Responses to Comments
On the
Draft TMDL Action Plan for the Upper Elk River Sediment TMDL

Prepared by:
North Coast Regional Water Quality Control Board
April 7, 2016

I. PROCEDURE

On December 24, 2015, the North Coast Regional Water Quality Control Board (Regional Water Board) issued a *Notice of Public Comment Period, Workshop and Hearing to Consider Adoption of the Draft Basin Plan Amendment to the Water Quality Control Plan for the North Coast Region for the Upper Elk River Sediment Total Maximum Daily Load and Action Plan* and posted *The Draft Action Plan For The Upper Elk River Sediment TMDL (TMDL Action Plan)* for public review. The TMDL Action Plan largely relies on the technical analysis presented in the *Upper Elk River: Technical Analysis for Sediment* (Technical Report), which is a comprehensive assessment of sediment conditions and associated beneficial uses in the Upper Elk River Watershed, produced by Tetra Tech, Inc. and dated October 21, 2015. The Technical Report is a condensed summary of multiple larger technical reports, including:

- Peer Review Draft TMDL Staff Report (Regional Water Board 2013a)
- Formal Peer Reviews and Staff Responses to Peer Review Comments 2013 (Regional Water Board 2013b).
- Informal Comments on the Peer Review Draft and Staff Reponses to Informal Comments (Regional Water Board 2015)
- Humboldt Redwood Company Watershed Analysis Revisited (HRC 2014)
- Salmon Forever Analysis 2013 (Lewis 2013)
- Elk River Hydrodynamic and Sediment Transport Modeling Pilot Project (Northern Hydrology Engineering and Stillwater 2013)
- Humboldt Redwood Company Report of Waste Discharge (HRC 2015)

The Public Notice indicated that with respect to CEQA, the TMDL Action Plan relies on the analyses conducted for three related projects, namely:

1. The Substitute Environmental Document (SED) for the Policy for the Implementation of Water Quality Objectives for Temperature (Temperature Policy), adopted by the Regional Water Board on March 13, 2014.
2. An addendum to the Temperature Policy SED for the Policy in Support of Restoration in the North Coast Region adopted by the Regional Water Board January 24, 2015.
3. The Initial Study and Mitigated Negative Declaration for the draft Waste Discharge Requirements for nonpoint source discharge and other controllable factors associated with activities on timberlands in the Upper Elk River Watershed owned by Humboldt Redwood Company to be considered in a hearing on April 7, 2016.

On February 5, 2016, Regional Water Board staff conducted a public workshop to review the contents of the TMDL Action Plan and answer questions. The written public comment period for the TMDL Action Plan, Technical Report, and CEQA closed on February 15, 2016. This document summarizes the main comments and provides staff's responses to those comments. The TMDL Action Plan will be revised and updated based on public comments received. A proposed TMDL Action Plan, as well as an adopting resolution, will be included in the Regional Water Board agenda package, typically available on our website beginning at least 10 days prior to the public hearing. The public hearing is scheduled for April 7, 2016 in the Eureka City Council Chambers, Eureka, CA.

II. COMMENTERS

Kristi Wrigley, Elk River resident
Jesse Noel, Elk River resident
Joel Fonner, Elk River resident
Lisa O'Keefe, Elk River resident
Christina Pasteris, Elk River resident
Matthew Turner, Elk River resident
Sylvia DeRooy, Elk River resident
Phillip & Sloan Nicklas, Elk River resident
Jerry Martien, Friends of Elk River
Nathan Madsen, interested party
Hank Seeman, County of Humboldt
Mike Miles, Humboldt Redwood Company (HRC)
Rob DiPerna, Environmental Protection Information Center
Wayne Whitlock, representing Humboldt Redwood and Green Diamond Resource Company
Vivian Helliwell, Pacific Coast Federation of Fishermen's Associations and Institute for Fisheries Resources
Ken Pimlott, California Department of Forestry and Fire Protection (CAL FIRE)
Gary Rynerson, Green Diamond Resource Company (GDRCo)
Dr. Lee MacDonald, consultant for Humboldt Redwood Company
Janet Parrish, United States Environmental Protection Agency, Region IX (US EPA)

Substantive comments received during the comment period are summarized below, followed by Regional Water Board staff response. Where commenters have made similar comments, those comments are summarized and a single response presented. Revisions to the December 24, 2015 TMDL Action Plan are reflected in the proposed TMDL Action Plan that will be considered for adoption by the Regional Water Board on April 7, 2016, and are highlighted in a "redline-strikethrough" version. The original comment letters are included as Attachment 1.

III. RESPONSES TO COMMENTS

Numerous comment letters were received from interested parties on the TMDL Action Plan, Technical Report, and CEQA documents. Commenters included federal, state, and local agencies; commercial timberland owners and their consultants; Elk River residents; environmental and advocacy organizations; and others. As a point of clarification, the Regional Water Board will be asked to consider adoption of an amendment to the Water Quality Control Plan for the North Coast Region (Basin Plan) to incorporate an Action Plan for the Upper Elk River Sediment TMDL. The proposed TMDL Action Plan before the Board will be a revised version that incorporates public comments, as appropriate. The Board will establish its adoption of the proposed TMDL Action Plan via an adopting resolution, which in combination with the adopted TMDL Action Plan includes all the elements necessary for US EPA approval of a TMDL. The *Upper Elk River: Technical Analysis for Sediment* by Tetra Tech dated October 21, 2015, on the other hand, is a final document and will not be revised; nor will the report be adopted by the Regional Water Board. It is simply a technical report that serves as a Staff Report, providing the scientific basis for the proposed TMDL Action Plan, as well as the Waste Discharge Requirements for Humboldt Redwood Company, also to be considered by the Board for adoption in April 2016.

Comments can generally be divided into 5 categories. These include comments related to the underlying science, comments related to the Human Right to Water, comments specific to the contents of the TMDL Action Plan, comments including an alternative approach to beneficial use attainment, and comments of a legal nature.

IV. **OVERVIEW**

Many comments focused on various elements of the source analysis that are uncertain, describing either too much or too little of the overall sediment loading as anthropogenic in origin. Responses to specific categories of comments are offered below. But, as an overview, it is important to make several general points.

- First, the collected data and special studies that form the basis for the source analysis and TMDL involve the skills, talent, and guidance of multiple reputable partners, have been reviewed by a panel of scientific peer reviewers, and have been synthesized by a third party consultant (US EPA's consultant Tetra Tech). All efforts to ensure accurate, reliable data have been made.

- Second, every environmental analysis includes some level of uncertainty, which is larger or smaller depending on the number of data, the number of assumptions required in its analysis, and how and for what purposes a given data set is extrapolated. The Upper Elk River sediment source analysis and TMDL are based on far more watershed-specific data than has been available in the development of any other sediment TMDL in the North Coast Region. So, to the degree that data have been extrapolated from one watershed to another, it has generally been between subbasins of the Elk River.

- Third, the proposed TMDL Action Plan specifically relies on continued monitoring and scientific evaluation to improve our understanding of conditions in the basin. The Elk River Recovery Assessment will help us to better define the desired future conditions through the impacted reach to Humboldt Bay. The monitoring designed by the working group of the Watershed Stewardship Program will allow for continual assessment of progress towards meeting system recovery goals. Regular evaluation of the effectiveness of the Program of Implementation will lead to adaptation of the approach, when shown as necessary. Within an adaptive management framework, data-driven changes to the Program of Implementation can and will be accommodated.

- Fourth, the development of a TMDL requires consideration of a margin of safety to ensure that any uncertainty in the data is conservatively managed in favor of water quality protection. Staff argue that the studies conducted in support of the sediment source analysis and TMDL have been designed with the intention of producing as accurate an assessment as possible; where uncertainties exist, conservative assumptions have appropriately been made.

The result is that the sediment TMDL proposed for Board adoption is as accurate as possible, addresses uncertainty through conservative assumptions that favor water quality protection, and includes a Program of Implementation that is designed to allow and encourage ongoing assessment and refinement of the factors most requiring control through ongoing monitoring and adaptive management.

As explained in more detail in the Response to Informal Comments, technical comments often stem from consideration of the regulatory consequences of the technical analysis. Many suggestions have been incorporated into the Technical Report. The sediment loading capacity was recalculated based on existing channel conditions, which is defined as zero in the first phase of a phased TMDL. As a result of this shift, technical uncertainties become less relevant. While we have, and will continue to strive toward as much precision as possible, perfection in the science is not required to move forward with this program.

The proposed Program of Implementation has been significantly modified from what was first presented in the Peer Review Draft Staff Report (Peer Review Draft), and it does not contain detailed and extensive regulatory requirements. The zero load allocation is a basic construct that directs the Regional Water Board to craft waste discharge requirements in a manner that reduce and eliminate waste discharges to the maximum extent practicable. The proposed TMDL Action Plan is clear that the zero load allocation does not constitute an effluent limitation or a waste load allocation, and the Regional Water Board has discretion on how it chooses to implement it. The implementation framework strongly relies on coordinated monitoring and adaptive management as the basis for tracking trends, updating scientific understanding, and modifying implementation actions over time. The intention of the proposed altered Program of Implementation is to focus immediate attention on control of all existing and potential future sediment sources in the upper watershed as phase 1 of the TMDL while a feasibility assessment of sediment and hydrologic remediation and habitat restoration of the impacted reaches and lower watershed is completed.

Many comments from residents focus on past actions of timber companies and appear to hoist the entire responsibility on the Regional Water Board for the impacts in this watershed. Some comments appear to be in the wrong venue as the Regional Water Board is not a court of equity and lacks authority to award damages. For example, a private cause of action for trespass/wrongful occupation is properly filed in superior court. These issues are outside of the scope of the Regional Water Board's expertise, authority and jurisdiction.

The Regional Water Board and its staff have invested extensive resources in addressing concerns of the residents. The Elk River has a long and strained history, and despite numerous efforts to improve conditions, and recent and promising changes in management strategies, the watershed remains severely impaired, specifically the existing beneficial uses in the downstream reach. Aggradation of the impacted reach has continued, causing continued beneficial use impairment and flooding conditions that affect individual health and welfare, the lives and livelihood of a whole community, and private and public property and infrastructure.

The TMDL defines the loading capacity and load allocation as zero until such time as beneficial uses can be restored. But the singular focus by some commenters on the upslope timber companies incorrectly assumes that we can attain water quality standards through regulation of timber alone.

The proposed TMDL Action Plan recognizes that multiple factors influence the effect of sediment in the impacted reach, and additional effort is needed. The Recovery Assessment and Watershed Stewardship Program are conceived for this reason, which through stakeholder involvement will focus on developing strategies to address three key areas: health and safety, sediment remediation and stream restoration, and monitoring and special studies. The proposed TMDL Action Plan represents staffs' best approach for advancing water quality improvements forward in a reasonable and meaningful way. It is truly our intent to find the pathway forward working together, if not perfectly harmonized, in a cooperative and productive manner.

A. <u>Supporting Science</u>

1. Dynamic Equilibrium

Issue: The Technical Report describes that a well-functioning system would be in dynamic equilibrium where, generally, inputs equal outputs. MacDonald criticized the use of dynamic equilibrium as a model for Elk River, stating that the term is "meaningless unless it has a specified time scale." CAL FIRE suggests that other types of equilibria may better suit Elk River and gives alternate conditions such as non-equilibrium and disequilibrium; CAL FIRE leans toward nonequilibrium as Elk River is highly sensitive to episodic events and many watersheds in tectonically active regions display behaviors characteristic of nonequilibrium. Moreover, the system's tendency toward equilibria may change, especially due to disturbance; i.e. a system tending towards dynamic equilibrium could shift into tending towards nonequilibrium due to some threshold perturbation.

Response: Dynamic equilibrium as defined in the Technical Report is more than just inputs equaling outputs, but also a "functioning natural system" and where the "relative balance in sediment input/output is also central to the attainment of WQS." Water quality standards and beneficial uses are legal constructs formulated less than a century ago and thus operate on human timescales (on the order of 10^1-10^2). Elk River before Maxxam's purchase of Palco was in attainment of water quality standards according to interviews from residents in the impacted reach (RCAA, 2003). The shift in tendency towards a different equilibrium requires a threshold disturbance exceeding the assimilative capacity of a system (Sprugel, 1991). Elk River is highly sensitive and thus may have a relatively low threshold. The cumulative impacts of Palco and past management met Elk River's threshold, shifting the system into tending towards an unknown equilibrium state. Assessing the degree to which human intervention can shift the system back into dynamic equilibrium is largely the responsibility of the Recovery Assessment. Nevertheless, Elk River was tending toward dynamic equilibrium before 1988-1997, but is currently no longer tending towards that state. The load allocation for Elk River is zero precisely because continual inputs into the system, natural or anthropogenic, will reinforce the system's tendency towards a different equilibrium that does not attain WQS. Natural disturbances (e.g. climate change) and their cumulative effects may exceed system thresholds; but, such disturbances would likely occur on timescales greater than human lives.

2. Conceptual model

Issue: CAL FIRE suggested that staff not "rely solely on assumptions in the conceptual model" in Figure 12 of the Technical Report, citing the lack of uncertainty associated with elements of the conceptual model. Additionally, CAL FIRE recommends outlining hypotheses for the conceptual model elements in order to determine causality from the different layers of the model.

Response: The purpose of the conceptual model was to illustrate the possible management-related risk factors affecting watershed impacts. The conceptual model is an attempt to comprehensively examine and link all the possible variables that could contribute to sediment production and downstream impairments. The specific linkages from management activities to watershed responses were not assumptions of cause-and-effect mechanisms, but risk factors that may lead to a watershed response. These linkages in themselves can be considered hypotheses and any competing hypotheses would be of the null variety. For example, "Soil Exposure" in Row C could be explained by yarding/roads, legacy practices, current timber harvest, *or* the null hypothesis that soil exposure is due to random chance. Because the Elk River is subject to stochastic events, random chance and the null hypothesis could be interpreted as natural causes.

3. Comments using Elk River Recovery Assessment materials

Several comments used information from the Technical Advisor Committee (TAC) meeting for the Elk River Recovery Assessment as supporting documents. Specifically, MacDonald used the longitudinal profiles and flows measured by the Recovery Assessment to support the comment that the Elk River has inherently "limited sediment transport capacity." MacDonald also used the flood-frequency analysis done by the Recovery Assessment to support the claim that during 1958-1967, Elk River had a relatively quiescent period in terms of peak flow, and thus 1958-1967 is not an appropriate time period to derive numeric targets for bankfull channel capacity on Table 3 of the draft Action Plan.

Response: The Elk River Recovery Assessment team held their first Technical Advisory Committee (TAC) meeting in December, 2015. The presentations and information from this meeting were only for TAC members to review; the team also stated that meeting materials were preliminary and not ready for public release. For this reason, staff has declined to respond to comments that reference TAC meeting materials, because to do so would require using the same materials. Their preliminary nature precludes any meaningful response.

4. Little River

Issue: Dr. MacDonald and CAL FIRE commented on the use of annual water yields for the Little River as a reference gage station for Elk River; the gage station at Elk River operated only between water years 1958 through 1967. Both MacDonald and CAL FIRE noted that annual water yields were an inappropriate measure, citing poor correlations with annual sediment yields. Both suggested instantaneous maximum annual peak flows were the better measure. CAL FIRE pointed out two annual peak flows that corresponded with the 1988-1997 time period. MacDonald performed a regression analysis to relate annual maximum peak flows and annual sediment yield for gage stations operated by HRC, finding a relatively high coefficient of determination. Board member Hales also provided feedback on the use of Little River data.

Response: As requested by commenters, staff has reproduced Figure 16 from the Technical Report (Figure 1 below) using annual peak flows for Little River instead of annual water yield. Annual peak flows from specific years should not be compared to the average sediment loading from Elk River over a time period as CAL FIRE has done, because individual datum of one variable should not be compared to the mean of a different variable (i.e. an ecological fallacy of inference between aggregate and individual data). For the following comparisons, staff uses median peak flows given the lack of corresponding historical annual sediment loads (as opposed to average loads over a time period). The median peak flow for the time period 1988-1997 was the lowest for the 1956-2011 record, yet sediment loading for the same period (1988-1997) was the highest according to Figure 15 from the Technical Report. From 1975 onwards, median peak flows on Little River did not differ greatly, while estimated sediment loadings from Elk River have changed during this time period. The low sediment load for the years 2004-2011from Figure 15 may seem to indicate that management practices have improved, but the narrow distribution of peak flows at Little River for this time period implied a lack of major peak flow events, bringing uncertainty as to the effect of changing management practices. See Attachment 2 for further analysis and discussion on this topic. With respect to weather effects, MacDonald concurs by concluding that "differences in management-related sediment sources over time are primarily due to differences in the amount and type of management activities rather than fluctuations in annual rainfall or annual maximum peak flows."

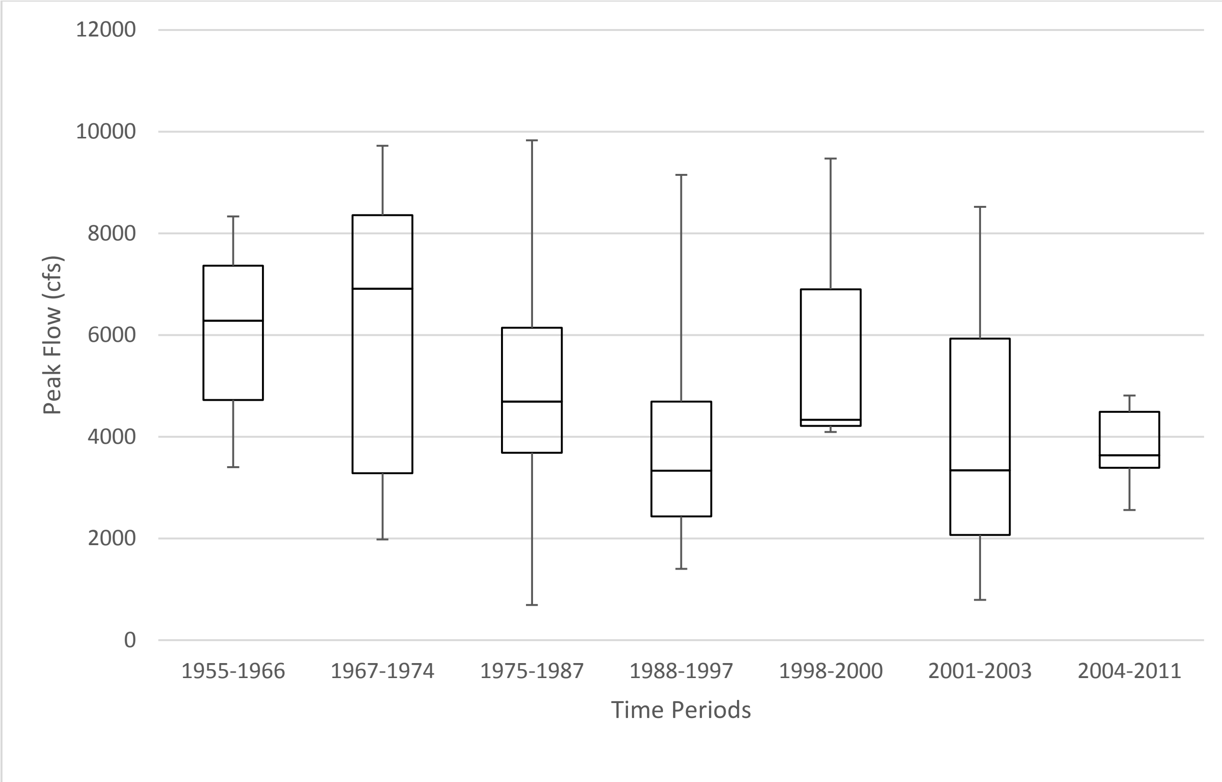

Figure 1: Boxplots of annual peak flows binned by time periods from Figure 16 of the Technical Report

5. Numeric targets

Issue: Numerous commenters have pointed out the inconsistencies in Table 2 and Table 3, which lists the water quality indicators, their numeric targets, and associated areas. EPIC comments that some targets are not 'numeric' despite their column name stating as such. Residents have likewise said the same, conveying confusion over the nature of the targets, numeric or otherwise.

Response: Staff acknowledges the confusion that may arise on seeing the term 'numeric targets,' but not finding an anticipated array of specific numbers. The TMDL Action Plan establishes regulation for the Upper Elk River Watershed. But, neither the TMDL targets nor the water quality objectives, which they are intended to interpret, are independently enforceable. It is their inclusion in a Waste Discharge Requirement or other regulatory control mechanism that makes them enforceable elements, subject to monitoring, assessment, and compliance determination. The purposes of the targets as described in the TMDL Action Plan are to (1) inform provisions in WDRs and waivers and (2) to be used as measures for assessing the overall effectiveness of the Program of Implementation. The numeric targets are generally expressed as "100%," "zero or no new," or "decreasing or increasing trends," all of which establish numeric sideboards, albeit with some discretion of its application within the context of a WDR or waiver. The numeric targets are intended to meet the spirit of the requirements of a TMDL, while establishing a broad range of indicators that are useful to the assessment of watershed recovery. Make note that within the context of adaptive management, future monitoring and study may inform new and improved ways of assessing landscape health and watershed recovery, indicators and targets of which can be incorporated into future regulatory and nonregulatory actions of the Board, as appropriate.

a) Hillslope water quality indicators

Issue: The timber companies and affiliates contest that some targets are infeasible, physically impossible, or has insufficient scientific basis. Conversely, residents and other interested parties say that targets are not stringent enough; Jesse Noell states that a 10% increase in peak flow would be "a death sentence… laughable, not enforceable." HRC gave recommendations on changes to the language of the hillslope targets:

1. "100% of road segments hydrologically disconnected from water courses" to "road segments should be hydrologically disconnected from watercourses to the extent feasible"
2. "100% of harvest areas have ground cover sufficient to prevent erosion" to "harvested areas have ground cover sufficient to prevent surface erosion"
3. "300 feet on either side of the channel" to "riparian zones associated with Class I, II, and III watercourses"

HRC also expressed confusion over the target of "less than 10% increase in peak flows in 10 years related to timber harvest." CAL FIRE recommended that staff explain how each hillslope indicator relates to downstream water quality objectives. Dr. MacDonald criticized the application of the peak flow model to Elk River.

Response: As stated in the response to numeric targets comment, the hillslope targets are not individually enforceable. They inform other regulatory actions and provide a basis for effectiveness monitoring. The peak flow target is based on the peak flow model initially developed by Lewis et al. (2001) at Caspar Creek and then adapted to Elk River (CAL FIRE, 2001; NCRWQCB, 2005). While the peak flow regression model is the same, the parameters differ, including wetness index, recurrence interval flow, and assessment area. MacDonald does not specify what parameters he used. The lower limit to catchment size that was evaluated in the Caspar Creek study was a function of physical constraints associated with gaging streamflow (not just the peak flows) and study treatment areas.

While we appreciate CAL FIRE's effort to explore the topic and that they point out that Appendix A is most reliably applicable to the gaged catchment sizes, we disagree that it should not apply to smaller catchment area, like Class IIIs in Upper Elk River. 25 acres should not be considered the lower limit of catchment size within which meaningful relative peak flow differences can be measured or assessed (Jack Lewis, personal communication). It would seem reasonable to apply that the peak flow regression model to catchments one order of magnitude smaller and that the smaller the catchment, the more direct a relationship between harvest and peak flow changes can be discerned. In fact, it is likely that the Class IIIs would be even more sensitive to peak flow changes than Class IIs because they are often steeper, have largely been impacted by past yarding activities (HRC, 2004), are the watercourses most often hydrologically connected to ridge-top road systems, the entire catchment area may be encompassed within a harvest unit, and generally have less riparian retention. With these factors considered, change in peak flows can have a more significant influence on sediment delivery in smaller Class III catchments than in larger Class II catchment areas.

In order to assess compliance with the peak flow target, the Regional Water Board may require that dischargers report their harvested acreage over the past ten years (or over a projected ten years at the end of a THP) in a spatially explicit format (i.e. a polygon shapefile viewable in ESRI or other GIS software). The percent of canopy removal is an important parameter in the peak flow model and is highly sensitive to assessment area, necessitating evaluation with spatial data. While the regulatory component of the Program of Implementation may require a subbasin-wide harvest limit, the spatial distribution of harvested area is more relevant in estimating peak flow changes in Class II and Class III watercourses.

Concerning the language changes, staff will retain the "100%" as it gives a numeric basis for the elements in the Program of Implementation. The phrases "to the extent feasible" and "sufficient" would lead to arbitrary percentages that may not support water quality standards, whereas "100%" leaves no room for interpretation. The same can be said for the definition of the riparian zones. Again, the water quality indicators may change in the phased TMDL approach. The effort to relate downstream objectives for each hillslope indicator has already been made and can be found in the *Regional Water Board Staff Reponses to Informal Comments Received on The Peer Review Draft Staff Report for the Sediment TMDL in Upper Elk River* (Response to Informal Comments) (NCRWQCB, 2015).

b) Habitat instream water quality indicators

Issue: EPIC and the residents have expressed concern over the omission of habitat-related numeric targets and water quality indicators. HRC has indicated through their AHCPs that the numeric target for chronic turbidity is currently being met for salmonid feeding. HRC further concludes that because there is no numeric target for chronic turbidity, this indicator cannot be evaluated.

Response: HRC did not elaborate on the specific details of how it interprets the numeric target for chronic turbidity in the AHCP and what evidence it has to demonstrate it is being met for salmonid feeding in order for staff to respond. Staff has corresponded with CDFW over the habitat-related instream indicators. The correspondences led to the Technical Report making significant revisions to the instream indicators compared to those found in the Peer Review Draft. Of primary concern are the unique characteristics of the Elk River Watershed that generate particularly fine sediment, when disturbed suggesting that regional habitat targets may not be appropriate. As described in the draft Basin Plan Amendment, "The Elk River Recovery Assessment will provide reach-scale targets defining channel and habitat conditions" specific to the Elk River as derived from sediment and hydrodynamic modeling and assessment of recoverable future conditions. The numeric targets for salmonids remain general until that time. HRC's recommendation to reduce overall turbidity exceedance times is a reasonable informal goal, which staff encourages.

c) Use of historic Elk River USGS gage station

Issue: Dr. MacDonald comments that the 1958-1967 peak flow data for Elk River are not an appropriate target condition, stating that the peak flows for that time period were relatively low compared to current conditions. He explains further that peak flow during the notable 1964 storm events was low because of a lack of snow or due to other "causal processes."

Response: While peak flows were relatively low for Elk River during the 1958-1967 time period compared to more recent flow measurements or to peak flows from other watersheds, a complete flow record does not exist. Thus one is unable to determine rigorously whether those flows were unusually low. In lieu of peak flows, staff uses annual precipitation totals as a proxy for peak flows. Figure 2 shows the empirical cumulative distribution function (ECDF) of annual precipitation measured at Woodley Island with the gage period's years labeled. An ECDF is the probability of a given annual precipitation equaling or being less than all other values below it; i.e. an ECDF is the inverse of an exceedance probability plot. For example, the maximum annual precipitation will yield a cumulative probability of 1.0 because all other values are below the maximum. Using Figure 2, staff determined that during the years for which the gage station was active, the precipitation totals were not out of the ordinary. To the contrary, the cumulative probabilities for the gaged water years were well spread out, indicating that the Elk River gage data are appropriate as a baseline and target condition.

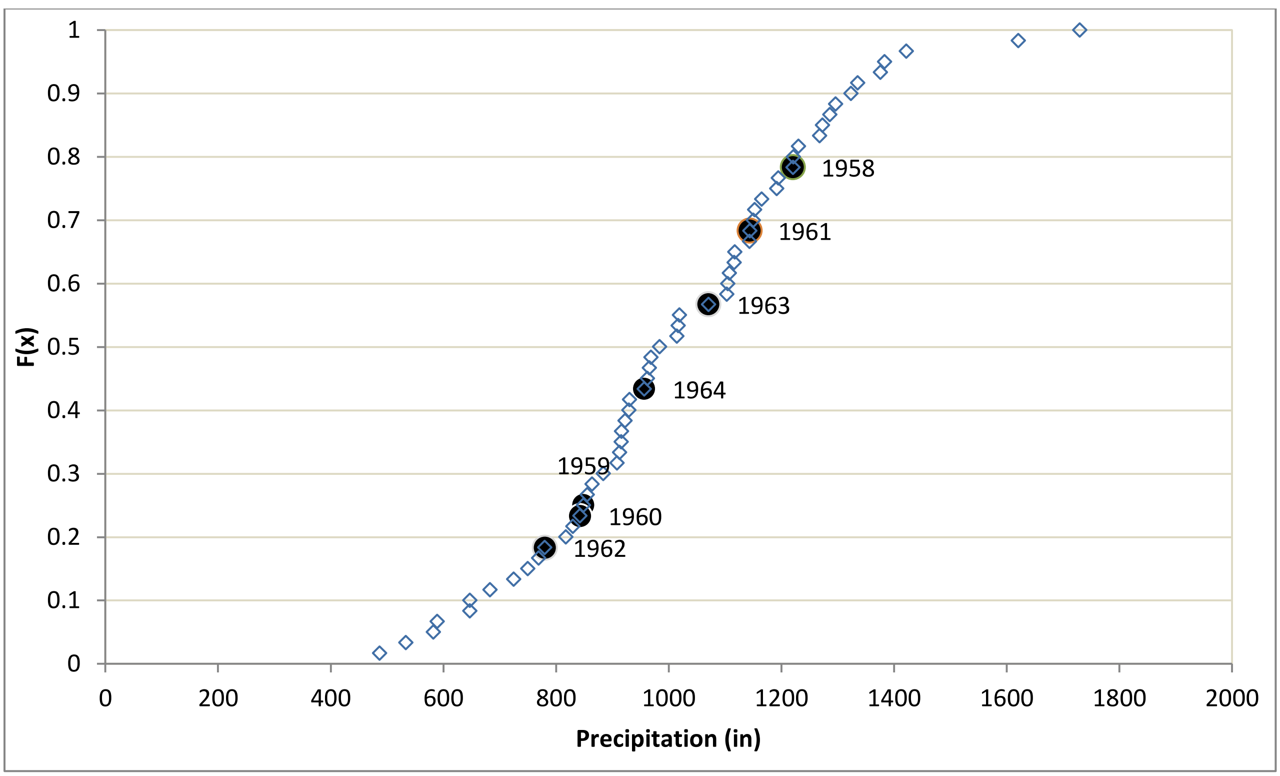

Figure 2: Empirical cumulative distribution function for annual precipitation totals at Woodley Island

6. Source Analysis

a) Lower Elk influences

Issue: HRC and GDRCo expressed concerns over the lack of consideration over Lower Elk River contributions to impairments in the impacted reach, stating that the "unusual bifurcation of the Elk River watershed" results in the exclusion of backwater effects on sediment transport capacity. The companies and their affiliates state that human activities such as road building and diking in the lower floodplain, lack of channel maintenance and riparian vegetation management, and navigation improvements and hardening of the shoreline in Humboldt Bay. Additionally, the commenters cited sea level rise (SLR) as another element exacerbating the Lower Elk and impacted reaches; SLR would reduce the stream gradient and sediment transport capacity of Elk River. Commenters summarize that the combination of continued sediment deposition, human activities, and SLR will amplify the backwater effects into the impacted reach, further reducing the sediment transport capacity. MacDonald notes that the valley bottom was historically an active floodplain that was aggrading over time, and this floodplain would have had a complex channel network developed to accommodate the high flows and provide a greater sediment transport capacity than currently exists.

Response: Staff has considered the potential effects of the Lower Elk on the impacted reach, but the watershed delineation and load allocation are for the Upper Elk and sediment inputs from activities or events upstream of the impacted reach as well as sediment stored in the impacted reach. The Program of Implementation's Watershed Stewardship approach seeks to address all Lower Elk factors influential in the impacted reaches' impairment and harm to beneficial uses. The effects of the Lower Elk to the impacted reach have not been completely studied, an effort for which the Recovery Assessment was conceived in part. The Elk River Recovery Assessment should result in a description of the channel characteristics of the lower watershed and identification of priority actions to achieve a functional hydrologic system to the extent feasible. The future condition of the lower watershed is constrained by numerous factors, including infrastructure, property ownership, and landuse. It is unlikely that the future condition of the lower Elk River will be identical to the natural floodplain conditions described by MacDonald; but the goal of the TMDL Action Plan is to promote the Elk River's return to a trajectory of recovery in which beneficial uses are restored and nuisance conditions are prevented.

Regarding SLR and climate change impacts to Elk River, the value for mean SLR provided by commenters neglected to include the confidence intervals from Griggs (2010): 4.72 ± 1.58 mm/yr. Additionally, the tide station at North Spit from which that value was derived has a record of only 37 years (Griggs, 2010), well below the median record length of 68 years for all tide gauges along the California coast. Caution must be taken when citing numeric values for climate change impacts such as SLR, because such values predicate on assumptions regarding current and future global greenhouse gas emission rates. Moreover, tectonic activity in the region complicates the relative influences of SLR and subsidence/uplift, leading to great spatial variation in projected sea level rise along the

North Coast shore. For example, 80 miles north of the North Spit station at Crescent City, sea level is dropping at a rate of -0.65 ± .36 mm/yr (Griggs 2010).

b) Natural background loading

Issue: MacDonald and HRC contend that the natural background loading rate in the TMDL Action Plan is underestimated. MacDonald summarizes the natural background underestimation as due to limitations of the methods used and the failure to include all sources. MacDonald relies on long-term erosion rates estimated through cosmogenic ^{10}Be concentrations for the basis for natural loading. Using the uplift rates, the assumption of dynamic equilibrium only operating on long time-scales, and other assumptions about sediment characteristics (e.g. density), MacDonald calculates a natural background rate that is twenty times the rate in the TMDL Action Plan.

Response: Concerning using uplift and denudation rates to derive long-term erosion rates, mass loss associated with uplift is not the same as sediment load in the river. As the land surfaces rise, valleys may continue to incise and denudation moves mass from the ridges to the valleys. Much of the transport occurs as landslides and not all of the landslide mass may enter the stream channels. MacDonald maintains that because few terraces are observed above the south and north fork confluences, sediment storage in the system is unlikely; however, terraces are not the only potential sediment storage—e.g. alluvial or colluvial fill in smaller valleys could potentially play a role. Much of the comments about natural background loading and relations to reference subbasins have been addressed in the Response to Informal Comments, but one particular response will be re-iterated here.

Using ^{10}Be concentrations to estimate long-term erosion rates requires a number of assumptions that may not be applicable to Elk River. Jack Lewis (2014) in his informal comment states that these assumptions are "probably far from true in mountainous watersheds with high spatial variability." The references cited by MacDonald (Balco et al 2013; Ferrier et al 2006) are suspect as estimates from Balco for North Fork Caspar Creek were "82% higher than Ferrier *from the same laboratory data*" (emphasis Lewis's). The assumptions made by the two studies were different, which led to the discrepancy. Hence the use of ^{10}Be and its assumptions have not been satisfactorily justified for Elk River and therefore not a good estimate of natural background rates. Moreover, the zero load allocation does not require a precise distinction between anthropogenic and natural sediment load estimates. The load allocation is based on impairments and impacts to beneficial uses, regardless of source.

As this comment relates directly to uncertainty, please see second bullet in the Overview for a broader response regarding uncertainties in the scientific basis.

c) Anthropogenic loading in GDRCo timberlands

Issue: GDRCo noted that Table 1 of the TMDL Action Plan had anthropogenic loading incongruent with the GDRCo's modest harvest rates for the period 1978-2000. GDRCo states there is a poor correlation between watershed-wide anthropogenic loads and its harvested acres. Additionally, GDRCo provided commentary on each sediment source category and their relationship with GDRCo's current management practices, concluding that their management has not introduced additional sediment.

Response: Using the watershed-wide average sediment loads to compare acres harvested by GDRCo is misleading, because GDRCo's ownership in Elk River is largely in McCloud Creek and Tom Gulch subbasins. According to Table 8: Total Management-Related Loads from the Technical Report, the estimated management-related sediment loading for McCloud Creek and Tom Gulch were:

Time Period	McCloud Creek	Tom Gulch	Elk River Average
1975-1987	267	195	268
1988-1997	637	534	966
1998-2000	532	357	531
2001-2003	495	381	476
2004-2011	480	691	308

Table 1: Excerpt from Table 8 of Technical Report detailing management-related sediment loads in $yd^3mi^{-2}yr^{-1}$

The 1988-1997 average loading rate in the table above for McCloud Creek was well below the rates plotted in Attachment 3 of GDRCo's comment letter. Furthermore, GDRCo did not provide any formal correlation calculation and significance testing, so any correlation would be visual at best. The visual inspection of Table 1 does suggest a correlation with harvested acres and sediment loads in the two sub-watersheds: low loads during 1978-1987 (no harvest) followed by consistently higher loads in 1998-2011 with harvest present, congruent with Attachment 3 in GDRCo's comment letter. Staff recognizes that GDRCo has improved its management practices and that they have helped reduce anthropogenic sediment discharges; however, any timber harvest, regardless of silvicultural practices, will yield a nonzero sediment discharge. Improved management practices do not justify changing the water quality indicators and their targets in the TMDL Action Plan. Also, the Regional Water Board has discretion on how to implement a zero load allocation and interpret the targets in a WDR.

d) Drainage density and low-order channel incision

Issue: GDRCo commented on the drainage densities used to derive management-related sediment loads, criticizing the methodology in Buffleben (2009) as "fundamentally flawed." Buffleben used median drainage area derived from field surveys of channel heads in three subbasins to estimate drainage densities for other subbasins in Upper Elk River. GDRCo states that the fundamental problem for the drainage area methodology is that it "doesn't account for… channels typically form[ed] in areas of localized, concentrated flow," and that drainage densities "are a function of more than simply drainage area." GDRCo evaluated Buffleben's methodology for McCloud Creek using field channel mapping and GIS. The field-based calculation for drainage density in McCloud was half of that calculated using Buffleben's extrapolation from surveys in South Branch North Fork Elk River and Corrigan Creek. Dr. MacDonald was also concerned about the sample size for determining the drainage densities and the use of the median instead of the mean. MacDonald notes that drainage density varied with geology in managed areas but not in unmanaged areas like Little South Fork Elk River (LSFER).

Response: Staff appreciates GDRCo's effort in mapping channel heads for their ownership in McCloud Creek and the calculation of a subbasin-specific drainage density. The response in the Peer Review Draft to HRC's estimate of drainage density is also relevant for GDRCo: (1) incomplete ownership in McCloud Creek prevented the complete mapping of channel heads in McCloud Creek, and (2) GDRCo's comment did not state whether the channel heads were identified after logging operations, when sediment produced from headward channel incision would be most apparent. Extrapolation of GDRCo's drainage density would be inappropriate because the channel heads identified are for McCloud Creek, whereas Buffleben's surveys covered three subbasins whose catchments were randomly selected. The random selection and number of channel heads surveyed covered the variability of drainage densities, including channel heads influenced more by factors other than drainage area. Additionally, Buffleben performed regression analyses for slope and drainage area, finding no statistically significant relationship. The use of the medians for choosing the drainage density for extrapolation is defensible: environmental data often are not normally distributed (Reimann & Filzmoser, 2000), thus nonparametric means of determining values of central tendency are necessary for robust statistics.

The methodology and effort in locating channel heads, determining drainage area, and calculating drainage densities are not in dispute. At issue is the extrapolation of the drainage density from these reference subbasins for the rest of Elk River. Clearly, uncertainties are expected in extrapolations as Elk River is a varied system, especially in regards to geology. With respect to these uncertainties, TMDL development guidelines require consideration of seasonal variability and margin of safety. That the drainage density is relatively high compared to estimates by GDRCo and HRC ensures that the TMDL meets the margin of safety requirement. Staff encourages landowners to continue these studies as part of adaptive management, but ultimately, the present assimilative capacity for Elk River is zero and the concerns over drainage densities used in the Source Analysis are less important with respect to the Program of Implementation as aggradation and additional sediment loads from any source, natural or anthropogenic, continues to negatively impact beneficial uses.

e) Subbasins not included in sediment source analysis

MacDonald makes note of the fact that estimates of sediment delivery to Shaw Gulch and from residential and agricultural uses on the Elk River mainstem east of Berta Road are not included in the sediment source analysis. He suggests that per unit area sediment yields from Shaw Gulch should be at least comparable to the 450 yd3 mi-2 yr-1 for the rest of the upper watershed. He also suggests that anthropogenic sources from residential and agricultural should be quantified for the TMDL.

Response: MacDonald is correct that estimates as he's described are not currently included in the TMDL. This is neither intentional nor unintentional, but merely the result of changes in the project scope over 10+ years. Adoption of the TMDL does not require these additional estimates, as the existing information is more than adequate to establish a load allocation of zero. The load allocation applies to all nonpoint source discharges of sediment.

f) Legacy sources

Issue: The timber companies have commented on the lack of recognition for differences between different legacy sources that continue to produce sediment. HRC identifies two distinct periods for legacy sediment: sources predating Forest Practice Rules in 1974 and sources pre-1999 establishment of the Aquatic Habitat Conservation Plan. CAL FIRE identified the one particular legacy source in the millponds near the abandoned town of Falk and recommends that this sediment source be factored into the source analysis.

Response: Staff appreciates CAL FIRE's effort in pointing out an additional, specific legacy source and look forward to additional detail about the Falk millpond legacy source and its possible magnitude. The identification of an additional legacy source not quantified in the source analysis, while important, would not alter the Program of Implementation, particularly for the regulation of timber harvest and related activities which focuses on control of all controllable sources to the extent feasible.

Staff recognizes and appreciates HRC's improved management practices since obtaining its Elk River ownership. As stated in the response to natural background loading, the zero load allocation does not require a precise distinction between anthropogenic and natural sediment load estimates. The load allocation is based on impairments and impacts to beneficial uses, regardless of source.

g) Control of controllable Sediment Sources

Issue: MacDonald points out that given the geologic context of the affected reach and the modifications to the channel and floodplain through the affected reach to the mouth of the Elk River, the assimilative capacity cannot be restored simply by further reducing management-induced sediment inputs from the Upper Watershed. Nor is it possible to eliminate nuisance flooding, even if the channel capacity in the lower mainstem is restored to 2250 cfs, as this is substantially lower than the predicted 2-year flood. Continuing treatment of management-related discharge sites should continue to reduce this sediment source, and any sediment from these treatments is effectively a down payment to reduce further sediment inputs and hence beneficial in the long term. Sediment from untreated sites will continue to decline as the worst sites are treated and/or natural stabilization continues. But, given the differences in geology, slope, and rainfall between the different sub-watersheds, the forest practice prescriptions should be adjusted according to the relative site-specific risk rather than applying them equally across the entire Elk River watershed.

Response: Staff completely agrees that the assimilative capacity of the lower river for sediment cannot be restored simply be further reductions in management-induced sediment inputs. Staff also agrees that continued treatment of management-related discharge sites will continue to reduce that sediment source, generally even if some initial erosion is the result. Proper assessment, prioritization, design, implementation, and monitoring can reduce the amount of unintentional sediment delivery. The proposed TMDL establishes a load allocation and water quality indicators and targets to be implemented via a WDR or waiver. The exact provisions of the permit are not specified by the proposed TMDL. The predicted 2-year flood, which is greater than the target channel capacity, is a preliminary result of the Recovery Assessment; please see the response to comments A.3 on the use of Recovery Assessment preliminary materials. Staff maintains that 2250 cfs is a valid channel capacity target for reducing nuisance flooding.

h) Other anthropogenic loading and additional science

Issue: MacDonald provided extensive commentary on the anthropogenic loadings on Table 1, going into detail for each sediment source category. Comments from HRC, GDRCo, and CAL FIRE reference MacDonald's letter as the scientific basis for their objections to the anthropogenic loads. Generally, MacDonald's comments recommended: (1) additional science should be conducted to understand the processes for all subbasins and their response to specific management practices, and (2) the decreasing sediment delivery from the source categories are indicative of improving management practices and that present practices should be maintained until evidence suggests otherwise according to adaptive management principles. HRC also asserted that the zero load allocation would be an indefinite load allocation.

Response: Regional Water Board staff thanks Dr. MacDonald for his in-depth analysis of the source categories and loadings. Many of MacDonald's comments have been addressed in the Response to Informal Comments. Compared to other sediment TMDLs in the North Coast region, the body of science and work conducted for Elk River is enormous. The Regional Water Board believes that the science to date as synthesized in the Technical Report is sufficient for determining a TMDL for Elk River. Regarding best available science and inclusion of various documents, the Technical Report was developed in consideration of all available Elk River reports, including HRC's ROWDs.

While we have, and will continue to strive toward as much precision as possible, perfection in the science is not required to move forward with this program. The phased approach described in the TMDL Action Plan meet the requirements for adaptive management. Adaptive management principles require that new science be incorporated and used to inform or update the current approach. What adaptive management principles do not prescribe is updating approaches faster than what can be implemented. Given the continuing impairment to beneficial uses in Elk River, waiting until new science confirms or refutes the validity of the Regional Water Board's approach would only worsen impairments. Such analysis paralysis is unacceptable to the impacted residents and other downstream stakeholders in Elk River. While data may suggest that improved management practices have decreased sediment loads, the impacted reach still experiences impairments to beneficial uses and a zero load allocation requires further source control. Moreover, activities in a sensitive watershed or a watershed particularly vulnerable to disturbance must be moderated based on the given vulnerabilities, including those related to past activities. Contrary to HRC's assertion of an "indefinite 'zero load' allocation," the Regional Water Board may reconsider the zero load allocation upon completion or execution of the Recovery Assessment, Watershed Stewardship Program, and other ongoing studies cited by commenters.

As this comment relates directly to uncertainty, please see second bullet in the Overview for a broader response regarding uncertainties in the scientific basis.

7. *Margin of Safety*

Issue: US EPA, residents, and other interested parties have expressed confusion or uncertainty in the incorporation of margin of safety (MOS), an element requisite to TMDL development.

Response: The TMDL Action Plan states that the zero load allocation "incorporates a conservative, implicit" MOS. The TMDL equation with implicit MOS for Upper Elk River is TMDL = LA + WLA = 0 + 0; both waste load allocation and load allocation are zero. The MOS is implicit because conservative assumptions and values were used in calculating LA. Some conservative assumptions and values include:

- Drainage densities used to calculate bank erosion, streamside landslides, and low order channel incision are markedly higher than those reported by HRC or GDRCo; a range of drainage densities exist in the Upper Elk River and the use of a drainage density in the higher end of the range is a margin of safety.
- Natural loading from soil creep was not included in estimates for natural bank erosion and streamside landslides because material from soil creep is already delivered to the stream channel through bank erosion; this exclusion increases the proportion of controllable sources from anthropogenic activities, constituting a margin of safety.
- Relatively low estimates of natural bank erosion and streamside landslides sediment were assumed to be uniform across Upper Elk River, so management-related load estimates may be higher in subbasins that could have a higher natural loading than the volume estimated, constituting a margin of safety for controllable sediment sources.

As noted in the response to dynamic equilibrium, due to past management activities, the Elk River has shifted to tending towards an equilibrium state not supportive of beneficial uses. Any additional sediment, natural or anthropogenic, would only push the tendency further to the non-supportive equilibrium state. A negative load allocation is currently not scientifically defensible because understanding of Elk River is not so complete that staff could determine how much sediment can be removed to restore beneficial uses (and thus push the tendency towards a dynamic equilibrium). Thus, zero is the only number that can be allocated for sediment loads. Greater understanding through the Recovery Assessment would allow the Regional Water Board to assign a less conceptual load allocation at a later date as described in the phased TMDL approach.

Staff acknowledges that the explanations for the "conservative, implicit MOS" were not completely clear and have modified the TMDL Action Plan accordingly.

8. Seasonal variations and critical conditions

Issue: US EPA Region IX has requested that considerations for seasonal variations and critical conditions be explained.

Response: Most precipitation falls during late autumn through winter in the California North Coast, typical of temperate Mediterranean climates. The concentration of storm events around the beginning of the water year would lead to higher peak flows and higher sediment loads for that time period, exacerbated by disturbance from land use activities or natural events like tectonic uplift. Sediment loads described in Table 1 of the TMDL Action Plan are annual rates based on water year. Annual totals would encompass the high-precipitation season and would also encompass sediment loads not primarily influenced by rainfall (e.g. management-related loads from non-winter operations). Staff believes the use of annual totals satisfies the seasonal variations consideration for TMDL development.

Critical conditions are addressed through the use of annual totals, the relatively long record (56 years) in the source analysis, and the binning of the record into seven periods. The winter or 'rainy' season would be considered a critical period where most erosional processes occur; however, stochastic events like tectonic activity are independent of weather, justifying annual loads. The long record would cover critical conditions induced by extreme events expected at human time scales. Management practices in Elk River have devolved and evolved over time as timber lands have changed ownership. The seven periods reflect these changes and account for critical periods (i.e. 1988-1997) where sediment production peaked. Staff has modified the TMDL Action Plan to expand on seasonal variations and critical conditions.

B. <u>Human Right to Water</u>

Issue: Wrigley commented that the inherent right of residents to a usable surface water supply has been jeopardized by the discharge of sediment from timber operations in the upper watershed. Her suggestion is that the Regional Water Board has prioritized the right of the upper watershed landowners to discharge sediment over the rights of the downstream landowners to use the surface waters of the Elk River as a water supply. MacDonald provides an alternative view that landuse in the lower watershed, including residential development, has constrained channel migration and floodplain function, with long-term implications for drinking water supplies and protection from flooding.

Response: The State Water Resources Control Board adopted in February 2016 Resolution No. 2016-0010 declaring the Human Right to Water. In keeping with the State's specific interest in ensuring access to all Californians of drinking water of potable quality, the TMDL Action Plan establishes several important elements. First, it establishes that many surface water withdrawals that previously provided domestic and agricultural water supplies in the Elk River are no longer able to deliver water suitable for drinking during some or all times of the year. Second, it establishes that restoration of domestic and agricultural water supplies (and other impaired beneficial uses) requires *both* a reduction in sediment delivery as well as sediment remediation and stream channel restoration. To accomplish the former, the draft TMDL assigns a zero sediment load allocation. To accomplish the latter, the draft TMDL relies on a) the *Elk River Recovery Assessment* to establish the feasible remediation and restoration actions and b) the *Watershed Stewardship Program* to coordinate a multi-stakeholder effort to develop projects, acquire necessary permits, acquire necessary funds, implement project designs, and monitor their success. To date, these two efforts have been largely funded by the State Water Resource Control Board. The Regional Water Board will assess the success of the regulatory efforts to control sediment discharge and the non-regulatory efforts to remediate stored sediment and restore stream channel functions to determine if the implementation program is sufficient to restore beneficial uses, including domestic and agricultural water supplies. Third, recognizing that full restoration of beneficial uses may take up to 20 years, the draft TMDL identifies as part of the *Watershed Stewardship Program* the development of a Health and Safety working group to develop infrastructure projects that support the real and immediate needs of local residents, including the need for access to potable water.

It is correct to say that regulatory programs of the state failed to prevent impairment of domestic and agricultural water supplies prior to 1998 when the waterbody was listed on the 303(d) list of impaired waters. It is also correct to say that the continued discharge and delivery of sediment in the upper watershed, in combination with other systemic factors such as channel and floodplain constraints, have resulted in continued aggradation and concomitant worsening of instream conditions for beneficial use (e.g., domestic and agricultural water supplies) and nuisance conditions. It is on that basis that the proposed Upper Elk River Sediment TMDL establishes a zero load allocation for sediment, until sufficient sediment remediation and stream restoration can be accomplished so as to restore beneficial uses and prevent nuisance. Should the results of the Elk River Recovery Assessment indicate that sediment remediation and stream restoration cannot restore beneficial uses and prevent nuisance, then the numeric targets for instream water quality indicators may have to be revised and beneficial use designations reviewed.

C. <u>The Draft Action Plan For The Upper Elk River Sediment TMDL (TMDL Action Plan)</u>

Issue: Several commenters had specific recommendations regarding language contained in the TMDL Action Plan. Where the recommendations appeared to strengthen the Action Plan by providing greater clarity or more appropriate regulation, staff has proposed revisions to the TMDL Action Plan accordingly, which will be reflected in the proposed TMDL Action Plan to go before the Regional Water Board for adoption.

1. Introduction

Issue: The Pacific Coast Federation of Fishermen's Associations (PCFFA) recommended that the Introduction includes the following statement, quoted from the Upper Elk River: Technical Analysis for Sediment, Oct.21, 2015, page 2.

> "The Regional Water Board has a duty to implement the Clean Water Act, the Porter Cologne Water Quality Control Act (Porter Cologne), the *Water*

Quality Control Plan for the North Coast Region (Basin Plan; Regional Water Board 2011a) and other plans and policies of the State Water Resources Control Board and Regional Water Board for the protection of water quality. "

Response: The basic sentiment of this sentence is contained in Chapter 1 of the Basin Plan and described in more detail than given here. Staff does not recommend repeating this content in the Elk River TMDL Action Plan.

2. Problem Statement

Issue: Numerous commenters suggested that the problems identified in the Elk River Watershed are largely related to factors other than contemporary sediment discharges, a fact that should be reflected in the Technical Report and the TMDL Action Plan. HRC in particular recommended that the Problem Statement be revised to more fairly and accurately represent the complexity of land use history and inherent environmental circumstances present in the entire Elk River Watershed, including mention of rural residential development in the floodplain, cumulative impacts associated with agricultural land use, floodplain modification over the last 150 years, sea level rise, and the lack of stream channel management. Similarly, MacDonald provided extensive comments on the role of uplift and denudation, subsidence of Humboldt Bay, climate change, sea level rise, and constraints to stream channel meandering in the lower river, among others factors. Others pointed to the condition of the watershed prior to the 1988 period as a time when despite periodic elevated turbidity and flooding, beneficial uses were nonetheless maintained.

US EPA indicated the need for greater clarity on which portions of the Elk River Watershed are addressed by the TMDL Action Plan and the relationship of the TMDL to the 303(d) listing. US EPA also recommended specific mention of any portions of the Elk River Watershed that will be proposed for future actions, such as delisting or future TMDLs.

Response: Staff agrees that multiple factors affect the ability of the transport reaches of the Elk River to competently transport water and sediment to the river's depositional reaches and to the bay. Further, multiple factors affect the ability of the depositional reaches of the river to receive, transport, and store sediment in a manner that is in harmony with landuses in low gradient areas.

With respect to the Problem Statement itself, staff has revised the Problem Statement to clarify that multiple factors influence the fate and transport of sediment through the system, including both controllable and uncontrollable factors. Further, the Problem Statement has been revised to make clear that assessment of the degree to which these other factors can be influenced or controlled by sediment remediation and stream restoration activities is being assessed through the Elk River Recovery Assessment. The Elk River Recovery Assessment will identify feasible actions that can improve the assimilative capacity. Further, staff has revised the Problem Statement to provide greater clarity with respect to watershed delineation and the relationship of the TMDL to the

303(d) listings. The adopting Resolution R1-2016-0017 also includes clear discussion of this matter.

3. Source Analysis

Issue: HRC recommends that the Source Analysis be revised to include a description of current forestry practices pursuant to existing Aquatic Habitat Conservation Plans and the Board of Forestry Forest Practice Rules. Further, it recommends that it be acknowledged that an estimated 350,000 cubic yards of sediment has been removed or prevented from entering the stream system since 1999, including the strategic decommissioning of 45 miles of historic logging roads for the purpose of erosion control on HRC timberlands. As a corollary, HRC suggests that current practices are adequate to control sediment discharge and contends that no further restrictions are necessary to improve sediment delivery. Further, HRC recommends that the natural sediment loading rate be revised to reflect MacDonald's comments.

Response: Staff agrees that HRC deserves credit for the improvement in land management that has resulted from their purchase of former Palco property in the Upper Elk River Watershed. Though it would be inappropriate to include an assessment of HRC's current practices within the Regional Water Board's regulations (i.e., Basin Plan), staff fully acknowledges as part of these responses to comments the dramatic improvement to timberland management that is the result of HRC's ownership in Elk River. There are a number of issues to point out:

1. The Elk River Watershed is unusually erosive as a result of geology, tectonics, rainfall and other factors. The primary moderating factor is vegetative cover, particularly multi-storied canopy and significant ground cover that serve to intercept rainfall, promote groundwater recharge, introduce soil stability through added root strength, and protect soil particles from becoming dislodged. As such, any activity that results in canopy removal, soil exposure, or disturbance to particularly vulnerable areas (e.g., headwall swales, stream banks, steep slopes) has the potential to result in high erosion risk, as compared to other watersheds in the region.
2. Turbidity data neither indicates an improvement of water quality conditions on HRC-owned lands, nor correlates management practices with water quality improvements. (See Response to Comments on draft WDRs for HRC).
3. While the source data represented in Table 1 of the draft TMDL Action indicates a lower rate of sediment delivery in the 2004-2011 period than in any other period of record except 1975-1987, the Little River peak flow data make clear the very narrow range of peak flows and modest rates of flow that were experienced in the 2004-2011 period, after HRC's purchase. (See Science, Little River responses above). Since sediment is generally delivered as a result of storm events, it is important to acknowledge that the storm events of this period are unremarkable.
4. Though the conditions in the impacted reach can surely be attributed to multiple intersecting influences, it is also important to acknowledge the evidence of ongoing aggradation in the impacted reach. This is important, because regardless of any measured or hypothesized reduction in sediment delivery as a result of HRC's management practices, the sediment leaving tributary subbasins and entering the

north and south forks of the Elk River, overwhelms the capacity of the impacted reach to assimilate the sediment without further impairment of the beneficial uses and increases in flooding conditions.

Staff has added a sentence to the TMDL Action Plan, which acknowledges the changes in management practices over time, with a trend towards the implementation of more protective measures in the 2004-2011 time period. However, staff has also added a sentence that describes the changes in observed peak flows per time period, as evidence of the effects of management practices on sediment discharge (e.g., median peak flows and high sediment discharge in the 1988-1997 period) and that not all time periods have included large peak flow events to test the veracity of management practices (e.g., relatively stable median peak flows from 1975 through 2011, with the smallest range of peak flows occurring during the 2004-2011 period).

Regarding the removal and control of 350,000 cubic yards of sediment, staff acknowledges HRC's efforts and commends its commitment to fully implementing the terms of the Cleanup and Abatement Orders that direct this work. Normally, such data is presented as the percent of total estimated sediment associated with inventoried erosion control sites, thereby representing both the effort so far accomplished and the effort still to come. In the case of the Upper Elk River Watershed, some assertions have been made that a considerable amount of sediment from "legacy" sources have already entered the fluvial system and are the primary source of continued aggradation downstream. Once entering the fluvial system, such "legacies" are obviously more difficult to control. As such, HRC is all the more commended for its efforts at stabilizing erosion control sites prior to their delivery to the stream channel and is encouraged to continue to do so. It is important to note, however, all the management-related sediment sources on lands now owned by HRC are considered in this discussion to be sources deserving of treatment and control, where control is feasible[1]. Similarly, for the purposes of this TMDL, excess sediment now stored in the tributary system, which can be metered or controlled via sediment remediation or stream restoration techniques, should be assessed and prioritized with respect to delivery downstream to the impacted reach via a subwatershed feasibility assessment, as proposed in the WDRs for HRC. This is in keeping with a zero load allocation and the special circumstances associated with the Elk River Watershed, including direct impact to individuals, a community, and private and public property and infrastructure. Staff does not recommend any revisions to the TMDL Action Plan to address this point. Instead staff relies on the WDRs and waivers as the regulatory mechanisms within which these detail will be spelled out.

Finally, with respect to the estimates of natural sediment delivery contained in Table 1 of the TMDL Action Plan, the numbers presented represent Tetra Tech and staff's analysis of

[1] Given the unique environmental characteristics of the Elk River Watershed, elevated erosion risks associated with its landuse history, and critical downstream impacts that affect individuals, a community, and private and public property and infrastructure, erosion control, erosion site treatments, and stream restoration techniques may need to be developed that are site specific, innovative, and consider the unusual vulnerability of the landscape to disturbance.

the best available data. (See also Source Analysis and the second bullet in the Overview for a broader response regarding uncertainties in the scientific basis). Unlike many other sediment source analyses, the natural sediment source estimates developed for this TMDL are based largely on site-specific data, rather than regional estimates. As with any data that are extrapolated to define similar settings, there are certainly confounding factors that prevent perfect correlation among all subbasins. However, staff maintains that the confounding factors are limited to those that exist in the Elk River Watershed itself, rather than include all those present throughout the Coastal Range. One reason the natural sediment source estimates appear low, given the unusual vulnerability of the Elk River Watershed to erosion, is related to the value of multi-storied canopy, root structure, duff and woody debris, and significant ground cover at moderating erosive risk as measured in the reference subwatershed. Staff does not recommend any changes to the estimates of natural sediment loading as described in Table 1 of the TMDL Action Plan. The sediment loading capacity is defined as zero, as is the TMDL and load allocations. As such, the exact proportion of the overall annual sediment load that is natural versus anthropogenic is less important at this juncture than it may be in the future, when the load allocation is re-evaluated post recovery (i.e. attainment of water quality standards). In addition, implementation of a robust monitoring strategy, including special studies, should augment the existing Elk River Watershed sediment-related database, allowing for refinement in the future. Finally, if truly underestimated, the natural loading estimates currently contained in Table 1 of the TMDL Action Plan represent a margin of safety with respect to the proportion of the total annual load that is anthropogenic.

4. Water Quality Indicators

Issue: Numerous comments were received on the water quality indicators contained in Tables 2 and 3 of the TMDL Action Plan. (See Numeric Targets discussion above). With respect to the specific language of TMDL Action Plan, several recommendations were made. HRC and GDRC commented on the hillslope water quality indicators and targets, recommending several specific revisions:

a) Hydrologic connectivity of roads to watercourse.

Issue: The draft indicator is defined as "100% of road segments hydrologically disconnected from watercourses." HRC and CAL FIRE recommend that the indicator target be revised. HRC specifically recommends the following language: "road segments should be hydrologically disconnected from watercourses to the extent feasible (generally >90% in coastal watersheds.)

Response: Adoption and implementation of a TMDL are deemed necessary when the existing Program of Implementation does not result in any measurable improvement in impaired conditions. Staff does not recommend the requested change because: 1) it requires too much individual judgment (e.g., what is "feasible"?), 2) does not improve conditions beyond existing requirements, 3) is written not as regulation (e.g., "should" versus "must") but as guidance, and 4) is not consistent with a zero sediment load allocation. Staff acknowledges that 100% disconnection may not be feasible in all circumstances. But, as a target not an objective, staff is persuaded that within the context of a WDR or waiver, it can be applied in a manner that takes into account site specific factors.

b) Sediment delivery due to surface erosion from harvest areas.

Issue: The draft indicator is defined as "100% of harvest areas have ground cover sufficient to prevent surface erosion." HRC and GDRC recommend that the indicator/target be revised to read "harvested areas have ground cover sufficient to prevent surface erosion deliver (sic)" or "…prevent sediment from surface erosion from delivering to watercourses."

Response: Staff does not recommend the proposed changes for reasons similar to that above. They require too much individual judgment (e.g., how much ground cover is sufficient to prevent surface erosion delivery?) and non-attainment of the target condition is determined after a failure of judgment (e.g., once surface erosion is delivered, which is too late).

c) Characteristics of riparian zones.

Issue: There are two draft riparian targets, which are described as "Characteristics of riparian zones (i.e., 300 feet on either side of the channel) associated with Class I and II watercourses" and "Characteristics of riparian zones (150' on either side of the channel) associated with Class III watercourses." HRC, GDRC, and CAL FIRE recommend that the indicator targets for riparian zones be revised to mimic the Forest Practice Rules for anadromous salmonid watersheds. HRC specifically recommends that the two indicators be consolidated to one indicator applicable to Class I, II and III streams.

Response: Staff does not support the requested change. The Technical Report and TMDL Action Plan describe the unique characteristics of the Elk River Watershed which indicate the watershed's specific vulnerability to erosion and the importance of tree roots, multi-storied canopy, large wood, substantial ground cover, and groundwater recharge to the prevention of excess sediment discharge. The targets simply promote support of these riparian functions. The Technical Report (and cited documents) provides ample evidence that protection of these functions, at least in the riparian zone, are well-justified. GDRC argues that being derived from the Northwest Forest Plan, the specified riparian widths are not applicable. Given the specific finding in the Technical Report that the largest remaining anthropogenic sources of sediment are those within the riparian zone, staff finds that protection of these riparian functions is well-justified. GDRC emphasizes language from the Record of Decision on the Northwest Forest Plan that appears to support this conclusion. It says that riparian reserves as defined will "help maintain and restore riparian structures and functions, benefit fish and riparian-dependent species" among other benefits. Staff is persuaded that the goal of the Northwest Forest Plan to maintain and restore riparian structures and functions conforms well with the goals of the TMDL, including the riparian-related indicators and targets. Finally, as stated previously the TMDL targets are not independently enforceable. It is their application in a Waste Discharge Requirement or other regulatory control mechanism that makes them enforceable elements, subject to monitoring, assessment, and compliance determination. The purposes of the targets as described in the TMDL Action Plan are to (1) inform provisions in WDRs and waivers and (2) to be used as measures for assessing the overall effectiveness of the Program of Implementation.

5. *Sediment TMDL and Load Allocation, Including Margin of Safety an Consideration of Seasonal Variation*

Issue: US EPA has requested greater clarity for the determination of the load allocation, margin of safety, and considerations for seasonal variations.

Response: The TMDL and Load Allocation, Including Margin of Safety and Consideration of Seasonal Variation section is updated to reflect EPA's request for greater clarity, and to reflect the discussion above. Please see response to margin of safety and seasonal variations issues in the Supporting Science section for additional details.

6. *Program of Implementation*

Issue: Commenters indicated that alternative programs of implementation have not been considered or have not been described in the draft TMDL Action Plan.

Response: Alternative programs of implementation are described in Section D below. No changes to the Program of Implementation section have been made.

