UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

JUN 20 2019

Hope A. Smythe
Executive Officer
Santa Ana Regional Water Quality Control Board
3737 Main Street, Suite 500
Riverside, CA 92501

Subject: Newport Bay Watershed Freshwater Selenium Total Maximum Daily Loads (TMDLs)

Dear Ms. Smythe:

I am pleased to approve the subject TMDLs consistent with the requirements of section 303(d) of the Clean Water Act and 40 C.F.R. Part 130.7(c)(1). Supported by robust science and stakeholder outreach, the Santa Ana Regional Water Quality Control Board has clearly identified TMDLs for selenium in the fresh waters of the Newport Bay Watershed.

The TMDL analysis describes the applicable water quality standards, sources of the pollutant, and quantifies their contribution to the impairment. The analysis includes appropriate numeric targets and linkage calculations, provides reasonable load and waste load allocations to protect the designated uses, and sets reasonable and appropriate TMDLs. EPA's evaluation of the TMDLs is further described in the attached checklist.

I look forward to our continued partnership to advance water quality improvements in the Newport Bay Watershed. Please call me if you would like to discuss further, or your staff may contact Diane Fleck at (213) 244-1836 for specific questions concerning this approval.

Sincerely,

Tomás Torres June 20, 2019
Director, Water Division

Enclosure

cc: Terri Reeder, Santa Ana Regional Water Quality Control Board
Rebecca Fitzgerald, State Water Resources Control Board

Enclosure

Total Maximum Daily Load (TMDL) Checklist

State/Tribe/Territory:	**California (Santa Ana Region)**
Water Bodies:	**Newport Bay Watershed**
Pollutant(s):	**Selenium**
Date of Letter Requesting: EPA Approval	**February 28, 2019**
Date EPA Received: Complete Submittal	**April 29, 2019**
EPA Reviewer:	**Diane E. Fleck. P.E., Esq.** *DEF*

1. Submittal Letter

The Santa Ana Regional Water Quality Control Board (SARWQCB) submittal letter, dated February 28, 2019 from Hope A. Smythe, Executive Officer, to Tomás Torres, EPA Region 9 Water Division Director, requests EPA approval of TMDLs for selenium in the freshwater portions of the Newport Bay Watershed.

The State's submittal package includes:

1) *Total Maximum Daily Loads for Selenium in Freshwater: Newport Bay Watershed, Orange County, California* (Staff Report, dated July 2017);
2) SARWQCB Resolution No. R8-2017-0014, dated August 4, 2017, and Attachment A2 to Resolution No. R8-2017-0014, *Amendment to the Water Quality Control Plan for the Santa Ana River Basin to Incorporate Total Maximum Daily Loads for Selenium in Freshwater: Newport Bay Watershed, Orange County, California* (the Basin Plan Amendment, BPA);
3) State Water Resources Control Board (SWRCB) Resolution No. 2018-0041, dated September 20, 2018, approving the BPA;
4) State of California Office of Administrative Law (OAL), Notice of Approval of Regulatory Action, OAL Matter Number 2019-0307-05, dated April 19, 2019; and
5) Public Notices, Public Comments, and Responses to Public Comments.

EPA considers the submittal complete as of the date of receipt of the full submittal, April 29, 2019, the date of receipt of the OAL Notice of Approval of Regulatory Action.

2. TMDLs Included

The SARWQCB reviewed water column, bird tissue, and fish tissue data collected between 2001 and 2013 throughout the watershed to determine whether the waterbodies in the watershed were impaired for selenium. The San Diego Creek Reach 1 Subwatershed is currently listed on the State's Clean Water Act (CWA) section 303(d) list, and the data confirmed its impairment. The data indicated that the Santa Ana-Delhi Channel Subwatershed and the Big Canyon Wash Subwatershed were also impaired for selenium. The data showed that the other freshwater tributaries to Upper Newport Bay were not impaired, and that Upper and Lower Newport Bay (both saltwater bodies) were also not impaired. (See BPA, pages 3-5 and Staff Report, section 3.5.)

Waterbody ID	Pollutant	Listing Status
San Diego Creek Reach 1 Subwatershed (Freshwater)	Selenium	Listed (2006)
Santa Ana-Delhi Channel Subwatershed (Freshwater)	Selenium	New Impairment Finding
Big Canyon Wash Subwatershed (Freshwater)	Selenium	New Impairment Finding
Other Freshwater Drainages Tributary to Upper Newport Bay (Costa Mesa and Santa Isabel Channels)	Selenium	Confirmation of Finding of Non-Impairment
Upper Newport Bay (Saltwater)	Selenium	Confirmation of Finding of Non-Impairment
Lower Newport Bay (Saltwater)	Selenium	Confirmation of Finding of Non-Impairment

The SARWQCB compared the California Toxics Rule (CTR) (40 C.F.R. 131.38 et seq.) water column selenium freshwater and saltwater aquatic life criteria with the water column data to determine impairment, and the bird and fish tissue numeric targets with the tissue data to determine impairment. Since the CTR criteria apply in the watershed, these are appropriate comparisons to determine whether impairment exists. The bird and fish tissue targets are also appropriate comparisons to determine impairment, as explained below in the Numeric Targets section.

EPA concurs with the SARWQCB's findings of impairment and concludes that it is appropriate to develop and establish TMDLs for selenium for the San Diego Creek Reach 1 Subwatershed, the Santa Ana-Delhi Channel Subwatershed, and the Big Canyon Wash Subwatershed.

