July 17, 2012

Dr. Gerald Bowes
Manager, Cal/EPA Scientific Peer Review Program
Office of Research, Planning and Performance
State Water Resources Control Board
Post Office Box 100
Sacramento, CA 95812-0100

Dear Dr. Bowes:

Subject: Request for External Peer Reviewers of the Scientific Basis of 1) the *Draft Upper Elk River Sediment Total Maximum Daily Load (TMDL) Summary and Implementation Framework and 2) Draft Basin Plan Amendment of Beneficial Uses*

Staff of the North Coast Regional Water Quality Control Board (Regional Water Board) request that you initiate the process for identifying external scientific peer reviewers for two proposed actions related to the assessment and control of sediment discharges in the Elk River watershed. These are described in the 1) *Draft Upper Elk River Sediment Total Maximum Daily Load (TMDL) Summary and Implementation Framework* and 2) the *Draft Amendment of Beneficial Uses in Elk River*, referred to herein as the TMDL Summary and Implementation Framework and the Beneficial Uses Amendment, respectively. The scientific basis for these two proposed actions is contained in the *Staff Report for the Upper Elk River Sediment TMDL* (Staff Report), which is the primary scientific document submitted for review. The secondary document submitted for review is *Landslide Hazard in the Elk River Basin, Humboldt County, CA* (Stillwater 2007).

<u>Expected Date of Regional Board Workshop</u>
Staff is expected to present to the Regional Water Board the *Draft TMDL Summary and Implementation Framework* and the *Draft Basin Plan Amendment of Beneficial Uses* at its scheduled meeting in December 2012 with a proposed adoption by the Regional Water Board in February 2013. In order to meet this schedule, we request receipt of the scientific peer reviewer's comments no later than October 1, 2012.

Expected Date the Documents will be Available for Review
August 14, 2012

Requested Review Period
We request that scientific peer review be accomplished within the normal review period of thirty (30) days.

Length of Documents and References
The primary and secondary documents for review are approximately 200 pages and 50 pages, respectively. References cited in the documents for review will be provided to reviewers either on CD or in hard copy.

Suggested Areas of Expertise for Reviewers
The Staff Report (primary scientific document) and secondary scientific document are comprehensive and encompass numerous disciplines. We suggest that having several reviewers with varying expertise is appropriate for this project. Scientific peer reviewers should have expertise in the following fields:

- Slope stability – landslide processes, slope stability modeling, landslide hazard and risk assessments
- Hydrology and geomorphology – redwood forest hydrology, hillslope erosion processes, stream and floodplain processes
- Water quality – suspended sediment and turbidity data collection, analyses, and linkages to watershed sediment loads
- Fisheries biology – impact of fine sediment on fisheries resources

Contact Information
Adona White is the project manager: Adona.White@waterboards.ca.gov (707) 576-2672.

Attached please find (1) a plain English summary of the Staff Report, (2) a list of focused scientific topics for the peer reviewers, and (3) a list of scientists involved in development of the draft document.

Please contact me if you have questions. Thank you for your assistance.

Sincerely,

Alydda Mangelsdorf

Alydda Mangelsdorf
Acting Supervisor Basin Planning Unit

Attachments

cc: North Coast Regional Water Quality Control Board

Attachment 1

Summary of *TMDL Summary and Implementation Framework* and *Basin Plan Amendment of Beneficial Uses*

INTRODUCTION TO TMDL SUMMARY AND IMPLEMENTATION FRAMEWORK

As part of the North Coast Regional Water Quality Control Board's (Regional Water Board) ongoing water quality protection programs in the Elk River watershed of Northern California, staff of the Regional Water Board has developed a *TMDL Summary and Implementation Framework* to address the sediment impaired condition of the upper Elk River watershed. The *TMDL Summary and Implementation Framework* presents the regulatory program that staff will propose to the Regional Water Board for their adoption. The scientific basis for the *TMDL Summary and Implementation Framework* is described in the Staff Report.

