State of California
Regional Water Quality Control Board
North Coast Region

Alydda Mangelsdorf
March 10, 2010

Executive Officer's Summary Report
10:00 a.m., March 24, 2010
Eureka Public Marina
#1 Marina Way
Eureka, California

ITEM: 1

SUBJECT: Public Hearing on Resolution No. R1-2010-0025 to consider adoption of an amendment to the Water Quality Control Plan for the North Coast Region to revise Table 3-1 to incorporate a recalculated **Site Specific Dissolved Oxygen Objective for the Klamath River in California**

DISCUSSION

The North Coast Regional Water Quality Control Board (Regional Water Board) is scheduled to hold a Public Hearing on the proposed amendment to the *Water Quality Control Plan for the North Coast Region* (Basin Plan) to revise Table 3-1 to incorporate a recalculated Site Specific Dissolved Oxygen Objective for the Klamath River in California (hereinafter proposed Amendment). A copy of the Public Notice is included as Attachment A to this Executive Officer's Summary Report (EOSR). Copies of proposed Resolution R1-2010-0025, and the proposed Amendment language are included with this EOSR.

The draft Dissolved Oxygen (DO) Staff Report for the proposed Amendment (Appendix 1 of the draft Klamath TMDL Staff Report) was released July 9, 2009. The draft DO Staff Report contained:

- A description of the area in which the proposed Amendment applies;
- A description of the existing dissolved oxygen (DO) objectives in the Klamath River and the necessity for the proposed Amendment;
- An overview of the scientific basis for the recalculation of the Site Specific Objective (SSO) for DO in the Klamath River;
- The proposed Basin Plan Amendment language*;*
- Reference to the environmental analysis and checklist, contained in the draft Klamath TMDL Staff Report.

A public workshop to present the draft Klamath TMDL, including the Site Specific Objective (SSO) for Dissolved Oxygen, and to receive public comment was held on July 23, 2009. The draft Klamath TMDL Staff Report, including the draft DO Staff Report as Appendix 1, was released for public review on July 9, 2009 with a 50 day review and comment period.

At the September 10, 2009 Regional Water Board meeting, staff held an additional workshop to receive oral comments from the public, to present to the Board an overview of the oral and written comments received to date, and to present options to the Board regarding potential modifications to the draft Klamath TMDL Staff Report, including the draft DO Staff Report contained as Appendix 1.

At the October 1, 2009 Regional Water Board meeting staff presented for Board consideration a schedule for completing the Klamath TMDL, including the SSO for DO, and sought the Board's input on the schedule.

At the March 24, 2010 Regional Water Board meeting, the Board will hold a public hearing to consider adoption of Resolution 2010-0025. A strikeout and underline version of the draft Klamath TMDL Staff Report, including the draft DO Staff Report contained as Appendix 1, were released for public review on December 23, 2009 with a 47-day review and comment period. In accordance with Section 13244 of the California Water Code, notice of the public hearing and the availability of the Klamath TMDL Staff Report, including the DO Staff Report contained as Appendix 1, were published on December 26, 2009 in the *Herald & News* out of Klamath Falls, OR; on December 24, 2009, in the *Press Democrat* out of Santa Rosa, CA; on December 24, 25, and 26, 2009, in the *Sacramento Bee* out of Sacramento, CA; on December 23, 24, and 28, 2009 in the *Siskiyou Daily News* out of Yreka, CA; and on December 22, 23, and 24, 2009, in the *Times-Standard* out of Eureka, CA. The public comment period was open from December 23, 2009 through February 9, 2010.

A further refinement of the method by which barometric pressure was represented in the *Klamath TMDL model* from Iron Gate Dam to Turwar was conducted after the release of the December 23, 2009 draft DO Staff Report, as a result of consultation with the Hoopa Valley Tribe (and others). The DO Staff Report has been revised to include the updated data. A final strikeout and underline version of the DO Staff Report (dated March 8, 2010), revised in response to public comments received by February 9, 2010 and based on consultation with representatives of the Hoopa Valley Tribe (and others), is included with this agenda item as Attachment C. A summary of, and responses to, the oral testimony and written comments received by Regional Water Board staff during the comment period, and response to the comments are also included with this agenda item as Attachment B.

During the public hearing, the Regional Water Board may receive further comments on the proposed Amendment. Following closure of the hearing, the Regional Water Board will consider adoption of Resolution R1-2010-0025, including the revisions to Table 3-1 of the Basin Plan to incorporate the recalculated Site Specific Dissolved Oxygen Objectives for the Klamath River in California (Attachment 1 to the Resolution).

BACKGROUND

At the direction of the Regional Water Board, staff developed a proposed Amendment to the *Water Quality Control Plan for the North Coast Region* (Basin Plan) that would revise the DO objectives for the whole region. After the initial CEQA scoping, staff focused its attention on the revision of the SSOs for DO in the Klamath River to ensure the development of revised DO objectives for the Klamath on a timeline consistent with the consent decree requiring adoption of the Klamath TMDL by December 2009, revised to December 2010. The proposed Amendment applies only to the Klamath River mainstem; but, it puts into practice the region wide approach to DO revision scoped under CEQA and peer reviewed in 2008 and 2009, respectively.

The purpose of this proposed Amendment is to address the conflict between the existing SSOs for DO in the Klamath River (originally adopted in 1975), evidence that even under natural conditions the established SSOs for DO in the Klamath River could not be achieved consistently, and continuous monitoring devices which result in 24-hour DO data. The existing SSOs for DO in Table 3-1 of the Basin Plan, including those adopted for the Klamath River, are based on daytime grab samples. They are presented as daily minima; but are based on data that does not capture the true daily minima which generally occurs in the pre-dawn hours. The water quality and hydrologic model (*Klamath TMDL model*) developed to calculate the Klamath TMDLs, when configured to represent natural conditions, indicates that DO under natural conditions is sometime, especially during the summer, lower than that currently required by the Basin Plan. Conditions of barometric pressure, temperature and salinity also indicate that even when at perfect equilibrium (100% DO saturation), the Klamath River is unable to hold oxygen in solution in concentrations sufficient to consistently meet the existing requirements.

To address the conflict between the existing SSOs for DO in the Klamath River, new scientific data, and modern monitoring tools, staff recommends that the Regional Water Board consider adoption of the proposed Amendment, which would incorporate into the Basin Plan a recalculated SSO for DO in the Klamath River based on updated information.

The proposed Amendment consists of three distinct actions:

- The elimination of the existing SSOs for DO in the mainstem Klamath River from Table 3-1 of the Basin Plan.
- The incorporation of a footnote in Table 3-1 referring to a new Table 3-1a in which the recalculated SSOs for DO in the Klamath River are contained.

  The recalculated SSOs for DO in the Klamath River are based on simulated DO data output from the *Klamath TMDL model* configured to represent natural conditions. From the Oregon-California state line to the lower estuary, they are presented as percent DO saturation objectives based on natural receiving water temperatures including inter-annual variation due to varying climatic

conditions. In the lower estuary, a narrative DO objective is proposed. These objectives apply to the maximum extent allowed by law. To the extent that the State lacks jurisdiction, the Site Specific Dissolved Oxygen Objectives for the Klamath River in California are extended as a recommendation to the applicable regulatory authority.

- A minor editorial correction to Table 3-1 under “Coastal Waters” by which the font type is changed from normal to superscript in keeping with standard footnoting practice.

STAFF RECOMMENDATION: Adopt Resolution R1-2010-0025 with Attachment 1 amending the Basin Plan to incorporate recalculated Site Specific Dissolved Oxygen Objectives for the Klamath River in California.

ATTACHMENT A

Notice of
Availability of Draft Documents,
Public Comment Period,
Public Workshop, and Public Hearing

For the

Klamath River Total Maximum Daily Loads Addressing Temperature,
Dissolved Oxygen, Nutrient, and Microcystin Impairments,
Klamath River Site Specific Dissolved Oxygen Objective, and
Klamath River TMDL Action Plan and Lost River Implementation Plan

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December 23, 2009

REVISED
February 17, 2010

Purpose of Notice
Notice is hereby given that the California Regional Water Quality Control Board, North Coast Region (Regional Water Board) and United States Environmental Protection Agency (EPA) Region 9 are making the following documents available for public review and comment: 1) the *Staff Report for the Klamath River Total Maximum Daily Loads (TMDLs) Addressing Temperature, Dissolved Oxygen, Nutrient, and Microcystin Impairments in California,* 2) the *Klamath River Site Specific Dissolved Oxygen Objective*, 3) the *Klamath River and Lost River Implementation Plans*, and 4) the *Klamath River TMDL Action Plan and Lost River Implementation Plan*; together these documents are referred to as the "December 2009 Public Review Drafts". Written comments for this joint Regional Water Board and EPA Region 9 public comment period should be submitted to the Regional Water Board, as described below, by February 9, 2009. After the public comment period, the Regional Water Board staff will make any necessary revisions and propose the *Klamath River TMDL Action Plan and Lost River Implementation Plan* and the *Klamath River Site Specific Dissolved Oxygen Objective* to the Regional Water Board as amendments to the *Water Quality Control Plan for the North Coast Region* (Basin Plan).