7. *Timeline*

Issue: USEPA asked for clarity on the timeline associated with completion of the TMDL, particularly with respect to any future phases. Many other commenters raised concerns regarding the long time period expected prior to restoration of beneficial uses and prevention of nuisance conditions.

Response:
The timeframes associated with individual elements of the Program of Implementation are contained in Table 4 of the TMDL Action Plan. The Watershed Stewardship Program is expected to launch in 2016. The Elk River Recovery Assessment is expected to be completed in 2017. The progress of the Watershed Stewardship Program to plan, permit and design remediation and restoration actions will be assessed in 2021, the completion of projects anticipated by 2026. Attainment of water quality standards is expected by 2031, with an evaluation of whether or not the sediment load allocations should be recalculated as Phase 2 of the TMDL, or the waterbody simply de-listed.

The total anticipated time to complete remediation and restoration in the impacted reach and lower watershed is 10 years. This timeline can be accelerated by good coordination among stewardship participants, sustainable funding, and early interaction with permitting agencies. If good progress is not apparent at the 5 year evaluation mark, the Regional Water Board may consider alternative approaches.

D. Alternatives to the Draft Program of Implementation

Issue: Numerous commenters offer an alternative to the draft Program of Implementation as a means of restoring beneficial uses and preventing nuisance conditions. One proposal is identified as "Plan B" and includes 7 elements:

1. Reduce harvest-related activities to zero sediment delivery
2. Expand moratorium on timber harvest to include all of Upper Elk River
3. Ensure recovery first, followed by phased re-introduction of logging
4. Adjust the zero load allocation only after successful implementation of the non-regulatory actions
5. Monitoring to show effective sediment remediation as basis for incremental resumption of logging activities
6. Watershed Stewardship working groups take an active advisory role in health and safety project, monitoring and sediment remediation/restoration
7. Watershed Stewardship Program includes a Community Group
8. Restoration and watershed health to lead the regulatory process rather than the other way around.

Many commenters specifically support element #2, to initiate a full moratorium on logging until recovery is successful. One commenter elaborated on element #7, by suggesting that the State acquire grant funds to hire displaced fishermen and loggers to conduct stream restoration work to support system recovery. On the other hand, HRC proposes a program in which they continue harvest activities under their existing forestland management program, while downstream remediation and restoration efforts proceed in parallel. HRC recommends that the load allocations to drive such an outcome be established as 125% above natural sediment loads, similar to other North Coast sediment TMDLs.

Response: The TMDL Action Plan describes 4 primary components that are relevant to a comparison with Plan B, as described above.

First, the TMDL Action Plan describes a sediment load allocation of zero as necessary to prevent additional harm in the impacted reach prior to its remediation and restoration. While the TMDL Action Plan does not specifically indicate how a zero sediment load allocation is to be accomplished, it identifies the development and/or revision of regulatory control mechanisms (e.g., WDRs, general WDRs, or waivers) as the method for establishing specific requirements. The TMDL is silent on whether the zero load allocation is best achieved via a moratorium on all logging in the upper watershed or only in individual high risk subbasins; through requirements to improve management practices or continue existing practices; and/or through requirements to remove, slow, or mitigate the effects on the impacted reach of the transport of tributary stored sediment downstream or continue the status quo. (One caveat is that the TMDL Action Plan does define hillslope water quality indicators and numeric targets that essentially serve as performance measures. While the indicators and targets do not in themselves describe required management actions, they do define hillslope conditions that are improved over those present today, suggesting the need for improved management practices.) Nonetheless, the TMDL Action Plan is not specifically in conflict with any of the commenter's proposed implementation alternatives. The Regional Water Board will use its discretion with respect to the implementation of the

TMDL load allocations within the context of its adoption of waste discharge permits or waivers.

The second component of the TMDL Action Plan is the Elk River Recovery Assessment, which through hydrodynamic and sediment modeling will establish the “restorability” of the lower watershed from the top of the impacted reach to the bay and the actions necessary to accomplish a restored condition. All of the commenter’s proposed alternative programs of implementation appear to support this science-driven approach to defining desired future conditions in these reaches and the feasible sediment remediation and stream restoration techniques to accomplish those defined conditions.

The third component of the TMDL Action Plan is the Watershed Stewardship Program, which through stakeholder involvement will focus on developing strategies to address three key areas: health and safety, sediment remediation and stream restoration, and monitoring and special studies. All of the commenter’s proposed alternative programs of implementation appear to support the development of the Watershed Stewardship Program, including these three key areas of focus. Some commenters suggest that a community organizing component be added to draw on the expertise of fishermen, advocacy groups, and the wider community. It should be noted that the Watershed Stewardship Program is due to launch sometime later in 2016. Membership in this program has not been predetermined, nor will it be restricted in any manner.

The fourth component of the TMDL Action Plan is re-evaluation of the sediment load allocation, once system recovery is complete[2]. Inasmuch as the proposed sediment load allocation is zero, the TMDL Action Plan only contemplates the assignment of a positive sediment load allocation once assessment of the progress made under the non-regulatory components of the program indicates system recovery. In this regard, the TMDL Action Plan does not appear to be in conflict.

HRC’s proposed alternative program is coupled with a recommendation that load allocations be established at no more than 125% above natural background, similar to the approach taken in other North Coast sediment TMDLs. Please see comments and responses related to the source analysis above. Staff believes a zero sediment load allocation is well supported, given the ongoing aggradation and existing risk to human health and welfare, public and private property, and infrastructure. Implementation of a zero sediment load requires additional protective measures not reflected in HRC’s existing land management strategy.

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2 One commenter noted that “system recovery” and “restoration of beneficial uses” are not synonymous terms; the latter should be the goal. This comment is noted. It should be said that it is staff’s current hypothesis that “system recovery” will result in “restoration of beneficial uses.” It is possible, however, that the Elk River Recovery Assessment will indicate that there are no feasible sediment remediation and stream restoration techniques that can result in full beneficial use support. In this case, a revision to the Program of Implementation may be warranted.

E. <u>CEQA</u>

1. Range of Alternatives

Issue: Vivian Helliwell of Pacific Coast Federation of Fishermen's Associations (PCFFA) commented that the TMDL Action Plan must contain the elements of CEQA. Actions must be described, alternatives must be described, and their possible effects described and fully mitigated. She asked that consideration of a full moratorium on logging in the watershed and other alternatives be analyzed as options in the TMDL Action Plan.

Response: As explained below, the Board has reasonable alternatives available for its consideration, and additional analysis under CEQA is not required.

For the TMDL Action Plan, the Regional Water Board is relying on a previously prepared SED for the Temperature Policy basin plan amendment, and the subsequent addendum to the SED that was prepared for the Policy in Support of Restoration in the North Coast. This is consistent with the Resources Agency's approval of the basin planning process as a "certified regulatory program" that adequately satisfies CEQA requirements. (Cal. Code Regs., tit. 14, § 15251, subd. (g); Cal. Code Regs., tit. 23, § 3782.) Any water quality control plan proposed for board approval must include or be accompanied by Substitute Environmental Documentation (SED), which may be comprised of a single document or a compilation of documents. (Cal. Code Regs., tit. 23, § 2777.)

The SED analyzes a variety of implementation actions to meet temperature objectives, which includes measures to control sedimentation and restoration. The Temperature SED included a range of alternatives for implementation of the region-wide Temperature Policy, much of which is relevant for the regulation of waste discharges and other controllable water quality factors associated with timber operations. As explained in the addendum for the Restoration Policy, which is neutral as to whether restoration actions are voluntary or otherwise required under the law, the only meaningful alternative is to not adopt the Restoration Policy, which presents a possibility that fewer restoration projects would be implemented. This alternative would not meet the purpose of the Restoration Policy, which is to encourage and promote restoration consistent with the Clean Water Act and the Porter-Cologne Water Quality Control Act. In addition, various alternatives specific to the Elk River watershed have been examined substantively as an inherent part of the planning process, in the TMDL Action Plan and within the draft WDR for HRC.

Both the Technical Report and HRC's watershed analysis show that significant sediment sources are present both within and adjacent to stream channels throughout the headwater tributaries of the Elk River. Headwater streams destabilized from past logging activities will likely continue to adjust and discharge sediment for many years. It is also clear that the downstream reach has aggraded and continues to aggrade, and lacks assimilative capacity for further sediment inputs. Alternatives for addressing legacy sediment impacts have been considered, including naming current timberland owners as responsible parties for excess sediment stored in the impacted reach and issuing cleanup and abatement orders, mitigation banking that would require timberland owners to fund offsetting mitigations to remove downstream sediment based on sediment discharge from timber operations, and tying allowable discharges associated with harvest rates to progress on downstream remediation. Ultimately, the Regional Water Board has supported the development of the Elk River Watershed Stewardship Program, based on voluntary participation that engages community members, residents, scientists, land managers, and regulatory agencies to plan and collaborate on actions to achieve recovery of downstream beneficial uses and abatement of nuisance conditions.

The Regional Water Board also considered various options to implement the zero load allocation for upstream sediment inputs through permit requirements. This includes consideration of a complete prohibition on any activities with the potential to discharge sediment until the assimilative capacity in the impacted reach has been increased. (See e.g. *In re: Petition of Petition Kristi Wrigley, Jesse Noell and Stephanie Bennett,* for failure to act on Petitioner's May 7, 2014 request for a logging moratorium in the Elk River watershed (July 21, 2014), SWRCB/OCC File No. 2318.) The proposed Order for HRC proposes a temporary harvesting prohibition in high risk subbasins. We note that the Board may choose to expand, reduce or eliminate the proposed temporary harvesting prohibition upon consideration of the evidence and testimony.

As described in finding 57 of the proposed Order, halting all timber harvest activity in the Upper Elk River watershed is not necessarily feasible or helpful in promoting HRC's participation in cleanup and restoration efforts. The Regional Water Board has also considered the option of relying solely on the provisions proposed in HRC's ROWD. The proposed Order relies on and incorporates the majority of measures proposed in HRC's ROWD; however, the ROWD is not considered fully adequate to meet all water quality requirements associated with Elk River. Ultimately Regional Water Board staff has proposed an approach that establishes strong controls, including the ROWD measures, additional water quality protection and a temporary prohibition of harvesting in high risk areas and limiting harvest rates throughout the watershed. Management controls can be modified (relaxed or strengthened) over time based on further evaluation of watershed conditions and progress towards restoring beneficial uses and abating nuisance conditions.

2. Scope

Issue: HRC and Green Diamond (Companies) submitted CEQA comments on the TMDL Action Plan, stating that "[t]he imposition of highly burdensome measures outlined in the TMDL Action Plan without adequate consideration of the evidence submitted by the Companies would be arbitrary and capricious" and "the Regional Board *imposes* the zero load allocation across all Green Diamond and Humboldt Redwood activities in the Watershed without regard to the actual positive contribution to the sediment problems under current management…." (Emphasis added.) HRC states that it has demonstrated that its operations result in net sediment benefits and therefore the measures the Regional Board proposes as mitigation measures are not necessary to mitigate or avoid any significant individual or cumulative effect.

Response: The companies mischaracterize the regulatory effect of the TMDL Action Plan and accordingly confuse the scope of the projects subject to CEQA. The TMDL Action Plan does not contain extensive regulatory requirements, and in fact is quite deferential to how a WDR may be crafted. (See TMDL Action Plan at 7 ["[t]he Regional Water Board has discretion in developing WDRs that can allow individual dischargers to tailor a compliance strategy"].) The Action Plan is clear that the zero load allocation does not constitute an effluent limitation or a waste load allocation, and the Board has discretion on how it chooses to implement it. The zero load allocation is a basic construct that directs the Board to craft the permit in a manner that reduces and eliminates waste discharges to the maximum extent practicable. (See also, *Conway v. State Water Res. Control Bd.*, 235 Cal. App. 4th 671, 680 [TMDL is an informational document, and does not by itself prohibit any conduct or require any actions; rather, the TMDL represents a goal for the level of a pollutant in a water body].)

Issue: The Companies also argue that the mitigated negative declaration does not provide adequate support for the basin plan amendment because it must include an alternatives analysis

Response: As described in detail above, the Temperature SED and Restoration Addendum provide programmatic consideration of alternatives; in addition to the Elk-specific alternatives generated in the planning process (see Response under Range of Alternatives above for more specifics). A good example of this is the evolution of the technical TMDL and recommended implementation strategy. The Peer Review Draft Staff Report contained a sediment source analysis and hillslope and instream load allocations were described for each of the sediment source categories identified. Hillslope load allocations were developed for such management related sources as road and skid trail related erosion, harvest area related erosion, sediment source delivery sites, and channel related erosion from low order channel incision, bank erosion and streamside landslides triggered by management activities conducted in the riparian area. Instream sediment load allocations were derived based on an estimate of the volume of instream-stored sediment in the impacted reaches, and the total volume of stored sediment was allocated to each of the upstream landowners according to the proportion of their ownership upstream of storage reaches.

As a result of numerous comments expressing concern and objections to the approach, the Program of Implementation was significantly modified from what was first presented in the Peer Review Draft Staff Report. The implementation framework now strongly relies on coordinated monitoring and adaptive management as the basis for tracking trends, updating scientific understanding, and modifying implementation actions over time. The intention of the proposed altered Program of Implementation is to focus immediate attention on control of all existing and potential future sediment sources in the upper watershed as phase 1 of the TMDL while a feasibility assessment of sediment and hydrologic remediation and habitat restoration of the impacted reaches and lower watershed is completed. The programmatic and Elk-specific alternatives are sufficient to support the TMDL Action Plan.

The mitigated negative declaration provides additional CEQA documentation and is project-specific to the HRC WDRs. As described in detail in the mitigated negative declaration, implementation of the draft WDR provisions, including limiting canopy removal through enforceable watershed-wide and subwatershed-wide harvest limits, limiting harvesting to partial harvest methods (i.e., no clearcutting), temporary prohibition on harvesting in high risk subbasins, robust riparian buffers, measures to control sediment discharge from roads, limitation on wet weather operations, identification and treatment of existing controllable sediment discharge sources throughout the watershed, a feasibility study to treat sediment in and adjacent to stream channels, and an adaptive management framework informed by a monitoring and reporting component. All of which are to ensure that HRC's continued operations in the Elk River watershed will not cause significant effects on the environment that cannot be mitigated to a less-than-significant significant level (above the baseline condition-See Issue H(d) below). As a result, a project-specific EIR for the draft WDR, including an analysis of a range of alternatives is not required.

Issue: HRC stipulates that it has demonstrated that their operations result in net sediment benefits and therefore the measures the Regional Board proposes as mitigation measures are not necessary to mitigate or avoid any significant individual or cumulative effect.

Response: As explained in detail in the WDR Response to Comments, the draft WDR provisions are necessary to protect water quality under the Water Code and federal Clean Water Act first and foremost. Implementation of these provisions may inform the Regional Water Board's CEQA findings, but they are not imposed independently under CEQA. We have also explained that HRC's "net sediment benefits" argument fails because a landowner is responsible for continuing discharges on their property as well any newly-proposed or change in an existing discharge.

Issue: The Companies argue that the Regional Water Board did not properly consider economic factors in the TMDL Action Plan.

Response: The Regional Water Board adequately considered economic factors in carefully crafting the TMDL Action Plan. This is evident in the evolution of the Plan in consideration of and in response to numerous public comments and concerns. In addition, the draft WDR relies on HRC's existing environmental commitments to the maximum extent possible, and great effort was made to dovetail various monitoring and reporting to avoid duplication or redundancies. Economic considerations also informed the proposed temporary prohibition on harvesting activities in high-risk subbasins. (See draft Order at finding 57.) See also WDR Response to Comments Issue 14.

F. Public Trust

Issue: EPIC cites the evidence of past upstream industrial timber operations and the impaired reach to support its argument that "the permitting of these activities by state and federal regulatory agencies has violated the government's duty to uphold the Public Trust Doctrine, and to protect regular people, and the local environment on which they depend." EPIC argues that the impaired condition of the Upper Elk River Watershed "has largely accrued in the last 25–30 years, under the implementation of the Porter-Cologne Water Quality Control Act by the State and Regional Water Boards."

Response: EPIC's comments, while appreciated, are generally broad and vague as to what it would have the Regional Water Board do now that would better implement the public trust or the Porter-Cologne Water Quality Act for that matter. EPIC's comments appear to focus on the Regional Water Board's past implementation rather than the present.

The public trust doctrine, while normally raised in the context of water rights and allocations (see e.g. *Light v. State Water Res. Control Bd.* (2014) 226 Cal. App. 4th 1463, 1480 [citing *National Audubon Society v. Superior Court* (1983) 33 Cal. 3rd 419), is certainly relevant when implementing water quality law. (See e.g., *United States v. State Water Res. Control Bd.* (1986) 182 Cal.App.3d 82, 149 [Board acted within its water quality authority to establish standards for the protection of fish and wildlife].) Implementing water quality and the public trust, while not always exactly consistent, are very much aligned and can be implemented concurrently. In the case of regulating waste discharges, the discharge of waste is considered a privilege and not a right, (Wat. Code, § 13263, subd. (g)), rendering the public trust balancing that occurs with vested water rights less crucial for imposing requirements. To some extent, water quality statutes "codify" the public trust. (See generally, *Envtl. Prot. Info. Ctr. v. California Dep't of Forestry & Fire Prot.* (2008) 44 Cal. 4th 459, 515-16; see also Richard M. Frank, *The Public Trust Doctrine: Assessing Its Recent Past & Charting Its Future*, 45 UC DAVIS L. REV. 665, 678 (2012) [public trust-based protections are codified in Fish and Game statute, leaving little or no room for judicial amplification].) Either way, the Regional Water Board's authority under the Water Code and Clean Water Act is sufficient on its own to take the necessary actions to restore and protect water quality in the Elk River watershed.

Staff acknowledges that past efforts by the Regional Water Board were not enough to prevent the impacts and impairments now being addressed. But the Regional Water Board has, and continues to put enormous energy and resources into finding solutions and a way forward for residents in the Elk River. (See also WDR RTC Issue 1, Attachment A [summary and timeline of important milestones and Regional Water Board actions taken to address beneficial use impairment and nuisance flooding].)

The TMDL Action Plan addresses factors contributing to impairments, and establishes three primary mechanisms (regulation of upslope discharges under WDRs or Waivers, Recovery Assessment, and Watershed Stewardship Program) to achieve sediment related water quality standards, including the protection of the beneficial uses of water. The TMDL Action Plan identifies a process for assessing and implementing necessary and feasible remediation and restoration actions, and describes a Program of Implementation to be considered and incorporated into regulatory and non-regulatory actions of the Regional Water Board and other stewardship partners in the watershed. The TMDL Action Plan represents the best approach for advancing water quality improvements forward in a reasonable and meaningful way.

G. <u>Administrative Procedures Act</u>

Issue: HRC and Green Diamond (Companies) argue that the TMDL Action Plan as proposed would violate applicable requirements of the Administrative Procedures Act.

Response: Government Code Section 11353(b)(4) provides that all basin plan amendments proposed by the Regional Board must meet the standards of necessity, authority, clarity, consistency, reference and nonduplication. These standards are reviewed by the Office of Administrative Law (OAL) upon approval of any basin plan amendment by the State Water Resources Control Board.

The TMDL Action Plan meets these standards. The record contains overwhelming evidence of the necessity for water quality regulation and remediation in the Elk River watershed. It is not credible for the Companies to claim that ongoing timber operations do not contribute to the sediment loading in the impacted reach of the watershed. The TMDL Action Plan also meets the consistency and nonduplication standards as well. It is not credible to argue that the Regional Water Board's efforts to regulate water quality are inconsistent with the forest regulation program of CAL FIRE under the Forest Practice Act. In California, water quality regulation of discharges from nonpoint source land uses is no longer in significant controversy. (See e.g., *Pronsolino v. Nastri* (9th Cir. 2002) 291 F.3d 1123.) The California Supreme Court has upheld the Regional Water Board's independent authority and responsibility to administer water quality laws for logging activity. (See, *Pacific Lumber Company et al., v. State Water Resources Control Board* (2006) 37 Cal. 4th 921, 934.) The State of California successfully defended a $700 million damages action brought by Palco in 2006 alleging that it breached the Headwaters Agreement by regulating timber operations to protect water quality. (*Avidity Partners LLC v. State of California* (2013) 221 Cal.App.4th 1180.)

The Regional Water Board can, and does rely on existing regulatory measures by other agencies to the extent that it can, in an effort to make the process more efficient. HRC ownership in the Elk River watershed is covered by a multi-species state and federal Habitat Conservation Plan (HCP) approved in 1999. The HCP implements state and federal Incidental Take Permits (ITP) issued for aquatic species including Chinook salmon, Coho salmon, steelhead trout, southern torrent salamander, tailed-frog, red-legged frog, foothill yellow-legged frog, and the northwestern pond turtle in conformance with the state and federal Endangered Species Acts. The HCP, and Forest Practice Rules for that matter, impose prescriptions and other requirements helpful for water quality protection needs; however, endangered species act protections may not ensure full compliance with federal and state water quality laws.

The Regional Water Board has independent authority and responsibility to administer water quality laws, which protect a broader range of beneficial uses than fisheries. The California Supreme Court has expressly rejected the argument that the Z'berg-Nejedly Forest Practice Act of 1973 provides the exclusive, "one stop" regulatory process for proposed logging activity. (See, *Pacific Lumber Company et al., v. State Water Resources Control Board* (2006) 37 Cal. 4th 921, 934 [relying on the Forest Practice Act's savings clause, which provides: "No provision of this chapter or any ruling, requirement, or policy of the [Board of Forestry] is a limitation on…the power of any state agency in the enforcement or administration of any provision of law which it is specifically authorized or required to enforce or administer"].) Water quality law differs significantly from the authority vested in wildlife agencies concerning endangered species and streambed alterations, and is in addition to the authority vested in CDF for timber harvest review. The Elk River is unusual in that human uses are the focus of the impaired beneficial uses.

H. **WDR-Specific Comments**

Issue: In their comment letter on the TMDL Action Plan, the Companies reiterate several comments that are more properly made in their WDR comments as they address the very specific permit conditions.

Response: The TMDL Action Plan does not impose any specific requirements on logging activity. The Action Plan articulates a zero load allocation but leaves ample discretion in how the Regional Water Board chooses to implement that. We will briefly address each argument below but generally refer commenters to the WDR Response to Comments document for specific evaluation of each draft waste discharge requirement.

a) Nollan/Dolan

Issue: HRC argues that the TMDL Action Plan lacks the necessary essential nexus to a legitimate government interest (*Nollan v. California Coastal Commission* (1987) 483 U.S. 825) and violates the rough proportionality standard articulated in *Dolan v. City of Tigard* (1994) 512 U.S. 374 (hereinafter referred to as *Nollan* and *Dolan*).

Response: The draft WDRs require HRC to temporarily refrain from logging activities on subbasins determined to have a high risk of contributing sediment load to a stream system that has been assigned a zero load allocation for sediment. The draft WDRs also provide additional water quality protection measures, including harvest rate limitations, Class III riparian protections, wet weather restrictions and a feasibility study for in-channel sediment remediation. These measures are required to limit the amount of sediment discharged downstream to the impacted reach that could potentially exacerbate already impaired beneficial uses and existing nuisance conditions. These requirements do not amount to a physical occupation or land dedication as was at issue in *Nollan* or *Dolan*.

Even if the draft WDRs' conditions somehow amount to an otherwise compensable taking, where *Nollan/Dolan* applies, the conditions do comply with the *Nollan* and *Dolan* standards. The conditions in the draft WDRs are directly related to, and proportional to the goal of limiting sediment discharges to the Elk River. The assertion that a nexus is not satisfied because conditions and requirements in the upper Elk do not relate to the Regional Water Board's interest in discharges that originate from the lower Elk is not supportable. The evidence shows that any additional sediment load will impact the beneficial uses of the Elk River. That is precisely the impact that the temporary prohibition, and other conditions in the draft WDRs address. Finally, the assertion that the draft WDRs' requirements are not proportional to its activities because it is requiring the discharger to mitigate for past harms is inaccurate. The current conditions in the watershed require the Board to significantly limit future sediment discharges in order to meet water quality objectives and sustain beneficial uses. The draft WDRs' conditions are designed to significantly limit future discharges to protect beneficial uses in the Elk River. The Board is not attempting to require the discharger to mitigate more than the effects of HRC's proposed activity; the current conditions are such that additional discharges must be limited.

b) Other Sources of Contribution to Impairments

Issue: The Companies claim that the Regional Water Board violates state and federal law by excluding consideration of non-forest management sources that are contributing to the ongoing sediment problem in the Lower Elk River watershed.

Response: The TMDL Action Plan includes consideration and implementation of the various other contributing factors that the Companies claim the Regional Water Board ignores. In response to informal public comment, the implementation strategy was revised to include not only WDRs for timberland owners in the upper watershed, but also instream remediation, and stewardship. The Program of Implementation's Watershed Stewardship approach seeks to address all Lower Elk factors that could influence the impacted reaches' impairment and harm to beneficial uses. The effects of the Lower Elk to the impacted reach have not been completely studied, an effort for which the Recovery Assessment is conceived. See also WDR RTC Issue 2.

The draft WDRs to HRC is one component of the larger TMDL Action Plan, and is specifically designed to limit new and existing sources from further exacerbating the impacted reach. Other components of the TMDL Action Plan address other sources and more importantly, implementation of remediation in the impacted reach. The TMDL Action Plan and the draft WDRs acknowledge that additional work is needed (other than upslope controls) to fully meet water quality standards downstream.

c) Water Code section 13360

Issue: The Companies argue that the TMDL Action Plan violates Water Code section 13360 by specifying manner of compliance by dictating silvicultural prescriptions, harvest rates and other land use management decisions.

Response: The Regional Board has broad discretion to choose a reasonable method in calculating a TMDL, which it has defined here as zero. (See 40 C.F.R. § 130.2(i); see generally, *San Joaquin River Exch. Contractors Water Auth. v. State Water Res. Control Bd.*, 183 Cal. App. 4th 1110, 1123-24 [TMDL can be expressed in terms of either mass per time, toxicity, or other appropriate measure].) This is essentially a receiving water limitation to not cause or contribute to exceedances of water quality objectives, unreasonably affect beneficial uses, or cause or contribute to a condition of pollution or nuisance. Where lack of available alternatives is a constraint imposed by present technology and the law of nature, rather than the Board specifying a particular manner of compliance, there is no violation of Water Code section 13360. (*Tahoe-Sierra Pres. Council v. State Water Res. Control Bd.*, 210 Cal. App. 3d 1421, 1438.) The draft WDRs articulate a balance of provisions designed to meet this load allocation, and a detailed discussion of each water quality provision is contained in the WDR Response to Comments document.

d) Mitigated Negative Declaration

Issue: In its TMDL comments, EPIC argues that the draft Initial Study and mitigated negative declaration "does not address the significant adverse and cumulative environmental impacts of Green Diamond Resource Company's timber operations in the Upper Elk River Watershed."

Response: The draft Initial Study and mitigated negative declaration supports the HRC WDRs. EPIC is correct when stating that no regulatory actions to amend Green Diamond's WDR (Order No. R1-2012-0087) or its South Fork Elk River Management Plan have been developed, or publically noticed for adoption by the Board. Accordingly, the existing Green Diamond management regime is considered part of the baseline condition for evaluating impacts from the proposed project, in this case, the draft WDRs for HRC. Implementation of that permit is expected to improve conditions over baseline. Further, the Board will consider modifications to Green Diamond's management at a later date, consistent with the TMDL Action Plan, and presumably those requirements will also be more stringent leading to improved conditions over baseline. We agree that the existing condition is a watershed cumulatively impacted by sediment, and additional discharges have the potential to further exacerbate this condition. That is why the proposed WDR contains additional stringent provisions. Please see the Responses to Comments on the draft WDR for additional discussion.

e) WDR Monitoring

Issue: Jesse Noelle comments that the methods and analysis in the proposed WDR provide minimal and ineffective monitoring, specifically: 1) road surface runoff is not monitored during peak rainfall events; 2) water bars, rolling dips, soil piping, rills and gullies and channel extension are not continuously monitored during peak flow runoff, 3) the effect of concentrated discharge is not monitored to determine the extent to which it overloads the deranged hydrology of the slopes below.

Response: The WDR requires regular inspections of all harvest areas during period a THP is active and throughout the three year erosion control maintenance period following completion of operations, 2) all treated CSDS, and 3) all roads on their ownership in the watershed, including storm triggered inspections. The purpose of the inspections is to ensure that drainage facilities and erosion control measures are functioning properly, identify where they are not, and correct those sites in a timely manner. One of the primary purposes of erosion control and road upgrading to is to avoid concentration of runoff from roads and disturbed ground. The WDR also requires water quality monitoring, including suspended sediment and hydrology, to evaluate ongoing watershed conditions and trends.

Road inspections are conducted according to the following triggering conditions:
All accessible roads are inspected as soon as conditions permit following any storm event that generates 3 inches or more of precipitation in a 24-hour period. Road maintenance sites that are discovered are either addressed immediately or added to the database and scheduled for repair.

HRC forestry staff inspects all completed stream crossing related roadwork to ensure HCP stormproofing and DFW MATO standards are correctly implemented and that each work site has been properly treated for erosion control in advance of the wet weather season. In coordination with ARIP and Storm-Triggered Inspections, these newly treated sites are specifically inspected for sediment prevention and minimization performance following the first winter. Accessible sites then continue to be monitored over time per the ARIP and Storm-Trigger Inspection requirements.

THP areas must occur at least three times each winter period and as outlined below, including appurtenant roads and harvest units where timber operations are or have been active. Inspections will be scheduled as follows:

- Prior to October 16th – to ensure erosion control measures are in place;
- Between October 16th and April 1st – Storm-triggered inspections following any storm that generates over 3 inches of rain falling in a 24 hour period; and
- After April 1st – Inspection of THP areas including all appurtenant roads to document any discharges resulting from the preceding winter period and to schedule any required road maintenance or other corrective action.

It is unclear what is meant by "continuously monitoring water bars, rolling dips, soil piping, rills and gullies and channel extension during peak flow runoff." Hydrology is continuously monitored throughout the winter period by automated equipment. This type of monitoring is for the purpose of trend detection, including measuring peak flows in large tributaries. However, due to the large area covered under the WDR it is not feasible, nor necessary, to continuously monitor the roads and associated drainage facilities. As stated above, monitoring these sites is for the purpose of ensuring erosion control is functioning properly and correcting those sites where needed.

I. <u>Anti-Degradation</u>

Issue: Resident Kristy Wrigley asks the Regional Water Board to explain how the TMDL Action Plan is consistent with state and federal antidegradation policies.

Response: The TMDL Action Plan is consistent with the state and federal antidegradtion policies. State Water Board Resolution No. 68-16 Statement of Policy with Respect to Maintaining High Quality of Waters in California (Policy) requires that regional water boards, in regulating the discharge of waste, to maintain high quality waters of the state, require that any discharge not unreasonably affect beneficial uses, and not result in water quality less than that described in regional water board's policies. The Policy applies whenever a) there is high quality water, and b) an activity which produces or may produce waste or an increased volume or concentration of waste that will discharge into such high quality water. "Existing quality of water" has been interpreted to mean baseline water quality, the best quality that has existed since the Policy was adopted in 1968. Thus, the Regional Water Board must determine baseline water quality and compare with current water quality objectives. If the baseline water quality is equal to or less than the objectives, the water is not "high quality" and the Policy is not triggered. In this case the water quality objectives govern the water quality that must be maintained or achieved. (*Asociación de Gente Unida por el Agua v. Central Valley Regional Water Quality Control Board* (2012) 210 Cal. App. 4th 1255, 1270.)

If baseline water quality is better than water quality objectives, the Policy is triggered and baseline water quality must be “maintained” unless the Board makes the requisite findings. Following a century of logging, and in particular, following the post-world war II era of intensive tractor logging, water quality conditions in Elk River in 1968 were likely already impacted by sediment to some extent. However, evidence shows that beneficial uses, specifically domestic and agricultural water supplies, salmonid-related beneficial uses, and recreation, were supported during that time frame. Further impacts have occurred after 1968 as a result of excessive and poorly-regulated logging and large storm events. The capacity of the Upper Elk River for sediment is limited by the ongoing aggradation in the impacted reach and resulting nuisance conditions and compromised beneficial uses. Unless and until its capacity can be expanded through sediment remediation and channel restoration, nuisance conditions abated, and beneficial uses supported, the TMDL Action Plan defines the nonpoint source load allocation as zero. As explained elsewhere in this response to comments, the TMDL Action Plan does not impose any specific requirements on logging activity. The Action Plan articulates a zero load allocation but leaves ample discretion in how the Regional Water Board chooses to implement that. The proposed WDRs contain additional antidegredation findings specific to that permit.The TMDL Action Plan also establishes a Recovery Assessment and Watershed Stewardship Program to explore remediation actions necessary to cure water quality impairments, in addition to the control of upslope sediment. To the extent that the Upper Elk River had existing higher quality water in 1968, the Regional Water Board finds that the authorization of some sediment discharges from ongoing timber operations (subject to proper management and stringent restrictions) is necessary to accommodate important economic and social development in the area and is consistent with the maximum benefit to the people of the state. To the extent that the TMDL Action Plan contemplates discharges from certain cleanup and restoration activities, those activities may result in small short term discharges associated with placement of large wood into streams or excavation to stabilize or remove fill material stored in channels and adjacent riparian zones. The potential impacts of minor short term discharges are outweighed by the benefits of long term sediment control derived by such projects. Larger restoration actions will be subject to project-specific analysis, including antidegradation.

J. <u>Federal Endangered Species Act</u>

Issue: In his comments on the TMDL Action Plan, Jesse Noelle cites various provision of the federal Endangered Species Act.

Response: The purpose of these comments is not clear to us. We have stated elsewhere in this document that endangered species act protections may not ensure full compliance with federal and state water quality laws. The Regional Water Board has the authority and responsibility to implement the Porter-Cologne Water Quality Act and the federal Clean Water Act.

V. **References**

Buffleben, M.S. (2009). Assessment of soil creep sediment generation for total maximum daily load development in a northern coastal California watershed. PhD Disseration, University of California at Los Angles, Los Angeles, CA. 143 pp.

Griggs, G.B. (2010). *Introduction to California Beaches and Coast*. University of California Press, Berkeley, CA, 311 p.

Lewis, J. (2014). *Comments on Lee MacDonald's Presentation at the Elk River TMDL Information Workshop, May 7, 2014*. Available at: <http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/elk_river/pdf/140602/TMDL_comment_Jack_Lewis_May_2014_final_signed.pdf>

Lewis, J., Mori, S. R., Keppeler, E. T., & Ziemer, R. R. (2001). Impacts of logging on storm peak flows, flow volumes and suspended sediment loads in Caspar Creek, California. *Land use and watersheds: human influence on hydrology and geomorphology in urban and forest areas*, 85-125.

Natural Resources Services Division of Redwood Community Action Agency (RCAA). (2003). *Elk River and Freshwater Creek TMDL Resident Interviews: Historic Perspectives*. Prepared for the North Coast Regional Water Quality Control Board, Fall 2013. Available at: <http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/elk_river/pdf/elkriverfreshwatercreekresidentinterviews.pdf>

North Coast Regional Water Quality Control Board (NCRWQCB). (2005). *Empirical Peak Flow Reduction Model for the Watershed-wide Waste Discharge Requirements for Elk River and Freshwater Creek, Humboldt County, California*. Santa Rosa, California September 2, 2005. Available at: <http://www.waterboards.ca.gov/northcoast/board_decisions/adopted_orders/pdf/2006/060508_WWDRs_Attachment_B_Peak_Flow_Model.pdf>

North Coast Regional Water Quality Control Board (NCRWQCB). (2015). *Regional Water Board Staff Reponses to Informal Comments Received on The Peer Review Draft Staff Report for the Sediment TMDL in Upper Elk River*. December 23, 2015. Available at: <http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/elk_river/pdf/151222/04_20151223_Responses_to_Informal_Comments.pdf>

Reimann, C., & Filzmoser, P. (2000). Normal and lognormal data distribution in geochemistry: death of a myth. Consequences for the statistical treatment of geochemical and environmental data. *Environmental Geology*, *39*(9), 1001-1014.

Tetra Tech, Inc. (2015). *Upper Elk River: Technical Analysis for Sediment*. Prepared for the North Coast Regional Water Quality Control Board. October 21, 2015. Available at

<http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/elk_river/pdf/151222/03_20151021_Upper_Elk_River_Tech_Analysis_for_Sediment.pdf>

Sprugel, D. G. (1991). Disturbance, equilibrium, and environmental variability: what is 'natural'vegetation in a changing environment? *Biological Conservation*, *58*(1), 1-18.

ATTACHMENT 1
PUBLIC COMMENT LETTERS

From: Arnold, Jane@Wildlife
Sent: Friday, October 09, 2015 12:36 PM
To: St.John, Matt@Waterboards
Subject: RE: Request for review of instream sediment indicators in Elk River TMDL staff report

Hi Matt,

Thanks for letting me review this. I only read Page 26 and my comments are based only on that page. Some of the comments may be addressed elsewhere in the document.

I believe the statement instream indicators is correct, but not well supported in the table on Page 27. That is the table lacks information concerning which targets are for which life stage. The table appears loosely based on the NMFS PFC matrix, which has similar targets but by life stage in Appendix A and in other portions (see attached). I would suggest adding the salmonid life stage being protect to the numeric target. I would also suggest either a numeric target or more description of the narrative target for inhibiting salmon feeding in turbid waters. Newcombe and Jensen may be a source for this information. Turbidity can cause a full range of reactions in salmon, from coughing, to increased time to find food, to sublethal (abraded gills and reduced growth), and finally to lethal effects. I am unsure why only one effect is chosen to have a target. The reason why only one effect of turbidity has a target may need to be explained.

I hope this is of some use and if you have any questions, please feel free to contact me.

Jane Arnold
Senior Environmental Scientist (Specialist)
California Department of Fish and Wildlife
(707) 441-5671

Upper Elk River:
Technical Analysis for Sediment

Prepared by:

Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, Virginia 22030

Prepared for:

Environmental Protection Agency,
Region 9

North Coast Regional Water Quality
Control Board

October 5, 2015

Chapter 4 – Desired Watershed Conditions

This chapter includes a description of the WQS applicable to the Elk River watershed (Regional Water Board 2011a). By defining instream and hillslope WQIs, it also describes the desired watershed conditions that represent a functioning hydrologic and ecologic system. Collectively, these are presented as numeric targets and are appropriate for inclusion in the TMDL and WDR(s). The narrative water quality objectives (WQOs) for sediment are interpreted by deriving numeric instream WQIs and target conditions from the scientific literature and other agencies. Attainment of the instream targets is further interpreted by deriving numeric hillslope WQIs and target conditions (also obtained from scientific literature and documentation from other agencies). The goal condition described by the narrative WQOs, numeric instream targets, and numeric hillslope targets is a dynamic equilibrium (Chapter 6.1.1) in which WQS are attained, including supporting conditions for beneficial uses and abatement of flooding risks in the impacted reach[7] (Figure 9).

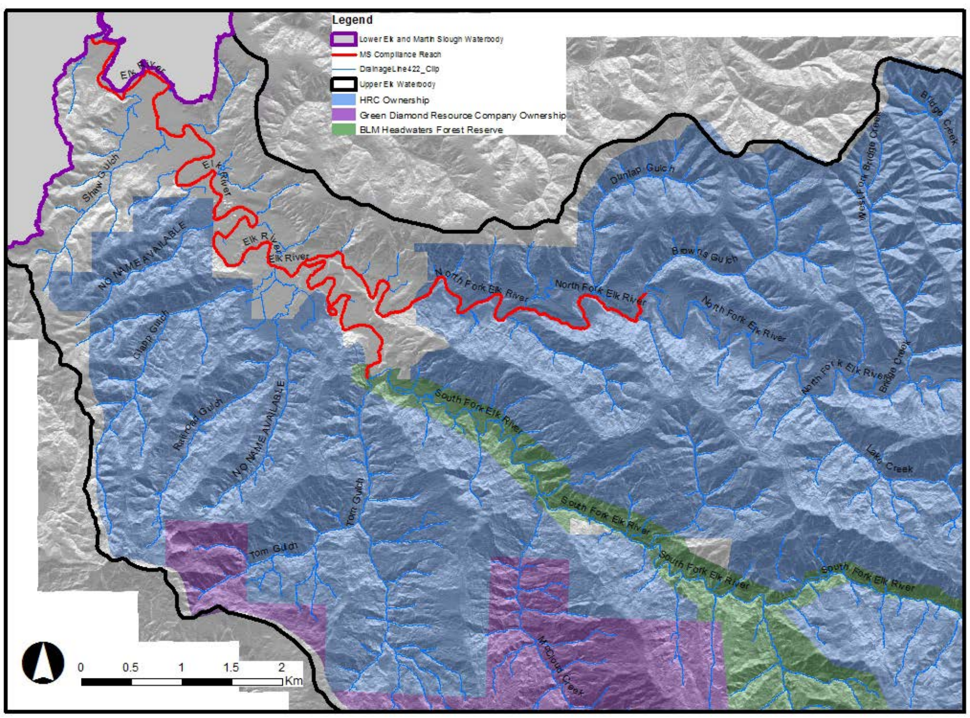

Figure 9. Upper Elk River watershed impacted reach

[7] The impacted reach extends from the confluence of Browns Gulch on North Fork Elk and Tom's Gulch on South Fork Elk downstream to the mainstem Elk River to Berta Road.

The desired watershed conditions and numeric targets are based on the current understanding of recovery potential and the conditions necessary to support beneficial uses. Under the Regional Water Board's proposed implementation strategy, these conditions and targets are expected to be continuously evaluated as part of the adaptive watershed management approach. This chapter can be considered as the initial starting point for the adaptive management process.

4.1 Water Quality Standards

WQS are adopted by the Regional Water Board to protect public health and welfare, enhance the quality of water, and serve the purposes of the federal CWA (as defined in Sections 101(a)(2), and 303(c) of the CWA). WQS, as described in the Basin Plan (Regional Water Board 2011a), consist of 1) designated beneficial uses, 2) the WQOs to protect those beneficial uses, and 3) implementation of the Federal and State policies for antidegradation. In accordance with the federal CWA, TMDLs are set at a level necessary to achieve applicable WQS. This chapter describes the state WQS for the Elk River watershed.

4.1.1 Beneficial Uses

Beneficial uses of water (beneficial uses or uses) are those uses of water that may be protected against quality degradation such as, but not limited to, domestic, municipal, agricultural supply, industrial supply, power generation, recreation, aesthetic enjoyment, navigation, preservation and enhancement of fish, wildlife and other aquatic resources or preserves.

Beneficial uses of water in the Elk River watershed include:

- **Municipal Water Supply (MUN)**
- Non-Contact Water Recreation (REC-2)
- **Agricultural Supply (AGR)**
- Commercial or Sport Fishing (COMM)
- Industrial Service Supply (IND)
- **Cold Freshwater Habitat (COLD)**
- Industrial Process Supply (PRO)
- Wildlife Habitat (WILD)
- Groundwater Recharge (GWR)
- **Rare, Threatened, or Endangered Species (RARE)**
- Freshwater Replenishment (FRSH)
- **Migration of Aquatic Organisms (MIGR)**
- Navigation (NAV)
- **Spawning, Reproduction, and/or Early Development (SPWN)**
- Hydropower Generation (POW)
- Aquaculture (AQUA)
- **Water Contact Recreation (REC-1)**
- Estuarine Habitat (EST) (applies only to estuarine portion of the watershed)
- Flood Peak Attenuation/Flood Water Storage (FLD)
- Wetland Habitat (WET)
- Water Quality Enhancement (WQE)

Comment [NPS2]: If SPWN is to be accurately assessed, incorporation of fish population monitoring should be incorporated and discussed. Current and potentially restorable high quality coho spawning and rearing reaches should be mapped and identified.

Comment [MG3]: CDFW, Arcata office (Ricker) has Humboldt Bay anadromous fish monitoring reports available. Elk River is included in the random samples.

Comment [NPS1]: It may be worth mentioning the current LWD barriers on the Upper North Fork Elk River and South Fork River, which have blocked coho passage to approximately 7 miles of upstream habitat for the last ten years. An assessment of these potentially limiting factors is going to be conducted this winter by BLM, HRC and CDFW . It might be good to have a NCRWQB representative there as well. See HRC Elk River Watershed Analysis Revisit 2014.

As noted above, there are many beneficial uses of the Elk River watershed. The beneficial uses of primary focus in this document for the Upper Elk River include: domestic drinking water (MUN) and agricultural (AGR) water supplies and salmonid habitat (including cold freshwater habitat [COLD]; rare, threatened and endangered species [RARE]; migration of aquatic organisms [MIGR]; spawning, reproduction, and/or early development [SPWN]). These are shown in bold in the list above. Water contact recreation (REC-1) is also a key

These goals (and, therefore, the associated beneficial uses) are linked to the specific Instream WQIs in Table 4~~Table 4~~ below.

While the Instream WQIs focus on conditions within the stream channel, it is also important to manage and improve conditions on the land. The Hillslope WQIs collectively describe hillslope conditions that are expected to support attainment of beneficial uses. This is accomplished by reducing the signature left on the landscape from land use activities. The Hillslope WQIs describe conditions in which sediment delivery, hydrology, and large woody debris recruitment supports attainment of beneficial uses, as measured by trends in the Instream WQIs.

4.2.1 Instream Water Quality Indicators

The proposed Instream WQIs are comparable to those adopted by the Regional Water Board and EPA in numerous sediment TMDLs throughout the region[11]. They are adapted from the *Desired Salmonid Freshwater Habitat Conditions for Sediment-Related Indices* (Regional Water Board 2006b; see also Regional Water Board 2013a, 2013b for additional rationale on use of the specific indicators) as well as the National Oceanic and Atmospheric Association (NOAA) National Marine Fisheries Service *Properly Functioning Conditions Matrix* as incorporated into the HCP for HRC (USFWS and Calfire 1999).

The Instream WQIs offer a suite of numeric targets to strive for and to gage improvements in the aquatic system (see Chapter 4.2.3 for a discussion on the application of WQIs). Table 4~~Table 4~~ identifies the Instream WQIs, their associated instream goal, numeric target, and the associated stream type (each Instream WQI is not applicable to all stream reaches). When evaluated comprehensively (Chapter 4.2.3), these are numeric targets that demonstrate attainment of beneficial uses; however, when evaluated individually, they should be interpreted as recommendations.

The salmonid habitat indices that serve as a foundation for the Instream WQIs were developed primarily for Franciscan geology (produces both course and fine sediment) and the Wildcat Group, which is predominate in the Upper Elk River watershed and produces primarily fine sediment. Therefore, specific numeric target values should be evaluated using a weight-of-evidence approach to ensure applicability to the watershed (Chapter 4.2.3). Sediment related habitat needs vary by life stage for different salmonid species, and the numeric target values selected generally represent average conditions supportive of all life stages. In addition, specific values may not be appropriate for all life stages of all salmonids, so a series of environmental conditions that trend toward the target conditions is the desired condition.

[11] See http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/ for sediment TMDLs adopted by the Regional Water Board.

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Comment [MSS4]: Geoff: would you support this statement?

Comment [NPS5]:

D50 particle size goals have been established in Table 4 below and HRC's Properly Functioning Condition Matrix as between 65-95 mm. This was based on a study conducted by Knopp (1993), which compared a series of index and impacted streams in Northern California. Index stream pebble counts fell within this range. Index reaches were established with watershed areas ranging between 4 and 6,000 acres.

I would recommend index monitoring reaches in Elk River fall within the 4 to 6,000 acre range if the 65-95 mm metric is used.

Table 4. Summary of Instream Water Quality Indicators

Instream Indicator	Instream Goal[a]	Numeric Target[b]	Associated Stream Type[c]
Percent Fine Sediment	SALMON; SUPPLY	≤10% fines <0.85 mm in diameter ≤30% fines <6.40 mm in diameter	Wadeable streams and rivers with a gradient <3%
Particle Size	SALMON	D_{50} of 65–95 mm	Streams with slopes between 1 and 4%
Large Woody Debris (LWD)	SALMON	Increasing volume and frequency of LWD and key pieces of LWD	Streams and rivers with bankfull channel widths >1 meter
Embeddedness	SALMON	Increasing number of locations where gravels and cobbles are ≤25% embedded	All wadeable streams and rivers
Pools – Average Residual Pool Depth	SALMON; SUPPLY	Pools >1 meter in depth, based on minimum residual pool depth	Wadeable streams and rivers with channel morphology that supports the development of specified pool-type, as appropriate
Pools – Backwater Pool Distribution	SALMON	Increasing number of backwater pools	
Pools – Lateral Scour Pool Distribution	SALMON	Increasing number of lateral scour pools	
Pools – Primary Pool Distribution	SALMON	Increasing number of reaches where length of the reach is composed of ≥40% primary pools	
Thalweg Profile	SALMON	Increasing variation in the thalweg elevation around the mean thalweg profile slope.	Streams and rivers with slopes ≤2%
Bankfull Channel Capacity	FLOOD	Channel cross-sectional area sufficient to contain the historic bankfull discharges (see Regional Water Board 2013a for additional details): Upper Mainstem = 2,250 cfs Lower North Fork, = 1,172 cfs Lower South Fork = 1,015 cfs	Area of impacted reach near confluence of North and South Forks Elk River
Chronic turbidity[d]	SALMON; SUPPLY	Clearing of turbidity between storms to a level sufficient for salmonid feeding and surface water pumping for domestic and agricultural water supplies	Salmonid feeding—watershed-wide historic range of salmonids Water supplies—Impacted reach

[a]Key for Instream Goals:

SALMON: Support salmonids throughout their historical range in Elk River

SUPPLY: Support the use of surface water for domestic drinking water and agricultural water supplies

FLOOD: Contain flood flows within the channel bankfull discharge

[b]Adapted from Regional Water Board 2006b; mm = millimeters; cfs = cubic feet per second.

[c]There is no numeric target for streams reaches that fall outside of the specified criteria for stream type.

[d]The WQO for turbidity also applies (Chapter 4.1.2). The Instream WQI target condition focuses specifically on turbidity values between storms.

Monitoring of Instream WQIs is critical to track progress toward attainment of WQOs and beneficial use protection and restoration. Recovery of some habitat conditions, such as an increasing number of pools, is likely to take a number of years. If during this period progress is not being made toward attainment of the Instream WQIs, then through an adaptive management process, additional implementation measures could be identified, such as pool enhancement by placement of large wood. The stewardship process can assist with coordinated monitoring to track progress towards improved salmon habitat and water supplies. Evaluation of the proposed instream numeric targets through special

Comment [MG6]: Do the NMFS Coho recovery plan (2014) and now the public review draft multispecies recovery plan (2015) support information presented in this table?

Comment [NPS7]: The sediment sample for this metric is pebble counts. I believe pebble counts are the most quantitative measure for measuring changes in bed composition. In my experience, QAQC studies revealed the smallest error between the measurements.

See my comment above (NPS 5), which describes where the targeted metric came from.

Comment [NPS8]: This may be in contrast to SALMON beneficial uses, as flood plain habitat and associated backwaters/off channel habitat is very important to coho rearing and habitat development. (Roni 2010)

Comment [NPS9]: Recommend setting specific thresholds based on actual fish feeding data. See my 6.1.3.4 comment on turbidity below.

studies is encouraged and could be guided by the proposed watershed stewardship group, as appropriate. Similarly, landowners could propose alternative targets, as determined necessary, through monitoring and adaptive management.

4.2.2 Hillslope Water Quality Indicators

The proposed Hillslope WQIs are divided into two categories: 1) common indicators that are comparable to those adopted by the Regional Water Board in numerous sediment TMDLs or WDRs and 2) Hillslope WQIs that are specific to the Upper Elk River watershed due to its unique characteristics. A subset of these indicators may be translated to permit terms, so they become enforceable.

The Hillslope WQIs offer a suite of controllable factors that can be managed through the use of best management practices (BMPs) that can be implemented in support of beneficial use attainment (see Chapter 4.2.3 for a discussion on the application of WQIs). Table 5~~Table 5~~ depicts the Hillslope WQIs, associated instream goal, numeric target for each indicator, and the applicable area in the Upper Elk River watershed. This table includes both the common and specific indicators. The Peer Review Draft provides detail on these indicators, including applicable source categories (Regional Water Board 2013a).

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It is important to recognize that these Hillslope WQIs require careful interpretation. Similar to the Instream WQIs, when evaluated comprehensively (Chapter 4.2.3), these are numeric targets that demonstrate attainment of beneficial uses; however, when evaluated individually, they should be interpreted as recommendations. They focus on the controllable sources of sediment in the watershed and their implementation is expected to support attainment of instream WQOs. The pertinent instream goals are generally associated with salmon habitat; however, meeting Hillslope WQIs is also expected to indirectly support the other instream goals through reduction in sediment loads, including fine sediments, which can reduce aggradation and turbidity (thereby improving nuisance flooding and water supply, respectively).

Table 5. Summary of Hillslope Water Quality Indicators

Indicator	Instream Goal[a]	Numeric Target	Associated Area
Common Road Indicators			
Hydrologic connectivity of roads to watercourses	SALMON SUPPLY FLOOD	100% of road segments hydrologically disconnected from watercourses	All roads
Sediment delivery due to surface erosion from roads	SALMON SUPPLY FLOOD	Decreasing road surface erosion	
Sediment delivery due to road-related landslides	SALMON SUPPLY FLOOD	Decrease in sediment delivery from new and reactivated road-related landslides	
Common Harvest-Related Indicators			
Sediment delivery due to surface erosion from harvest areas	SALMON SUPPLY FLOOD	100% of harvest areas have ground cover sufficient to prevent surface erosion	All harvest areas
Sediment delivery from open slope landslides due to harvest-related activities	SALMON SUPPLY FLOOD	Decrease in sediment delivery from new and reactivated open-slope landslides	All open slopes

Indicator	Instream Goal[a]	Numeric Target	Associated Area
Sediment delivery from deep seated landslides due to harvest-related activities	SALMON SUPPLY FLOOD	Zero increase in discharge from deep-seated landslides due to management-related activities	All deep-seated landslides
Common Management Discharge Site Indicators			
New management discharge sites	SALMON SUPPLY FLOOD	No new management discharge sites created	Across ownership
Specific Upper Elk River Watershed Indicators			
Headward incision in low order channels	SALMON SUPPLY FLOOD	Zero increase in the existing drainage network	Lower order channels
Peak flows	SALMON SUPPLY FLOOD	Less than 10% increase in peak flows in 10 years related to timber harvest	Class II/III catchments
Channels with actively eroding banks	SALMON SUPPLY FLOOD	Decreasing length of channel with actively eroding banks within sub-basins	Across ownership
Characteristics of riparian zones (i.e., 300 feet on either side of the channel) associated with Class I and II watercourses	SALMON SUPPLY FLOOD	Improvement in the quality/health of the riparian stand so as to promote 1) delivery of wood to channels, 2) slope stability, and 3) ground cover	Class I and II watercourses
Characteristics of riparian zones (150' on either side of the channel) associated with Class III watercourses	SALMON SUPPLY FLOOD	Improvement in the quality/health of the riparian stand so as to promote 1) delivery of wood to channels, 2) slope stability, and 3) ground cover	Class III watercourses

[a]Key for Instream Goals:

SALMON: Support salmonids throughout their historical range in Elk River

SUPPLY: Support the use of surface water for domestic drinking water and agricultural water supplies

FLOOD: Contain flood flows within the channel bankfull discharge

4.2.3 Application of Water Quality Indicators

The WQIs identified above can be applied in multiple settings. They help to:

- Establish appropriate metrics for ongoing monitoring, whether it is effectiveness monitoring, trend monitoring, or compliance monitoring;
- Determine appropriate control measures to be included in a regulatory mechanism, including specific numeric permit provisions; and
- Establish adaptive management thresholds, appropriate for identifying temporal and spatial conditions for re-evaluation of the applied control measures.

Because NPS restoration is driven by BMPs, evaluating post-implementation monitoring data against these numeric targets can show if the BMPs are adequate to restore and maintain beneficial uses. BMPs prevent sediment from entering waterways and increase the potential that instream numeric targets will be met.

Scientific methods to describe hydrogeomorphic processes are constantly expanding and evolving and, because of this, specific methodologies are intentionally not prescribed for the Instream or Hillslope WQIs. This encourages use of the latest techniques and emerging science to characterize and monitor water quality conditions. The numeric targets can be

Comment [NPS10]: CDFW recommends the retention of the largest trees in the riparian stands, to ensure large diameter logs are being recruited to watercourses. Scott et al 2014 showed larger logs perform more efficiently than similar volumes of small wood in storing and routing sediment. 13 largest trees per acre in Class I and II watercourse riparian zones is established in the HRC Properly Functioning Condition Matrix.

Scott, D. N., Montgomery, D. R., Wohl, E. E., 2014. Log step and clast interactions in mountain streams in the central Cascade Range of Washington State, USA. Geomorphology 216, 180-186.

Chapter 9 – References

Benda, L.E., P. Bigelow, and T. M. Worsely. 2002. Recruitment of Wood to Streams in Old-Growth and Second-Growth Redwood Forests, Northern California, USA. Canadian Journal of Forest Research. 32: 1460-1477.

Buffleben M. 2009. Evaluation of soil creep rates for application in Elk River and Freshwater Creek watersheds.

Cafferata, P. and L. Reid. 2013. Applications of long-term watershed research to forest management in California: 50 years of learning from the Caspar Creek Experimental Watersheds. California Forestry Report No. 5. The Natural Resources Agency, Sacramento, CA. 110 pp.

Calfire. 2014. Memorandum from D. Shintaku to Mr. St. John. Comments on "Peer Review Draft – Staff Report to Support the Technical Sediment Total Maximum Daily Load for the Upper Elk River. Dated April 8, 2014. California Department of Forestry and Fire Protection, Sacramento, California, 16 p.

California Department of Fish and Game (CDFG). 2008. Letter from Gary B. Stacey, Regional Manager, Northern Region to Mr. Kevin Hamblin, Director, Community Development Department, City of Eureka Subject: "Draft Eureka Greenways and Gulches Ordinance." Dated May 19, 2008.

California Department of Fish and Wildlife (CDFW). 2014. Memorandum to North Coast Regional Water Quality Control Board. Subject: Elk River Total Maximum Daily Load Analysis and Technical Report. Dated October 6, 2014. CDFW Region 1.

Dhakal, A.S., and K. Sullivan, 2014. Shallow groundwater response to rainfall on a forested headwater catchment in northern coastal California: implications of topography, rainfall, and throughfall intensities on peak pressure head generation. Hydrological Processes 28: 446-463.

Dudik, E. 1998. Interview of residents in the North Fork Elk River watershed, Humboldt County. North Coast Regional Water Quality Control Board. February 2, 1998.

Eastlick, D.J. 1993. Surface Processes and Landforms. New York: MacMillan Publishing Co.

Environmental Protection Agency (EPA). 2012. *Channel Processes: River Stability Concepts*. U.S. Environmental Protection Agency, Office of Science and Technology. Updated March 6, 20112; accessed March 11, 2015. Available at: http://water.epa.gov/scitech/datait/tools/warsss/rivstab.cfm.

Comment [MG16]: Additional recommended references:
-CDFW's State Wildlife Action Plan is available online while it is under 90 day review by USFWS: https://www.wildlife.ca.gov/SWAP/Final . See North Coast and Klamath Province sections, anadromous fish chapter, etc…
-CDFG, Recovery Strategy for California Coho Salmon (2004)
- There are numerous Elk River tributary stream inventory reports in CDFW Document library. Query for Elk River at this site: https://nrm.dfg.ca.gov/documents/ContextDocs.aspx?cat=Fisheries--StreamInventoryReports . I believe large woody debris inventories may also be available from CDFW Fortuna office.
-NMFS Coho and Mulit-Species Recovery Plans
-Impact of Fine Sediment on
Egg-To-Fry Survival of Pacific Salmon:
A Meta-Analysis of Published Studies
DAVID W. JENSEN,* E. ASHLEY STEEL, AIMEE H. FULLERTON,
and GEORGE R. PESS
Northwest Fisheries Science Center, NOAA Fisheries, Seattle, Washington, USA
-Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. Meehan. Special Publication 19
Turbidity impact references:
Bash et al, 2001; Berg and Northcote, 1985; Gregory and Levings, 1998; Sontag, 2013. I have all 4 of these pdfs.

1/17/16

To whom it may concern,

My name is Joel Fonner, I am a resident of the Elk River community. As I sit to write this letter the road has flooded, and the river is rising at two feet per hour or more. I am not able to drive out if needed. This concerns me because I have kids.

I am new to this area and have already experienced three floods in less than two months of being here.

It seems to be an accepted fact that widespread logging in the area has adversely affected the health of the river, with sediment run-off and associated problems.

I am no expert, but it seems that continued logging will adversely affect the river even more.

It is my opinion that the water quality board should focus more on getting the river healthy first, then address future logging projects. I am not against logging, but wish to see the Elk River be a healthy system, for my kids and future grandkids. I know with the right vision, and cooperation of interested parties this can be accomplished.

Sincerely,

Joel Fonner
2001 Wrigley Rd.

Public Comment for Upper Elk River Technical Sediment TMDL

Attn: Alydda Mangelsdorf
Regional Waterboard

Nathan Madsen
P.O. Box 441
Trinidad, Ca 95570
n84now@gmail.com

Introduction

At the out set please note that I agree with the conclusion found in section 7.2 of the report that since load capacity is currently exceeded by sediment input, a zero LA is the only acceptable management strategy for the impacted reaches of Elk River. However, there are a few points in the report worth mentioning critically and those are to follow.

Natural Loading

First point in interest is the direct correlation between fluctuations in the natural loading data and the management related sediment loading data as discussed but easily visualized in the Figure 15 on page 62 of the report. The direct correlation between increase in management sourced sediment and natural sediment begs the question of whether the two sources are being accurately measured and independently assessed. The direct correlation between an increase in management related sediment input and natural sources (absent a showing of similar fluctuations in natural causes such as rain quantity and intensity) seems to indicate that management related sediment sources may be “bleeding” into natural load data.

Absent a showing that rain (or other natural events) are the cause of the fluctuations in natural loading it appears that management sources are the actual cause of an increase in this natural load source and therefore management activities are actually causing more of the load than are being assed to that management. That is management is having more of an affect than is measured in the report because as sediment increases more of that sediment is being allocated to "natural load source" even though it is likely management sources are the cause.

Additionally as relates to actually assessing natural sources of sediment Figure 14 on page 58 of the report illustrates this point well. Upper Little South Fork Elk River (i.e. the headwaters preserve… a largely undisturbed forest ecosystem) is by far delivering the least sediment of any contributing sub-basin. It is therefore logical to conclude that actual natural sources are less than seem to be attributed to those sources in the report.

The bottom line here is that it appears that management sediment sources are actually delivering more sediment than is attributed to them due to the fact that some of the management related sediment is being attributed to natural sources.

Silviculture Improvement and Sediment Delivery Decrease

Figure 11 on page 36 of the report shows a very interesting trend related to Silviculture improvements and the affect of those improvements on sediment delivery. We know that in theory how logging is implemented has improved over time from the use of creeks as skids back in the day to leaving creek side buffers and soil retention oriented extraction. However, it is clear in this table that improvement in implementation is not sufficient to support on going extraction if good water quality is to be achieved. Basically Figure 11 shows that although silviculture technique improves over time sediment delivery goes up and down depending on rate of harvest primarily (see discussion below).

Additionally Figure 11 shows in the pie graph portion an inevitable reality that this TMDL process must deal with. That is as you follow the pie graphs from left to right as a progression through time you see that once the soil is disturbed the sediment has to go somewhere and as the old saying goes "sh*# rolls down hill". That is to say that once the harvest boom of the decade between 1988-1997 occurred the silt rolled down hill and now in no uncertain terms if water quality is to improve the only logical conclusion is that silviculture improvements are not the solution. As discussed below the answer is to slow the cut rate, and given the goal of a zero LA for the time being the only acceptable cut rate is zero until a time when WQO's have been achieved.

Harvest Rate of Greatest Significance

The most telling decade of interest in Elk River's history as discussed in this report is the time period of 1975-1987. During this time period Elk River sees the least sediment delivery and the greatest percentage of that delivery is from surface run off. Some of this improved condition seems attributable to the improvements in silviculture as discussed above through the passage of the Forest Practice Act.

However, it is also the period that saw the lowest cut rate. The most logical conclusion is a lower cut rate produces less sediment. Simple. It is true that over time less sediment is produced per acre cut, but still what we have here is a watershed that is impacted beyond its ability to deal with the management related impacts.

In addition to improved silviculture methods rate of harvest must be decreased and in the short term halted until the watershed can recover.

Data Source

Though it is commendable that the waterboard has chosen to use many data sources to achieve the broadest most inclusive document, the prudence of accepting estimates from the polluting entity and basing regulations off those estimates is questionable at best. Asking the foxes input on how to best guard the hen house might not be the best tactical approach.

The Goal

In section 4.2 it is stated, "<u>Any change</u> from pre-permit condition toward the numeric targets will be considered as making measurable progress." It is appropriate to recognize and appreciate motion towards a goal and encourage that trajectory but it is also import to not define any motion towards a goal as reaching the goal itself. The goal of reaching WQO's is the goal. Progress toward that goal is progress, but not the goal it self. Striving toward and reaching WQO's would be well served by redrafting this portion of the report to represent that distinction.

Restorative Efforts Prescribed

It is a very common human approach to a problem to want to do something about an existing issue. Here we have a dramatically impaired watershed suffering from sedimentation due to a cut rate dramatically in excess of what is sustainable. As mentioned above the only logical management plan at this point is to give the watershed time to recover. It is tempting to think we can help that process along with restorative measures like placing of LWD etc. as discussed in section 8.2 but this approach should be taken with extreme caution. All to often in human history there are examples of people meddling in natural systems, "messing" them all up, and then doing more harm than good in trying to repair the condition of imbalance we created in the first place. Some times the best cure is time alone. Not that a helping hand could not be lent and help improve water quality, it would just be prudent to take a very cautious approach to these measures. Sometimes more disturbance is just more disturbance even when done with the best of intention.