The *TMDL Summary and Implementation Framework* and Staff Report:

- Evaluate current conditions in the watershed with respect to sediment.
- Establish a causal linkage between pollutant sources and loads on water quality conditions.
- Present in-stream and hillslope metrics that represent properly functioning conditions.
- Establish load allocations for constituents and conditions affecting sediment-related instream metrics.
- Present an implementation program which describes the nature of actions and activities necessary to protect and restore water quality standards and be compliant with the TMDL by addressing such controllable water quality factors[1] as: sediment control measures; channel, riparian, and floodplain protection and restoration; and management of timber harvest operations and roads.

  This Implementation Framework contains:
  - A description of the implementation actions and management measures necessary to meet the TMDL sediment load allocations and restore the beneficial uses of water in the Elk River.
  - A time line for implementing the identified management measures.
  - A monitoring strategy for tracking compliance with the TMDL management measures and progress toward meeting TMDL sediment load allocations, water quality objectives, and numeric targets.
  - An adaptive management strategy that allows for the revision of the TMDL and Implementation Framework, if necessary, and is supported by documented progress towards TMDL compliance.

---

[1] Controllable water quality factors are defined in the Basin Plan as "those actions, conditions, or circumstances resulting from man's activities that may influence the quality of waters of the State and that may be reasonably controlled.

INTRODUCTION TO THE BASIN PLAN AMENDMENT OF BENEFICIAL USES

The Water Quality Control Plan for the North Coast (Basin Plan) contains definitions of beneficial uses present within the North Coast Region (NCRWQCB 2007, 2-1.00), including 1) Wetland Habitat (WET), 2) Flood Peak Attenuation/Flood Water Storage (FLD), and 3) Water Quality Enhancement (WQE). Table 2-1 of the Basin Plan designates WET as an existing beneficial use in freshwater and saline wetlands and FLD and WQE as potentially existing in freshwater and saline wetlands throughout the region. Staff proposes that WET and FLD be identified in Elk River as existing in wetlands and WQE be identified as existing in wetlands, as well as the entire stream system and associated riparian zones. The Staff Report contains the scientific basis for the proposed *Basin Plan Amendment of Beneficial Uses*.

Elk RIVER WATERSHED INFORMATION

The Elk River watershed located in the coastal temperate forest of Humboldt County, California, drains 58.3 mi^2, and is the largest freshwater tributary to Humboldt Bay, which is the second largest estuary in California. The locations of the North Coast Region and Elk River are shown in Figure 1. The watershed is comprised of a steep, forested upper watershed, characterized by the North and South Forks, which drain to a broad valley, through which the low gradient mainstem Elk River meanders. The upper watershed is managed primarily for private industrial timber harvesting, and the Headwaters Forest Reserve, managed by Bureau of Land Management for recreation and conservation. The remaining area is in rural residential uses. The hillslopes draining to the mainstem are primarily managed for non-industrial timber and agriculture and urban development.

Elk River was first included on California's 303(d) impaired waters list in 1998 on the basis of excessive sedimentation/siltation. A suite of natural and anthropogenic-related factors in the Elk River watershed have impaired beneficial uses of water, including but not limited to fisheries habitat, domestic and agricultural water supplies, recreation uses, flood peak attenuation and water quality enhancement functions. The tectonically-active watershed is steep and underlain by weak geologic formations which produce primarily fine grained silts and sands. Management activities, most notably extensive timber harvest activities in the upper watershed, have accelerated sediment production from the naturally erodible landscape. Extensive re-entry harvesting and roading activities beginning in 1986 were followed by large winter storm events. Unprecedented discharges of sediment and organic debris resulted in major morphologic changes to the channel and floodplain in the middle reach of the Elk River watershed, significantly impairing domestic and agricultural water supplies and coldwater fisheries habitat and causing an increase in flood frequency and magnitude.

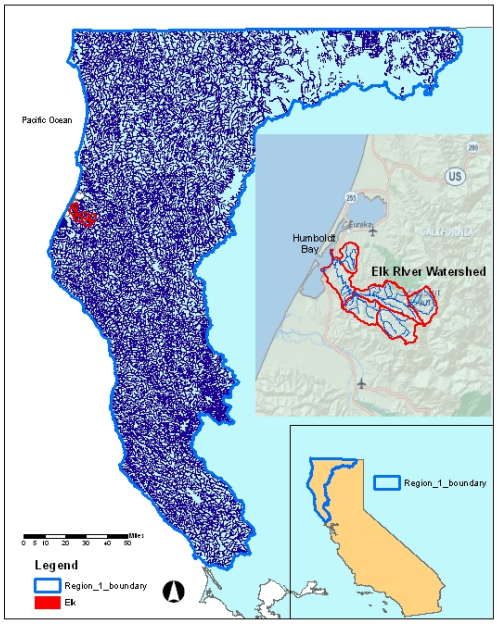

Figure 1. Locations of the North Coast Region (Region 1) and the Elk River Watershed within the state of California.

