to timber harvesting on private lands, the Klamath TMDL calls for the application of California Department of Forestry (CDF 2009) Threatened and Impaired watershed rules throughout the Klamath River Basin because of watershed-wide need for protection. We strongly support this recommendation.

Another valid improvement for TMDL implementation is increased timber harvest restrictions in Class III water courses, intermittent headwater streams, to prevent alteration to channel structure. This is needed since these areas are often steep and unstable.

6.6 TMDL Implementation on Federally Managed Lands, Timber Harvest, Grazing

The Klamath TMDL clearly defines the need to protect cold water refugia. The zero increase in sediment target for Middle Klamath tributaries will help achieve that objective. However, there are no targets or thresholds to limit disturbance and risk of cumulative effects that have been a pervasive problems in the basin (Kier Associates 1999). Recent information provided by USFS Region 5 hydrologist Barry Hill (2009) indicates that the cumulative effects risk has actually increased on the Klamath National Forest and that there are now 50 watersheds recognized as over cumulative effects thresholds:

> "The Klamath National Forest had 45 watersheds above TOC in 2004, based on three separate models. Since 2004, two watersheds on the Klamath NF have gone over the TOC threshold due to timber harvests and 13 have gone over threshold due to wildfires. During the same period, six watersheds that were above TOC fell below threshold due to passive recovery and four watersheds fell below threshold due to road treatments. The current total of watersheds over TOC is therefore 50."

The Klamath TMDL proposes the use of waste discharge requirement (WDR) permits or negotiated waivers as a means to prevent non-point source pollution and protection of refugia. This strategy is logical and could be successful, but we are concerned about recent efforts by SWRCB staff (2009) to shift management authority for USFS oversight to Sacramento and to eliminate Regional Water Board participation.

Past comments by Work Group members on the Klamath and Scott River TMDLs have clearly established problems with regard to Klamath National Forest sediment pollution and the need for improvement in land management to be more compatible with Pacific salmon protection and restoration and Clean Water Act compliance.

It is absolutely necessary that the Regional Water Board continue in its on-the-ground oversight role and that the Memorandum of Agreement (MOA) that governs timber harvest and grazing be completed in a timely manner since it is a critical link in successful TMDL implementation. As mentioned in previous comments, the MOA should also increase the monitoring requirements of USFS staff and the timely provision of data for trend monitoring for adaptive management. Comments from the Quartz Valley Indian Reservation (2009) to the SWRCB regarding the proposed changes in USFS oversight in the Klamath Basin are included here as appendix 1 to these comments and are submitted here for the Klamath TMDL record.

The goal of protecting tributary refugia will be confounded by increased peak flows caused by timber harvest and road building in the rain-on-snow zone (3,500-5,000 ft elevation), which the TMDL continues to ignore. Rain on snow events can increase peak discharged that widen stream channels and make streams more subject to warming. Van Kirk and Naman (2007) point out that the snow elevation is rising due to climate change and this means that rain-on-snow effects can extend to still higher elevations and increase the risk of damage. KNF has many watersheds with high-elevation headwaters and potentially increased peak flow risk. Firm targets for limiting road densities, and dates for their attainment are needed to prevent still more flood damage to refugia.

Another issue is the inability to keep grazing allotments in close proximity from merging with one another. An increased number of cattle on one allotment leads to over-grazing and the increase of nutrients and pathogens. USFS allotments in the Scott border private timber grazing allotments and this merging of cattle onto the high mountain lake allotment creates pollution beyond the assimilative capacity of the lake/inlets/outlets, data collected from the Shackleford Creek allotment (Campbell Lake) by the QV Tribe in 2007 found high levels of *E.coli*.

6.7 Klamath River Water Quality Accounting and Tracking Program (KlamTrack).
We are very supportive of the general concept of KlamTrack, but there are important details that are not yet addressed and need further development.

There must be strong evidence and a high likelihood that any pollution trading allowed will have at least as positive an effect on water quality, at the site of the discharge, as pollution control done in a "normal" way – that is, pollution reduced at the source, rather than at an alternate site.

Given that pollution trading could result in substantial economic benefit to the entities responsible for pollution discharges, because pollution trading could be much cheaper than on-site compliance, the burden of proof should be on such entities to demonstrate that pollution trading would be effective. Also, due to the uncertainties surrounding effectiveness the predicted outcomes of pollution trading should contain some safety factor (i.e. >200% of the effectiveness of on-site compliance, perhaps larger if the uncertainties were very large) to assure that goals are met.

One shortcoming of the proposed KlamTrack Program is the lack of specific mention of Tribes in the development of the program. This should be rectified.

Chapter 7: Monitoring Program

General comments on Chapter 7

The monitoring plans within the Draft TMDL reflect years of work and a great deal of collaboration with scientists from other agencies, Tribes and private entities and it sets new standards for thoroughness for a TMDL. The strategy laid out is logical, methods are scientifically valid, and maps and tables are clear and powerful summaries. Additional monitoring, however, is recommended at some locations because there are large geographic areas where there is insufficient coverage to gage results of TMDL implementation (i.e. Middle Klamath). The special studies section shows that Regional Water Board staff understand where there are critical knowledge gaps and they are to be commended for taking an interdisciplinary approach to understanding Klamath River water quality and fish health problems. There are many locations in the basin where there are accepted assignments for monitoring responsibilities by tribes, agencies, Resource Conservation Districts (RCDs), PacifiCorp and other private parties, but given past experience we have concerns that not all these data will in fact be made available. *The final Klamath TMDL needs to go further and state that monitoring data collection and sharing will be mandatory under Waste Discharge Requirement (WDR) permits, Waivers of WDRs and in the Memorandum of Agreement (MOA) envisioned with federal agencies.*

The map of locations for monitoring (Figure 4) reflect a major strategic effort and results from these locations will go a long way towards understanding water quality trends and in helping gauge TMDL implementation success. The rationale for location and parameters measured is clearly defined in Table 7.3 and the summary in this form is very useful. Similarly Table 7.7 displays a matrix of parameters and locations as showing the periodicity of sampling, which is an important element of understanding temporal patterns of Klamath River water pollution.

