***Staff Report***

***Justification for Revisions Proposed to the***

***Hoopa Tribe’s Water Quality Control Plan***

Prepared for the:

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### SUMMARy

This document summarizes and provides justification for the proposed revisions to the Hoopa Valley Tribe’s 2008 Water Quality Control Plan (WQCP)(Hoopa Valley Tribe 2008). It is organized by pollutant. Table numbers correspond to those used either in the source document (2008 WQCP or NCRWQCB 2010). The figures included in this document do not appear in the 2008 WQCP, so are numbered according to their appearance herein.

U.S. EPA approved amendments to Hoopa's Water Quality Control Plan (WQCP) for several parameters including dissolved oxygen, total nitrogen and total phosphorus, "with the understanding that unless and until the Hoopa Valley Tribe completes the process of establishing Natural Condition reference conditions, the stated numerical criteria... will constitute the operative criteria for all purposes." (EPA approval letter, Feb 14, 2008.). In December of 2010, U.S. EPA approved the North Coast Regional Quality Control Board’s (NCRWQCB) Total Maximum Daily Loads (TMDLs) and Basin Plan Amendment for the Klamath River. The water quality simulation model developed for the TMDLs, composed of a series of integrated models, provided a methodology to generate specific and reproducible natural conditions numbers for water temperature and dissolved oxygen. The model results demonstrated TMDL compliance with the Hoopa WQCP. U.S. EPA and the Hoopa Valley Tribe engaged in email correspondence and conference calls in 2012 to discuss whether the Tribe’s triennial review of its WQCP would include a process for establishing Natural Conditions. In those discussions, U.S. EPA and the Hoopa Valley Tribe reached agreement on what updates should be made to the WQCP as part of triennial review. This memorandum provides a justification for those proposed revisions.

Any proposed additions to the WQCP (including Appendices) will appear as red underlined text and any deletions will appear as ~~red struck through text~~.

### Proposed revisions

**Total Nitrogen (TN) and Total Phosphorus (TP)**

Existing criteria in 2008 WQCP (p. 53)

Nutrients ‐ For the Klamath River only (Trinity River standards yet to be developed), the mean nutrient concentrations in any 30‐day period from May‐ October shall not exceed the values shown in Table 3.2. There should be at least two samples per 30‐day period. If total nitrogen and total phosphorus standards are not achievable due to natural conditions, then the standards shall instead be the natural conditions1 for total nitrogen and total phosphorus.

***Table 3.2*** *– Klamath River Nutrient Criteria Standards.*

|  |  |
| --- | --- |
| **Parameter** | **Standard** |
| Total Nitrogen (TN) (mg/L) | 0.2 mg/L |
| Total Phosphorus (TP) (mg/L) | 0.035 mg/L |

1 Through consultation, the ongoing TMDL process for the Klamath River is expected to further define these natural conditions.

Proposed changes

No changes proposed.

Justification:

The methodology for developing the numeric criteria for TN and TP are described in the Tribe’s 2008 WQCP. As noted in the summary above, U.S. EPA has approved these numeric criteria. The “T1BSR” model scenario from the Klamath River TMDL model indicates that these numeric criteria would be achievable under natural conditions (Figure 1), but the fate of the Klamath River TMDLs adopted by states of California and Oregon are not completely certain due to unresolved legal challenges by other parties and the State of Oregon’s ongoing reconsideration of parts of the Upper Klamath and Lost River TMDLs. Given this uncertainty, and the lack of a strong reason why any revisions need to be made, during the current triennial review process the Tribe has opted not to include any revisions to the TN and TP criteria or establish a process for determining natural conditions for TN and TP.





Figure 1. Comparison of Hoopa Valley Tribe’s nutrient criteria for total nitrogen (top panel) and total phosphorus (bottom panel) and modeled natural conditions from the Klamath River TMDL model scenario “T1BSR” (NCRWQCB 2010). The modeled TN concentrations slightly exceeded the Tribe’s criteria for a few days in May but the exceedance is de minimis.

# Water Column Dissolved oxygen (DO)

Existing criteria in in 2008 WQCP (page 52):

ii. Water Column Dissolved Oxygen – For the Trinity River and other Reservation Tributaries with the designated uses from §3.5.1 (A), the minimum level of dissolved oxygen shall not drop below **11.0 mg/l** in the water column. Klamath River D.O. criteria based on the designated use COLD (year-round), the 7-day moving average of the daily minimum D.O. in the water column shall not drop below **8.0 mg/L**, whereas SPWN (whenever spawning occurs, has occurred in the past or has potential to occur), the 7-day moving average of daily minimum D.O. in the water column shall not drop below **11.0 mg/L**. 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. If water quality monitoring indicates that dissolved oxygen levels are below the criteria listed, then an investigation of impact will be conducted.