The Regional Water Board has been working collaboratively with EPA Regions 9 and 10, and Oregon Department of Environmental Quality (ODEQ) on the development of coordinated TMDLs for the Oregon and California portions of the Klamath River and the Lost River. Nutrient and temperature TMDLs for the Klamath River, from the Oregon border to the Pacific Ocean, are to be established by December 31, 2010 in accordance with the consent decree *Pacific Coast Federation of Fishermen's Associations, et al. v. Marcus (No. 95-4474 MHP, 11 March 1997*), amended in December 2007 (*Notice of Agreement to Modify Schedule for Establishment of Total Maximum Daily Loads* (filed in U.S. District Court for the Northern District of California).

Should the nutrient and temperature TMDLs for the California Klamath River mainstem not be adopted by California in time to be approved by EPA Region 9 by December 31, 2010, EPA Region 9 would be required to establish federal TMDLs for the Klamath River by that date. EPA would not establish any implementation plan for these federal TMDLs, in that implementation plans are solely the responsibility of the state. To

address the potential need for EPA to establish federal TMDLs for the Klamath River, EPA is jointly issuing this notice to solicit public comment on the December 2009 Public Review Draft and to announce the public workshop and public hearing.

Overview of the December 2009 Public Review Drafts
The December 2009 Public Review Drafts include revisions resulting from written and oral public comments received on the previous June 2009 Public Review Draft documents. Revisions have been made to each component of the December 2009 Public Review Drafts, including the Klamath River TMDL allocations and targets, the *Klamath River site specific dissolved oxygen objective*, and the *Klamath River TMDL Action Plan and Lost River Implementation Plan*. The Summary of Public Review Draft Revisions, included in the Staff Report, summarizes the scope and the content of these revisions.

Availability of the December 2009 Public Review Drafts
The complete December 2009 Public Review Drafts are available for review starting December 23, 2009. Copies of the December 2009 Public Review Drafts will be available at the following Regional Water Board and EPA web sites:

http://www.waterboards.ca.gov/northcoast/

and

http://www.epa.gov/region09/water/tmdl/progress.html

Please contact Ben Zabinsky at 707-576-6750 or bzabinsky@waterboards.ca.gov if you have any problems accessing the documents via the websites.

Additionally, copies will be made available at 7 libraries through the North Coast Region including the following locations:

Humboldt County Library 1313 3rd Street Eureka, CA 95501	Yreka Branch Library 719 4th Street Yreka, CA 96097	Tulelake Branch Library 451 Main St. Tulelake, CA 96134

Solicitation of Comments on the December 2009 Public Review Drafts
The public comment period will start December 23, 2009, and continue for a period of 47 days. Written comments are due *no later than* **5:00 PM on Tuesday February 9, 2010**. Revisions are shown in ~~strikeout~~ and underline text**,** except for Chapters 6 and 9 and Appendices 1, 6, and 7 of the *Staff Report* and the *Klamath River TMDL Action Plan and Lost River Implementation Plan*. The revisions to these sections could not be highlighted in a readable format and are therefore presented as clean, rewritten text. The Regional Water Board and EPA are soliciting comments on the revised text and substantive changes only. **Previously submitted comments need not be resubmitted.**

This notice is being provided pursuant to state and federal regulation. See Cal. Code Regs., tit. 14, §15087, 15105; Wat. Code, § 13244; Gov. Code, §11125; 11125.9 and 40 CFR § 130.7(d)(2). Notice is also provided in newspapers of general circulation pursuant to Government Code sections 6061 and 6061.3.

Please address and submit written comments to Catherine Kuhlman, Executive Officer, by February 9, 2010, via U.S. Postal Service, email, fax, or delivery, to the following address:

North Coast Regional Water Quality Control Board
c/o Katharine Carter
5550 Skylane Blvd, Suite A
Santa Rosa, CA 95403
phone: 707-576-2290
fax: 707-523-0135
e-mail: kcarter@waterboards.ca.gov

Regional Water Board Workshop
Regional Water Board staff will host a public workshop to present the revised TMDL implementation plan and receive oral comments. The workshop will be held at the following date, time, and location:

January 27, 2010 10:00 AM
Holiday Inn Express
707 Montague Road
Yreka, CA 96097

Public Hearing – NEW LOCATION
After the close of the written public comment period on February 9, 2010, Regional Water Board and EPA staff will review the comments received on the December 2009 Public Review Drafts. In addition, Regional Water Board staff will consider the oral comments presented at the January 27, 2010 Board Workshop. Staff responses to the comments received on both the June 2009 and December 2009 Public Review Drafts, as well as any proposed changes to the December 2009 Public Review Drafts, will be available from the Regional Water Board prior to the Regional Water Board hearing considering approval of these documents.

The *Klamath River TMDL Action Plan and Lost River Implementation Plan*, and the *Klamath River Site Specific Dissolved Oxygen Objective* will be presented for Regional Water Board approval on:

NEW LOCATION
March 24-25, 2010
Eureka Public Marina
#1 Marina Way
Eureka, CA 95501

Information about this Regional Water Board hearing will be issued in February 2010 at:
www.waterboards.ca.gov/northcoast/board_info/board_meetings/

March 24-25, 2010 Public Hearing Procedures
Written comments received after the public comment period (after 5:00 p.m. on February 9, 2010) will not be accepted, except at the discretion of the Regional Water Board Chair. All those who plan to testify at the Public Hearing are encouraged to submit written statements during the public comment period. Testimony at the Public Hearing may summarize or explain timely submitted or late-accepted written evidence, but new evidence shall not be added. Non-evidentiary policy statements to be made during the Public Hearing need not be submitted in advance. Depending on the number of people wishing to speak at the Public Hearing, the Regional Water Board Chair may set time constraints for oral testimony or comments. A timer may be used and speakers are expected to honor the time limits. Where speakers can be grouped by affiliation or interest, such groups will be expected to select a spokesperson and not be repetitive.

Accessibility
Anyone requiring reasonable accommodation to participate in the public meetings should contact Jean Lockett, Executive Assistant, at 707-576-2307 at least five days prior to the scheduled meeting. The meeting locations are accessible to persons with disabilities. TTY users may contact the California Relay Service at 800-735-2929 or voice line at 800-735-2922.

Staff Contacts
If you have any questions on the Regional Water Board's Klamath River TMDL, please contact:

Matt St. John at 707-570-3762 or by email at mstjohn@waterboards.ca.gov.

Catherine Kuhlman
Executive Officer

December 23, 2009

Revised February 17, 2010

RESPONSE TO COMMENTS
SITE SPECIFIC DISSOLVED OXYGEN OBJECTIVES
FOR THE KLAMATH RIVER IN CALIFORNIA

Comments Submitted on the June 2009 Draft

1. Comment(s):
   The superficial evaluation of the ramifications of the proposed DO objective does not satisfy the stringent requirements of these laws. (see Cal. Water Code 13000, 13241, 13242) (p. 15)

   Comment(s) Made By:
   Addington and Danosky – Klamath Water Users Association

   Response:
   The revised Staff Report for the Site Specific Objectives (SSOs) for Dissolved Oxygen (DO) (Appendix 1 of the TMDL Staff Report) includes a new Chapter 8 in which the factors listed in Section 13241 of the Porter Cologne Act are assessed with respect to the proposed Basin Plan Amendment for DO in the Klamath. In addition, Chapters 9, 10, 11, and 12 of the DO Staff Report refer the reader to the TMDL Staff Report for discussions of public participation, implementation, economics, and CEQA, respectively. The final DO Staff Report will be further revised to more directly refer the reader to the Klamath TMDL Staff Report for a discussion of monitoring, as well. Thank you for highlighting these issues.

2. Comment(s):
   USEPA Region 9 withholds comments on the Site Specific Objectives for DO at this time. But, it provides the elements necessary for inclusion in the State's water quality standards when submitted to EPA for review and approval. Further, USEPA Region 9 identifies the need for the staff report to support the simulation of "natural conditions" using the hydrodynamic model used for the Klamath TMDL and to demonstrate that the proposed Regional Board dissolved oxygen objectives are consistent with downstream objectives.

   Comment(s) Made By:
   Hashimoto and Ziegler – USEPA

   Response:
   Regional Board staff appreciate the assistance USEPA Region 9 staff have offered in the development and review of the SSOs for DO prior to the release of the staff report as contained in Appendix 1 of the Klamath TMDL staff report. The Staff Report for the revision of the SSOs for DO (December 2009) includes a discussion of the hydrodynamic model used for the Klamath TMDL and its application in estimating "natural conditions." It also provides a discussion of compliance with downstream objectives.

3. Comments(s):
Chapter 2, Section 2.2.1.2, Page 6 states: “The first set of objectives included on page 3-4.00, are minimum DO levels for various beneficial uses.” Nothing on page 3-4 specifically states these objectives. Please add objectives in TMDL document.

