
North Coast Regional Water Quality Control Board

May 20, 2013

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

Dear Dr. Bowes:

Subject: Request for External Peer Reviewers of the Scientific Basis of the Proposed Basin Plan Amendment to Establish a Policy for the Implementation of the Water Quality Objective for Temperature

Staff of the North Coast Regional Water Quality Control Board (Regional Water Board) is initiating the process of amending the *Water Quality Control Plan for the North Coast Region* (Basin Plan) to add a Policy for the Implementation of the Water Quality Objective for Temperature and Action Plan for the Implementation of the Water Quality Objective for Temperature. Staff of the Regional Water Board requests that you initiate the process for identifying external scientific peer reviewers for these proposed actions at this time. The amendment establishes a policy and action plan that achieves compliance with the Basin Plan's interstate and intrastate water quality objective for temperature region-wide. The scientific basis for the proposed action is contained in the *Staff Report Supporting the Policy for the Implementation of the Water Quality Objective for Temperature*.

There are three documents associated with the Basin Plan amendment package: the *Draft Policy for the Implementation of the Water Quality Objective for Temperature* (Policy), the *Draft Action Plan for the Implementation of the Water Quality Objective for Temperature* (Action Plan), and the *Draft Staff Report in Support of the Policy for the Implementation of the Water Quality Objective for Temperature* (Staff Report). The Staff Report presents each component of both the Policy and Action Plan and discusses their rationale and scientific support. The focus of the review is presented in Attachment 2, Description of Assumptions and Conclusions to be Addressed by Peer Reviewers, contained herein. Attachment 2 directs the reviewers to specific points of science related to the Policy, Action Plan, and

Staff Report to be reviewed. The Policy, Action Plan, and Staff Report are the subject of the review, and will be provided upon initiation of the review.

The Policy for the Implementation of the Water Quality Objective for Temperature will be the first region-wide policy for the control of temperature in California. Please note that given the nature of thermodynamics and the similarity of the Basin Plans among regions, it is possible that the same approaches outlined in the policy could be adopted by other regions, or possibly the State Water Resources Control Board as a statewide policy.

Expected Date of Regional Board Workshop

Staff is expected to present to the Regional Water Board the *Policy for the Implementation of the Water Quality Objective for Temperature* at its scheduled meeting in October 2013, with a proposed adoption by the Regional Water Board in November 2013. In order to meet this schedule, we request receipt of the scientific peer reviewer's comments no later than July 15, 2013.

Expected Date the Documents Will Be Available for Review

June 15, 2013

Requested Review Period

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

Suggested Areas of Expertise for Reviewers

The *Staff Report Supporting the Policy for the Implementation of the Water Quality Objective for Temperature* (primary scientific document) and associated references 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:

- Stream thermodynamics – heat transfer processes (i.e., conduction, convection, radiation, evaporation, and advection).
- Riparian forest ecology – riparian vegetation dynamics, including response of riparian vegetation to disturbance.
- Hydrology and geomorphology – forest hydrology, fluvial geomorphology, effects of sediment loads on stream dimensions.

Contact Information

I am the manager of this project, and can be contacted at:

Bryan.McFadin@waterboards.ca.gov, or (707) 576-2751.

Attached please find (1) a plain language 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,

Original Signed By

Bryan McFadin
Senior Water Resource Control Engineer
Water Temperature Specialist

Attachments:

1. Summary of the Basin Plan Amendment to Establish a Policy for the Implementation of the Water Quality Objective for Temperature, in Plain English
2. Description of Assumptions and Conclusions to be Addressed by Peer Reviewers
3. List of participants

To be provided upon initiation of the review:

4. *Draft Policy for the Implementation of the Water Quality Objective for Temperature*
5. *Draft Action Plan for the Implementation of the Water Quality Objective for Temperature*
6. *Staff Report in Support of the Policy for the Implementation of the Water Quality Objective for Temperature*

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cc: Alydda Mangelsdorf, Senior, Basin Planning Unit, NCRWQCB
David Leland, Acting Asst. Executive Officer, NCRWQCB