Please use caution, be attentive to the results, and keep an eye open to the possibility that the intention to do more good can and does sometimes produce more harm and change the plan if that appears to be the result.

Conclusion

The watershed is over burdened with sediment as the report indicates. The report concludes that a watershed wide management plan with zero management related sediment input is required at this time since the watershed cannot affectively move the existing sediment load. I support the findings and conclusions of the report in general and hope the board can actuate the plan to reach the goal of zero sediment input from management related sources in both the short and long term.

DEPARTMENT OF FORESTRY AND FIRE PROTECTION
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February 11, 2016

Matthias St. John
Executive Officer
North Coast Regional Water Quality Control Board
5550 Skylane Boulevard, Suite A
Santa Rosa, California 95403

Attention: Ms. Alydda Mangelsdorf
Mr. James Burke

RE: CAL FIRE Comment to NCRWQCB on the "Upper Elk River: Technical Analysis for Sediment" and the "Draft Action Plan for the Upper Elk River Sediment TMDL"

Dear Mr. St. John:

Thank you for the opportunity to comment on the "Upper Elk River: Technical Analysis for Sediment" (Tetra Tech Report) and the "Draft Action Plan for the Upper Elk River Sediment TMDL" (Basin Plan Amendment). The Tetra Tech Report provides technical support for draft "Order No. R1-2016-004, Waste Discharge Requirements for Nonpoint Source Discharges and Other Controllable Water Quality Factors Related to Timber Harvesting and Associated Activities Conducted by Humboldt Redwood Company, LLC, in the Upper Elk River Watershed" (Draft WDR) and the "Draft Action Plan for the Upper Elk River Sediment TMDL" (Basin Plan Amendment). As such, we primarily focused on the technical adequacy of the Tetra Tech Report to ensure that sound science informs regulatory decision-making.

The California Department of Forestry and Fire Protection (CAL FIRE) hopes you find the following comments constructive and helpful. We have organized our remarks into both general and specific comments, which are provided below.

<u>**General Comments:**</u>

The Need to Identify and Evaluate Alternative Hypotheses in Conceptual Model

CAL FIRE applauds the willingness of the North Coast Regional Water Quality Control Board (North Coast Water Board) to implement an adaptive management framework for addressing water quality impairments in the Upper Elk River watershed. Key steps in adaptive management are to identify and evaluate competing hypotheses about the resource(s) of concern (Williams, 2011). According to Williams (2011), this involves:

- Identification of competing hypotheses to explain observed pattern or process;
- The use of models imbedding these hypotheses to predict responses to management interventions;
- Monitoring of indicators of actual responses; and
- Comparison of actual vs. predicted responses to produce improved understanding.

The Tetra Tech Report presents a conceptual model in Chapter 6 (6.1.3), which includes a number of assumptions regarding cause-and-effect and system response. Rather than rely solely on assumptions in the conceptual model, we recommend that the North Coast Water Board outline areas of uncertainty within the conceptual model where competing hypotheses regarding cause-and-effect and system response can be identified and tested.

Assumption of Dynamic Equilibrium

The goal condition for the Elk River watershed is dynamic equilibrium, and this goal condition also informs numeric instream targets in the Basin Plan Amendment. Chapter 6 of the Tetra Tech Report describes dynamic equilibrium as a state where "inflow and outflow are balanced ... and the system remains unchanged" (pg. 40). The Tetra Tech Report goes on to say, "The Elk River is aggrading (Chapter 6.2.4); therefore it is not in dynamic equilibrium." These statements denote a particularly rigid definition of dynamic equilibrium, as Knighton (1998) describes equilibrium as, "not a static state but form displays relatively stable characteristics to which it will return after disturbance."

What the Tetra Tech Report does not mention is that there are alternative hypotheses to dynamic equilibrium in the literature. Besides equilibrium, Knighton (1998) describes additional types of relationships between system inputs and outputs including:

- Non-equilibrium – there is no net tendency toward equilibrium and therefore no possibility of identifying an average or characteristic; and
- Disequilibrium - adjustment is towards equilibrium but, because response times are relatively long, there has not been sufficient time to reach such as state.

Renwick (1992) described non-equilibrium (i.e., metastable equilibrium) landforms as displaying relatively long periods of environmental stability punctuated by sudden or substantial changes in form or mass flux. These rapid changes occur when high magnitude thresholds are exceeded; a condition common in tightly coupled slope-channel systems subject to infrequent landsliding triggered by large storms and/or earthquakes (Renwick, 1992). Management can increase the likelihood that these thresholds are exceeded (Montgomery, 1994; Montgomery et al., 2000) and may even trigger new equilibrium states (Bunn and Montgomery, 2004), but there can still be a natural tendency towards non-equilibrium for some systems. As noted in the Tetra Tech Report, the environmental context of the Elk River watershed is one of high tectonic activity and episodic sediment delivery even in the absence of management. This indicates that the Elk River watershed has a strong likelihood of expressing non-equilibrium behavior.

Consideration of alternative hypotheses of system behavior in the Elk River watershed is crucial, as a different hypothesis might inform the likelihood of achieving a target condition. For example, the Tetra Tech Report and Basin Plan Amendment contain target conditions for bankfull channel capacity in the impacted reach that were derived from historic USGS gage data from 1956 to 1965 (NCRWQCB, 2013; Patenaude, 2004). A system in dynamic equilibrium can achieve this target condition once the land use signal decays significantly (Figure 1a). However, if this system is in non-equilibrium, the system may not reach the target condition, even if the land use signal is reduced to zero (Figure 1b).

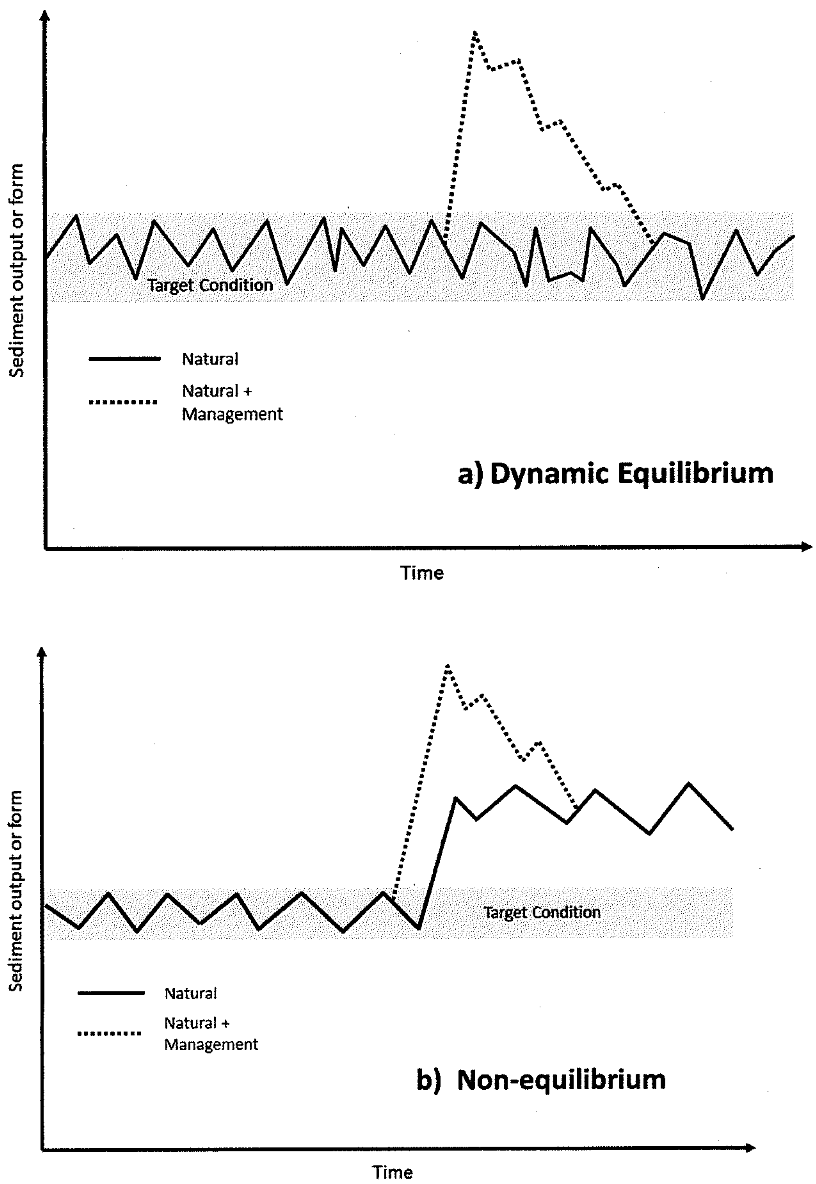

Figure 1. Hypothetical sediment output or form over time for a geomorphic system in a) dynamic equilibrium and b) non-equilibrium. The shaded area represents the target condition. If subject to management-induced perturbation, the system in dynamic equilibrium can still achieve the target condition once the management signal is significantly reduced. However, a non-equilibrium system cannot reach the target condition, even if the management signal is reduced to zero.

Likewise, assumptions regarding system behavior have implications for restoration planning and implementation. Restoration actions may be ill conceived if they are based on unsuitable expectations of geomorphic form and process (Wohl and Merritts, 2007), and expectations of equilibrium conditions are almost never met in the Mediterranean montane rivers of California (Kondolf et al., 2007; Kondolf et al., 2013). Given the fact that evidence suggests that equilibrium conditions may not be the norm in Lower Elk River, it might be necessary to modify current strategies (Chapter 8) to reflect a more feasible target condition.

Linkage of New Sediment Load Reduction Measures to Downstream Recovery

There is a high level of uncertainty regarding the effectiveness of the proposed sediment load reduction measures in achieving desired downstream target conditions. For example, our letter dated January 26, 2016 addressing draft Order R1-2016-0004 indicates that in the absence of mass wasting, 90 percent of wood recruitment occurs within approximately 100 feet of the watercourse. It is uncertain how much additional sediment savings can be provided by doubling the width of the WLPZ from 150 to 300 feet, whether this sediment savings can be tracked through monitoring, and what the response time is for this action to achieve the desired result in the downstream reach. To address these uncertainties, we propose that potential measures or actions be assessed for factors such as their likely benefit, cost, probability of success, and potential impact to both downstream and headwater landowners (Beechie et al., 2008). Projects such as the multi-year BACI study in the Railroad Gulch subwatershed should be encouraged to determine if the assumptions behind load reduction measures are correct.

Uncertainty Regarding Legacy Impacts in the Elk River Watershed

The Tetra Tech report mentions the log pond on the South Fork at Falk (pg. 33), but does not state that the millpond, built around 1884, was not removed with the aid of explosives until 1952 (PALCO 2005) – a duration of almost 70 years. It is unclear how much sediment moved downstream from this site, but historical photos indicate that there were at least two structures (Figure 2), and the height of the structures were approximately 20 feet or taller (Figures 3 and 4). Whether the volume of material stored behind these structures significantly affected downstream aggradation in the impacted reach of the South Fork and main stem of Elk River remains uncertain. However, mobilization of millpond sediments has been documented as a major source of sediment in the eastern United States (Wohl and Merritts, 2007; Schenk and Hupp, 2009; Wegmann et al., 2012). The South Fork Elk River has the highest suspended sediment loads in the Humboldt Bay region (Lewis, 2014; Figure 5), and is recognized as a significant outlier for chronic turbidity as well (Klein et al., 2012). It should be noted that the drainage area above the abandoned town of Falk is approximately 15 square miles, and the duration in which these structures influenced sediment storage was almost 70 years. Simple assumptions regarding unit area sediment yield and sediment trapping efficiency can be made to determine if stored sediment above the dams were a significant source of instream sediment and an unaccounted sediment source in the analysis. As such, this type of information could help to inform a more refined hypothesis for sediment dynamics in the Elk River watershed.

Figure 2. Looking downstream at the town of Falk in the South Fork of the Elk River circa 1900. The picture indicates at least two dam structures (from the Humboldt Room Photographs Collections).

Figure 3. A dam in the town of Falk circa 1894 (from the Humboldt Room Photograph Collections).

Figure 4. Looking upstream at the town of Falk circa 1890 (from the Humboldt Room Photograph Collections).

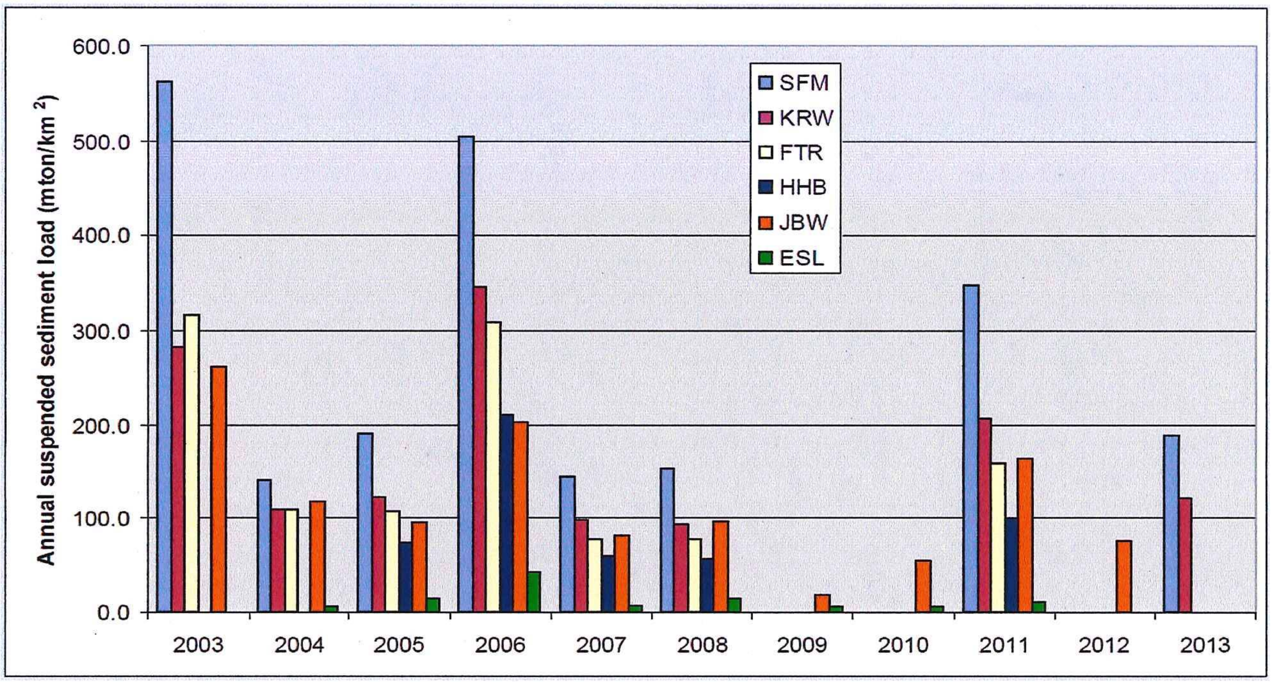

Figure 5. Annual suspended sediment load for gaging stations in the Elk River and Freshwater Creek watersheds. SFM is the gaging station in the South Fork Elk River (from Lewis, 2014).

Specific Comments:

Pg 28, Table 5 - Summary of hillslope water quality indicators. Some of the listed indicators appear to be inappropriate. Having a numeric target of 100% of road segments hydrologically disconnected from watercourses is unrealistic and unachievable, if it is assumed that this means total disconnection. Even with our best efforts, in many cases 10% or slightly more of road network will remain connected. Weaver et al. (2014) state that the goal should be to have less than 10 percent hydrologic connectivity along roads. As stated in the California Forest Practice Rules, Technical Rule Addendum No. 5, *"Not all road segments are hydrologically connected and complete hydrologic disconnection is not possible for most roads. For example, insloped road segments with an inside ditch will generally include a segment that is connected between the watercourse and first road drainage facility or structure located up-grade from the watercourse crossing (Refer to Figure 2). The likelihood of connectivity generally decreases rapidly as the distance between the road and the watercourse increases. Low delivery potential roads also include road segments on flat terrain that do not intersect watercourse channels. For all existing road segments where hydrologic connection may be present, 14 CCR § 923.1(e) [943.1(e), 963.1(e)] requires that an evaluation be conducted to identify which segments need to be disconnected and how the disconnection will occur."* If there will still be a significant sediment discharge even with this level of disconnection work, additional treatment, such as rocking road approaches, will be necessary. If there is a low likelihood of a significant sediment discharge, no further work should be necessary. These concepts should be incorporated into Table 5.

<u>Pg 47 - Increased Turbidity.</u> The report describes turbidity levels in three sub-basins of Upper Elk River, and that turbidity values from the two managed sub-basins were much greater than 20 percent higher than measurements in the reference sub-basin, indicating exceedance of the turbidity WQO. CAL FIRE's letter to the NCRWQCB dated April 4, 2014 addressing the "Peer Review Draft Staff Report to Support the Technical Sediment Total Maximum Daily Load for Upper Elk River" showed how using the Upper Little South Fork Elk River sub-basin for reference conditions for sediment (and hence turbidity) yields was biased due to differing hydrogeomorphic processes operating in this headwater catchment. No acknowledgment of this issue was included in the Tetra Tech report.

<u>Pg 62 - Using annual water yields to relate to annual sediment loading for the Little River watershed is incomplete.</u> An additional analysis, which would complement the data presented in the report, would be to use annual instantaneous peak discharge data for the Little River watershed versus annual sediment yield. Keppeler (2012) reported that regression analysis revealed a strong correlation between annual suspended sediment load and peak flows. For the Little River watershed, the plot of instantaneous annual peak discharges is (Figure 6):

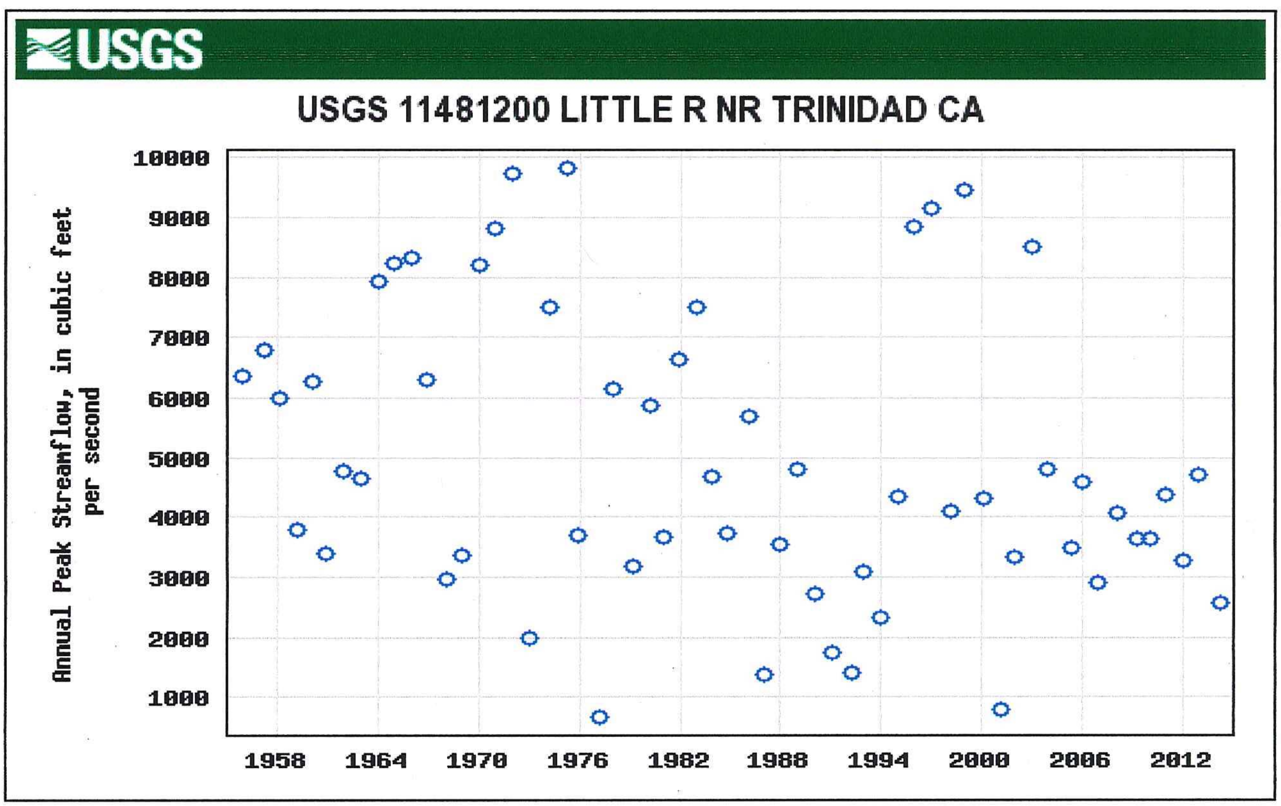

Figure 6. Annual peak stream flow (cfs) for the Little River watershed.

The peak flows that occurred on December 14, 1995, and January 1, 1997, were 14-15 year recurrence interval events, and correspond well with the high sediment yield shown in Figure 15 for the 1988-1997 time period. Conversely, the high peak discharges in the mid-1970's do not correspond to high sediment yields in the 1967-1974 period.

Recommendations

1. Consider alternative hypotheses to dynamic equilibrium for the impacted reach.

2. Explicitly address the uncertainty with achieving downstream objectives for each hillslope-related sediment load reduction measure.

3. Determine if significant sediment was stored in the South Fork Elk River near the abandoned town of Falk, and if this sediment needs to be factored in the sediment source analysis.

4. Modify the numeric target for hydrologic disconnection in the Basin Plan Amendment to reflect more achievable outcomes.

Thank you again for the opportunity to comment on the Tetra Tech Report and Basin Plan Amendment. If you have any questions or comments regarding this letter, please do not hesitate to contact Drew Coe at 530-224-3274 or drew.coe@fire.ca.gov, or Pete Cafferata 916-653-9455 or pete.cafferata@fire.ca.gov.

Sincerely,

Ken Pimlott

KEN PIMLOTT
Director

cc: Helge Eng
Dennis Hall

References

Beechie, T., G. Pess, P. Roni, and G. Giannico. 2008. Setting river restoration priorities: a review of approaches and a general protocol for identifying and prioritizing actions. North American Journal of Fisheries Management. 28: 891-905.

Bunn, J. T., and D.R. Montgomery. 2004. Patterns of Wood and Sediment Storage Along Debris-Flow Impacted Headwater Channels in Old-Growth and Industrial Forests of the Western Olympic Mountains, Washington. P. 99-112 *in* Riparian Vegetation and Fluvial Geomorphology.

Humboldt Room Photo Collections. http://library.humboldt.edu/humco/holdings/photodetail.php?S=elk river dam&CS=All Collections&RS=ALL Regions&PS=Any Photographer&ST=ALL words&SW=&C=2&R=1

Keppeler, E.T. 2012. Sediment production in a coastal watershed: legacy, land use, recovery, and rehabilitation. In: Standiford, Richard B.; Weller, Theodore J.; Piirto, Douglas D.; Stuart, John D., tech. coords. Proceedings of coast redwood forests in a changing California: A symposium for scientists and managers. Gen. Tech. Rep. PSW-GTR-238. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. pp. 69-77.

Klein, R.D., J. Lewis, and M. Buffleben. 2012. Logging and turbidity in the coastal watersheds of northern California. Geomorphology. 139:136-144.

Knighton, D. 1998. Fluvial forms and processes. John Wiley and Sons, New York. 383 p.

Kondolf, G. M., S. Anderson, R. Lave, L. Pagano, A. Merenlender, & E.S. Bernhardt. 2007. Two decades of river restoration in California: What can we learn?. Restoration ecology. 15(3): 516-523.

Kondolf, G. M., K. Podolak, & T.E. Grantham, T. E. 2013. Restoring mediterranean-climate rivers. Hydrobiologia. 719(1): 527-545.

Lewis, J. 2014. Results from a Decade of Watershed Monitoring in Elk River and Freshwater Creek (Humboldt County, CA). Presented at the Monitoring Study Group of the California Board of Forestry and Fire Protection (http://bofdata.fire.ca.gov/board_committees/monitoring_study_group/msg_archived_documents/msg_archived_documents_/lewis_msg_meeting.pdf)

Montgomery, D. R. 1994. Road surface drainage, channel initiation, and slope instability. Water Resources Research. 30(6):1925-1932.

Montgomery, D. R., K.M. Schmidt, H.M. Greenberg, & W.E. Dietrich. 2000. Forest clearing and regional landsliding. Geology. 28(4): 311-314.

North Coast Regional Water Quality Control Board. 2013. Peer Review Draft Staff Report to Support the Technical Sediment Total Maximum Daily Load for the Upper Elk River. 229 p.

PALCO. 2005. Elk River Salmon Creek watershed analysis. Prepared by Hart Crowser. Scotia, CA. The Pacific Lumber Company.

Patenaude, J.R. 2004. Preliminary Assessment of Flooding in Elk River. Staff report to the North Coast Regional Water Quality Control Board.

Renwick, W.H. 1992. Equilibrium, disequilibrium, and nonequilibrium landforms in the landscape. Geomorphology. 5: 265-276.

Schenk, E.R. and C.R. Hupp. 2009. Legacy effects of colonial millponds on floodplain sedimentation, bank erosion, and channel morphology, Mid-Atlantic, USA. 45(3):597-606.

Weaver, W.E., E.M. Weppner, and D.K. Hagans. 2014. Handbook for forest, ranch, and rural roads. Mendocino County Resource Conservation District. Ukiah, CA. 406 p.

Wegmann, K. W., R.Q. Lewis, R. & M.C. Hunt. 2012. Historic millponds and piedmont stream water quality: Making the connection near Raleigh, North Carolina. in Eppes, M. C., and M.J. Bartholomew, eds., From the Blue Ridge to the Coastal Plain: Field Excursions the Southeastern United States: Geological Society of America Field Guide 29: Boulder, Geological Society of America. 29: 93-121.

Williams, B.K. 2011. Adaptive management of natural resources – framework and issues. Journal of Environmental Management. 92:1346-1353
Wohl, E., & D.J. Merritts, D. J. 2007. What is a natural river? Geography Compass, 1(4): 871-900.

DEPARTMENT OF PUBLIC WORKS

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February 12, 2016

California Regional Water Quality Control Board - North Coast Region
ATTN: Alydda Mangelsdorf
5550 Skylane Blvd., Suite A
Santa Rosa, California 95403

Subject: Draft Sediment TMDL for the Upper Elk River Watershed

Dear Ms. Mangelsdorf:

In January 2015, Humboldt County applied to the State Water Resources Control Board for funding to support the proposed Elk River Stewardship Program. The purpose of the Stewardship Program is to create opportunities for collaboration between residents and stakeholders to implement projects that improve watershed conditions. The County and the State Water Board are in the final stages of developing a grant agreement and I expect to forward this agreement to the Humboldt County Board of Supervisors for review and approval within the next few months. If approved by our Board, the County would serve as the contract manager for the Stewardship Program through June 2018.

Recognizing the importance of the proposed Elk River Stewardship Program as a key element in addressing longstanding issues in Elk River, County staff have been meeting regularly with the University of California-Cooperative Extension, CalTrout, the Natural Resources Conservation Service, and the North Coast Regional Water Board for preliminary planning and coordination discussions since late 2014. If the grant agreement is approved by the Board of Supervisors, we hope to formally initiate the Stewardship Program with the public in late spring or early summer.

The purpose of this letter is to express support for the general framework of the Draft Action Plan for the Upper Elk River Sediment TMDL and the inclusion of the proposed Elk River Stewardship Program as a non-regulatory component of the Program of Implementation. I look forward to working collaboratively to implement the Stewardship Program and achieve on-the-ground projects that deliver improvements for the Elk River and its community.

Sincerely,

Hank Seemann
Deputy Director - Environmental Services

2-15-16

To North Coast Water Board,

Regarding the Elk River TMDL Action Plan

My name is Christina Pasteris and I have lived on Wrigley Rd. on the North Fork of Elk River for almost fifty years.

I have watched the North Fork of Elk River go from a clean water river with a rocky bottom and deep enough spots the children to swim in to a silt filled channel with no places to swim and no rocks on the bottom. The banks have fallen in due to sediment (silt) being left behind on the banks when it floods. It is so heavey, it pulls the banks down into the river along with whatever is on the bank. Trees Blackberries etc.

It has been over twenty years of distruction to the river and it will take a good twenty years of NO LOGGING to get it back to what we use to. Clean water for house hold use, for my animals, flower beds, and grow my veggies and fruits.

There is no way that any kind of logging isn't going to put more sediment into the river. It can't be done!!

It time the North Coast Water Board stood up to Humboldt Redwood and said no more logging on the North Fork of Elk River.

We as land owners and residents have a right to clean water and our land not being covered in sediment year after year. As more sediment is deposited in the river every year the flood water is higher year after year. It is now close to my husband shop and my horse arena.

This is not right that a neighbor can do this to another.

Submitted by,
Christina Pasteris

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125 YEARS
California Timberlands Division
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February 15, 2016

Mr. John Corbett, Chairman

Mr. Matt St John, Executive Officer

North Coast Water Quality Control Board

5550 Skylane Blvd. Suite A
Santa Rosa, CA 95403

VIA EMAIL; NORTHCOAST@WATERBOARDS.CA.GOV

RE: Comments on the Tetra Tech, Inc. report (Oct. 21, 2015): "Upper Elk River: Technical Analysis for Sediment" and the "Draft Action Plan for the Upper Elk River Sediment TMDL"

Dear Chairman Corbett and Matt:

Thank you for the opportunity to provide comments on the Upper Elk River: Technical Analysis for Sediment (Tetra Tech Report) and the Draft Action Plan for the Upper Elk River Sediment TMDL (Draft Action Plan). Green Diamond owns 2059 acres of timberland in the Elk River drainage with all but 154 acres in the South Fork Elk River drainage. This land was acquired by Simpson Timber Company in 1978, and this property experienced limited harvesting activing during this period until 2006.

Recognizing that Elk River is a very sensitive watershed, we have worked closely with your staff for over 20 years to develop workable management solutions for our ownership in this basin. This started in 1993 with the development of the Salmon Creek Management Plan which was also implemented in Elk River. This plan recognized the sensitivity of these two drainages and included unique and "ahead of their time" mitigations that included: straw mulching of new roads, no winter road use, and no broadcast burning. In 2006 we worked closely with your staff to develop the "South Fork Elk River Management Plan" that was the foundation for the SF Elk River Watershed Wide-WDR (SF Elk WDR) approved in 2006. In 2010 we again worked with staff to develop the Property-Wide Roads WDR (Roads WDR), that directs the reconstruction and maintenance of forest roads. This was followed by the property-wide Forest Management WDR in 2012 that covers silviculture, road construction and other management activities and is the only such permit in the state.

Even though we purchased the property in 1978, our first harvest occurred in 1993 under the Salmon Creek Management Plan with a second harvest in 1998. Our next harvest entry was not until 2006 , after the approval of the 2006 SF Elk WDR. From 1978 to 2006 we harvested a total of 280 acres, which included long periods of no harvest. In 2006 we conducted a complete sediment-source survey of our road system in the SF Elk River drainage and implemented a sediment removal and road upgrading program. This sediment reduction program is now 98% complete with final completion planned for 2016. Based on Tetra Tech Report the total management-related sediment from our lands from 2006-

2011 was 3290 yd^3/mi^2. During this same time period we have removed or prevented 9353 yd^3/mi^2 of sediment from delivering from our road system to a watercourse.

Based on GDRCo's long history of proactive and prudent management in the watershed, we believe the management related sediment estimates provided in the Tetra Tech Report are inaccurate and the natural sediment estimates are underestimated. We also believe there are many other technical issues and concerns in the Tetra Tech Report. As such GDRCo, in coordination with HRC, requested Dr. Lee MacDonald to conduct a thorough technical review of the Tetra Tech Report. Dr. MacDonald has provided his technical comments in a separate correspondence to the Water Board. However, GDRCo would like the Water Board to recognize Dr. MacDonald's technical comments on the Tetra Tech Report as an extension of GDRCo's comments. Additionally, GDRCo conducted a thorough evaluation of an underlying and foundational assumption made in the Tetra Tech Report which has been perpetuated from previous Water Board Staff reports (e.g. Peer Review Draft Staff Report to Support the Technical TMDL for the Upper Elk River). This key issue is related to the inappropriate estimation of the drainage density for both managed and unmanaged basins. This issue results in a significant overestimation of management related sediment sources (e.g. bank erosion, streamside landslides, low order channel incision, and deep-seated landslides) and a significant underestimation of natural sediment sources (e.g. bank erosion, streamside landslides, and deep-seated landslides). As you can see this error impacts nearly all the sediment source categories; both natural and management. The write-up of this evaluation of the drainage density assumptions in the Tetra Tech Report and other related Water Board staff documents is included as Attachment 1 to this comment letter and should be utilized in adjusting the sediment source estimates that were derived and extrapolated based on drainage density estimates.

For reference, included as Attachment 2 is a summary of the unique management practices that GDRCo implements on our South Fork of Elk River property.

<u>Response to Sediment Source Analysis</u>

A review of Table 1 from the Draft Action Plan and Table 9 from the Tetra Tech Report provides a timeline of sediment estimates for the period 1955- 2011 by anthropogenic and natural loading. The peak sediment anthropogenic loading occurred during the period 1988- 1997 at 966 $yd^3/mi^2/yr$. During this 10 year period Green Diamond only harvested 140 acres in the Elk River drainage. During the period 1998-2000 the anthropogenic loading was 531 $yd^3/mi^2/yr$, when we harvested an additional 140 acres. Given that GDRCo only harvested 280 acres for the period 1978-2000 (23 years for an average of 12.2 acres per year), it is hard to imagine that GDRCo's harvest contributed significantly to the sediment loading during this period. It is also of interest to note that Table 1 from the Draft Action Plan and Table 9 and Figure 15 from the Tetra Tech Report show improving sediment conditions for Elk River. Attachment 3 shows the gross harvest acres per year since GDRCo has owned property in Elk River through 2015 with the corresponding watershed-wide annual management related sediment delivery estimated from the Tetra Tech Report from 1978 through 2011 (the latest year estimated in the report). The estimates in the Tetra Tech Report do not correlate with our harvesting activities in the watershed. Furthermore, as mentioned above, when GDRCo did conduct operations in the watershed we did so recognizing the basin's sensitivity by incorporating additional mitigation measures in our practices.

Response to Hillslope Water Quality Indicators and Numeric Targets

The following is an item-by-item response to Table 2 of the Draft Action Plan and Table 5 of the Tetra Tech Report that outlines the Hillslope Water Quality Indicators and Numeric Targets for the Upper Elk River Sediment TMDL:

Hydrologic connectivity of roads to Watercourses: Since 2006 GDRCo has upgraded nearly all of the road systems and treated 98% of the sediment sites. This included hydologically disconnecting the roads from watercourses and installing "critical dips" at every watercourse crossing. It must be noted that it is not possible to achieve 100% disconnection. With critical dips properly installed there are short distances (potentially on either side of the crossing depending on the road grade) that slopes towards the watercourse. These segments of road can never be truly hydrologically disconnected as the numeric target indicates (e.g. 100% of road segments hydrologically disconnected from watercourse). GDRCo has specific feasible mitigation measures to address to address surface erosion from roads such as by straw mulching all newly-constructed roads prior to the winter period, excluding winter operations and limiting winter road use. The only management use of the roads during the winter is for quad runners, and we even close some roads to quad runners.

Sediment delivery due to road-related landslides: Our road construction, reconstruction and maintenance efforts are designed to minimize road width and soil movement and to address unstable fill slopes. GDRCo's road treatment efforts have been very extensive and effective over time as evidenced by the road effectiveness monitoring GDRCo has conducted under the Road WDR for Elk River.

Sediment delivery due to surface erosion from harvest areas: Our harvesting systems are designed to minimize soil disturbance. We use skyline cable yarding on slopes averaging >35% and shovel yarding on the more gentle slopes. This means that we not construct skid roads. We also do not conduct broadcast burning. Post- harvest conditions often include undisturbed duff layers and small to medium sized slash distributed across the area. We are concerned that "100% of harvest areas have ground cover sufficient to prevent surface erosion" is an unobtainable goal. There will always be small areas of bare soil. Where these areas are adjacent to watercourses they are treated to prevent sediment from entering the watercourse. A better way to word with numeric target is: "Harvest areas have ground cover sufficient to prevent sediment from surface erosion from delivering to watercourses."

Sediment delivery from open slope landslides due to harvest-related activities: We have not witnessed non-road related "open slope landslides" as a sediment source on our Elk River timberlands. Our road management and harvest planning are designed to avoid and mitigate identified unstable features. By not constructing skid trails and by hydrologically disconnecting the road systems we maintain the natural surface and subsurface drainage system thereby preventing concentration of water or disrupting soil tubes. Since 2001 (beginning 5 years prior to the implementation our SF Elk WDR) we have observed only 5 landslides on our Elk River timberlands through aerial photo review. Of these five landslides none would be considered an open slope landslide and only two resulted in delivered sediment to a watercourse for a total of 243 cubic yards of delivered sediment. Both of the landslides that delivered to a watercourse would be considered streamside landslides and represent an annual loading of about 6 $yd^3/mi^2/yr$ over this period using aerial photographs.

Sediment delivery from deep-seated landslides due to harvest- related activities: We believe GDRCo's harvesting mitigations are effective in preventing accelerated movement of deep-seated landslide. See above response.

New management discharge sites: Our entire management regime (SF Elk Management Plan, Roads WDR, shovel yarding, sediment site treatments/road upgrades, no winter operations, seasonal road use restrictions, no broadcast burning) is designed to avoid sediment discharge into watercourses. Looking forward, the potential for generating new sediment sources will occur following treatment of the sediment sites and road upgrades due to minor site adjustments. Small amounts of mobilized sediment from post-treatment adjustments is fully expected and justified as these actions are preventing potential larger volumes of sediment from entering the system. GDRCo's road treatment process is nearly completed and was delayed in 2015 due to the presence of a spotted owl.

Headward incision in low order channels: This has been a key discussion with staff and an issue we have investigated. We have not seen examples of this on harvested areas in Elk River. Our management measures that include RMZs and EEZs adjacent to all watercourses and our cable and shovel yarding minimizes soil compaction and prevents the need to construct skid trails thereby not interrupting the soil tubes and maintaining natural water drainage patterns.

Peak flows: Our ownership in nearly entirely in the SF Elk drainage. The confluence of the NF and SF are downstream of the area with chronic flooding (Dead Woman's Curve). In our 2006 SF Elk WDR we were not regulated for peak flow issues. Regardless, we do not believe GDRCo's limited harvesting is significantly contributing to peak flows. Our ownership represents 15.3% of SF Elk River and 5.5% of the entire Elk River drainage. Our SF Elk River Management Plan provides for 75 acres/year (three year average) of harvest. Since 2006 , in actuality GDRCo has harvested an average of 63 acres/year, of which 55.4 acres/year were harvested using evenaged management.

Channels with actively eroding Banks: Actively eroding stream banks are a natural process within the watershed that can be exacerbated by harvest activities. Our observations indicate that the observed bank erosion adjacent to watercourses on our ownership is primarily related to stored sediment from historical logging. These areas are protected by RMZs and EEZs that prevent disturbance during operations. We have observed occasional inter-channel soil movement and stream bank erosion. However these processes are not the result of contemporary practices, but are the result of a combination of natural processes and historical logging events (pre 1900 and 1950-1960s). This stored sediment appears to move when in-stream LWD decays and during high flow events. The degree of movement and adjustment is dependent upon the channel flows.

Characteristics of riparian zones (i.e., 300 feet on either side of the channel) associated with Class I and II watercourses: The use of a 300' zone is based on the North West Forest Plan that was applicable to federal lands with the habitat of the northern spotted owl. We do not believe this should be used in the TMDL/WDR process. The following is an excerpt from RECORD OF DECISION for Amendments to Forest

Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl, April 1994: “Riparian reserves are areas along all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis. **The main purpose of the reserves is to protect the health of the aquatic system and its dependent species; the reserves also provide incidental benefits to upland species. These reserves will help maintain and restore riparian structures and functions, benefit fish and riparian-dependent non-fish species, enhance habitat conservation for organisms dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide for greater connectivity of late-successional forest habitat.” (emphasis added)** Clearly this is out of the scope of the TMDL and beyond the authority of the Board. Further, we believe that our current RMZ measures that are part of the approved SF Elk Management Plan and our approved federal Aquatic HCP is adequate to protect the beneficial uses of water and the goals of the TMDL. Under our evenaged management regime it may be difficult to demonstrate “Improvement in the quality/health of the riparian stand so as to promote 1) delivery of wood to channels, 2) slope stability, and 3) ground cover” within the proposed 300’ riparian zone. We have found that our 150’ zones on Class I and 75-100’ zones on Class II watercourses are providing the key riparian function of: sediment filtering, large wood recruitment, and temperature control. We do believe there is a need for 300’ zones. Also, we have a limitation of one entry per rotation within our riparian zones. This means that once we have harvested any trees within a riparian zone, we will not reenter that zone for 50+ years in the future. Given the average harvest age is around 60 years of age, upon reentry the riparian zones will be over 100 years of age before any future harvesting occurs.

<u>Characteristics of riparian zones (150’ on either side of the channel) associated with Class III watercourses:</u> The primary purpose for Class III protection is to maintain channel and bank stability, and maintain in-channel structures that store and meter sediment. We have EEZs that prevent any equipment disturbance within the protection zone (30’ for slopes <60% and 50’ for slopes >60%). The protection measures within these zones include retention of hardwood and sub-merchantable conifers (<12” DBH) and all trees that provide channel and bank stability.

<u>Bankfull Channel Capacity:</u> See Dr. Lee MacDonald’s comments on the Tetra Tech Report for additional information on this subject.

<u>Chronic turbidity:</u> Based on the responses provided above, we do not believe that our current management practices are significantly contributing to chronic turbidity. GDRCo believes that Elk River has always had exceptionally high natural sediment loads and associated turbidity levels due to the poorly consolidated underlying bedrock and rapid uplift rates in the watershed. We further believe the principle source of management turbidity is from the adjustment of in-channel stored sediment that is a function of historical logging practices. See Dr. Lee MacDonald’s comments on the Tetra Tech Report for additional information on this subject.

Again, we appreciate the opportunity to comment on the Tetra Tech Report and Draft Action Plan and look forward to the completion of this TMDL process and plan to continue to support and participate in the Elk River Watershed Stewardship Program. In addition we recognize the need to reconsider the South Fork Elk River Management Plan to ensure consistency with the TMDL and look forward to working with your staff in this process.

Sincerely,

Gary C. Rynearson, Manager

Forest Policy and Communications

CC: NCRWQCB Members

ATTACHMENT 1

Analysis of the Drainage Density Assumption in the Elk River TMDL Documents

Analysis of the Drainage Density Assumptions in the Elk River TMDL Documents

By

Matthew House and David Lamphear

The following three documents make the assumption that management activities have expanded the drainage network in Elk River due to a combination of tractor and road crossings and hydrologic modifications: 1) Peer Review Draft Staff Report to Support the Technical TMDL for the Upper Elk River (Regional Water Board 2013), 2) Upper Elk River Sediment Analysis and Implementation Plan (Regional Water Board 2015), and 3) Upper Elk River: Technical Analysis for Sediment (Tetra Tech 2015). In the following text, these three documents are collectively referred to as the "Elk River Sediment Source Analysis", unless otherwise specifically identified.

The management effects identified in the Elk River Sediment Source Analysis on the natural drainage network is purported to have caused headward incision of low order channels. GDRCo believes the methodology utilized in the Elk River Sediment Source Analysis to estimate this potential management effect and determine the drainage density for both the unmanaged and managed basins is fundamentally flawed and grossly overestimates management related sediment where ever the analysis utilizes a natural or management derived drainage density.

The Elk River Sediment Source Analysis relies on the PhD dissertation of Matthew Buffleben (Buffleben 2009) to establish unmanaged and managed drainage densities. The assumed differences in drainage densities are the basis for which the sediment delivery estimates are extrapolated from an unmanaged condition to a managed condition. Buffleben (2009) surveyed six channels heads in Little South Fork Elk River (representing an unmanaged area) and derived a median contributing area value (4.22 ha) that defined the stream inception to then develop a representative natural drainage density for all of Elk River (5.5 mi/mi^2). Buffleben (2009) similarly surveyed a total of 39 channel heads in two managed basins (Corrigan Creek and South Branch North Fork Elk River). The median contributing area value for these managed basins was 0.52 ha that defined the stream inception and resulted in a purported management drainage density 16.5 mi/mi^2 for Elk River.

It has long been recognized that drainage densities are a function of more than simply drainage area (e.g. Montgomery and Dietrich, 1988). Pelletier (2013) describes two fundamental problems with the contributing area methodology: 1) a drainage density derived from the analysis of average (or median) contributing area depends on the threshold, which is circular reasoning; and 2) the contributing area methodology doesn't account for the fact that channels typically form in areas of localized, concentrated flow; not just because there is a large contributing area. We believe Pelletier's second point is the principal reason the drainage density is so grossly overestimated. The process creates so many fictitious channels in areas where there are no valley constrictions in which to confine flow. The literature is rich with many more sophisticated methodologies to derive a drainage network (e.g. Montgomery and Dietrich, 1988; Montgomery and Dietrich, 1989; Tarboton and Ames 2001; Orlandini et al. 2011; Pelletier 2013; Clubb et al. 2014) than the contributing area process alone; but, it is has been demonstrated that these methodologies overestimate the true drainage density (Clubb et al. 2014). The methodology used by Buffleben was a contributing area process whereby the median contributing area calculated from a sample of field mapped channel heads was used as the threshold to derive a GIS-based stream network for managed and unmanaged conditions.

GDRCo further evaluated the validity of the contributing area approach presented in Buffleben (2009) to derive managed versus unmanaged drainage densities by utilizing field based channel mapping that was conducted for timber harvest plan layout within the McCloud Creek basin. McCloud Creek is a 2.37 mi^2 watershed and GDRCo owns approximately 85% of the basin. In 2006, GDRCo was issued WDRs for its operations in S.F. Elk River including McCloud Creek. Since 2006, GDRCo laid out 17 THP units within the McCloud Creek catchment that included 46 channel heads that terminated either within or adjacent to the THP boundary (Figure 1). Since these channel heads were within a THP boundary they were guaranteed to be field verified by an RPF and a high proportion received confirmation by state agency representatives during the Pre-Harvest Inspection process for THP approval to ensure no watercourses were missed and to verify the terminus of the channel head (e.g. top of the Class III channel). A GIS analysis was conducted to calculate the contributing area for each channel head location. The summary results for the two managed basins from Buffleben (2009) were included with the McCloud Creek data for comparison (Table 1). The drainage areas for the channel heads in McCloud Creek is highly positively skewed (Figure 2). Based on the range, median and average presented for the data in Buffleben (2009) we assume the data for all three study basins were also highly positively skewed (Table 1). GDRCo's actual field mapped drainage density is 9.41 mi/mi^2. If GDRCo was to derive the stream layer using the contributing area methodology with the median drainage area (0.258 ha), the resulting drainage density would be 26.28 mi/mi^2, 2.8 times higher than reality (Figure 3). For illustration purposes GDRCo also developed the hypothetical drainage network for McCloud Creek using the 0.52 ha as was applied in the Elk River Sediment Source Analysis and compared it to GDRCo's field mapped drainage network (Figure 4). The resulting stream density was 18.86 mi/mi^2 which overestimates the actual field mapped stream density by 100%. All the watercourses shown in yellow in Figure 4 are fictitious streams that amount to an extra 22.4 miles of channels that do not exist on the landscape. The implications of this is that Elk River Sediment Source Analysis attributes management related sediment from deep seated landslides, low order channel incision, bank erosion, and streamside landslides to these nonexistent channels.

As mentioned above, the Elk River Sediment Source Analysis assumes that the managed drainage density is 16.5 mi/mi^2. With such highly skewed data and with drainage areas of channel heads that span multiple orders of magnitude, it is inappropriate to use simple descriptive statistics such as average, median, or mode and expect to derive a realistic watercourse network that represents field conditions. Utilizing the median and average, for example, creates fictitious watercourse channels that do not exist on the landscape which the Elk River Sediment Source Analysis assumes are present and asserts are causing and delivering sediment to the Lower Elk River.

It is equally inappropriate to use simple descriptive statistics of a few drainage areas of channel heads to derive the natural stream network and drainage density (especially from a sample size of six) in Little South Fork Elk River and assume a uniform natural drainage density. An appropriate methodology would be to field map the drainage network in the manner in which THPs are laid out; all the channel heads are delineated. The actual drainage density of the field mapped watercourses from an unmanaged watershed would determine the natural drainage density. However it is important to note that even extrapolating an average drainage density from a complete field derived drainage network such as what we recommend be done in Little South Fork Elk River can still result in great uncertainties in the actual natural drainage densities and spatial arrangement of the watercourses across the entire Elk River watershed. To illustrate this point we evaluated the drainage density of various watersheds where the drainage network was derived from a standardized contributing area (e.g PWA 2008).

PWA (2008) conducted bank erosion surveys in three watersheds within Elk River (Corrigan Creek, South Branch North Fork Elk River, and Little South Fork Elk River). The basins were selected to represent managed (Corrigan Creek and South Branch North Fork Elk River) and unmanaged areas (Little South Fork Elk River) for purposes of comparing banks erosion estimates. PWA developed a GIS-based stream layer by assuming a 0.8 ha contributing area to define the location of the stream inception and create a sampling frame to randomly select reaches to survey for bank erosion. This stream layer development process is management independent and heavily influenced by basin shape (long and skinny vs round) and drainage pattern (trellis vs dendritic). Utilizing the standardized contributing area of 0.8 ha resulted in varying stream densities for these three basins within Elk River (11.09 mi/mi^2, 11.88 mi/mi^2, and 10.57 mi/mi^2 for Corrigan Creek, South Branch North Fork Elk River, and Little South Fork Elk River, respectively). Even though these three basins have similar shape (long and skinny) and drainage patterns (trellised), this contributing area methodology resulted in a greater than 12% difference in drainage densities. If you compare a drainage pattern that is more dendritic, you would expect to have even a higher drainage density using the contributing area methodology. For example McCloud Creek has a combination of a dendritic and trellised drainage pattern. The drainage density of McCloud Creek when a 0.8 ha contributing area is used to define the location of the stream inception is 15.19 mi/mi^2 (a 43.7% increase above Little South Fork Elk River simply due to basin shape and drainage pattern). This illustrates the flawed methodology of utilizing a standardized contributing area approach to create a drainage network. Interestingly the GDRCo field mapped drainage density of 9.41 mi/mi^2 compares very closely to the HRC field mapped drainage density of 9.96 mi/mi^2 that was reported in the Peer Review Draft Staff Report to Support the Technical TMDL for the Upper Elk River (Regional Water Board 2013). However the Board staff dismisses this best available data and chooses to utilize the flawed methodology presented in Buffleben (2009). The Water Board staff gave the following reasons for disregarding this information (Regional Water Board 2013):

> 1) Incomplete mapping of low order channels in the watershed assessment area as they were done associated with THP lay-out over time and standards of practice for identification of low order watercourses have evolved.
>
> 2) Most watercourses were initially mapped on the coarser-scale USGS topographic maps. The use of LiDAR for channel mapping would likely improve the channel mapping, however was not available until 2005.

3) Watercourses have likely extended following first, second, and third cycle logging. Watercourses identified as part of THP layout in the period spanning the1980s through the 2000s, likely have incised headward following THP operation.

It is interesting that GDRCo's and HRC's independent drainage density estimates that were derived from LiDAR and field mapping differed by only 6%. Even if we were to assume that all the watercourses in GDRCo's McCloud Creek had extended due to headward incision from early logging practices by 100 feet, the drainage density would have been 8.51 mi/mi^2(potentially a realistic unmanaged drainage density). This illustrates how the attempt by Water Board staff to account for the potential effect of early logging practice impacts on the watercourse network has resulted in a gross overestimate of the management related sediment inputs to Elk River.

To illustrate the magnitude of error this created in the Elk River Sediment Source Analysis let's assume a theoretical management related rate 3 $yds^3/mi/yr$ for bank erosion and streamside landslides. The sediment yield on a per unit area basis utilizing GDRCo's actual field mapped drainage density value of 9.41 mi/mi^2 for McCloud Creek would result in 28 $yds^3/mi^2/yr$; however, using the inappropriately modeled drainage network derived from Buffleben (2009) with the median contributing area value of 0.52 ha and resulting drainage density of 16.5 mi/mi^2 would result in 48 $yds^3/mi^2/yr$ (a 70% overestimate in management related bank erosion and streamside landslides. There would be similar gross overestimations for each sediment source category in the Elk River Sediment Source Analysis that utilized the fictitious management drainage density estimate. A corresponding underestimation error will also be present for all nature sediment source categories in the Elk River Sediment Source Analysis that relied on the fictitious natural drainage density estimate.

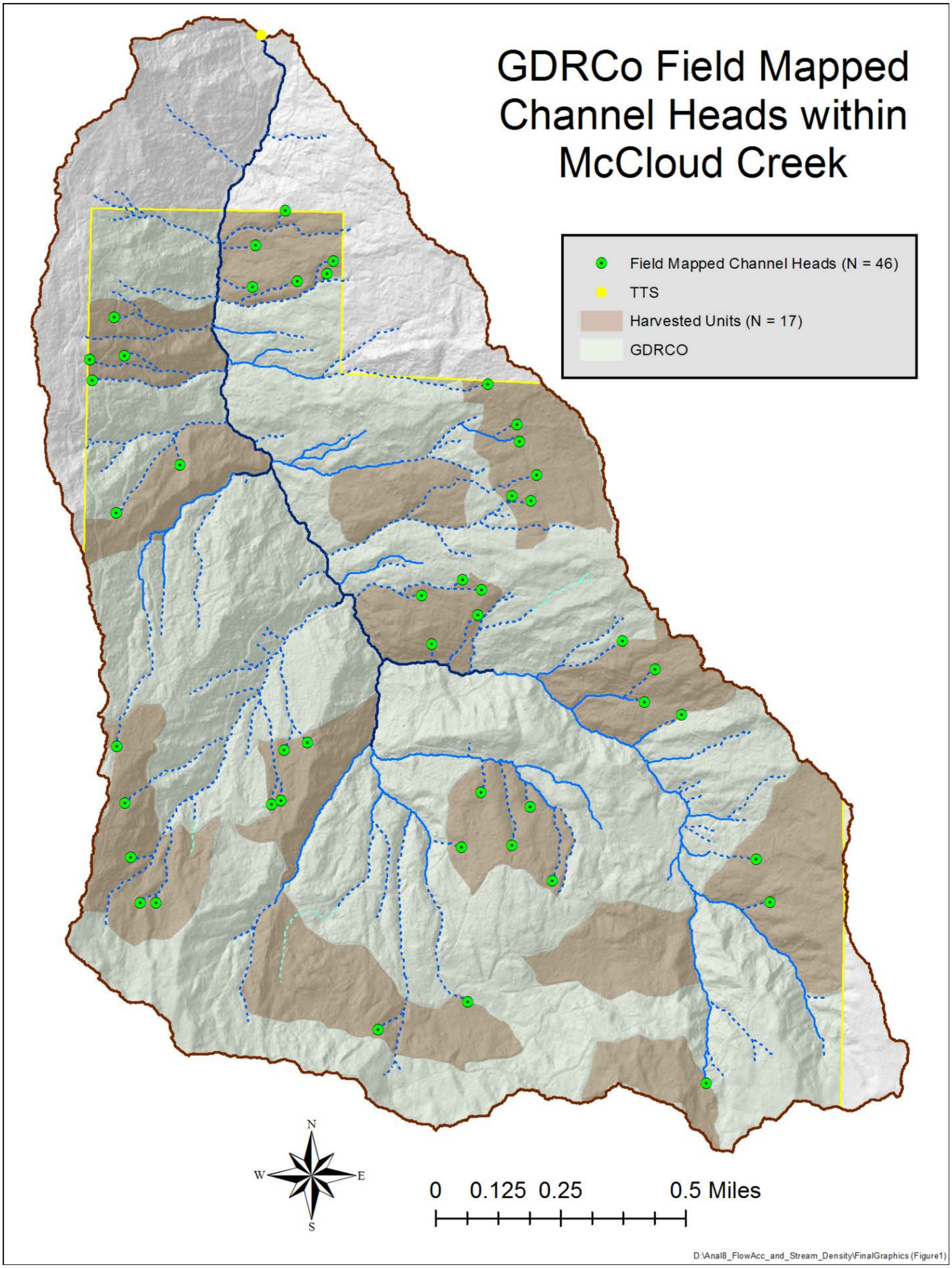


Figure 1. GDRCo's field mapped channel heads from 14 THP units in McCloud Creek.

Table 1. Contributing drainage area above field mapped channel heads. South Branch North Fork Elk and Corrigan Creek data from Buffleben (2009).

		Drainage Area (ha)			
Watershed	Number of channel heads	Minimum	Maximum	Median	Average
South Branch North Fork Elk River	22	0.07	2.69	0.42	0.69
Corrigan Creek	17	0.12	3.3	0.72	0.98
McCloud Creek	46	0.0015	4.098	0.258	0.746

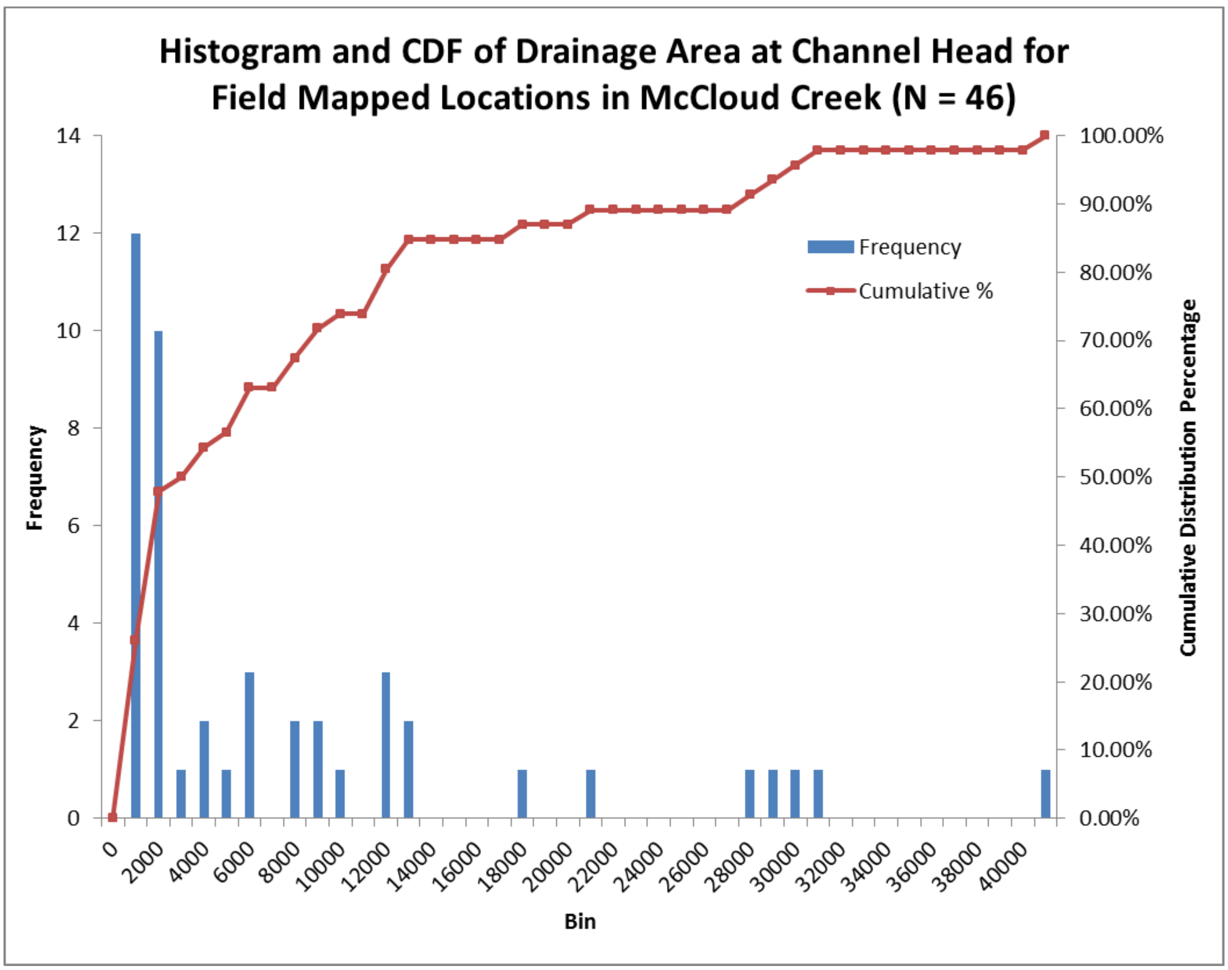


Figure 2. Histogram and cumulative distribution of drainage area above the 46 field mapped channel heads from 17 THP units in McCloud Creek. Bins are in units of m^2.

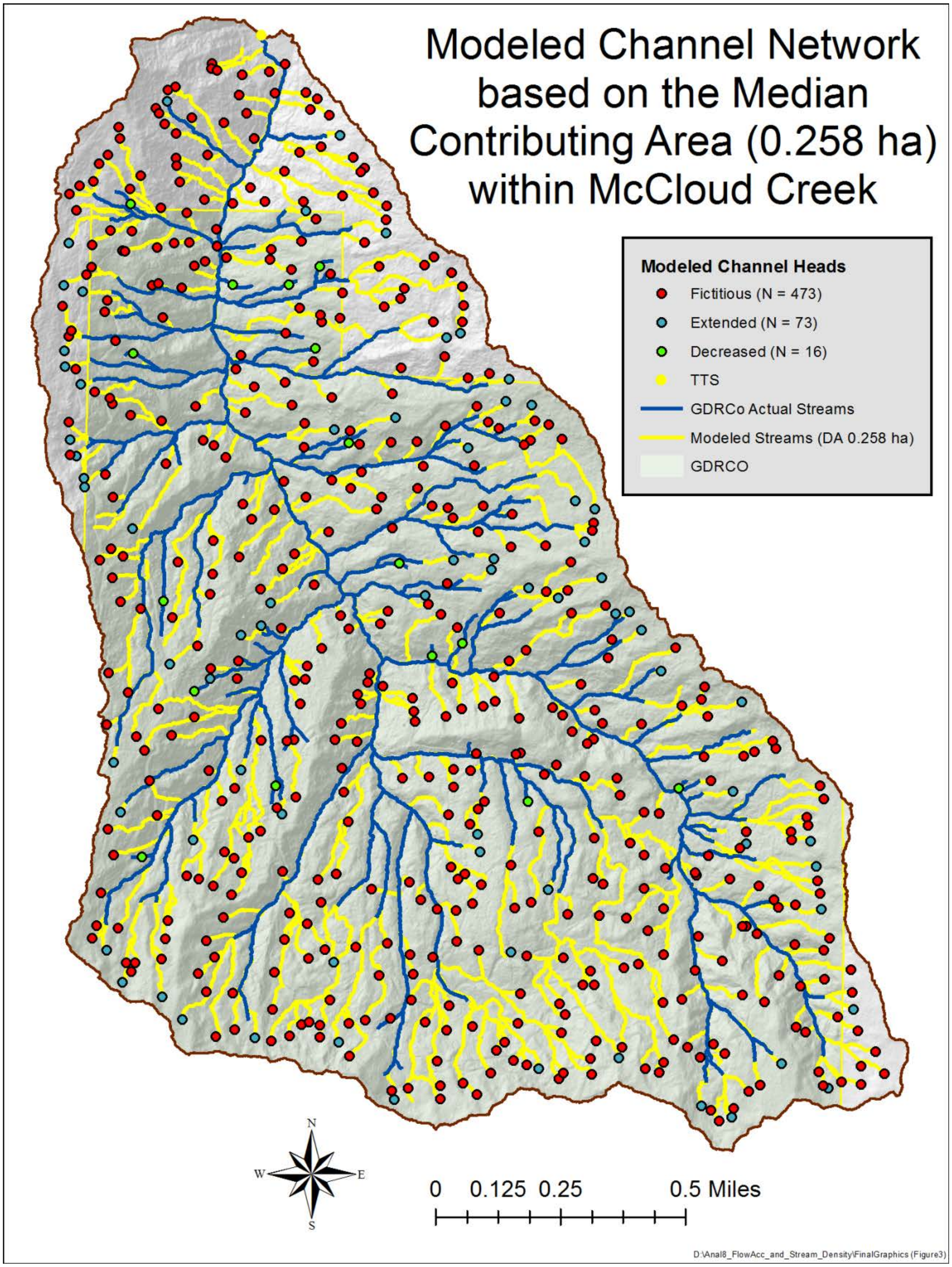


Figure 3. McCloud Creek field mapped channel network (blue lines) compared to the fictitious channel network (26.28 mi/mi^2) derived from the median contributing drainage area (0.258 ha) from field mapped channel heads within 14 THP units in McCloud Creek. Note: an additional 40 miles of hypothetical stream are shown in yellow due to this contributing area calculation.