TOPICS EVALUATED IN THE STAFF REPORT

The water quality conditions and impacts that are addressed in the Staff Report are summarized below:

- Altered Channel and Floodplain Morphology: Anthropogenic sediment loads have overwhelmed the transport capacity of the river resulting in substantial sediment deposition.
- Cumulative Effects: In addition to the morphologic changes, persistently high suspended sediment loads in combination with low stream velocities have limited the river's ability to scour deposited sediment. Reduced channel cross-sectional area has resulted from continuing sediment deposits on bed, bank, and floodplain areas.
- Nuisance[2] Flooding: Flooding occurs at an increased frequency and magnitude compared to historic conditions. Fields, roadways, driveways, homes and septic

[2] California Water Code section 13050 defines nuisance to mean anything which meets all of the following requirements:

(1) Is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property.

(2) Affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal.

(3) Occurs during, or as a result of, the treatment or disposal of waste.

systems are inundated and damaged, affecting the health and safety as well as the livelihoods of residents in the Elk River valley.

- Beneficial uses are not supported: Fisheries habitat and domestic and agricultural water supplies are impaired. Pools and gravels are filled with fine sediment. High turbidity and suspended sediment concentrations, beneficial uses result in physiologic stress to salmonids, limit their feeding capabilities, and in-turn their growth rates and survival in ocean conditions. These conditions limit the usability of water without damaging equipment and causing health problems.
- Water Quality Objectives for sediment are not achieved: Suspended sediment concentrations adversely affect water supplies and fisheries and result in deposition of material which fills pools and embeds gravels. The deposition of material violates the water quality objective for settleable material resulting in reduction of cross-sectional area, contributing to nuisance flooding conditions. Turbidity is significantly elevated above naturally occurring background conditions throughout the basin. The overall sediment loads have been altered in violation of water quality objectives and the assimilative capacity of the watershed reduced.
- Anthropogenic-related sediment sources exceed the stream's assimilative capacity: Quantification of the stream's sediment loading capacity and natural and management-related sediment source categories since 1955 indicates that management-related sources have contributed to degradation of instream resources. Reduction in management-related sediment loading, in combination with addressing the stored instream sediment deposits, is necessary to ensure recovery of the ecosystem functions, beneficial uses of water, and abatement of nuisance conditions.

EXISTING REGULATORY FRAMEWORK

The Water Quality Control Plan for the North Coast Region (Basin Plan) is designed to provide a definitive program of actions to preserve and enhance water quality and protect beneficial uses in the North Coast Region. The Basin Plan addresses many factors and activities which may affect water quality. It includes actions to be taken by the State Water Board and the Regional Water Board as they have primary responsibility for maintenance of water quality in the North Coast Region.

The current regulatory program in Upper Elk River watershed consists of 1) Permits designed to control new sources of sediment associated with timber harvest activities; 2) A program of sediment control for threatened discharges of sediment from existing sources of erosion; and 3) A trend monitoring program to evaluate changes in instream indices and landslide patterns.

Staff proposes that the *TMDL Summary and Implementation Framework* be used to inform modifications to the Regional Water Board's existing regulatory framework, including future revisions to the WDRs and inclusion of a strategy to recover channel capacity and function in the middle reach of Elk River.

Attachment 2

Description of Assertions, Findings, and Conclusions to be Addressed by Peer Reviewers

The statutory mandate for external scientific review (Health and Safety Code Section 57004) states that it is the reviewer's responsibility to determine whether the scientific portion of the proposed rule is based upon sound scientific knowledge, methods, and practices.

