Peer review of selected sections of the report ***Draft Basin Plan Amendment – Total Maximum Daily Loads for Selenium in Freshwater in the Newport Bay Watershed***

Peer review by Judson Harvey, USGS, May 10, 2017

Background: The reviewers were asked to comment on whether the scientific portion of the proposed rule was based upon sound scientific knowledge, methods, and practices through examination of the Staff Report and associated materials. Peer reviewer comments about selenium TMDLs given in this document **only apply** to three freshwater tributary subwatersheds in the Newport Bay watershed (San Diego Creek, Santa Ana-Delhi Channel, and Big Canyon Wash subwatersheds), and do not apply to any other watershed or to saltwater bodies that are further downstream in in the Newport Bay watershed.

Scope of this review: This peer review examines certain aspects of the "linkage analysis" relating to the translation between fish tissue or bird egg concentrations of Selenium to water column concentrations, and aspects of the TMDL and Allocations analysis, aspects of the TMDL and Allocations, and aspects of the TMDL evaluation monitoring, BMP effectiveness monitoring, special studies, etc., and aspects of the site-specific objectives. The reviewer specifically examined aspects of TMDL numeric targets 7-8, 9-10, and 12 in Attachment 2 as summarized by Attachment 1 of the "***Proposed Basin Plan Amendment – Total Maximum Daily Loads for Selenium in Freshwater in the Newport Bay Watershed".*** The peer reviewer further examined the ***"Staff Report" entitled Total Maximum Daily Loads for Selenium in Freshwater: Newport Bay Watershed, Orange County, California*** and its supporting appendices. The Staff Report provides the scientific, technical, and regulatory basis for the development and adoption of an amendment to the Water Quality Control Plan for the Santa Ana River Basin, termed a Basin Plan amendment (BPA), to incorporate these selenium TMDLs for the Newport Bay watershed.

Review comments:

Linkage Analysis, targets 7-8

1) The Staff Report documents that the currently available criteria has been underprotective in the freshwater parts of the Newport Bay watershed, and argues effectively for the use of dominant tissue-based Se concentrations to drive the analysis, using a thoroughly peer-reviewed biodynamic model, with a provision that the fish tissue criterion should be thresholded at two levels based on whether the bird egg concentration criterion has been met, and using as a fall back criterion the water column-based criteria that matches the currently applicable CTR criterion in freshwater.

2) The data set collected between 1999 and 2007 and its targeted updates collected between 2008 and 2014 are well suited for the purpose, representing fish and bird egg tissue concentrations as well as sediment, algae, suspended particulates from the three sub-watersheds.

3) In summary, the biodynamic model results in a range of water column concentrations that can be protective of fish and wading bird consumers. This site specific application in the Newport Bay watershed has a good working data set to support the present

modeling. The data set will be updated and model rerun-as new monitoring data become available.

TMDL and Allocations, target 9

4) The primary source of selenium is mobilization in groundwater of selenium derived from the Monterey formation and transport through the subsurface to the streams. Groundwater levels have been rising over time, and streams flow perennially now unlike in the past as a result of numerous hydrologic changes that have occurred in the basins, including water management practices involving residential and commercial spaces, and water management on municipal open spaces including reservoirs. There are currently widely varying concentrations of selenium measured in groundwater wells and surface water seeps with concentrations throughout the entire watershed varying over a factor of 40. Further isolation of source pathways and evaluation of treatment options would require considerable investment, and may not be practical given uncertain treatment options for selenium, limited space for treatment facilities in the highly urbanized watershed, and given that water quality regulations for selenium are under revision at the federal, state, and local level. Nonetheless it would be of interest to better understand groundwater selenium sources, in particular whether loading is primarily from shallow or flow deep flow paths, residence times, and oxidation/reduction characteristics of water flowing along those pathways.

5) Seasonality was accounted for in the development of the TMDL and Allocations that considers the negative correlation between flow and selenium concentration. Wet and dry season measurements were made in the main channels and used to calibrate flow on the basis of stage measurements. These were supplemented with groundwater measurements, seep measurements, storm drain measurements, etc. Many focused studies were conducted to specifically isolate selenium sources as they relate to subsurface flow generated by golf course irrigation, reservoir storage, etc. This reviewer found the quantity and scope of the available dataset to be impressive and entirely supportive of the analysis that was undertaken. The load analysis itself concentrated on baseflow time periods, which is reasonable given that baseflow is sustained by groundwater discharge which is the source of selenium, which is independently supported by geologic analysis, concentrations measurements in potentials source waters, and hydrogeochemical source tracking. The Staff report shows conclusively that recharge of local precipitation is too small to account for measured mobilization of selenium that is occurring. The hydrogeochemical source tracking analysis identified that there are different sources of recharge to the shallow perched aquifer, apart from the very small contribution from precipitation, that become the primary pathway for mobilizing selenium. If mitigation is ever to be envisioned there could be more learned about the relative contributions from, for example, local residential and commercial irrigation operations, storm drains, reservoir leakage, etc., by expanding the footprint of the hydrogeochemical analysis.

6) The staff report and associated materials argue effectively for the development of SSOs in the coming years based on monitoring of biologic tissue and water column concentrations (rather than sediment concentrations, which are relevant but enormously variable). The SSOs are to be based on monitoring the biological tissue criteria are to be used to derive site-specific water column-based criteria for the sub watersheds. The

SSOs are intended to eventually replace the currently applicable CTR chronic criterion of 5 ug/L for selenium in freshwater with site specific objectives.

TMDL Evaluation Monitoring, BMP Effectiveness Monitoring, special studies, etc. targets 9-10

7) The frequency of Assessment Point Monitoring does not seem to be specified, except to say that is "must be sufficient to evaluate WLAs and Las". The difficulty of such monitoring is representing storm peaks, however the present problem involves subsurface mobilization of selenium which often may be well represented by baseflow monitoring, and thus there is less concern for this application. The degree of selenium dilution during storm peaks should be evaluated in any non-point waste load allocation analysis. No doubt such an analysis was conducted for the present problem, although this reviewer was not successful in finding the analysis in the report materials.

8) All monitoring programs describe water column and flow measurements, from which one of the important outcomes is a load analysis. Substantial load analysis has been conducted, concentrating on baseflow time periods, which is reasonable given that baseflow is sustained by groundwater discharge which is the source of selenium (which is independently supported by geologic analysis, concentrations measurements in potentials source waters, and hydrogeochemical source tracking). The Staff report shows conclusively that recharge of local precipitation is too small to account for measured mobilization of selenium that is occurring. The hydrogeochemical source tracking analysis identified that there are different sources of recharge to the shallow perched aquifer, apart from the very small contribution from precipitation, that become the primary pathway for mobilizing selenium. If mitigation is ever to be envisioned there could be more learned about the relative contributions from, for example, local residential and commercial irrigation operations, storm drains, reservoir leakage, etc., by expanding the footprint of the hydrogeochemical analysis.

Site-Specific Objectives for targets 12

9) In the future the TMDL and allocations are expected to be adjusted iteratively in an adaptive management framework based on a monitoring program that will be used to update and re-run the biodynamic model. For the reasons stated in Attachement 2, the Newport Bay Watershed TMDL will not adopt site specific objectives in water for selenium, instead the tissue concentrations known to be of concern will drive the targets, as informed by the biodynamic modeling, using a fallback water concentrations criterion where necessary, and updating targets as appropriate based on the expanded data sets that become available as a result of monitoring programs. This reviewer finds the stated arguments and approaches chosen to be convincing.