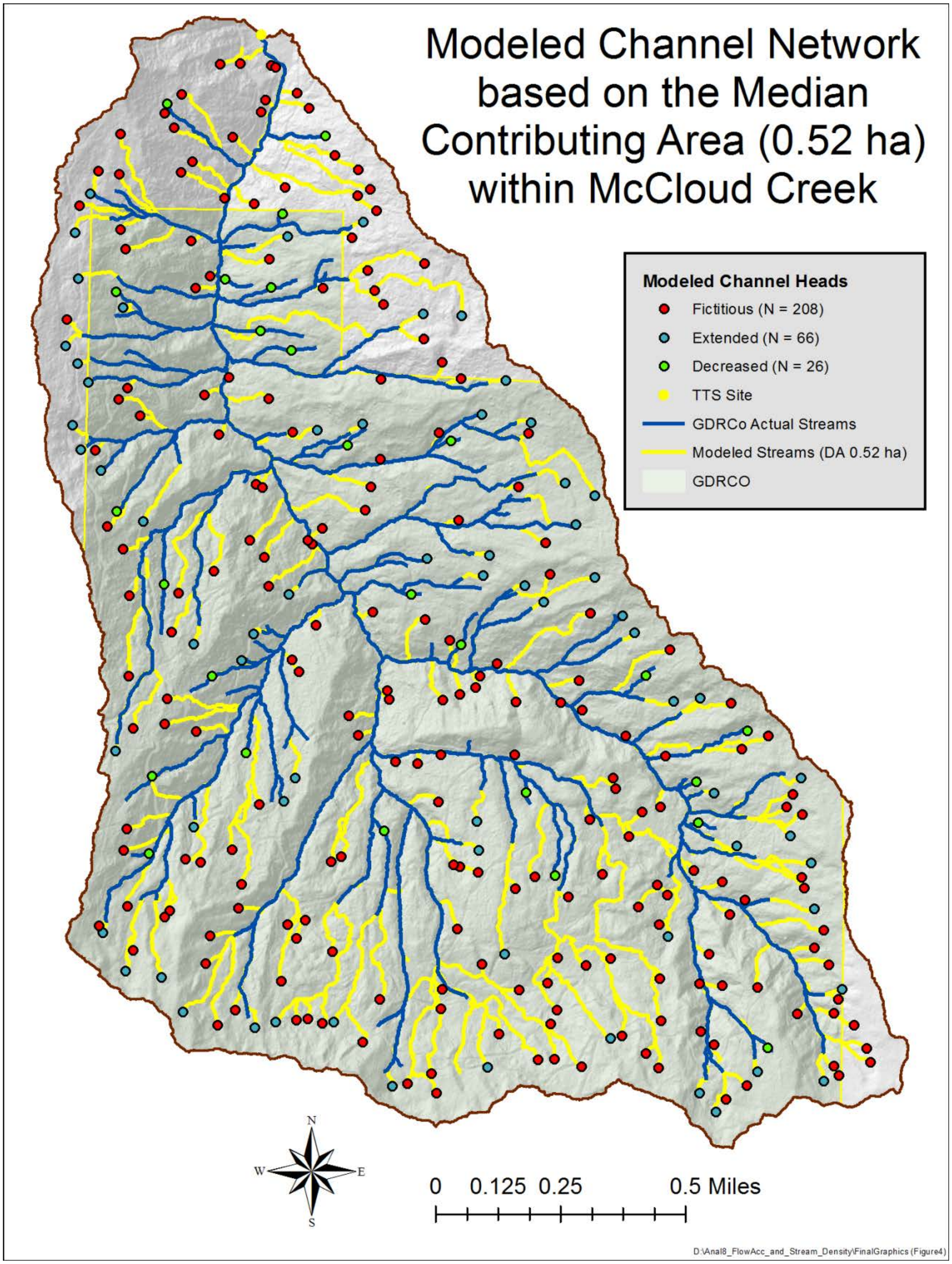


Figure 4. McCloud Creek field mapped channel network (blue lines) compared to the fictitious channel network (18.86 mi/mi^2) derived from the median contributing drainage area (0.52 ha) used in the Elk River Sediment Source Analysis (yellow lines). Note: an additional 22.4 miles of hypothetical stream are shown in yellow due to this contributing area calcuation.

References

Buffleben M. 2009. Assessment of soil creep sediment generation for total maximum daily load development in a Northern Coastal California Watershed. PhD Dissertation, University of California, Los Angeles.

Clubb, F. J., S. M. Mudd, D. T. Milodowski, M. D. Hurst, and L. J. Slater (2014), Objective extraction of channel heads from high-resolution topographic data, Water Resour. Res., 50, 4283–4304, doi:10.1002/2013WR015167.

Montgomery, D.R. and Dietrich, W.E., 1988. Where do channels begin? Nature 336, 232-234.

Montgomery, D.R. and Dietrich, W.E., 1989. Source areas, drainage density, and channel initiation. Water Resources Research 25, 1907–1918.

North Coast Regional Water Quality Control Board (Regional Water Board). 2013. Peer Review Draft Staff Report to Support the Technical Sediment Total Maximum Daily Load for the Upper Elk River. March 4, 2013.

North Coast Regional Water Quality Control Board (Regional Water Board). 2015. Upper Elk River Sediment Source Analysis and Implementation Plan. March 18, 2015.

Orlandini, S., P. Tarolli, G. Moretti, and G. Dalla Fontana (2011), On the prediction of channel heads in a complex alpine terrain using gridded elevation data, Water Resour. Res., 47, W02538, doi:10.1029/2010WR009648.

Pacific Watershed Associates (PWA). 2008. Elk River bank erosion void assessment and bank erosion-related wood inventory Humboldt County, California, report prepared for North Coast Regional Water Quality Control Board, Arcata, CA. June 2008.

Pelletier J. D. (2013): A robust, two-parameter method for the extraction of drainage networks from high-resolution Digital Elevation Models (DEMs): Evaluation using synthetic and real-world DEMs. *Water Resources Research 49(1): 75–89*. DOI: 10.1029/2012WR012452

Tarboton, D. G., and D. P. Ames (2001), Advances in the Mapping of Flow Networks from Digital Elevation Data, World Water and Environmental Resources Congress, ASCE, Orlando, Fla.

Tetra Tech. 2015. Upper Elk River: Technical Analysis for Sediment. Report to the Environmental Protection Agency, Region 9 and North Coast Regional Water Quality Control Board. October 21, 2015.

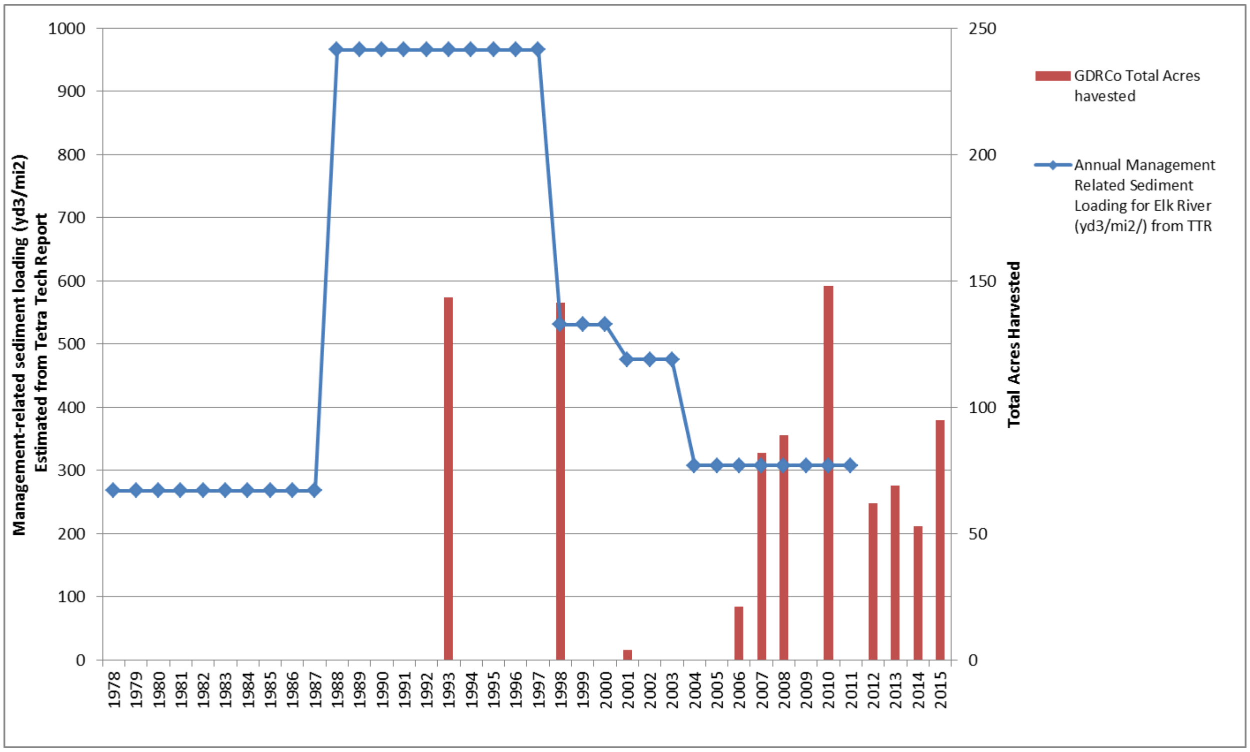
ATTACHMENT 2

Summary of GDRCo's Key South Fork Elk River Management Measures

- Shovel logging of all evenaged ground based yarding (no tractor trails or tractor skidding)
- No winter operations (except tree falling)
- Winter access limited to quads only
- No broadcast burning
- Single entry into RMZs for the life of the AHCP/WDRs
- High basal area retention in RMZs
- Enhanced Class III EEZs
- Completed treatment of all road-related sediment sites
- Surface treatment of all new roads prior to first winter period
- 4-year adjacency; 75-acre harvest limit (3-yr rolling avg.)
- Extended no harvest periods: 1978-1992; 2002-2005 (18 years total)
- Limited harvest period: 1993-2001 (280 acres)

ATTACHMENT 3

Harvest history on GDRCo's Elk River property through 2015 with the corresponding watershed-wide annual management related sediment delivery from 1978 through 2011 estimated in the Tetra Tech Report.



FRIENDS OF ELK RIVER
friendsofelkriver@gmail.com

15 February, 2016

North Coast Regional Water Quality Board
5550 Skyline Blvd
Santa Rosa, CA 95403
Attn: Alydda Mangelsdorf
NorthCoast@waterboards.ca.gov

Dear Board and Staff Members:

Thanks to all who presented the Elk River TMDL Action Plan at the Water Board's February 5 workshop in Eureka. It was a helpful step in our ongoing effort to piece together this multi-layered and contradictory plan. But serious questions remain.

After reviewing the documents, the literature, and the history, we continue to be baffled by a conspicuous omission—nowhere do we find a recovery option that does not include uninterrupted logging. Instead of suspending this activity *known* to add sediment, the Action Plan makes incremental adjustments to policies that have permitted the condition of the river to deteriorate. Its new prescriptions and controls are another version of a failed strategy that has been tried for nearly two decades.

Accordingly, we respectfully submit an alternate proposal. **The Elk River Recovery Plan: People and Fish Option** offers the public and board members a choice we have not yet been given. Just as HRC, the discharger of sediment, has tailored their own compliance strategy, we have tailored a strategy on behalf of the recipients of their discharge.

Like the TMDL Action Plan, The Elk River Recovery Plan: People & Fish Option *identifies a **process** for assessing and implementing necessary and feasible remediation and restoration actions, and describes a **program** of implementation to be considered and incorporated into regulatory and non-regulatory actions of the Regional Water Board and other stewardship partners in the watershed. [italics are quoted from the Plan]*

1. Begin Elk River's recovery by first reducing harvest-related activities to zero sediment delivery. This is the **process** recommended by both the Elk River Technical Study and your revised Waste Discharge Requirements. But instead of making timber harvest a prior condition, The Elk River Recovery Plan follows our most ancient rule of healing: First Do No Harm.

2. Expand the proposed moratorium on timber harvest to include all of Upper Elk River. In this regard, please reference our November 18, 2016 and January 18, 2017 comments approving the WDR's recommendation of no winter logging and a moratorium in the five "sensitive" watersheds of the Upper South Fork. As stated there, this should not include "exceptions" to be traded as mitigation for more logging. The moratorium should include the remainder of the upper watershed.

FRIENDS OF ELK RIVER
friendsofelkriver@gmail.com

3. *First* recovery, *then* the phased re-introduction of logging. The priorities of the TMDL Action Plan should be reversed, following your own Margin of Safety recommendations: *the loading capacity for additional sediment is defined as zero* ***until*** *the capacity of the impacted reaches can be expanded.* It should also be emphasized that the resumption of logging is not the only goal of expanded capacity.

4. Regulatory action—adjustment of the zero load allocation, for example—should occur only *after* the assessment of successful non-regulatory action. As per the Action Plan: *Once the loading capacity has been expanded, the Regional Water Quality Board can reevaluate the load allocation, as appropriate.* But the Margin of Safety should be maintained or increased as assimilative capacity increases, rather than increasing logging till capacity is—oops—exceeded again.

5. As monitoring shows effective sediment remediation, logging resumes incrementally. The People and Fish Option follows the TMDL Action Plan in calling for the regulatory process to be guided by a **program** of recovery and restoration. The Stewardship Program will add its findings to staff evaluations at five-year intervals, beginning in 2021, with benchmarks established toward a goal of returning water quality and historic uses to pre-Maxxam conditions.

6. Elk River Watershed Steward Groups take an active advisory role in health and safety projects, monitoring, and sediment remediation / restoration. The three Stewardship Groups are an integral part of the assessment and adaptive management that will allow logging to resume when the river's assimilative capacity has been restored. But here again, the People and Fish Option differs from the underlying assumption of the Action Plan. Its primary objective is not expanded logging opportunity, but watershed health.

7. The Stewardship Program includes a Community Group. In addition to the science and engineering, this undertaking needs to include fishermen and advocacy groups (Baykeepers, for example) as well as the wider community. A community organizing component expands opportunities for grant funding and public support and addresses social elements of recovery (such as the valley's historic grievances, laid-off workers, and suburban development).

8. Restoration and watershed health lead the regulatory process. The funding and organization of the recovery portion of the TMDL Action Plan are already lagging behind the regulatory apparatus, which after decades of delay is now racing in high gear toward permitting the failed policies of the past to continue. The Elk River Recovery Plan: People and Fish Option, bolstered by reform initiatives like AB 1492, will allow recovery and stewardship to guide the regulatory process.

Sincerely,

Jerry Martien

Alydda Manglesdorf
North Coast Water Quality Control Board

Date: February 15, 2016

Subject: Total Maximum Daily Load for Elk River and associated actions and projects

The Elk River TMDL will continue to render the waters of the state unfit because it is not designed to attain the objectives of the Basin Plan, the fishable swimmable and existing use requirements of the Clean Water Act, State and Federal Anti-Degradation policies, Section 7 and Section 10 of the Endangered Species Act, the Public Trust Doctrine, public trustee duties, CEQA, or Section 13242 of the Water Code. RB1 needs to consider the alternative TMDL that can achieve the sediment related water quality standards. This is the people and fish alternative.

In 1997, the State Agencies placed a moratorium on harvest plan approval in Elk River that lasted until summer 2002, and as Table 1 attests, anthropogenic loading rapidly dropped by 51%--- from 966 cubic yards per square mile per year to 476; while road surface erosion loading dropped by 59%. Similarly, Salmon Forever's suspended sediment concentration (SSC) monitoring of samples collected during 106 storm events between 2002 and 2013 detected a 59% reduction in South Fork SSC by 2008. As high rates of logging resumed after 2008, SSC adjusted for antecedent rainfall index and flow increased 89% by 2013. This demonstrates that RB1's plan to log its way to attainment of water quality standards is a non-starter.

The TMDL relies on insufficient monitoring and inadequate methods. Thus, if or when the data is analyzed it will be insufficient to detect trends. Furthermore, even if RB1 implements a robust monitoring program, designed to, and capable of, detecting trends in the shortest period of time, the TMDL still does not define an enforceable trajectory toward attainment of water quality standards. Like the trajectory for control of cumulative aggradable sediment chosen by the RB1 in 2002, here RB1's TMDL does not require that harvest be halted when the trajectory towards attainment of water quality standards is not met.

I find it improper and a failure to proceed in the manner required by law, for the North Coast Regional Water Quality Control Board (RB1) regulatory agency to permit activity that results in wrongful trespass occupation of residents' property. RB1 has not demonstrated that RB1 has flood servitude[1] over residents' property nor that it is proper for RB1 to permit polluters to fill the public trust river channels with sediment debris---so that ordinary rains create flooding that severely damages residents. Instead of terminating permits for wrongful trespass, RB1's TMDL substitutes a "conceptual" zero load allocation that is wing-nutted to a concept---"

[1] California Civil Code 804. A servitude can be created only by one who has a vested estate in the servient tenement.

no amount of land use restriction can physically result in zero loading ….i.e. the control of all natural sediment delivery from the tributary system. This non sequitur arbitrarily avoids the primary purpose of a proper TMDL---to control all anthropogic discharge of sediment and peak flow.

The TMDL also wing-nuts the 40 CFR 130.7©(1) margin of safety –"The TMDL is equivalent to the loading capacity of the waterbody for the pollutant in question" then identifies that the TMDL's goal is an "expansion sediment loading capacity" and concludes that once the program of implementation increases transport of sediment and water---RB1 can "recalculate" the sediment TMDL. By failing to consider existing uses of water and a thriving commercial and recreational fishery within the Clean Water Act's margin of safety, the TMDL fails to attain legal muster. Congress intends that TMDL be more that a vehicle to get logging trucks in and out of the forest while the community floods--

Twenty one years have passed and the dischargers have not been ordered to remove a single shovel full of their wastes from the affected river bed or banks. The cross-sections along the channel tell us that the channel is rapidly infilling. Table 1 tells us what is required for a margin of safety---1985 conditions. Table 1 and 2, also tell us that the TMDL is completely unenforceable as written: because there is no moratorium coupled with the requirement that forest stands recover equivalent to 1985 levels, there can be no measure of safety for residents, their health, their homes, or their farms. A 10% increase in peak flow over 15 year old background is a death sentence---"decreasing road surface erosion" is laughable, not enforceable---there is no sufficient monitoring and many WDR roads are egregious sediment sources---deepseated landslide rates are highly elevated—so how is zero increase, with no monitoring, a measure of safety? Zero increase in drainage network—while truth is every rolling dip is a derangement contributing to new gully formation and slumpage or openslope landslides. "Decreasing length of channel with actively eroding banks"—get real, come on—the forest stand has been reduced from 60 to 80 year old unre-entered to 15 year selection re-entries where basal area is reduced to de minimus. Ok, Class III retentions will help, but the target is not near what the 70 year old stand provided in 1985 when the anthropogenic loading was 268 tons per sq.mi.per year.

How much of the volumetric loading reduction 2004-2011 is due to the '97 to 2002 moratorium and the low harvest as PL slumped into bankruptcy? By 2013, residual SSC had spiked 89% in the South Fork! By 2016 storms' turbidity was reaching 1,500 and 2,200 and slow coming down on the falling limb. We've got 1.5" to 4" deposits on the overbank this year.

The TMDL action on the load allocation must be stringent, and to the extent that the TMDL adoption fails to require the dischargers to pay the value of the use of the residents' property and that the amount paid shall be the greater of the reasonable rental value of that property **or** the benefits obtained by the discharger[s] (via Regional Board permits to) wrongfully occupy[ing] the property by reasons of that wrongful occupation [2] , the TMDL action violates civil code that requires economic dis-incentives for would-be polluters. This TMDL, by stretching out the agreed time schedule for beginning implementation from 2002 to 2016 and then making the deadline an open ended date somewhere after 2031 knowingly increases the benefits obtained by the dischargers. So, here we have appointed Board Members acting to incentivize benefits for would-be polluters. All done while residents' water supplies are polluted and homes and farms are purposefully flooded.

Does RB1 have servitude over residents' property to permit wrongful occupation by the wastes of a discharger pursuant to the TMDL? Is RB1 by adoption of the TMDL in effect "ordering residents" to provide a servitude impacting residents' rights to beneficial uses of water, permitting exceedances of Water Quality Objectives, reducing the quality of high quality water and/or permitting nuisance conditions for an open ended period of time? Is this forced occupation pursuant to proper/ legitimate police power? Were alternatives such as a cessation of harvest on the dischargers' lands that could reduce the duration of the occupation of residents' properties? Has RB1 considered an alternative that would place a civil liability lien on the dischargers to pay the residents to remove tree branches acting as resistance to flow and/or dig sediment deposits off of the stream banks? Is RB1 forcing residents' properties to serve as flood way easement by exercise of its inverse condemnation eminent domain authority? Does the TMDL violate or run counter to the Legislative intent identified during the enactment of Civil Code 3334(b)(1)?[3]

Clayton Creiger announced at the workshop that "a moratorium on timber harvest until the sediment flushes through is off the table" because "RB1 wants to keep HRC involved in non-regulatory efforts to increase the waste load allocation" over residents' properties by altering the river's assimilative capacity. Is the TMDL failure

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[2] California Civil Code 3334(b)(1): 3334. (a) The detriment caused by the wrongful occupation of real property, in cases not embraced in Section 3335 of this code, the Eminent Domain Law (Title 7 (commencing with Section 1230.010) of Part 3 of the Code of Civil Procedure), or Section 1174 of the Code of Civil Procedure, is deemed to include the value of the use of the property for the time of that wrongful occupation, not exceeding five years next preceding the commencement of the action or proceeding to enforce the right to damages, the reasonable cost of repair or restoration of the property to its original condition, and the costs, if any, of recovering the possession.

(b) (1) Except as provided in paragraph (2), for purposes of subdivision (a), the value of the use of the property shall be the greater of the reasonable rental value of that property or the benefits obtained by the person wrongfully occupying the property by reason of that wrongful occupation.

[3] Civil Code 3334, subdivision (b)(1) was amended in 1992 to address a specific problem addressing how damages were awarded for the wrongful occupation of land. Before the amendment, damages were limited in wrongful occupation cases to the value of the property—usually the fair rental value. If the owner of the property sought redress, the polluter faced relatively low potential damage awards because the land was essentially worthless. (Sen. Com. On Judiciary, com. on Assem. Bill 2663). The Legislature's goal was to create an economic **disincentive** to would-be polluters. [63 Cal.Rptr.3d 181}

to fully analyze the no harvest or greatly reduced harvest rate alternative improper? If not, why not? Does this precedent setting TMDL create an economic incentive to would-be polluters?

Economic statistics released by **NOAA** show that commercial and recreational fisheries in the U.S. contributed $72 billion to the Gross National Product and supported 1.4 million jobs in 2010. How much of it could have supported Humboldt County jobs?

Instead of avoiding or fully mitigating ongoing cumulative impacts, the TMDL proposes to permit the types of activities that have increased coho competition for space and food to continue. The unmitigated cumulative effects harm coho by maintaining the river as a shallow beyond-fully-allocated waste ditch. The TMDL in reliance on the proposed WDR, creates a high likelihood that the historically deeply incised, gravel bedded, Elk River channel will permanently remain degraded---a silt/ sand bedded, wider channel with shallow pools and where much of the flow is subsurface.

The failure of the WDR and TMDL to implement an enforceable trajectory of attainment of water quality standards assures a continuing reduction in the likelihood of restoration of properly function condition to the affected stream habitat. Remember, **Water Board members are voting FOR or <u>against</u> fishery JOBS, not just a proper TMDL**.

The WDR proposes to continue to permit discharges in amounts known to impair reproductive activities of coho, increase mortality, interfere with feeding and breeding success, add to already severe channel and pool infilling, loss of riparian shade and tree canopy, causing potentially lethal reductions in dissolved oxygen levels as miles of aquatic habitat grows duckweed and reeds causing biological oxygen demand to skyrocket during the night.[4] **Recovery of the commercial salmon fishery begins with Elk River's core salmon habitat!**

Mitigations in both the present WDR and the HCP have proven to be woefully inadequate: impacts to coho and human beings have worsened over time; the enforcement provisions fail to prevent degradation, require clean up, abate impacts or provide financial resources for remedy; the WDR and HCP monitoring fails to detect, analyze, and locate sources of the impacts that elevate suspended sediment concentrations downstream. Thus, avoided costs of compliance are externalized onto neighboring residents, tribes, commercial and recreational fishermen, and future generations.

The methods and analysis in the proposed WDR provide minimal and ineffective monitoring: specifically- 1) road surface runoff is not monitored during peak rainfall events; 2) water bars, rolling dips, soil piping, rills and gullies and channel extension

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[4] Salmon Forever monitored dissolved oxygen demand at station SFM and sent that data to the North Coast Regional Water Board in 2009 or 2010.

are not continuously monitored during peak flow runoff, 3) the effect of concentrated discharge is not monitored to determine the extent to which it overloads the deranged hydrology of the slopes below.

Does this concentrated discharge significantly accelerate erosion in soil piping networks? Would discharging a fire hose in a soil pipe increase downstream suspended sediment concentration?

Because the Regional Board has **purposefully taken** Cease and Desist, Administrative Civil Liabilities, and Clean up and Abatement **off the table *for dischargers***, the **TMDL will be ineffective at restoring water quality, the fishery or abating downstream flooding in the necessary timeframe**. The only remaining plausible purpose of the regulatory inaction is to enable the discharger to pocket the avoided costs of compliance. Can you say **coddling the polluters that profit by destroying the fishery?**

Section 7(d) of the Endangered Species Act (Act) prohibits federal agencies and permit applicants from making any "irreversible or irretrievable commitment of resources"...which has the effect of foreclosing the formulation or implementation of any reasonable and prudent alternative measures which would not violate section 7(a)(2) of the Act, during consultation under section 7(a)(2). Section 7(a)(2) prohibits Federal actions that jeopardize the continued existence of listed species or which destroy or adversely modify their critical habitat.

Section 7 of the Endangered Species Act requires Federal agencies to initiate consultation with the Services when they determine that any action they authorize, fund, or carry out may affect a listed species or designated critical habitat. Although the ESA does not dictate a timeframe within which an action agency must make this determination, agencies should review their actions at the earliest possible time to determine whether consultation is required. The regulations for implementing section 7 of the ESA at 50 CFR part 402 describe procedures for conducting consultations, including distinguishing formal consultation from informal consultation.

A principal purpose of section 7(d) is "to prevent Federal agencies from 'steam rolling' activity in order to secure completion of projects regardless of their impact on endangered species." [*North Slope Borough v. Andrus*, 486 F.Supp. 332, 356 (D.D.C.), *aff'd in part and reversed in part on other grounds*, 642 F.2d 589 (D.C. Cir. 1980)]. The U.S. Court of Appeals for the Ninth Circuit wrote "Section 7(d) does not amend section 7(a) to read that a biological opinion is not required before the initiation of agency action so long as there is no irreversible or irretrievable commitment of resources...Rather, section 7(d) clarifies the requirements of Section 7 (a), ensuring that the status quo will be maintained during the consultation process" [*Conner v. Burford*, 848 F.2d 1441, 1455 n.34 (9th Cir. 1988)].

The Services' Interagency Consultation Handbook provides guidance regarding the application of section 7(d) during the consultation process and states that the section 7(d) restriction is triggered by the determination of "may affect”. Destroying potential alternative habitat within the project area, for example, could violate section 7(d).

Section 7(d) is increasingly becoming an issue for the Services, especially during internal Service consultations involving the issuance of section 10(a)(1)(B) permits and review of Habitat Conservation Plans (HCPs). Concerns over this issue have also been raised by HCP applicants following a district court decision [*Environmental Protection Information Center v. Pacific Lumber Company*, 67 F. Supp. 2nd 1113 (N.D. Cal 1999)] which asserts that section 7(d) applies to both formal and informal consultations as specified in 50 CFR part 402.

Sincerely,

Jesse Noell

Attachments to follow:

Kristi Wrigley 2.15.2016

Comments: Elk River TMDL for Sediment

The goal of the Elk River sediment TMDL should be optimum restoration of water quality to Basin Plan beneficial uses and recovery of a thriving fish population especially threatened Coho. Though the TMDL calls for a zero discharge its reliance on a WDR which continues to permit new logging ensures new discharges will occur. Therefore one must conclude that zero isn't zero once again, an all too familiar scenario for downstream residents. Explain and describe how zero will be attained with all the permitted discharges of all timber operations and how you plan to deal with unplanned discharges.

The term "feasible remediation" is worrisome; explain this term fully. All too often it is interpreted as economically thrifty for the polluter while it allows untold economic and emotional harm; economic damage to real property, income loss, precludes anticipated use of private property and environmental damage onto downstream residents. Explain how these adverse effects will be prevented.

In all the verbiage leading up to this TMDL there has never been a thorough or even a timid analysis of the economic hardships pressed upon downstream residents by the timber industry and the State. Either do this analysis or put downstream residents' rights first instead of allowing more logging first. The residents deserve an explanation from the Board members their long standing obvious bias for logging as residents often hear staff cannot fully advocate for residents' rights because the Board would

never approve that alternative.
Please explain the basis of an unreasonably long 20year recovery period timeline for what at best will be a defined recovery for the river and will likely not be a real recovery for the residents' rights as they have historically known and depended on; clean water for domestic and agricultural use with an abundant fish population. Even a Central Valley TMDL for agricultural runoff has a 10year timeline. The 20year timeline is egregious in the light of the 20years of severe damage already experienced by direct downstream residents. The State has essentially taken much of our property for their use without any compensation. Returning residents' property for their full usage should be the first goal of the Elk River TMDL, not keeping HRC engaged.
Explain how this TMDL is consistent with State (and therefore Federal) Antidegradation Policy in view of the fact that the State and Federal Anti-degradation Policy has been flagrantly violated in actual physical fact in the river itself and in the legal environment as no hearing or notice was ever given. If this TMDL serves that purpose it needs to openly address it. The waters of Elk River have been knowingly and continuously degraded by WQ since 1997.
The crushing and burdensome demands of the State's process for dealing with sediment from logging is impossible for ordinary citizens to effectively participate. Every State proposal, including each and every THP requires yet more comment from a very limited citizenry. Their comments are what they have known, seen and experienced in a narrative format, which is easily ignored by the scientific realm of the

agencies. After 20 years of repeated testimonials the privilege of the upstream neighbor, logging, prevails over their basic right to clean water. It is unclear how this TMDL will adequately control sediment discharge to recover the high quality water of Elk River in 1978-1985. It does not even appear to be a clear goal. What is clear is the intended priority use of Elk River is as a waste ditch for industrial timber while working to restore conveyance capacity but not necessarily restore high quality fishable, swimable, drinkable water quality known to residents for decades.

Please explain, enumerate and substanciate the tried and true methods in this TMDL used to achieve success. Just asigning a zero discharge especially in the light of new logging which renders this zero a qualified zero does not achieve success. Real accountable methods need to be thoroughly explained, not just alluded to. This TMDL assurs new logging activity generated sediment not a successful zero which achieves optimum relief and recovery for residents. This is especially significant in the light of the unsuccessful reputation the State has had over the last 20yrs. even with the latest landowner HRC. When the residents also see WQ fully allocating the sediment load the States failure is down right scary. They know exactly what has been going on in Elk River because they've been watching it for years and years.

Explain why/how not being able to achieve an immediate zero discharge if logging were stopped is a basis to allow new logging. There is no science that I have seen that shows logging how ever good does not produce new sediment. HRC or any timber company, contending so does not make it so. Surely the failure to stop sediment from past operations would support stopping logging now, till manmade discharges reach a nonharmful level. Clearly the watershed and Elk River would optimumaly recover water quality to comply with Basin Plan objective and compliance with the Antidegradation Policy if such a temporary stoppage did occur. Merely saying you believe the best choice is to keep HRC engaged doesn't make it so. Demonstrate how this choice best serves the people of the State of California. Clean drinking water and a thriving fish population would best serve Californians as well as all Americans. The reliance of this TMDL on nonregulatory means to recovery is an unknown as a means to achieve recovery of all the beneficial uses of Elk River. Implementation of phase 1 requires control of all existing and potential future sediment sources while the Elk River Assessment is completed and the Elk River Stewardship Program is developed, initiated and has successful results in the activities necessary to expand the sediment loading capacity of impacted reaches and abate nuisance conditions; then goes on to describe normal sediment transport. That is inadequate to achieve recovery of the beneficial uses of Elk River and should not substitute as an end goal. "Normal sediment" loading and transpord is not 100% allocation which is most probably not going to be achieved on the ground and is merely a paper achievement. There needs to be a real and effective margin of safety - say a 50% loading capacity to allow for uncertainty, miscalculations and unintended discharges.

Flooding based on bankful events should harken back to 1978/1985 conditions before the deposition of 4 feet of sediment at bankful. Caution needs to be addressed in relation to the planned yet unfunded non regulatory measures which will supposedly enhance the volume of water the river carries. That sounds like a Flood Control Plan and does not serve as a river recovery plan. Plans which are only vague at this point, Residents must be assured that they have control of what activities occur on their property. None of us have seen the 319H grant and until we do we cannot give it our whole support as a means to recovery. There are practical and legal aspects which must be clearly explained before any non regulatory recovery is an actuality this TMDL can depend on. Recalculating the sediment allowed based on channel transport is unacceptable in a Basin Plan. Water quality objectives need to be recovered and resident lives made whole before any logging is allowed in the upper watershed and should be the standard of comparison for any adjustments.

The Elk River Recovery Assessment should necessarily have directly affected upper Elk River residents on the Committee to represent their knowledge, interests and will. All their meetings should be open to attend by affected residents, otherwise planning for a problem we exclusively suffer are contemplated by and direction taken without our knowledge and consent.

The residents and Salmon Forever have done more river analysis and have more direct knowledge of the impacted reach yet are excluded from the Recovery Assessment Planning process. The residents have learned that they cannot rely on W.Q. staff, independent environmental groups, the County or other public trust agencies to adequately represent, protect or restore their rights. The nonregulatory Stewardship program is an ill defined entity with underdefined goals and guidelines at this point. Therefore it is premature to rely on that as a proven means to recovery.

The WDR which is an integral part of this TMDL is an unclear regulatory instrument at this time. The fact that it permits logging up to 2% of the watershed equal to what they log now in the North Fork Elk River, obviscates any real Margin of Safety. It has clearly failed to protect downstream residents and they added measures effects are only conjecture at this point. You cannot precisely calculate nature. Any unforseen occurrance or incorrect calculation in sediment production and delivery reflects what is so wrong with the existing System. It becomes an oops and on we go. There is no provision made as to what should be done if there is failure, mirroring so often what government regulations fail to do - address their own failure.

The TMDL needs to rigorously specify effective monitoring in the affected reach by other than lumber Company monitoring. Salmon Forever has opperated two strategically located monitoring stations in Elk River and W.Q. should support continued operation which has produced robust sediment data. The timber company data should not be the only source of data in Elk River. Corraberative data should be essential at this point to ensure verifiable accurate results. The lumber companies have controlled far too much of the science associated with logging related sediment production with disasterous results for downstream residents and fish populations. It is insufferable that the public trust agencies require innocent victims who are obviously harmed by sediment from logging to have to create the science that shows in data format their harm. Such is the case where eyewitness observations showed that stopping new logging produced the best recovery which was then demonstrated in a report sent to W.Q., CDF and appeared as an article in Forest and River news. Residents know what they see and are the most knowledgeable source of cumulative effects. Our knowledge is ignored by the system always circumvented by timber science.

It is difficult to understand how this TMDL adequately addresses logging activities by Green Diamond - the statement that their activities will be consistent with the TMDL action plan rings hollow. It needs to be explained especially since it is the Board not the E.O. that enrolls their plans. The TMDL needs to clearly explain how all this logging along with the NTMPs in Elk River and other sediment producing activities like road building and reconstruction will be acurately accounted for in the zero discharge. It is obvious neither HRC or GD take the residents loss seriously. HRC continues winter logging and massive road building and reconstruction without real consideration to the immediate downstream landowners in real time. So often future gain is given credence over immediate harm. THP's always conclude that all harm has mitigated to less than significant no matter what has happened to residents water, property and welfare. The entire system of logging analysis fails the downstream affected residents that it is supposed to protect and serves only to enable logging. The WDR/TMDL process by Water Quality further codifies the subjugation of residents' rights. The process is biased to enable logging even though logging has and is destroying residents' inherent right to water in Elk River and to live freely on their own property without invasion by the upstream neighbors waste.

Explain thoroughly why W.Q chooses more harm over optimum recovery for the adversely affected residents. W.Q. using their power of Cease and Desist and Cleanup and Abatement could choose to recover Elk River in a more timely manner. Many of us will likely die before we see recovery; some have already. Using Cease and Desist to stop even temporarily all the logging would give residents much needed relief after years of constantly increasing harm and deprivation of their inalienable rights.

W.Q needs to use Cleanup and Abatement to mandate the timber company to keep his pollution up on his property. This TMDL should also designate such be immediately persued using their own money and manpower not public funds.

This TMDL enables logging while getting to a trajectory of recovery. The best interests of California demand a TMDL that restores all Elk River's beneficial uses in a sure and timely manner.

Kristi Wrigley

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Lee MacDonald, Ph.D.
15 February 2016

Comments on the Tetra Tech Report and the Draft Action Plan for the Upper Elk River Sediment TMDL

1. INTRODUCTION AND KEY POINTS

1.1. My Role

In 2013-14 I was contracted by Humboldt Redwood Company (HRC) to provide a scientific review of some of their monitoring activities, specifically with respect to best management practices, to review their watershed analysis of the Elk River and Salmon Creek watersheds. I also was contracted by HRC and Green Diamond Resource Company (GDRCo) to provide a scientific review of the Peer Review Draft: Staff Report to Support the Technical Sediment Total Maximum Daily Load for the Upper Elk River (NCRWQCB, 2013), and I provided two sets of comments (MacDonald, 2014a, 2014b). This work led to my helping HRC formulate the proposed project to evaluate Best Management Practices using a paired watershed design in Railroad Gulch, which has since been funded by Cal-Fire and HRC. Working with GDRCo I helped to formulate a project to evaluate the relative effects of forest management activities over time for two sub-basins in the Little River watershed, and this is being funded by Cal-Fire and GDRCo.

In fall 2015 I was contracted by HRC to provide science-based comments on the Technical Analysis for Sediment for the Upper Elk River (TTR, 2015). This memo sets out my comments based on my professional knowledge and experience, field trips on HRC and GDRCo lands, discussions with HRC and GDRCo staff, and numerous discussions with a wide range of scientists, agency personnel, and other parties interested in the Elk River Watershed and analogous sites.

I want to emphasize that these comments are submitted under my name and I am solely responsible for the content. I should note that my professional life has been devoted to trying to understand the effects of land use and other disturbances on runoff and erosion, especially in forested areas, and then use the results to guide management decisions (I'm sending my c.v. as a separate document). My overall objectives are that with better information society can make better management decisions, and we can further reduce the adverse effects of human activities on ecosystem sustainability and water resources at the site and watershed scales. This means that the following comments should be taken not as a critique, but as a means to better understand the Elk River watershed in order to help improve the proposed TMDL and guide future efforts to improve water quality and human welfare.

The goal of these comments is to help ensure that future regulations and restoration efforts are as effective as possible in terms of reducing the observed problems while still allowing for activities that yield important resource uses and economic benefits (e.g., domestic and agricultural water supply, timber harvest, salmonid production, etc.). Since the exact balance between these various uses and activities is ultimately a political decision, my hope is that this document and any subsequent discussions can help lead to a better understanding of the key issues and a broader consensus on how to move forward from here. I trust that these comments will be taken in this spirit, not only for the Elk River watershed, but by extension to other coastal watersheds under the jurisdiction of the North Coast Regional Water Quality Control Board (NCRWQCB).

1.2. Introduction

The TTR provides an improved summary of many of the key issues related to sediment in the Elk River watershed. It also provides a better overall context in terms of uplift in the upper watershed and subsidence in the lower part (TTR Figure 8). However, this conceptual context is not effectively or quantitatively used to more accurately define the broader geomorphic setting and processes that are largely determining the erosion rates, sediment dynamics, water quality issues, and restoration potential in the Elk River watershed. A more rigorous analysis of this spatial and temporal context, along with a more specific and quantitative analysis, is critical to defining both the relative effects of past and present management activities, and realistic water quality management goals.

A second main point is that—as noted in the TTR—there is a tremendous and relatively unique wealth of spatially and temporally explicit data available for the Elk River watershed. The problem is that the TTR does not effectively use this information to quantify and understand the relative importance of the fundamental causal processes in time and space as conceptually outlined in TTR Figure 12. In my comments my goal is to combine the broader context, process-based understanding, and existing data to provide a more specific and precise analysis that can then lead to more realistic, specific, and efficient management recommendations. The tremendous amount of data collected over time also must drive the adaptive management structure that the TTR recommends but does not actual applied (e.g., see the recent overall trends in sediment sources as shown in Figure 15 of the TTR, the sediment sources over time by subwatershed in TTR Table 7, and the linkages between the hillslope water quality indicators in TTR Table 5 and the trends in TTR Table 7/Figure 15).

Hence Section 2 of my comments address the overall geomorphic context, including the definition and applicability of the concept of dynamic equilibrium and the validity of the 1958-1967 period as a valid baseline for water quality. Section 3 of my comments addresses the trends and relative values of the different natural and management-related sediment sources. This analysis is combined with a process-based logic to help identify specific and realistic water quality indicators and management goals. Section 4 of my comments is a synthesis summarizes the resulting implications for the achievable water quality goals for the Elk River.

1.3. Key Points

The key points that are made in this document include:

1. The concept of dynamic equilibrium as defined in the TTR is not valid for the Elk River watershed as it does not define a time scale nor is the watershed in equilibrium given the rapid uplift, subsidence, and rise in sea level.
2. We cannot expect that sediment outputs from the affected reach should equal the sediment inputs.
3. The valley bottom was historically an active floodplain that was aggrading over time, and this floodplain would have had a complex channel network developed to accommodate the high flows and provide a greater sediment transport capacity than currently exists. In all

likelihood the mainstem of the Elk River was historically aggrading, which would then lead to periodic avulsions.

4. The human activities in the floodplain along the affected reach and further downstream have exacerbated, and are probably a major if not primary cause, of the increased inchannel deposition and overbank flooding. The anthropogenic changes in the floodplain and channel in the affected reach must be explicitly considered in the establishment of the TMDL and the design of recovery and restoration alternatives.
5. Similarly, any discussion of sediment, water quality, and recovery of the affected reach must include an explicit consideration of floodplain and channel changes from the lower end of the affected reach to the mouth of the watershed, as these have a direct effect on flooding and the sediment dynamics in the affected reach.
6. The infilling and loss of side channels, cutoff meanders, and other pre-European features of the valley bottom due to agriculture and rural development have not only altered the runoff and sediment dynamics of the affected reach, but also severely reduced the off-channel rearing habitat and refugia for the endangered salmonids. The current concerns over salmonid habitat in the affected reach must be placed into and compared with this larger context.
7. The broader geomorphic context and downstream alterations indicates that even if all anthropogenic sediment sources were immediately stopped, the mainstem of the Elk River would still continue to aggrade and overbank flooding would still occur on a regular basis (e.g., about every other year on average).
8. Watershed denudation rates can generally be expected to be in dynamic equilibrium with the uplift rate of around 0.5 mm yr^{-1}, so the long-term baseline erosion rates in most of the watershed are almost certainly greater than 1100 Mg km^{-2} yr^{-1} (approximately 3000 English tons mi^{-2} yr^{-1})[1].
9. The conditions during the period of USGS stream gaging (water years 1958-1967) are not an appropriate set of reference conditions because this was a relative quiescent period in terms of peak flows, the streambank vegetation had almost certainly been altered by human activities, and there is no explicit information on the extent to which this or other reaches had been subjected to channel and floodplain alterations.
10. Annual sediment yields are remarkably correlated with instantaneous annual maximum peak flows, confirming that the largest storms are responsible for most of the sediment yield. Annual rainfall or annual water yields are not an appropriate index for normalizing or predicting sediment yields.

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[1] The TTR uses yd^3 mi^{-2} yr^{-1} for calculating sediment loads and deposition, which is a volumetric rate. Most larger-scale erosion and sediment yields in the scientific literature are expressed as Megagrams (Mg) km^{-2} yr^{-1}, which is a mass per unit area per unit time, where 1 Mg is 10^6 grams or 1000 kg or 1 metric ton and 1 kilometer is 0.386 mi^2. The assumed density of suspended sediment--and presumably the eroded sediment--in the TTR is 1.4 English tons/yd^3 (p. 65), and since 1 mi^2=2.59 km^2 and one English ton equals 0.907 metric tons (or Mg), 1 yd^3 mi^{-2} yr^{-1}= 0.49 Mg km^{-2} yr^{-1}. Conversely, 1 Mg km^{-2} yr^{-1}= 2.85 English tons mi^{-2} yr^{-1}, or just over 2 yd^3 mi^{-2} yr^{-1} using the assumed density of 1.4 English tons/yd^3. Note that for converting denudation rates to mass one should use the much higher rock density of 2.65 or 2.7 Mg m^{-3}, and the TTR uses an assumed density for the deposited sediment in the affected reach of 0.847 Mg/m3 or 0.71 English tons/yd^3. (Life would be much easier if we all just used metric units!)

11. Poor logging and road practices in the past have clearly increased sediment inputs into the Elk River. These exacerbated the natural tendency for channel aggradation and overbank flooding.
12. The sediment source analysis shows that there has been a major reduction in management-related sediment yields since the peak years of 1988-1997. Updates and additional studies since 2011 show that management-related landslides, harvest and skid trail erosion, and headward channel extension have been reduced to nearly negligible levels or zero; road erosion also has been greatly reduced. Given the observed peak flows during this time, the inevitable conclusion is that management changes through the Habitat Conservation Plans and California Forest Practice Rules as presented in the Report of Waste Discharge (HRC, 2015) have greatly reduced sediment from both current and legacy sources on industrial timberlands.
13. The sharp reduction in sediment production from current harvesting and roads is limiting the potential for further reductions, especially in comparison with the high natural sediment supply. The treatment and reduction of legacy sediment sources is more difficult, and these sources are becoming a larger proportion of the management-related sediment inputs to the Upper Elk River watershed.
14. Road-related surface erosion and sediment delivery cannot be reduced to zero given the high road and stream densities.
15. Continuing treatment of management-related discharge sites should continue to reduce this sediment source, and any sediment from these treatments is effectively a down payment to reduce further sediment inputs and hence beneficial in the long term. Sediment from untreated sites will continue to decline as the worst sites are treated and/or natural stabilization continues.
16. The values in the Tetra Tech Report for management-related streamside landslides and bank erosion relative to natural values are not consistent with measured stream densities, the expected volumes from deep-seated landslides and soil creep, or more recent data.
17. The Beck's Gulch BMP Effectiveness Monitoring study and post-harvest observations from recent timber harvest units show no evidence of any further headward extension.
18. The TTR presumes that the sediment contributions from the 2.1 mi^2 that includes Shaw Gulch and drains directly into the lower portion of the affected reach are negligible. This is not a valid assumption as this portion of the watershed has substantial areas with steep slopes, sensitive geologies, and a variety of land uses, including roads, agriculture, and residential. No quantitative assessment of these sources has been made, but the landscape characteristics and diversity of management activities suggests that per unit area sediment yields should be at least comparable to the value of 450 $yd^3\ mi^{-2}\ yr^{-1}$ (630 tons $mi^{-2}\ yr^{-1}$) for the upper watershed.
19. The TTR also does not consider the sediment from the 1.3 mi^2 of residential and 0.5 mi^2 of agriculture in the upper watershed. Anthropogenic sediment inputs from these sources should be quantified, and comparable efforts be made to reduce anthropogenic inputs as for the industrial timberlands.
20. The sediment source analysis shows a relatively dramatic reduction in management-related sediment inputs since 1988-1997, but the gaging record generally does not show a corresponding recovery in sediment yields or turbidity levels except in Bridge Creek.

21. The predicted peak flow changes due to forest harvest are less than 10% at the sub-watershed scale using the peak flow model developed from the Caspar Creek data. Any logging-induced increase in peak flows in the affected reach would be substantially less and well within the measurement uncertainty.
22. An increase in peak flows can be expected to increase suspended sediment yields according to the data from Caspar Creek, but it is not known to what extent these results can be extrapolated to Elk River; how much of the increase is due to an increase in transport capacity, bed incision, or bank erosion; how the increases might vary with channel slope, substrate, etc.; how the increases might affect substrate size; and hence how the peak flow increases might affect salmonids.
23. The hydrodynamic modeling confirms that the affected reach is inherently depositional, as deposition is predicted even if all management-related sediment sources were eliminated.
24. The calculated deposition of 640,000 yd^3 in the affected reach from 1988-2011 represents 76% of the total sediment inputs to the affected reach, which is a far higher percentage than suggested by the hydrodynamic modeling. This suggests that this volume is too high, and that natural sediment yields are substantially underestimated.
25. There is no explicit consideration or estimate of the amount and role of bedload with respect to the sediment sources, sediment transport capacity, or aggradation.
26. Given the differences in geology, slope, and rainfall between the different sub-watersheds, the forest practice prescriptions should be adjusted according to the relative site-specific risk rather than applying them equally across the entire Elk River watershed.
27. Given the geologic context of the affected reach and the modifications to the channel and floodplain through the affected reach to the mouth of the Elk River, the assimilative capacity cannot be restored simply by further reducing management-induced sediment inputs from the Upper Watershed. Nor is it possible to eliminate nuisance flooding, even if the channel capacity in the lower mainstem is restored to 2250 cfs, as this is substantially lower than the predicted 2-year flood.
28. The only path that can lead to substantial improvement in water quality in the affected and downstream reaches in the Elk River watershed is to restore some of the natural functioning of the floodplain while continuing to minimize the sediment inputs from all anthropogenic activities.

2. DYNAMIC EQUILIBRIUM AND DESIRED WATERSHED CONDITIONS

2.1. Uplift, Denudation Rates, and Natural Sediment Yields

The TTR report defines a functioning natural system as one in “dynamic equilibrium” (p. 40). It goes on to state that dynamic equilibrium can be defined as “the condition of a system in which inflow and outflow are balanced [Eastlick, 1993] and the character of the system remains unchanged”. The TTR then states that “The geomorphic role of rivers is to transport flows and sediment from the watershed while maintaining its dimension, pattern, and profile without aggrading or degrading significantly.” This last statement is not referenced, but it appears to be drawn directly from p. 1-3 in Rosgen (1996). A review of Rosgen’s (1996) text indicates his general belief that streams should be in equilibrium, but he notes that broad alluvial valleys often have braided or anastomosing channels that are often vertically accreting, but “kept in balance due to the subsidence effects of tectonically active basins” (p. 5-122). This general characterization of streams as being in equilibrium is in contrast to the more general view that landscapes can be in disequilibrium or nonequilibrium regardless of human activities (e.g., Renwick, 1992; Schumm, 1991; Knighton, 1998).

The TTR report notes that the feedback mechanism between sediment inputs and outputs is central to the dynamic equilibrium of a river channel (citing EPA, 2012), and that the relative balance in sediment input and output is central to the attainment of water quality standards. On page 41 the TTR report states that "The Elk River is aggrading … therefore it is not in dynamic equilibrium." and "Returning the river to a state of dynamic equilibrium that meets WQS is the ultimate water quality improvement goal for the Elk River."

The problem is that equilibrium is simply the state toward which rivers naturally trend and should not be confused with the state they are actually in. As stated by Kondolf et al. (2007) "In Mediterranean-climate coastal California, conventional notions of stability and equilibrium are usually not applicable. The highly dynamic nature of these channels must be considered when setting goals and choosing strategies more so than in regions with less variable hydrology."

The fundamental key concerns with respect to the use of dynamic equilibrium in the TTR are: 1) dynamic equilibrium is a meaningless term unless it has a specified time scale; 2) sediment inflows into the affected reach cannot be expected to be "balanced" or equal to the sediment being exported by the river out of that reach; 3) many rivers are naturally out of equilibrium; 4) the tectonic and geomorphic context means that the lower portion of the watershed is inherently aggradational independent of land use effects; 5) the conditions during the period of the USGS gaging station (water years 1958-1967) are not an appropriate reference conditions for evaluating the recovery and restoration of the affected reach; 6) there have been major anthropogenic alterations to the valley bottom floodplain in the affected reach and further downstream, and these must be considered when evaluating the sediment dynamics and expected conditions in the affected reach; and 7) the geomorphic and sediment dynamics in the affected reach cannot be considered independently of the conditions in what I term the lowest reach (i.e., from the downstream end of the affected reach to the mouth of the watershed, including the rise in sea level).

With respect to dynamic equilibrium, the widely acclaimed 2014 geomorphology textbook by Bierman and Montgomery states: "Landscapes may appear unchanging, but considered geologically, topography is dynamic because material is constantly being entrained, transported, and deposited. Over centuries to millennia, such changes result in a **dynamic equilibrium** that maintains topographic forms in an average sense even as individual slopes experience landslides; coastal landforms shift…; and rivers migrate across their floodplains. Over longer timescales, landforms evolve in concert with tectonic and climatic changes...." (p. 27, emphasis in the original). Figure 8 in the TTR provides an excellent conceptual diagram for evaluating the concept of dynamic equilibrium as it may or may not apply to the Elk River Watershed, and this is reproduced below but I with numbers to indicate our best estimate of the uplift and subsidence rates, respectively.

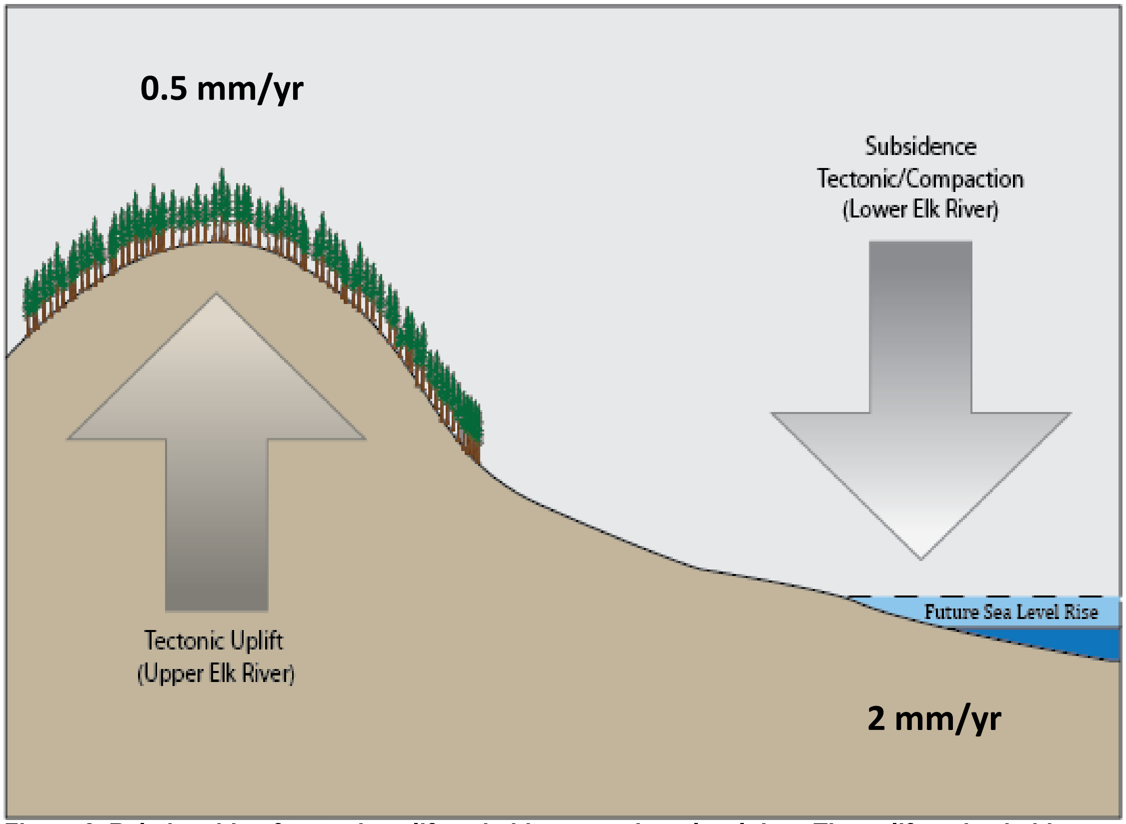

Figure 8. Relationship of tectonic uplift, subsidence, and sea level rise. The uplift and subsidence values shown on this figure were added.

The uplift rate is generally accepted to be around 0.5 mm per year (Stallman and Kelsey, 2006; Balco et al., 2013), and this is a relatively rapid rate of uplift compared to most other landscapes. If the landscape is in dynamic equilibrium, then the uplift and denudation rates should match. The TTR report notes that this tectonic uplift is "balanced by erosion via channel incision and steep slopes" (p. 17). Stallman and Kelsey (2006) reported bedrock incision rates of 0.85 mm yr^{-1} in the North Fork of the Elk River, but a denudation rate of only 0.10 mm yr^{-1} from the loss of an assumed rock volume. As noted in my comments on the Peer Review Draft (MacDonald, 2014b), beryllium-10 concentrations provide an accurate measure of denudation rates over periods of several thousand years or more.

Three studies have analyzed denudation rates using beryllium-10 for watersheds around the Elk River. Ferrier et al. (2006) reported rates of 0.07 to 0.44 mm yr^{-1} with a rate of 0.225 for Panther Creek. Balco et al. (2013) sampled extensively up and down the coast, and his data show a sharp increase in denudation rates in areas with rapid uplift, where uplift varies with latitude. These data are shown in Figure 2, and plotting the Elk River watershed on this graph based on its latitude of 40.7^{o}N indicates that a denudation rate of 0.5 mm yr^{-1} may well be a conservative estimate. Given the importance of the long-term denudation rate for understanding the sediment dynamics in the Elk River watershed, six fluvial sand samples have been collected from different locations in the Elk River for Be-10 analysis with support from HRC and Cal-Fire. These include the North and South Forks as well as samples both the East and West Branches of Railroad Gulch, where a paired-watershed study is being initiated to rigorously evaluate the effectiveness of current best management practices for minimizing sediment production. Taken together, these samples will also indicate if there is any spatial variability in longer-term denudation rates within the Elk River watershed (we are betting that spatial variability will be minimal in the absence of any variation in the uplift rate).

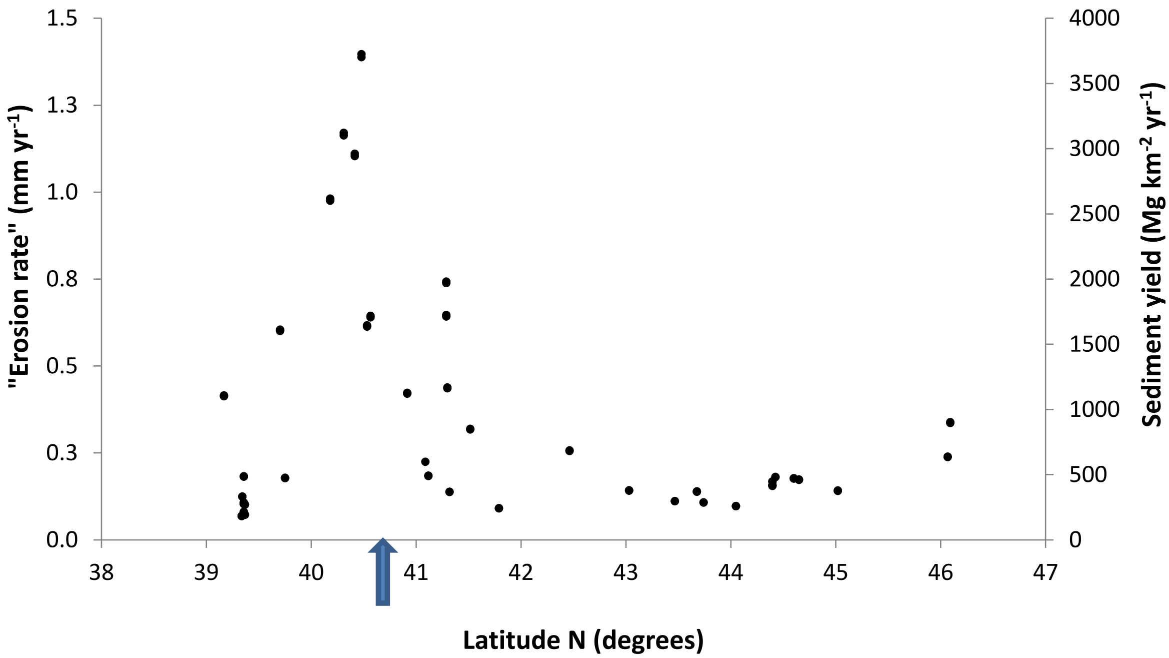

Figure 2. Plot of the calculated denudation rates for different watersheds along the North Coast versus latitude. The blue arrow indicates the latitude of the affected reach and the approximate center of the Upper Elk River watershed.

What the TTR report does not do is convert the estimated uplift rate of 0.5 mm yr^{-1} into a denudation rate and then an expected natural sediment yield. Assuming a standard rock density of 2.65 Mg m^{-3}, a denudation rate of 0.5 mm yr^{-1} converts to just over about 1300 Mg km^{-2} yr^{-1}. Since chemical dissolution generally accounts for only a small fraction of the denudation rate, the long-term average mineral sediment yield can reasonably be assumed to be around 1200-1300 Mg km^{-2} yr^{-1}. This converts to ~3500 English tons/yr or ~2500 yd^3 mi^{-2} yr^{-1} assuming a density 1.4 English tons yd^{-3} assumed in the Draft Sediment TMDL and TTR. This is nearly 20 times the mean natural sediment loading of 140 yd^3 mi^{-2} yr^{-1} for 1955-2011 given in the TTR (time-weighted average from Table 8). Hence either the natural erosion rate is underestimated by more than an order of magnitude in the TTR, or the watershed is dramatically out of equilibrium as over 90% of the material being uplifted is somehow being stored on the hillslopes and in the valleys.

This amount of storage is not a viable hypothesis given that the upper portions of the Elk River watershed have been experiencing substantial uplift for at least 500,000 years (S. Beach, HRC, pers. comm., 2016), and there is an inherent limit on slope steepness and hillslope/headwater sediment storage. Studies in other rapidly uplifting areas show that uplift and denudation rates are generally in dynamic equilibrium, and Stallman and Kelsey (2006) conclude that the establishment of a maritime climate and a mesic redwood ecosystem approximately 4000-8000 years ago has led to approximate equilibrium.

To help resolve this issue the amount of sediment stored in the Elk River watershed was further investigated by Dr. Patrick Belmont and a student at Utah State University. They used the TerEx tool (Stout and Belmont, 2014) to identify and map depositional terraces from the high resolution lidar data. The results generally indicate that there are few terraces above the confluence of the North and South Forks of the Elk River (Figure 3). Most of the terraces in the upper portion of the watershed are primarily along the North Fork and occur at relatively high elevations, 60-120 feet above the modern river. It is expected that these are strath terraces (cut into bedrock) and therefore do not represent significant stores of alluvial sediment that are readily available to the modern river, but field verification is necessary to confirm or refute that expectation. Nearby and downstream from the confluence of the North and South Forks are many large floodplain and terrace surfaces. Elevations from the lidar data indicate that these large floodplain/terrace features range from 8-30 feet in height and are likely to represent significant sources of sediment if the channel is indeed incised through these features as suggested by the lidar data. More work is needed to refine these results and attempt to identify smaller terraces.

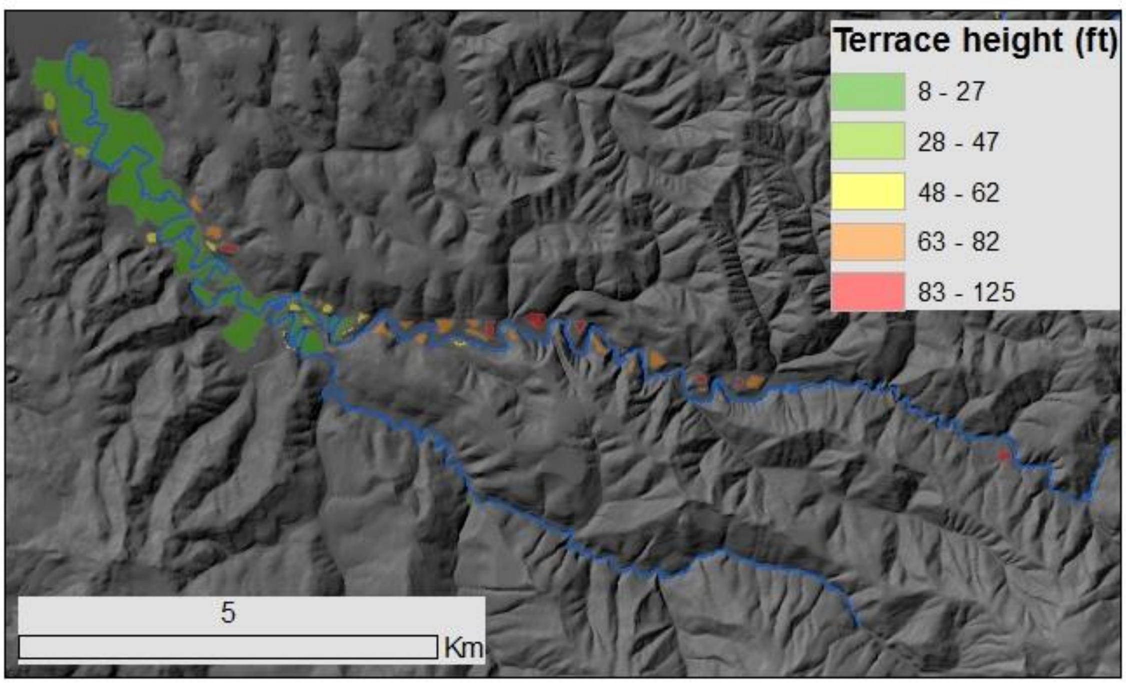

Figure 3. Map of the terraces identified in the Elk River Watershed by Dr. Patrick Belmont and his student at Utah State University. Figure courtesy of Dr. Patrick Belmont.

The argument for a much higher natural sediment yield is also supported by the longer-term measured sediment yields of 1100-3700 tons km^{-2} yr^{-1} from the Van Duzen, South Fork Eel, North Fork Eel, Mattole, and Navarro rivers (Andrews and Antweiler, 2012). The average natural sediment loading for five other TMDLs on the North Coast is 330 tons mi^{-2} yr^{-1} with a range of 275-380 tons mi^{-2} yr^{-1}. The mean of 330 tons mi^{-2} yr^{-1} is more than 60% higher than the estimated value for the Elk River of 202 tons mi^{-2} yr^{-1}, even though one would expect the Elk River watershed to have higher sediment yields due to the more rapid uplift (Figure 2) and erodible Wildcat and Hookton formations.