We request that the scientific peer reviewers make this determination for each of the identified assertions, findings, and conclusions that constitute the scientific portions of the Staff Report and Stillwater (2007). An explanatory statement is provided for each assertion, finding, and conclusion.

Nature of the Water Quality Problem

1. **Anthropogenic sediment loading has resulted in habitat changes, impacts to beneficial uses, and increase in nuisance flooding.**

The Staff Report concludes that beneficial uses of water in the watershed, notably salmonid habitat and domestic and agricultural water supplies, have been adversely affected by increased sediment loadings related to anthropogenic activities. This impact to beneficial uses is seen in watershed data indicating high suspended sediment loads, degraded habitat, channel filling, and instream conditions. Additionally, water quality objectives are not met. In-stream sampling data show that excess sediment within the river system are outside the range that fosters desired conditions for optimal salmonid habitat and other beneficial uses. Significant discharges of sediment and organic debris to watercourses have aggraded the stream channels in the low gradient reaches of the Elk River watershed, significantly reducing channel capacity and, along with increased peak flows, have contributed to increased flood frequencies and severity and have created a nuisance condition.

Review should focus on Chapter 2: Problem Statement of the *Draft Staff Report for the Upper Elk River Sediment TMDL.*

Desired Numeric and Narrative Target Conditions

2. **The instream desired target conditions represent desired conditions supportive of beneficial uses including fisheries uses and domestic and agricultural water supplies.**

3. **Historical measurements by USGS from 1954-1965 on the upper mainstem Elk River provide an appropriate basis for the desired target conditions to prevent nuisance in upper mainstem, lower North Fork and lower South Fork Elk River.**

4. **The hillslope desired target conditions represent conditions in which sediment sources are likely to be controlled by addressing controllable water quality factors.**

5. **The watershed desired target conditions support watershed and stream processes and functions for beneficial use protection.**

The Staff Report proposes a suite of numeric and narrative targets which collectively describe conditions that support salmonid migration, habitat, water supplies, ecosystem function and the prevention of nuisance flooding. The specific indicators (and their desired target conditions) have been identified to assess critical aspects of watershed health and to provide measureable tools for determining the effectiveness of TMDL implementation measures. The TMDL implementation measures are designed to attain water quality objectives, protect beneficial uses, and prevent nuisance conditions. The numeric indicators and desired target conditions will be compared to monitoring data so as to evaluate watershed health recovery over time.

Review should focus on Chapter 4: Desired Target Conditions of the *Draft Staff Report for the Upper Elk River Sediment TMDL.*

<u>Sediment Source Analysis.</u>

6. **The sediment source analysis reasonably quantifies the timing and magnitude of natural and management-related sediment source categories.**

7. **Little South Fork Elk River provides a reasonable reference watershed for Upper Elk River.**

The Staff Report quantifies the timing and magnitude of past sediment loading associated with both natural and management-related hillslope sediment sources based upon a combination of site specific data, generalized erosion rates extrapolated from surveyed subbasins, and literature values. The time periods analyzed correspond to aerial photograph sets used to quantify many of the source categories from 1955-2010. The source analysis does not evaluate channel routing and remobilization of instream deposits.

Review should focus on Chapter 3: Sediment Source Analysis for Upper Elk River of the *Draft Staff Report for the Upper Elk River Sediment TMDL.*

<u>Sediment TMDL, Load Allocations and Margin of Safety</u>

8. **125% of natural sediment loading is a reasonable estimate of the sediment loading capacity for Upper Elk River and is likely to be supportive of beneficial uses of water.**

9. **The load allocation strategy appropriately represents 1) that a portion of the loading capacity is currently taken up by the instream sediment deposits in the**

middle reach of Elk River and 2) that a change in the volume of instream deposits resulting from recovery of the middle reach may result in a greater portion of loading capacity available for management-related sediment loads.

