Calleguas Creek Watershed Metals and Selenium TMDL

Staff Report

June, 2006

Introduction

This Staff Memorandum discusses Regional Board staff's analysis of key elements of the Calleguas Creek Metals and Selenium TMDL. The proposed TMDL, including numeric targets, allocations, and implementation plan, is based on the TMDL Technical Report, "Calleguas Creek Watershed Metals and Selenium TMDL" prepared by Larry Walker Associates on behalf of the Calleguas Creek Watershed Management Plan, a stakeholder group in the Calleguas Creek Watershed. This staff report documents Regional Board staff's rationale and describes the alternatives considered for proposed TMDL.

This TMDL addresses water quality impairments of Calleguas Creek, including its tributaries, segments and Mugu Lagoon, caused by metals and selenium. Development of these TMDLs was mandated by the Consent Decree between Heal the Bay, et al. and US EPA (C 98 4825, 1999). In accordance with this Consent Decree, US EPA must approve or establish these TMDLs by March, 2007.

Calleguas Creek stakeholders have been actively engaged with US EPA and the Regional Board on a variety of watershed planning initiatives through the Calleguas Creek Watershed Management Plan (CCWMP), an established, stakeholder-lead watershed management group, operating since 1996. The CCWMP includes broad participation from Federal, State and County agencies, municipalities, POTWs, water purveyors, groundwater management agencies, and agricultural and environmental groups. As part of its mission to address issues of long-range comprehensive water resources, including land use, economic development, and open space preservation, the CCWMP proposed to the US EPA and Regional Board that they take a key role in development of the TMDLs for the Calleguas Creek Watershed. US EPA and Regional Board staff have worked directly with CCWMP members and their consultant through an open, collaborative process to develop the Metals and Selenium TMDLs.

This Staff Report discusses staff's rationale for specific TMDL items and alternatives considered.

TMDL Development

During the development of the TMDL reports, Regional Board staff worked with US EPA, the CCWMP and Larry Walker Associates staff on a frequent and regular basis. Outreach and stakeholder comments were solicited through the CCWMP structure, which included monthly steering committee meetings and several subcommittees, responsible for various aspects of watershed management. These meetings were open to the public; agendas and meeting minutes were also published on the CCWMP website: www.calleguascreek.org. In addition to these monthly meetings, the CCWMP, Regional

Board and US EPA staff, and a representative from the City of Camarillo, Sanitation Department, met on a monthly basis to discuss TMDL issues. These meetings were facilitated and noted by staff of the CCWMP, and several of these meetings were attended by representatives of the Calleguas Creek Watershed POTWs, Heal the Bay, and the Ventura County Coastkeeper. Finally, the CCWMP arranged and hosted a public meeting with invitations mailed to 3,000 persons in the watershed in January, 2005.

In addition to stakeholder and public involvement, the TMDL workplan also set forth a Technical Advisory Committee composed of independent reviewers from Universities and National Laboratories for technical review. The Technical Advisory Committee considered issues such as numeric targets, margin of safety, and load allocations. Comments from the Committee were addressed by Larry Walker Associates, and the record of communications, comments and responses were included as an appendix to the TMDL Report. In response to comments from environmental stakeholders regarding transparency of the CCWMP process the CCWMP TMDL development process was reviewed by the UCLA Institute of the Environment (Pendleton and Long, June 2005) from a policy perspective. The report provided several recommendations for improved stakeholder processes, but found that a broad constituency was invited to attend CCWMP meetings and "Overall, the requirement for Regional Board and EPA review of work products was satisfied."

The development of the TMDL reports followed a process in which the CCWMP and LWA prepared draft documents for discussion. Regional Board and US EPA staff considered these approaches and in some instances provided alternative proposals. These alternative proposals were brought back to the CCWMP for consideration and the CCWMP provided direction to LWA staff on how to address the required modifications. During development of the TMDL reports, differences between the US EPA, CCWMP, LWA and the Regional Board staff on technical and policy issues were carefully considered and the TMDL Technical reports were written in consideration of input from all of these sources and represent the discussions of the stakeholder process.

Problem Statement

In developing the Problem Statement, Regional Board and USEPA staff reviewed both water quality data that formed the basis for the 303(d) for metals and selenium and more recent data. For Zinc, the data show that levels in the listed waterbody, Mugu Lagoon, no longer exceed the CTR targets. Of 59 samples taken in Mugu Lagoon since 1998, none showed an exceedance of the CTR zinc criterion. As described below, the linkage analysis for this TMDL is complex and staff supported a decision to focus resources on the other metals which continue to exceed numeric targets. The zinc data used by Regional Board to conclude that the impairment in Mugu Lagoon no longer exists is appended to this Staff Report.