Comment(s) Made By:
Hicks – U.S. Bureau of Reclamation

Response:
A discussion of the DO objectives is found on page 2-6 through 2-8 of the revised TMDL staff report. The statement identified by the reviewer regarding page 3.-4.00 is referring to page 3-4.00 of the Basin Plan. We apologize for the confusion.

4. Comment(s):
Chapter 2 - Section 2.2.1.2, Page 2-6 states: “Upstream of the Iron Gate Dam, the instantaneous minimum concentration of DO required is 7.0 mg/L. Half of the monthly mean DO values for the year must also be 10.0 mg/L or greater.

Downstream of the Iron Gate Dam, the instantaneous minimum concentration of DO required is 8.0 mg/L. Half of the monthly mean DO values for the year must also be 10.0 mg/L or greater.”

These dissolved oxygen concentrations are unrealistically high, since they are greater than 100% saturation at the elevations and “natural background” temperatures listed in Section 2.4.2 of this document. At a location immediately downstream of Iron Gate Dam (elevation of 2,162 feet above NAVD 1929) with a water temperature of 23.0C, 100% dissolved oxygen saturation is approximately 7.9 mg/L. The reviewer strongly recommends the revision of the numeric dissolved oxygen objectives to reflect dissolved oxygen concentrations that are appropriate for the water temperatures and the elevations within the Klamath River Watershed.

The reviewer recognizes that the Staff of the North Coast Regional Water Quality Control Board intends to propose revision to the Basin Plan to implement more reasonable dissolved oxygen objectives to be “…a minimum 85% saturation limit, as calculated based on natural water temperatures, will be proposed. Additionally, the proposed revision will state that in no case will the DO fall below 6.0 mg/L as an instantaneous minimum.”

Comment(s) Made By:
Hicks – U.S. Bureau of Reclamation

Response:
Appendix 1 of the TMDL Staff Report includes Regional Water Board staff’s proposal to the Regional Water Board for the revision of the existing SSOs for DO in the mainstem Klamath River. The existing DO objectives were developed from

many years of data collection headed by the Department of Water Resources in the 1950s and 1960s. Because the data were collected by grab sample during daylight hours, they represent DO saturation values sometime greater than 100% due to photosynthetic activity. Staff proposes their revision because 24-hour monitoring data can not appropriately be compared to the existing objectives.

Based on the rerun of the TMDL model, DO saturation under natural conditions in the mainstem Klamath is predicted to vary from 85% (upstream of the estuary) up to 98% depending on the location and the month. This being the case, staff has restructured the proposed revision of the SSO for DO as follows:

Waterbody/Reach	Percent DO Saturation under natural receiving water temperatures	Time period
Stateline to Scott River	90%	October 1 through March 31
	85%	April 1 through September 30
Scott River to Hoopa	90%	Year round
Hoopa to Turwar	90%	September 1 through May 31
	85%	June 1 through August 31
Turwar to Hunter Creek	85%	September 1 through July 1
	80%	August 1 through August 31
Hunter Creek to mouth	For the protection of estuary habitat (EST), the dissolved oxygen content of the lower estuary shall not be depressed to levels adversely affecting beneficial uses as a result of controllable water quality factors.	
These objectives apply throughout the length of the mainstem Klamath River except for where there is Tribal jurisdiction.		

Further, staff has removed the proposal that 6.0 mg/L be established as an absolute minimum because the TMDL model indicates that the proposed revised SSOs for DO already result in DO concentrations greater than 6.0 mg/L at all times.

5. <u>Comment(s):</u>
The dissolved oxygen standard of 85% saturation is not reasonable under the varying conditions of the river when it is based upon conjectured historically non existent ‘natural background’ temperature estimates, rather than using ‘actual’ current water temperatures. By doing so, in conjunction with already exaggerated ‘safety margins’ for dissolved oxygen minimums in excess of 6 mg/l which is unjustified on a ‘blanket’ coverage, determines an inability for those conditions to ever be realistically met. (p. 4)

Comment(s) Made By:
Cozzalio

Response:
The commenter raises several issues as follows: 1) the need to account for the variability in DO, 2) the unreliability of estimated natural temperatures as representative of actual historical conditions, 3) the unreasonableness of using estimated natural temperatures rather than actual temperatures, 4) the excessive (exaggerated) safety margin as represented by the 6.0 mg/L absolute minima, 5) the poor justification for applying a single safety factor to the whole mainstem, and 6) the improbability of achieving the proposed objective.

One, a given percent DO saturation results in varying DO concentrations over the course of time, primarily as a function of the change in temperature. Regional Water Board staff account for the variability in DO by proposing a percent DO saturation criterion rather than a static concentration limit which is more typical.

Two, natural temperatures in the Klamath River were estimated considering two primary factors: unimpaired flow and riparian shade conditions. A third factor, the unimpaired volume of cold spring water, was also estimated; but, only for those locations where cold springs have a significant influence on the temperature of the surface water downstream. These factors were estimated using well-established scientific methods and represent only the most significant factors influencing stream temperature. Less significant factors and historic factors more difficult to estimate were not considered. As a result, the estimate of natural temperatures is robust and well-supported by science.

Of particular note is the importance of unimpaired flows in the mainstem to the estimate of mainstem temperatures. There is insignificant uncertainty with respect to these estimates, resulting as they do from very well studied and vetted data collection, analysis, and modeling. Greater uncertainty exists in the estimates of natural temperatures in the minor tributaries due to the limited data available there. However, the influence of minor tributaries on mainstem temperatures is insignificant.

Three, a water quality objective is established to protect the most sensitive beneficial uses of the waterbody in question. In the case of the mainstem Klamath River, the most sensitive beneficial use is the use by salmonids for migration, spawning, incubation, and rearing. The Regional Water Board can not establish life cycle-based water quality objectives for the mainstem Klamath River because the DO concentrations associated with salmonid life cycle requirements can not be met even under natural conditions—conditions in which there are no anthropogenic influences. As such, the Regional Water Board staff has proposed water quality objectives that protect natural DO conditions from further degradation.

Percent DO saturation is used as the tool for estimating natural DO conditions. But, this can only be accomplished if the corresponding concentration values are calculated based on estimates of natural temperature. Were the DO concentration values associated with the percent DO saturation criteria to be calculated based on actual receiving water temperatures, then the criteria would not represent natural conditions; but current conditions. As demonstrated by the threatened and endangered status of salmonid species in the Klamath, as well as the water quality impairment analysis as represented by the TMDL, the existing DO conditions are unsuitable for the protection of the beneficial uses of the mainstem Klamath.

Four, the 6.0 mg/L DO absolute minima was proposed as a means of ensuring that salmonids would be provided with the minimum DO necessary to make successful use of the habitat available in the mainstem. The absolute minimum has been eliminated from the draft final proposal because further analysis indicated that concentration values associated with application of the proposed percent saturation criteria always exceed 6.0 mg/L DO. Thus, the absolute minimum is unnecessary and duplicative.

Five, the justification for applying the 6.0 mg/L DO as an absolute minimum throughout the mainstem Klamath is based on the life cycle requirements of salmonids, the most sensitive of the beneficial uses in the mainstem. A DO less than 6.0 mg/L can act as a barrier to use of the habitat by salmon. Given that salmon have been barred from the use of a large portion of their historical habitat in the Klamath watershed (e.g., upstream of Iron Gate Dam), Regional Water Board staff proposed the 6.0 mg/L as protection against any further loss of access to available habitat. All of the available salmonid habitat should remain available to salmonids as one of the means of supporting their recovery.

Six, the Klamath TMDL model has been run to establish the load and waste load allocations necessary to meet the water quality objectives, including the proposed DO objective. The Klamath TMDL model indicates that the proposed DO objectives are achievable.

6. Comment(s):
Page 4-34, Last Paragraph. There is no presentation of dissolved oxygen data. At a minimum a description of data used, methods for filling data gaps and other assumptions outlined, and graphical and tabular presentation of dissolved oxygen data along with corresponding dissolved oxygen saturation percentage should be provided. Without such information, review of assumptions is not possible.

Review of the model input files identifies that all minor tributaries to the Klamath River are placed at 90 percent of saturation under current conditions and 100 percent of saturation under natural baseline condition. This important assumption is undocumented in the TMDL. What is the basis for this assumption? Limited grab sample and water quality probe data suggest many

of these tributaries are oligotrophic and, with perhaps the exception of sediment and in some cases temperature, have dissolved oxygen concentration at saturation. Why place a dissolved oxygen impairment on these tributaries where none may exist. At a minimum a sensitivity analysis should be completed and clear documentation of the conditions and results presented. (p. 42) (PacificCorp – Appendix A and B.doc)

Comment(s) Made By:
Hemstreet – PacifiCorp

Response:
Chapter 4 of the Klamath TMDL Staff Report (pages 4-1 through 4-34) is the Pollutant Source Analysis. As described in the first paragraph of this chapter, "the purpose of a TMDL pollutant source analysis is to inventory and describe all sources of pollutants that are impacting the water quality standards of the impaired waterbody." DO is not considered a pollutant source, but one of the water quality parameters affected by pollutant sources. As such, Chapter 4 does not include a discussion of DO data, data gaps, and other assumptions with respect to DO; but, focuses on organic matter, nutrient and temperature loading as pollutant sources.