10. **The margin of safety will ensure beneficial uses are protected and it reasonably accounts for uncertainty in the estimates of the sediment source analysis, the loading capacity, and seasonal variation.**

The Staff Report evaluates data and literature to arrive at a calculation of the sediment loading capacity of the Upper Elk River watershed. The TMDL is set equal to the sediment loading capacity and includes estimates of natural sediment loading, sediment loading from management-related hillslope sources, loading capacity lost due to stored instream deposits, and a margin of safety, as represented by the following equation:

TMDL = (Natural) + (Upslope Loading) – (Instream Deposits Loading) + MOS

Many sediment TMDLs in the North Coast Region have relied on USEPA's Noyo River TMDL as the basis for establishing allowable management-related sediment loads. USEPA used a reference time period to calculate the TMDL for the Noyo River (USEPA, 1999). Analysis of Noyo River sediment sources during this period indicated that there was about one part human induced sediment delivery for every four parts natural sediment delivery (i.e. a 1:4 ratio, or a 25% increase). Based upon the findings in the Noyo River TMDL, and consistent with other lines of evidence regarding the sediment loading capacity, the Upper Elk River TMDL is set at 125 percent of natural sediment loading. Suspended sediment concentrations and durations resulting from the proposed TMDL are estimated to be generally supportive of salmonids based upon analysis of the severity of ill effects (Newcomb and Jensen, 1996). The allowable sediment loads are also anticipated to be consistent with the water quality objective for turbidity and settleable material.

The instream deposits in the middle reach of Elk River limit the stream's capacity to assimilate and transport sediment. Recovery actions could lead to a reduction in the effect of the deposits, but take time to evaluate and implement. There is uncertainty associated with the lost loading capacity associated with the instream deposits because they have not been carefully measured; the volume of instream stored sediment is based upon gross estimates from surveys and observations. The margin of safety considers the uncertainty associated with the volume of the instream deposits, the time period over which they will be treated, and uncertainty and error associated with the sediment source estimates.

Review should focus on Chapter 6: Linkage Analysis and TMDL and Chapter 7: Load Allocations and Margin of Safety of the *Draft Staff Report for the Upper Elk River Sediment TMDL.*

<u>Slope Stability Modeling and Resulting Landslide Hazard Maps</u>

11. **The 4-meter Digital Elevation Model (DEM) generated from the bare-earth Light Detection and Ranging (LiDAR) points using kriging is a reasonable technique to model hillslope stability in the project area to maximize representative elevations and definition of actual geomorphic features while reducing**

topographic artifacts and computation time required for model application and other spatial analyses.

12. **SHALSTAB and PISA represent reasonable models for predicting potential shallow landslide hazards, in common usage with proven performance in forest mountainous terrain.**

13. **The model testing resulted in determination of appropriate thresholds for breaks in potential instability classes that balance the goals of maximizing correct landslide prediction and minimizing over prediction of unstable area.**

Slope stability models were applied to the Elk River watershed, using a LiDAR gridded bare-earth DEM. Two distributed, physically-based models were initially selected for predicting potential shallow landslide hazards based on their common usage and past performance in forested mountainous terrain: the deterministic model SHALSTAB (Montgomery and Dietrich 1994, Dietrich et al. 2001) and the probabilistic model PISA (Haneberg 2004, 2005). Two variations of these models were subsequently included in the analyses to allow more parameterization, most notably, spatial variation in soil depth. These include SHALSTAB.V (Dietrich et al. 1995) and what analysts refer to as PISA.V. All four approaches are objective, mechanistic models based on high resolution (4-m) DEM topography developed from LiDAR data. The models were parameterized based upon literature values and local measurements. The results of the models were tested with Upper Elk River landslide inventories to determine if areas of known landslides were modeled as areas of potential instability; the landslide inventories were based upon sequential aerial photo analysis and field visits. The resulting gridded model results were interpreted using relative ranking criteria based upon percentage of observed landslides in different slope stability categories, thus indicating relative landslide hazard.

The Implementation Framework describes use of the landslide hazard map during project planning and development. The allowable activities and required subsequent investigations vary with landslide hazard class. For example, timber harvest operations may not be allowed on areas of high landslide hazard, while operations in areas of low hazard are of little concern. In areas of moderate hazard, a plan proponent may offer additional site characterization and project mitigations.

Review should focus on: Stillwater. 2007. *Landslide Hazard in the Elk River Basin, Humboldt County, California.* Prepared for North Coast Regional Water Quality Control Board.