Attachment 1

Summary of the Basin Plan Amendment to establish a Policy for the Implementation of the Water Quality Objective for Temperature, in Plain English

Background:

Approximately sixty-three percent of the area of the North Coast Region is listed as temperature impaired, per Section 303(d) of the Clean Water Act, because the water quality of those rivers and streams does not meet the temperature water quality objectives, or protect certain beneficial uses. Temperature impairments in the watersheds of the North Coast Region are predominantly associated with nonpoint source pollution. Temperature TMDL analyses of 12 watersheds in the north coast have found the following factors to be responsible for elevated water temperatures: increased exposure to solar radiation due to loss of stream shade, physical stream channel alteration in response to elevated sediment loads, and alteration of hydrology resulting from impoundments, water diversions, and landscape alteration. Widespread temperature impairments within the North Coast Region point to the need for a region-wide approach for addressing temperature issues. The establishment and implementation of this Policy will provide a common approach to ensuring attainment of the water quality objectives for temperature. Similarly, the establishment and implementation of such a policy will ensure that high quality waters are also protected.

On January 19, 2012, the Regional Water Board adopted resolution R1-2012-0013 titled "*Policy Statement for Implementation of the Water Quality Objective for Temperature in the North Coast Region*" (Policy Statement)¹. The Policy Statement describes the water quality objectives for temperature, identifies common activities that have the potential to elevate water temperatures in excess of water quality objectives, and identifies regulatory mechanisms by which they are addressed in order to provide a comprehensive and consistent approach to the control of elevated temperatures throughout the North Coast Region. The Policy Statement also provides direction to staff developing and implementing permits and evaluating the water quality impacts of proposed actions, clarification to the public regarding what is required to comply with the objective, and direction to staff to incorporate a temperature implementation policy into the Basin Plan.

Proposed Action:

Regional Water Board staff has prepared and will present to the Regional Water Board for adoption into the Basin Plan, to include in Chapter 4 (Implementation Plans), a

¹ Resolution R1-2012-0013 can be downloaded at:

http://www.waterboards.ca.gov/northcoast/board_decisions/adopted_orders/pdf/2012/120127_12_0013_Resolution_Temperature.pdf

temperature implementation policy, as directed by the Regional Water Board through resolution R1-2012-0013. The proposed Basin Plan amendment will describe the approach to implementing the water quality objectives for temperature in one cohesive policy, as described in the Policy Statement.

The Regional Water Board's goal in developing and adopting the Policy and Action Plan into the Basin Plan is to describe factors that the Regional Water Board will address to achieve the water quality objectives for temperature, as well as actions and approaches that the Regional Water Board will take to address the factors and achieve the water quality objectives for temperature. It will direct staff to address temperature concerns through existing authorities and processes. It will also include consideration of issues other responsible agencies, with jurisdiction over controllable factors that influence water temperature, must consider when taking actions that may affect temperature. Finally, the Policy will clearly identify the removal of vegetation that provides shade to a waterbody as a controllable water quality factor that must be assessed and addressed, if necessary, in order to achieve the intrastate water quality objective for temperature.

Attachment 2

Description of Assumptions 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 assumptions and conclusions that constitute the scientific basis of the proposed actions. An explanatory statement is provided for each assertion, finding, and conclusion.

The following topics reference the most relevant section of the Staff Report for the discussion. The Staff Report provides the background and justification for the contents of the Policy and Action Plan. Findings and conclusions in the Staff Report include the citation to the reference source. Selected references will be provided for the peer reviewer's convenience upon initiation of the review. Additional references will be provided upon request.

Nature of the Water Quality Problem

- 1. Increased solar radiation loads are the primary controllable driver of elevated water temperatures. Increasing solar radiation loads (decreased shade) result in increasing stream temperatures. Preserving shade is a legitimate means of preventing stream temperature increases.**

The temperature TMDL source analyses conducted to date have evaluated the conditions necessary to achieve the intrastate water quality objective for temperature. Those source analyses have consistently identified the role of solar radiation, sediment, and hydrology in determining the temperature of waterbodies. The TMDLs established load allocations in terms of site-potential effective shade, which is equal to the shade provided by topography and full potential vegetation conditions at a site, with an allowance for natural disturbances such as floods, wind throw, disease, landslides, and fire. The physics that determine the temperature of impaired and unimpaired water bodies are the same, thus the conclusions of TMDL source analyses regarding the drivers of temperature and the importance of preserving effective shade apply to all waterbodies.