The expected sediment yield—given the uplift rate—of 1200 Mg km^{-2} yr^{-1} is more than four times the measured sediment yield of about 260 Mg km^{-2} yr^{-1} for the mainstem of the Elk River by Humboldt Redwoods Company (HRC) (station 509). Some of this discrepancy can be explained because the gaging stations operated by HRC, GDRCo, and Salmon Forever only measure suspended sediment loads; bedload can be an important part of the total sediment yield, especially in sand-bedded streams where the bed material can be relatively easily detached and transported. Bedload in Caspar Creek has been estimated at 30% of the measured suspended sediment yields (P. Cafferata, Cal-Fire, pers. comm., 2016), and bedload in Elk River is crudely estimated to be around 40% of the measured suspended load but could be as high as 50% (S. Beach and N. Harrison, HRC, pers. comm., 2016). Even if the unmeasured bedload component is assumed to equal 40% of the measured suspended sediment yield, this still leaves a nearly three-fold difference between the measured sediment yields and the expected natural long-term sediment yield. On the other hand, the measured sediment yields include the additional sediment from anthropogenic sources, which would increase the large discrepancy between the natural component of the measured sediment yields and the expected sediment yields based on uplift.

A key consideration in explaining the difference between the expected and measured sediment yields is to evaluate the effect of variations in precipitation and streamflow. The general principle that sediment yields follow a lognormal distribution (Figure 4). The long tail of this distribution means that the median sediment yield is much lower than the mean, so most years have relatively low sediment yields, while the less common large events account for the vast majority of long-term sediment yields. This lognormal distribution generally applies across different time scales—within a year, over decades, or over centuries to millennia. At the time scale of one year, Andrews and Antweiler (2012) found that half of the annual sediment yields for most north coastal rivers is produced in just one day. Warrick (2002) found that one-quarter of the 72-year sediment load in the Santa Clara River was transported in just four days. In the Mattole River 35 times more sediment was transported during a cool PDO (Pacific Decadal Oscillation) La Nina phase compared to a warm PDO with La Nina (Andrews and Antweiler, 2012). At even longer time scales the lognormal distribution explains why measured sediment yields—even if there is a 20- to 50-year record— are typically less than the long-term sediment yields as estimated by beryllium-10 concentrations (Kirchner et al., 2001). The implication is that watersheds may be **relatively** calm most of the time, and these more quiescent periods—which might appear to be a dynamic equilibrium—are punctuated by a continuum of increasingly large OMG (Oh My God) events along the long tail of the lognormal distribution that can reset the system and lead to long periods of disequilibrium or quasi-equilibrium (Schumm, 1991; Wohl et al., 2015).

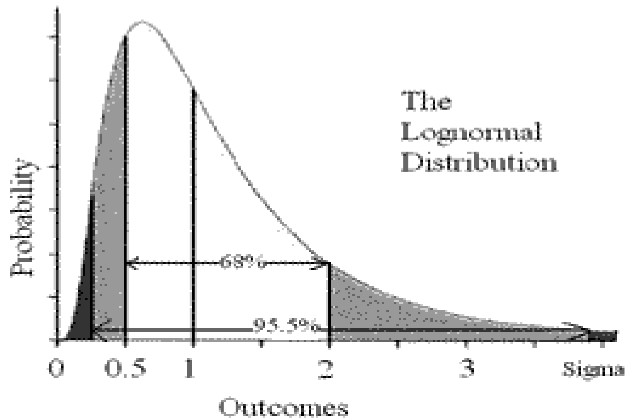

Figure 4. Example of a lognormal distribution showing the data that would fall within one and two standard deviations of the mean, respectively, using a log scale. Note that the mean will generally be larger than the median, and the mode will be less than the mean.

The overall conclusion is that the upper portion of the Elk River Watershed must have a very high average natural sediment production rate. The upper watershed should generally be in dynamic equilibrium with respect to the tectonic uplift, so the channel network generally has to be capable of transmitting this material to the lower portions of the watershed, including the affected reach.

2.2. Subsidence, Sediment Storage in the Lower Reaches, and Aggradation

The second part of Figure 8 (Figure 1 in this document) shows that the lower portion of the Elk River watershed is subsiding. The subsidence rate in Humboldt Bay increases to the southwest, and the estimated rate near the mouth of the Elk River is about 1-2 mm/yr (Cascadia Geosciences, 2013). Drilling near the mouth of the watershed has shown that there is approximately 130 feet of deposited sediment (S. Beach, HRC, pers. comm., 2015). It is logical to presume that this amount of sediment has accumulated since the last sea level minimum at the height of the last ice age approximately 19,000 years ago. Dividing this 40 m of deposition (40 m) by 19,000 years results in a rate of just over 2 mm per year. It should be noted that the surface accrual rate may be somewhat larger because the deposited sediments are compacted as new sediments are deposited.

The basic problem is that the TTR report effectively defines dynamic equilibrium as sediment (and water) inputs should equal sediment outputs (p. 40), but this is not correct. The fundamental continuity equation for both water and sediment is:

$$\text{Inputs} = \text{Outputs} + \Delta S \qquad (1)$$

where ΔS refers to the change in storage (e.g., Dietrich et al., 1982). For water, inputs and outputs almost always match over time scales over a year or longer, as it is simply not possible to continuously increase the amount of water in storage. However, in sediment budgets the storage component is much more important and very often dominant relative to sediment outputs, particularly at the watershed scale (e.g., Trimble et al., 1999). One needs only to look at the amount of sediment being eroded from the surrounding mountains into the Central Valley of California to see that this is a large-scale, long-term sediment sink, with most of this sediment never reaching San Francisco Bay.

The observed aggradation in the affected reach is used to justify the assertion in the TTR that the Elk River is not in dynamic equilibrium. There is no question that the affected reach has been aggrading, and the sediment from past management activities has contributed to the rate of aggradation documented over the past 30 years or so. However, the TTR does not address the basic issue of whether this aggradation is the normal condition in the lower portion of the watershed given the high uplift and denudation rates, the subsidence of the downstream portion of the watershed, and our understanding of watershed-scale sediment budgets. The alternative hypothesis that underlies much of the TTR and the associated management recommendations is that this aggradation is solely due to the higher sediment loads and other changes resulting from management activities from the industrial timberlands.

In gross terms, we can assume that most of the sediment eroded from the portion of the watershed that is experiencing uplift will be delivered to the hinge point in the lower portion of the watershed where there is no longer active uplift. The location of this hinge point is uncertain, but it is most likely in the upper half of the affected reach, and this is where one would expect high sediment deposition rates. It is striking that the valley bottom profile, which is too large of a feature to be significantly affected by recent anthropogenic sediment loads, shows a distinct, nearly zero gradient reach just below the confluence of the North and South Forks of the Elk River (Figure 5). This is about eight miles upstream of the mouth of the Elk River, and the length of this nearly zero gradient reach is shown as two miles, but is probably less as the length scale shown on the x axis does not appear to match the length scale of the mapped area. Geomorphically, it is not clear if this flat section is due to a long-term wedge of accumulated sediment, an unmapped fault, massive co-seismic landslides, or some combination of these. Regardless of its cause, this sharp decrease in valley gradient will induce considerable deposition due to the resulting decrease in fluvial sediment transport capacity.

Below this point the valley slope appears to increase, and then drop to near zero about two miles from the mouth of the watershed according to Figure 5. The thalweg profile surveyed by Bernard indicates a gradient of less than 0.01% from the mouth of the watershed for roughly 3.5 miles upstream (Pryor et al., 2015). This low gradient will limit the sediment transport capacity, and recent measurements indicate that the velocity of the storm peaks in the lower portion of the basin are less than two feet per second (Pryor, 2015). This low peak flow velocity indicates a limited capacity of the Elk River to efficiently transmit peak flows to the mouth of the watershed, and a correspondingly limited sediment transport capacity.

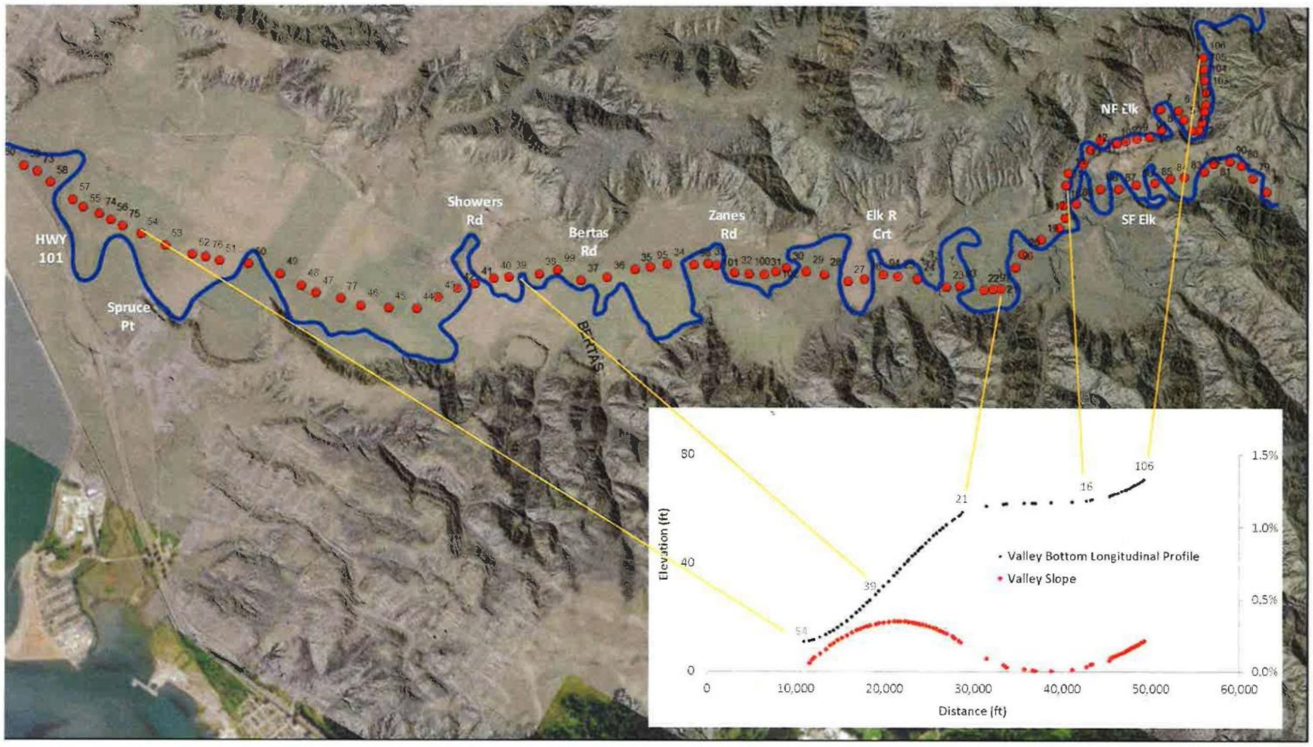

Figure 5. Longitudinal profile of the lower portion of the Elk River showing the distinct flattening of the valley bottom gradient just below the confluence of the North and South Forks of the Elk River. Figure taken from the presentation by J. Stallman at the Technical Advisory Committee meeting for the Elk River in November 2015. Note that the distances shown on the x axis in the inset do not appear to be proportionally to the distances shown on the map as indicated by the variable spacing of the points plotted in the inset and the even spacing of these points on the map.

Longitudinal profiles were plotted for the Elk River, including both the North and South Forks, to help confirm the overall geomorphic context. These profiles were derived from the USGS digital elevation models using the Stream Profiler tool (www.geomorphtools.org) by Dr. Patrick Belmont at Utah State University, and they are plotted in Figure 6. These show the expected relatively steep profiles in the upper portion of the Elk River watershed, but unexpectedly low gradients in the lower 8-20 km of the watershed. For both the North and South Forks the concavity of the lower reach is -1.5, while a value of -0.45 would be expected for a well graded channel (see theta values for the regression in the lower reach of the slope-area plots in Figures 7a and 7b). This high concavity indicates a high natural tendency for aggradation in the lower reaches of the Elk River.

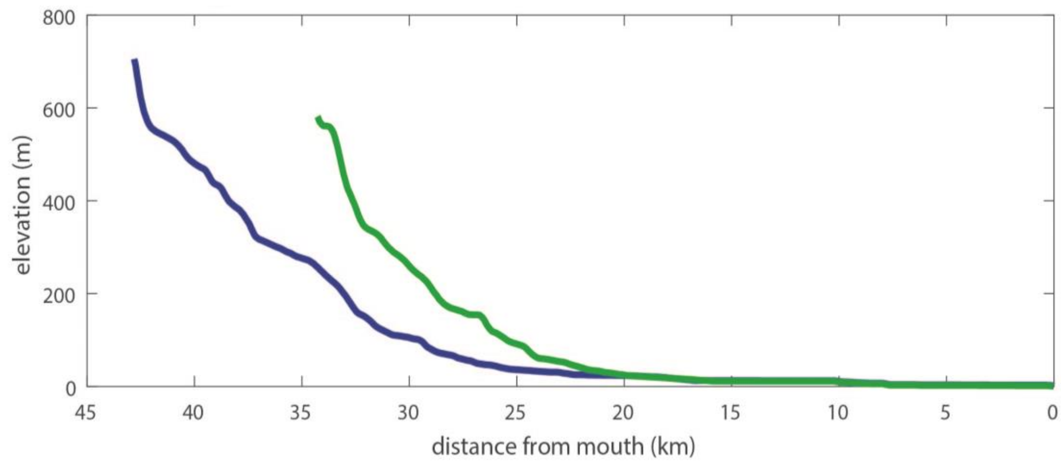

Figure 6. Longitudinal profiles of the North (blue) and South (green) Forks of the Elk River. Both profiles contain significant knickpoints (anomalous breaks in slope).

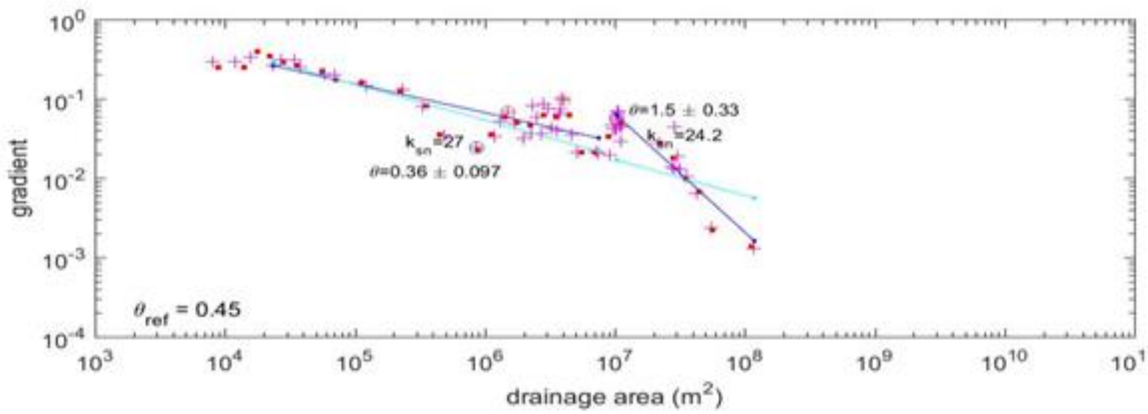

Figure 7a. Plot of local channel slope versus contributing area for the North Fork of the Elk River. Figure courtesy of Dr. Patrick Belmont, Utah State University.

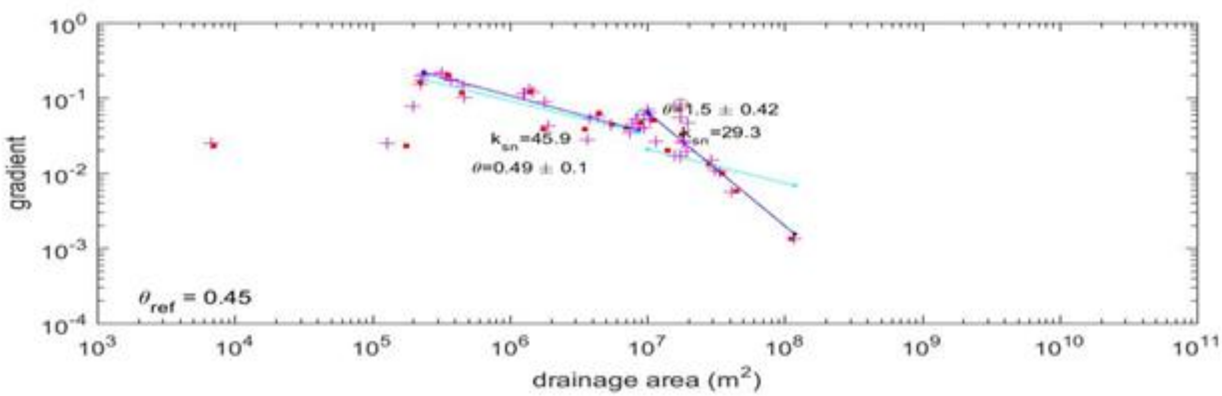

Figure 7b. Plot of local channel slope versus contributing area for the South Fork of the Elk River. Figure courtesy of Dr. Patrick Belmont, Utah State University.

The TTR and the discussions of water quality standards focus on aggradation and flow capacity in the main channels of the affected reach, but the water quality concerns and transport capacity in the affected reach cannot be separated from the geomorphic processes and anthropogenic changes in the adjacent floodplain and valley bottom. As explained below, the conditions in the affected reach also cannot be separated from the hydrologic and geomorphic processes in what I call the "lowest reach", which can be defined as the reach from the downstream end of the affected reach to the mouth of the watershed. Hence it is necessary to not only expand the temporal scale of the assessment in order to determine if the watershed is in dynamic equilibrium, but also to expand the spatial scale to include both the adjacent floodplain and the lowest reach.

While we unfortunately do not have clear and explicit documentation of the affected and lowest reaches prior to human settlement, the basic geomorphic context, residual features, and observations from analogous watersheds strongly indicate that the lower portion of the watershed was a complex, relatively wet system with multiple channels. Sitka spruce was probably the dominant tree species because of its salt tolerance, and the floodplain was well vegetated with a mix of trees, shrubs, and some forbs or grasses. Flows with a recurrence interval of two years or less were probably sufficient to induce overbank flow and floodplain deposition. The high natural sediment loads, low channel gradients, and wide valley bottom would have allowed for deposition, substantial channel migration, and avulsion during the more extreme events. These different channel processes operating at different time scales are why dynamic equilibrium has to be defined for a specified time scale (e.g., Schumm, 1991; Renwick, 1992). The combination of overbank deposition, channel migration, and avulsions was responsible for building the relatively flat valley bottom.

Evidence for this complex and evolving network of main and side channels can still be seen from the high resolution lidar and aerial photos (Figures 8, 9). The problem is that the floodplain and pre-European channel network has been severely altered by human settlement. The side channels have been filled in, levees have been constructed along the main channel, and the main channel has been severely altered (note the succession of five 90-degree bends in Figure 9). The construction of levees along the main channel is of particular concern because this will induce aggradation, while the loss of side channels has decreased the total channel capacity and thereby increased the amount of flow over the floodplain (e.g., Huang and Nanson, 2007).

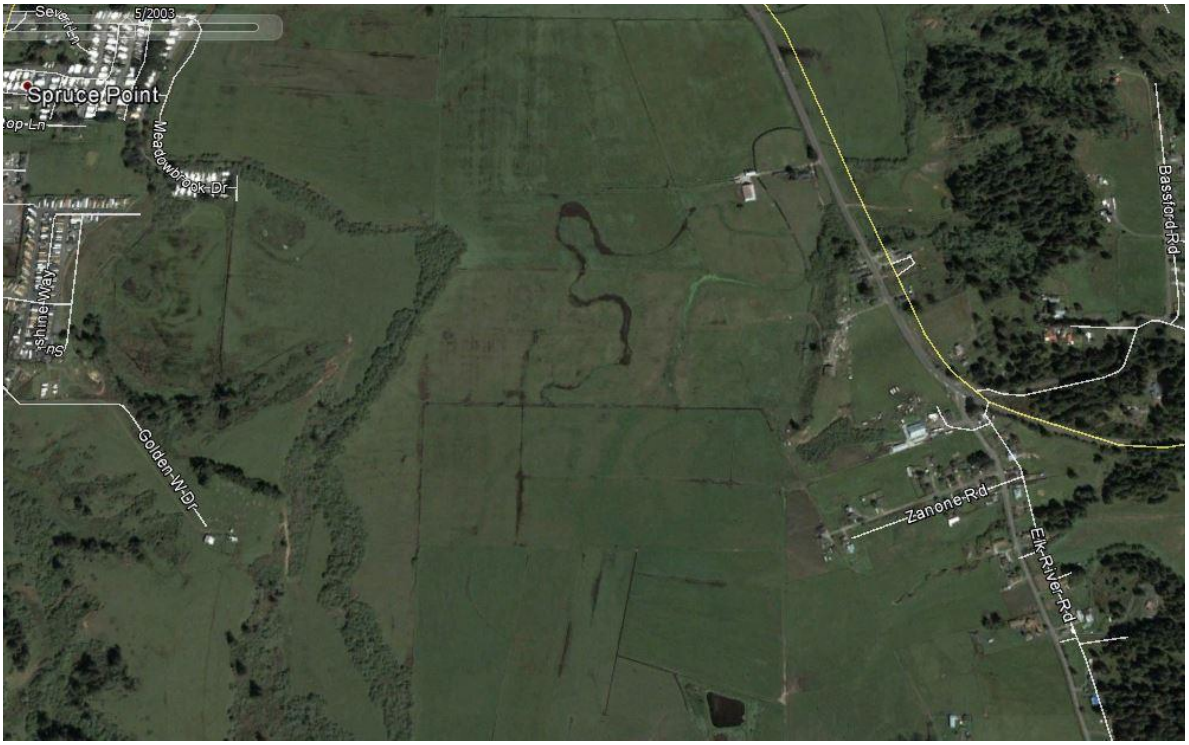

Figure 8. Section of the Elk River floodplain by Zanone Road showing a large number of former channels, indicating that the Elk River floodplain was a wet, multi-channeled system. Image from Google Earth.

Figure 9. Section of the Elk River floodplain in the affected reach with some residual channel features in the floodplain. The five right-angle bends in this image show the extent to which the main channel has been altered by human activities, and the presence of these sharp bends

will greatly reduce the sediment transport capacity and induce deposition and overbank flow as a result of the reduction in stream velocity. Image from Google Earth.

The Elk River Road hugs the northern side of the valley, and this indicates that the valley bottom was too wet and swampy to support the roadway. Redwood stumps extend only to about station 509 or the old USGS gaging station, and the implication is that the valley bottom below that point was too saline for redwoods. Management of the river and its lower floodplains was a common practice and there are many anecdotal accounts by residents, ranchers, and county managers of the need for stream clearing for flood management purposes (Palco, 2005). The early residents put dikes along the river banks to minimize overbank flooding, and all of these activities indicate that much of the valley bottom was inundated and therefore subject to sediment deposition during high flows. The 2015 map of the 100-year floodplain (Figure 10) includes nearly all of the valley bottom from the lower portion of the North and South Forks all the way to the mouth of the watershed, and this wide swath of designated floodplain cannot be attributed to any recent reduction in the capacity of the main channel.

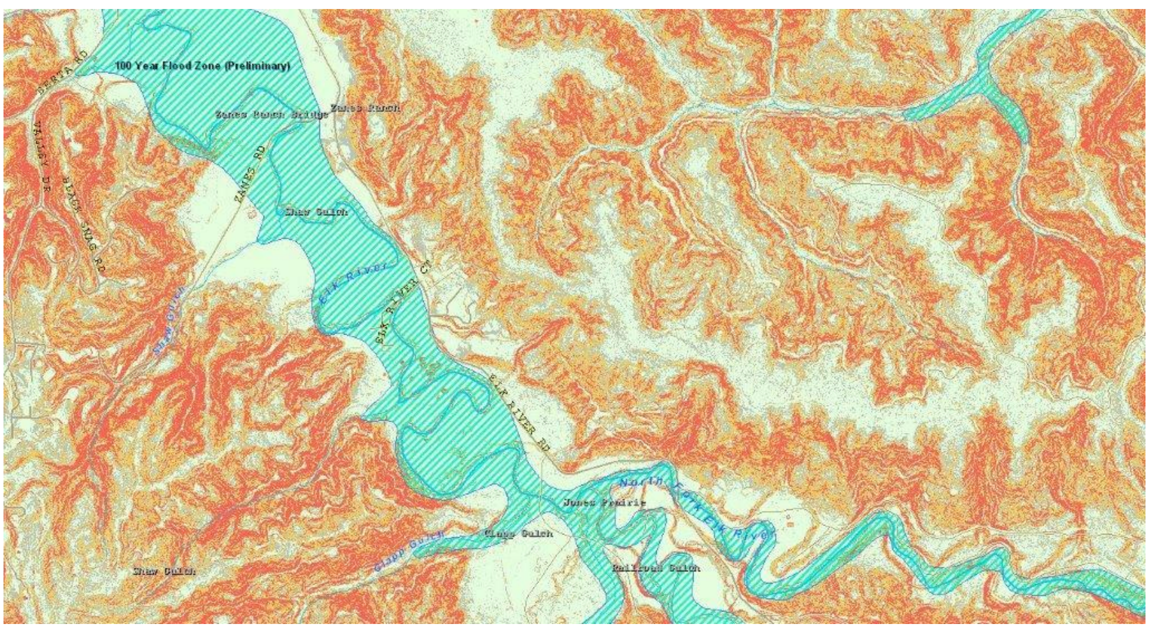

Figure 10. Map of the 100-year floodplain in the lower portion of the North and South Forks of the Elk River and the affected reach (Humboldt County, 2015).

Other studies provide strong evidence that the natural state of these wide, flat floodplains would include multiple channels (e.g., Beechie et al., 2006). Huang and Nanson (2007) show that self-adjusting alluvial channels can anabranch (build side channels) to alter their sediment transport capacity per unit stream power without adjusting channel slope. Sediment transport efficiency can be significantly increased by reducing channel width, which can occur as a result of vegetated alluvial islands and incision below the rooting depth. They also note that, as with other river patterns, anabranching can be characterized by stable equilibrium or accreting disequilibrium.

The hydrodynamic modeling provides further evidence that the affected reach is inherently aggradational. Model results predicted that 18% of the sediment entering the pilot model study area from 2003-2008 was stored within the channel and floodplain, 26% was deposited for the entire impacted reach, and 19% for current conditions (TTR, pp. 68-70). The modeling results and the observed aggradation are used to justify the conclusion that there is zero assimilative capacity. Yet the TTR also notes that even if the upstream influent load is reduced by 75%, which is the amount of sediment assigned to management in the TTR, only 86% of this greatly reduced sediment input would be transported out of the affected reach while 14% would still be deposited (p. 71).

In short, it is simply not valid to assume that the natural state for the affected reach is a single-thread channel where sediment inputs equal sediment outputs. The TTR report erroneously assumes that the natural state of the Elk River is one of dynamic equilibrium (i.e., a simple pipeline where the inputs of water and sediment to the affected reach are equal to the outputs). The box on page 46 states "Such a landscape can be said to be in dynamic equilibrium when the inputs match the outputs over time." The presence of the large floodplain means that considerable deposition has been occurring over a relatively long time period, so by definition sediment outputs are less than sediment inputs. The erroneous characterization of the affected reach as a single thread channel with no deposition results from the failure to consider the larger-scale processes that are the first-order controls on sediment transport and storage in the lower Elk River (see Schumm, 1991). Restoration efforts to recreate a more historically correct main channel, and to establish overflow or side channels, would still not eliminate flooding or sediment deposition on the valley bottom in the affected reach.

The presumption that sediment outputs from the affected reach should match the sediment inputs is further undermined by the failure to consider the conditions and controls on flows and sediment transport in the lowest reach. Figure 8 shows that sea level is rising, and the TTR notes that the conservative estimate for absolute sea level rise (i.e., independent of the subsidence) is 6 inches by 2020, 12 inches by 2050, and 36 inches by 2100 (p. 12). This rise in sea level is causing an increase in baselevel, which in turn causes a corresponding reduction in stream gradient and thus the water and sediment transport capacity in the lowest reach. This reduction in sediment transport capacity due to sea level rise will further exacerbate the ongoing channel and floodplain deposition in the lower portions of the Elk River basin, which in turn will preclude any transformation of the Elk River into a purely transport reach, especially over time scales longer than a year or so.

Even if the affected reach was dredged to remove all of the deposited sediment and increase the stream channel gradient, and all of the water and sediment delivered into the affected reach was exported at the downstream end, there is another six miles of channel with a gradient of no more than 0.12% in the lowest reach (Pryor et al., undated). If the hydrodynamic modeling and other data indicate substantial deposition in the affected reach and the valley gradient in the lowest reach is similar or even lower, it is not realistic to expect that all of the water and sediment being exported from the affected reach can then be transmitted through the lowest reach to the mouth of the watershed. Sediment deposition in the lowest reach, when added to the effect of high tides and the rise in sea level due to low pressure storms, will create even more of a backwater effect that could help reduce sediment transport capacity in the lowest portion of the affected reach.

The box on page 74 in the TTR states that "The loading capacity is defined as zero because:… During high flows (when sediment deposits would be scoured in a functioning system), incoming water and sediment overtops the channel bank and flows across the floodplain. This slows velocities and causes sediment to fall out of suspension." The classic textbook by Dunne and Leopold (1978) notes that "The channel is formed and maintained by the flow it carries but is never large enough to carry without overflow even discharges of rather frequent occurrence." (p. 599). On the next page Dunne and Leopold define a floodplain as "that flat area adjoining a river channel constructed by river in the present climate and overflowed at times of high discharge.", and note that "The floodplain is indeed part of the river under storm conditions." (p. 608).

The problem statement on page 30 of the TTR report notes that the impacted reach is impaired for sediment because excess sediment has been deposited on the floodplain. Yet the floodplain exists because the Elk River from the top of the affected reach to its mouth is essentially a leaky pipe. The storage of sediment predicted by the hydrodynamic modeling is said to be deposited "within the channel and on the floodplain" (p. 68). It is an inescapable conclusion that most if not all of the valley bottom in the affected reach must have been a floodplain at the time of European settlement, and therefore was regularly subjected to overbank flows and sediment deposition. This sediment would be predominantly fine-grained, and in a wet environment would be rapidly colonized by vegetation if the deposit was sufficiently deep to suppress the pre-existing vegetation. The soils and climate, plus observations from analogous systems, mean that the valley bottom of the Elk River was densely vegetated, and bare mineral deposits were only present for a very short period after particularly extreme sediment deposits. Yet the box on page 74 in the TTR goes on to state:

> "The loading capacity is defined as zero because: … Vegetation readily colonizes newly deposited sediment. This slows down flow due to resistance, causing additional sediment deposition. During high flows (when sediment deposits would be scoured in a functioning system), incoming water and sediment overtops the channel bank and flows across the floodplain. This slows velocities and causes sediment to fall out of suspension."

The analogous situation is in Freshwater Creek, where Dr. Lee Benda reviewed Dr. Matt O'Connor's report on channel aggradation, sediment transport, and flooding issues (Benda, 2000). Dr. Benda's final conclusion noted that human activity on the floodplain, particularly the filling of overflow channels by agricultural activities, would have exacerbated flooding, and this is a commonly documented impact on large floodplains in the region.

In summary the flat valley bottom in the lower portions of the North Fork, South Fork and mainstem of the Elk River are nothing more than a large store of deposited sediment. This downstream storage will continue as long as there is continuing uplift in the watershed above the affected reach, subsidence in the lower portion of the watershed, and rising sea levels. The TTR almost completely ignores the cumulative impacts of these processes on the frequency and magnitude of flooding and aggradation in the affected and lowest reaches. Yet these processes must be explicitly recognized in any effort to determine the causes of the current water quality impairment. This geomorphic setting has direct implications for the natural loading capacity and the extent to which the TMDL process can help the Elk River achieve water quality standards.

2.3. Use of the USGS Gaged Record as a Baseline and Target Condition

The TTR states the discharge data collected by the USGS gaging station for 10 water years from October 1957 to September 1967 "offer a baseline condition on the mainstem of the Elk River, which represents a target condition" (p. 11). It also states that "According to the Regional Water Board's assessment, the domestic water supply use was supported and there was evidence that suggests excessive flooding did not regularly impact residents in the Upper Elk River during this period." (p.11). Since I address whether the Elk River can meet drinking water standards in Section 3.3, here I only focus on the extent to which the flows recorded during water years 1958-1967 are valid for establishing a target condition. This will be done by comparing the peak flows measured at the USGS gaging station with recent peak flows measured from the HRC mainstem gaging station (509). Both sets of flow values are normalized to cubic feet per second per square mile (csm) to remove any possible effect of the very small difference in drainage areas.

The left-hand side of Figure 11 plots the instantaneous annual maximum flows from the USGS gaging station on Elk River for water years 1958 to 1967. The annual maximum peak flows over this period are notable because they only varied from 47 to 78 csm with a mean of 62 csm, and there is no apparent relationship between the annual precipitation at Eureka and the magnitude of the peak flow. The right-hand side plots the instantaneous annual maximum flows from HRC station 509 for water years 2003-14. The mean instantaneous annual maximum peak flow of 69 csm was only slightly larger than the mean recorded by the USGS fifty years earlier, but the range of 22 to 133 csm was much greater. Four years (2003, 2006, 2008, and 2011) had an instantaneous peak flow that was from 8% to 71% higher than any of the peak flows from the USGS record. This means that the relative lack of flooding from 1958-1967 should be attributed to the relatively low peak flows experienced during that period, and cannot be used to indicate that this area was generally not subjected to flooding.

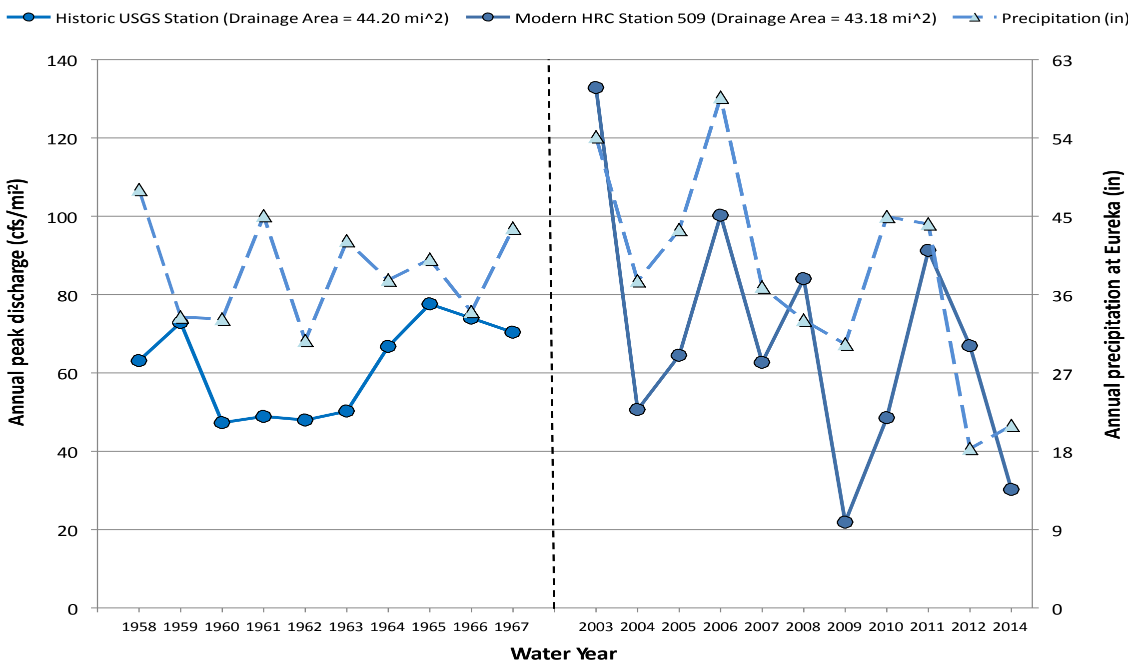

Figure 11. Comparison of the instantaneous annual maximum peak flows for the USGS gaging station near Falk for water years 1958-1967 and the corresponding annual precipitation at Eureka (left side), and the instantaneous annual maximum peak flows at the nearly co-located HRC station (509) for water years 2003-2014 and the corresponding annual precipitation at Eureka.

The relatively low magnitude of the peak flows from WY 1958-1967 is further confirmed by the flood-frequency analyses by B. Pryor (Pryor, 2015). This compared the 2- to 500-year peak flows predicted from the gaging station data at the Elk River near Falk, Jacoby Creek near Freshwater, and the Little River to the predicted flows using regional flood-frequency equations (Table 1). The results show that the 2- and 100-year peak flows predicted for the Elk River using the USGS data were only 2740 and 3960 cfs, respectively, while the predicted peak flows from the regional equations were 2880 and 11,900 cfs, respectively. The 2-year floods from the USGS record and the regional equation vary by only 5%, relatively similar, while the 100-year flood predicted by the regional flood-frequency equation is three times the value predicted from the gage data for 1958-1967. In contrast, the 2- and 100-year peak flows predicted from the gaged data for Jacoby Creek and Little River were very close to the predictions from the regional flood-frequency equations. This indicates that the regional flood-frequency equations are relatively valid, and on this basis the highest measured peak flow at Elk River from 1958-1967 (3430 cfs in WY 1965) is well below the predicted 5-year flood of 5140 cfs using the regional flood frequency equation. These comparisons clearly show that the measured peak flows for 1958 to 1967 were remarkable for their relative consistency and the lack of any high flows.

	Elk River near Falk, CA (11479700)		Jacoby Creek near Freshwater, CA (11480000)		Little River near Trinidad, CA (11481200)	
Watershed Area (sq mi)	43.2		6.05		40.5	
Method	17B Gaged Estimate	Regional Equation	17B Gaged Estimate	Regional Equation	17B Gaged Estimate	Regional Equation
Year of Record	10	-	20	-	54	-
Period of Record	1958-1967	-	1958-1967	-	1953-2006	-
Return Interval	Discharge (cfs)	Discharge (cfs)	Discharge (cfs)	Discharge (cfs)	Discharge (cfs)	Discharge (cfs)
2	2740	2880	757	606	4990	3250
5	3190	5140	1230	1070	7380	5590
10	3430	6730	1560	1390	8840	7220
25	3670	8780	1980	1810	10500	9310
50	3830	10300	2310	2130	11700	10900
100	3960	11900	2630	2450	12700	12500
200	4080	13400	2960	2760	13700	13900
500	4220	15400	3400	3170	14900	15900 [26]

Table 1. Flood frequency calculations based on gaged data and a regional flood frequency equation for Elk River, Jacoby Creek, and Little River (B. Pryor, 2015).

These flow analyses also indicate that the two major storms for 1959 and 1964 as identified in Figure 10 in the TTR report from the precipitation record at Eureka did not produce a large peak flow. Figure 10 also is used to claim that there were no major storms from 2006 to 2014, but this claim is belied by the fact that the measured peak flows in both 2008 and 2011 were 5% and 14% larger than any of the peak flows measured from 1958-1967 (Figure 11). The very poor linkage between the large storms as identified in the TTR and the measured peak flows in the Elk River means that the timing and importance of large storms in the TTR is not consistent with the recorded peak flows on the Elk River.

The TTR also states that “the channel was relatively stable near the Elk River gaging station in the period from 1955-1965, even given the enormity of the 1964 floods that dramatically impacted most other watersheds in the North Coast Region (NCRWCB, 2013b).” The analysis above indicates that the relative channel stability could be due primarily to the lack of any flows from water years 1958-1967 that exceeded about a 3-year recurrence interval using the regional flood-frequency equations. Contrary to the TTR, the USGS gaging station data show that the 1964 flood was **not** a large event in the Elk River basin, and this also was explicitly noted in the Peer Review Draft.

The low peak flow from the 1964 flood is generally attributed to the lack of snow in the Elk River basin, and this means that the extrapolation of precipitation and flood data from other locations to the Elk River watershed must be done with caution and careful attention to the causal processes. As one example, there is a relatively poor correlation between the instantaneous annual maximum peak flows on Little River and Elk River, and this is why I did not use the long-term flow data from Little River to reconstruct peak flows on the Elk River.

3. SEDIMENT SOURCE ANALYSIS AND TRENDS OVER TIME

3.1. Natural Sediment Sources

<u>3.1.1. Accuracy of the Estimated Natural Sediment Sources.</u> The time-averaged value for natural sediment sources in the TTR is 140 yd^3 mi^{-2} yr^{-1}. If a density is 1.4 English tons/yd^3 is assumed, then there is nearly a 20-fold discrepancy between the natural sediment loading as estimated in the TTR and the estimated natural sediment yield if denudation equals uplift. There are several probable reasons for this discrepancy, with the first being that the amount of deep-seated landslides and soil creep are greatly underestimated. Materials submitted by geologists working for the California Geological Survey (CGS) note that the amount of sediment from deep-seated landslide and soil creep is underestimated for other sediment TMDLs on the North Coast by at least an order of magnitude (Bedrossian and Custis, 2002; Bedrossian and Custis, 2003). A 2002 memorandum to the Regional Water Quality Control Board states "CGS concludes that natural/background erosion estimates of 300 to 3000 tons/sq mi/yr are more realistic for most North Coast watersheds underlain by Franciscan terrain", and provides a long list of citations (Bedrossian and Custis, p. 16). A recent study in the Eel River found that 7% of the study area was covered by earthflows, and when these sources were averaged over the entire watershed they would contribute 1100 Mg km^{-2} yr^{-1} (Mackey and Roering, 2011).

A second reason is that the sediment source analysis largely focusses on void measurements to estimate sediment production. This means that the sediment source analysis does not include the sediment delivered to streams by soil creep and diffusive processes that deliver sediment to the streams but do not leave measurable voids. Diffusive processes such as treethrow, shrink-swell, freeze-thaw, and burrowing organisms are a very important source of sediment in steep, humid terrain (e.g., Swanston et al., 1995), but these are not easily quantified and appear to have been ignored in the TTR.

A third reason for the very low estimate of natural sediment yields is that the sediment source analysis is based on 1955 to 2011. A review of the instantaneous annual maximum peak flows at the Little River gaging station shows that from 1956-2014 there were four peak flows of 9-10,000 cfs, and six peak flows that were between 8000 and 9000 cfs. While these data cannot be directly extrapolated to the Elk River, they do indicate a lack of extreme events (e.g., larger than a 25-year recurrence interval) over the 50-year record (Table 1).

Similarly, the rate of natural shallow landslides in the TTR is estimated to be only 30 yd^3 mi^{-2} yr^{-1} (Table 8). This value is almost certainly too low because landslides are so episodic but there have not been any particularly large peak flows and by implication exceptional rainstorms from 1955-2011.

The similarities between estimated sediment sources and the measured sediment yields are taken as evidence "that the loading values estimated by this analysis are reasonable" (p.57). The problem is that the TTR does not recognize that the measured sediment loads only include suspended sediment, which is generally finer than 0.1 to 1 mm (MacDonald et al., 1991). As noted earlier, bedload is not being measured at any of the gaging stations, and this could easily add 40% to the measured sediment loads. Hence any comparison between sediment sources and measured sediment yields (e.g., Figure 17) needs to explicitly recognize that the measured sediment yields are underestimates because they do not include bedload (Edwards and Glysson, 1989).

My conclusion is that the natural sediment yields in the Peer Review Draft and the TTR are greatly underestimated, and this is due to the limitations of the methods used, the failure to include all sources, and the absence of any extreme storm events from 1955 to 2011. The underestimate of natural sediment sources then increases the relative importance of the management-related sediment sources, which in turn inflates the estimated potential reduction in sediment loads that can be achieved through additional regulations on industrial timberlands.

3.1.2. Weather Effects. A key issue is the extent to which the trends or variations in sediment sources over the different time periods are due weather rather than changes in management. The TTR tries to assess the effect of variations in rainfall by comparing the estimated sediment sources over time to the corresponding mean annual water yields from Little River (e.g., Figure 16 in the TTR). The problem is that annual water yields can be a poor predictor of annual sediment yields given that most of the sediment is generated by the biggest storms as documented in Section 2.1. Figure 11 showed virtually no correlation between annual precipitation at Eureka from 1958-1967 and the instantaneous annual maximum peak flows. Annual precipitation only accounts for about 30% of the variability in annual sediment yields for 2003-2014 for the mainstem Elk River station (509).

In contrast, 86% of the variability in annual suspended sediment yields for the mainstem Elk River (station 509) can be explained by the instantaneous annual maximum peak flow (Figure 12). Similarly, 78-80% of the variability in annual sediment yields for the North and South Fork gaging stations can be explained by their respective instantaneous annual maximum peak flows. These remarkably strong relationships confirm that annual sediment yields are primarily driven by the biggest flows. Our analysis also shows that annual sediment yields are very tightly correlated amongst nearly all of the HRC stations for nearly all years; this indicates that the relationship between annual peak flows and annual sediment yields is probably valid for all of the gaging stations in the Elk River watershed, and this is consistent with other studies (e.g., Andrews and Antweiler, 2011).

The TTR uses the poor relationship between sediment source values and annual water yields on the Little River to indicate that the high sediment loads for 1988-1997 were not caused by a difference in rainfall. This is problematic because water yields per unit area are much larger for Little River than Elk River, and water yields are not nearly as strongly correlated with sediment yields as the instantaneous annual maximum peak flow. Nevertheless, I also found little correlation between the estimated sediment sources for each time period and the corresponding mean instantaneous peak flows from Little River. Hence I agree that the differences in the management-related sediment sources over time are primarily due to differences in the amount and type of management activities rather than fluctuations in annual rainfall or annual maximum peak flows.

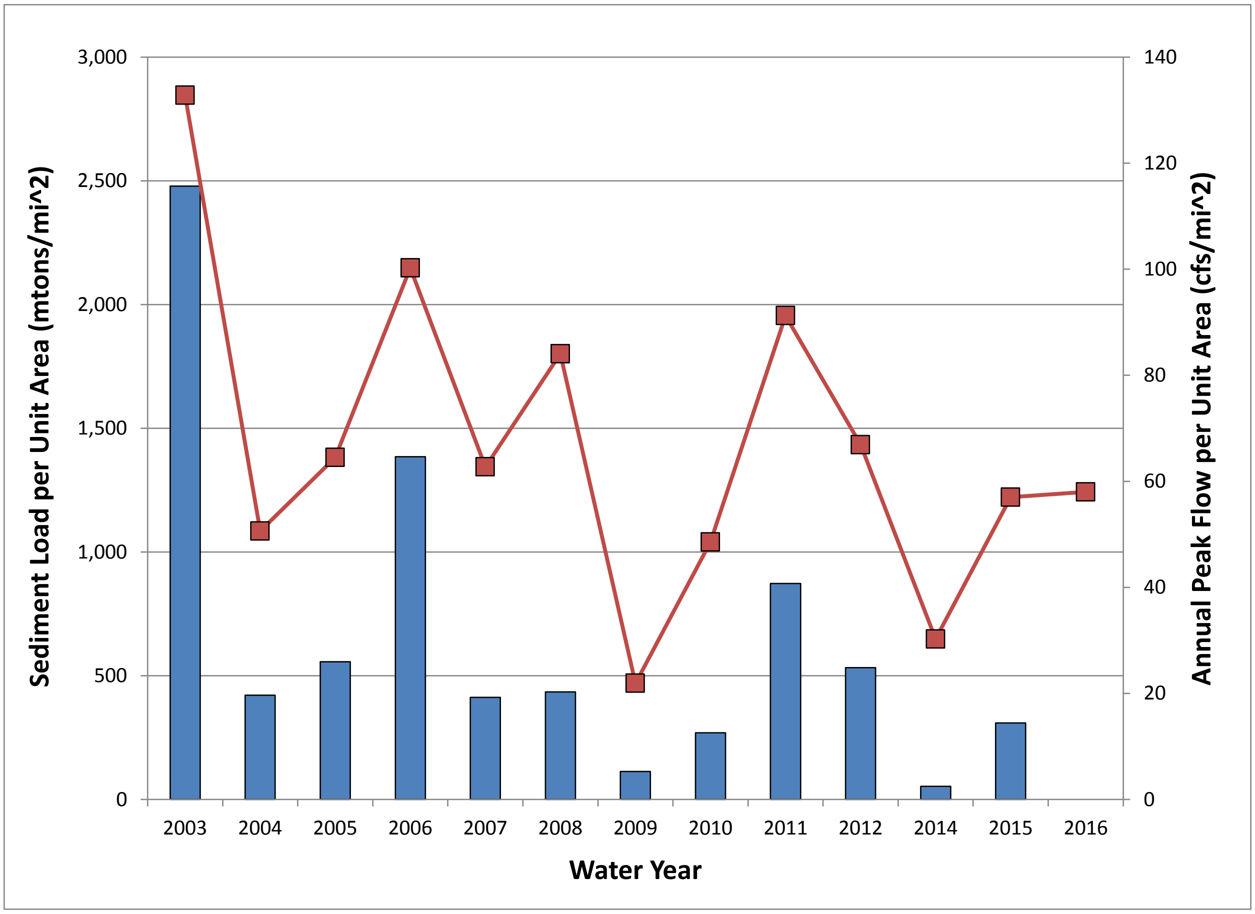

Figure 12. Plot of annual maximum instantaneous peak flows (red squares) and annual sediment yields (blue bars), both normalized by unit area, for the mainstem of Elk River (HRC station 509). Data are not available for 2013, and the peak flow of 58 csm for WY 2016 is only for data collected through 31 January 2016. The sediment yield for water year 2016 will be calculated at the end of the rainy season.

3.2. Anthropogenic Sediment Sources

3.2.1. Summary of trends over time. Table 8 and Figure 15 in the TTR show more than a 60% decline in total (natural and management related) sediment inputs from the peak of more than 1100 yd^3 mi^{-2} yr^{-1} in 1988-1997 to 450 yd^3 mi^{-2} yr^{-1} for the most recent period of 2004-2011. Management-related sediment loadings have dropped to just 32% of the value estimated for 1988-1997 (Figure 13). This sharp decline over the last 20 or so years indicate that the changes in management practices due to Habitat Conservation Plans, changes in California Forest Practice Rules, Waste Discharge Requirements, and timber harvest practices are effective in greatly reducing in management-related sediment yields.

The updated and revised analyses of each of the different management-related sediment sources in the following sections indicate an even greater decline. This decline in sediment from the industrial timberlands leads to questions of: 1) how much further reduction is possible; 2) what additional benefits in water quality and salmonid populations can be gained from more stringent controls on commercial timberlands versus other management or regulatory alternatives; and 3) the extent to which the water quality indicators in the TTR are achievable. To some extent these questions are discussed along with the validity of the estimates for each sediment source category in the TTR. Note that the order of the discussion of the different sources generally follows the order in the text on pages 54-56 in the TTR rather than the order in Table 8.

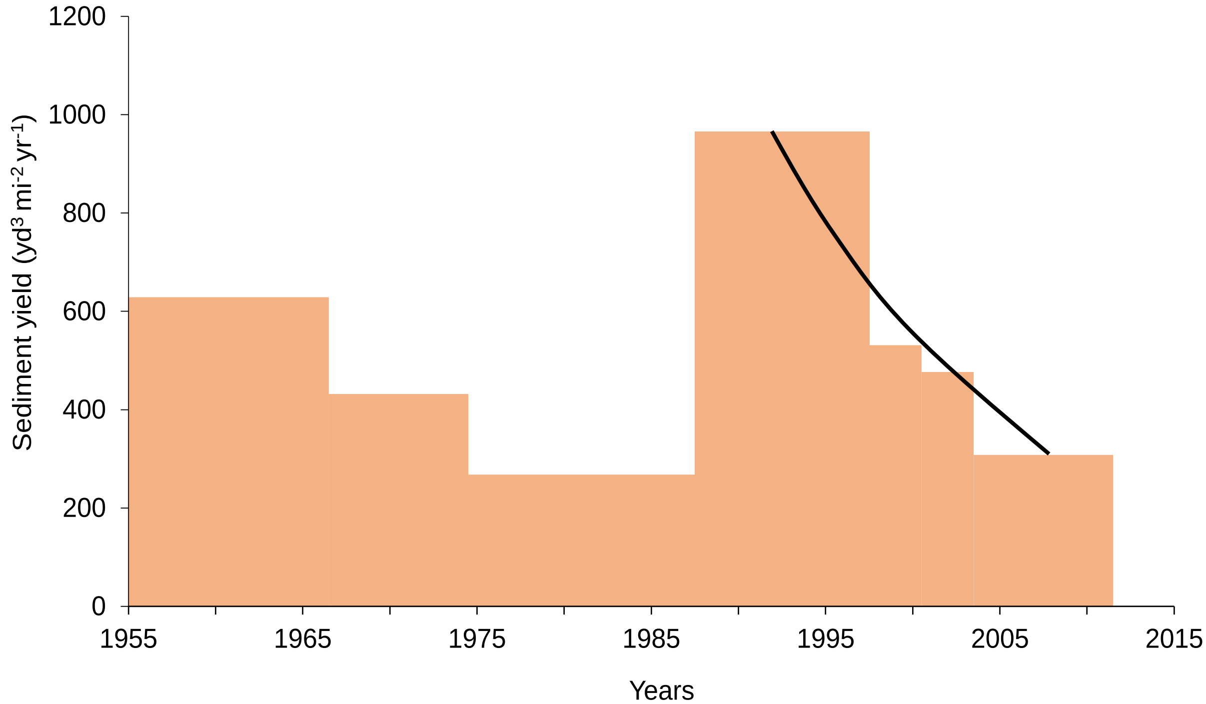

Figure 13. Total management related sediment sources over time (values from Table 8 in the TTR). The trend line was drawn by hand to help show the overall trend.

<u>3.2.2. In-channel management-related bank erosion and streamside landslides.</u> In-channel bank erosion and streamside landslides is the single largest source of management-related sediment in the TTR, accounting for 52% of the total management-related sediment sources in 2004-2011. Three studies provided rates, and the proportion attributed to management is based in large part by the relative drainage densities in unmanaged and managed areas. As noted in my previous comments (MacDonald, 2014a), the unmanaged drainage density of 5.6 mi mi^{-2} was derived from the median contributing area for just four channel heads in the Upper Little South Fork (Buffleben, 2009). The problem is that channel heads are typically a function of both area and local slope (e.g., Montgomery and Dietrich, 1988), and this was clearly true for the four channel heads used to define the median contributing area for unmanaged and unroaded areas (Figure 14).

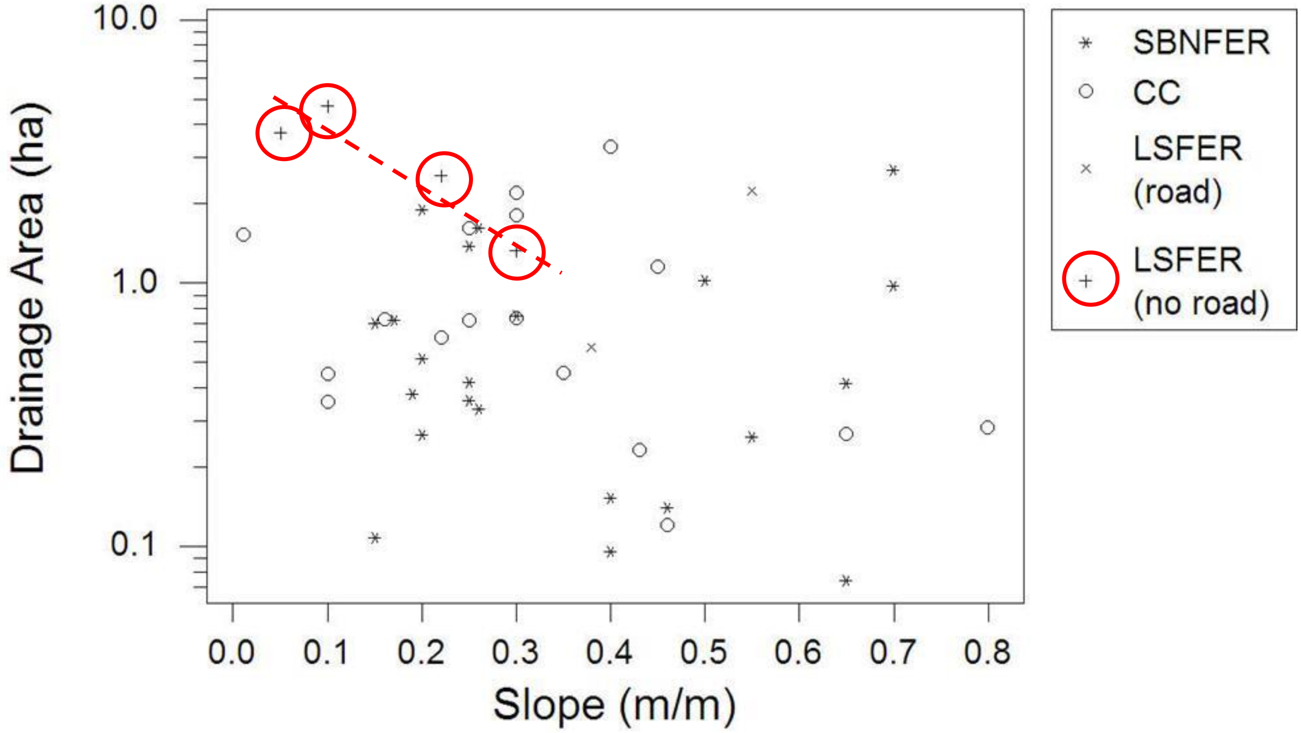

Figure 14. Plot of the channel heads identified in Buffleben (Figure 2.6, 2009). The four channel heads used to determine the drainage density in unmanaged areas are the four crosses in the upper left of this figure, and they clearly show a dependence on both drainage area and slope.

There are also issues with respect to the extremely small sample size used to determine the unmanaged drainage density, the use of a median value rather than a mean, and the inconsistent selection of data used for determining drainage density in both unmanaged and managed areas (MacDonald, 2014a). Although not explicitly stated in the TTR report, the drainage density in unmanaged areas did not vary with geology, while the drainage density for managed areas varied with geology from 16.5 mi mi^{-2} in Wildcat and Yager to 11.7 mi mi^{-2} in Franciscan terrain (NCRWQCB Peer Review Draft, 2013); it is not clear why geology would affect the drainage density in managed areas but not in unmanaged areas. The bottom line is that the drainage density for unmanaged areas is highly uncertain and this directly affects the relative proportion of sediment attributed to natural vs. management-induced bank erosion and streamside landslides.

In my comments on the Draft Peer Review and my presentation to the NCRWQCB (MacDonald, 2014a,c) I made a series of specific points with respect to the accuracy and methodology used to estimate streamside landslides for managed areas vs. unmanaged areas, and my difficulty in following exactly how all of the numbers were generated. The information in the TTR was much less detailed so again it was not possible to determine exactly how the values were determined for natural and management-related deep-seated landslides, streamside landslides, and bank erosion. I will not repeat my comments in detail and GDRCo are providing additional information on the drainage density issue, but briefly: 1) the streamside landslide rate for unmanaged areas was effectively based on just seven landslides larger than 10 yd^3 over a 28-year period from 1975-2003; 2) there was no attempt to relate the rates or size of streamside landslides and bank erosion to key factors such as geology, hillslope gradient, channel size or stream order, geology, amount of large woody debris, or between young forest and advanced second growth; 3) there was no analysis to determine how or why the bank erosion and landslide rates might vary across the three study areas used to generate the basic sediment production rates; 4) the relative rates of management-induced streamside landslides and bank erosion among the 17 sub-basins in Table 8 are constant except for 2003-2011, so the variations in management and site conditions amongst the different sub-basins cannot be related to the variations in bank erosion and streamside landslide rates; and 5) the TTR does not explicitly state how different forest management activities are directly causing the observed different rates of streamside landslides and bank erosion. With respect to these last two points, the various causal processes shown in Figure 12 and elsewhere include increased peak flows, “channel simplification”, “riparian zone simplification”, and reduced slope stability, but there is no effort to assess the relative importance of these different causes or the extent to which they are being addressed by improving best management practices (ROWD, 2015).

The net result is that the streamside landslide and bank erosion data are lumped and the only management guidance that can be provided is a blanket limit on timber harvest rates, regardless of geology, stream type, hillslope gradient, or other factors. If the recommendation is that timber harvest rates should be further restricted to reduce the rates of streamside landslides and bank erosion, there should be more recent data and analyses to support this recommendation, and to provide a clearer, process-based linkage between specific management practices and the rates of streamside landslides and bank erosion for different stream types, geologies, and site conditions. A process-based understanding is could then provide more specific guidance on what specific management activities are of greatest concern for which site conditions. This increased understanding is particularly important given that streamside landslides and bank erosion account for just over half of the estimated management-induced sediment inputs in the Upper Watershed (TTR Table 8).

The relative proportion of sediment from streamside landslides and bank erosion in managed and unmanaged areas is also incorrect because of the demonstrable errors in the assumed drainage densities in managed areas. Matt House of GDRCo is providing a more detailed analysis of this issue, but field mapping by GDRCo in the managed and geologically sensitive McCloud Creek watershed yielded a drainage density of 9.4 mi mi^{-2}. HRC also has provided data to the NCRWQCB that indicated a drainage density of just under 10 mi mi^{-2}, and this study was cited in the Peer Review Draft but this measured drainage density was not used in any of the calculations. The use of these values would reduce the estimated amounts of streamside landslides and bank erosion in managed areas by more than one-third, or around 50-60 yd^3 mi^{-2} yr^{-1}.

Recent data from a 2012 survey of 26 miles of channels yielded a streamside landslide and bank erosion rate of 71 yd^3 mi^{-2} yr^{-1} (SHN, 2012). One-quarter of this amount was due to legacy sources, while the primary causal mechanisms were most frequently related to unstable geology and natural flow deflection. Causal mechanisms due to recent management were virtually non-existent (SHN, 2012). This indicates that current management-related streamside landslides and bank erosion could be as low as 20 yd^3 mi^{-2} yr^{-1} instead of the value of 160 yd^3 mi^{-2} yr^{-1} in the TTR for 2004-2011. A shift of most of the streamslide landslides and bank erosion from management to natural sources would increase loading from natural sources from 144 yd^3 mi^{-2} yr^{-1} to at least 250 yd^3 mi^{-2} yr^{-1}.

The related Water Quality Indicator (WQI) in the Draft Action Plan for the Upper Elk River Sediment TMDLs (NCRWQCB, 2015) is "decreasing length of channel with actively eroding banks", and this is for Class I, II, and III channels. It follows from the above discussion that there are three primary issues associated with this indicator, and these are: 1) what is the true background rate for the percent of actively eroding channel lengths? 2) how well can background rates be separated from natural rates if there the streams have a 50-150 foot buffer? and 3) what are the realistic expectations for the amount of channels with actively eroding banks in an area with highly erosive rock types and rapid uplift? These issues make this WQI particularly difficult to implement. The bottom line is that changing practices appear to have greatly reduced the estimated volume of sediment from streamside landslides and bank erosion in the industrial timberlands, and the values in the TTR for both managed and unmanaged areas are highly questionable.

3.2.3. Low order channel incision. Low order channel incision is estimated to have dropped by one-third from 21 yd^3 mi^{-2} yr^{-1} in 1988-97 to 14 yd^3 mi^{-2} yr^{-1} in 2003-11 (Table 8). The problem is that the recent calculated values for low order channel incision are based on two key assumptions that cannot be readily supported by the available data. The first assumption is that 75% of the increase in channel density occurred by 1950-59, and there has been a consistent 5% increase in drainage density for each subsequent decade (Table 4.1 in the Peer Review Draft). By 2000-2009 drainage densities in managed areas are assumed to have reached the (demonstrably erroneous) values of 16.5 mi mi^{-2} for the Wildcat, Yager and Hookton geology, and 11.7 mi mi^{-2} for Franciscan geology. Given these assumptions there is no clear justification for the assumed increase in low order channel incision from 12 yd^3 mi^{-2} yr^{-1} for 2001-2003 to 14 yd^3 mi^{-2} yr^{-1} for 2004-2011 in Table 8 in the TTR. More importantly, if the drainage density has reached its maximum extent, there should be no more headward extension.

Buffleben (2009, p. 38) states "Most channel heads in the managed watersheds are associated with some type of management feature, the most common of which are skid trails." The current designation of channel heads and their associated equipment exclusion zones, when combined with the shift to either uneven-aged management or shovel logging in the case of even-aged management, means that current harvest practices are not causing the concentrated surface runoff that was largely responsible for the expanding channel network. As noted in my previous comments (MacDonald, 2014a), unpublished results from the Beck's BMPEP monitoring project have shown no headward channel extension as a result of recent management activities (D. Manthorne, HRC, pers. comm., 2013). The new paired-watershed project in Railroad Gulch will provide a more detailed and sensitive test by tracking the locations of at least 30 channel heads over time in sensitive geologies.

The second key assumption is to use the erroneous channel densities in managed areas to estimate the amount of sediment being generated from low order channel incision. If the true drainage density is less than 10 mi mi^{-2}, the amount of sediment from headward channel incision would drop by more than one-third.

A key issue with this sediment source is that it does not clearly separate headward channel extension from headwater channel incision. The assumptions underlying headward channel extension are questionable, and there is no process-based logic or physical evidence to suggest that this is an important process. Headwater channel incision has not been directly measured, and can only be inferred from work in Caspar Creek. Until more specific data show otherwise, the current rate of management-related sediment from low order channels is probably much less than 14 yd^3 mi^{-2} yr^{-1}, but there are no recent quantitative data for this source.