<u>Identification of Additional Beneficial Uses of Water for the Elk River Watershed</u>

14. **The Wetland Habitat (WET), Flood Peak Attenuation/Flood Water Storage (FLD), and Water Quality Enhancement (WQE) beneficial uses exist in Elk River.**

The Basin Plan contains definitions of beneficial uses present within the North Coast Region, including WET, FLD, and WQE. Table 2-1 of the Basin Plan identifies beneficial uses

designated for specific water bodies within the region, as well as general categories of waters (e.g., wetlands). Staff proposes to designate the WET, FLD, and WQE beneficial uses in the Elk River watershed, including an amendment to Table 2-1 of the Basin Plan.

According to 1978 mapping of wetlands made available by the US Fish and Wildlife Service (FWS, 2012) delineating the location, areal extent, and type of wetlands and surface waters wetlands exist in the Elk River watershed. Additionally, the Humboldt Bay Recreation and Conservation District provides maps of wetland habitat (as of 1993) in Elk River watershed (HBHRCD, 2012). WET and FLD are proposed as existing beneficial uses in all the identified wetlands in the watershed and WQE is proposed as an existing beneficial use in wetlands and riparian zones.

Review should focus on Chapter 4: Proposed Beneficial Uses of Water of the *Draft Staff Report for the Upper Elk River Sediment TMDL.*

Other Topics

Reviewers are not limited to addressing only the specific topics presented above. Additionally, we invite you to contemplate the following "Big Picture" questions.

(a) In reading the technical reports and proposed implementation language, are there any additional scientific issues that should be part of the scientific portion of the proposed rule that are not described above? If so, comment with respect to the *TMDL Summary and Implementation Framework* and *Beneficial Use Amendment* given above.

(b) Taken as a whole, is the scientific portion of the proposed actions based upon sound scientific knowledge, methods, and practices?

Reviewers should also note that some proposed actions may rely significantly on professional judgment where available scientific data are not as extensive as desired to support the statute requirements for absolute scientific rigor. In these situations, the proposed course of action is favored over no action.

The preceding guidance will ensure that reviewers have the opportunity to comment on all aspects of the scientific basis of the proposed Regional Water Board actions. At the same time, reviewers also should recognize that the Regional Water Boards have a legal obligation to consider and respond to all feedback on the scientific portions of the proposed rule. Because of this obligation, reviewers are encouraged to focus feedback on the scientific issues that are relevant to the *TMDL Summary and Implementation Framework* and *Beneficial Uses Amendment* being proposed.

References

FWS Wetlands WMS CONUS. Accessed on July 9, 2012.
https://explore.data.gov/Geography-and-Environment/FWS-Wetlands-WMS-CONUS/xuie-dunk

Dietrich, W. E., D. Bellugi, and R. Real de Asua. 2001. *Validation of the shallow landslide model, SHALSTAB, for forest management.* Pages 195-227 in Land use and watersheds: human influence on hydrology and geomorphology in urban and forest areas. American Geophysical Union.

Dietrich, W. E., and D. R. Montgomery. 1998. *SHALSTAB: a digital terrain model for mapping shallow landslide potential.* Prepared for publication as a technical report by NCASI.

Haneberg, W. C. 2004. *A rational probabilistic method for spatially distributed landslide hazard assessment.* Environmental and Engineering Geoscience X: 27-43.

Haneberg, W. C. 2005. *PISA: probabilistic infinite slope analysis, user manual. Version 1.0*. Haneberg Geoscience.

Humboldt Bay Harbor Recreation and Conservation District. Accessed July 9, 2012.
http://www.humboldtbay.org/gis/interactivemap.html (2012).

North Coast Regional Water Quality Control Board. May 2011. Water Quality Control Plan for the North Coast Region.