The sensitivity and response of stream temperatures to factors that drive them have been evaluated in temperature TMDL analyses completed in the north coast region. These sensitivity analyses were conducted using temperature models and data representing site-specific conditions. The results consistently show the level of solar radiation reaching the water surface is the most influential driver of stream temperatures subject to human

control associated with nonpoint source pollution. Point source discharges of higher temperature effluent, such as water used in industrial processes, wastewater effluent, or power plant cooling water, also have great potential to elevate water temperatures, but are prohibited in the north coast during summer months.

The results of temperature analyses conducted for north coast streams also demonstrate that the restoration of solar radiation loads to levels associated with unaltered riparian vegetation conditions can result in a substantial decrease in stream temperatures, particularly daily maximum temperatures, in streams with a history of riparian vegetation removal.

Reviewers are asked to critique the approach of preserving shade for the control elevated water temperature. The rationale for the finding above is presented in “Section 6.1 Land Use Activities with the Potential to Reduce Riparian Shade” in the *Staff Report Supporting the Policy for the Implementation of the Water Quality Objectives for Temperature*.

2. The establishment of riparian buffers for temperature protection is an effective and important management measure for the control of some types of sediment and discharges.

The temperature TMDLs developed for waterbodies in the North Coast Region have consistently identified the role excess sediment loads play in altering temperature regimes. Many of the temperature TMDLs were developed concurrently with sediment TMDLs. Implementation of those sediment TMDLs is identified as a necessary action to achieve the intrastate water quality objective for temperature in those temperature TMDLs. Other temperature TMDLs, such as the Klamath River and Shasta River temperature TMDLs, also identify sediment control as necessary to achieve the water quality objective for temperature even in the absence of sediment impairment.

Riparian vegetation helps stabilize soils in stream banks and floodplains by reducing scouring forces and increasing the sheer strength of soil through roots. Maintenance of a vegetated buffer provides a control on the discharge of sediment mobilized by surface erosion. Also, the retention of mature trees (and their roots) along a stream bank provides bank stability, reducing the discharge of sediment associated with stream bank landslides and debris flows. Maintenance of a vegetated buffer along streams also can ensure a supply of large woody debris to the stream channel, which is critical for metering of sediment, channel forming processes, and fish habitat.

The Regional Water Board regulates the thermal impacts associated with solar radiation and the shade provided by riparian vegetation as a controllable factor, in the context of associated discharges of waste, such as sediment. The regulation of shade (but not sunlight) coincidentally with discharges of sediment, nutrients, and other wastes in a riparian management approach is a standard approach in nonpoint source regulatory programs.

Reviewers are asked to critique the approach of addressing sediment discharges and temperature concerns associated with riparian vegetation concurrently through the establishment of riparian buffers. The rationale for the finding above is provided in Section 3.4 “Regulation of shade as a controllable factor”, and Section 6.2 “Land use activities with the potential to increase sediment delivery” of the *Staff Report Supporting the Policy for the Implementation of the Water Quality Objectives for Temperature*.

3. The diversion and storage of water has the potential to elevate water temperatures.

Flow alteration has been identified as a cause of unnaturally elevated water temperatures in many temperature TMDLs. Reductions in surface flow decrease the volume of water in the stream, and thereby decrease a stream’s capacity to assimilate heat. When water is removed from a stream the thermal mass and velocity of the water is decreased. Thermal mass refers to the ability of a body to resist changes in temperature. Basically, less water heats or cools faster than more water. Decreases in velocity increase the time required to travel a given distance, and thus increases the time heating and cooling processes can act on the water.

Temperature TMDL analyses completed in the north coast region have found that in-stream impoundments can result in reduced diurnal fluctuations, consequently resulting in reduced feeding opportunities for fish in downstream thermal refuge habitats. Shifts in daily average temperatures resulting in impairment of the spawning beneficial use were identified downstream of large impoundments, as well.