3.2.4. Road-related Landslides. One of the biggest apparent success stories is the sharp decline in road-related landslides from the peak value of over 300 yd^3 mi^{-2} yr^{-1} in 1988-97 to just 25 yd^3 mi^{-2} yr^{-1} in 2004-2011 (Figure 15). About 85% of the latter value is due to one large slide in the Lower South Fork, and if this is excluded the rate of road-related landslides drops to less than 4 yd^3 mi^{-2} yr^{-1} as shown by the dashed black line for 2004-2011 in Figure 15.

A compilation of more recent data from HRC and GDRCo from 2012 through the storms of January 2016 indicates that there have been only nine road-related landslides, and the average sediment input from these is only 1.6 yd^3 mi^{-2} yr^{-1}. The sharp decline in road-related landslides since 1997 shows that the extensive road stormproofing and decommissioning has greatly reduced the risk of road-induced landslides on industrial timberlands. The observed rates do have the caveat that the maximum measured peak flow in 2003 of 5740 cfs in the mainstem of the Elk River has an estimated recurrence interval of seven years using the regional regression equation, but the adaptive management approach means that present practices and road stormproofing efforts be maintained continued until there is evidence to suggest that these are not sufficient. Storm recurrence intervals as a cause for road-related landslides have not been calculated from the Eureka rainfall record as the data from this gage are compromised by adjacent vegetation and the uncertain applicability of the Eureka data to the Elk River watershed.

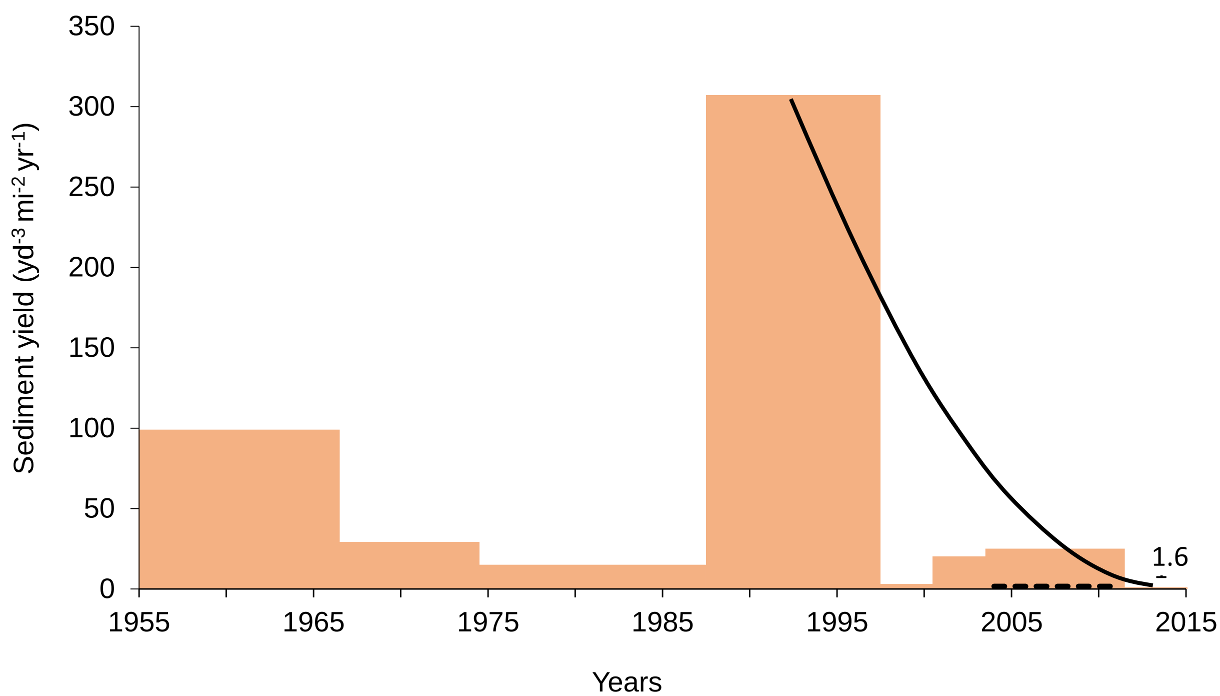

Figure 15. Delivered sediment from road-related landslides over time. Data through 2011 are from Table 8 in the TTR, and the black dashed line for 2004-2011 indicates the unit area rate if the one very large landslide in the Lower South Fork is excluded. The value of 1.6 indicates the average rate from 2012 through January 2016, and the black trend line is drawn by hand to indicate the overall trend.

3.2.5. Open Slope Shallow Landslides. Sediment produced from open slope shallow landslides shows a similar but more consistent trend as road-related landslides. The estimated amount of delivered sediment from this source has dropped from just over 200 yd^3 mi^{-2} yr^{-1} in 1988-97 to just 5 yd^3 mi^{-2} yr^{-1} in 2004-2011 (Figure 16). Virtually all of the sediment from 2004-11 was from just one failure in the Upper South Fork, and a compilation of data from HRC and GDRCo for 2012 through the storms of January 2016 indicate that there have been only two small landslides that can be fully or partially attributed to timber harvest. Hence the average amount of sediment delivered per year from 2012 through January 2016 is less than 0.1 yd^3 mi^{-2} yr^{-1}. This shows that the on-site evaluations and more stringent regulations (HRC, 2015) have greatly reduced the landslide risk in areas subjected to timber harvest. There is still the caveat that the Elk River has not been subjected to a peak flow with more than a seven year recurrence interval since the gaging records began in WY 2003, but the principle of adaptive management would suggest that current regulations be maintained until there is evidence that current practices are inadequate.

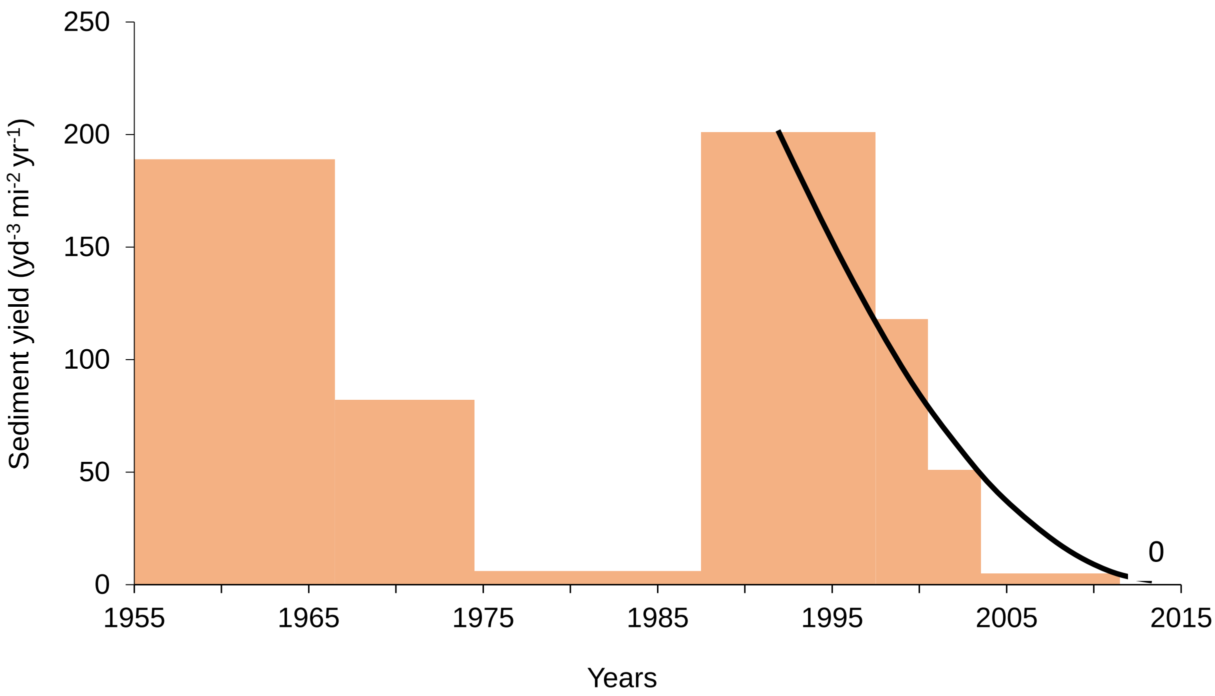

Figure 16. Delivered sediment from open-slope shallow landslides over time. Data through 2011 are from Table 8 in the TTR. The value of 0 indicates the average rate from 2012 through January 2016, and the black trend line is drawn by hand to visually indicate the overall trend.

3.2.6. Skid Trails. The estimated amounts of sediment delivered from skid trails over time from TTR Table 8 are presented in Figure 17. This graph is notable in that it shows a general increase over time, with the highest value of 15 $yd^3\ mi^{-2}\ yr^{-1}$ for 2001-11. The values from 1955 to 2003 in this figure and the TTR are identical to the values in the Peer Review Draft (2013), but the TTR report appears to have simply applied the estimated value of 15 $yd^3\ mi^{-2}\ yr^{-1}$ for 2001-03 to 2004-11 without any explanation or justification. The estimated sediment delivery from skid trails also varies by subwatershed from 1954 to 2000, while from 2000 all watersheds have the same rate of 15 $yd^3\ mi^{-2}\ yr^{-1}$. The Peer Review Draft (NCRWQB, 2013) was very clear in documenting the calculations behind the values presented the associated uncertainty, and this clarity was very much appreciated.

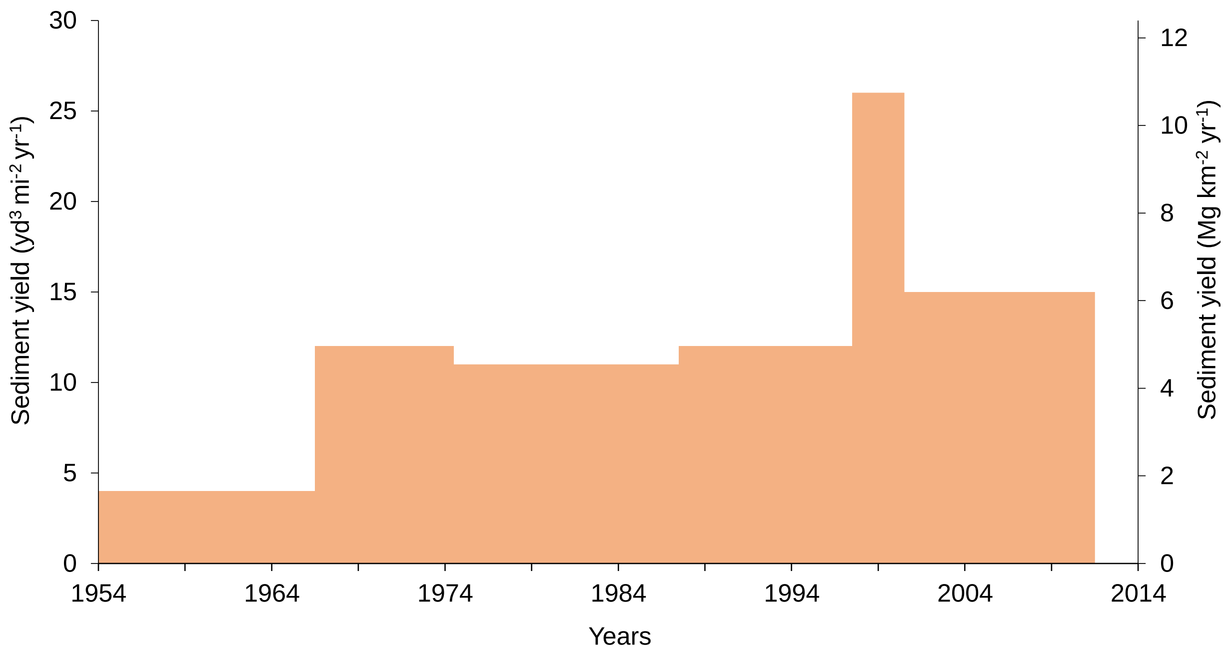

Figure 17. Estimated sediment delivery from skid trails over time. Data through 2011 are from Table 8 in the TTR.

From an adaptive management perspective, the sediment from skid trails should be divided into a legacy portion and sediment from current management, including cable rows. The values presented in the TTR were derived in part from Cleanup and Abatement Orders, and the Peer Review Draft (NCRWQCB, 2013) assumed future delivery will occur uniformly over the next 50 years (this is presumably the basis for extrapolating the 15 $yd^3\ mi^{-2}\ yr^{-1}$ value forward in time). From a process-based perspective, an exponential decay of sediment delivery from historic skid trails would be more realistic as the worst sites are treated, an increasingly small proportion of the remaining unstable sites fail, and the sites that have not been treated or fail revegetate and stabilize. The remaining legacy sites that are suitable for treatment will be treated over time as they are incorporated in Timber Harvest Plans (HRC, 2015).

Sediment production from skid trails in current harvest units is believed to be near zero given the shift to shovel logging and selection harvest. Shovel logging in even-aged management should largely eliminate skid trail erosion because there are no more skid trails, and the temporary roads need to be slash packed, water barred, or otherwise treated if there is any threat of surface erosion being delivered to a stream. Skid trails in ground-based uneven-aged management should be treated to preclude the generation of concentrated overland flow that can initiate surface rilling and delivery of sediment to a stream. The procedures to minimize, if not eliminate, skid trail erosion are well known, and the sediment from skid trails and cable rows in current harvest activities should be close to zero; any problems observed in post-harvest inspections should be immediately treated. The bottom line is that the value of 15 yd^3 mi^{-2} yr^{-1}, while only representing about 5% of the management-related sediment yields according to TTR Table 8, is a legacy rate and sediment production from this source should decline over time.

3.2.7. Land-use Related Sediment Discharge Sites. This is the second most important source of management-related sediment according to TTR Table 8, and this refers to the erosion from a wide variety of legacy watercourse crossings, gullies, skid trails, and other features. Figure 18 shows that the peak rate of sediment production from these sources was 80 yd^3 mi^{-2} yr^{-1} from 1975-1987, and this has since dropped to 39 yd^3 mi^{-2} yr^{-1}. This reduction is due to the systematic attempt to identify and inventory these, and then treat sites on the basis of their relative priority and as feasible given access and the disturbance associated with treating a given site (HRC, 2015). In 2015 there were still 112 sites that needed be treated with a potential delivery of just over 22,000 yd^3 (HRC, 2015) These are supposed to be treated by the end of 2017, so the sediment loading from these sources should rapidly decline to a near zero value.

A separate survey of 12,300 acres that were subjected to significant ground-based disturbance due to timber harvest identified 143 potentially controllable off-road sites. Nearly half of these have been treated, and the majority of the untreated sites either cannot be readily treated or the benefits in terms of sediment savings are not sufficient to justify treatment. Taken together, these data indicate that this source will continue declining and will become a relatively small value by the end of 2017.

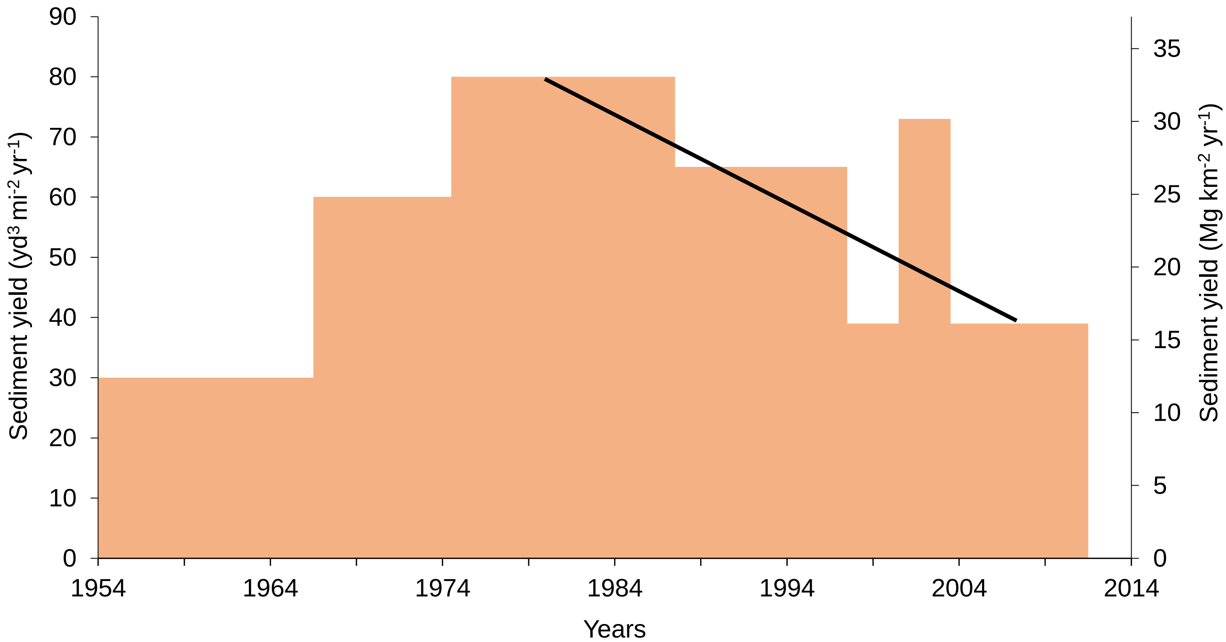

Figure 18. Estimated sediment delivery from management-related discharge sites over time. Data through 2011 are from Table 8 in the TTR, and a relatively rapid decline is projected from 2012 through 2017. The black line is drawn by hand to indicate the overall trend.

<u>3.2.8. Treatment of Management Discharge Sites.</u> This refers to the sediment generated by treating a legacy problem associated with a watercourse crossing, road, skid trail, gully, or other feature. This is the only sediment source that has increased over time, as in 1998-2000 it was estimated at 13 yd^3 mi^{-2} yr^{-1} and as 24 yd^3 mi^{-2} yr^{-1} for 2004-2011 (TTR Table 8). This increase presumably reflects the increased number and size of sites that have been treated in 2004-2011. As such, this sediment source represents a down payment to reduce future sediment sources. Over time the volume of sediment from treated sites should decline as the worst sites are treated and stabilize, and with increasing experience HRC and GDRCo have been seeing a smaller proportion of the sediment being lost as a channel or site adjusts.

<u>3.2.9. Road Surface Erosion.</u> Road surface erosion is another sediment source that has sharply declined from the estimated peak value of 137 yd^3 mi^{-2} yr^{-1} in 1988-1997 to just 22 yd^3 mi^{-2} yr^{-1} in 2004-2011, or an 84% reduction (Figure 19). This reduction has been achieved in large part by stormproofing nearly 80% of the roads on HRC property and decommissioning another 50 miles of roads (HRC, 2015). This process of stormproofing and decommissioning is continuing, so the expectation is that road surface erosion has dropped further from 2012 to 2015, but no data are available on this.

The Draft Action Plan and the TTR call for 100% of roads to be disconnected, but this is not realistic given that road densities are typically around 6 mi mi^{-2} but can reach 10 mi mi^{-2} in some watersheds (NCRWQCB, 2013). Since the drainage density in managed areas is about 10 mi mi^{-2}, it follows that there will be numerous stream crossings and a certain length of road has to drain directly into the stream. Road-stream connectedness can be minimized by draining the road prior to the stream crossing and minimizing the length of the road segments draining directly into the stream at a road crossing, but road=stream connectivity cannot be reduced to zero. Sediment delivery from connected road segments can be reduced by rocking to reduce the road sediment production. The combination of minimizing road-stream connectivity and reducing sediment production on connected road segments is reducing reduce road sediment delivery to a relatively small number, but it cannot be reduced to zero.

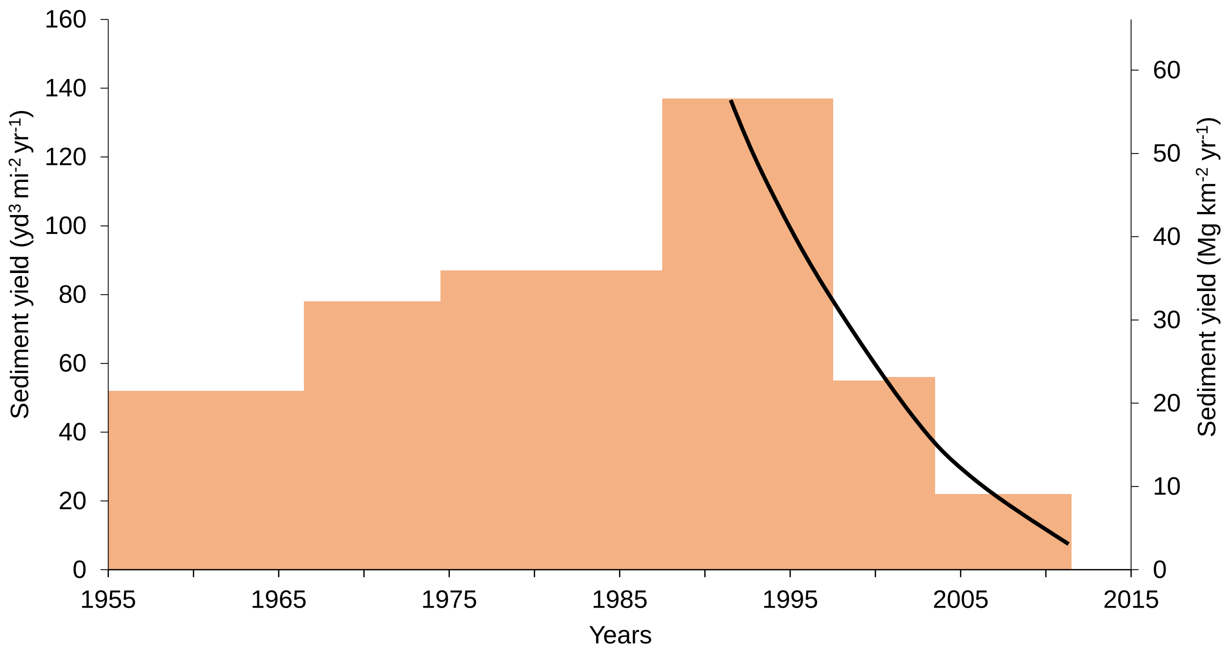

Figure 19. Estimated sediment from road surface erosion over time. Data through 2011 are from Table 8 in the TTR, and the black line is drawn by hand to indicate the overall trend.

<u>3.2.10. Harvest Surface Erosion.</u> Harvest surface erosion is a relatively minor source of sediment, as this has been estimated at just 2-6 $yd^3\ mi^{-2}\ yr^{-1}$ over the different time periods (TTR Table 8). These values are probably too high given the tendency of the WEPP model to overestimate erosion, particularly in wet areas (e.g., Miller et al., 2011). The proposed hillslope water quality indicator in the Draft Action Plan is that "100% of harvest areas have ground cover sufficient to prevent surface erosion". No specific value of cover is provided, but published relationships between erosion and ground cover indicate that 70-80% cover should be sufficient to minimize surface erosion in all but the most intense rainstorms (Figure 20). In particularly sensitive areas close to streams consideration should be given to ripping the skid trails to increase infiltration and slash packing, but cover still needs to be added (Sosa-Perez and MacDonald, in preparation). Providing a high level of cover, when combined with the use of buffer strips, will minimize rainsplash impact and surface sealing, and slow overland flow. The combination of such treatments and the use of buffer strips should ensure that little or no surface runoff and erosion is produced or delivered from harvest units.

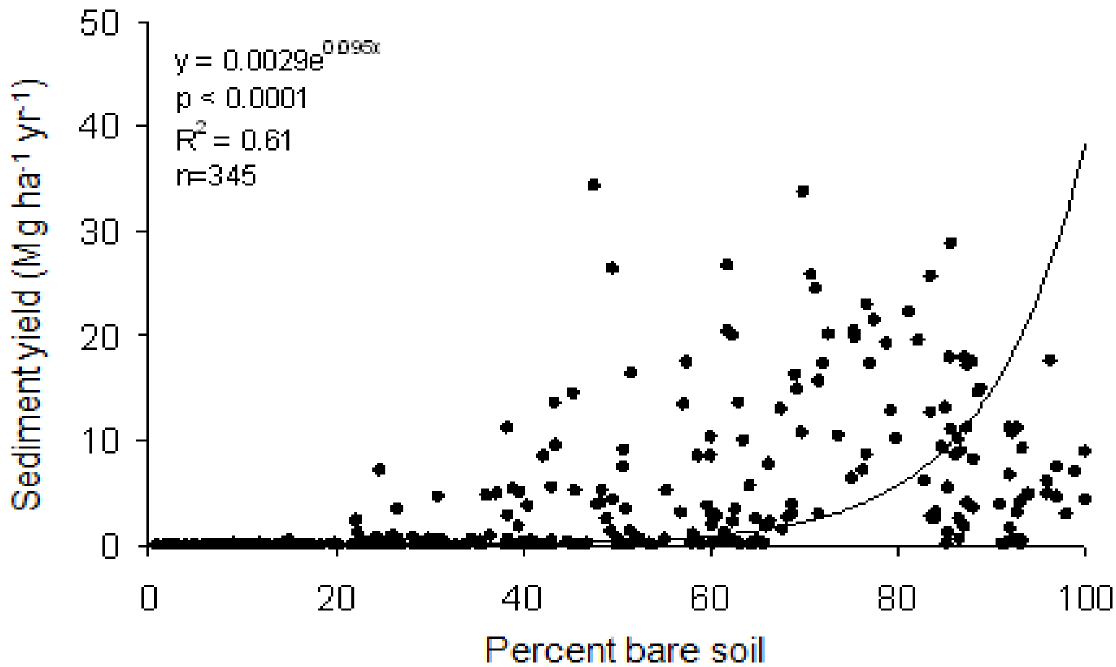

Figure 20. Sediment yield versus percent bare soil (Larsen et al., 2009). Hillslopes with more than 80% cover are highly unlikely to produce any surface erosion.

3.2.11. Summary of Management-induced Sediment Loads. From the above discussion it should be clear that current amount of sediment from low order channel incision, road-related landslides, open slope shallow landslides, current skid trails, road surface erosion, harvest surface erosion in harvest units, and management-related discharge sites have all declined sharply and are continuing to decline as a result of improved management practices and treatment of legacy sites. Collectively I would roughly estimate these sources at roughly 20-30 yd^3 mi^{-2} yr^{-1} for land use-related sediment discharge sites, 15 yd^3 mi^{-2} yr^{-1} for post-treatment discharge sites, 10 yd^3 mi^{-2} yr^{-1} each for legacy skid trails and road surface erosion, less than 5 yd^3 mi^{-2} yr^{-1} each for road-related landslides and low order channel incision, and no more than about 1 yd^3 mi^{-2} yr^{-1} for open slope landslides and surface erosion from harvest units, including current skid trails. This would make a total of about 70 yd^3 mi^{-2} yr^{-1}, with the majority of this being legacy sources and the 15 yd^3 mi^{-2} yr^{-1} from treated discharge sites being an investment for reducing future sediment loading.

The estimated total of about 70 yd^3 mi^{-2} yr^{-1} points out the importance of more accurately quantifying both the natural and management-related values for streamside landslides and bank erosion. The estimate of 160 yd^3 mi^{-2} yr^{-1} for 2004-2011 for management-related streamside landslides and bank erosion is almost certainly too high (Section 3.2.2), and more recent surveys and the revised drainage density values would suggest that the current rate should be around 20 yd^3 mi^{-2} yr^{-1}. This would make the total for all management-related sediment sources around 100 yd^3 mi^{-2} yr^{-1}, with most of this coming from legacy sources. HRC's Watershed Analysis (2014) estimated legacy sources at close to 150 yd^3 mi^{-2} yr^{-1} and current sources at 34 yd^3 mi^{-2} yr^{-1} for a total of roughly 180 yd^3 mi^{-2} yr^{-1}. Their estimated natural erosion rate was 190 yd^3 mi^{-2} yr^{-1}, which was roughly equal to the management-related sediment sources and about 30% higher than the estimate for natural sediment sources in the TTR (Table 9). The total of 370 yd^3 mi^{-2} yr^{-1} still converts to only about 130 Mg km^{-2} yr^{-1} if a density of 1.4 English tons/yd^3 is assumed, and this less than 40% of the mean suspended sediment yield measured at HRC station 509 on the mainstem of the Elk River. This supports the view that there is much more sediment being produced from unmeasured sources such as soil creep and from deep-seated landslides as noted in Section 2.1.

Two other sediment sources that were not considered in the TTR are: 1) the sediment from other portions of the watershed that drain to the affected reach; and 2) sediment from other land uses in the Upper Watershed. Each of these are discussed below, and they both need to be included in the estimated sediment loading to the affected reach, the TMDL, and the Draft Action Plan.

3.3. Additional Natural and Management-Related Sediment Sources for the Affected Reach

As noted above, the sediment source analysis in the TTR is inherently flawed in that it does not include all the area draining into the affected reach, nor does it include all the land uses in the Upper Elk Watershed. The TTR states that the drainage area above the affected reach ("Upper Elk Watershed", p. 7 in TTR) is 44 mi^2, and the sum of all the different sub-watersheds in Tables 7 and 8 is 44.13 mi^2. The problem is that the maps in Figures 6 and 7 with the numbered subwatersheds all show the lower boundary of the upper watershed as concave in the upstream direction, while the map of the numbered subwatersheds in Figure 1 shows the lower boundary as being convex in the downstream direction. A closer analysis shows that the area attributed to area #3 is entirely excluded from the sediment source analysis, but 2.11 mi^2 of subwatershed 3 is included in the Upper Watershed according to Figure 1. This missing 2.11 mi^2 is highlighted in Figure 21, and this includes Shaw Gulch as well as numerous smaller tributaries.

The TTR appears to recognize this discrepancy and states that this area "is not anticipated to contribute significant sediment loads" (p. 7); hence only the upper 17 subwatersheds were used to calculate sediment loading. This exclusion is noted to be "consistent with the load estimates in all the supporting documentation". The problem is that all of the supporting documentation also ignored this area, and this does not justify excluding both natural and anthropogenic sediment loads from this area. All of the sediment from this area will be part of the total sediment loading into the affected reach, and must be considered in any sediment TMDL.

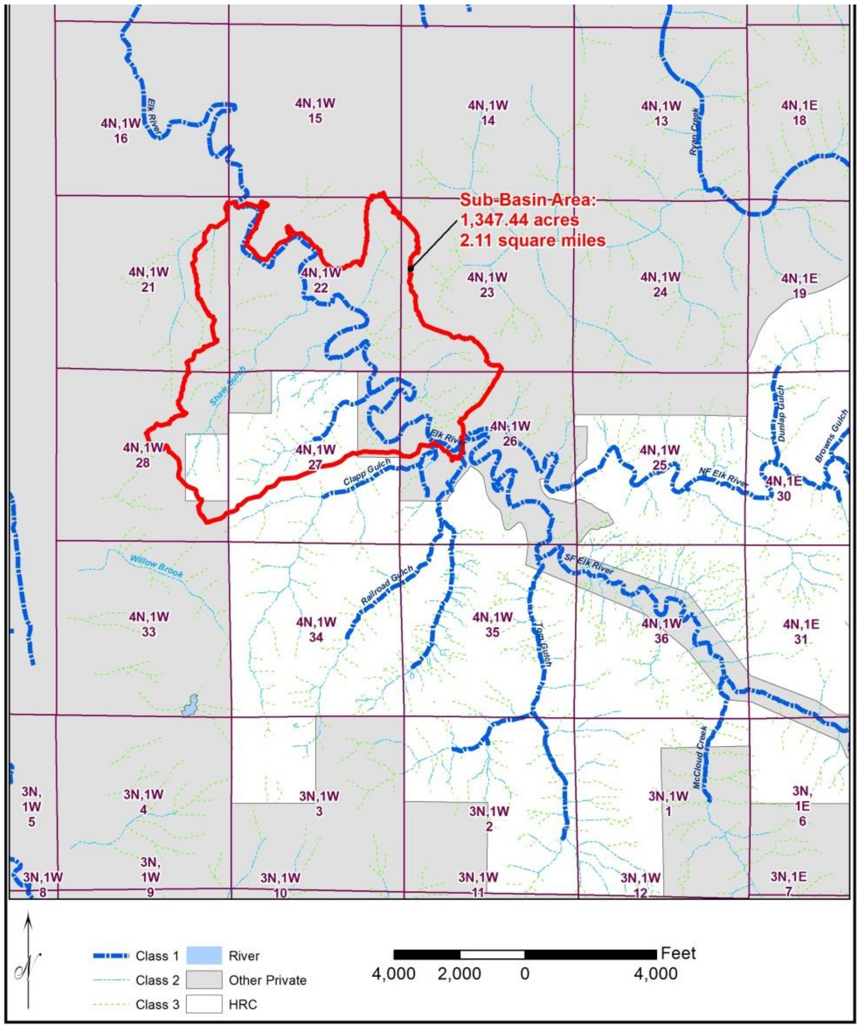

Figure 21. Map of the 2.11 mi^2 of area draining to the affected reach that is not included in the sediment source analysis in Tables 7 and 8.

The land use and ownership map (TTR Figure 3) shows that most of this area is residential, agricultural, or used for timber production by smaller landowners, and this plus Figure 4 suggests that this area is probably densely roaded. The slope gradient map (TTR Figure 6) shows that a substantial portion of this area has gradients similar to the upper watershed. The geologic map in TTR Figure 7 and data from Hart-Crowser (2000) indicates that 44% of the area draining to the affected reach is Wildcat, with quaternary marine and nonmarine sediments adjacent to the alluvium in the valley bottom. The highly erosive Hookton formation occupies 21% of the lower basin as opposed to just 7% in the Upper Watershed (Hart-Crowser, 2000).

A map of the lower basin provided by S. Beach (geologist, HRC) provides a closer view of this area (Figure 22). This shows the presence of earthflows on each side of the Elk River and confirms the extensive roading (Figure 21). Commercial timber harvest also has occurred in this area (S. Beach, HRC, pers. comm., 2015). The relative proximity of this area and these land uses to the affected reach may give them added significance as there is less potential storage. Given these site conditions and land uses, it is clear that the sediment delivery from this area cannot be assumed to be insignificant. It follows that these areas should be subjected to management requirements under the TMDL in order to minimize sediment production and delivery into the affected reach.

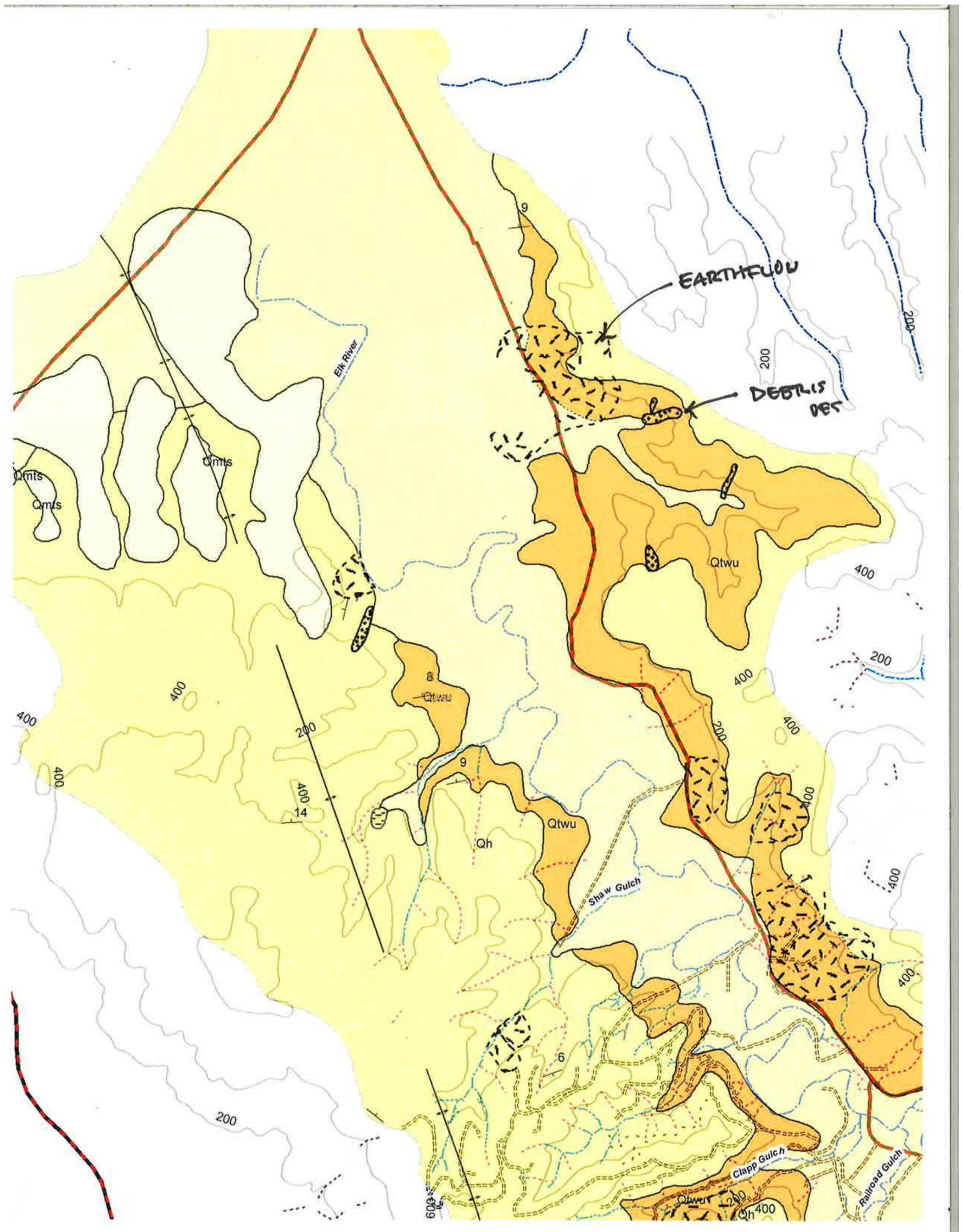

Figure 22. Map of the lower portions of the Elk River Watershed immediately adjacent to the affected reach showing the dense road networks in some portions of the area and the presence of deep-seated earthflows (unpublished figure from S. Beach, HRC, 2015).

The second limitation of the sediment source analysis is that it does not account for all of the land uses in the Upper Watershed. TTR Table 2 indicates that land used in the Upper Elk River Watershed (now 44.6 mi^2) includes 1.3 mi^2 of residential and 0.5 mi^2 of agricultural land uses, but neither of these land uses are included in the sediment source analysis. Again one would expect a relatively dense road network and a variety of other sediment sources depending on the exact land uses and practices. It is beyond the scope of my comments to even try to estimate the magnitude of the sediment being delivered from these two land uses in the Upper Watershed. The first step is to identify and quantify the management-related sediment inputs from these land uses, and then the burden of reducing sediment loads to the affected reach needs to be fairly apportioned amongst all the sources and landowners.

3.4. Accuracy of the Estimated Aggradation in the Affected Reach

A final issue is the accuracy of the estimated volume of 640,000 yd^3 of sediment that has been stored in the impacted reach (TTR Table 10). This number is "based on calculations of cross-sectional changes identified primarily as of 1993" (TTR, p. 66), and the data appear to go through 2011, so dividing volume of 640,000 yd^3 by 18 years leads to a mean deposition rate of roughly 35,000 yd^3 per year. The Draft Action Plan states that this volume of 640,000 yd^3 has accumulated since 1988, which would result a mean rate of about 28,000 yd^3 per year from 1988-2011.

The TTR states that 18% of the sediment entering the pilot hydrodynamic study area during the simulation period of 2003-2008 is stored within the channel and floodplain. While the pilot modeling reach does not extend to the top of the affected reach on the North and South Forks, the TTR states "estimated upstream inputs likely don't change too much on the upper end of the model, although there may be a reduction in the suspended sediment load due to deposition between the top of the impacted reach and the top of the pilot reach" (p. 68). The TTR also notes that "the pilot model extends past station 509, but also does not extend to the downstream end of the impacted reach, ending at Berta Road".

A sum of the total natural plus management-related sediment loads from 1998-2011 (452-707 yd^3 mi^{-2} yr^{-1} according to Table 8) times 44 mi^2 times the appropriate number of years yields a total summed sediment loading for this 24-year period of 840,000 yd^3. This means that 76% of the estimated sediment loading was deposited just in the main channel of the Elk River in the affected reach over this period. The Peer Review Draft also has pictures of roughly 1-4 feet of sediment deposition on the floodplain, and this volume is presumably not included in the 640,000 yd^3 of assumed deposition. On this basis it appears that the sum of the deposition is larger than the total sediment load as estimated in the sediment source analysis.

A comparison of the deposited volume to the measured sediment load at HRC station 509 indicates that the suspended sediment load was about 50,000 yd^3 per year assuming a density of 0.71 English tons/yd^3. This means that 54% of the suspended sediment load was being deposited in the affected reach if one assumes the average annual deposition rate of 28,000 yd^3. Some of this discrepancy can be explained by the failure to include bedload in the sediment loading and measured sediment yields, and by the fact that the hydrodynamic modeling reach was shorter than the affected reach. However, the mass balance calculations in the previous paragraphs clearly show that the assumed deposition of 640,000 yd^3 is unrealistic, and this should not be surprising given the variability in channel change over closely-spaced cross-sections and the fact that there were only 11 cross-sections reach, or an average of one cross-section every 0.4 miles. The large magnitude of the discrepancy between the assumed depositional volume, the measured sediment yields, and the modeled percent deposition must be resolved before an action plan can be formulated to address this assumed amount of deposition. A much higher natural sediment load will directly affect the relative reductions that can be expected from additional regulations on the industrial timberlands and the extent to which the natural sediment yields can be stored or delivered through the existing channels. These discrepancies also undermine any engineering-based restoration plan, and there is a substantial history of failed channel restoration projects due to the highly dynamic nature and high natural sediment loads of California coastal rivers (Kondolf, 1998).

3.5. Achieving the Water Quality Standard for Unfiltered Domestic Water Supply

A key water quality concern and indicator in the Peer Review Draft and the TTR is the ability of the Elk River to meet the water quality criterion for turbidity for unfiltered drinking water. This criterion is <5 NTU with no more than two exceedences in twelve months or five exceedances in 120 months. This criterion is clearly unattainable, as Klein et al. (2012) showed that the value of 5 NTUs was exceeded more than 5% of the time in five pristine streams, and the number of hours with turbidity values greater than 25 NTU in these five streams ranged from 34 to 227 hours. A review of the continuous turbidity data from the Little South Fork of the Elk River from 2007-2014 indicates that 5 NTU is exceeded at least ten times per year, even in the very dry year of 2014.

The Draft amendments to the Basin Plan appear to recognize this limitation, as it specifies that the Elk River should meet this criterion between storms without providing a more specific numerical target. The expectation for between-storm turbidity values below 5 NTU was assessed by examining the continuous turbidity data from the Little South Fork for 2004-2014. The data for the first three years were excluded as these showed much greater fluctuations than any of the other years, and the poor quality of the early data was noted by Sullivan et al. (2012) and in my earlier comments to the Regional Water Quality Control Board (MacDonald, 2015a). Data for water year 2013 also were not available. For each of the remaining seven years the continuous turbidity measurements were plotted with a line at 5 NTU. The percent of time and the number of hours greater than 5 NTU were calculated for each year.

A visual review showed that each year had at least ten storm events that exceeded the water quality threshold of 5 NTU, and some years had substantially more than ten events. The average number of hours per year with turbidities greater than 5 NTU was 754 hours, with a range of 447 to 1101 hours. If one assumes an average of 10-15 storms that have peak turbidities greater than 5 NTU, the mean duration of those exceedances is 2-3 days. The mean percent of time greater than 5 NTUs was 13%. In 2011 turbidity values in excess of 5 NTUs occurred 22% of the time. Figure 23 presents the turbidity data from water year 2012, and the shape of the turbidigraph indicates the strong dependence of turbidities on storm precipitation and duration. This shows how compound storms can lead to longer periods of high turbidities, and how the ability to meet the proposed criterion will depend in part on how a storm is defined.

In conclusion, turbidity levels in tectonically active areas in the North Coast region will exceed the unregulated drinking water criterion of 5 NTU during most storm events, and this exceedance will typically continue for several days.

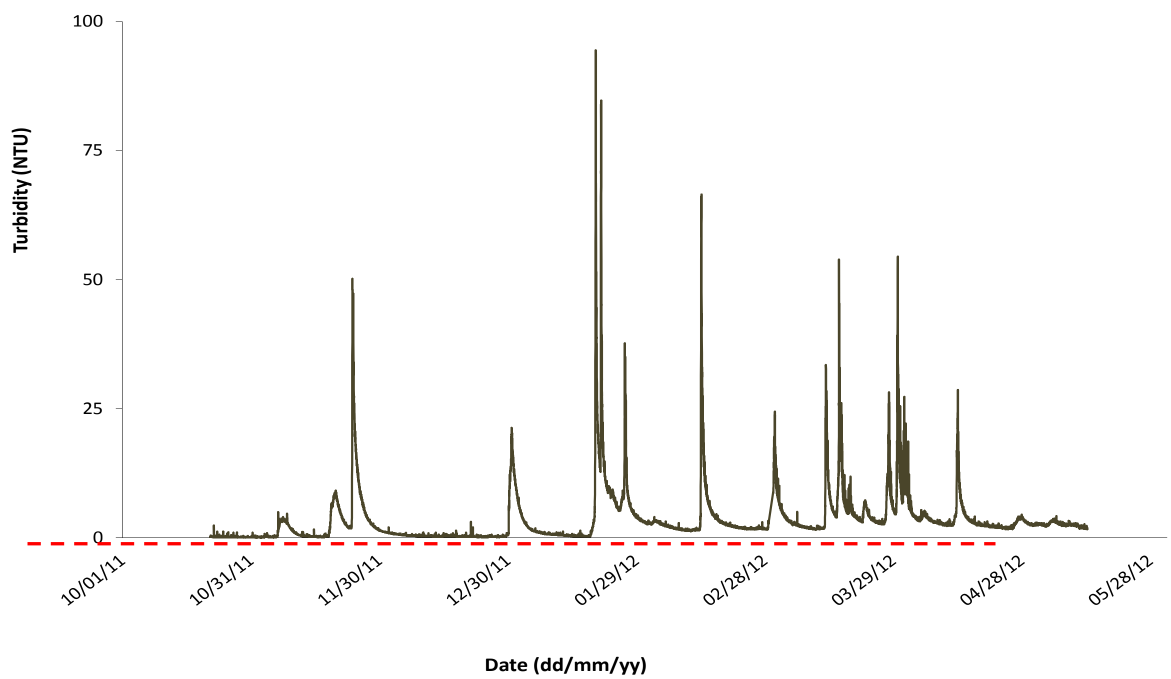

Figure 23. Turbidities in the undisturbed Little South Fork of the Elk River watershed for water year 2012. The dashed red line represents the unfiltered drinking water criterion of 5 NTU, and this was exceeded for 840 hours or 17% of the time.

3.6. Changes in Peak Flows

The TTR and Draft Action Plan set a hillslope water quality indicator and numeric target of less than a 10% increase in peak flows in 10 years related to timber harvest for Class II/III catchments. In the TTR this is justified on the basis of containing flood flows within the channel bankfull discharge, supporting the use of surface water for drinking and agricultural use, and supporting salmonids throughout their historical range (p. 28). With respect to the first issue, the modelled increases in peak flows are less than 10% at the subwatershed scale using the Caspar Creek peak flow model (Cafferata and Reid, 2013) (HRC, 2015).

The increase in peak flows at the scale of the affected reach will be substantially smaller because of the dilution effect from other subwatersheds, hydrodynamic dispersion, floodplain storage, transmission losses, and the peak flows from the different managed subwatersheds are highly unlikely to be synchronized (MacDonald and Coe, 2007; Grant et al., 2008). These principles mean that control of hydrologic changes at the site or small watershed scale will effectively preclude cumulative hydrologic effects at larger scales (MacDonald, 2000; Grant et al., 2008).

The lumped modeling for the North Fork and South Fork did not take hydrodynamic dispersion, floodplain storage, or transmission losses into consideration, but the predicted increase for the North Fork is declining from 10% to 7% due to regeneration (CRWQCB North Coast Region, Resolution No. R1-2006-0038). No peak flow related harvest limit was established for the South Fork watershed as nuisance flooding in this tributary was not as well documented and the Caspar Creek flow model indicated that timber management would increase peak flows by less than 5 percent (HRC, 2015, p. 27). The stage-discharge relationships for the HRC gaging stations on the mainstem, lower North Fork, and lower South Fork (509, 510, and 511) indicate that a 5% increase in peak flow would increase the stage by only 5-8 cm (2-3 inches).

The very large interrannual variability in the size of peak flows shown in Figure 11 means that any management-induced increases in peak flows will be trivial compared to the much larger interrannual variability in peak flow, and a reduction in the amount of downstream flooding cannot realistically be achieved by further restrictions on the rates of timber harvest. (If one really wants to reduce the amount of overbank flooding, this could be most effectively done by restoring the side and overflow channels in the lower portion and floodplains of the Elk River watershed. This downstream restoration also would be much more beneficial to salmonids in terms of providing off-channel rearing habitat, and reducing the tendency for aggradation.)

It should also be noted that the TTR also is concerned about the opposite problem, namely the "reduction in flow capacity of the channel, effectively reducing the achievable water velocities and the sediment transport capacity of Upper Elk River" (p. 64). It also notes the lack of flow velocities to scour out the channel and coarsen the bed material, but both of these would be improved by an increase in peak flows. On the other hand, bed scour would increase turbidities and sediment loads (Cafferata and Reid, 2013), so the TTR and the Water Board need to clarify to what extent and where an increase in peak flows would be beneficial as opposed to detrimental.

With respect to water quality, the data presented here indicate that turbidities commonly exceed 5 NTUs for at least ten storm hydrographs a year in the undisturbed Little South Fork. The modeled increase in peak flows can be put into the measured relationships between flow and turbidity, or between flow and suspended sediment concentrations and hence sediment yields. While this has not been done, the incremental effect of any increase in peak flows will be dwarfed by the interannual variability in peak flows and sediment yields described and quantified in these comments (see Figures 24a-c).

The effect of timber harvest on the larger peak flows that drive most of the sediment yields is still uncertain, as most paired watershed studies have shown that timber harvest does not cause a detectable increase in the size of the larger peak flows (NRC, 2008). A change in the size of peak flows for a series of paired watershed studies in western Oregon and Washington only found changes in the size of peak flows for recurrence intervals of 6 years or less, and that roads appeared to be a very significant contributor to the observed increases in the size of peak flows (Grant et al., 2008). In theory the larger peak flows could be increased if the rainfall interception rate is maintained for these more extreme storms (Reid and Lewis, 2009), but this has not been documented in the forest hydrology literature (Grant et al., 2008; NRC, 2008).

The applicability of the Caspar Creek model to Elk River is also not known given the differences in timber harvest practices, particularly the surface disturbance due to ground-based skidding. There also are differences in geology and other site factors (e.g., Dhakal and Sullivan, 2006), and again the Railroad Gulch study should help resolve some of these issues.

The TTR also does not explain how the proposed restriction on the increase in peak flows would help improve conditions for salmonids. In the lower order channels it is difficult to postulate a significant geomorphic effect of the predicted increase in peak flows. To quote from the abstract in Grant et al. (2008): “When present, peak flow effects on channel morphology should be confined to stream reaches where channel gradients are less than 0.02 and streambeds are composed or gravel and finer material.” It is only in the downstream areas where these channel conditions would be met, but in these downstream reaches the management-induced increases in peak flows will be very small as noted above. Hence it is very difficult to quantitatively link the predicted increases in peak flows in the headwater channels with stream channel conditions in the larger streams used by salmonids.

A final point is that more stringent limitations on the amount of timber harvest over a 10-year period in a given Class II or Class III drainage will force a greater dispersal of timber harvest activities. If there is a total amount of timber that needs to be harvested in order to maintain economic viability, then the dispersal of timber harvest will result in an overall net increase in the amount of ground-disturbing activities and traffic as more areas are entered per year. An economically viable timber industry is important for addressing legacy sites, maintaining and improving the existing road network, and for assisting with restoration. Hence there is a trade-off between allowing for a small increase in sediment from current operations in order to reduce the legacy sources versus stopping timber harvest and having no funds for maintaining and improving the current road system and management-related discharge sites.

3.7. Additional Evidence and Implications for Modeling and Restoration

My comments have shown or postulated: 1) much higher natural sediment loads than in either the Draft Peer Review or the TTR; 2) comparatively small amounts of sediment being generated by current management activities on the industrial timberlands; and 3) the lognormal distribution of sediment yields. Each of these three precepts have important implications for the Draft Action Plan, the likelihood of meeting water quality standards, and what remediation and restoration efforts are most likely to be successful. This section presents three additional analyses using data from HRC’s gaging network to help document these points.

First, an analysis of the sediment yield data from the mainstem station (509) shows that the largest peak flow from 2003-20014 was 5730 cfs in 2003, and this has an estimated recurrence interval of approximately 7 years (Section 2.3). The annual sediment yield for this year was 960 Mg km^{-2}, which is close to the value of around 1200 Mg km^{-2} yr^{-1} (3400 English tons mi^{-2} yr^{-1}) that I postulated as a long-term mean. The next largest peak flow in 2006 had only about a 3-4 year recurrence interval, and the associated annual sediment yield was substantially smaller at 530 Mg km^{-2}. Annual sediment yields in 2009 and 2014 were both exceptionally low. This distribution of sediment yield data appears to be almost exactly what one would expect from a lognormal distribution, and I believe that the mean value of about 300 Mg km^{-2} yr^{-1} measured at station 509 is low because of the lack of high flows, and that a longer record would yield a substantially higher average value.

The logic for this argument is that years with a larger peak flow (e.g., recurrence intervals of 15 or more years) would be expected to produce substantially more than the 960 Mg km^{-2} yr^{-1} that was measured in 2003 due to the nonlinear increase in sediment yields with increasing discharge. If we extrapolate from the relationship shown in Figure 24a below, a 25-year peak flow of 8780 cfs or just about 200 csm (Table 1) would generate an annual sediment yield of about 3000 Mg km^{-2} yr^{-1} (8500 tons mi^{-2} yr^{-1}). The estimated 100-year storm of 11,900 cfs (270 csm) is projected to generate an annual sediment yield of about 7000 Mg km^{-2} yr^{-1} (20,000 tons mi^{-2} yr^{-1}) . While I would not normally do such extrapolations because of the high uncertainty, I have done so here because of the unusually strong R^2 between the instantaneous annual peak flows and annual sediment yields, and the need to illustrate the potential magnitude of the sediment yields that can be expected from the Elk River watershed in more extreme storm events. Shane Beach of HRC said jokingly that if we had flows similar to what was observed on the Eel River in 1964 that we would fill up Humboldt Bay with sediment, and without doing the calculations it seems that there is some truth to this statement!

The second data set from Bridge Creek indicates the relatively low impact of current management on sediment yields. This is the only watershed in the HRC gaging network that has shown a clear decline in sediment yields over the period of record beginning in 2003. This decline has occurred even though 30% of the basin was harvested—primarily by cable-yarded clearcuts—from 2001-2011, and another 7% was harvested from 2013-2015. The basic story of this watershed is that there were large landslides in 1997-1998, and these caused the very high sediment yields in the first years of monitoring. The subsequent timber harvest activities have had no apparent effect on sediment yields given the large amount of natural recovery from the landslides in the late 1990s, and this is consistent with the estimated volumes of management-related sediment sources in Section 3 of my comments.

The third set of data comes from the sediment yields being measured at the gaging stations in the East and West Branches of Railroad Gulch. This monitoring is in preparation for the paired watershed experiment to evaluate the effectiveness of current best management practices in a highly erosive watershed. The gaging stations are now in their third year of monitoring, and in water year 2015 the measured sediment yields were 660 and 1070 Mg km^{-2} yr^{-1} (1900 and 3000 English tons mi^{-2} yr^{-1}), while in water year 2016 the sediment yields are expected to be higher if there is normal late winter and spring precipitation. The highly sensitive geology means this study will be a sensitive test of best management practices, and a critical contribution to the adaptive management approach advocated in the Peer Review Draft and the TTR.

It is of interest that the estimated natural and management sediment loading for Railroad Gulch in the TTR for 2004-2011 is 430 yd^3 mi^{-2} yr^{-1}. This converts to only 230 Mg km^{-2} yr^{-1} at a density of 1.4 tons/yd^3, or roughly one-quarter of the mean measured sediment yield for water year 2015, which had lower than average sediment yields at the mainstem HRC stations. While it is not yet possible to say how much of this sediment is due to legacy effects versus natural sediment sources, the magnitude of these measured sediment yields is entirely consistent with the expected mean annual sediment yield in Section 2.1. Taken together, these data indicate that any remediation or restoration project must recognize the potential for very high sediment yields from only moderately extreme events (e.g., peak flows with a 25- to 100-year recurrence interval).

4. SYNTHESIS AND IMPLICATIONS FOR RECOVERY

The data presented earlier clearly show that the natural sediment sources estimated in the TTR (140 yd^3 mi^{-2} yr^{-1}) are too low. For the short term this value is too low by at least a factor of two as indicated by the measured sediment yields, and in the long-term it is at least an order of magnitude too low given the uplift rate, beryllium-10 data, and measured sediment yields in other North Coast watersheds.

The TTR and the analysis in Section 3 both show that the estimated sediment from management-related sources in the industrial timberlands have greatly declined from their peak in 1988-1997. The values for 2004-2011 in the TTR indicate a nearly 70% reduction in management-related sources, while my updated analysis in Section 3 suggests a decline of approximately 80% since 1998-97.

If the management-related sediment sources are the primary cause of the observed impairment in the affected reach as indicated in the Peer Review Draft and the TTR, I would expect to see an improving trend in the measured turbidities and sediment yields, and also in the habitat characteristics from HRC's Aquatic Trend Monitoring data. The discharge, turbidity, and suspended sediment data are of very good quality, but an initial analysis shows relatively little evidence of improving trends in terms of the duration of high turbidity values or suspended sediment concentrations. Jack Lewis also has found little evidence of an improvement in terms of suspended sediment concentrations or loads from the Salmon Forever gaging stations in the Elk River watershed (Lewis, presentation to the MSG).

Section 3.1.2 noted the very strong relationship between the annual maximum peak flows and the annual suspended sediment yields for each of the downstream HRC stations (R^2=0.78-0.86). If sediment inputs were declining substantially, one would expect the more recent years to plot below the overall regression line. Figures 24a-c do not show a clear recovery over the period of record (water years 2003-2015), although there may be a weak signal of recovery in the North Fork (Figure 23c). The ATM data presented in the Peer Review Draft and my subsequent review of those data for HRC provide a few tantalizing hints that the bed material in some locations is coarsening or that pool depths may be increasing, but there is not a consistent or strong trend as might be expected given the relatively dramatic decrease in sediment sources from the industrial timberlands over the last twenty years.

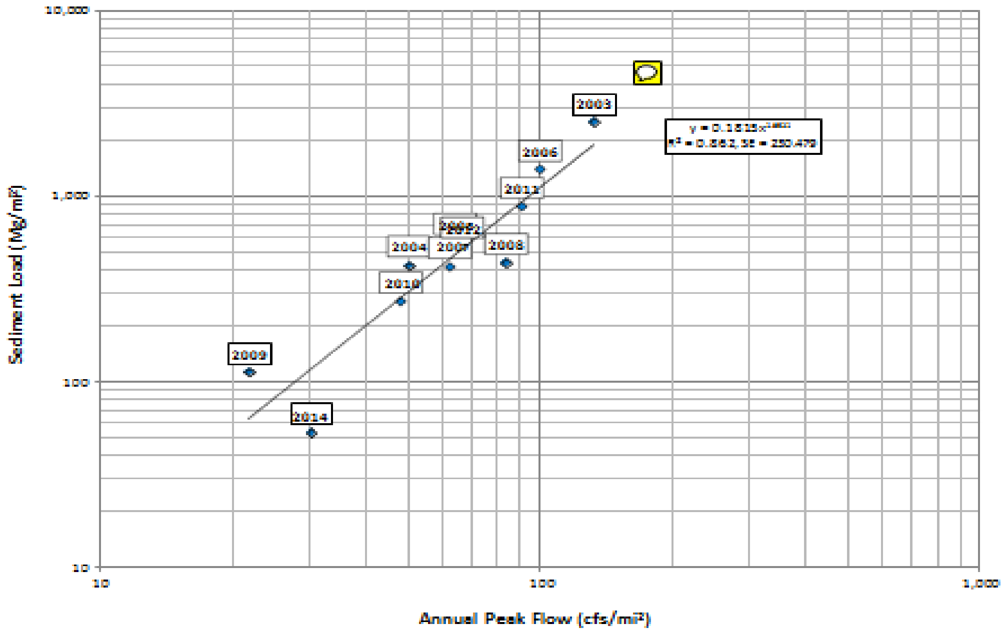

Figure 24a. Plot of annual sediment yields versus the corresponding instantaneous annual maximum peak flows for HRC station 509 on the mainstem of the Elk River. Note the very high R^2 value of 0.86.

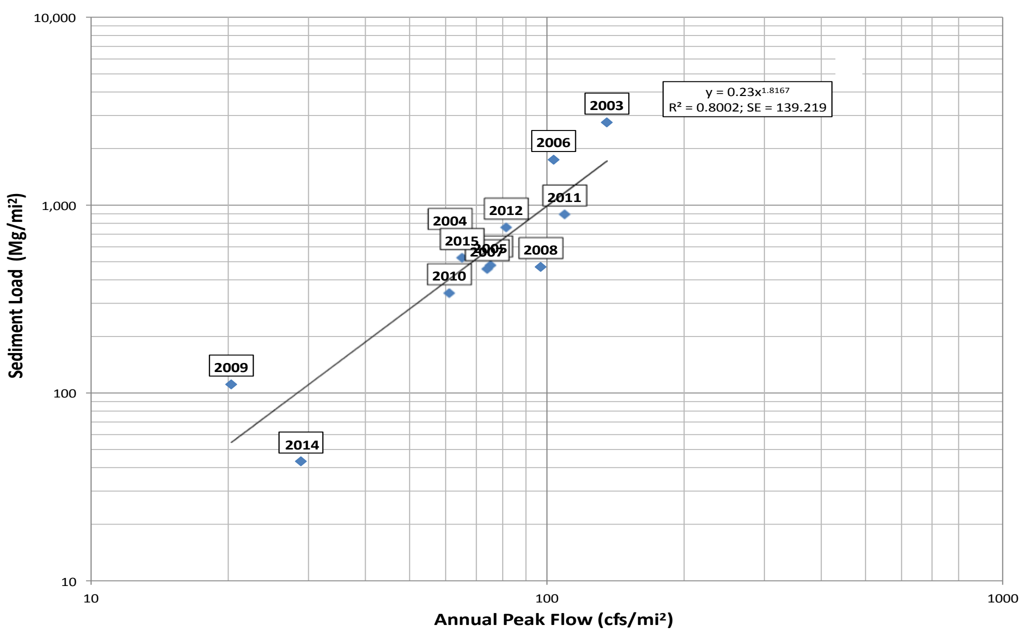

Figure 24b. Plot of annual sediment yields versus the corresponding instantaneous annual maximum peak flows for HRC station 510 on the lower mainstem of the South Fork of the Elk River. Note the high R^2 value of 0.80.

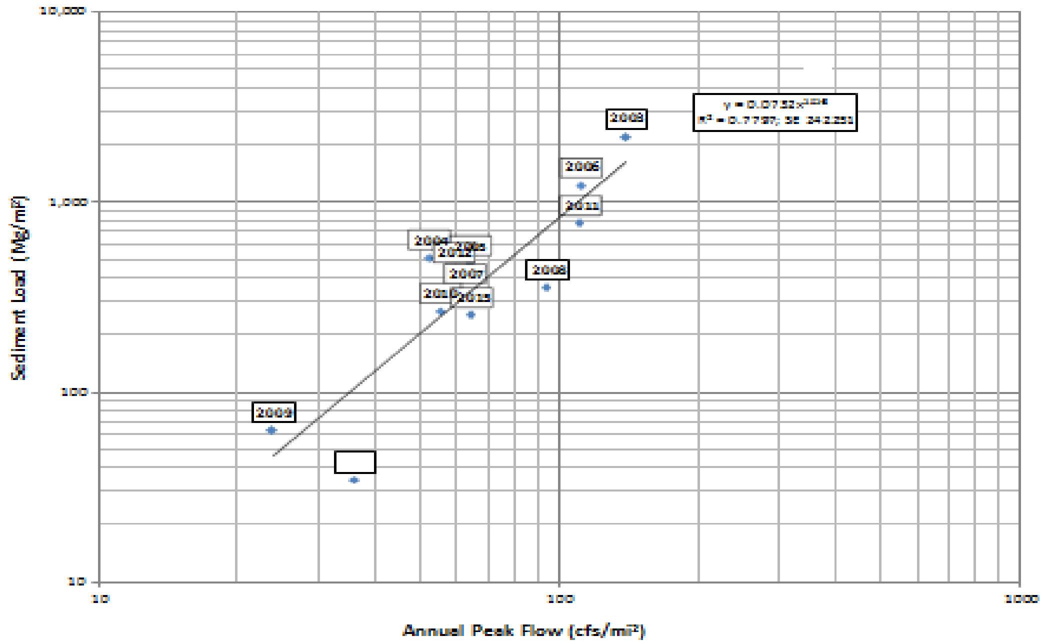

Figure 24c. Plot of annual sediment yields versus the corresponding instantaneous annual maximum peak flows for HRC station 511 on the lower mainstem of the North Fork of the Elk River. The unlabeled box is 2014, and there is a tendency for the more recent years to fall below the regression line. Note the high R^2 value of 0.78.