Chapter 2, describing the Klamath River Problem Statement, provides a conceptual model of the relationship among stressors (e.g., pollutants), environmental conditions (e.g., DO concentrations and diurnal fluctuation), responses/outcomes (e.g., decreases spawning and reproductive success), and beneficial use impairment (e.g., loss of salmonid fishery). It also provides in tabular and graphical form the results of DO data collection in the mainstem Klamath River. With respect to the DO data used to populate the Klamath TMDL model, a summary is given in Chapter 3, Analytic Approach, and a detailed description is given in Appendix 6, Klamath River Model for TMDL Development.

Thank you for your keen observation and detailed review with respect to the question of DO saturation values assigned to tributary streams. The difference in DO saturation assigned to tributaries between the compliance and natural conditions scenarios was an artifact of the length of time over which the Klamath TMDL model was developed, reviewed, revised, and run. The last revision of the model made consistent the DO saturation values assigned to tributaries in both the compliance and natural conditions scenarios. The new assignments are based on a review of historic DO saturation data and represent unimpaired conditions. As described in the DO Staff Report (Appendix 1 of the TMDL Staff Report), the newly assigned percent saturation boundary conditions are as follows:

1. For minor tributaries, 100% saturation
2. For the Shasta, Scott and Salmon Rivers, 95% saturation
3. For the Trinity River, 100% saturation

7. Comment(s):
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.

Comments Made By:
Fetcho – Yurok Tribe
Crosby – Karuk Tribe

Response(s)
Regional Water Board staff agrees that a large proportion of the nutrients delivered to the Klamath River are a result of the loss of wetland habitat in the upper Klamath basin where nutrients were historically sequestered in the wetland vegetation and soils. Staff also acknowledges that the Klamath TMDL model does not fully take into account the buffering capacity of the extensive wetlands system of the upper Klamath basin as part of the T1BSR (natural conditions) run. However, it is not correct to say that much of the naturally produced phosphorus of the upper basin would have been *trapped* by historic wetlands. In that period of history when there were vast, functioning wetlands in the upper basin, they more likely served to *meter* the release of nutrients and organic matter downstream to the Klamath River rather than trap them. Regional Board staff asserts that the naturally high productivity of the upper Klamath basin serves to cause a diurnal fluctuation in DO downstream; but, staff acknowledges that the diurnal fluctuation has been exaggerated by the modification of upper basin wetlands.

8. Comment(s):
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 DO variability.

Comments Made By:
Fetcho – Yurok Tribe
Crosby – Karuk Tribe

Response(s):
Regional Board staff agrees that the modification of wetland habitat in the upper basin has served to modify the nutrient dynamics and exaggerate the diurnal fluctuation in DO.

9. Comment(s):
Water temperature conditions before mining, deforestation, dam construction and massive sedimentation were likely moderated by mainstem Klamath River hyporheic function. Thus DO 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.

Comments Made By:
Fetcho – Yurok Tribe
Crosby – Karuk Tribe

Response(s):
Regional Water Board staff agrees with the commenters that hyporheic flows serve to moderate surface water temperatures in a free flowing river; though the significance of this effect on a river the size of the mainstem Klamath is unknown. Regional Water Board staff also agrees that as a general matter, water temperatures were lower in the mainstem Klamath before watershed disturbance than they are now. This is amply demonstrated by the Klamath TMDL for temperature. It is because of the availability of estimates of temperature under natural conditions as provided by the Klamath TMDL that use of percent saturation and natural temperatures as a surrogate for natural DO conditions is possible as a water quality objective.

The commenters are correct that hyporheic flow is not included in the Klamath TMDL models, the lack of which may have a minor effect on results. But, Regional Water Board staff does not believe the effect to be significant, except in localized areas of thermal refugia. And, the Klamath TMDL provides an alternate mechanism for identifying and protecting thermal refugia.

10. Comment(s):
Standards that cannot be met are not practical, but ascribing current impairment in conditions as partially natural may be in error and does not foster a sense of urgency in what is a critical problem with DO 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, DO problems are pervasive during the spawning season (after September 15) on the mainstem below Iron Gate Dam.

Comments Made By:
Fetcho – Yurok Tribe
Crosby – Karuk Tribe

Response(s):
Water quality standards are developed to protect the beneficial uses of the waterbody in question. In the case of DO in the mainstem Klamath River, Regional Water Board staff has determined that ensuring ambient water quality conditions do not vary substantially from natural background conditions provides the best means of protecting the beneficial uses of the waterbody, notably spawning salmonids. Regional Water Board staff believes that by establishing *natural conditions* as the basis for the proposed DO standard, we are unequivocally highlighting the critical nature of the current problem associated with DO in the mainstem Klamath.

The December 2009 proposed revised Site Specific Objectives (SSOs) for DO has been modified to provide even greater protection during the spawning season. That is, a 90% DO saturation criteria as calculated from estimates of natural temperature is proposed for application during the months of October 1 to March 31 in that portion of the mainstem from the Stateline to the Scott River, year round from the Scott to Hoopa, and September 1 through May 31 from Hoopa to Turwar.

11. Comment(s):
We have concerns that the proposed DO 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 DO 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.

Comments Made By:
Fetcho – Yurok Tribe
Crosby – Karuk Tribe

Response(s):
The proposed revised SSOs for DO in the mainstem Klamath are derived from data output from the natural conditions run (T1BSR) of the Klamath TMDL model. In T1BSR, the California portion of the river is simulated as free-flowing with no impoundments from the Stateline to the Pacific Ocean. Thus, the SSOs for DO at the location now downstream of Iron Gate Dam—as throughout the river—represent natural conditions without the presence of impoundments.

The December 2009 DO Staff Report (Appendix 1 of the Klamath TMDL Staff Report) includes as Table 7.4 the concentration values associated with the percent saturation criteria as calculated using estimated natural temperatures. The

concentration values are given for locations throughout the mainstem Klamath, including downstream of Iron Gate Dam.

12. Comment(s):
Discussions of setting criteria are necessary, but non-normative water quality events in the mainstem Klamath River may be a greater concern with regard to fish health and source of juvenile salmonid mortality. 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 in discussions between the US Bureau of Reclamation, US Fish and Wildlife Service, National Marine Fisheries Service and the Tribes on flow releases at Iron Gate dam to minimize algae bed shedding.

Comments Made By:
Fetcho – Yurok Tribe
Crosby – Karuk Tribe

Response(s):
Regional Board staff agrees with the commenters regarding the importance of non-normative water quality events, as well as the commenters' particular concern regarding the effects of rapid changes in flow. As a result of discussion and research on the topic of flow in the Klamath basin over the last few years, Regional Board staff has developed a narrative flow objective, now contained in Region 1 and 2's draft Stream and Wetland Policy, to apply throughout both regions, including the Klamath River. The Stream and Wetlands Policy is currently being peer reviewed and will be released for public review and Regional Water Board consideration in 2010. If adopted as currently written, the narrative flow objective would require in essence that the natural pattern and range of flows be protected to ensure protection of beneficial uses and a functional ecosystem.

Comment [dfl1]: 2010? Also, is the response up to date?

Comments Submitted on December 2009 Draft

13. Comment(s):
The Proposed Implementation Plan of the Klamath River TMDL and Lost River TMDL does not address the inconsistency between various water quality standards applicable to the waters that the Proposed Implementation Plan attempts to address. (See. e.g., Proposed DO Objective at Staff Report, p. 1-4 of Appendix I [proposing to change the DO objective applicable at "Stateline" to a narrative objective based on saturation levels]; see also, e.g., EPA Lost River TMDL, p. 30 [explaining numeric DO objective applicable to Lost River. which is based on minimum DO levels].)

Comment(s) Made By:
Addington and Danosky - Klamath Water Users Association

Response:
The proposed recalculated SSOs for DO in the Klamath River apply only to the Klamath River mainstem. They do not extend to the Lost River or any other tributary to the Klamath River. The Lost River TMDL is appropriately calculated to attain the concentration-based DO objectives currently contained in Table 3-1 of the Basin Plan.

Similarly, the Klamath River TMDL is appropriately calculated to attain the percent DO saturation-based objectives proposed for adoption into the Basin Plan prior to the adoption of the Klamath River TMDL.

The proposed Implementation Plan is designed to provide tools in both the Lost River and the Klamath River for reducing pollutant loads to a degree sufficient to attain the associated water quality objectives. Monitoring will provide the information necessary to determine when attainment of the respective objectives has been accomplished.

14 Comment(s):
We agree with staff that Alternative 3, using a percent saturation based on natural receiving water temperatures, is the most appropriate method to use for setting the criteria; however, we disagree with the values proposed in Table 7.5. It is our opinion that the values the Regional Water Board proposes in Table 7.5 are erroneous, based on artifacts of the TMDL water quality model, and should be revised. We suggest a value of 90% year-round for Stateline to above Turwar, and 85% for Turwar.