Commenters noted that zinc has not yet been delisted and the TMDL must allocate wasteloads and loads to sources of zinc. Regional Board staff note that Consent

Decree between Heal the Bay and the US EPA states, "In fulfilling its obligations under this Consent Decree, EPA is under no obligation to establish TMDLs for any pairing of a WQLS (water quality limited segment) and a pollutant that EPA determines for purposes of this Decree only, consistent with Section 303(d) of the Act and its implementing regulations, including 40 CFR 130.7(b), as codified as of the Effective Date of this Consent Decree or as subsequently amended, does not require a TMDL or which has been removed after the Effective Date from an EPA approved California Section 303(d) list of waters requiring pursuant to Section 303 (d) (1) of the Act, consistent with the provisions of the Act and EPA's implementing regualtions."

The CCWMP has submitted water quality data to the State Board in 2005 and requested that zinc be delisted in the 2006 303 (d) list. Regional Board staff has discussed with listing status of zinc with State Board staff and understand that State Board staff preliminarily agree that current data do not support continued listing of zinc. State Board staff may review the listing status in the forthcoming 2006 listing cycle. Staff propose that the TMDL Implementation Plan is clarified to Should zinc not be delisted by the end of the 303(d) listing cycle following the effective date of this TMDL, zinc wasteload and load allocations will be developed within one year.

Numeric Targets

Although the 303(d) listings were based on total metals in water, staff advocated for and supported use of multiple targets for different media, including fish tissue, bird egg and sediment targets. Staff rationale for supporting multiple targets was based on differences in the fate and transport between constituents, as well as the need to protect beneficial uses for both human health and wildlife. For example, while excessive copper, nickel and zinc can cause toxicity to aquatic organisms, mercury and selenium can bioaccumulate in fish tissue, and all metals are associated to different degrees with organic compounds, sediment or suspended solids. The fate, transport and effect of these metals necessitate additional targets using multiple media to protect beneficial uses of Calleguas Creek.

The numeric targets selected include environmentally conservative targets relative to other TMDLs adopted statewide. These include targets selected from both promulgated regulations and guidance from resource and regulatory agencies. The multiple targets include those for dissolved metals in the water column, total metals in the water column, metals concentrations in sediment, fish tissue and bird egg targets. Water column targets are based on CTR, while sediment targets are based on NOAA guidance and include the low range of values of those recommended by NOAA. Bird egg targets are also used for both mercury and selenium, the latter proposed in the Mercury TMDL for SF Bay, and the former based on the USFWS Biological Opinion.

An issue raised regarding targets is using the median hardness values, i.e. 50^{th} percentile, rather than the 10^{th} percentile. Regional board staff believe median hardness levels are more representative of the seasonal values in the watershed. Further, the

calculation procedure utilizes an upper limit for hardness as a cap on setting the water quality standard. Regional Board staff note that, except in two reaches during wet weather, when both the 10th and 50th percentiles hardness values exceed the cap, there is no practical difference in using the 10th percentile of the data. For the reaches where there is a difference in hardness values below the cap, the difference between the 10th and 50th percentiles results in an approximate 20% difference in the water quality standards. This difference is compensated by the use of saltwater standards in freshwater reaches, e.g. copper, zinc, and zinc in freshwaters upstream of Mugu Lagoon. Saltwater standards are more conservative than freshwater criteria, and result in more stringent wasteload allocations for POTWs that discharge to freshwater reaches. Also, two other TMDLs adopted by this Board, as well as other metals TMDLs adopted in the state, use a 50th percentile hardness value. Staff believe median hardness data will provide water quality standards for those metals with standards that are hardness dependent.

Alternatives

Alternatives considered by the Regional Board staff regarding water quality targets include use of water quality targets based on either total or dissolved metals. This alternative was rejected because it is not protective of beneficial uses associated with bioaccumulation or uses that can be impaired by high levels of metals in sediments. Further, WLAs derived from these targets may not reflect the mechanism of how metals are loaded into the waterbody (i.e. associated with sediments) and will not result in attainment of water quality objectives.

Linkage Analysis

Comments stated that the linkage analysis is overly complex and not based on sufficient data. Regional Board staff supported the selection of the Hydrologic Simulation Program-Fortran (HSPF) model for the Calleguas Creek Watershed (CCW), since this model has been maintained, refined, and successfully used for watershed water quality analyses for 30 years. HSPF is considered a premier, high-level model among those currently available for comprehensive watershed assessments. HSPF has undergone extensive development and application in the last few decades and is currently supported by both USEPA and USGS.