Our comments below provide some suggestions for improving the monitoring plan.

Comments regarding data sharing

We recommend that requirements for monitoring and data sharing be made explicit. The Regional Water Board has the authority to require monitoring and data sharing as part of all WDRs, Waivers and MOAs, and we strongly encourage that the Board utilize that authority. The Draft TMDL relies in part on a spirit of cooperation through the KBWQMCG, but experience shows that both private parties and organizations like KNF sometimes withhold data that discloses conditions that do not reflect well on management. It is unrealistic to rely on entities to release data that is contrary to their self-interest.

For example, KNF collected extensive data from lower Scott River and Middle Klamath tributaries after the January 1997 storm that are not available in raw form. Related studies were never completed or produced for public dissemination that gave more in depth information about damage to channels, although de la Fuente and Elder (1998) reported 437 miles of channel scour on KNF from that event. For years, PacifiCorp failed to tell the public or regulators about its finding that toxic algae were commonly present in Copco and Iron Gate reservoirs, until the Tribal sampling also discovered the algae brought the issue to public’s attention. Lack of data sharing by the Siskiyou RCD discussed above is another example. These examples all point to the need for the Regional Board to make data provision a requirement of all permits.

The Draft TMDL describes new efforts to set up a data sharing mechanism “allowing users to contribute, access and download data” in order to “encourage the transfer and sharing of fundamental water quantity and quality information amongst monitoring organizations needed to inform water resources studies.” It envisions a “web portal” hosted by a third party for accessing and uploading data. While such a tool would obviously be helpful in facilitating data sharing, it will not guarantee that all entities will upload their data.

7.1.1 Components of the TMDL Monitoring Program

In this section, the Draft TMDL touches in implementation monitoring and the need for documentation that “can be as simple as a photographic record of activities.” (p. 7-2). We recommend that the final Klamath TMDL should require photo monitoring points as a condition of all permits. There should be a minimum five year history of photo documentation with reports or annotation to see trends at the site and whether the project succeeded. Language should include the need to take pictures after large storm events or wet high flow years.

7.4 Public Health Monitoring

Cyanotoxin monitoring and issuance of public health warnings is an appropriate step given the significance of this pollution issue in Klamath Hydroelectric Power reservoirs and in the lower Klamath River below Iron Gate Dam. The inclusion of tissue sampling of Klamath River freshwater mussels and fish is also appropriate. Findings of potentially hazardous levels of cyanotoxin on yellow perch in Copco Reservoir should prompt health advisories from the County of Siskiyou to protect its citizens.

7.5 TMDL Ambient Compliance and Trend Monitoring

This section is too mainstem-centric, and should be expanded to include more monitoring of tributaries. While Chapter 5 of the TMDL includes targets and allocations regarding tributary shade and sediment, the monitoring plan does not proposes any monitoring to track progress towards reaching the targets and allocations.

The *Draft TMDL* states that “the sampling frequency and density should be of a high enough resolution and over a reasonable period time to determine whether management actions are having the desired effect on water quality conditions.” (p. 7-2). The map of locations where the Regional Water Board has a commitment for monitoring (Figure 4) shows a large number on Six Rivers National Forest (SRNF) in the lower Middle Klamath Basin, but almost none on Klamath National Forest (KNF) further upstream. Most of the data SRNF is supplying are likely from automated temperature probes and there is no reason that KNF should not be supplying similar data for Middle Klamath (e.g. Elk, Grider) and also for lower Scott River (e.g. Kelsey, Canyon) tributaries that serve as Pacific salmon refugia. Figure 5 shows water temperature data previously collected for the Middle Klamath (MKWC 2008) and all of these stations need to be added. If the USFS cannot provide staff to collect, process and submit data, then they should be required to provide funding for other entities such as the Salmon River

Restoration Council (SRRC), Quartz Valley Tribe, Karuk Tribe or the Middle Klamath Watershed Council (MKWC) to do so.