Comment(s) Made By:
Bowman – Quartz Valley Indian Reservation
Sloan – Yurok Tribe

Response:
Thank you for your suggestion. We have rerun the Klamath TMDL model for that portion from Iron Gate Dam to Turwar with the revised barometric pressure assignments necessary to eliminate the artifacts associated with previous runs of the model. The results with respect to DO indicate better DO saturation under natural conditions than was represented in previous versions of the model. However, the improvement is not as great as you've suggested. Percent DO saturation under natural conditions is still shown as less than 90% saturation from April through September from Iron Gate Dam to Shasta and from June through August from Hoopa to Turwar. We have revised our proposed SSOs for DO accordingly. Please review the final proposed Basin Plan Amendment.

15. Comment(s):
Regarding the values proposed for the various portions of the Estuary, at this time we cannot endorse setting site-specific dissolved oxygen objectives based on the

TMDL water quality model for the Estuary, given: 1) the complex dynamics of the Estuary are not well understood, in part due to the lack of data, 2) the inherent difficulty of modeling a system as complex as the Estuary, 3) due to reasons 1 and 2 we regard the Estuary as the most uncertain geographic area of the TMDL water quality model, and 4) we have not closely examined model outputs for the Estuary. Furthermore, Table 6.7: "Minimum Percent DO Saturation at Locations throughout the Klamath River Mainstem under Natural Conditions (T1BSR Model Run)" does not include modeled percent saturation values for the Estuary (only displays as far downstream as Turwar).

It is our understanding that given that the Estuary is located on the Yurok Reservation, the Regional Water Board does not have authority to set a criterion anyway, as is alluded to in the text of page 7-3 "To the extent that the State lacks jurisdiction, the proposed SSO is extended as a recommendation to the applicable regulatory authority". Given the substantial uncertainty regarding the model predictions for the Estuary (even under current conditions, aside from the issue of natural conditions), and the lack of a need for the Regional Water Board to recommend a criteria due to lack of jurisdiction, we recommend that the Upper and Middle Estuary and Lower Estuary be removed from Table 7.5, and that area be left as a gap in the site-specific D.O. criteria.

<u>Comment(s) Made By:</u>
Bowman – Quartz Valley Indian Reservation
Sloan – Yurok Tribe

<u>Response:</u>
We are very sensitive to the issue of jurisdiction and have no intention of asserting water quality control authority on Yurok Tribal land. To protect against any future confusion on this matter we propose updating our current DO objectives to include a phrase specifically acknowledging that the State's water quality objectives do not apply where there is Tribal jurisdiction.

Our current DO objectives are assigned for the mainstem Klamath River from the Stateline to the Pacific Ocean. The existing concentration-based objectives assigned to the estuary are numbers reflective not of estuarine conditions, but of day time freshwater conditions. The *Klamath TMDL model* provides an assessment of DO under natural conditions in the estuary which is a vast improvement over that which came before it. We feel it important to update the existing objectives to codify this improved science.

This is particularly important since the Yurok Water Quality Control Plan includes the same DO objectives for the estuary which are currently in our Basin Plan and as such represent outdated science. Our intention is to update our existing DO objectives with more scientifically-defensible DO objectives, acknowledge their application only on lands and watercourses under State jurisdiction, and offer them as potential alternative objectives to the Yurok Tribe or USEPA should a situation

ever arise in which a NPDES permit or 401 certification requires consideration of DO conditions protective of the beneficial uses of the lower Klamath River.

16. Comment(s):
Barometric pressure and water temperature are key determinants of dissolved oxygen saturation, and barometric pressure is dependent on elevation (higher elevation means lower barometric pressure and hence lower dissolved oxygen). The information included in the "Table 6.6: Barometric Pressure Assignments, corrected for elevation at key locations" indicates that while representations of barometric pressure in the TMDL water quality model have been improved since previous versions of the model, the situation is still less than desirable, particularly for the portion of the Klamath River that lies within the Hoopa Valley Reservation.

For example, there is an approximately 900 foot elevation drop between Seiad Valley and the Saints Rest Bar on the Hoopa Valley Reservation; however, the model uses a single atmospheric pressure for that entire reach. It appears (based on Table 6.6) that the model's atmospheric pressure changes from 964.70 millibars (mb) to 1006.30mb right at Hoopa. We did some calculations to explore how this would affect the model results at a water temperature of 20 degrees C:

- 100% saturation is 8.66 mg/L at 964.70 mb and is 9.03 mg/L at 1006.30 mb, a difference of 0.37 mg/L D.O concentration. This represents the approximate magnitude of the model artifact affecting Hoopa.
- If water above Hoopa was at 90% saturation (7.79 mg/L)(100% saturation would be 8.66 mg/L), then once that water enters Hoopa and the modeled atmospheric pressure changes (and hence 100% saturation changes from 8.66 mg/L to 9.03 mg/L), then the 7.79 mg/L is equivalent to only 86.2% saturation (7.79/9.03*100).

Thus, it is highly likely that the jump up in exceedance of the 90% saturation threshold from 0% at DS Salmon to 35.89% at Hoopa (see Table 7.3 embedded below) in August (and similar for July and September) is probably caused almost solely by this issue of the location of the atmospheric pressure breakpoint, and is thus an artifact of the model, not any real characteristics of that river reach.

There is also a jump of 27 mb from above US Iron Gate Dam (909.83 mb) to DS Iron Gate Dam (936.40), and this also probably accounts for the jump in the exceedance of the 90% saturation threshold from 0% at 23.92% between these two stations (see Table 7.3 embedded below).

Table 7.3- Percentage of time in which a Percent Saturation Criterion of 90% DO Saturation is met under Natural Conditions (T1BSR)

90% Saturation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Stateline	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.27%	0.13%	0.00%	0.00%	0.00%	0.00%
DS_COPCO DAM	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
DS_IGDAM	0.00%	0.00%	0.00%	10.28%	1.88%	8.75%	23.92%	27.69%	8.47%	0.00%	0.00%	0.00%
US_SHASTA	0.00%	0.00%	0.00%	4.58%	0.54%	7.08%	5.78%	1.08%	0.00%	0.00%	0.00%	0.00%
DS_SHASTA	0.00%	0.00%	0.00%	0.42%	0.00%	2.08%	0.54%	0.13%	0.00%	0.00%	0.00%	0.00%
US_SCOTT	0.00%	0.00%	0.00%	0.00%	0.00%	0.28%	1.21%	1.08%	0.00%	0.00%	0.00%	0.00%
DS_SCOTT	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
SEIAD	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.54%	0.00%	0.00%	0.00%	0.00%	0.00%
US_INDIAN	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
DS_INDIAN	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
US_SALMON	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
DS_SALMON	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
HOOPA	1.08%	0.00%	0.00%	0.00%	0.00%	1.53%	28.90%	35.89%	21.11%	1.75%	0.00%	0.00%
US_TRINITY	1.21%	0.00%	0.00%	0.00%	0.00%	2.08%	28.63%	35.08%	18.89%	1.34%	0.00%	0.00%
DS_TRINITY	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.34%	9.14%	0.28%	0.00%	0.00%	0.00%
YOUNGSBAR	0.54%	0.00%	0.00%	0.00%	0.00%	0.00%	0.27%	8.33%	0.00%	0.00%	0.00%	0.00%
TURWAR	1.48%	0.00%	0.00%	0.00%	0.00%	1.53%	25.00%	23.39%	1.94%	0.00%	0.00%	0.00%
Upper Estuary	2.02%	0.00%	0.00%	0.00%	0.00%	4.58%	20.97%	34.27%	30.42%	8.06%	0.00%	0.00%
Middle Estuary - Top	2.02%	0.00%	0.00%	0.00%	0.00%	2.92%	14.52%	34.27%	34.17%	18.15%	0.00%	0.00%
Middle Estuary - Bottom	2.02%	0.00%	0.00%	0.00%	0.00%	2.92%	14.52%	34.68%	34.58%	18.95%	0.00%	0.00%
Lower Estuary - Top	20.65%	0.00%	0.00%	0.42%	1.21%	16.67%	28.63%	50.81%	57.08%	89.52%	99.58%	91.29%
Lower Estuary - Bottom	40.08%	28.45%	21.77%	49.17%	62.90%	70.42%	65.32%	66.13%	84.17%	100.00%	100.00%	97.51%

Lightly shaded cells are months and locations at which a 90% saturation criterion is always met under natural conditions. Dark shaded cells are months and locations at which a 90% saturation criterion is violated no more than 1% of the time. Unshaded cells are months and locations at which a 90% saturation criterion is violated under natural conditions.

Following a recent conference call to discuss the compatibility of the Regional Water Board's proposed site-specific D.O. objectives and the Hoopa Valley Tribe's water quality standards, Kier Associates notified Regional Water Board staff to the issues/calculations above, and staff responded that they would attempt to resolve the issue by having the TMDL modeling team add more break-points for barometric pressure between Seiad and Hoopa and re-run the model. This seems like a sensible approach and we look forward to seeing the results of the proposed model runs. We expect this will show that the TMDL model is compatible with the Hoopa Valley Tribe's natural conditions clause that specifies that:

> "If dissolved oxygen standards are not achievable due to natural conditions, then the COLD and SPAWN standard shall instead be dissolved oxygen concentrations equivalent to 90% saturation under natural receiving water temperatures." (Hoopa Tribe 2008).