The thermal impacts of the diversion of streams and springs and consequent reduction of stream flows has been evaluated in north coast temperature TMDLs. The Shasta River temperature TMDL analysis found that diversions from Big Springs Creek are resulting in substantial temperature changes downstream. Restoration of cold water flows of a magnitude associated with historic unimpaired flows were predicted to decrease the temperature of Big Springs Creek and Shasta River dramatically, resulting in maximum stream temperature reductions of approximately 1°C to 2°C, with the largest reduction of 2.2°C. These temperature benefits were predicted to persist to the mouth of the river, approximately 30 miles.

The Scott River temperature TMDL analysis also investigated the stream temperature response associated with stream diversions. The Scott River analysis predicted downstream temperature impacts associated with diversions similar to those identified in the Shasta River TMDL analysis. However, the amount of groundwater entering the river was determined to have an even larger influence on Scott River temperatures. The majority of Scott River flows in Scott Valley (and downstream) enter the river as groundwater in Scott Valley, which explains the groundwater influence.

Reviewers are asked to assess the need to address flow related factors as part of the proposed *Policy for the Implementation of the Water Quality Objectives for Temperature*. The rationale for the finding above is presented in Section 6.5 “The location, size, and operation of in-channel impoundments with the potential to alter the natural hydrograph” and Section 6.7 “Land use activities with the potential to reduce instream summer flows or reduce specific sources of cold water in COLD designated waterbodies (e.g., springs and seeps)” of the *Staff Report Supporting the Policy for the Implementation of the Water Quality Objectives for Temperature*.

Approach to Controlling Factors Affecting Water Temperature

4. The Policy comprehensively identifies the temperature factors that must be addressed.

The Policy identifies land use activities and other actions that have the potential to elevate water temperatures (temperature factors) through alteration of the most significant drivers of water temperature. The identified temperature factors are meant to be a comprehensive list of actions and features subject to human control that influence the most significant drivers of stream temperature, as described in the scientific literature and demonstrated in the TMDL analyses. The temperature factors are those activities and features that the Regional Water Board must address to ensure the water quality objectives for temperature are achieved.

The Action Plan has been identifies actions that the Regional Water Board may take to address the threat of temperature impacts associated with the identified temperature factors. The Action Plan elements represent the range of regulatory remedies at the Regional Water Board’s disposal, as well as non-regulatory actions that the Regional Water Board can employ to address the possible temperature impacts associated with the identified temperature factors. It is important that all temperature factors be identified to ensure that the suite of actions identified in the Action Plan are sufficient to address elevated water temperature concerns and achieve the water quality objectives for temperature.

Reviewers are asked to consider whether the Policy comprehensively identifies the actions and features subject to human control that influence the most significant drivers of stream temperature. The discussion of the scientific basis for the actions described in the amendment is presented in “Section 6.0 Justification of the Policy Factors” and associated sub-sections, contained in *Staff Report Supporting the Policy for the Implementation of the Water Quality Objective for Temperature*.

5. Evaluation of the risk of temperature impacts associated with a project is most appropriate on a site-specific, case-by-case basis.

Interpretation of the intrastate water quality objective for temperature at the project scale requires consideration of the particular conditions present in each situation. The drivers of elevated water temperature are well understood; however the site-specific impacts of those drivers in any specific situation, and the degree to which a project is likely to alter those drivers, are best evaluated for each type of situation.

This proposed Policy does not attempt to establish prescriptive rules to address any particular activity on a region-wide basis. Rather, this proposed Policy directs staff to address the possible thermal impacts associated with the identified temperature factors when developing or implementing the terms of permits for activities that may influence those factors, for each case encountered. Given the complexity and site-specific nature of the various factors that drive water temperatures, one-size-fits-all approaches that prescribe the same rules over a wide range of activities and conditions, such as those that exist in the north coast region, risk establishing rules that in some cases are too protective at the expense of land management flexibility, while still not being protective enough to ensure attainment of the objective in others. The approach embraced in this policy recognizes this difficulty and leaves the specifics of any permitting requirements or grant conditions related to temperature controls to be developed based on the specifics of the activity or situation. It is important to note that the proposed Policy does not prevent the Regional Water Board from developing prescriptive rules when developing a regulatory program for a particular activity, if it is appropriate for that activity.