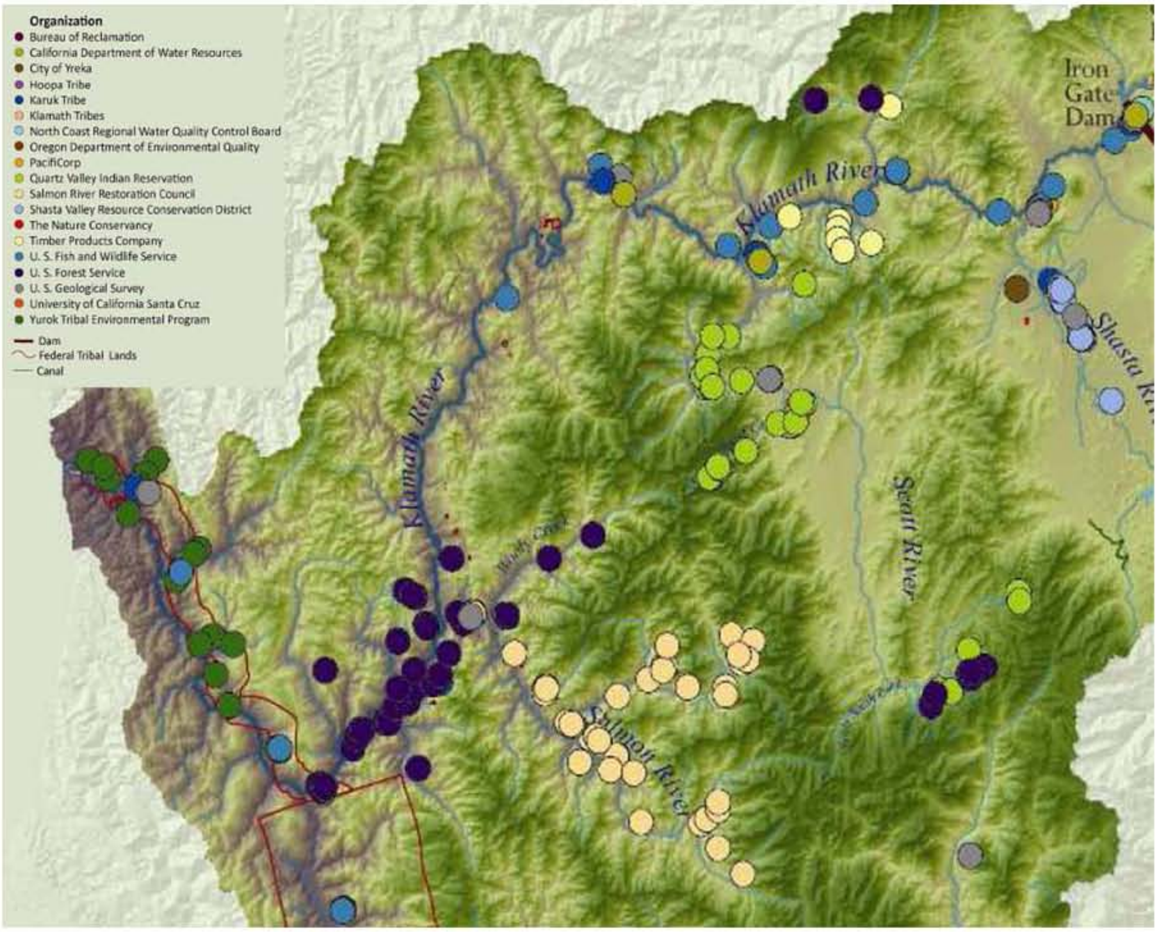

Figure 4. This map shows a detailed area taken from Figure 7.1 in the *Draft TMDL* and shows lack of sufficient stations in the Middle Klamath and Scott River basins.

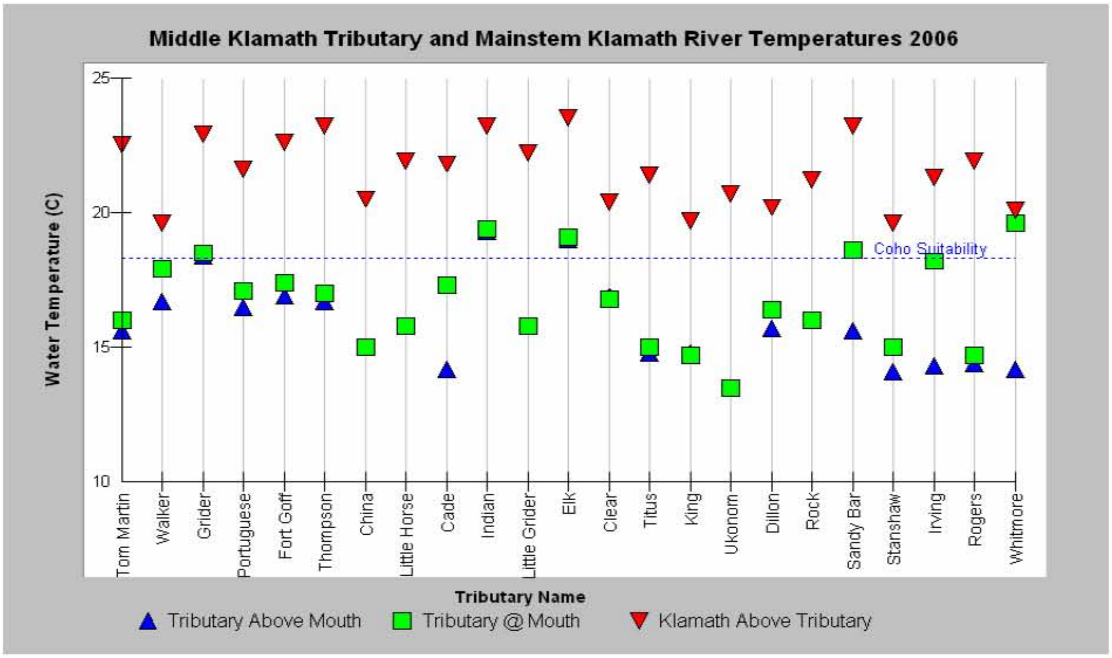

Figure 5. This chart shows floating weekly average water temperatures at the mouths of Middle Klamath tributary tributaries and in the mainstem Klamath River. All tributaries should have automated temperature probes every year. From MKWC (2006).