It is our understanding that the jump in atmospheric pressure at Iron Gate Dam could not be fixed, because it was part of an upstream model segment that would have required more work that there is time for at this stage in the TMDL adoption schedule.

<u>Comment(s) Made By:</u>
Bowman – Quartz Valley Indian Reservation
Sloan – Yurok Tribe

<u>Response:</u>
We have rerun the Klamath TMDL model for that portion from Iron Gate Dam to Turwar with the revised barometric pressure assignments necessary to eliminate the artifacts associated with previous runs of the model. The results with respect to DO indicate better DO saturation under natural conditions than was represented

in previous versions of the model. Percent DO saturation under natural conditions is still shown as less than 90% saturation from April through September from Iron Gate Dam to Shasta and from June through August from Hoopa to Turwar. We have revised our proposed SSOs for DO accordingly. Please review the final proposed Basin Plan Amendment.

17. Comment(s):
We object to staff's proposal of a standard that automatically weakens with climate change:

> "Further, using an estimate of natural temperatures as the basis for calculation DO concentration allows for consideration of the effects of climate change. If convincing data is developed which confirms a rise in natural temperatures due to the effects of climate change, then consideration can be given to adjusting the estimate of natural temperatures upon which the percent saturation criteria are based. If the percent saturation criteria were applied based on existing temperatures, no specific consideration would be given to climate change and all increase in natural [sic] temperature would automatically adjust the DO objective without executive or public review." (Page 7-15)

The text does not explicitly state whether climate change is natural or human-caused, an important distinction that should be made. It is our opinion that the majority of climate change that has occurred in the past few decades (and will continue to occur) is human-caused. Thus, climate changes are not "natural" and should not be included in "natural receiving water temperatures."

Comment(s) Made By:
Bowman – Quartz Valley Indian Reservation
Sloan – Yurok Tribe

Response:
The text is intentionally vague on the question of whether or not climate change can be considered a natural phenomena or a human-caused one. In addition, the text is vague on whether or not if convincing data is developed proving climate change as the cause of water temperature rise in the Klamath, staff would recommend a revision of the temperature estimates and thereby the DO concentration requirements. This is because it is not our intention to automatically accept climate change as a natural phenomenon; but, to closely examine any data regarding the effects of climate change as it becomes available.

The intention of the text as currently written is only to highlight the benefit of a percent DO saturation objective based on natural receiving water temperatures. That is, in a changing climate, a percent DO saturation objective based on natural receiving water temperatures allows for a flexibility that does not exist with concentration-based objectives. But, it requires a maintenance of conditions as

close to natural as possible which does not exist with a percent DO saturation criteria based on existing receiving water temperatures.

The text as quoted will be changed to better describe staff's intentions.

18. Comment(s):
Chapter 1 states multiple times that the site specific objectives for dissolved oxygen have been recalculated. Although there is a lengthy discussion as to the reason for these recalculations in Appendix 1, there is no such discussion in Chapter 1. A brief explanation should be presented in Chapter 1 of the document to make it clear to readers why this has been done.

Comment(s) Made By:
Cameron – U.S. Bureau of Reclamation

Response:
Thank you for this suggestion. The following text will be added to Chapter 1;

> "The SSOs for DO in the mainstem Klamath River have been recalculated because conditions of barometric pressure, salinity and natural receiving water temperatures at equilibrium (e.g., 100% DO saturation) do not consistently allow for attainment of the existing SSOs for DO. Further, the *Klamath TMDL model*, as described in detail throughout the rest of this report, indicates that under natural conditions, the DO concentrations achieved in the mainstem Klamath are periodically less than the existing SSOs for DO, particularly during the summer months. For a detailed analysis of DO conditions in the mainstem Klamath River, including the recalculation of the SSOs, please see Appendix 1."

19. Comment(s)
Allowing the dissolved oxygen calculations and standards to shift with climate change incorrectly implies that climate change is natural, rather than manmade. We recommend that the TMDL language clarify that climate change is not natural, and should not be included in natural receiving water temperatures.

Comment(s) Made By:
Terence – Karuk Tribe, Pacific Coast Federation of Fisheries Associations, IFR, and the North Coast Environmental Center

Response:
The text is intentionally vague on the question of whether or not climate change can be considered a natural phenomena or a human-caused one. In addition, the text is vague on whether or not if convincing data is developed proving climate change as the cause of water temperature rise in the Klamath, staff would recommend a revision of the temperature estimates and thereby the DO concentration requirements. This is because it is not our intention to automatically

accept climate change as a natural phenomenon; but, to closely examine any data regarding the effects of climate change as it become available.

The intention of the text as currently written is only to highlight the benefit of a percent DO saturation objective based on natural receiving water temperatures. That is, in a changing climate, a percent DO saturation objective based on natural receiving water temperatures allows for a flexibility that does not exist with concentration-based objectives. But, it requires a maintenance of conditions as close to natural as possible which does not exist with a percent DO saturation criteria based on existing receiving water temperatures.

The text as quoted will be changed to better describe staff's intentions.

20. Comments:
In reviewing the draft proposed DO SSO, EPA notes that it is of paramount importance that RB 1 provide clear language describing how the proposed DO SSO will be protective of the Beneficial Uses on the RB1 jurisdiction of the Klamath River. Additionally, EPA notes that clarification is required to satisfy 40 CFR section 131.10(b), the protection of downstream uses. Specifically, we request that explicit information be provided that describes how the draft DO SSO protects the spawning and incubation beneficial uses of the Hoopa Valley Tribal Reservation water quality standards, and meets the 90% saturation standard at the boundary of the Hoopa Reservation.

Comment(s) Made By:
Hashimoto - USEPA

Response:
New text has been added to Chapter 6 of the DO Staff Report stating "The *Klamath TMDL model* indicates that under natural conditions, daily minimum and monthly mean DO concentrations ensure no production impairment and no more than slight production impairment, respectively, of other (non-embryo and non-larval) life stages of salmonid. It also indicates that under natural conditions, daily minimum and monthly mean DO concentrations essentially meet National criteria for the protection of all early (embryo and larval) life stages if the primary spawning and incubation season in the mainstem Klamath River is understood to occur from about October 1 through April 30."

With respect to compliance with Hoopa Valley Tribal standards, a rerun of the *Klamath TMDL model*, improving the application of barometric pressure to the calculation of percent DO saturation, allows for the revision of the proposed SSO for DO from the Scott River to the Hoopa boundary as "90% DO saturation under natural receiving water temperatures year round." This is consistent with the Hoopa Valley Tribe's percent DO saturation objective.

21. Comment(s):
The draft DO SSO, in the paragraph at the bottom of page one of the Executive Summary, refers to EPA guidance suggesting "two pathways" for the development of DO criteria for the protection of beneficial uses. We would like to clarify that an existing use (applicable in the current case) is required to be protected. Life cycle requirements *in conjunction* with natural conditions must be applied to achieve this protection. They are not "alternative pathways".

Comments Made By:
Hashimoto - USEPA

Response:
Thank you for your interpretation of the guidance on this point. The DO Staff Report text has been revised to compare natural DO concentration to National Criteria for the protection of cold water aquatic life indicating essential consistency between the two.

To elaborate on the confusion, however, USEPA's DO guidance says: "Where natural conditions alone create dissolved oxygen concentrations less than 110 percent of the applicable criteria means of minima or both, the minimum acceptable concentration is 90 percent of the natural concentration." (USEPA 1986, p. 38). In addition, Tudor Davies, USEPA Director of Office of Science and Technology states in a memorandum dated November 5, 1997 that "For aquatic life uses, where the natural background concentration for a specific parameter is documented, by definition that concentration is sufficient to support the level of aquatic life expected to occur naturally at the site absent any interference by humans." These two statements in combination suggest that establishing DO criteria based on life cycle requirements is one method for establishing standards sufficient to protect aquatic life; but, establishing DO criteria based on natural background conditions is another method by which to achieve the same goal, regardless of the relationship between the two.

22. Comment(s):
In the Executive Summary (first full paragraph on page 2), the draft SSO compares the proposed DO standards to EPA guidance. In the last line, a daily minimum of 9.0 mg/L is cited. The appropriate EPA number to be cited is 8.0 mg/L.

Comment(s) Made By:
Hashimoto - USEPA

Response:
Thank you for this correction. The 9.0 mg/L was cited as the criteria ensuring no production impairment. The DO Staff Report has been revised to compare the recalculated SSOs for DO to the National Criteria of 8.0 mg/L.