HSPF simulates watershed hydrology, point and non-point source loading, and receiving water quality for both conventional pollutants and toxicants. The receiving water component allows dynamic simulation of one-dimensional stream channels with several hydrodynamic routing options available. The toxics program combines metals and chemical process kinetics with sediment balance algorithms to predict both the dissolved and particulate-bound concentrations of metals in the upper sediment bed and overlying water column. In addition, HSPF accounts for the variability from different point sources as well as differences in receiving water assimilation, in order to develop concentration-based TMDL waste load allocations (WLAs). The output from the model

can be used to determine allocations on probability estimates of receiving water concentrations rather than worst-case conditions.

For the Calleguas Creek Metals and Selenium TMDL, the model underwent two steps of model calibration. As described in the technical report, the first step of calibration concerns hydrology. The calibration parameters are precipitation, evaporation adjustment factor and soil coefficients, e.g. infiltration rate, field capacity, and porosity (saturated moisture). Most of the coefficients are selected from literature values and adjusted slightly to match the timing and magnitude of Calleguas watershed hydrology. Precipitation and evaporation data were obtained and extended to allow model simulation up to 17 years. Topographic data, soils, land use, and agricultural cropping information were used to develop the model segmentation and input, and detailed streamflow data were selected to allow calibration over a 9 year period (WY 1994-WY 2002) and validation over a separate 6 year period (WY 1988-WY 1993). The procedure and parameters used for hydrology were extensively reviewed by Regional Board staff and are believed to scientifically appropriate.

Water quality calibration proceeded after hydrologic calibration. Water quality calibration follows the same principles as hydrologic calibration, but instead uses temperature, sediment, TSS, hardness, chloride, metals. For Calleguas Creek, many parameters are considered known and therefore are not adjusted. The values of these parameters are also within the range of available scientific literature. The parameters adjusted for Calleguas Creek are the partition coefficient and potency factor. Available in-stream water quality data are from October 1, 1987 through December 31, 2004. For metals and selenium, data from October 1993 to December 2002 were used for calibration of model parameters, and the data from January 2003 through Decembers 2004 were used for validation. After several iterations to minimize relative and absolute errors, a set of best-fit rates were developed, which are within reasonable range of available literature values.

To summarize, there are a large number of parameters that can be adjusted in model calibration. Like any scientific investigation, model calibration is often an iterative process. Further improvements can be made as more data become available. Staff believes the calibration and parameters used for Calleguas Creek Metals TMDL are appropriate and in agreement with available scientific data. All data used for the calibration and validation have been reviewed and checked by the Regional Board staff. Therefore, the proposed WLAs obtained from the calibrated model are believed to be appropriate and the suggested 15% of margin of safety (MOS) for copper and zinc is within a reasonable range.

Staff also supports the method used for the TMDL to calculate the translator, i.e. partition coefficient, between the total and dissolved metals concentrations. This method has been adopted in the EPA guidance on translators ("The Metals Translator: Guidance for Calculating A Total Recoverable Permit Limit From A Dissolved Criterion, EPA 823-B-96-007, June,1996"). EPA guidance indicates "use of the partition coefficient may provide an advantage over the dissolved fraction when using dynamic simulation for

waste load allocation (WLA) or the total maximum daily load (TMDL) calculation …". For the Calleguas Metals TMDL, the translator is a function of adsorbent concentrations (e.g. TSS), and is statistically robust. Therefore, the Regional Board staff considers the translators used in the model are appropriate for the metals TMDL and are on the conservative side.

BATHTUB is a peer reviewed model supported by Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station and was applied to the Mugu Lagoon, the estuary at the mouth of the Calleguas Creek Watershed. The Mugu Lagoon model is developed from the fundamental principal of mass balance, with the entire lagoon modeled of as single completely mixed system. The system can be considered in equilibrium on a daily basis, which means the diluting effect of the flood tide is neglected. The lagoon is modeled as a constant volume system to make the computation of metals concentration conservative, and to ensure water quality standards will be met in Mugu Lagoon. The comparisons of model results with measured data presented in Technical Report have affirmed this assumption.

The model can be used to estimate metals concentration in the benthic sediment. The model estimates suspended sediment deposition during lower flows, and benthic sediment erosion during higher flows. Concurrently, the model tracks the metals content of the suspended and benthic sediment, and models the transfer of metals between the water column and sediment (i.e. partitioning). The only method currently available to assess metals toxicity in sediment is to collect the sediment, perform toxicity tests, and if toxicity is found, then run TIE/TRE type analysis. If the TIE/TRE indicates metals as the source of toxicity, the level of metals in the sediment is considered toxic. The model could then be used to evaluate metals loads and benthic sediment metals content and how they might affect sediment toxicity.