The USFS must also be compelled through the MOA to supply all other trend data, such as V*, bulk gravel samples, habitat surveys, macroinvertebrate data and other standard metrics so that patterns of degradation and recovery trajectories can be developed. Such data can be used to assess aquatic habitat quality (Kier Associates and NMFS 2008). Macroinvertebrate data are increasingly powerful for water quality analysis because of regional studies that allow understanding of communities associated with intact aquatic habitats and those associated with different levels of impairment (Rehn et al. 2007).

The basin-wide monitoring location map (Figure 4) also shows a significant problem with lack of provision of monitoring data in the Scott River. While the Shasta Valley RCD has apparently committed to supplying data in the Shasta basin, the Siskiyou RCD appears to be making no similar commitment. There are over two dozen water temperature monitoring locations that have been monitored routinely in the Scott Valley and trend data for these locations is essential for understanding compliance with permits and gauging trends resulting from TMDL implementation. The health and water quality of the mainstem Klamath River is tied to that of major tributaries like the Scott River and to have significant data gaps is therefore troubling.

We recognize the resources available for monitoring are always limited, but we are disappointed to see the recommended frequency for most nutrient sampling locations is monthly. For the purposes of constructing mass-balances, biweekly (every two weeks) would be far better. One compromise between monthly and bi-weekly sampling would be to have monthly sampling at most stations, but then biweekly sampling at a subset of stations such the mainstem Klamath USGS gages: Iron Gate, Seiad, Orleans, and Turwar.

7.6 Additional Monitoring Needs and Key Questions for Special Study Consideration

The Draft TMDL goes beyond requirements of just assessing pollution loads and setting limits, it tries to help focus additional research and monitoring on answering key questions about linkages between river dynamics, flows, water quality and fish health. Sections on the relationship of fish disease and water quality conditions in the Draft TMDL are excellent and appropriate studies are recommended.

The Regional Water Board might consider specifically mention the need to explore algal bed dynamics, water quality fluctuations and non-normative water pollution events (Higgins 2009).

The Draft TMDL cites the need to assess nutrient mass balance to "better understand the sources and sinks of nutrients and organic matter, in the Klamath River basin." (p. 7-2). We recommend that the TMDL specifically recommend a study of the nutrient removal capacity of a re-expanded Lower Klamath Lake, and also estimate the increase in summer water availability from storage excess of Lost River flow. During high-flow months/events, the current water management practice is to route water from the Lost River into the Klamath River through the Lost River Diversion canal. It may be feasible to route that water instead into Lower Klamath Lake, then release it back into the Klamath River during lower-flow months.

The Comprehensive Water Quality Monitoring special study includes a recommendation to collect water samples at the springs below J.C. Boyle Dam. We agree that this is a critical data gap, given the large volume of flow contributed by these springs and the uncertainty regarding their nutrient concentrations. It is our understanding that sampling these springs is logistically difficult, even potentially dangerous, because it requires kayaking or skilled rock-hopping to reach the site, then diving down to the bottom of a pool in swift water to collect the sample (the springs do not cascade in from the bank, they enter from the bottom of the river bed). We strongly encourage someone to do the sampling, even as a stand-alone exercise not part of the Comprehensive Water Quality Monitoring special study.

We support the proposed Periphyton Characterization in the Mainstem Klamath River special study, but think that the number of samples should be expanded to include at least one sample in July, August, and September. One of the key uncertainties in Klamath River water quality is relative importance of the factors that govern growth and decay of periphyton, and the resultant effects on pH and dissolved oxygen. For example, how will the periphyton react to changes in nutrient concentrations and water clarity based on upstream management changes and/or dam removal? What are the triggers for summer proliferation and fall senescence (e.g. day length, flow, temperature)? The Klamath TMDL model provides an answer to some of these questions; however, it may not be the correct answer, given that it does not include key factors influencing periphyton such scour. For example, the Klamath TMDL model predicts that mainstem Klamath River periphyton biomass peaks in late June or early July, whereas field data indicate that biomass is just starting to proliferate during that time and does reach a peak until late August or September.

The final Klamath TMDL should include a special study recommendation to discern the length of time required for recovery of stream channels from cumulative effects from events such as the January 1997 storm. Channel scour events flatten stream profiles, diminish pool frequency and depth, alter riparian conditions dramatically and substantially elevate water temperatures. Elk Creek is one case study referenced by de la Fuente and Elder (1998) as having experienced substantial increase in water temperature; data are needed to understand how long it takes this major refugia to recover. Studies on the Elk River in Oregon by the USFS (1998) showed how water temperature recovered after logging and flood damage, and we recommend that Regional Water Board staff require a similar analysis from the USFS as part of the MOA currently in development. The study might be best conducted or overseen by the USFS Pacific Southwest Forest and Range Experiment Station (Redwood Sciences Lab) with collaboration including Regional Water Board staff and KNF resource scientists. Tools such as the shallow landslide stability model (Dietrich et al. 1998) should be recommended to discern associations of land management on steep ground and sediment yield (Kier Associates 2005). In this way past mistakes can be avoided and disturbed areas in high SHALSTAB risk zones could be prioritized for treatment. The mouths of streams that serve as refugia should also be studied using aerial photos from different eras to determine changes in channel width as an index of recovery (Grant 1988).