This apparent lack of recovery for the three downstream gaging stations is somewhat surprising and can be attributed to one or more of the following four hypotheses:

1) There is so much sediment stored from past management activities that it will take many years to flush this out; this hypothesis appears to be favored in the TTR and the Draft Action Plan as a two-phase TMDL is proposed and recovery is expected over the next 10-15 years;
2) The HRC gaging stations and ATM data have not been able to consistently show any recovery because the data are too confounded by the interannual variations in precipitation and runoff, plus the data are too inaccurate and/or noisy;
3) Natural sediment yields are very high and the geologic setting means that the lower portion of the Elk River watershed is inherently aggradational; hence one cannot expect a sharp change in either water quality or stream channel conditions; or
4) The downstream floodplain has been so severely altered by human activities that downstream aggradation and nuisance flooding are inevitable.

It is possible that the lack of recovery is due to some combination of these four hypotheses. Hypotheses 3 and 4 can be easily combined, while hypotheses 1 and 3 represent almost opposite and competing explanations for the lack of recovery.

Hypothesis 2 can be partly denied given that Jack Lewis' analysis indicates some recovery in Freshwater Creek for a similar time period and roughly similar management history (Lewis, 2013[?]). As noted above, the gaging station data are generally of excellent quality, and some of the uncertainty in the estimates of sediment loads can be quantified from the variability in the stage-discharge and turbidity-suspended sediment relationships. Evaluating the accuracy of the pumped water samples and hence the true suspended sediment concentrations is much more difficult (e.g., Edwards and Glysson, 1988). Statistical techniques can help eliminate the weather-induced variations in turbidities, sediment concentrations, and sediment yields, but any assessment of trends in annual sediment yields is limited by the relatively short length of record compared to the longer-term trends sediment sources. Trends in the ATM data are more difficult to establish because the data have much more unexplained variation, and monitoring stream channel conditions is very difficult given the high temporal and spatial variability and the different responses in different stream types (MacDonald and Montgomery, 2002; Roper et al., 2010). Nevertheless, it is my best professional judgment that a decline of 75-80% in management-related sediment yields as indicated by the sediment source analysis should be detectable IF anthropogenic sediment is the primary cause of water quality impairment as indicated in the TTR and the Peer Review Draft (NCRWQCB, 2013).

The choice among the remaining hypotheses (1, 3, and 4) is critical because these have very different implications for how much improvement can be expected, and what changes in management are most likely to lead to the desired future condition. The uplift, beryllium-10 data, and measured sediment yields from other North Coast watersheds all strongly support hypothesis #3 (see Section 2). Similarly, the longitudinal profiles, presence of the floodplain, and high rate of subsidence support the concept that the affected reach and the lowest reach are both inherently aggradational.

A key issue that could help us distinguish between hypothesis 1 and hypothesis 3 is the amount of stored sediment, but unfortunately there is very little quantitative data on this in the Upper Watershed. The TTR notes the lack of cross-section change at the USGS gaging station from 1958-1967, but only quantifies the amount of sediment stored in the affected reach since 1988. As shown in Section 3.4, the calculated volume of 640,000 yd^3 deposited since 1988 is clearly excessive when compared to the sediment source analysis and the measured sediment yields. The TerEx analysis was a first attempt to estimate sediment storage in a much larger proportion of the watershed, and the results do not show massive deposition (Figure 3). The rapid uplift, and the general principle that denudation rates equal uplift rates, both suggest an overall dynamic equilibrium between uplift and denudation for the Upper Elk River Watershed.

From a scientific perspective, I am forced to choose the combination of hypotheses 3 and 4 as the most plausible explanation for the current water quality impairment in the Elk River watershed, and the lack of recovery despite the large, 20-year decline in management-related sediment sources. If the TTR favors hypothesis 1 and this is to be used as the basis for the Action Plan and the sediment TMDL for the Elk River watershed, scientific evidence must be presented to support hypothesis 1 and refute hypothesis 3. Such evidence is not presented in the TTR or the other documents relating to the sediment TMDL.

Similarly, hypothesis 4 is very consistent with hypothesis 3, but is generally inconsistent with hypothesis 1. When I started reviewing the TTR report I expected to focus on the Upper Watershed, but the geologic context, geomorphic processes, and scientific data all led me to formulate and ultimately accept hypotheses 3 and 4. The selection of hypotheses 3 and 4 as the primary cause of water quality impairment has direct and important implications for the proposed Action Plan and TMDL as discussed below.

The TTR proposes a two-phase TMDL, and sets the loading (assimilative) capacity at zero (p. 74). On page 75 the TTR states "In sum, Phase I of the TMDL is proposed to include a current sediment loading capacity of zero to prevent and minimize sediment delivery to the impacted reach." The Draft Action Plan identifies three main components for the implementation program associated with phase 1 of the TMDL, and these are: 1) regulatory programs to reduce sediment loads on lands in the Upper Elk River Watershed; 2) a feasibility assessment of sediment remediation and channel restoration activities; and 3) watershed stewardship, which would include both health and safety as well as remediation and restoration activities (p. 7).

With respect to the first component, which is to reduce sediment loads on lands in the Upper Elk Watershed, the Draft Action Plan identifies 12 hillslope and water quality indicators. Most of these already are being met on the industrial timberlands, but it is not clear how the remaining indicators would either significantly reduce sediment delivery (e.g., 150 foot characteristics of riparian zones on Class III watercourses), or if they are all physically feasible (e.g., 100% of roads to be hydrologically disconnected). At a minimum, the TTR and Draft Action Plan should provide a science-based justification for estimating the magnitude of the additional sediment reductions that could be expected from the indicators that are not yet being met, and compare the expected reductions to an updated estimate of natural sediment sources.

There also is no indication as to how the NCRWQCB will estimate and attempt to reduce sediment inputs from the residential and agricultural lands in the Upper Watershed that are not yet included in the sediment source analysis, or the additional area draining into the affected reach that also has not been included in the sediment source analysis (see Section 3.3). Including these land uses and areas is a necessary step for a fair estimate of loading and a fair allocation of effort to reduce sediment loadings. Each of these steps also is essential to quantitatively put the expected reductions in sediment loading from the industrial timberlands into context, and to improve cold water fisheries.

In Phase II "the sediment loading capacity of the impacted reach could be recalculated and allocations redistributed" (TTR, p. 75). On page 75 the TTR states "The goal of proposed remediation **and channel restoration** [emphasis added] is to restore a dynamic equilibrium in which WQS are attained in the Upper Elk River watershed. This is expected to expand the sediment loading capacity and restore hydrologic function, bringing into balance the sediment output from the impacted reach with the sediment input…". Section 2.1 already noted that it is not realistic to expect sediment outputs to equal sediment inputs, so the goal of balancing sediment inputs and outputs is not attainable given the basic principles of river-floodplain interactions.

It is not explicitly stated but the "sediment remediation" presumably refers to inchannel or floodplain projects rather than reducing sediment inputs (item #1 above). It is striking that two of the three components of the Action Plan are directed at channel remediation and restoration activities, and that channel restoration is explicitly identified in the TTR as an important accomplishment towards completing phase 1 of the TMDL (Section 8.2). The Action Plan assumes on page 6 that "Normal sediment and water transport occur with 1.5 to 2-year flood events are contained within the bankfull stream channel." This goal also is fundamentally flawed because: 1) overbank flooding in many streams occurs every 1.5-2 years, and wouldn't this cause nuisance flooding and floodplain deposition? and 2) the Elk River is implicitly characterized as a single-thread river, when the geomorphic evidence and the restoration alternatives recognize that overflow channels were probably important for transporting water and sediment from the lower magnitude peak flows (e.g., 1.5-2 year events).

I find it somewhat inconsistent that channel remediation and restoration are two of the three main components in the Draft Action Plan, indicating their importance for achieving water quality standards. The list of potential recovery actions includes new channel construction, levee construction or modification, creation of inset floodplains, high flow channels, and placement of instream large wood debris. This list implies that the existing floodplain and channel of the Elk River have been heavily modified, yet the anthropogenic changes to the mainstem channels and floodplain (other than aggradation) are never identified as a potential contributing cause to the nuisance flooding and floodplain sedimentation. This discrepancy should be addressed when characterizing the relative causes of the observed water quality impairment.

In summary, the geologic and geomorphic context indicate that the Elk River would regularly overflow its banks to build the present floodplain. The high natural sediment yields from the Upper Watershed, when combined with the relatively rapid subsidence in the lower watershed and the low valley gradient, would have resulted in a consistent pattern of aggradation prior to any European settlement. The Elk River floodplain would have had a complex network of overflow channels and wetlands rather than a single main channel, and these overflow channels were needed to help convey the peak flows and high sediment yields to the mouth of the watershed. Further efforts to minimize the anthropogenic sediment inputs from timberlands is important, but the residents and NCRWQCB cannot expect that further reductions in the amount of sediment generated from the industrial timberlands will solve the water quality problems that caused the Elk River to be listed as impaired for sediment. It also is not clear to what extent channel remediation and restoration activities can reduce, much less eliminate, the existing impairment given the high natural sediment yields, low stream gradients, and inevitable occurrence of Oh My God events of varying magnitude. One can dream of a stable channel in dynamic equilibrium where sediment inputs equal sediment outputs with no overbank flooding and low turbidities, but I do not believe that this is a realistic vision for the Elk River.

5. ACKNOWLEDGMENTS

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6. REFERENCES

Andrews, E.D., and R.C. Antweiler, 2012. Sediment fluxes from California coastal rivers: the influence of climate, geology, and topography. *Journal of Geology* 120(4): 349-366.

Balco, G., N. Finnegan, A. Gendaxzek, J.O.H. Stone, and N. Thompson, 2013. Erosional response to northward-propagating crustal thickening in the coastal ranges of the U.S. Pacific Northwest. *American Journal of Science* 313: 790-806.

Bedrossian, T., and K. Custis, 2002. Review of July 2002 EPA analysis of impacts of timberland management on water quality. Memorandum submitted to Ross Johnson from the California Geological Survey, 27 November 2002, 23 pp.

Bedrossian, T., and K. Custis, 2003. Importance of deep-seated landslides in determining background rates of sedimentation for Total Maximum Daily Loads on California's North Coast. Conference abstract, Association of Environmental and Engineering Geologists.

Beechie, T.J., M. Liermann, M.M. Pollock, S. Baker, and J. Davies, 2006. Channel pattern and floodplain dyanamics in forested mountain river systems. *Geomorphology* 78: 124-141.

Benda, L., 2000. Review of: Analysis of erosion and sedimentation and its effects on flooding in Fresahwater Creek: Freshwater Creek between Graham Gulch and Little Freshwater Creek (6/26/00). 6 pp.

Bierman, P.R., and D.R. Montgomery, 2014. Key concepts in geomorphology. W.H. Freeman and Co., New York, NY. 494 pp.

Buffleben, M.S., 2009. Assessment of soil creep sediment generation for total maximum daily load development in a northern coastal California watershed. Ph.D. dissertation, University of California at Los Angeles, Los Angeles, CA. 143 pp.

Cafferata, P., and L. Reid, 2013. Applications of long-term watershed research to forest management in California: 50 years of learning from the Caspar Creek Experimental Watersheds. California Forestry Report No. 5, The Natural Resources Agency, Sacramento, CA. 110 pp.

Cascadia Geosciences, 2013. Tectonic land level changes and their contribution to sea level rise, Humboldt Bay region, California: 2013 status update. Report to the U.S. Fish and Wildlife Service Coastal Program, 9 pp.

Dhakal, A.S., and K. Sullivan, 2006. Application of Caspar Creek model to predict increase in peak flow following harvesting in large watersheds: selection of parameters, probabilistic approach, and limitations of the model. Palco, Scotia, CA. 56 pp.

Dietrich, W.E., T. Dunne, N.F. Humphrey, and L.M. Reid, 1982. Construction of sediment budgets for drainage basins. In *Sediment budgets and routing in forested drainage basins*, USDA General Technical Report PNW-141, pp. 5-23.

Edwards, T.K., and G.D. Glysson, 1999. Field methods for measurement of fluvial sediment. U.S> Geological Survey Techniques of Water Resources Investigations, book 3, chapter C2.

Ferrier, K.L., J.W. Kirchner, and R.C. Finkel, 2005. Erosion rates over millennial and decadal timescales at Caspar Creek and Redwood Creek, Northern California Coast Ranges. *Earth Surface Processes and Landforms* 30: 1025-1038.

Grant, G.E., S.L. Lewis, F.J Swanson, J.H. Cissel, and J.J. McDonnell, 2008. Effects of forest practices on peak flows and consequent channel response: a state-of-science report for western Oregon and Washington. USDA Forest Service Gen. Tech. Report PNW-GTR-760, Portland, OR. 76 pp.

HRC, 2015. Report of waste discharge. Humboldt Redwood Company, LLC, Scotia, CA. 66pp.

Huang, H.Q., and G.C. Nanson, 2007. Why do some alluvial rivers develop an anabranching pattern. *Water Resources Research* 43, doi:10.1029/2006WR005223, 12 pp.

Kirchner, J.W., R.C. Finkel, C.S. Riebe, D.E. Granger, J.L. Clayton, J.G. King, and W.F. Megahan, 2001. Mountain erosion over 10 y., 10 k.y., and 10 m.y. time scales. *Geology* 29(7): 591-594.

Klein, R.D., J. Lewis, and M. Buffleben, 2011. Logging and turbidity in the coastal watersheds of Northern California. *Geomorphology* 139: 136-144.

Knighton, D., 1998. Fluvial forms and processes. John Wiley and Sons, N.Y., 383 pp.

Kondolf, G.M., 1998. Lessons learned from river restoration projects in California. *Aquatic Conserv: Mar. Freshw. Ecosyst.* 8:39-52. doi: 10.1002/(SICI)1099-0755(199801/02)8:1<39::AID-AQC250>3.0.CO;2-9

Larsen, I.J., L.H. MacDonald, E. Brown, D. Rough, M.J. Welsh, J.H. Pietraszek, Z. Libohova, J. de Dios Benavides-Solorio, and K. Schaffrath, 2009. Causes of post-fire runoff and erosion: water repellency, surface cover, or soil sealing. *Soil Science Society of America Journal* 73(4): 1393-1407.

Lehre, A.K., 1982. Sediment budget of a small Coast Range drainage basin in north-central California. In *Sediment budgets and routing in forested drainage basins*, USDA General Technical Report PNW-141, pp. 67-77.

MacDonald, L.H., 2000. Evaluating and managing cumulative effects: process and constraints. *Environmental Management* 26(3): 299-315.

MacDonald, L.H. (with A. Smart and R.C. Wissmar), 1991. Monitoring guidelines to evaluate effects of forestry activities on streams in the Pacific Northwest and Alaska. EPA/910/9-91-001, U.S. Environmental Protection Agency Region 10, Seattle, WA. 166 pp.

MacDonald, L., 2014a. Initial comments on the Peer Review Draft. Document dated 17 January and submitted to the North Coast Regional Water Quality Control Board. 29 pp.

MacDonald, L., 2014b. Additional comments on the Peer Review Draft. Document dated 2 February and submitted to the North Coast Regional Water Quality Control Board. 10 pp.

Mackey, B.H., and J.J. Roering, 2011. Sediment yield, spatial characteristics, and the long-term evolution of active earthflows determined from airborne LiDAR and historical aerial photographs, Eel River, California. *Geological Society of America Bulletin* 123: 156—1576.

MacDonald, L.H., and D. Coe, 2007. Influence of headwater streams on downstream reaches in forested areas. *Forest Science* 53(2): 148-168.

Miller, M.E., L.H. MacDonald, P.R. Robichaud, and W.E. Elliot, 2011. Predicting post-fire erosion in the western U.S. *International Journal of Wildland Fire* 20: 982-999.

Montgomery, D.R., and W.E. Dietrich, 1988. Where do channels begin? *Nature* 336: 232-234.

Montgomery, D.R and L.H. MacDonald, 2002. Diagnostic approach to stream channel assessment and monitoring. *J. of the American Water Resources Association* 38(1):1-16.

NRC, 2008. *Hydrologic effects of a changing forest landscape*. National Research Council, National Academies Press, Washington, D.C. 142 pp.

NCRWQCB, 2013. Peer review draft: staff report to support the technical sediment total maximum daily load for the Upper Elk River. North Coast Regional Water Quality Control Board, Santa Rosa, CA.

NRWQB, 2015. Draft action plan for the Upper Elk River Sediment TMDL. 10 pp.

Pryor, B., 2015. A restoration strategy for the Elk River. Presentation at the Elk River Technical Advisory Committee.

Pryor, B., J. Stallman, D. Mireau, and A. White, 2015. A multi-faceted approach to restoring the sediment impaired Elk River. Presentation to the Salmon Restoration Foundation.

Renwick, W.H., 1992. Equilibrium, disequilibrium, and nonequilibrium landforms in the landscape. *Geomorphology* 5:265-276.

Roper, B.B., J.M. Buffington, S. Bennett, S.H. Lanigan, E. Archer,S.T. Downie, J. Faustini, T.W. Hillman, S. Hubler, K. Jones, C. Jordan, P.R. Kaufmann, G. Merritt, C. Moyer, and A. Pleus, 2010. A comparison of the performance and compatibility of protocols used by seven monitoring groups to measure stream habitat in the Pacific Northwest. *North American Journal of Fisheries Management* 30:565-587, doi: 10.1577/M09-061.1.

Rosgen, D., 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, Colorado.

Schumm, S.A., 1991. To interpret the earth: ten ways to be wrong. Cambridge University Press, Cambridge, MA. 133 pp.

Stallman, J.D., and H. Kelsey, 2006. Transient geomorphic response to late Pleistocene baselevel change and climate forcing in the southern Cascadia thrust-and-fold belt, north coastal California. Friends of the Pleistocene Field Guide, 17 pp.

Stout, J.C., and P. Belmont, 2014. TerEx toolbox for semi-automated selection of fluvial terrace and floodplain features from lidar. *Earth Surface Processes and Landforms* 39: 569-580.

Sullivan, K., D. Manthorne, R. Rossen, and A. Griffith, 2012. Trend in sediment-related water quality after a decade of forest management implementing an Aquatic Habitat Conservation Plan. Humboldt Redwoods Company, Scotia, CA. 187 pp.

Swanston, D.N., R. R. Ziemer, and R.J. Janda, 1995. Rate and mechanics of progressive hillslope failure in the Redwood Creek basin, northwestern California. U.S. Geological Survey Professional Paper 1454-E, Washington D.C.

Trimble, S.W., 1999. Decreased rates of alluvial sediment storage in the Coon Creek Basin, Wisconsin, 1975-93. Science 285: 1244-1246.

Walling, D.E., 1983. The sediment delivery problem. *Journal of Hydrology* 65: 209-237.

Wohl, E., B.R. Bledsoe, R.B. Jacobson, N.L. Poff, S.L. Rathburn, D.M. Walters, and A.C. Wilcox, 2015. The natural sediment regime in rivers: broadening the foundation for ecosystem management. *BioScience* 65(4): 358-371.

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Subject:	Two written comments in regard to the draft action plan for Upper Elk River Sediment TDML
Date:	Monday, February 15, 2016 4:58:18 PM
Attachments:	Letter to North Coast WCB - Joel Fonner - 1-17-16 - Elk River.pdf

The attached is a letter my husband Joel Fonner sent in regard to the WDR and wants to express the same sentiment for the TDML action plan for Elk River.

I would like to express my confusion over continued logging efforts in the Elk River area when the "goal" has been a zero TDML for quite some years. I am hoping that this draft action plan can bring that zero to an operational zero where the sediment sources that we have control over can be put on pause for the time for being. Specifically, that timber harvesting be stopped while the river heals. Let us try to think outside the box and perhaps the loggers can be paid to perform the restoration work. We all want people to have jobs and sustain income for their families and I would not want to come in the way of people and their means of survival. However, the larger issue of survival of the human species looms and to continue to prioritize "industry" over the environment will put all of our lives at risk.

Please do the right thing, protect our water sources at all cost and let us be creative with how our human efforts can accomplish this shared vision together.

Signed,
Lisa O'Keefe, Elk River Resident

From: lisokee@hotmail.com
To: northcoast@waterboards.ca.gov
Subject: Letter from Elk River resident in regard to HRC permit
Date: Mon, 18 Jan 2016 19:52:43 -0500

Attached is a scanned letter from my husband, Joel Fonner. This letter is in regard to the draft permit for Humboldt Resource Company and the proposed methods to work with the sediment deposits caused, both past and present, by timber cutting in this fragile ecosystem.

Thank you, Lisa O'Keefe and Joel Fonner

February 15, 2016

VIA E-MAIL

RE: DRAFT ACTION PLAN FOR THE UPPER ELK RIVER SEDIMENT TMDL

Dear Members of the Board:

I can tell you that the draft TMDL action plan for Upper Elk River is not going to do a single thing to recover the beneficial uses of water on anything resembling a reasonable schedule. We've already been dealing with poor water quality and undue threats to our health and safety for 20 years because our public trust agencies were asleep at the regulatory wheel. Now we have to wait until 2020 for full-scale remediation to even begin? The residents of Elk River deserve meaningful environmental improvement *now*.

Table 2 of the draft TMDL action plan scares me. The "numeric target" for sediment delivery due to surface erosion from roads is "Decreasing road surface erosion" (please tell me where the number is in that target) and for peak flows the target is a 10% reduction in 10 years. Ten percent less than what? The horrendously unnatural, harmful peak flows we experience now? These targets are so weak and vague that they cannot possibly represent worthwhile goals. Well-defined, hard targets for the recovery of beneficial uses of water need to be developed.

Please explain to me how you maintain a margin of safety when the channel has zero loading capacity. With this type of blatant lack of logic, you are giving residents of Elk River the run-around on paper (and the shaft in real life). When will I be able to drink water directly from Elk River again? When am I going to be able to fish in Elk River, like I did when I was a child?

Let's be honest: a meaningful action plan for Elk River would include a moratorium on timber harvest for an extended period. It's a proven method of watershed recovery. It wouldn't be a huge public expense. But you would have to stand up to well-funded timber interests. Hey, isn't that kind of your job?

Don't piss on my shoes and tell me it's raining,

Matthew Turner
matthew_bk@yahoo.com
707-498-8138

MENDOCINO • HUMBOLDT
Redwood Companies

February 15, 2016

Via Electronic Mail

Mr. John W. Corbett, Chair

Board Members

Mr. Matthias St. John, Executive Officer
North Coast Regional Water Quality Control Board
5550 Skylane Blvd. Ste. A
Santa Rosa, CA 95403

Re: Upper Elk River: Technical Analysis for Sediment (Tetra Tech, 2015) and Proposed Adoption of a Basin Plan Amendment to the Water Quality Control Plan for the North Coast Region for the Upper Elk River Sediment Total Maximum Daily Load and Action Plan

Dear Chairman Corbett, Members of the Regional Water Quality Control Board, and Mr. St. John:

Humboldt Redwood Company (HRC) appreciates the opportunity to comment on the Upper Elk River Sediment Total Maximum Daily Load (TMDL) and associated Action Plan being proposed for amendment into the North Coast Region Water Quality Control Basin Plan. HRC recognizes and supports the NCRWQCB's longstanding desire to establish an effective and meaningful TMDL and implementation plan for the Elk River watershed. Matters of health and safety related to downstream flooding and water supplies have been reported now for nearly 20 years and have been pointed to as reason for intense scrutiny of upstream land use activities, primarily forest management related. As a result forestry practices were substantially modified over 15 years ago to reduce sediment effects, and harvest acreage limitations were established to address concerns over peak flows and landsliding. Cleanup and Abatement Orders (CAOs) were issued requiring the largest timberland owner in the upper watershed (PALCO) to inventory and remediate sediment sources originating from past practices to the maximum extent feasible. Rigorous timber harvest and watershed trends monitoring and reporting programs were established to evaluate compliance and effectiveness of the change in forestry practices and the watershed's response over time. Further modifications in forestry practices occurred in 2008 when Humboldt Redwood Company acquired the PALCO timberlands and immediately eliminated the use of clear-cut harvest practices and harvest of old-growth timber. The substantial reduction in sediment inputs to the system as a result of these actions is well documented (Tetra Tech, 2015; HRC, 2015; HRC 2014; SHN, 2013; Oswald, 2012; Sullivan and Simpson, 2012; Sullivan and Manthorne, 2012; Sullivan and Dhakal, 2011).

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Success in minimizing timber harvest related sediment inputs and riparian impacts in the upper watershed has allowed for ongoing recovery of the upper watershed and has reduced downstream effects from what they might have been otherwise. However it is becoming apparent that this success can do little to increase the sediment and streamflow carrying capacity of the mid and lower channel reaches. The extent to which improvements in water quality itself (i.e. suspended sediment concentration and turbidity) have been made cannot be quantified since water quality conditions were not measured in the 1990s and prior during periods of substantially less restrictive logging practices. Available water quality monitoring data from 2003 to present indicates a relatively static condition throughout most of the upper watershed with suspended sediment concentration yields and turbidity strongly correlated to rainfall frequency and intensity.

The Upper Elk River: Technical Analysis for Sediment (Tetra Tech, 2015) concludes that despite a significant reduction in timber management related sediment delivery, stream channel, banks, and floodplain continue to aggrade; and therefore revisions to existing Waste Discharge Requirements (WDRs) must be made to further reduce sediment loading in combination with instream sediment remediation and channel restoration activities if a condition of watershed 'dynamic equilibrium' is to be achieved. The Tetra Tech Report (TTR) defines dynamic equilibrium as a condition in which suspended sediment entering the TTR designated 'impacted reaches' equals the volume of sediment exiting theses reaches, and ongoing aggradation is abated.

Dr. Lee MacDonald, consulted as a third-party expert, provides his scientific opinion on the information, concepts (including *dynamic equilibrium*), and strategies contained within the TTR relative to the feasibility of proposed TMDL targets and actions necessary to achieve or trend towards these targets. Dr. MacDonald's detailed technical comments regarding the TTR and TMDL are being submitted under separate cover by him at the request of HRC. Discussions with Dr. MacDonald and review of his written comments, in combination with our understanding of the environmental effects of forestry operations lead us to conclude the problem statements found in both the TTR, and more pointedly the proposed Basin Plan amendment, are oversimplified and place excessive and arbitrary emphasis on the effect of contemporary timber management on downstream conditions.

The TTR, extensively referenced in both staff's proposed WDRs for HRC timberlands (Draft Order R1-2016-0004) and the proposed Basin Plan amendment, does not evaluate the HRC Report of Waste Discharge (ROWD, 2015) in sufficient detail to make any specific findings as to the effectiveness of the sediment prevention and minimization measures and strategies presented therein. Instead, the TTR relies primarily upon floodplain channel conditions, along with hypothetical forestry impacts, to support a pre-determined recommendation that additional forestry restrictions must be warranted. The heavy reliance upon floodplain conditions to support this conclusion, including the proposed unusual assignment of a zero (0) TMDL allocation, is further confounded by the TTR's misguided application of the concept of 'dynamic equilibrium'.

Important to understanding the relative effect of contemporary forestry practices on total sediment loading is the establishment of a reasonable estimation of natural background loading; and the discernment of contemporary timber management loading from that of pre-existing chronic legacy sources. MacDonald provides a detailed analysis of natural sediment loading suggesting inherent rates are substantially higher than those presented in both the TTR and HRC Watershed Analysis (2014). This finding suggests that the HRC watershed analysis estimate of contemporary forestry-related loading (~48 tons/mi2/yr; HRC 2014) is less than 10 percent of total loading. This amount is not only offset by ongoing legacy source remediation activities, such as upstream crossing decommissioning or upgrading and removal of unstable fills threatening discharge, but is itself minor, relative to total sediment loading and downstream land use affecting channel conditions such as levees and dikes limiting off-channel capacity and converting estuary and wetlands to productive agriculture, and other channel constrictions associated with floodplain roads and bridges.

It is promising to see the TTR and TMDL Action Plan call for attention to the floodplain as downstream land use and infrastructure, combined with inherent geomorphic setting and sea level rise are likely the primary factors controlling conditions and behavior of the lower Elk River. While we are concerned the TMDL presents an unrealistic theoretical future in which a further significant reduction in loading combined with removal of 600,000 cubic yards of sediment from the affected reach results in a self-maintaining, non-aggrading floodplain channel condition; we do agree the Elk River Recovery Assessment and Stewardship Project can, with good leadership and participation, strategically address TMDL objectives of reducing flooding impacts, improving domestic and agriculture water supplies, and enhancing the existing relatively productive Elk River fisheries. These efforts should not be limited to in-channel and off-channel solutions, but should also look to infrastructure improvements. Such improvements may include floodplain-sensitive road and bridge design and alternative access routes, and alternative domestic water supply sources such as community wells or annexation by the Humboldt Bay Municipal Water District. It is for this latter reason we are particularly pleased to see the County of Humboldt in a leadership role in the Stewardship Project.

Recommendations

In this section we provide specific recommendations to the NCRWQCB which we believe would significantly improve the Elk River TMDL prior to adoption. Much of the technical detail in support of these recommendations can be found in Dr. Lee MacDonald's comments.

The proposed basin plan amendment *problem statement* (page 2) declares sediment discharge from timberlands *alone* as responsible for exceedance of water quality objectives and flooding rather than presenting a more balanced and accurate summary of the problem. Residential rural development and associated infrastructure located on the floodplain, along with the cumulative effects of longstanding downstream agricultural land use share the stage with upstream timber management influences on the current condition and carrying capacity of the 'impacted reaches'. There is substantial evidence indicating that significant floodplain modification over the last 150 years combined with sea level rise and lack of stream channel management all play a prominent role in how the mid and lower stream channel and floodplain function. The unusual bifurcation of the Elk River watershed in this proposed TMDL resulting in exclusion of the lower watershed and historic estuary immediately downstream of the 'impacted reach', suggests an underestimation of the effect the conditions the lower channel and associated floodplains have on the impacted reaches' capacity to transport sediment and streamflow.

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We respectfully request that both the TMDL and Action Plan more fairly and accurately represent the complexity of land use history and inherent environmental circumstances and that the TMDL include the entire Elk River watershed. **(Recommendation 1)**

In support of the basin plan amendment problem statement, the proposed Action Plan source analysis (page 2) limits its description of primary land-use related factors to timber harvest, logging roads, and historic logging practices. Neither the Tetra Tech Report (TTR) nor the proposed basin plan amendment, discern in any meaningful detail the difference between persistent chronic sediment sources originating from historic logging practices (i.e. pre 1974 establishment of the California Forest Practice Rules; pre 1999 establishment of the HRC Aquatic Habitat Conservation Plan), and sediment generated from current state-of-the-art forestry practices. This missing distinction is critical to understanding the significance of contemporary forestry operations relative to downstream channel conditions. The *physical change* in practices beginning in 1999 include the establishment of enhanced riparian zones and no harvest areas adjacent streams, use of slope stability models and licensed geologists to investigate and avoid impacts to unstable areas, changes in logging techniques reducing ground disturbance, and requirements to upgrade logging road conditions and restrict use during periods of wet weather. Persistent chronic sediment sources originating from pre-1999 practices dating back many decades are addressed and remediated to the extent feasible as part of contemporary forest plans. The details of current forestry practices are readily available (HRC ROWD, 2015; California FPRs, 2015). It seems reasonable considering their demonstrated effectiveness in sediment prevention and minimization they be considered for adoption by the NCRWQCB in the form of Waste Discharge Requirements (WDRs) in compliance with CWC 13360 prior to being pre-empted by the TTR or TMDL Action Plan. We note comment letters provided by CDFW (January 20, 2016) and CAL-FIRE (January 26, 2016) in support of HRC's current practices as effective in erosion control and comment by NOAA (January 15, 2016) suggesting efforts to most effectively address downstream TMDL concerns should now be focused downstream. **(Recommendation 2)**

It also seems reasonable and necessary that a description of current forestry practices pursuant existing Aquatic Habitat Conservation Plans (AHCPs) and the Board of Forestry Forest Practice Rules (FPRs) be referenced in the 'Source Analysis' and the 'Watershed Efforts' sections of the proposed TMDL Action Plan. In addition, significant actions taken in the Elk River watershed such as the estimated 350,000 cubic yards of sediment removed or prevented from entering the stream system since 1999, including the strategic decommissioning of 45 miles of historic logging road for the purpose of erosion control on HRC timberlands should be acknowledged as critical to watershed recovery. No mention of these measures is currently noted in either the TTR or proposed Basin Plan amendment. **(Recommendation 3)**

Comparison of the proposed Elk River TMDL's natural loading estimates to other adopted TMDLs for north coast California streams suggests Elk River has *inherently lower sediment yields* than other coastal watersheds located on more competent, less erosive terrains. However, softer localized terrain present in the mid and lower Elk River watershed combined with local tectonic uplift rates make for inherently higher natural erosion rates and sediment yields. Measured in-stream sediment yields support the contention Elk River has several sub-watersheds with inherently high sediment concentrations. This, along with Dr. MacDonald's comments regarding Elk River sediment loading, suggests the TMDL should assign a higher natural loading estimate prior to Board adoption. **(Recommendation 4)**

The level of anthropogenic loading presented in the proposed TMDL, on the other hand, is too high for several reasons:

- The proposed TMDL ignores field verified measurements provided by HRC and Green Diamond Resource Company resulting in overestimates of stream channel densities on managed lands by one-third (33%). This overestimation significantly effects TMDL calculations for management-related bank erosion and streamside landslides.
- The proposed TMDL assigns the majority of streamside bank erosion and small streamside landslides to management activities in a manner *inconsistent* with the findings of the report from which the overall rates were developed (SHN 2012).
- The TMDL contends low order channel headward migration is occurring on managed lands at a perpetual rate distinct from unmanaged lands. Studies undertaken to document this phenomena have found no physical evidence in support of this theory.

The importance of understanding and accurately depicting the relative proportion of sediment loading sources in the TMDL is critical to the Board determining feasible TMDL targets and where action should be focused to effectively address flooding, water supply, and other beneficial use concerns, including whether or not any additional sediment prevention and minimization measures beyond those detailed in the HRC ROWD should be required. We ask that the TMDL use the best available science relative to stream densities and the calculation of associated inputs, remove low order channel incision and headward migration as a management-related source, and rely upon the findings of the SHN streamside landslide and bank erosion report in allocation of these sources as background or management-related. **(Recommendation 5)**

While we generally support the TTR list of hillslope Water Quality Indicators (WQIs) and numeric targets, there are several minor modifications to items listed in Table 2 of the proposed Action Plan (page 4) that would benefit the logic and feasibility of the TMDL WQIs and associated targets:

(1) 100 percent of road segments cannot be hydrologically disconnected from watercourses. We recommend the target read: *road segments should be hydrologically disconnected from watercourses to the extent feasible* (generally >90% in coastal watersheds).

(2) It is not necessary that 100% of harvested areas have ground cover in order to prevent surface erosion. We recommend the target read: *harvested areas have ground cover sufficient to prevent surface erosion deliver.*

(3) We are uncertain as to what is meant by *a less than 10% increase in peak flows in 10 years related to timber harvest*. Perhaps the intent is less than a 10% increase in peak flows on an individual instantaneous peak flow basis considering cumulative harvest conducted over a prior rolling ten year period? The area associated with this target currently reads Class II/III catchments, however assessment of peak flow effect is typically done at a larger scale, which we

would suggest for the purpose of implementation should be identified as individual sub-watersheds or sub-basins (a term used in both HRC's ROWD as well as staff's proposed watershed-wide WDRs).

(4) The restoration of riparian function is a valid and important indicator, however, the specification of *300 feet on either side of a Class I or II watercourse and 150 feet on either side of a Class III watercourse* does not appear supported by any specific line of reasoning in the TTR. As pointed out in the CAL-FIRE comment letter (January 26, 2016) regarding the draft WDRs for HRC, detailed review of scientific literature available on the subject of necessary riparian widths to provide for maintenance and restoration of aquatic function and water quality upon which the State's FPRs for anadromous salmonid watersheds are based, have found buffer widths similar to those presented in the HRC ROWD as typically sufficient. The CAL-FIRE letter goes on to note that additional riparian protection can and should be applied on a project by project basis where site conditions (e.g. slope stability) warrant. We recommend the WQIs for Class I, II, and III streams be consolidated and simply read *characteristics of riparian zones associated with Class I, II, and III watercourses.*

(Recommendation 6)

We agree modification of channel conditions at strategic locations within and downstream of the TMDL designated 'impacted reaches', combined with other downstream strategies addressing infrastructure, provides the greatest opportunity for reducing flooding impacts. Sediment and stream flow modeling and implementation of pilot projects as being coordinated under the active Elk River Recovery Assessment are important steps in evaluating short and long term means for expanding carrying capacity. However the establishment of a 'steady-state' channel cross-sectional area as a specific WQI seems premature until the Elk River Recovery Assessment has had the opportunity to test the TTR theory of *dynamic equilibrium*. Recognizing approximately 25% of the total suspended sediment load that enters the impacted reach currently becomes temporally entrapped, while the remaining 75% passes through (Tetra Tech 2015), is it reasonable to believe that this 25% can be reduced to 0%, and that aggradation in a <1% gradient stream channel can be eliminated completely without substantial routine channel maintenance?

The proposal to establish an *off-property* targeted downstream channel condition that is linked to the proposed WDRs and our forestry activities, is unfounded. The scientific evidence does not support the TMDL's current underlying contention as presented in the TTR, proposed WDRs, and Action Plan, that channel conditions in the impacted reach are a reflection of the effectiveness of HRC forestry operations on the hillslope. *There are other significant inherent and anthropogenic factors at play dictating the channel's behavior as it flows across its floodplain.* The evaluation of the effectiveness of HRC forestry practices for the purpose of regulation and meeting waste discharge requirements should be made *on the hillslope* through investigation for significant sediment discharge sources (SDS) related to HRC land use activities. We would ask that the TMDL *remove its two phased approach* linking upstream forestry WDRs to downstream off-property current and future channel conditions. **(Recommendation 7)**

The other instream indicator presented in Table 3 of the proposed Basin Plan amendment (page 4-5) is chronic turbidity. The numeric target relative to salmonid feeding appears to be currently being met as salmonids are found throughout their historic range in the watershed and are feeding year around as evidenced by their year around presence, including relatively abundant returns in recent years based on available data (HRC, 2014). Domestic and agricultural water supplies are currently being pumped from Elk River however water quality for the purpose of domestic water supplies remains a significant concern. The 'numeric targets' presented in Table 3 are not quantified and therefore, as presented, cannot be evaluated for feasibility of achievement. Concerns remain that without a specific target to evaluate there may remain a significant gap in what RWB staff interprets the TMDL target to be and what is inherently feasible considering watershed setting and land use history. We understand the intent of the target being *a reduction in overall turbidity exceedance times* and believe a more general measureable target such as this is more appropriate, absent the establishment of specific feasible numeric targets. **(Recommendation 8)**

The TMDL proposes an indefinite 'zero load' allocation based on the condition of specific stream channel reaches, banks, and floodplains until the sediment and streamflow capacity of the affected reaches can be expanded. The recommendation is confounded by the Action Plan's acknowledgement that no "amount of land use restriction and channel restoration can physically result in zero loading of sediment." Because the weight of evidence does not support the inferred contention that affected reaches conditions are a reflection of upstream sediment loading alone, but rather a reflection of inherent watershed setting, downstream land use activities, contemporary sea level rise, *and* sediment loading; we ask that the Board to consider the establishment of a load allocation consistent with other coastal stream TMDLs (e.g. 125% of background). **(Recommendation 9)**

In closing we again emphasize that HRC recognizes and supports the NCRWQCB's longstanding desire to establish, in the near term, an effective and meaningful TMDL and implementation plan for the Elk River watershed. Based on the input provided by Dr. Lee MacDonald, and the understanding of our own science team in discussion with others including representatives from state and federal agencies, we believe careful consideration of the recommendations provided herein, along with Dr. MacDonald's comments, will serve to accomplish a scientifically defensible TMDL and effective implementation plan for Elk River. We therefor ask that the Regional Board not approve the TMDL and Action Plan as proposed but, rather, direct its revision to be consistent with the extensive science and documentation referenced herein and in Dr. MacDonald's submission.

Thank you for your consideration.

Sincerely

Michael W Miles
Director Forest Science

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References:

California Regional Water Quality Control Board North Coast Region. 2015. DRAFT Order No. R1-2016-0004.

California Regional Water Quality Control Board North Coast Region. 2015. DRAFT Action Plan for the Upper Elk River Sediment TMDL.

Humboldt Redwood Company, 2015. Report of Waste Discharge. Elk River Watershed. Humboldt County, CA. 66 pp.

Humboldt Redwood Company, 2015. *2014 Aquatic Trends Monitoring Report*, Scotia, CA. 78 pp.

Humboldt Redwood Company, 2014. Elk River/Salmon Creek Watershed Analysis Revisited. Final Report. 120 pp.

Oswald, J., 2012. Landslide Inventories for the 2003, and 2006, 2010 Storm Seasons, Elk River, Humboldt Co. 29 pp.

SHN Consulting Engineers and Geologists, 2013. Streamside Landslide and Bank Erosion Survey, Summer 2012, Elk River, Humboldt County, California. 14 pp.

Sullivan K, Dhakal AS, Kunz MJ, Medlin M, Griffith A, Rossen R, Williams K. 2011. Sediment production from forest roads on Humboldt Redwood Company Lands: Study of erosion rates and potential delivery to streams [technical report]. Scotia (CA): Humboldt Redwood Company. 108 pp.

Sullivan, K., Manthorne, D. 2012. Instream Effectiveness Monitoring: Effects of Timber Harvest on Turbidity of Class II Streams in the Freshwater Creek Watershed. Technical Report, Humboldt Redwood Company, Scotia, CA. 112 pp.

Sullivan K, Simpson N. 2012. Effectiveness of forest road construction practices in preventing sediment delivery [technical report]. Scotia (CA): Humboldt Redwood Company. 99 pp.

Tetra Tech, Inc. 2015. Upper Elk River: Technical Analysis for Sediment. Prepared for the North Coast Regional Water Quality Control Board. 83 pp.

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Comment on the Elk River TMDL Action Plan

Please make this a real zero sediment TMDL not a calculated qualified not really a zero TMDL
upper Elk River residents need and deserve relief as soon as possible not in another 20 years; hoping something good happens before that based on possible recovery projects.
More logging is more sediment delivery and deposition and we've had too much deposited on our property already.
Stop the logging & require the upstream landowner to keep his pollution on his property, bring back the water quality we've we had in the early 1980's and recovery a thriving fishery in Elk River before allowing any more logging sediment.
We need a people and fish TMDL not a logging TMDL.

Philip & Sharon Nicklas
9000 Elk River Rd.
Eureka, CAL. 95503

Feb 15, 2016

Sent via electronic mail to: northcoast@waterboards.ca.gov on date shown below

February 15, 2016

Mr. Mathias St. John
Executive Officer
North Coast Regional Water Quality Control Board
5550 Skylane Boulevard, Suite A
Santa Rosa, CA 95403

RE: EPIC Comments Regarding Draft Combined Upper Elk River Total Maximum Daily Load Action Plan and Basin Plan Amendment

Dear Mr. St. John and Regional Board Staff and Members,

The following comments are submitted on behalf of the Environmental Protection Information Center (EPIC) regarding the proposed Upper Elk River Total Maximum Daily Load (TMDL) Action Plan and associated North Coast Regional Water Quality Control Plan (Basin Plan) Amendment. EPIC appreciates the opportunity to provide written comments at this time, and respectfully requests a formal written response.

General Comments

EPIC supports both the authority of the Regional Board in adopting regulatory controls to uphold its statutory mandate to protect the quality and beneficial uses of waters of the State, such as the TMDL Action Plan, and the Basin Plan Amendment, as well as WDRs, as well as the necessity to do so in the case of the Upper Elk River Watershed, given the heavily impacted watershed conditions and the unreasonable burden that these conditions place on the public, especially local residents, beneficial uses and natural resources.

Elk River was determined to be "Significantly Adversely Cumulatively Impacted" by excessive sedimentation generated from poorly-regulated and implemented timber operations all the way back in 1997, almost 19 years ago, by the Inter-agency Team investigating watershed condition in the wake of the New

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Year's Eve 1996–1997 storms, and the lawless and reckless logging conducted by the Pacific Lumber Company under MAXXAM ownership. In the present day, timber operations continue to contribute to the unreasonably degraded water quality conditions in the Upper Elk River Watershed.

Water Quality Objectives are not being attained in the Upper Elk River Watershed, and have not been so in almost two decades; the regulatory agencies have simply not done enough to constrain the root cause of adverse watershed conditions; industrial timber harvesting and associated activities. As articulated in the original 1998 303(d) listing by the Regional Board, water quality problems resulting from timber operations include, but are not limited to: sedimentation and threat of sedimentation, impaired domestic and agricultural water supplies, impaired spawning habitat for listed salmonids and steelhead, and real property damage. (*Upper Elk River Technical Analysis for Sediment* (Tetra Tech 2015), at section 3.1, p. 18.). The Regional Board has an affirmative duty to take whatever actions are necessary to attain and recover the water quality conditions in the Upper Elk River Watershed.

Thus, EPIC fundamentally questions the overall approach, and likelihood of compliance with applicable legal and regulatory standards, for achieving a zero new sediment input load allocation in the Upper Elk River watershed as expressed in the Notice and Proposed TMDL Action Plan and Basin Plan Amendment. The extensive and rigorously tested scientific information available clearly demonstrates that conditions in the Upper Elk River Watershed continue to worsen under the current management and regulatory regimes, and that Water Quality Standards and Objectives are not presently being attained. The results of the *Upper Elk River Technical Analysis for Sediment* (hereafter, "Tetra Tech 2015") demonstrates that existing regulatory constraints to protect, enhance, and restore water quality in the Upper Elk River Watershed simply have not been enough to stem to the tide of sedimentation and aggradation resulting from contemporary timber operations, and that far more stringent measures are needed, given the reality of a zero assimilative capacity for new sediment inputs in the so-called "Impacted Reach."

The approach articulated in the December 23, 2015 *Notice and Draft Combined TMDL Action Plan and Basin Plan Amendment*, will not actually result in a zero additional allocation of anthropogenic sediment loading, and thus, it seems highly unlikely that Water Quality Objectives can be attained, and nuisance conditions that are adversely affecting the lives, safety, and property of local residents and natural resources can be remedied.

The proposed TMDL Action Plan and Basin Plan Amendment, at page 5, states that the zero load allocation is "necessarily conceptual," reasoning that no amount of land use restrictions can completely eliminate new sediment inputs from anthropogenic and "natural" sources. This logic and reasoning fundamentally fails to recognize that there are very real—and anything but conceptual—impaired water quality conditions in the Upper Elk River , especially as experienced by those people and resources most affected by the failure of the regulatory agencies to adequately constrain logging practices in the watershed. Poorly regulated and implemented industrial logging practices have and continue to directly result in the severely impacted conditions we now see. Local residents have lost their property, property values, livelihoods, and their ingress and egress have been compromised. EPIC remains concerned that the Regional Board's reliance on non-regulatory and voluntary measures to achieve compliance with the Basin Plan and other applicable laws is itself, nothing more than "conceptual," with no real evidence, or hope, of actually attaining the needed objective, which is to recover the river, and as soon as possible.

Applicable Legal and Regulatory Standards—"Rules of the Road"

In evaluating whether or not the proposed *Draft Combined TMDL Action Plan and Basin Plan Amendment* will cut muster, we must necessarily gauge the proposals in light of the myriad of applicable legal, regulatory, and policy requirements articulated by State and federal Law. The following provides a brief outline of these, in the context of their applicability to the Regional Board's regulatory and non-regulatory proposals for the Upper Elk River watershed.

Public Trust

As we know, the genesis of modern law and regulation is rooted deeply in its predecessor, known as "common law." Common law forms the guiding principles by which civil, democratic societies then formulate laws to generate laws that constrain order and self-governance. One of the most basic underpinnings of common law in democratic societies is the Justinian "Public Trust Doctrine."

The Public Trust Doctrine, as it relates to water, holds that the sea, the shores of the sea, the air and running water are common to everyone, and not appropriate to be held for private use alone. Here in the United States, the Public Trust Doctrine has been a recognized underpinning of the law since the 1892 case, *Illinois Central Railroad v. Illinois*, 146 U.S. 387, in which federal courts held that the government could not alienate the public's right to lands under, and associated with, navigable waters.

The Public Trust Doctrine persists as a fundamental and foundational basis of public and environmental law in California today. In *Environmental Protection Information Center v. California Dept of Forestry & Fire Protection,* 44 Cal.4th 459 (2008), California courts articulated a two-part public trust responsibility for government agencies, which relative to water, involves the government's affirmative duty to consider the public trust in the planning and allocation of water resources of the State.

It is this basic principle of the Public Trust, that the public's right to use, and enjoy navigable waters of the State and Nation, and government's affirmative responsibility to refrain from allocating these for private use, must necessarily guide the formation of all other laws, regulations, and policies regarding water quality, protection, allocation, and management.

The case of the Upper Elk River Watershed represents a bench-mark example of how state and federal regulators have failed to uphold their responsibilities to the public and the Public Trust in the regulation of the timber industry in the watershed.

Federal Clean Water Act

The federal "Clean Water Act," came into being, in its modern form, in the Federal Water Pollution Control Act Amendments of 1972. The intent of Congress in enacting this legislation was "to restore and maintain the chemical, physical, and biological integrity of the nation's waters," by preventing point and nonpoint pollution sources. By the early 70's research was showing that runoff from non-point source pollutants were degrading the quality and beneficial uses of water across the country, and resulting from a number of different anthropogenic industries. It is very telling, given this context, that the intent of the Clean Water Act is to "restore and maintain," and not solely to protect.

Under Section 303(d) of the Clean Water Act, water bodies suffering from some limiting factor which prevent attainment of Water Quality Standards are listed as "impaired," and a Total Maximum Daily Load (TMDL), with specified Numeric Targets must be developed. The applicable requirements for TMDL development and implementation is discussed below.

California Porter-Cologne Water Quality Control Act

California's Porter-Cologne Water Quality Control Act, California Water Code, Division 7, section 130000 *et seq.*, reiterates the spirit of the Public Trust Doctrine in its statement of legislative findings, stating, "the people of the state have a primary interest in the conservation, control, and utilization of the water resources of the state, and that the quality of all the waters of the state shall be protected for use and enjoyment by the people of the state."

The legislature, in enacting the Porter-Cologne Water Quality Control Act, was very explicit to state that, "the health, safety and welfare of the people of the state requires that there be a statewide program for the control of the quality of all the waters of the state." This means that the rights of the people, the public at-large, bestow a duty onto the government of this state to prioritize the health, safety, and general welfare of the people over private interests when implementing the provisions of this important statute.

It is the Porter-Cologne Water Quality Control Act that established the State Water Resource Control Board, and the associated Regional Water Quality Control Boards. Each region has an associated Water Quality Control Plan, otherwise referred to as a "Basin Plan."

A Water Quality Control Plan, or Basin Plan, by statute, must include three main public benefits: (1) beneficial uses protected; (2) Water Quality Objectives (to ensure beneficial uses are protected); and (3) A program of implementation needed for achieving water quality objectives.

The Porter-Cologne Act provides that "All discharges of waste into the waters of the State are privileges, not rights." California Water Code section 13263[g]. This principle is consistent with the tenants of the Public Trust Doctrine, which prioritizes the rights of public benefits over the privilege of private use.

North Coast Region Water Quality Control Plan (Basin Plan)

The *Water Quality Control Plan for the North Coast Region* (May, 2011) articulates an overarching water quality objectives policy for the region. This policy is articulated at 3-1:

> "Controllable water quality factors shall conform to the water quality objectives contained herein. When other factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, then controllable factors shall not cause further degradation of water quality. Controllable water quality factors are those actions, conditions, or circumstances resulting from man's activities that may influence the quality of the waters of the State and that may be reasonably controlled."

In addition to this general policy objective, the Basin Plan also includes an Action and Implementation Plan to address non-point source pollutants, such as sediment, generated as a result of industrial logging operations on the North Coast at section 4-26.00. Prohibitions in the Basin Plan's Action Plan for Logging on the North Coast include:

> 1. The discharge of soil, silt, bark, slash, sawdust, or other organic and earthen material from any logging, construction, or associated activity of

whatever nature into any stream or watercourse in the basin in quantities deleterious to fish, wildlife, or other beneficial uses is prohibited.

2. The placing or disposal of soil, silt, bark, slash, sawdust, or other organic and earthen material from any logging, construction, or associated activity of whatever nature at locations where such material could pass into any stream or watercourse in the basin in quantities which could be deleterious to fish, wildlife, or other beneficial uses is prohibited.

Total Maximum Daily Loads

The *Peer Reviewed Draft Staff Report* to support the development of the Upper Elk River TMDL (Draft Staff Report) (NCRWQCB 2013) clearly articulates the required components for a TMDL:

The requirements of a TMDL are described in Title 40 of the Code of Federal Regulations, Section 130.2 (40 CFR 130.2), and Section 303(d) of the CWA, as well as in various guidance documents. A TMDL is defined as the sum of the individual point source waste load allocations (*WLA*), nonpoint sources load allocations *(LA)*, load allocation to account for natural background pollutant loads (*NB*) as well the need to provide a margin of safety (*MOS*) to account for uncertainties in the analysis. (NCRWQCB 2013, at section 1-3, p. 1-15).

In addition, the Water Quality Management Planning process requires States to include TMDLs and associated implementation measures and monitoring in the State Water Quality Management Plans. In this context, the adoption of the TMDL Action Plan as an amendment to the Basin Plan is proposed to codify and make enforceable the TMDL numeric targets and other substantive requirements.

Environmental Setting and Condition in Upper Elk River Watershed

The *Draft Proposed TMDL Action Plan for Upper Elk River* (NCRWQCB 2015,) provides a concise rendition of the water quality problem in the watershed:

Site specific assessment of water quality conditions in the Upper Elk River Watershed confirm that sediment discharges from timberlands in the upper watershed and sedimentation in the impacted reaches exceed the water quality objectives for sediment, suspended material, settleable matter, and turbidity resulting in adverse impact to several beneficial uses, including domestic water supplies (MUN), agricultural water supplies (AGR), cold water habitat (COLD); spawning, reproduction and early development (SPWN); rare, threatened, or endangered species (RARE), and recreation (REC-1 and REC-2). Sedimentation in the impacted reaches also has resulted in conditions of nuisance, including increased rates and depth of annual flooding and loss of property, use of property, access to property, and risk to human health and welfare. (Draft Combined TMDL Action Plan and Basin Plan Amendment, at p. 2).

The Upper Elk River was placed on the federal Clean Water Act's 303(d) list of impaired waterbodies in 1998 when the Regional Board fully recognized the severity and extent of non-point source pollution plaguing the watershed as a result of modern timber harvest activities. Today, some 18 years later, the condition of the Upper Elk River watershed has not substantially improved, and in some regards, has actually gotten worse, despite changes in regulatory framework, ownership, and HCP implementation by the two large industrial timberland owners in the watershed, and no TMDL has yet been adopted or implemented.

The overwhelming evidence gathered since 1997–1998 in the Upper Elk River watershed shows a clear nexus between the impacts of upstream industrial timber operations and the adverse, and extremely impaired nuisance conditions in the watershed. When considered in light of the legal and regulatory standard articulated herein, it is clear that industrial timber operations permitted in the watershed from approximately 1985–present have caused, and continue to cause, water quality violations and have continually violated state and federal law and regulations. Most importantly, the permitting of these activities by state and federal regulatory agencies has violated the government's duty to uphold the Public Trust Doctrine, and to protect regular people, and the local environment on which they depend.

Moreover, the intent of the Legislature in enacting the Porter-Cologne Water Quality Control Act has not been upheld in the case of the Upper Elk River Watershed. And, the impaired condition of the Upper Elk River Watershed cannot be blamed on so-called "legacy" inputs from pre-regulatory logging. Rather, the impairment now chocking the life out of Elk River has largely accrued in the last 25–30 years, under the implementation of the Porter-Cologne Water Quality Control Act by the State and Regional Water Boards.

The Proposed TMDL Action Plan and Basin Plan Amendment

On December 23, 2015, the Regional Board issued and circulated the notice of public comment period, and announced the hearing date, for its proposed adoption of the Upper Elk River TMDL Action Plan and associated Basin Plan Amendment (hereafter, "Notice"). The three main components of this action include: 1) the *Upper Elk River Sediment TMDL Technical Report* (Tetra Tech 2015); 2) *The Program of Implementation* (WWDRs, Recovery Assessment, Watershed Stewards Program); and 3) CEQA compliance documentation. We herein address each of these in turn.

Upper Elk River Sediment TMDL Technical Report

The *Upper Elk River Sediment TMDL Technical Report* (Tetra Tech 2015 or Tetra Tech Report), is largely a synthesis of previous work, most notably, the Regional Board's Draft Staff Report (NCRWQCB 2013). The Tetra Tech Report sums up its findings thusly:

> This document confirms several important findings, which can be addressed through TMDL analyses and implementation. Specifically, existing control mechanisms are not correcting the sediment impairment and the sediment source analysis confirms that the impairment continues to persist and worsen. (Tetra Tech 2015, at section 2.3.4, p. 19).

It should be noted that this condition is being documented after approximately 15 years of implementation of Regional Board regulatory actions, such as WWDR's, Clean-up and Abatement Orders, Cease and Desist Orders, Monitoring and Reporting Orders, and THP-by-THP CEQA/Forest Practice Act review. The litany of these regulatory actions is listed and provided in the Regional Board's *Draft Staff Report* (NCRWQCB 2013), at Appendix 2-C, and thus will not be revisited here.

The Tetra Tech Report graphically illustrates that anthropogenic sediment loading from industrial logging activities in the watershed, peaked at a whopping 966 yd3/mi2/yr, which constitutes approximately 77 percent of the total sediment loading in the watershed, from the time period between1988-1997, which was the MAXXAM/PALCO era. (Tetra Tech 2015, section 6.2.3.2, Table 9, p. 61). By sharp contrast, the period between 1998–2000 and 2001–2003, the period of the so-called "moratorium," i.e., temporary prohibition period, during which CAL FIRE and the Regional Board did not permit new industrial timber operations in the entire watershed by MAXXAM/PALCO, the anthropogenic sediment loading was 531 $yd^3/mi^2/yr$, and 476, $yd^3/mi^2/yr$, respectively. (*Ibid.*).

This striking difference is significant on two fronts. First, it clearly shows that temporary logging prohibitions can, and do work to stem the tide of non-point source sediment pollution in the Upper Elk River. Second, it points out that, even if this is done, the damaging and long-lasting legacy of contemporary industrial timber harvest activities can still result in non-point source sediment pollution, which will still be felt in the watershed because of occurrences such as harvest-related landslides, bank erosion, and road and crossing-related sediment delivery. In other words logging-related sediment will still continue to get into the river system because of the significant disturbance caused, whether logging is ongoing or not, and probably for a considerable period of time.

The fact that logging-related sediment will get into the river system regardless of a temporary probation on harvesting is not, and should not, be a reason to permit further logging; quite to the contrary, it is the very reason why a temporary prohibition on all industrial logging activities should be implemented, and as soon as possible, especially given that the Report has found that a zero load allocation for new sediments is necessary to recover beneficial uses and the conditions of the river.

A final, and very real and significant part of the TMDL Action Plan is the amendment of the Numeric Targets into the Basin Plan so as to codify them and make them enforceable. The Numeric Targets articulated in the *Draft Combined TMDL Action Plan* and *Basin Plan Amendment*, ironically, are mostly not actually numeric, but rather, qualitative and narrative. For example, the Instream Water Quality Indicators and Numeric Targets for chronic turbidity state, "Clearing of turbidity between storms to a level sufficient for salmonid feeding and surface water pumping for domestic and agricultural water supplies." (NCRWQCB Draft Combined TMDL Action Plan and Basin Plan Amendment, Table 3, at p. 5).

How does one define, "clearing of turbidity," and based on what criteria? This is, in essence, not a Numeric Target, but a hard to define or enforce, qualitative and highly subjective judgmental decision. This example is one of but many of how the Numeric Targets and Water Quality Indicators articulated in the *Draft Combined TMDL Action and Basin Plan Amendment* are simply not actually numeric, objective, enforceable targets, but narrative, qualitative, and highly debatable as to their meaning and interpretation.

What's more, Numeric Targets and Water Quality Indicators for instream habitat for listed fish species have been excluded, on the basis that the PALCO/HRC HCP addresses these. Given that the Regional Water Board is not a signatory agency to the HCP, and that there appears to be no legal or regulatory escape valve to allow the Regional Board to exclude these instream Numeric Targets for listed fish on the basis of a landowner's HCP, EPIC seriously questions the legality and appropriateness of the exclusion.

Overall, the TMDL Numeric Targets and Water Quality Indicators are really where the rubber hits the road in terms of enforceability and actual, real-life, instream improvement of nuisance conditions in the watershed. What is provided by the Regional Board simply will not result in abatement of nuisance conditions or watershed recovery.

Program of Implementation

The Program of Implementation contains three constituent parts. These include, 1) the *HRC Watershed-Wide WDR* (WWDRs) proposal; 2) the *Elk River Recovery Assessment*; and 3) the *Elk River Watershed Stewards Program*.

1). HRC Watershed-Wide WDR

EPIC submitted comments regarding the HRC Watershed-Wide WDR proposal on January 18, 2016. These comments are attached, and incorporated herein by reference.

2). Elk River Recovery Assessment

The purpose of the *Elk River Recovery Assessment*, as described in the December 23, 2015 Notice, is that, "instream sediment remediation and channel restoration is necessary to improve the hydrologic and sediment transport capacity of the impacted reach of Upper Elk River."

The December 23, 2015 Notice does not actually describe or articulate the framework of the Recovery Assessment, or otherwise describe the purpose or goals of it. There is no information about what actions might be contemplated, the planned-for funded projects or their purpose or intent, and no information about the anticipated contribution of Recovery Assessment efforts to the remediation of nuisance conditions in the Impacted Reach, and if anticipated, the time frame in which remediation efforts may result in physical reality.

In sum, the Recovery Assessment effort, while certainly meritorious, simply does not seem to have advanced to the point of accruing actual on-the-ground and in-the-stream benefits to the river, or local residents who suffer, and will continue to suffer, from the heavily impacted conditions in the Upper Watershed. Therefore, any anticipated benefits at this stage, are simply "conceptual," and based on speculation, and belief, not substantial evidence.

Elk River Stewardship Program

The December 23, 2015 Notice describes the *Elk River Stewardship Program* as, "the overarching component of implementation is to convene a participatory program that engages residents, community members, scientists, land owners, land managers, and regulatory agencies in developing a collaborative planning process that seeks to enhance conditions in the Elk River watershed." (Notice, at p. 2).

While this process certainly sound potentially promising, its effect on remediation of nuisance conditions currently impairing the Upper Elk River watershed, are not even as real as "conceptual"; rather, a review of the Regional Board's website reveals that there is no publically available information whatsoever about this program as yet. Whatever this process is, or ends up evolving into, one thing is clear: the condition of the Upper Elk River Watershed will only continue to worsen in severity while the collaborative process—which is very likely to engender even yet more process, not actual protection or remediation—and the river, the fish, and the local residents will continue to suffer as water quality standards and objectives continue to be exceeded.

CEQA Compliance

The Regional Board has prepared and circulated a Draft Initial Study and Mitigated Negative Declaration to support its adoption of the TMDL Action Plan and Basin Plan Amendment. The Regional Board has the authority to promulgate such actions pursuant to its certified regulatory program under CEQA.

EPIC fundamentally questions how the proposed actions can be compliant with CEQA given that the *Draft Initial Study and Mitigated Negative Declaration* do not address the significant adverse and cumulative environmental impacts of Green Diamond Resource Company's timber operations in the Upper Elk River Watershed. Additionally, EPIC questions how the Regional Board can be assured that a Mitigated Negative Declaration is appropriate, given that no regulatory actions to amend Green Diamond's WDR (Order No. R1-2012-0087) or its South Fork Elk River Management Plan have been developed, or publically noticed for adoption by the Board. Reliance upon the hopes or presumptions that such *may* happen in the future leaves the environment, as well as local residents, very much at continued risk, and these risks are clearly significant, especially since there appears to be no mechanism proposed to prohibit Green Diamond timber operations in three of the five-identified "high-risk" sub-watersheds.

For example, the Green Diamond-Property-Wide WDR for forest management activities (Order No. R1-2012-0087), in its attached South Fork Elk River Management Plan, in sub-section C, page 9 of the management plan, states the allowable harvest for Green Diamond in its South Fork Elk River holdings: "Green Diamond will limit the rate of harvest in South Fork Elk River to approximately 75 acres per year, calculated on a 3-year rolling average. The 3-year rolling average provides operational flexibility while maintaining a low annual harvest rate."

Similarly, in its most-recent approved THP in the South Fork Elk River Watershed holdings, (THP 1-14-119HUM), Green Diamond provides the following table to demonstrate its projected future harvest activities in its holdings:

The following table summarizes the forecasted available harvest areas by year within the 10 year planning horizon discussed above:

YEAR SOURCED	AVAILABLE	CLEARCUT	SELECTION	GROUND	CABLE
2015	211.50	198.53	12.97	164.02	47.48
2016	26.61	26.61	0.00	10.75	15.86
2017	36.53	34.52	2.01	36.45	0.08
2018	59.89	55.91	3.98	42.10	17.79
2019	139.88	114.74	25.14	97.15	42.73
2020	87.46	84.09	3.37	66.34	21.12
2022	57.53	49.61	7.92	52.19	5.34
2023	70.11	49.11	21.00	44.39	4.60
Total	689.50	613.11	76.39	513.39	155.00

(THP 1-14-119HUM, Section IV, page 229 of approved plan.).

As stated in our January 18, 2016 comments on the HRC Draft WWDR, Green Diamond owns and manages timber in three of the five so-called "high risk," sub-basins in the South Fork Elk River, in which Humboldt Redwood Company would be temporarily be prohibited from harvesting for at least five years, if the Draft Order (Order No. R1-2016-004) is adopted by the Regional Board.

The Draft Initial Study does not consider, or analyze the potential for significant adverse and cumulative impacts to result from restricting HRC harvesting while allowing Green Diamond timber operations to continue, unchanged. Furthermore, the Draft Initial Study fails to articulate or discuss equally feasible, less damaging alternatives to the current proposal, which would allow Green Diamond to continue its short-rotation clearcutting and other potentially damaging practices, in three of the five so-called "high risk" sub-basins in the Upper Elk River Watershed.