Proposed criteria (changes highlighted in red):

ii. Water Column Dissolved Oxygen – For the Trinity River and other Reservation Tributaries with the designated uses from §3.5.1 (A), the minimum level of dissolved oxygen shall not drop below **11.0 mg/l** in the water column. Klamath River D.O. criteria based on the designated use COLD (year-round), the 7-day moving average of the daily minimum D.O. in the water column shall not drop below **8.0 mg/L**, whereas SPWN (whenever spawning occurs, has occurred in the past or has potential to occur), the 7-day moving average of daily minimum D.O. in the water column shall not drop below **11.0 mg/L**. 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 temperatures1. If water quality monitoring indicates that dissolved oxygen levels are below the criteria listed, then an investigation of impact will be conducted.

1Corresponding DO concentrations are calculated as daily minima, based on site-specific barometric pressure, site-specific salinity, and natural receiving water temperatures as estimated by the T1BSR run of the Klamath TMDL model and described in Tetra Tech, December 23, 2009, *Modeling Scenarios: Klamath River Model for TMDL Development.*  The estimates of natural receiving water temperatures used in these calculations may be updated as new data or method(s) become available. To facilitate interpretation of the standard, the following table contains monthly minimum of daily minimum dissolved oxygen values corresponding to 90% saturation as calculated from monthly minimum water temperatures predicted by the T1BSR model scenario for the Klamath River at Saints Rest Bar on the Reservation:

|  |  |
| --- | --- |
| **Month** | **Monthly Minimum of** **Daily Minimum Dissolved Oxygen (mg/L)** |
| January | 11.0 |
| February | 10.6 |
| March | 10.0 |
| April | 9.5 |
| May | 8.5 |
| June | 7.6 |
| July | 7.4 |
| August | 7.3 |
| September | 7.8 |
| October | 8.3 |
| November | 10.1 |
| December | 11.0 |

Justification for proposed changes:

As noted in the summary above, U.S. EPA approved the numeric criteria for D.O. in 2008, but in its acceptance letter noted that the natural conditions would not have effect unless the Tribe defined a process for establishing natural conditions. The Tribe considered several options for defining natural DO conditions, and in the end chose the same process used by the North Coast Regional Water Quality Control Board to develop DO criteria for the Klamath River (NCRWQCB 2010 Appendix 1, NCRWQCB 2011). The process relies on water temperatures predicted by the “T1BSR” natural conditions scenario of the Klamath River TMDL model, from which 90% dissolved oxygen saturation is then calculated. The proposed revisions would create consistency with the regulatory authority upstream and downstream of the Hoopa Valley Reservation.

An alternative approach considered, but not selected, was to use dissolved oxygen saturations directly predicted from the Klamath River TMDL model. Modeling dissolved oxygen requires simulation of inherently complex biochemical processes such as photosynthesis and respiration by communities of living organisms, and thus predictions for dissolved oxygen are subject to a relatively high degree of uncertainty. In contrast, water temperatures can be modeled without biology or ecology, relying solely using physics which can be adequately represented by mathematical equations; thus, predicted temperatures are subject to relatively less uncertainty than dissolved oxygen concentrations.

The wording of the footnote proposed for insertion into the WQCP is nearly identical to the NCRWQCB (2011) Basin Plan:

“Corresponding DO concentrations are calculated as daily minima, based on site-specific barometric pressure, site-specific salinity, and natural receiving water temperatures as estimated by the T1BSR run of the Klamath TMDL model and described in Tetra Tech, December 23, 2009. Modeling Scenarios: Klamath River Model for TMDL Development. The estimates of natural receiving water temperatures used in these calculations may be updated as new data or method(s) become available. After opportunity for public comment, any update or improvements to the estimate of natural receiving water temperature must be reviewed and approved by Executive Officer before being used for this purpose.”

Two minor differences between the wording of the NCRWQCB Basin Plan and the wording of Tribe’s proposed standards are: 1) the Tribe’s proposed standards do not include the last sentence of the Basin Plan because it is not applicable, 2) The Tribe’s proposed standard includes a new sentence “To facilitate interpretation of the standard, the following table contains monthly minimum dissolved oxygen values corresponding to 90% saturation as calculated from monthly minimum water temperatures predicted by the T1BSR model scenario for the Klamath River at Saints Rest Bar on the Reservation” and a table. The Basin Plan does not include such a table, which therefore impedes a user’s ability to easily apply the standard because it necessitates consultation an external document (i.e., Appendix 1 of NCRWQCB 2010). For September through May, the 90% saturation values for September-May were taken from the "Hoopa" row in Table 7.4 in Klamath TMDL (NCRWQCB 2010) appendix 1. The values for June-August were calculated from the 85% values presented in that same table. Table 7.4 had 85% saturation values for June-August, so the 90% saturation were calculated by dividing the 85% saturation by 0.85 to get 100% saturation, then multiplying by 0.90. The 85% values in the table already been rounded to the nearest 0.1 mg/L in Table 7.4. It would have been slightly better to use un-rounded value (i.e., to nearest 0.01 mg/L), because the calculated 90% values may be off by up to 0.1 mg/L from the true values, but it would have been time consuming for NCRWQCB/EPA to retrieve the original un-rounded values from archival files.