Similar studies should also be conducted on mixed ownership basins like Beaver and Horse Creek, which are critical refugia and have a checkerboard land ownership pattern of private timberlands and USFS holdings. Co-participation of private timber companies should be a requirement of WDR or Waivers under TMDL implementation and complete data transparency needs to be required of private parties as well.

<u>Other comments on Chapter 7</u>

Also, there appears to be some errors in Table 7.7:

- The site “Klamath River at Shasta River at Walker Bridge (RM- 176.7)” is listed, when in fact this actually is two separate sites: Klamath River above Shasta River (river mile 176.08) and Klamath River at Walker Bridge (river mile 156.00).
- Klamath River at Brown Bear River Access is not river mile 157.5, it is 150.0 (see http://mapper.acme.com/?ll=41.82314,-122.96104 and http://www.fs.fed.us/r5/klamath/recreation/rivercenter/rivermaps/map3.shtml)

We are disappointed to see the TMDL proposing a new 6-digit site ID system (i.e. Klamath River at Seiad Valley is “KR1285”) when there is already an existing 7-digit site ID system in use. Much of the nutrient and automated probe water quality data collected in the Klamath River and its tributaries collected up through 2005 has been compiled into a single Microsoft Access database. The database was begun by PacifiCorp (2004) and added to through other studies, such as the development of Klamath TMDL, nutrient budgets for Iron Gate and Copco Reservoirs (Kann and Asarian 2005), and nitrogen budgets for river reaches below Iron Gate Dam (Asarian and Kann 2006). That database, including lookup tables of site IDs, is available online at: http://www.krisweb.com/ftp/KlamWQdatabase\KR_TMDL_database_with_PCorp_USFWS_CDWR_data.zip

PacifiCorp has continued (mostly, but with a few exceptions) to use the same Site ID system in their 2006-2008 reports. Figure 4 and Table 2 show a sub-selection of sites and their 7-digit site ID codes.

The TMDL states that the "station ID's are per the KBWQMCG.", but we do not see any mention of them in KBWQMCG documents such as Royer and Stubblefield (2009). *It would be a waste of time to re-invent the wheel unless it is absolutely necessary*.