23. Comment(s):
The second full paragraph, on page two of the Executive Summary, cites 11.0 mg/L as the EPA recommended spawning criterion. 11.0 mg/L is the EPA recommended water column number for "no production impairment" and assumed to attain an 8.0 mg/L intergravel DO level. In the same EPA guidance, for "slight production impairment", a criterion of 9.0 mg/L in the water column is required. According to the model results (shown in Figures 6.5 and 6.6 of the Staff Report), 9.0 mg/L is met under natural conditions at nearly all times and locations in the late April to early June and September-October portions of the spawning season. The last sentence in the paragraph ("Thus, the first pathway towards developing DO criteria is unavailable to the North Coast Regional Water Quality Control Board [Regional Water Board] in the mainstem Klamath River".) indicates that spawning cannot be protected in the Klamath River. We believe that your Staff Report shows that spawning will be protected (at 9.0 mg/L), and we would like clarification regarding this.

Comment(s) Made By:
Hashimoto USEPA

Response: This clarification has been made.

24. Comment(s):
Where staff proposes DO criteria based on natural conditions (in the 3rd full paragraph of page 2 of the Executive Summary), EPA requests some clarification. Staff should include a clear statement indicating that the proposed applicable water quality objectives are not solely those in the draft amended Basin Plan Table 3-1. Also applicable are the existing narrative objectives as defined by and implemented through the natural conditions generated by the TMDL model (see also Table 7.4 of the Staff Report). These objectives together are protective of the existing aquatic life and spawning and incubation uses in the Klamath River. Further, there should be clear indication that the Hoopa Valley Tribal standards which have been adopted by the Tribe and approved by EPA will also be met by means of adopting the draft amended Basin Plan Table 3 - 1 along with the proposed TMDL.

Comment(s) Made By:
Hashimoto USEPA

Response:
Thank you for this suggestion. The text will be revised to include this explanation.

25. Comment(s):
In the statement concerning monitoring, EPA recommends that monitoring not only occur at key locations, but also at key times to verify that sufficient intergravel DO levels are being maintained.

Comment(s) Made By:
Hashimoto USEPA

Response:
Thank you for this suggestion. The text will be revised to include this modification.

26. Comment(s):
The Revised Draft TMDL introduces a new term: "recalculated Site Specific Objectives". This term is then used throughout the Revised Draft TMDL with regard to dissolved oxygen (DO) targets and allocations. This term should be defined for the reader, and an explanation given as to the reason, purpose, and rationale for "recalculated Site Specific Objectives" for DO.

Comment(s) Made By:
Hemstreet - PacifiCorp

Response:
Thank you for this suggestion. The following text will be added to Chapter 1;

"The SSOs for DO in the mainstem Klamath River have been recalculated because conditions of barometric pressure, salinity and natural receiving water temperatures at equilibrium (e.g., 100% DO saturation) do not consistently allow for attainment of the existing SSOs for DO. Further, the *Klamath TMDL model*, as described in detail throughout the rest of this report, indicates that under natural conditions, the DO concentrations achieved in the mainstem Klamath are periodically less than the existing SSOs for DO, particularly during the summer months. For a detailed analysis of DO conditions in the mainstem Klamath River, including the recalculation of the SSOs, please see Appendix 1."

27. Comment(s):
There is no presentation in the Klamath TMDL of dissolved oxygen data. At a minimum a description of data used, methods for filling data gaps and other assumptions outlined, and graphical and tabular presentation of dissolved oxygen data along with corresponding dissolved oxygen saturation percentage should be provided. Without such information, review of assumptions is not possible. Review of the model input files shows that all minor tributaries to the Klamath River are placed at 90 percent of saturation under current conditions and 100 percent of saturation under natural baseline condition. This important assumption is undocumented in the TMDL. What is the basis for this assumption? Limited grab sample and water quality probe data suggest many of these tributaries are oligotrophic and, with perhaps the exception of sediment and in some cases temperature, have dissolved oxygen concentrations at saturation. Why assume dissolved oxygen impairment in these tributaries where none may exist? At a minimum, a sensitivity analysis should be completed and clear documentation of the conditions and results presented.

Comment(s) Made By:
Hemstreet – PacifiCorp

Response:
The following is the response drafted to this comment when it was made on the June 2009 draft of the report.

Chapter 4 of the Klamath TMDL Staff Report (pages 4-1 through 4-34) is the Pollutant Source Analysis. As described in the first paragraph of this chapter, "the purpose of a TMDL pollutant source analysis is to inventory and describe all sources of pollutants that are impacting the water quality standards of the impaired waterbody." DO is not considered a pollutant source, but one of the water quality parameters affected by pollutant sources. As such, Chapter 4 does not include a discussion of DO data, data gaps, and other assumptions with respect to DO; but, focuses on organic matter, nutrient and temperature loading as pollutant sources.

Chapter 2, describing the Klamath River Problem Statement, provides a conceptual model of the relationship among stressors (e.g., pollutants), environmental conditions (e.g., DO concentrations and diurnal fluctuation), responses/outcomes (e.g., decreases spawning and reproductive success), and beneficial use impairment (e.g., loss of salmonid fishery). It also provides in tabular and graphical form the results of DO data collection in the mainstem Klamath River. With respect to the DO data used to populate the Klamath TMDL model, a summary is given in Chapter 3, Analytic Approach, and a detailed description is given in Appendix 6, Klamath River Model for TMDL Development.

Thank you for your keen observation and detailed review with respect to the question of DO saturation values assigned to tributary streams. The difference in DO saturation assigned to tributaries between the compliance and natural conditions scenarios was an artifact of the length of time over which the Klamath TMDL model was developed, reviewed, revised, and run. The last revision of the model made consistent the DO saturation values assigned to tributaries in both the compliance and natural conditions scenarios. The new assignments are based on a review of historic DO saturation data and represent unimpaired conditions. As described in the DO Staff Report (Appendix 1 of the TMDL Staff Report), the newly assigned percent saturation boundary conditions are as follows:

1. For minor tributaries, 100% saturation
2. For the Shasta, Scott and Salmon Rivers, 95% saturation
3. For the Trinity River, 100% saturation

28. Comment:
The Revised Draft TMDL needs to specify the pressure and air temperature at which the 85% saturation would be calculated.

Comment(s) Made By:
Hemstreet - PacifiCorp

Response**:**
The DO concentration corresponding to the percent DO saturation requirement is calculated by using site specific barometric pressure and salinity and the site specific estimate of natural receiving water temperature as generated by the T1BSR run of the *Klamath TMDL model* as is described in DO Staff Report (Appendix 1 of the Klamath TMDL Staff Report).

29. Comment(s)
Executive Summary, Paragraph 1. Note that the DO fluctuations, weekly averages, peaks, etc. are variable from year to year. And yet the comparisons are being made to the natural baseline scenario model output (T1BSR), which is only based on one year (2000) of data. This indicates that the Klamath River TMDL model is lacking as a tool in TMDL development because it does not adequately address annual variability.

Comment(s) Made By:
Hemstreet - PacifiCorp

Response:
The TMDL model accounts in a number of different ways for the variability associated with the parameters of concern. In addition, the model includes an inherent margin of safety to ensure resource protection even under scenarios that vary from that specifically modeled. With respect to the SSOs for DO, percent DO saturation was chosen as the appropriate parameter because it inherently accounts for interannual variability while remaining itself stable.

30. Comment(s):
Executive Summary, Paragraph 2, Line 4. The Revised Draft TMDL states "The proposed recalculated SSOs for DO are achievable under natural conditions…" However, "natural conditions" as identified in the Revised Draft TMDL will not likely be achieved. As noted elsewhere in the comments, the assumptions for natural conditions suggest extraordinary reductions that, given the geology, hydrology, meteorology, and land use, are unrealistic.

Comment(s) Made By:
Hemstreet - PacifiCorp

Response:
The recalculated SSOs for DO are established at levels achievable given the physical constraints of barometric pressure, temperature, and salinity in the Klamath River. This is not true of the existing SSOs for DO which can not be met at some elevations when summer temperatures naturally rise. As such, the recalculated SSOs for DO represent an important improvement to the existing SSOs for DO. In addition, the TMDL model indicates that the source reductions *will* result in compliance with the water quality objectives, including the proposed recalculated SSOs for DO. Staff believes the implementation plan can achieve the necessary source reductions. A monitoring plan is in place by which to track compliance and make adjustments as necessary. In short, staff believes

implementation of the TMDLs and SSOs for DO can reasonably be expected to achieve water quality objectives.

31. Comment(s):
Page 4-7 to 4-10, Section 4.4. What is the significance of discussing the CADDIS model? This model was not applied to the Klamath Basin, and so the points made in this section are just general ideas that may or may not apply to the Klamath River system. Discussion of an additional model that is not relevant misleads the reader and causes confusion about the role of the CADDIS model in the TMDL.

Comment(s) Made By:
Hemstreet - PacifiCorp

Response:
The CADDIS model has been moved to Chapter 5 where it is used to provide a framework for the discussion of past activities in the watershed and their potential effect on DO, as measured in the 1950s and 1960s. This is significant because the existing SSOs for DO are based on daytime grab sample data collected in the 1950s and 1960s and represent conditions already impacted by decades of watershed alteration and nonpoint source pollution.