During discussions in 2012, U.S. EPA asked the Tribe why the first part of the footnote describes the calculations as *daily minimum* but then in the second part of the footnote and table uses estimates of *monthly minima*. The remainder of this paragraph paraphrases the Tribe’s response, in case this information is helpful for future reference. The table balances several conflicting goals: 1) maintain standardization/compatibility with the NCRWQCB standards and the Tribe’s numeric criteria, and 2) figure out an easy way (based on information already had in-hand) way to provide numbers for the footnote. The resulting compromise is functional but not perfect. Since the Tribe's numeric criteria are based on the 7-day moving average of the daily minimum D.O., ideally the natural conditions clause/footnote would also be based on a 7-day moving average. However, the Tribe did not have ready access to daily outputs from the TMDL model, only the monthly minimum values in Table 7.4., so that is why the table in the footnote presents monthly minimum values. The beginning of the footnote references daily minima because that's what the NCRWQCB standards are. There is no inherent conflict between having the criteria be daily, but presenting example monthly values in the table (the way to interpret this is that the daily minimum value for any day within a month cannot be lower than the monthly minimum). In response to U.S. EPA’s comment, the Tribe revised the description of “monthly minimum dissolved oxygen” to “monthly minimum of daily minimum dissolved oxygen” in an attempt to clarify.

Another issue mentioned by U.S. EPA in 2012 was whether the most appropriate location from Table 7.4 for the Hoopa portion of the Klamath River is "Downstream Salmon River" rather than “Hoopa.” The remainder of this paragraph paraphrases the Tribe’s response, in case this information is helpful for future reference. Table 7.4 includes 90% saturation concentrations for all months for "Downstream of Salmon River”, but for “Hoopa” it presents 90% saturation concentrations for September through May and 85% saturation concentrations for June through August. 90% saturation concentrations for June, July and August can be estimated from the 85% saturation concentrations by multiplying the 85% concentrations (column A in Table 1) by 1.056 (90/85), resulting in the values in Column B of Table 1. The "Downstream of Salmon River" outputs are from directly below the Salmon River confluence, which is at river mile 66, 21 miles upstream of Saint's Rest Bar on the Hoopa Reservation. The elevation difference between those two sites is 463 ft vs 194 ft (actually 194 ft is for the Klamath/Trinity confluence at river mile 43.5 but for purposes of these calculations is close enough). The maximum amount of oxygen that water can hold is affected by air pressure. Since air pressure is higher at lower elevation, dissolved oxygen concentration increases as elevation declines (i.e., as water flow downstream). At summer water temperatures (i.e., ~20C) 90% saturation of DO should be 0.08 mg/L higher at the Trinity confluence than Salmon River confluence due to differences in elevation (and hence air pressure). Column D in Table 1 compares the estimated 90% saturation at “Hoopa” (Column B) with the 80% saturation at "Downstream of Salmon River" (Column C); all values in column D are <=0.1 mg/L except July which is 0.2 mg/L. Based on elevation difference it is expected that “Hoopa” should be 0.08mg/L higher than “Downstream of Salmon River” and therefore the July difference is quite small (i.e., <=0.1 mg/L), when the 0.08 mg/L is taken into account. Given the difference in elevation, plus the additional dynamics that occur in the 21 river miles which allow processes such as decomposition of upstream organic matter and nutrient removal, it is slightly more accurate use the “Hoopa” site rather than the “Downstream of Salmon River” site, even if the June, July and August 90% saturation concentrations must be estimated from the 85% saturation concentrations in Table 7.4.