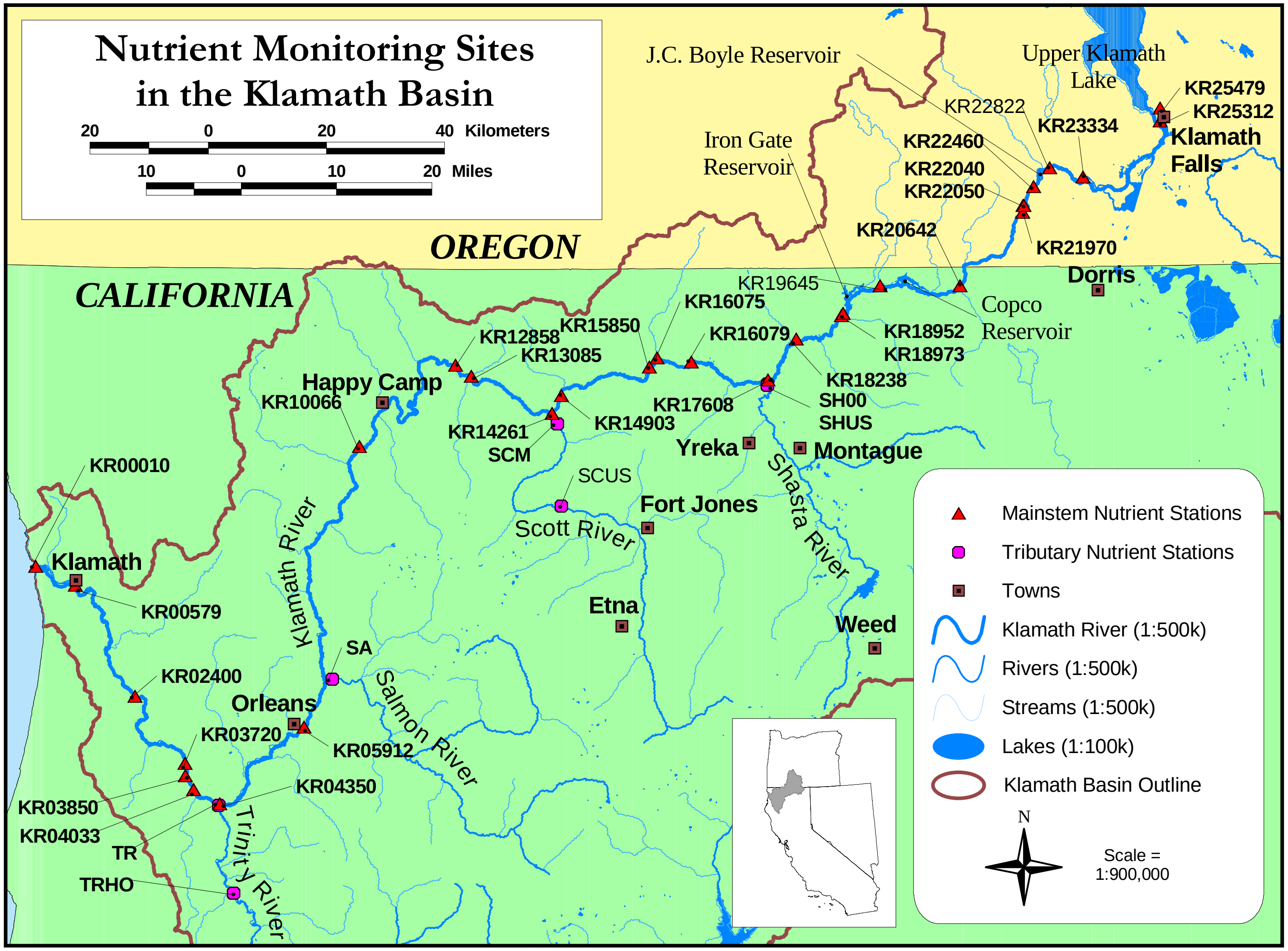

Figure 6. Location of nutrient sampling sites in the Klamath River and its tributaries. Note that the Site ID code for mainstem stations begins with "KR", followed by 5-digit river mile (i.e. KR18973 is river mile 189.73). Figure from Asarian and Kann (2006).

Table 2. Key and description for nutrient sampling locations shown in Fig. 2. Note that the Site ID code for mainstem stations begins with "KR", followed by 5-digit river mile (i.e. KR18973 is river mile 189.73). Table from from Asarian and Kann (2006).

Site ID	River Mile	Site Name	Latitude	Longitude
KR00010	0.10	Klamath River Estuary Mainstem	41.543610	-124.078890
KR00579	5.79	Klamath River at Klamath Glen	41.515280	-123.998890
KR02400	24.00	Klamath River at Johnson's Point	41.347630	-123.876000
KR03720	37.20	Klamath River at Young's Bar	41.246600	-123.773300
KR03850	38.50	Klamath River above Tully Creek	41.228060	-123.772220
KR04033	40.33	Klamath River at Martins Ferry	41.207220	-123.755280
KR04350	43.50	Klamath River at Weitchpec	41.185830	-123.703056
KR05912	59.12	Klamath River at Orleans	41.303330	-123.533330
KR10066	100.66	Klamath River below Happy Camp	41.729720	-123.424440
KR12858	128.58	Klamath River at Seiad Valley	41.854170	-123.230280
KR13085	130.85	Klamath River at Seiad Valley (2.25 mi above gage)	41.837333	-123.197500
KR14261	142.61	Klamath River above Scott River	41.781530	-123.033110
KR14903	149.03	Klamath River below Everill Creek	41.808133	-123.014067
KR15850	158.50	Klamath River at Round Bar Pool	41.851000	-122.835530
KR16075	160.75	Klamath River d/s Beaver Creek	41.865800	-122.819300
KR16079	160.79	Klamath River at Gottsville River Access	41.858450	-122.750220
KR17608	176.08	Klamath River above Shasta River	41.831280	-122.593467
KR18238	182.38	Klamath River u/s Cottonwood Creek	41.892730	-122.535400
KR18952	189.52	Klamath River below Iron Gate Dam (USGS Gage)	41.928056	-122.443056
KR18973	189.73	Klamath River below Iron Gate Dam (Hatchery Br.)	41.931600	-122.440000
KR19645	196.45	Copco Dam Outflow	41.973250	-122.363580
KR20642	206.42	Klamath River u/s Shovel Creek	41.972100	-122.201600
KR21970	219.70	Klamath River below Boyle powerhouse at USGS gage	42.083112	-122.071746
KR22040	220.40	Klamath River at J.C. Boyle Powerhouse	42.093060	-122.070830
KR22050	220.50	Klamath River above J.C. Boyle Powerhouse	42.093610	-122.069170

KR22460	224.60	Klamath River below J.C. Boyle Reservoir	42.121700	-122.049400
KR22822	228.22	Klamath River above J.C. Boyle Reservoir	42.149900	-122.015400
KR23334	233.34	Klamath River below Keno Dam	42.135300	-121.947220
KR25312	253.12	Link River at Mouth	42.218900	-121.788300
KR25479	254.79	Upper Klamath Lake at Fremont St Bridge	42.238300	-121.788060
SA	-	Salmon River at Somes Bar	41.376900	-123.477200
SCM	-	Scott River at Mouth	41.765830	-123.022800
SCUS	-	Scott River at USGS Gage	41.640500	-123.014500
SH00	-	Shasta River at Mouth	41.825000	-122.595100
SHUS	-	Shasta River at USGS Gage	41.823167	-122.595000
TR	-	Trinity River at Weitchpec	41.184330	-123.704167
TRHO	-	Trinity River at Hoopa	41.050400	-123.673300

Appendix 1: Proposed Site-Specific Dissolved Oxygen Objective for the Klamath River in California

Based on the results of the Klamath TMDL, Regional Water Board staff are recommending a change to Basin Plan dissolved oxygen (D.O) standards for the Klamath River. Staff's justification for the proposed change is described in the *Public Draft TMDL* Appendix 1.

In our comments here regarding Appendix 1, we discuss existing standards, the proposed revisions to the standard, and the strength of the justification for the change.

Current Basin Plan (NCRWQCB 2007) D.O. standards are an absolute minimum of 7 mg/l for the Klamath River above Iron Gate Dam in California, including reservoirs and 8 mg/l below the dam (Table 3). The Basin Plan also currently sets a 50% limit, which is based on a calculation of the monthly means over the course of 12 months, of 10 mg/l above and below Iron Gate Dam.