Alternatives Considered

Staff considered several other alternatives for linkage analysis including a mass balance model that was used on previous TMDLs. These alternatives were not selected because they do not account for partitioning and linkages based on hardness, total suspended solids, and benthic effects. The selected models provide a more comprehensive watershed analysis of metals in the Calleguas Creek Watershed.

Margin of Safety

Regional Board Staff find that the proposed TMDL Margin of Safety is appropriate for this TMDL. Staff analysis is based on consideration of several key factors including the stringency of numeric targets, robustness of available data sets, assumptions and sophistication of the linkage analysis model, the use of multiple targets for each constituent, source assessment accuracy, and the magnitude of uncertainty in the TMDL analysis. The data set for modeling hydrology was considered extensive as there

is an established record of rainfall, flow, and soil types in the watershed. For this TMDL, the water quality data set was augmented by a year of current monitoring. The linkage analysis was based on several assumptions, some of which were conservative and some of which were based on median conditions for metals in the watershed. Staff find that the overall results from the model appears to over predict the concentrations in the watershed and therefore is generally conservative. The watershed is relatively limited and the sources and their relative magnitude are reasonable.

Two uncertainties were evaluated in more depth and considered to be significant enough to warrant an explicit margin of safety for these constituents. (1) The calculation of the allowable load is based on the median flow rate for each flow category. (2) The translation between dissolved allowable loads and total allowable loads is calculated using the median translator for each flow category. The allowable loads calculated using the median flow rate and median translator were compared to the variable allowable load calculated using the model flow rate and model translator and compared to the allowable load generated using the environmental data flow and translator. The comparison showed that for the flow and average flow category, the chosen approach was fairly conservative, but it was less conservative for the elevated flow category. The advantages of using flow categories is a more precise identification of the critical conditions for the different metals. A 15% margin of safety was determined to be sufficient to address uncertainties introduced by using different dry weather flow categories.

For mercury and selenium, the model is used to estimate current loads from which the percent reductions are taken to determine allowable loads. Because there are multiple targets based on bioaccumulation of mercury, including its biologically active form – methylmercury, and selenium, and the model is overpredictive of mercury and selenium levels in the waterbody, an explicit margin of safety was considered unnecessary. Therefore, no additional explicit margin of safety is considered for these two constituents.

Staff also considered alternatives for applying the margin of safety to the targets rather than the waste load allocations. Staff finds that the targets selected are based on promulgated regulations and environmentally conservative guidance values, the greatest areas of uncertainty lie in the areas of the linkage analysis so that it is appropriate to apply the margin of safety to calculation of the wasteload allocations.

Wasteload and Load Allocations

Comments state that the allocation procedure is complicated and advocate for a simpler allocation scheme based on based primarily on water column based targets. Although staff agrees that basing allocations on water-based targets may be more straightforward, allocations based on multiple targets will provide more complete protection of beneficial uses. Staff supports the TMDLs allocation scheme because it is based on the most conservative calculation of load reduction required. Additionally, stakeholders are developing a robust, multi-media watershed monitoring program to ensure that beneficial uses are protected. The linkage analysis can be refined with monitoring data and allocations will be reconsidered under the TMDL implementation

plan. Additionally, implementation schemes, such as flow weighted mass loads, are already approved by the Regional Board in the Los Angeles River and by US EPA in the San Diego Creek Metals and Toxics TMDL.

In deriving effluent limits for waste discharge requirements and NPDES permits in the Calleguas Creek Watershed, Staff note that the load based wasteload allocations of this TMDL does not supersede or eliminate the requirements to include concentration based effluent limits in permits, including but not limited to, California Toxic Rule criteria.

Alternatives

Staff considered an alternative allocation scheme for mercury set forth by Heal the Bay. Heal the Bay commented that the allocation scheme used in the remanded San Francisco Bay Mercury TMDL, in which mercury allocations were expressed as total suspended solids loads, required fewer assumptions between the target and allowable annual sediment loads. Staff find the targets for the Calleguas Creek Metals TMDL are more comprehensive than those proposed in the SF Mercury TMDL. In addition, the multiple targets and sediment loads provided are appropriate for the Mugu Lagoon estuarine environment where concern is focused on the estuary as a sink and source for pollutants..

In the absence of further information, technical experts analysis during the development of the TMDL (Technical Advisory Committee) finds the assumption that percent reductions in mercury sediment loads will lead to proportional reductions in water, fish tissue and bird eggs appropriate. However, this assumption will be verified during Implementation and modified if findings show otherwise.