32. Comment(s):
Page 5-8, last paragraph. The Revised Draft TMDL states:

"Altering the shape of the hydrograph through anthropogenic manipulation simultaneously alters the seasonal pattern of DO availability. For example, lower flows from April to September likely result in lower DO concentrations by increasing the rate at which the river heats during the summer months, thereby reducing the concentration of DO at saturation. Further, the warm and slow moving conditions behind the dams promote the excess growth of algae which simultaneously promotes wider fluctuations in DO, including much lower night concentrations than occur naturally."

While it is correct that elevated temperatures lead to a decrease in dissolved oxygen saturation concentration, this argument completely ignores mechanical reaeration dynamics and local conditions in the river. Mechanical reaeration is typically represented as proportional to velocity and inversely proportional to depth (Bowie et al. 1985). So it is true that, while decreased flows lead to decreased velocity, reduced flows also lead to decreases in depth. Further, reaeration is a local phenomenon in the river which changes considerably under various flow regimes. In short, one cannot simply state that lower flows result in decreases in DO saturation without a more comprehensive assessment. Again, there is no quantification of these statements: would this assumed reduction be 0.01% or 10 percent? Simply stating that it is "lower" is not constructive.

Comment(s) Made By:
Hemstreet - PacifiCorp

Response:

Staff agrees with the commenter that when discussing specific locations in the river, one must take into account local phenomena such as the presence of falls or rapids, deep pools, channel constrictions, channel braiding, etc. when considering the effects on DO In this case, the discussion is not about specific locations but about the overall DO dynamics. Further, the paragraph cited is referring to the alteration of DO "at saturation" which is a measure of DO regardless of reaeration. The point of the cited paragraph is to indicate the change in DO concentrations at saturation that occur simply because of the presence of the dams.

33. Comment(s):
Page 5-9, Paragraph 1, Line 1 (Section 5.3.1.6). The Revised Draft TMDL states "Chapter 4.0 presents a USEPA's CADDIS generic conceptual model of the effects on DO expected from activities such as…" Why should the CADDIS model be relied upon? Though the CADDIS model could possibly be a very useful tool in water quality analyses, there is nothing to suggest that the results of CADDIS are applicable to the Klamath Basin.

Comment(s) Made By:
Hemstreet - PacifiCorp

Response:
The CADDIS model has been moved to Chapter 5 where it is used to provide a framework for the discussion of past activities in the watershed and their potential effect on DO, as measured in the 1950s and 1960s. This is significant because the existing SSOs for DO are based on daytime grab sample data collected in the 1950s and 1960s and represent conditions already impacted by decades of watershed alteration and nonpoint source pollution.

34. Comment(s):
Page 5-11, Paragraph 1, Lines 2-10. The Revised Draft TMDL states "The phosphorus-rich volcanic geology and organic wetland soils of the upper basin naturally feed episodic algae blooms downstream in the Klamath River mainstem leading to diurnal fluctuations in DO, particularly during the summer months. These natural conditions originate in the reaches downstream of Upper Klamath Lake in Oregon. Under natural conditions, they dissipate slowly in the downstream direction. Under existing conditions, though, *the fluctuation of DO is exacerbated and perpetuated further downstream by impoundments, agricultural return flows, water diversions, reduction in stream bank stability, reduction in stream side shade, and increase in sediment delivery* – conditions which were present when the SSOs for DO were first established" (emphasis added). How were dissolved oxygen conditions assessed to determine that impoundments perpetuate exacerbated DO fluctuations – was an existing conditions without dams scenario simulated to compare to baseline, and if so, are these results available? What are the specific diversions and agricultural return flows along the Klamath River being referred to in this statement? Where has stream bank instability in the mainstem

occurred (e.g., how many miles, and what is the natural instability of banks in the main stem)? To support this statement, the Revised Draft TMDL needs to quantify the reduction in stream shade on the Klamath River mainstem and provide estimates of what changes have occurred over the past 50, 100, and 150 years. What was the disturbance regime of mainstem riparian vegetation, i.e., how often was it removed by fire, flood, beaver, disease, etc.). What quantitative impact does increased sediment delivery have on DO?

Comment(s) Made By:
Hemstreet - PacifiCorp

Response:
Staff disagrees that the cited statement requires quantification of the sort suggested. The statement made is based on a qualitative assessment of the conditions and parameters influencing DO in the Klamath River and is based on the conceptual model developed specific to the Klamath River, as well as the CADDIS conceptual model.

35. Comment(s):
Page 5-12, last paragraph. The Revised Draft TMDL states:

"Staff concludes that the SSOs for DO in the Klamath River mainstem must be updated to: a) accurately depict daily minima conditions and b) deliberately define background conditions. As they are currently set, the SSOs for DO in the Klamath River mainstem are outdated with respect to the monitoring tools currently available. And, they erroneously establish as background, conditions which very likely reflect significant anthropogenic influence. More accurate and protective SSOs for DO would reflect the actual daily minima expected during the early morning hours and would be based on natural background conditions."

The goal of the SSOs for DO are not to protect fish populations, but to achieve hypothesized "pre-disturbance" conditions. Such conditions and SSOs have been set with little regard to attainable water quality standards or on-the-ground conditions in the Klamath River basin.

Comment(s) Made By:
Hemstreet - PacifiCorp

Response:
One of the goals of the recalculated SSOs for DO is to protect beneficial uses, including salmonid populations. Ideally, staff would have proposed DO objectives based on the life cycle requirements of salmonids, ensuring no production impairment, particularly given the threatened and endangered species status of several of the salmonids in the basin. But, the *Klamath TMDL model* demonstrates that under natural conditions DO does not consistently achieve the concentrations required to ensure no production impairment. There are a number of reasons why this may be true and the commenter is referred back to the DO Staff Report for additional information.

In summary, rather than establish the SSOs at DO concentrations known to allow for production impairment of salmonids, staff proposes to establish the SSOs based on natural conditions. As stated by Tudor Davies, USEPA Director of the Office of Science and Technology in a memorandum dated November 5, 1997, "For aquatic life sues, where the natural background concentration for a specific parameter is documented, by definition that concentration is sufficient to support the level of aquatic life expected to occur naturally at the site absent any interference by humans."

With respect to attainability, staff point out that the existing SSOs for DO are established at concentrations unattainable under barometric pressures and temperatures naturally found in the Klamath. The recalculated SSOs for DO are specifically designed to correct this problem and ensure their physical attainability.

36. Comment(s):
Page 6-6, last paragraph. The Revised Draft TMDL states:

"In 2005, peer reviews of the Klamath TMDL model were completed by Dr. Scott Wells (developer of CE-QUAL-W2 model), Portland State University; Brown & Caldwell (under contract to the City of Klamath Falls, Oregon); and the U.S. Bureau of Reclamation (Technical Services Center – Environmental Applications and Research Group, Denver). Peer review materials were also sent to Dr. Michael Deas, Watercourse Engineering, Inc., developer of the PacifiCorp Model. Dr. Deas did not submit any comments at that time."

Please note that neither the Regional Board nor EPA issued a contract that would allow Dr. Deas the means to provide peer review comments. Thus, no comments were submitted.

Comment(s) Made By:
Hemstreet - PacifiCorp

Response:
Dr. Deas was given the opportunity to comment on the Klamath TMDL model both as the originator of the model *and* as a paid consultant to PacifiCorp. The Regional Board and EPA hoped that PacifiCorp would fund Dr. Deas' review of the model and would have found his input useful at that juncture.

37. Comment(s):
Page 6-10, end of section 6.2.3. The Revised Draft TMDL states "The model simulation was run for the year 2000." The model run was only done for one year. In contrast, the existing SSOs from the 1950s and 1960s were based on monitoring data from multiple years. This suggests that the existing SSOs were based on a more comprehensive data set.

Comment(s) Made By:

Hemstreet - PacifiCorp

Response:
The existing SSOs for DO were indeed based on an comprehensive data set, covering many months and years during which numerous climatic conditions were represented. Each month's data, however, represents only one moment during the month, and generally during daylight hours. As such, it is very limited in its ability to predict daily minima. The *Klamath TMDL model*, on the other hand, produces DO simulations for every hour of every day over the course of a year. While interannual variability is not well represented, diel variability certainly is. With respect to identifying daily minima, the *Klamath TMDL model* provides a far more comprehensive data set.

Comments Provided as Oral Testimony at Klamath TMDL/DO Workshops:
None

Comments on Klamath TMDL Staff Report relevant to SSO for DO

Public comments and oral testimony were submitted on the monitoring plan, economic analysis, CEQA analysis, and implementation plan chapters of the Klamath TMDL Staff Report of which the DO Staff Report is a part. These chapters are incorporated into the DO Staff Report by reference and describe factors relevant to implementing the recalculated SSOs for DO in the mainstem Klamath River. Responses to those comments are included as an attachment to the Executive Office Summary Report for the Klamath TMDLs and are not reproduced here. They will, however, be made a part of the administrative record associated with the recalculated SSOs for DO in the mainstem Klamath.