The Hoopa Tribe (2008) adopted values originally recommended by the NCRWQCB (2005), and these standards have been approved by U.S. EPA:

> "Site-specific dissolved oxygen water quality objectives for the Klamath River are derived by calculating the daily minimum dissolved oxygen necessary to maintain 85% saturation under site salinity, site atmospheric pressure, and natural receiving water temperatures. In no event may controllable factors reduce the daily minimum DO below 6.0 mg/L."

The Hoopa Tribe (2008) D.O. criteria are set for floating weekly average minima (7 DA Min) based on recommendations of U.S. EPA (1986) to reflect potential accumulated effects of recurring D.O. depression that can stress salmonids. The Hoopa standards also reflect the varying life history requirements of Pacific salmon species similar to those of Washington State (WDOE 2002) with a 7 DA Min of 8 mg/l year around (COLD) and 11 mg/l in the water column during spawning season (SPAWN). The latter reflects an estimated drop of 3 mg/l between surface water D.O. and that inside the redd pocket in the gravel (U.S. EPA 1986).

Table 3. Comparison of current and proposed NCRWQCB D.O. standards and those of the Hoopa Tribe. Spawning period is September 15 to April 15.

Standard	**Minimum**	**Minimum SPAWN**	**% Sat****
NCRWQCB Existing above Iron Gate	7 mg/l	-----	-----
NCRWQCB Existing below Iron Gate	8 mg/l	-----	-----
NCRWQCB Proposed	6 mg/l	-----	85%
Hoopa Tribe	8 mg/l*	11 mg/l*	90%

*7-day moving average (7 DA Min)
** Percent dissolved oxygen saturation at natural temperatures

The arguments to support this change in standards are offered in Appendix 1 of the Klamath TMDL:

- Baseline data used to formulate existing Basin Plan standards (Table 3.1) were collected in the 1950s and 1960s when conditions were already degraded and only diurnal samples were taken and standards should not be applied to continuous probe data that include nocturnal samples.
- Previous DO objectives for the Klamath River are consequently unachievable using modern monitoring equipment.
- Modeling of "natural conditions" indicates that the Basin Plan standard of 8.0 mg/l could not be met on the Klamath River between June and September even before anthropogenic disturbance.
- According to staff calculations, 85% saturation reflects minimum values resulting from variation in saturation that could occur within a healthy, free-flowing river as a result of normal photosynthetic activity and decomposition.

The Klamath TMDL concludes that life cycle based criteria, such as those adopted by the Hoopa Tribe (2008) are not achievable due to naturally high nutrient background conditions. As a practical matter, the Regional Water Board is currently confronted with routine violations of its current D.O. standards that make enforcement impractical, if not impossible. However, Regional Water Board arguments that historical conditions in the Klamath River would have fostered substantial annual or diel periodicity of D.O. swings are not well founded:

> "The Klamath River begins in the upper basin as a low gradient river in nutrient rich volcanic soils where elevated loads of nutrients and organic material are released to the water column and flow downstream. This fuels elevated algal growth throughout the upper basin with a concomitant diel fluctuation." (p. 13)

In fact, volcanic terrain drainage often results in water percolating into underground aquifers and arising as very high quality water, such as in the case of the Williamson River above Upper Klamath Lake. While phosphorous from volcanic terrain would have enriched aquatic ecosystem productivity somewhat, much of it would have been trapped before delivery to the water column by hundreds of thousands of acres of wetlands, marshes and riparian zones that surrounded lakes and streams before disturbance. Further, extensive marshes and wetlands surrounding Upper and Lower Klamath Lakes created slightly acidic conditions that limited some forms of blue-green algae, such as *Aphanizomenon flos-aquae*. The latter was not present 100 years ago and only became well established after extensive destruction of the marshes following World War II. It now produces enormous quantities of nitrogen. When the Klamath River was nitrogen-limited and marsh buffer and filter capacity was still intact, mainstem conditions may not have had the excessive nutrients to cause periphyton blooms and associated D.O. variability.

Further, water temperature conditions before mining, deforestation, dam construction and massive sedimentation were likely moderated by mainstem Klamath River hyporheic function (U.S. EPA 2003, ODEQ 2008). Thus D.O. would have been higher because water temperatures were likely historically lower before watershed disturbance.
Due to complexities and uncertainties, hyporheic cooling is not included in the Klamath TMDL models, and thus is not reflected in model outputs for the natural condition scenario.

Certainly, standards that cannot be met are not practical, but ascribing current impairment in conditions partially natural may be in error and does not foster a sense of urgency in what is a critical problem with D.O. in some reaches of the mainstem Klamath River. While one of the largest concentrations of spawning chinook salmon in the Klamath River occurs immediately below Iron Gate Reservoir, D.O. problems are pervasive during the spawning season (after September 15) on the mainstem below Iron Gate Dam (Figure 7).

Data from the Karuk Tribe Department of Natural Resources (Karuk DNR 2008) show that the daily average surface water D.O. in October commonly drops below 7 mg/l. Data are lacking on streambed permeability below Iron Gate Dam. But,if there is a drop of 3 mg/l as estimated by U.S. EPA (1986),it would mean that in-redd D.O. was ranging from 3-5 mg/l. WDOE (2002) state that “average intragravel oxygen concentrations of 6-6.5 mg/L and lower can cause significant stress and mortality in developing embryos and alevin.” Although decreasing water temperature in the fall is a mitigating factor, that, too, is affected in the river below the dam due to the thermal mass of Iron Gate Reservoir.

The result is likely very poor survival to emergence and acute selective pressure on fall Chinook below Iron Gate Dam.