Reviewers are asked to critique the validity of using a case-by-case approach to addressing impacts of projects, as opposed to the establishment of prescriptive rules that apply region wide. The discussion for the finding above is presented in "Section 3.2 Site-specific Implementation", contained in *Staff Report Supporting the Policy for the Implementation of the Water Quality Objective for Temperature*.

6. The types of actions necessary to recover a waterbody that is temperature impaired due to reductions in stream shade are the same types of actions that prevent a waterbody from becoming temperature impaired.

This proposed Policy directs the protection of riparian shade for the control of temperature in both impaired and unimpaired waterbodies. Temperature impaired waterbodies are those that are not meeting the water quality objectives for temperature, whereas unimpaired waterbodies are those that are.

The findings of temperature TMDLs developed in the north coast region are not unique to impaired waterbodies, thus a consistent approach is warranted. The difference in regulatory approaches between impaired and unimpaired waterbodies is a matter of degree of protection. In waterbodies impaired by temperature, no additional temperature

increase can be accommodated. However, in an unimpaired waterbody setting, it is possible that a small increase in temperature can occur without the water quality objective being exceeded (up to 5 °F if it can be demonstrated that beneficial uses won't be adversely affected).

The actions necessary to recover a water body that is temperature impaired due to alteration of the drivers of water temperature are the same types of actions that prevent a waterbody from becoming temperature impaired by such alterations. In the case of a stream with elevated temperatures caused by increased solar radiation resulting from vegetation removal, the action necessary to recover the natural temperature regime is to allow the riparian vegetation to grow back to the degree that the natural shade condition is once again achieved. In the case of a stream with unaltered temperatures, the riparian management action necessary to prevent the elevation of water temperatures is to prevent increases in solar radiation by maintaining sufficient riparian vegetation. In both cases, the riparian vegetation must be maintained and allowed to persist. In order to prevent future temperature impairments and address existing temperature impairments, the regulatory approach to managing riparian vegetation consistent with the water quality objective for temperature and the regulatory approach to managing riparian vegetation to address elevated water temperatures should be consistent throughout the region.

Reviewers are asked to assess the rationale for the approach to regulating activities in impaired vs. unimpaired waterbodies. The rationale is presented in "Section 3.3 Implementation in Impaired vs. Unimpaired Waterbodies" of the *Staff Report Supporting the Policy for the Implementation of the Water Quality Objective for Temperature*.

The Big Picture

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, please comment with respect to the statute language 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 *Policy for the Implementation of the Water Quality Objectives for Temperature* being proposed.

Attachment 3

List of Participants

1. Regional Water Board staff prepared the staff report drawing on information and analyses presented in Total Maximum Daily Load documents established by the USEPA and their associated documentation. USEPA developed these reports using available literature and information, reports prepared by consultants, and reports developed by Regional Water Board staff. Individuals outside of the USEPA and Regional Water Board organizations contributing to TMDL development include the following people:
 - Michael Deas, Watercourse Engineering, Inc.
 - Sarah Null, Watercourse Engineering, Inc.
 - Alida Abbott, Watercourse Engineering, Inc.
 - Andrew Bale, Watercourse Engineering, Inc.
 - Joshua Viers, UC Davis
 - Michael Johnson, UC Davis
 - Joshua Johnson, UC Davis
 - Limor Geisler, UC Davis
 - Jeffrey Kennedy, UC Davis
 - Fraser Shilling, UC Davis
 - Andrew Parker, Tetra Tech, LLC
 - Mustafa Faizullahoy, Tetra Tech, LLC
 - Rui Zou, Tetra Tech, LLC
 - Matt Boyd, Watershed Sciences, Inc.
 - Frank Ligon, Stillwater Sciences, Inc.
 - Peter Baker, Stillwater Sciences, Inc.