Table 1. Comparison of dissolved oxygen concentrations at 85% and 90% percent saturation calculated from temperatures at two locations predicted by the “T1BSR” natural conditions scenario Klamath TMDL model. Columns A and C are extracted from Table 7.4 in Appendix 1 of NCRWQCB 2010. Columns B and D are calculated from columns A and C. Refer to text above for details.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Month** | **A) Minimum monthly D.O. (mg/L) based on 85% saturation at natural temperatures for June-Aug and 90% for September-May, at "Hoopa"** **(from Table 7.4)** | **B) Minimum monthly D.O. (mg/L) calculated based on 90% saturation at natural temperatures, at "Hoopa"** | **C) Minimum monthly D.O. (mg/L) based on 90% saturation at natural temperatures, at "Downstream of Salmon River"****(from Table 7.4)** | **D) 90% "Hoopa" minus 90% "Downstream of Salmon River"** |
| January | 11.0 | 11.0 | 11.1 | -0.1 |
| February | 10.6 | 10.6 | 10.6 | 0.0 |
| March | 10.0 | 10.0 | 9.9 | 0.1 |
| April | 9.5 | 9.5 | 9.4 | 0.1 |
| May | 8.5 | 8.5 | 8.5 | 0.0 |
| June | 7.2 | 7.6 | 7.6 | 0.0 |
| July | 7.0 | 7.4 | 7.2 | 0.2 |
| August | 6.9 | 7.3 | 7.2 | 0.1 |
| September | 7.8 | 7.8 | 7.7 | 0.1 |
| October | 8.3 | 8.3 | 8.2 | 0.1 |
| November | 10.1 | 10.1 | 10.0 | 0.1 |
| December | 11.0 | 11.0 | 10.9 | 0.1 |

# Inter-gravel Dissolved oxygen (DO)

Existing criteria in in 2008 WQCP (page 52):

iii. Inter-gravel Dissolved Oxygen - The inter-gravel dissolved oxygen on the Trinity River and other Reservation Tributaries with the designated uses from §3.5.1 (A), shall not be decreased below **8.0 mg/l** by any human related activity. Klamath River D.O. criteria that are based on the designated use SPWN (whenever spawning occurs, has occurred in the past or has potential to occur), where the 7- day moving average of the daily minimum D.O. in the inter-gravel water shall not drop below **8.0 mg/L**. 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.

Proposed criteria (changes highlighted in red):

iii. Inter-gravel Dissolved Oxygen - The inter-gravel dissolved oxygen on the Klamath River, Trinity River, and other Reservation Tributaries with the designated uses from §3.5.1 (A), shall not be decreased below **8.0 mg/l** by any human related activity. ~~Klamath River D.O. criteria that are based on the designated use SPWN (whenever spawning occurs, has occurred in the past or has potential to occur), where the 7- day moving average of the daily minimum D.O. in the inter-gravel water shall not drop below~~ **~~8.0 mg/L~~**~~. 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~~.

Justification for proposed changes:

The Tribe’s 2002 WQCP included an 8 mg/L inter-gravel DO standard for all reservation waters. When the Tribe was in the process of updating its WQCP in 2005-2006, the NCRWQCB was proposing to include an inter-gravel DO standard in their Basin Plan. The NCRWQCB’s draft proposed inter-gravel DO criteria served as the model for the Tribe’s 2008 WQCP criteria, with the addition of a natural conditions clause.

In subsequent years, NCRWQCB’s DO Basin Plan amendment moved very slowly and their staff recommendations changed. The NCRWQCB (2009) staff report stated: "SPWN: Staff does not recommend adding intragravel DO requirements to the Basin Plan at this time. Instead, staff recommends water column criteria that are 3 mg/L greater than the DO concentration required in the intragravel environment to protect eggs and pre-emergence life stages, as described above." The final version of DO amendment to the Basin Plan, which did not include an intragravel standard, was finally approved by the NCRWQCB in June 2015 (NCRWQCB 2015), the State Water Resources Control Board in February 2016, and is current pending being considered by U.S. EPA. (see <http://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/dissolved_oxygen_amendment.shtml>).

The NCRWQCB 2009 staff report describes reasons why it decided not to include an inter-gravel standards in its DO amendment: 1) intergravel DO is not commonly measured, 2) there is no standard method for measuring intergravel DO, 3) monitoring the inter-gravel environment during spawning, egg incubation, or early development might cause direct harm to eggs or alevin.

The Tribe’s 2008 WQCP included a natural conditions clause for inter-gravel DO concentrations but did not define a method for determining natural inter-gravel DO concentrations. In the current triennial review, the Tribe is adopting a method for determining water column DO concentrations (see above), but this method is not applicable to inter-gravel DO. Given the complexities involved in measuring intergravel DO, and the other factors mention in the previous paragraph, the Tribe concurs with the NCRWQCB’s approach that inter-gravel DO is best protected by ensuring adequate DO in the water column. Thus, for inter-gravel dissolved oxygen, the Tribe proposes to remove the numeric criteria for Klamath River DO and accompanying natural conditions clause that was adopted in 2008 WQCP, and revert back to the 2002 WQCP’s original inter-gravel criteria that “inter-gravel dissolved oxygen … shall not be decreased below 8.0 mg/l by any human related activity”. An alternative would have been to completely drop the inter-gravel criteria, but the Tribe chooses instead to retain it to be protective in the case of a human-caused event such as a spill which might disproportionately affect inter-gravel DO relative to water column DO.

### REFERENCES CITED

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