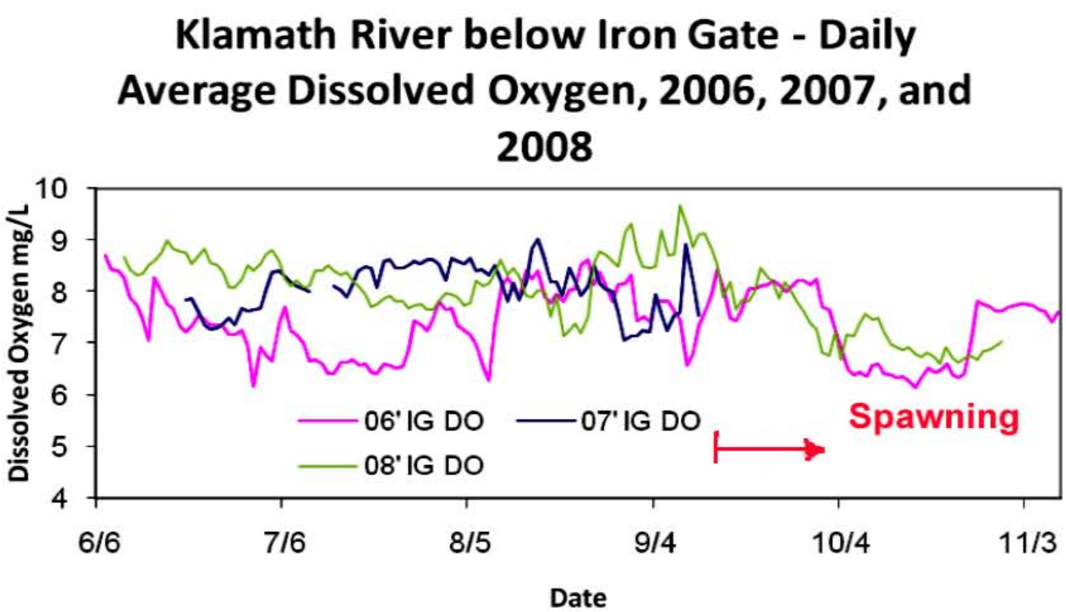

Figure 7. Floating daily average D.O. of the Klamath River below Iron Gate Dam for 2006-2008 show that depressions are occurring during Chinook salmon spawning season. Data from Karuk DNR (2008).

To its credit, the Klamath TMDL recognizes the problems created by Iron Gate Reservoir and calls for consideration of dam removal as a means to remediate water pollution problems as well as for the protection of refugia. We have concerns, however, that the proposed D.O. standards may regard tailwater flows below Iron Gate dam as being in compliance with the TMDL and Basin Plan when in fact they reflect acute impairment. To help us assess whether we should support the proposed revisions to the D.O. criteria, we would like to see what the 85% saturation dissolved oxygen concentrations are under the TMDL's natural conditions scenario for various locations along the Klamath River, including Iron Gate Dam.

Discussions of setting criteria are necessary, but non-normative water quality events in the mainstem Klamath River (Higgins 2009) may be a greater concern with regard to fish health and source of juvenile salmonid mortality. For example, immediately after flows had been ramped down 1,000 cfs in late June and early July of 2008, USFWS (2008) dive crews found that most of the tagged Iron Gate Hatchery juvenile Chinook salmon they were tracking had not survived:

> "The crew observed about 10 to 40 dead fish within 5 meters upstream and downstream of the location of each tag. Dead fish were observed at 23 of the 25 dives made. The appearance of dead fish observations ranged from what was assumed to be recent mortalities to carcasses fully engulfed by fungus. The two dives where dead fish were not observed occurred in water having relatively high water velocity. Dead and/or dying fish were also observed at several thermal refugia areas, which were also occupied by live salmonids (predominantly Chinook salmon, and to a lesser extent, steelhead). Most mortalities observed were juvenile salmonids; however, numerous dead sculpins, suckers, and one dead bullhead catfish were also observed."

Higgins (2009) noted that water quality stress must have been acute to cause mortality of warm water fish species like suckers and explored potential relationships of flow changes, algae bed dynamics and non-normative water quality as a potential triggering mechanism for the fish kill. The Regional Water Board needs to increase efforts to explore whether rapid changes in flow are linked to pollution events and fish mortality. If the hypothesis is upheld by patterns in data, then the Regional Water Board should join discussions between the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service and the Tribes on flow releases at Iron Gate dam to minimize algae bed shedding. A copy of Higgins (2009) is attached to these comments as Appendix 2 for the record.

Appendix 3: Nutrient Dynamics in the Klamath

As noted in comments on section 4.2.2 (Pollutant Source Area Loads: Copco 1 and 2 and Iron Gate Reservoirs) above, the TetraTech (2008) nutrient dynamics memorandum erroneously refers to May 2004 – May 2005 data from Kann and Asarian (2007), when in fact the data are from May 2005 – May 2006. This should be corrected (searching through the document looking for "2004" will find all the instances).

Appendix 5: Fish and Fishery Resources of the Klamath River Basin

We suggest the following additions to the fish distribution maps (Figures 2, 3, 4) in Appendix 5 for the Shasta River basin:
- Upper Shasta River above Dwinnell Reservoir: steelhead, coho, spring chinook (all three species extirpated)
- Parks Creek: steelhead, coho, spring chinook (all three species present)
- Yreka Creek: steelhead and coho (both species present, map shows only steelhead)

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