USEPA. December 1999. *Noyo River Total Maximum Daily Load for Sediment.*

Attachment 3

List of Participants

1. Regional Water Board staff prepared the documents using available literature and information. In addition, outside consultants contributing to TMDL development included the following:

   Jay Stallman, Project Technical Lead, *Stillwater Sciences*
   Rafael Real de Asua, Spatial Analyst, *Stillwater Sciences*
   Don Lindsay, CEG, *Curry Group*
   Ronna Bowers, geologist, *Stillwater Sciences*
   Dr. Bill Hanneberg, *Hanneberg Geoscience*
   Dr. Bill Dietrich, *UC Berkeley, Department of Earth and Planetary Sciences*
   Dr. Josh Roering, *University of Oregon*
   Ben Mackey, *University of Oregon*
   Dr. Laura Vaugois, *Washington Dept. of Natural Resources*
   Dr. Bill Weaver, *Pacific Watershed Associates*
   Danny Hagans, *Pacific Watershed Associates*
   Eileen Weppner, *Pacific Watershed Associates*
   Drew Lewis*, Sanborn Mapping*
   David Lamphear, *Green Diamond Resource Company*

2. Appropriate water quality protections for Elk River, especially as related to timber harvesting activities, have long been the subject of study and debate. Over the years, numerous individuals have been involved in this effort to varying degrees, including:

   Kathy Dube
   Wayne Adams, *Hart Crowser*
   Dr. Jeff Barrett, *formerly of Scotia Pacific Company*
   Dr. Kate Sullivan, *formerly of Pacific Lumber Company and Humboldt Redwood Company*
   Dr. Amod Dahkal, *formerly of Pacific Lumber Company*
   Ruthann Schulte, *formerly of Pacific Lumber Company*
   Matt O'Connor, *O'Connor Environmental*
   Jesse Noell, *Salmon Forever*
   Clark Fenton, *Salmon Forever*
   Kristi Wrigley, *Salmon Forever*
   William Conroy, *formerly of Pacific Lumber Company*
   Todd Kramer, *Pacific Watershed Associates*
   Dr. Jack Lewis, *private consultant, formerly of Redwood Sciences Laboratory*
   Craig Benson, *Redwood Community Action Agency*
   Don Allen, *Redwood Community Action Agency*
   Valerie Sherron, *formerly of North Coast Regional Water Quality Control Board*
   Nicole Morano, *formerly of Redwood Community Action Agency*
   Jennifer Aspittle, *formerly of Stillwater Sciences*

Dr. William Trush, *Humboldt State University, McBain and Trush*
Dr. Leslie Reid, *USDA Redwood Sciences Laboratory*
Dr. Andrew Collison, *Philip William & Associates*
Dr. William Emmingham, *Oregon State University*
Dr. Fred Everest, *University of Alaska Southeast*
Dr. David Tarbotonn, *Utah State University*
Dr. Richard Marston, *Oklahoma State University*
Dr. Robert Twiss, *UC Berkeley*
Dr. Dale Thornberg, *Humboldt State University*
Dave Fuller, *Bureau of Land Management*
Sam Flannigan, *Bureau of Land Management*
Chris Heppe, *Bureau of Land Management*
Dr. Tom Lisle, *Redwood Sciences Laboratory*
Mary Ann Madej, *USGS*
Dr. Eileen Cashman, *Dept. of Env. Resources Engineering, Humboldt State University*
Randy Klein, *Redwood National and State Parks*
YanToa Cui, *Stillwater Sciences*
Bonnie Prior, *Northern Hydrology and Engineering*
Jeff Anderson, *Northern Hydrology and Engineering*
Gordon Leppig, *California Dept. of Fish and Game*
Jane Arnold, *California Dept. of Fish and Game*
Bill Condon*, California Dept. of Fish and Game*
John Clancy, *NOAA Fisheries*
Lisa Roberts, *NOAA Fisheries*
John Peters, *USFWS*
Trinda Bedrosian, *formerly of California Geologic Society*
Dr. Andrea Tuttle, *formerly of California Department of Forestry and Fire Protection*
Pete Cafferatta, *California Department of Forestry and Fire Protection*
John Munn, *California Department of Forestry and Fire Protection*
Ed Salminen
Gary Simpson, *SHN*
Steve Horner, *formerly of Pacific Lumber Company*
Jenelle Black, *Hart Crowser*
John Coyle, *John Coyle and Associates*
Tom Koler, *USFS*
Tagg Nordstrom, *Humboldt Redwood Company*
John Oswald, *formerly of Pacific Lumber Company*
Rod Prellwitz
Terry Rollerson
Bill Short, *California Geologic Society*
Gerald Marshall, *California Geologic Society*
Marvin Piles
Bob Beschta
Dr. Roy Sidle