There seems to be no reason in law, science, or common sense, to allow Green Diamond to continue timber operations in these so-called "high-risk" sub-watersheds, and the Draft Initial Study fails to clear the legal bar of evaluating the potentially significant cumulative impacts of allowing such activities to continue, or to inform the public about what, if any alternatives were considered, and why the proposed alternative is deemed preferable.

Conclusion

EPIC strongly supports the Regional Board's authority, responsibility, and the clearly-demonstrated necessity of promulgating the proposed suite of actions. However, we are concerned that the *Proposed Combined TMDL Action Plan and Basin Plan Amendment* and its constituent parts, quite simply put, are coming far too little, and far, far, too late.

Please do not hesitate to contact me should there be any questions. We respectfully request a written response to these comments.

Sincerely,

Rob DiPerna
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Environmental Protection Information Center
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Arcata, California 95521
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Attachments

Attachment-A: EPIC Comments to Regional Water Board regarding Draft Order No. R1-2016-004 (Humboldt Redwood Company Watershed-Wide WDR). January 18, 2016.

Works Cited

North Coast Regional Water Quality Control Board 2013. Peer Review Draft Elk River TMDL Staff Report.

North Coast Regional Water Quality Control Board 2012. Green Diamond Resource Company Property-Wide Forest Management WDR (R1-2012-0087).

North Coast Regional Water Quality Control Board 2015. Draft Watershed-Wide WDR for Humboldt Redwood Company Timber Operations in Upper Elk River Watershed.

North Coast Regional Water Quality Control Board 2015. Draft Combined TMDL Action Plan and Basin Plan Amendment for Upper Elk River. December 23, 2015.

North Coast Regional Water Quality Control Board 2015. Notice of Public Comment Period, Workshop, and Hearing, to Consider Adoption of the Draft Basin Plan Amendment to the Water Quality Control Plan for the North Coast Region. December 23, 2015.

North Coast Regional Water Quality Control Board 2015. Draft Initial Study and Mitigated Negative Declaration in Support of Adoption of Humboldt Redwood Company Draft Watershed-Wide WDR. December 4, 2015.

Tetra Tech 2015. Upper Elk River Technical Analysis for Sediment. October 21, 2015.

From: Sylvia De Rooy
To: Mangelsdorf, Alydda@Waterboards
Subject: Elk River
Date: Monday, February 15, 2016 4:07:30 PM

The proposed TMDL is inadequate, particularly in terms of its limited restrictions on logging. The Water Board's job is water, not the protection of the interests of logging companies. I have watched the situation in Elk River for at least 18-20 years now and what I have seen is a disgraceful failure to apply rules for years now. I can remember watching Kristi Wrigley at least 16 or more years ago effortlessly push an 8' pole into the sedimented bottom of the river till the pole was embedded at least 6' down into the silt. And nothing has been done. Now it's time to put a stop to ALL logging and start the cleanup. Humboldt Redwood Company should be responsible for a portion of the costs for that cleanup. This should not be some "externality" that they can just walk away from. The residents have been living in hell for all these years and the Water Board has stalled and stalled, has done studies and held meetings year in and year out and done nothing. What you are proposing now is a slow and partial start and is totally insufficient, particularly in the face of your years of all talk and no action. Property destruction, lives endangered, loss of water supply, loss of incomes and on and on and you have done nothing but protect the logging companies. Your job is to protect the watershed from destruction and pollution and you have done neither after all these years. The river is polluted from the logging and from cattle and you do nothing but talk. Stop all logging now and see that the pollution from the cattle is dealt with, that is what you are supposed to do and it's past time you do it.

Sylvia De Rooy
210 Pomeroy Hollow
Eureka 95503

“The greatest country, the richest country, is not that which has the most capitalists, monopolists, immense grabbings, vast fortunes, with its sad, sad soil of extreme, degrading, damning poverty, but the land in which there are the most homesteads, freeholds – where wealth does not show such contrasts high and low, where all men have enough - …” Walt Whitman

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February 15, 2016

Via Electronic Mail

Mr. John W. Corbett, Chair
Board Members
Mr. Matthias St. John, Executive Officer
North Coast Regional Water Quality Control Board
5550 Skylane Blvd. Ste. A
Santa Rosa, CA 95403

Re: Proposed Draft Basin Plan Amendment to the Water Quality Control Plan for the North Coast Region for the Upper Elk River Sediment Total Maximum Daily Load and Action Plan

Dear Chairman Corbett, Members of the Regional Water Quality Control Board and Mr. St. John:

We file these comments on behalf of Humboldt Redwood Company ("Humboldt Redwood") and Green Diamond Resource Company ("Green Diamond") in (collectively referred to as the "Companies") connection with the above-referenced proposal for the Upper Elk River Total Maximum Daily Load ('TMDL") and Action Plan. These comments supplement those filed on this proposal by each of the companies and by Dr. Lee MacDonald. We incorporate applicable comments filed in connection with the proposed Waste Discharge Requirement ("WDRs") for Humboldt Redwood , as well as previous comments of Humboldt Redwood, Green Diamond and their representatives and experts on Upper Elk River TMDL matters.

I. Green Diamond's and Humboldt Redwood's Legal Objections to the TMDL and TMDL Action Plan.

Our legal objections are premised on the issues and circumstances described in Green Diamond's and Humboldt Redwood's comments and Dr. MacDonald's extensive technical report. To summarize, the Regional Board's proposed TMDL and Action Plan effectively ignore the extensive empirical information and analysis that Green Diamond and Humboldt Redwood have submitted in support of their current timber harvest operations and long term management plans. This information, including many years of monitoring data, confirms that implementation of Green Diamond's and Humboldt Redwood's management plans have resulted in a net reduction of sediment loading from the Upper Elk in relation to baseline conditions. In other words, the science shows that Green Diamond's and Humboldt Redwood's operations in the watershed are already achieving the TMDL's objective of reducing sediment inputs from current and legacy sources associated with timber operations in the Upper Elk watershed. The companies' operations have reduced and continue to reduce sediment inputs in the Upper Elk in relation to inputs that would occur without Humboldt Redwood's and Green Diamond's operations.

In addition, contrary to the Regional Board's assertions, the TMDL and Action Plan do not represent the best available science because the Regional Board is ignoring a great deal of watershed-specific scientific information and monitoring data supplied by the companies, their experts and other agencies. Rather, the best available science clearly demonstrates that the sediment aggradation problem in the Lower Elk River has multiple causes and current contributors aside from historical timber harvesting. River hydraulics and sediment transport capability have been affected by sea level rise and associated land subsidence in the Humboldt Bay area. In addition, aside from historical timber harvesting practices, there are significant human caused contributions to the deficient sediment transport and assimilation capacity of the Lower Elk River, including:

- road building and diking in the floodplain itself,
- lack of channel maintenance and riparian vegetation management, and
- navigation improvements and hardening of the shoreline in Humboldt Bay.

These factors have adversely affected sediment transport, deposition and accretion in the Elk River floodplain. They have caused extensive sand deposition and channel alteration in the storage portion of the watershed and at the mouth of Elk River.

Tetra Tech and the Regional Board have acknowledged these other causes and the underlying science demonstrating their contribution. Nevertheless, the Regional Board proposal reflects an inexplicable choice of ignoring those causes and contributors in the regulatory elements of its proposed TMDL and Action Plan, including the load allocation. The TMDL and Action Plan are based on the unfounded conclusion that, because the problem in the Lower Elk is not improving, the problem must be associated with Humboldt Redwood's or Green Diamond's current operations in the Upper Elk. The allocation in the TMDL Action Plan fails to account for other factors that are contributing to the sediment problem in the Lower Elk or are or preventing its recovery. Rather, through its "zero load allocaton" to Upper Elk forest management, the TMDL and Action Plan allocate all regulatory responsibility to Upper Elk River forest management and would impose extensive additional restrictions and management measures on the Companies' current operations. The great irony of this allocation is that the Companies management methods are, in fact, contributing to the solution, rather than the problem.

Humboldt Redwood and Green Diamond have voluntarily supported stewardship efforts to improve impaired conditions in the Lower Elk; but have consistently objected to any imposition of regulatory remediation obligations as a condition upon their operations. Although the Action Plan characterizes the remediation efforts as non-regulatory, it improperly ties remediation to the regulatory obligations the Action Plan assigns only to the timber companies. This quid pro quo is improper.

A. The TMDL Action Plan Conflicts With the Regional Board's Statutory Authority and Would Lead to Violations of Water Code Section 13360 in the Permitting Process.

The Action Plan would result in the imposition of management measures and restrictions that are outside the scope of the Regional Board's regulatory authority. The Regional Board's authority extends to the control of discharges, but it does not authorize the Regional Board to establish the exclusive means of managing the landscape. As reflected in the Regional Board's proposed WDRs for Humboldt Redwood—which states it is based on the proposed TMDL Action Plan—the implementation strategy would dictate specific management measures and thereby preempt the forestry-related management decisions of Humboldt Redwood and Green Diamond that are already regulated by the Department of Forestry under the Forest Practice Act. Although the Water Code authorizes the setting of standards to ensure that any authorized discharges meet water quality standards, the Water Code does not authorize the Regional Board to dictate the silvicultural prescriptions, harvest rates and other land use management decisions themselves. The approach reflected in the Action Plan is inconsistent with this authority. Further, the Action Plan proposes management measures that are not feasible for Green Diamond or Humboldt Redwood to implement. Feasibility is a primary consideration in the TMDL process, and it has not been given proper consideration here. See State Water Board Impaired Waters Guidance 5-19 (2005).[1] Green Diamond and Humboldt Redwood are concerned that the Regional Board's proposal is inconsistent with the State's and EPA's TMDL guidance and the Regional Board's authority in multiple respects.

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[1] State of California, S.B. 469 TMDL Guidance, *A Process for Addressing Impaired Waters in California (2005; approved by OAL in 2006)*

B. The Failure to Consider Alternatives and the Economic Impacts of the Regional Board's Proposal in the TMDL Action Plan Are Serious Flaws.

The Companies have repeatedly recommended alternatives to the TMDL allocation and implementation methods proposed in the Tetra Tech Report and proposed Action Plan. However, the Regional Board has not given these alternatives—or indeed any alternatives—fair and adequate consideration. Numerous authorities require the Regional Board to evaluate reasonable alternatives and consider economics in adopting a Basin Plan Amendment and TMDL, including the State Water Board's own guidance, the regulations governing substitute environmental documentation, and CEQA. See, e.g., State Water Board Guidance at pages 3-5, 5-19, 6-5.

Under State Board regulations, any basin plan amendment must be supported by substantial evidence and include a Substitute Environmental Documentation ("SED"). 23 C.C.R. § 3777(a). At a minimum, the Draft SED should contain "an analysis of reasonable alternatives to the project and mitigation measures to avoid or reduce any significant or potentially significant adverse environmental effect." 23 C.C.R. § 3777(b)(2). Further, the SED should also include a discussion of both "reasonably foreseeable methods of compliance" and "reasonably foreseeable alternative methods of compliance." 23 C.C.R. § 3777(b)(4). The proposed TMDL and Action Plan contain no discussion of alternatives, yet the public notice claims to have satisfied the requirements of CEQA as a certified regulatory program.[2] This failure should be corrected before the Board adopts a TMDL Action Plan.

C. Adoption of the TMDL Action Plan as Proposed Would Violate Applicable Requirements of California's Administrative Procedure Act.

Under the circumstances described above, adoption of the TMDL Action Plan would violate the essential requirements of the California Administrative Procedure Act ("APA") that govern the basin plan amendment process and approval of the proposed TMDL Action Plan.

Government Code Section 11353(b)(4) provides that all basin plan amendments proposed by the Regional Board must meet the standards of necessity, authority,

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[2] The requirements for certified regulatory programs, including consideration of mitigation measures and alternatives, are set out at Public Resources Code Section 21080.5.

clarify, consistency, reference and nonduplication established in the California Administrative Procedure Act. Without correcting the failures described above, the Action Plan cannot satisfy the necessity and consistency requirements of the APA

The proposed Action Plan fails to satisfy the necessity standard. In order to meet it, the record of the rulemaking must demonstrate by substantial evidence the need for a regulation. Gov. Code § 11349(a). The information provided by Green Diamond and Humboldt Redwood, as well as numerous agency comments, demonstrate that the Regional Board proposal does not satisfy the necessity standard. The TMDL Action Plan and its attendant restrictions are not supported by substantial evidence. The Regional Board has ignored a wealth of evidence demonstrating that the timber harvesting operations contemplated by the Companies will not contribute to the sediment difficulties in the lower reach of the Elk River. Further, Green Diamond and Humboldt Redwood have demonstrated through ongoing monitoring of their operations that their operations result in a net reduction of sediment inputs and, therefore, are not contributing to the sediment aggradation problem in the lower Elk. In other words, continuing the companies' operations as proposed by them reduces sediment inputs more than if they were not allowed to operate and baseline conditions continued. Similarly, the Regional Board has offered insufficient evidence to show that implementing the severe restrictions on Upper Elk landowners contemplated under its proposed Action Plan would actually resolve the ongoing problem, which the record reflects has significant causes that are improperly excluded from the Regional Board's load allocations and Action plan. Under these circumstances, the Regional Board cannot satisfy the necessity standard of the APA.

The proposed Action Plan would violate the APA's consistency and nonduplication standards as well. In order to satisfy the consistency standard, the proposal must be "in harmony with, and not contradictory to, existing statues, court decisions, or other provisions of law." In order to satisfy the nonduplication standard, the proposal must not serve the same purpose as a state or federal statute or other regulation.

As explained herein, the Action Plan is not consistent with the Regional Board's authority or the TMDL Guidance. Further, the Regional Board's efforts to regulate forest management activities duplicate and are inconsistent with the forest regulation program of CalFire under the Forest Practice Act. Public Resources code §§ 4511-4629.13; 14 C.C.R. §§ 895-1115.3. Under the Forest Practice Act, the Legislature has directed the Board of Forestry to adopt regulations "to assure the continuous growing and harvesting of commercial forest tree species" while protecting "the soil, air, fish and wildlife, and water resources, including, but not limited to, streams, lakes and estuaries." Pub. Res. Code § 4551. Implementation of this regulatory system is the purview of CalFire, which regulates forest management activities, not the Regional Board. In the Timber Harvesting Plan review process, CalFire receives input from the Regional Board through the Timber Harvest Plan process to ensure that those forest management practices will not result in a discharge to a watercourse that would cause or contribute to a violation of the Regional Board's water quality control plan. Pub. Res. Code § 4582.7. In addition, the Regional Board regulates discharges of pollutants based on its evaluation of how management activities that result in pollutant discharges may affect water quality in that process. However, the Regional Board is not authorized to dictate the forest management practices themselves. The Regional Board's efforts to specify these practices—without recognizing the necessity of providing for management flexibility in meeting water quality standards and particularly without considering alternatives—not only exceed its authority but violate the APA standards of authority, consistency and nonduplication.

D. The TMDL Action Plan Violates Constitutional Limitations on Agency Regulatory Actions.

Our legal comments on the proposed WDRs for Humboldt Redwood explained how they violate constitutional limitations on regulatory requirements imposed by regulatory agencies, as set forth in the Supreme Court's *Nollan* and *Dolan* decisions. As the foundation for the proposed WDRs and future revisions to Green Diamond's WDRs, the Regional Board's proposed TMDL Action Plan is similarly flawed.

Essential Nexus. The proposed TMDL and Action Plan lacks the necessary essential nexus to a legitimate government interest. The Regional Board is charged with the protection of waters within its jurisdiction. As shown in our comments, the evidence demonstrates that Humboldt Redwood's and Green Diamond's operations each have reduced and continue to result in a net reduction of sediment loading from current and historic operations. The Regional Board has not established a sufficient cause and effect connection between these operations and the result it seeks to achieve in the Lower Elk. Therefore, there is no essential nexus between the requirements and restrictions the Regional Board seeks to impose through the TMDL Action Plan in the Upper Elk and the conditions it seeks to improve in the Lower Elk.

Proportionality. In addition, the proposed Action Plan violates the *Dolan* rough proportionality standard. As the California Supreme Court has explained, the conditions must differentiate between the effects of the proposed project and those that are not—the regulated entity cannot be required to do more than mitigate the effects of its proposed activity.

As explained above, the Action Plan and its implementation measures are not supported by substantial evidence and are not adequately linked to Green Diamond's or Humboldt Redwood's timber operations in the Upper Elk watersheds. Thus, the regulatory burden that would be imposed under the Action Plan far exceeds the impacts of Humboldt Redwood's and Green Diamond's operations.

E. Adoption of the TMDL Action Plan as Proposed Would Be Arbitrary and Capricious.

The imposition of highly burdensome measures outlined in the TMDL Action Plan without adequate consideration of the evidence submitted by the Companies would be arbitrary and capricious. Humboldt Redwood, Green Diamond and Dr. MacDonald, have provided scientific findings from an array of local studies and monitoring efforts that call into question the conclusions of the Tetra Tech report and the Action Plan implementation measures. The TMDL is unjustified both substantively and procedurally by law, facts, and science, including:

- Forcing the Companies to accept responsibility for remediation of excess sediment without regard to cause or contribution
- Holding the existing management programs, which have achieved and continue to achieve significant reductions in sediment inputs from the Upper Elk over historic levels, hostage to offsite remediation efforts.
- Replacing Humboldt Redwood's and Green Diamond's management prescriptions for the watershed with the staff's approach.
- Imposing regulatory requirements exclusively on Green Diamond and Humboldt Redwood in spite of the scientific information, acknowledged by the Regional Board, showing that other sources are causing or contributing to the problem in the Lower Elk.

In addition, the Regional Board has itself acknowledged that the zero loading capacity determination, which is used to develop the implementation plan limits, is "conceptual." The Regional Board acknowledges that "there is no amount of land use restriction and channel restoration that can physically result in zero loading of sediment." Nonetheless, the Regional Board imposes the zero load allocation across all Green Diamond and Humboldt Redwood activities in the Watershed without regard to the actual positive contribution to the sediment problems under current management and without substantial evidence to show that the restrictions the Regional Board proposes would result in additional water quality improvements. Such action is the very definition of arbitrary.

F. Adoption of the TMDL Action Plan as Proposed Be Inconsistent With CEQA.

In addition to the concerns raised above about the lack of an alternatives analysis and failure to include economic considerations, the Regional Board's proposal raises other concerns about CEQA compliance. The companies have demonstrated that the measures the Regional Board proposes as mitigation measures are not necessary to mitigate or avoid any significant individual or cumulative effect, given that the companies have demonstrated that their operations result in net sediment benefits. In addition, CEQA requires that any measures required to mitigate or avoid significant environmental effects be feasible. However, the Companies comments demonstrate that the measures the Regional Board has proposed do not satisfy the feasibility requirement.

Further, the Regional Board proposes to rely on a number of other CEQA documents, including the as yet-uncertified proposed Mitigated Negative Declaration ("MND") prepared in support of the proposed WDRs for Humboldt Redwood. However, the MND does not provide adequate support for the basin plan amendment. As discussed above, any amendment to a basin plan must include an alternatives analysis. The MND provides no such analysis, and the Regional Board has offered no other consideration of alternatives or economics in the context of the specific circumstances involved in the Elk River Watershed. The Regional Board would, therefore, be in violation of Section 377(b)(4) if it were to proceed with adoption without—at the very least—carefully evaluating the alternatives proposals put forward by Humboldt Redwood and Green Diamond during this process.

The Regional Board has also expressed its intent to rely on the analysis provided in its review of Resolution No. R1-2014-0006 the Regional Board's Policy for Implementation of the Water Quality Objective for Temperature and Resolutions and the Policy in Support of Restoration in the North Coast Region. However, the Public Notice merely states that the various projects implemented under the Tetra Tech Report and Action Plan are similar to the projects described in Resolution No. R1-2014-0006. The Regional Board makes no similar statement with regard to the alternatives. In fact, the alternatives available to the Regional Board are quite different in the context of a sediment TMDL. The Companies have proposed and are currently implementing comprehensive, aggressive actions to fully offset and in fact improve upon conditions in the Elk River. However, the Regional Board has failed to give adequate consideration to these alternatives. In order to fulfill its obligations under these provisions, the Regional Board must actually consider alternatives to its proposal as well as the economic implications of its proposal and the alternatives.

G. The TMDL and Action Plan Violate the Clean Water Act, regulations and guidance.

The Regional Board's proposed TMDL is also inconsistent with federal TMDL requirements and EPA's guidance on the proper development of TMDLs for many of the same reasons the TMDL is inconsistent with State law. *See* 40 C.F.R. § 130.7. For example, as reflected above, the Regional Board's exclusion of the non-forest management source that are contributing to the ongoing sediment problem in the Lower Elk River watershed in the proposed allocation is inconsistent with the Regional Board's authority under State Law. In addition, it is inconsistent with EPA's guidance on developing TMDLs:

> The allowable pollutant load, in whatever way it is expressed, may be allocated in many ways, allowing for trade-offs among sources. <u>However, It is critical that all sources of a pollutant be accounted for in computing the load capacity.</u> . . . [I]f nonpoint sources are not causing or contributing to the impairment or threat to the waterbody, the allowable portion of the overall load to nonpoint sources for that waterbody would be their existing nonpoint load of the pollutant.

EPA Guidance for Water Quality-Based Decisions: The TMDL Process (1999) at page 3-5. The Regional Board's current proposed allocation clearly violates this direction.

II. <u>CONCLUSION AND REQUESTED ACTION</u>

The Regional Board should not adopt the TMDL and Action Plan as proposed. We request that the Regional Board direct the reevaluation and revision of its proposal to be consistent with these comments and those of Humboldt Redwood Company and Green Diamond Resource Company.

Thank you for your consideration.

Sincerely,

Wayne Whitlock

Wayne M. Whitlock

cc: Humboldt Redwood Company Distribution
Green Diamond Resource Company Distribution

PACIFIC COAST FEDERATION of FISHERMEN'S ASSOCIATIONS

Please Respond to:

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February 15, 2016

Sent via Electronic Mail to: *northcoast@waterboards.ca.gov*

North Coast Regional Water Quality Board
5550 Skyline Blvd
Santa Rosa, CA 95403
Attn: Alydda Mangelsdorf
NorthCoast@waterboards.ca.gov

Re: PCFFA and IFR Comments Regarding Upper Elk River Total Maximum Daily Load Action Plan and Basin Plan Amendment

Dear Board and Staff Members:

We concur with the comments of Friends of Elk River, and their proposed Elk River Recovery Plan People and Fish Option; also with the comments of EPIC, and include them by reference.

Given the recent legal challenge to the Regional Water Board Executive Officer's authority by Humboldt Redwood Company to trump CalFire's approval of certain Elk River timber harvest plans, it is critical for the Water Board to assert its authority, duty and direction to act in the public interest. To deal affectively with a variety of land use problems that affect or may affect water quality and the 26 beneficial uses of the surface and groundwaters of the State, we recommend you begin the Final Action Plan with this statement from your Tetra Tech report: Cha 1.2, pg 2:

> The Regional Water Board has a duty to implement the Clean Water Act, the Porter Cologne Water Quality Control Act (Porter Cologne), the *Water Quality Control Plan for the North Coast Region* (Basin Plan; Regional Water Board 2011a) and other plans and policies of the State Water Resources Control Board and Regional Water Board for the protection of water quality. The (Upper Elk River: Technical Analysis for Sediment, Oct. 21, 2015).

Moreover, several precedent setting Federal and State court decisions have reinforced that the Regional and State Water Boards have an affirmative duty to protect, enhance and maintain the public trust resources of the State (Audobon Society vs. Superior Court, 1983, including the settled case law cited or incorporated by reference therein).
The February 5 Workshop in Eureka helped explain the complex Action Plan. Clearly the staff has worked hard to be thorough in describing the sediment problem in Upper Elk River watershed. However, the Action Plan falls short of addressing the sediment problem in several significant ways.

First and foremost, it is counter-intuitive to keep adding sediment, via allowing ongoing logging operations, while just beginning the planning stages of remediation in the lower, affected reach. Priorities seem to be reversed: the first priority of the Water Board must be to uphold its affirmative duty to make an Action Plan that will attain the Water Quality Objectives, not to provide the discharger with mitigations based on the company paying for assessment of activities that have not yet been identified or described.
Logging needs to be halted until recovery of the beneficial uses is attained.

Actions that need to be taken in the upper watershed could be required of the landowner to restore the ecological functions of the forest to assimilate, infiltrate and filter water, recharge the groundwater, and meter water into the river. Requiring such would be equivalent to the treatment, for example, of cannabis growers in the Cannabis Waiver who have bought land with legacy road and sediment problems.

The Board TMDL Action Plan is supposed to be equivalent to a project subject to CEQA; therefore, it needs to contain the elements of CEQA. Actions must be described, alternatives must be described, and their possible effects described and fully mitigated. Counsel Samantha Olson stated at the Workshop that the staff had considered a full moratorium on logging in the watershed. That alternative and other alternatives should be included and analyzed as Options in the Draft Action Plan.

The CEQA compliance needs to at least include Potentially Significant Impacts from the CEQA checklist, such as:

I. AESTHETICS -- Would the project:

c) Substantially degrade the existing visual character or quality of the site and its surroundings?

II. AGRICULTURE RESOURCES: Would the project:

c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?

IV. BIOLOGICAL RESOURCES -- Would the project:

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

VI. GEOLOGY AND SOILS -- Would the project:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

iv) Landslides? b) Result in substantial soil erosion or the loss of topsoil?

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

VII. HAZARDS AND HAZARDOUS MATERIALS -- Would the project:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

(Forest topsoil/sediment smothers young fish and their food; turbidity prevents proper feeding.)

g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

VIII. HYDROLOGY AND WATER QUALITY -- Would the project:

a) Violate any water quality standards or waste discharge requirements?

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?

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

e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

f) Otherwise substantially degrade water quality?

i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

j) Inundation by seiche, tsunami, or mudflow?

IX. LAND USE AND PLANNING - Would the project:

a) Physically divide an established community? (Headwaters Bridge)

b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?

c) Conflict with any applicable habitat conservation plan or natural community conservation plan?

XV. TRANSPORTATION/TRAFFIC -- Would the project:

e) Result in inadequate emergency access?

XVII. MANDATORY FINDINGS OF SIGNIFICANCE

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

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

c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

The Action Plan must also comply with the Five Key Elements of the Regional Board's own Non-Point Source Policy. There has to be certainty of the effectiveness of the mitigations. That is not possible when the mitigations have not even been described. The Draft Actin Plan should include, in summary:

1) Program purpose explicitly stated;
NPS pollution addressed to achieve and maintain water quality objectives and the beneficial uses
2) Actions described; likelihood of attaining water quality objectives assured
3) Time frame described, where time is needed
4) Feedback mechanisms designed—is it working?
5) Consequences of failure to attain water quality objectives made clear

Alternatively to putting all the burden of cost on the landowner, we propose that the State agencies responsible for allowing the past violations of discharge prohibitions could find funding, either through disaster relief, Prop 1 monies, AB1492, or other public sources, to hire the skilled workers of the timber companies and other affected parties to do the work needed to restore ecosystem function of the hillslopes using commonly known techniques including those from the BAERcat Manual and the Technical 19 report of the Redwood National Forest.

There are precedents for restoration jobs programs to hire the affected parties to do restoration. That would include timber company employees, neighbors, fishermen, and other stakeholders who are able to do monitoring or active restoration work. Three precedents for this type of program are:

1. Disaster relief for fishermen in 1989-91 (Northwest Emergency Assistance Program, or "Hire the Fishermen") when ocean fishing for salmon was closed for Klamath stocks and coho, was received in the form of grants to do stream restoration, fish counts and habitat typing. This was at the request of the fishermen.
2. In the Klamath Basin Fisheries Resource Restoration Act (Klamath Act), restoration was designated to be done by affected parties: Tribes, fishermen, others whose livelihoods depend on the area's commercial resources and were being impacted by poor water quality conditions in the river.
3. Additionally, President Reagan, in his signing statement of the Klamath Act in October 27, 1986, said:

> I am pleased today to approve H.R. 4712, a bill that authorizes the Secretary of the Interior to promulgate regulations to increase the stock of fish in the Klamath River Basin and related areas. In signing this bill, I am stating my interpretation of certain of its provisions in order to make certain that the bill is implemented in a constitutional manner.
>
> First, the bill requires that certain restoration work be performed by unemployed persons who are commercial fishermen, Indians, or other persons whose livelihood depends upon commercial resources in the area. If the reference to Indians were an express racial classification, a serious constitutional issue would be raised. I understand from the legislative history of the bill that this reference, however, is not to be viewed as a racial classification, but simply as a reference to one of the groups whose members are most likely to depend on the commercial resources of the area. Accordingly, I sign this bill understanding that the Secretary of the Interior will give preference in employment only to Indians whose livelihood depends on the area's resources.

Page 78 of the Tetra Tech analysis, Section 8.3, Watershed Stewardship, reads:

> A key, and overarching, component of implementation is to convene a participatory program that engages community members, residents, scientists, land managers, and regulatory agencies in developing a collaborative planning process that seeks to enhance conditions in the Elk River watershed. The Elk River Watershed Stewardship program will include the entire Elk River watershed and will work to accomplish the following goals:
>
> 1. Promote shared understanding and seek agreements among diverse participants….

The timber industry has fixed costs and requires private investment capital. It has to be competitive to survive. Timber workers are highly skilled and want to do good work. The North Coast is still feeling the effects of the liquidated inventory of saw timber. Our area recently saw another mill close in Arcata in January this year; Sierra Pacific Industries laid off 123 employees.

> "A fall-off in the amount of suitable timber for sale in this area, coupled with flat home construction in the U.S., and increased lumber imports from Canada have all played a role in our decision to close the mill" said SPI spokesman Mark Pawlicki. "But, make no mistake, the largest factor was that the type and size of logs that this mill cuts are simply not available in ample supply to continue to run the mill," he added (Lost Coast Outpost, Jan 25, 2016).

Pacific Lumber Company knew in at least June of 1990, from the report they commissioned from Pacific Meridian to analyze the environmental impacts associated with their Timber Management Program, that if they chose the most aggressive alternative of four timber management regimes presented, which they proceeded to do, timber jobs would plummet starting around 1998. Essentially no "old growth" would remain on their land by 2003, and "residual stands after harvest" would decline to nothing by 2007. "Young growth stands remaining after harvest" would not start being cut until 2003, and "sub-merchantable stands" would slowly increase. The report said:

> "With careful planning, P.L. can minimize environmental and social impacts of their timber management program, while continuing to operate profitably."

Instead, the company chose to maximize their harvest, apparently with bankruptcy as a business plan, since the company did not pay down its debt. In January, 2007, when Pacific Lumber Company filed for Chapter 11 bankruptcy protections, the SF Chronicle reported:

> Jerry Partain, a retired forestry professor and former Director of the California Department of Forestry who has often sided with Pacific Lumber, said, "To a certain extent the environmentalists have been right'" because the higher rate of tree cutting "came at the expense of environmental protections."

The same Jerry Partain was Director of CDF in 1978 when Eureka Superior Court Judge Frank Peterson found that some of P.L.'s harvest plans were approved by CDF before they were even completed, leaving the Water Quality and Fish and Game officials believing their concerns would not be considered (L.A. Times, Nov 1978.)

> "It appears that California Department of Forestry rubber stamped the timber harvest plans as presented to them by Pacific Lumber company and their foresters," the judge wrote. "It is to be noted that in their eagerness to approve two of these (three) harvest plans (the department) approved them before they were completed," [Judge] Petersen said….
> The judge said the "most distressing" finding was that water quality and fish and game personnel believed that the Forestry Department would not take their findings into consideration….

> State Forestry Director Jerry Partain and a Pacific Lumber Co. spokesman said Tuesday they were disappointed with the decision.

In a 1985 hearing before the Assembly Subcommittee on Timber, Assembly Subcommittee on Rural Economic Development, Jerry Partain, while Director of CDF, spoke to "Job loss in the timber industry." After the old growth is logged, there is an expected drop in employment while the young trees are growing, and a shift to other types of products than saw logs.

> And whenever you harvest all of the old growth in an area as we did in the New England states and moved to the lake states, and on into the South and into the Pacific Northwest and then down here. When you go through that cycle, you harvest all the old growth, that's where the gravy is, that's where the big stuff is, that's where the large volume is and once that goes on, you do have a lag period there for the second growth, the young growth to catch up and it will never come back probably to that total volume on the site.
>
> However, you'll harvest it more frequently so …we will not be able to maintain the harvest rate that we've attained in the last…twenty years. That will decline or continue to stay flat for a while before it starts to rise after the turn of the century. "What happens in the future is you use different kinds of products.

Chip board and pecker poles, not saw logs, certainly not 30+ inch saw logs….

We propose a jobs program to help the timber company get through the tough transition predicted by the company from whom they inherited the cut-over lands while we recover the aquatic functions of the Elk River.

Thank you for considering our comments.

Vivian Helliwell
Watershed Conservation Director, PCFFA and IFR

Citations

An Analysis of Environmental Impacts Associated with Pacific Lumber Company's Timber Management Program, Executive Summary. Prepared by Pacific Meridian Resources, Emeryville, California. Received by CDFFP Region 1 on June 25, 1990.

Humboldt Herald. Pacific Lumber Company in Headwaters deal files for bankruptcy, citing logging restrictions. Tom Abate. Jan 20, 2007. https://humboldtherald.wordpress.com/2007/01/21/jerry-partain-environmentalists-were-right/

Klamath Basin Fisheries Resource Restoration Act (Public Law 99-552 [100 Stat. 3081, October 27, 1986) (Klamath Act). http://www.fws.gov/laws/lawsdigest/KLAMATH.HTML

L.A. Times. Judge Delays Plan to Cut Stand of Old Redwoods
Larry B. Stammer. Nov. 11, 1978. http://articles.latimes.com/1987-11-11/news/mn-13609_1_harvest-plan

Lost Coast Outpost. Sierra Pacific Announces Permanent Closure of Arcata Sawmill; More than 100 Jobs Lost. Ryan Burns Jan 25, 2016. http://lostcoastoutpost.com/2016/jan/25/sierra-pacific-announces-permanent-closure-arcata/

National Audubon Society v Superior Court. 33 Cal.3d 419 , 189 Cal.Rptr. 346;
658 P.2d 709 [S.F. No. 24368. Supreme Court of California. February 17, 1983.]
[33 Cal.3d 435], (P. 106.), (Pp. 259-260.)

Pacific Meridian Resources, Emeryville, California. An Analysis of Environmental Impacts Associated with Pacific Lumber Company's Timber Management Program; Executive Summary. Received June 25, 1990 by CDF, Region 1.

Redwood National Park Watershed Rehabilitation, Technical Report 19, July 1987. An evaluation of experimental rehabilitation work, Redwood National Park.

Ronald Reagan: "Statement on Signing the Klamath River Basin Fishery Restoration Bill ," October 27, 1986. Online by Gerhard Peters and John T. Woolley, *The American Presidency Project*. http://www.presidency.ucsb.edu/ws/?pid=36658.

Tetra Tech, Inc. Upper Elk River: Technical Analysis for Sediment, Oct. 21, 2015. Prepared for: Environmental Protection Agency, Region 9; North Coast Regional Water Quality Control Board.

USDA Forest Service, December, 2006. Burned Area Response Treatments Catalog (BAERcat).

From: Parrish, Janet [mailto:Parrish.Janet@epa.gov]
Sent: Monday, February 22, 2016 2:26 PM
To: NorthCoast
Cc: Mangelsdorf, Alydda@Waterboards; Parrish, Janet
Subject: Draft Elk River Sediment TMDL Comments

Comments to northcoast@waterboards.ca.gov

Subject: Comments on the public review drafts

1. Draft Basin Plan Amendment - Action Plan for the Upper Elk River Sediment TMDL (TMDL Action Plan), October 21, 2015
2. Upper Elk River: Technical Analysis for Sediment (Technical Report), Dec 23, 2015

Please note: a copy of these comments are also included in the attached document, for your convenience.

The U.S. Environmental Protection Agency (EPA) appreciates the opportunity to support your progress in completing the Elk River Sediment TMDL. We encourage you to consider our suggestions described in the attached comments, and we recommend that your Board adopt the TMDL, incorporating our suggested revisions.

The comments below are intended to assist the North Coast Regional Water Quality Control Board (Regional Board) staff in preparing TMDLs that will meet EPA requirements. These comments are not necessarily complete, and they do not constitute an approval or determination by EPA under Clean Water Act Section 303(d). We will continue working with you to further clarify our comments and to help finalize any remaining issues.

EPA commends the comprehensive use of available data, resulting in a well-supported sediment source analysis, and we acknowledge the utility of summarizing key points of the many historical analyses into a cogent, relevant, and readably condensed echnical support document. The data support the determination of loading capacity and corresponding TMDL as zero, as well as the necessity of a conservative approach to sediment source control.

EPA does not approve implementation plans, but we recognize and encourage the identified approaches to achieve in-stream conditions that fully support all beneficial uses and attain water quality standards. Furthermore, we are enthusiastic about your intention to develop a Nonpoint Source plan consistent with eligibility for future funding under the Clean Water Act Section 319(h) program.

As we have discussed, EPA must ensure that necessary elements are included in order to approve a TMDL under Clean Water Act Section 303(d). While many of the elements can be found in the documents, we would appreciate some clarifications and additional information. We understand that you intend to develop a Resolution that may include most of what may appear to be missing or incomplete information in the draft documents.

EPA appreciates your efforts in completing the Upper Elk River TMDL to address sediment impairment, and we look forward to reviewing the final TMDL when you provide the final documents containing all required elements to us for approval under Clean Water Act Section

303(d). If you have any questions, or if you would like further clarification of our comments, please call me at (415) 972-3456.

You will find the primary findings from our review detailed below.

Sincerely,

Janet Parrish
US EPA Region 9
Water Quality Assessment Section
415-972-3456

<u>Detailed Comments</u>

Problem Statement, Water Quality Standards, Numeric Targets, Linkage Analysis, Sediment Source and Data Analysis, and History of Restoration Efforts and Public Involvement

The components of these sections appear to be largely complete. However, we would appreciate a clearer, consistent, and more specific delineation of the waterbody or waterbodies to which the Upper Elk River Sediment TMDL (or TMDLs) applies. It would also be helpful to identify definitively the relationships between the existing Section 303(d) listing and any new listings or proposed delistings that were identified in the process.

It is not clear which parts of the watershed are included in the TMDL; various subwatershed areas appear to be delineated differently in different sections of the documents (e.g., Technical Report Figures 1-3 versus Figure 13, Upper Elk v. Lower Elk subbasins, the location of the "impacted reach" and the subwatersheds that drain to or are included or excluded in either, and the exclusion or inclusion of the Upper Little South Fork subwatershed). Please identify clearly which waterbody or waterbodies are subject to the TMDL, and which will be proposed for future actions, such as a delisting proposal or future TMDL actions.

It would also be helpful if the "impacted reach," and the relationships between the impacted reach, the subwatersheds, and TMDL waterbody delineations could be clearly specified. Chapter 2 of the Technical Report states that *"the drainage area to the impacted reach includes a portion of the Lower Elk River subbasin (Figure 1). While this portion of the Lower Elk River subbasin drains to the impacted reach, it is not anticipated to contribute significant sediment loads; therefore, the upper 17 subbasins were used to calculate sediment loading.…"* Is the impacted reach included within the delineation of the TMDL? Please explain. For the portion of the Lower Elk River that appears to be excluded from the TMDL analysis, can you identify the portion that is "not anticipated to contribute significant sediment loads" and support the statement or explain the reasoning?

Loading Capacity, TMDL, Load Allocations, and Waste Load Allocations

While we believe you have adequately supported your determination of an "assimilative capacity" of zero, we would appreciate greater clarity in explicitly identifying the loading capacity, TMDL, and allocations; perhaps this would be best accomplished in a section that is specifically devoted to these elements (i.e., loading capacity = 0; TMDL = 0; WLA = 0; LA = 0). Currently, the information is largely implied but not stated explicitly, and there are some contradictory statements (e.g., p. 5 of the Technical Report states, "These changes do not constitute a new TMDL"). Again, please state explicitly which waterbody or waterbodies the TMDL applies to.

It will also be beneficial to clarify the discussion of the phased implementation approach that you propose. You have proposed a TMDL of 0, corresponding to a loading capacity of 0, which is due in part to continued in-stream aggradation. This TMDL would apply until such time in the future that water quality standards are attained or loading capacity can otherwise be recalculated, which may require measures that increase sediment transport capacity. While current and future phases are described for the implementation efforts, a future TMDL is not specified; when the stream and watershed conditions are reevaluated in the future, you may find that another course of action is appropriate, such as delisting the Upper Elk River for sediment if water quality standards have been attained. If you do reevaluate watershed conditions in the future and find that water quality standards are not yet attained, you may determine that the loading capacity should be recalculated and the TMDL revised. To the maximum extent possible, it would also be helpful to describe a timeframe during which you anticipate that water quality standards will be attained, and identify the factors on which this estimate is based.

The Technical Report states incorrectly that load allocations apply to NPDES permitted discharges (p. 73). NPDES permitted discharges are considered point sources, and would be assigned waste load allocations. The Technical Report also states that there are no point source discharges of sediment in the Upper Elk River watershed. Please state specifically whether waste load allocations and load allocations are currently zero. In the future, if the loading capacity and TMDL are revised, it would be helpful to explain and fully describe waste load and load allocations. In particular, please ensure that any existing or anticipated NPDES permits will be addressed as required and appropriate, including any of the statewide General Permits.

Margin of Safety, Seasonal Variations, and Critical Conditions

The Technical Report and Draft Action Plan state that the loading capacity approach "incorporates a conservative, implicit MOS." Please provide additional explanation and support. In addition, please explain your consideration of seasonal variations and any critical conditions.

Public Involvement

You have documented an extensive and inclusive program of public involvement in the development of your proposed TMDL and action plan, and we encourage your continued diligent efforts to work collaboratively with all stakeholders toward attainment of water quality standards, and to consider all public comments fully and objectively, as you have demonstrated in the past.

ATTACHMENT 2
LITTLE RIVER DATA ANALYSIS

MEMORANDOM

TO: File

FROM: Lance Le, WRCE, Planning Unit

DATE: March 11, 2016

SUBJECT: LITTLE RIVER ANALYSIS REVISITED

Little River annual water yields derived from USGS gage data were used for comparison to sediment yields in Upper Elk River. The purpose was to support staff's conclusion that sediment yields from Figure 15 of *Upper Elk River: Technical Analysis for Sediment* (Technical Report) are not entirely explained by precipitation and weather; in particular the time period 1988-1997. The Little River was used because USGS gage data at Elk River were unavailable outside of the time period 1958-1967. Figure 1 was incorporated into the Technical Report; public comments noted that the particular application of water yields to explain sediment production were inappropriate, noting that peak flows would be a better predictor of sediment production. In response to those comments, I generated Figure 2 which shows peak flow distributions binned by time periods instead of water yield.

Revisiting Little River, some analysis done previously had not been incorporated into the Technical Report; only the boxplot of annual yields was present. This memo sets out to include the remainder of the Little River analysis. Specifically, this memo sets out to (a) validate the appropriateness of comparing Little River and Elk River data through correlation and significance testing and (b) classify water year types and plot their distribution congruent with Figure 15 of the Technical Report.

1. Comparability of Little River and Elk River data

Three variables are used to assess whether Little River is an appropriate watershed in place of Elk River. These variables are (1) annual water yields normalized by contributing area, (2) annual peak flows normalized by contributing area (Table 1), and (3) daily flows. Pearson's product-moment correlations and t-test were used to assess the variables. Daily flows are not included in this memo, but may be obtained from USGS NWIS: Web Interface (http://waterdata.usgs.gov/). The results are reported in Table 2. Correlations for water yield and daily flows are statistically significant ($\alpha=0.05$) at 0.92 and 0.88, respectively.

Correlation for peak flows (r=0.58) is not statistically significant (Table 2). An alternative to Pearson's *r* is Kendall's τ, which is a correlation based on the ranks of the data and results are similar: significant and positive correlation for water yield and daily flows, but non-significant positive correlation for peak flows (Table 3). Code used to conduct the correlations and significance testing is included in Attachment A.

Peak flow correlation is non-significant with a large confidence interval, suggesting the potential for similarity between Elk River peak flows and those of Little River, but with large uncertainty. Because of the limited number of data points and the fact that watershed conditions and management practices have changed over time, the correlation statistic may be non-stationary; that is to say, it may change over time. Since daily flows and annual yield are significantly correlated, Little River and Elk River are likely comparable.

Figure 1: Water yields at Little River binned by time periods congruent with Figure 15 of the Technical Report

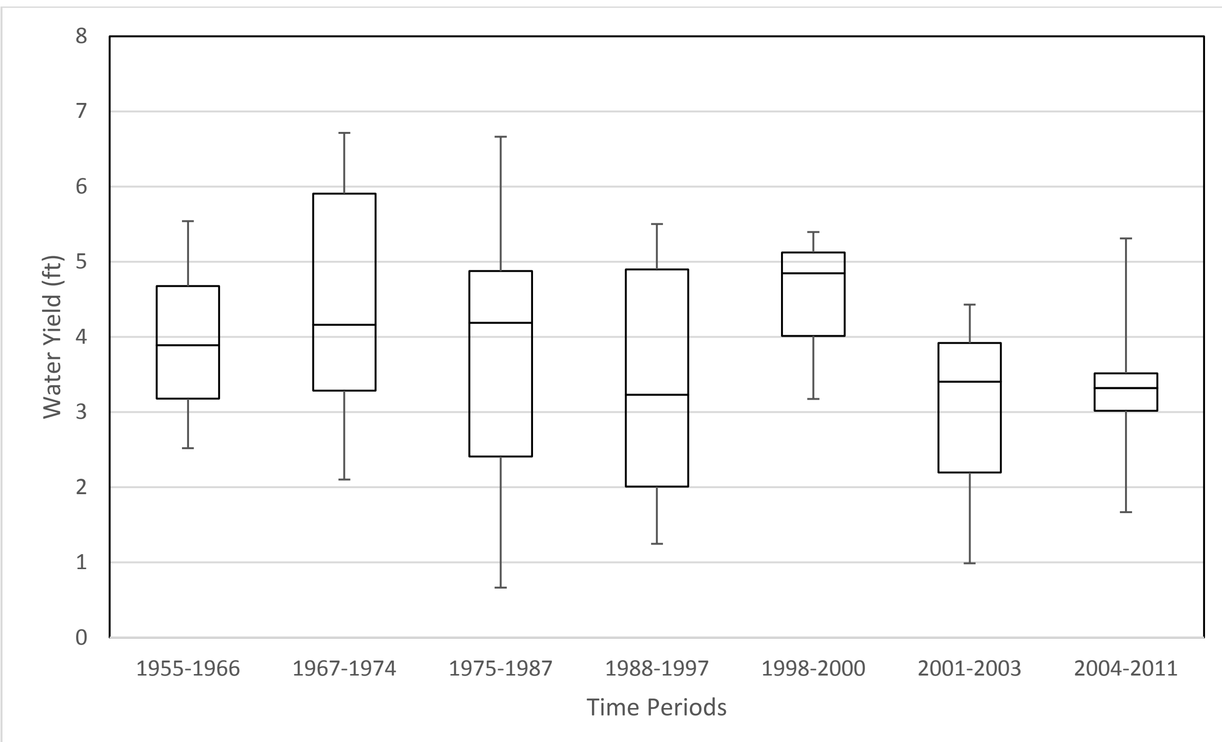


Table 1: Normalized annual water yields and peak flows for Elk River gage period

	Annual Water Yields (ft)		Annual Peak Flows (cfs/mi²)	
Year	Little River	Elk River	Little River	Elk River
1958	5.19	3.45	148.1	63.1
1959	2.61	1.53	94.1	72.9
1960	3.09	1.42	155.1	47.3
1961	3.95	2.05	84.0	48.9
1962	2.52	1.47	118.0	48.0
1963	4.46	2.30	115.1	50.2
1964	3.89	2.26	195.8	66.7
1965	4.90	2.77	203.5	77.6
1966	3.26	1.92	205.7	74.0
1967	3.37	2.28	156.0	70.4

Figure 2: Peak flows at Little River binned by time periods congruent with Figure 15 of the Technical Report

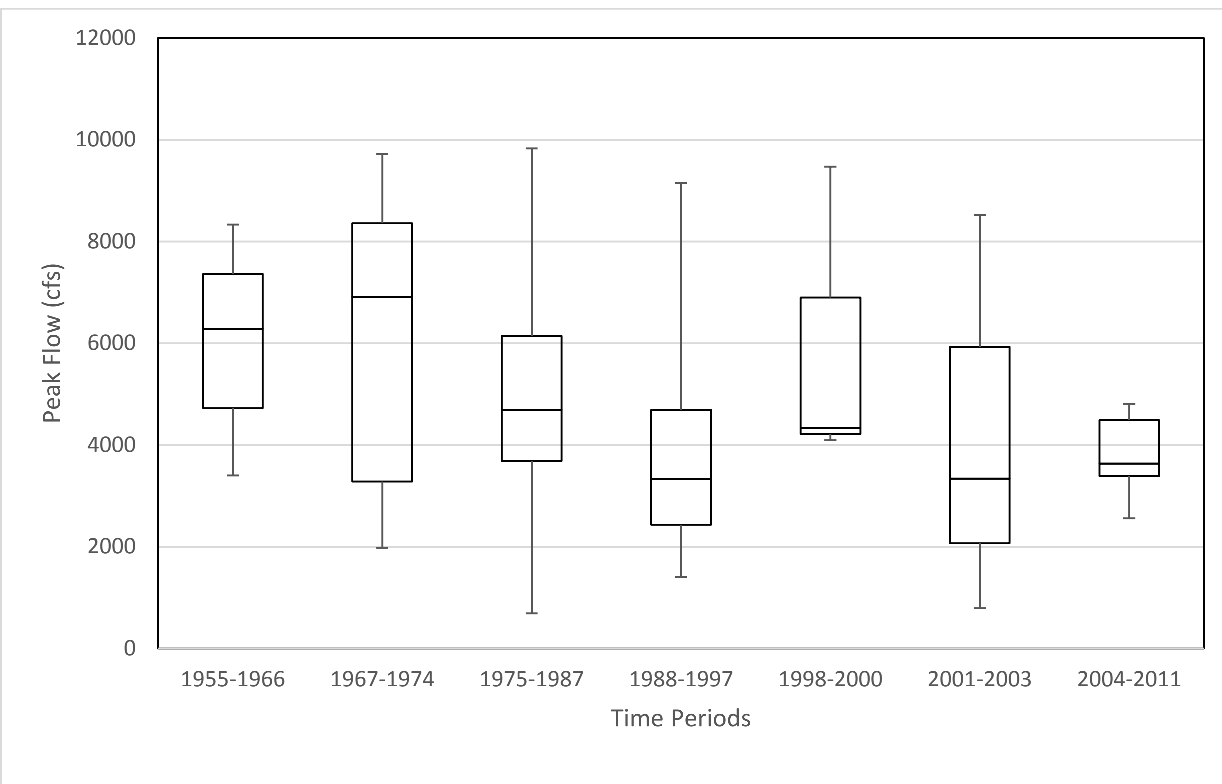


Table 2: Correlation and significance testing for water yields, peak flows, and daily flows

	Annual Water Yield	Annual Peak Flows	Daily Flows
Correlation coefficient *r*	0.92	0.58	0.88
Upper 95% Confidence Limit	0.98	0.89	0.89
Lower 95% Confidence Limit	0.69	-0.08	0.87
p-value	1.70×10^{-4}	0.0793	$<2.2\times10^{-16}$

Table 3: Kendall's rank correlation and significance testing

	Annual Water Yield	Annual Peak Flows	Daily Flows
Kendall's τ	0.78	0.38	0.87
p-value	9.46×10^{-4}	0.1557	$<2.2\times10^{-16}$

2. Qualitative classifications based on exceedance probability

Attachment B presents an analysis of annual water yields for Little River, constructing an exceedance probability plot. The analysis classifies the flows into five categories: Critically Dry, Dry, Average, Wet, and Extremely Wet. These categories are exceedance probabilities binned into five equal probability ranges; e.g. exceedance probabilities 0.0 to 0.19 are Extremely Wet, 0.2 to 0.39 are Wet, etc. The classified annual yields were further binned by time periods in correspondence with Figure 15 of the Technical Report (Figure 2). Figure 3 also shows the mean sediment loads from Figure 15.

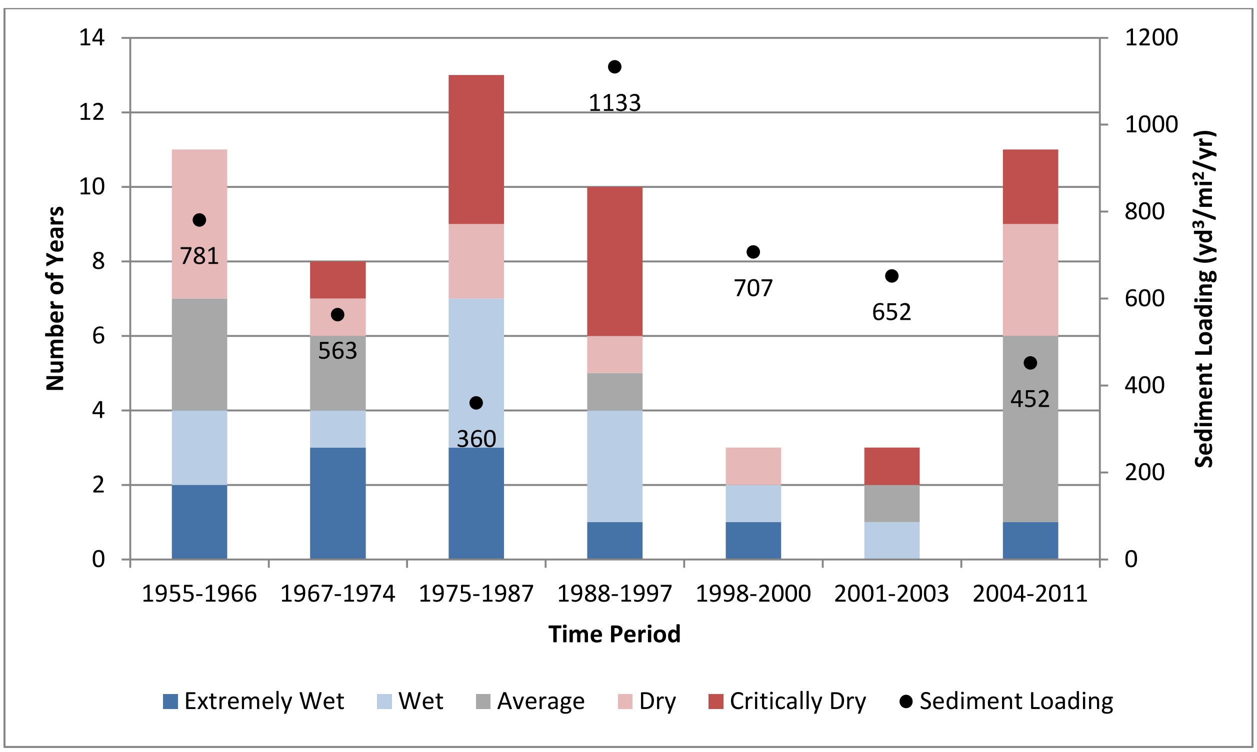


Figure 3: Stacked bar plot of classified water years binned into time periods congruent with Figure 15 of the Technical Report

Based on the evidence presented, staff's conclusion is supported given that 1988-1997 featured more Critically Dry water years than Extremely Wet water years. Any other visual inferences for the progressive decrease in sediment after 1997 is problematic due to two, short time periods and doubts as to whether annual water yields are good predictors for annual sediment yields.

Attachment A: R Code for correlation and significance testing
Attachment B: Analysis of Water Yield in the Little River Near Trinidad, CA (USGS Gaging Station #11481200)

Attachment A: R Code for correlation and significance testing

```
> cor.test(Water.Yield$LittleR,Water.Yield$ElkR)
        Pearson's product-moment correlation

data:  Water.Yield$LittleR and Water.Yield$ElkR
t = 6.5991, df = 8, p-value = 0.0001695
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.6871920 0.9810282
sample estimates:
      cor
0.9191331

> cor.test(Peak.Flow$LittleR,Peak.Flow$ElkR)
        Pearson's product-moment correlation

data:  Peak.Flow$LittleR and Peak.Flow$ElkR
t = 2.0101, df = 8, p-value = 0.07926
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.07922755  0.88582616
sample estimates:
      cor
0.5792962

# indQ is an index that matches time periods for Elk River and Little River
# gage data
> cor.test(litQ$q[indQ],LittleR,elkQ$q)
        Pearson's product-moment correlation

data:  litQ$q[indQ] and elkQ$q
t = 112.8524, df = 3650, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.8741769 0.8886387
sample estimates:
      cor
0.8816146

> cor.test(Water.Yield$LittleR,Water.Yield$ElkR,method='kendall')
        Kendall's rank correlation tau

data:  Water.Yield$LittleR and Water.Yield$ElkR
T = 40, p-value = 0.0009463
alternative hypothesis: true tau is not equal to 0
sample estimates:
      tau
0.7777778

> cor.test(Peak.Flow$LittleR,Peak.Flow$ElkR,method='kendall')
        Kendall's rank correlation tau
data:  Peak.Flow$LittleR and Peak.Flow$ElkR
T = 31, p-value = 0.1557
alternative hypothesis: true tau is not equal to 0
sample estimates:
```

```
      tau
0.3777778
```

```
> cor.test(litQ$q[indQ],elkQ$q,method='kendall')
```

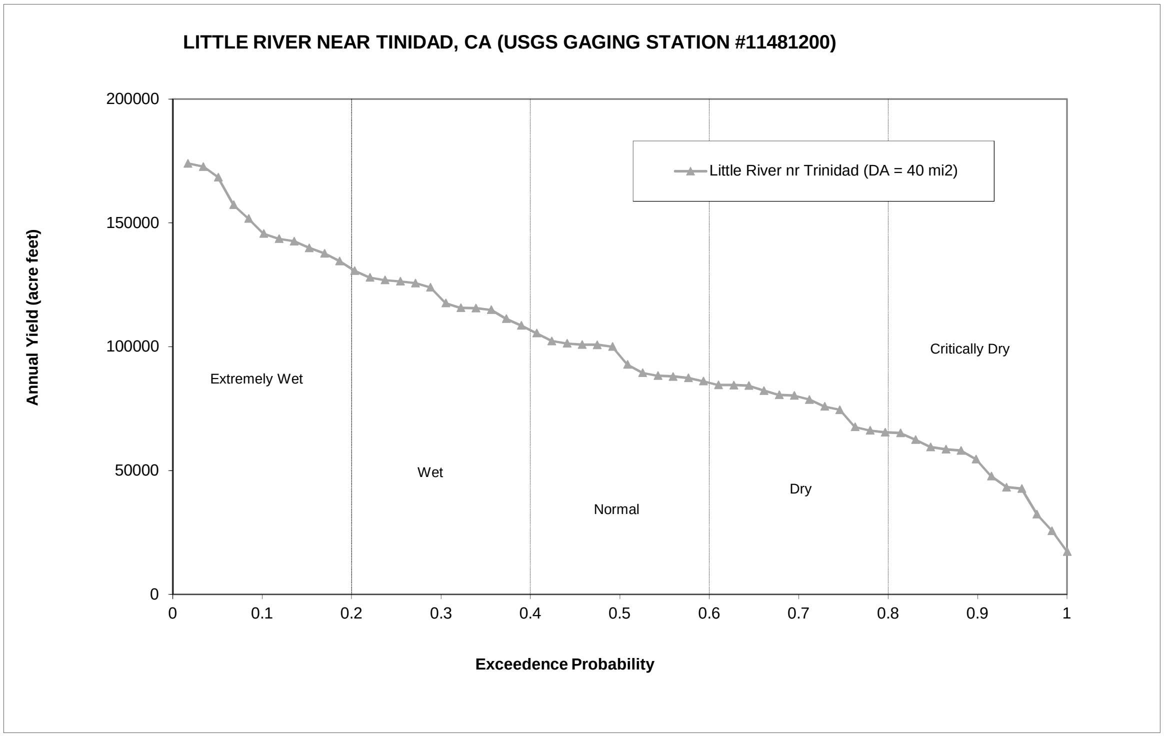
```
        Kendall's rank correlation tau
data:  litQ$q[indQ] and elkQ$q
z = 77.8789, p-value < 2.2e-16
alternative hypothesis: true tau is not equal to 0
sample estimates:
      tau
0.8649752
```

Attachment B: Little River analysis and water year classification

LITTLE RIVER NEAR TINIDAD, CA (USGS GAGING STATION #11481200). Drainage Area = 40.5 mi2.

Year	Water Yield	Water Year Class
1956	143,559	Extremely Wet
1957	100,718	Normal
1958	134,579	Extremely Wet
1959	67,587	Dry
1960	80,220	Dry
1961	102,275	Normal
1962	65,355	Dry
1963	115,532	Wet
1964	100,787	Normal
1965	126,891	Wet
1966	84,503	Dry
1967	87,334	Normal
1968	54,523	Critically Dry
1969	100,014	Normal
1970	115,670	Wet
1971	157,254	Extremely Wet
1972	151,725	Extremely Wet
1973	78,643	Dry
1974	174,014	Extremely Wet
1975	126,406	Wet
1976	84,442	Dry
1977	17,231	Critically Dry
1978	117,578	Wet
1979	62,408	Critically Dry
1980	108,568	Wet
1981	58,045	Critically Dry
1982	168,366	Extremely Wet
1983	172,720	Extremely Wet
1984	145,612	Extremely Wet
1985	74,500	Dry
1986	111,279	Wet
1987	59,456	Critically Dry
1988	66,141	Dry
1989	101,291	Normal
1990	65,143	Critically Dry
1991	42,657	Critically Dry
1992	32,334	Critically Dry
1993	127,891	Wet
1994	47,712	Critically Dry
1995	130,644	Wet
1996	123,949	Wet
1997	142,618	Extremely Wet
1998	125,678	Wet
1999	139,903	Extremely Wet
2000	82,254	Dry
2001	25,674	Critically Dry
2002	88,297	Normal
2003	114,875	Wet
2004	86,099	Normal
2005	84,224	Dry
2006	137,671	Extremely Wet
2007	92,826	Normal
2008	80,553	Dry
2009	75,909	Dry
2010	89,413	Normal
2011	105,485	Normal
2012	87,952	Normal
2013	58,570	Critically Dry
2014	43,246	Critically Dry

Rank	Exceedence	Total water yield	Water Year Class	
1	0.02	174,014	Extremely Wet	
2	0.03	172,720	Extremely Wet	
3	0.05	168,366	Extremely Wet	
4	0.07	157,254	Extremely Wet	
5	0.08	151,725	Extremely Wet	
6	0.10	145,612	Extremely Wet	
7	0.12	143,559	Extremely Wet	
8	0.14	142,618	Extremely Wet	
9	0.15	139,903	Extremely Wet	
10	0.17	137,671	Extremely Wet	
11	0.19	134,579	Extremely Wet	132,611
12	0.20	130,644	Wet	
13	0.22	127,891	Wet	
14	0.24	126,891	Wet	
15	0.25	126,406	Wet	
16	0.27	125,678	Wet	
17	0.29	123,949	Wet	
18	0.31	117,578	Wet	
19	0.32	115,670	Wet	
20	0.34	115,532	Wet	
21	0.36	114,875	Wet	
22	0.37	111,279	Wet	
23	0.39	108,568	Wet	107,027
24	0.41	105,485	Average	
25	0.42	102,275	Average	
26	0.44	101,291	Average	
27	0.46	100,787	Average	
28	0.47	100,718	Average	
29	0.49	100,014	Average	
30	0.51	92,826	Average	
31	0.53	89,413	Average	
32	0.54	88,297	Average	
33	0.56	87,952	Average	
34	0.58	87,334	Average	
35	0.59	86,099	Average	85,301
36	0.61	84,503	Dry	
37	0.63	84,442	Dry	
38	0.64	84,224	Dry	
39	0.66	82,254	Dry	
40	0.68	80,553	Dry	
41	0.69	80,220	Dry	
42	0.71	78,643	Dry	
43	0.73	75,909	Dry	
44	0.75	74,500	Dry	
45	0.76	67,587	Dry	
46	0.78	66,141	Dry	
47	0.80	65,355	Dry	65,249
48	0.81	65,143	Critically Dry	
49	0.83	62,408	Critically Dry	
50	0.85	59,456	Critically Dry	
51	0.86	58,570	Critically Dry	
52	0.88	58,045	Critically Dry	
53	0.90	54,523	Critically Dry	
54	0.92	47,712	Critically Dry	
55	0.93	43,246	Critically Dry	
56	0.95	42,657	Critically Dry	
57	0.97	32,334	Critically Dry	
58	0.98	25,674	Critically Dry	
59	1.00	17,231	Critically Dry	



1956-1965		
WY	Yield	Class
1956	143,559	Extremely Wet
1957	100,718	Normal
1958	134,579	Extremely Wet
1959	67,587	Dry
1960	80,220	Dry
1961	102,275	Normal
1962	65,355	Dry
1963	115,532	Wet
1964	100,787	Normal
1965	126,891	Wet

1988-1997		
WY	Yield	Class
1988	66,141	Dry
1989	101,291	Normal
1990	65,143	Critically Dry
1991	42,657	Critically Dry
1992	32,334	Critically Dry
1993	127,891	Wet
1994	47,712	Critically Dry
1995	130,644	Wet
1996	123,949	Wet
1997	142,618	Extremely Wet

	1956-1965	1988-1997
Ex wet	2	1
Wet	2	3
Normal	3	1
Dry	3	1
Crit Dry	0	4
	10	10
Sum water yield	1,037,502	880,381