3. Water Quality Standards

The TMDLs address selenium impairments for aquatic life and aquatic-dependent wildlife uses in the Newport Bay Watershed.[1] The applicable aquatic life and aquatic-dependent wildlife uses include: protection of warm freshwater habitat (WARM), estuarine habitat (EST), marine habitat (MAR), wildlife habitat (WILD), rare, threatened, or endangered species (RARE), spawning, reproduction, and development (SPWN), and preservation of biological habitats of special significance (BIOL). (See BPA, page 2 and Staff Report, section 3.2.1.)

EPA concurs that these are the applicable aquatic life and aquatic-dependent wildlife uses in the watershed. See Chapter 3, Beneficial Uses, of the *Water Quality Control Plan for the Santa Ana River Basin* (Basin Plan) at: RB8 Basin Plan.

The SARWQCB found that two narrative water quality objectives for toxic substances apply in the watershed (see BPA, page 3 and Staff Report, section 3.2.3):

1. Toxic substances shall not be discharged at levels that will bioaccumulate in aquatic resources to levels which are harmful to human health; and
2. The concentrations of toxic substances in the water column, sediments or biota shall not adversely affect beneficial uses.

Since selenium bioaccumulates in and up the aquatic food chain, the most sensitive uses are for the protection of aquatic-dependent wildlife, which are protected by the narrative water quality objective for the protection of all beneficial uses (narrative objective 2. above). EPA concurs that the two narrative objectives apply in the watershed, and that aquatic life and aquatic-dependent wildlife uses will be protected from the harmful effects of toxic substances.

The SARWQCB found that the CTR numeric selenium aquatic life water quality criteria also apply in the watershed. The applicable numeric aquatic life selenium criterion in the freshwater areas of Newport Bay Watershed is 5 micrograms per liter (µg/L) total recoverable selenium (4-day average, chronic value), and the applicable numeric aquatic life criteria in the saltwater areas are 71 µg/L total dissolved selenium (4-day average, chronic value) and 290 µg/L total dissolved selenium (short period of time, acute value) (see BPA, page 3 and Staff Report, section 3.2.2.). EPA concurs that these are the applicable CTR water quality criteria for the watershed.

EPA concurs with the SARWQCB's identification of applicable water quality standards, i.e., the aquatic life and aquatic-dependent wildlife beneficial uses, the narrative toxic substances water quality objectives, and the CTR numeric aquatic life water quality criteria.

[1] Big Canyon Wash is not listed in the SARWQCB's *Water Quality Control Plan for the Santa Ana River Basin* as a separate water body; it is a tributary to Upper Newport Bay. Since downstream uses must be met, the water quality standards for Upper Newport Bay are applied for the TMDL analyses.

4. Numeric Targets

Numeric targets for the freshwater TMDLs include fish tissue selenium targets, a bird egg tissue selenium target and a water column selenium target, to protect aquatic life and aquatic-dependent wildlife, the most sensitive uses, against reproductive effects, the most sensitive endpoint. The tissue-based targets are an interpretation of the narrative toxic substances objective for the protection of beneficial uses. Tissue targets are included because selenium accumulates primarily through diet, and tissue-based targets (and criteria) are a more direct indicator of the health of aquatic life and aquatic-dependent wildlife (e.g., birds) within the watershed, and are directly calculated from reproductive effect concentrations. An annual averaging period (utilizing a geometric mean) will be used to determine attainment of the tissue targets. The CTR water column values are included to ensure that current water quality standards for the protection of aquatic life are achieved.[2]

The numeric targets for the TMDLs are divided into two categories with different fish tissue targets: one applies where the bird egg target has been met, and the other applies where the bird egg target has not been met. If the bird egg target of 8 micrograms per gram dry weight[3] (µg/g dw) has been attained, a higher (less stringent) fish tissue target of 8.1 µg/g dw applies. This fish tissue target serves as a protective target for fish (i.e., aquatic life), as a separate endpoint. The bird egg target serves to protect shorebirds (i.e., aquatic-dependent wildlife). Where the bird egg target has not been attained, a lower (more stringent) fish tissue target of 5 µg/g dw applies. The lower fish tissue target serves as a protective dietary (prey fish) target for aquatic-dependent shorebirds to ensure their protection, and only applies if the bird egg target is not being attained at a fish tissue concentration of 8.1 µg/g dw. Since the dietary fish tissue target for shorebirds is lower than the fish tissue target for fish, both aquatic life and aquatic-dependent wildlife will be protected. The fish tissue targets are whole body values.

If the bird egg target is attained at a fish tissue concentration below 8.1 µg/g dw (or below 5 µg/g dw), then that fish tissue concentration becomes the site-specific fish tissue target for that area (and both aquatic life and aquatic-dependent wildlife will be protected). Below is the table of targets from the BPA, page 6:

[2] EPA proposed amending the CTR chronic freshwater selenium water column water quality criterion on December 13, 2018 to include bird egg tissue and fish tissue elements for the protection of both aquatic life and aquatic-dependent wildlife (83 FR 64059). EPA is currently responding to public comments. The SARWQCB tissue targets are consistent with the December 13, 2018 EPA proposal.

[3] All concentration values throughout this document are in concentrations of selenium, e.g., micrograms of selenium per gram of tissue in dry weight (µg selenium/g dw).

Numeric Targets for Selenium in the Newport Bay Watershed

Tissue-based Numeric Targets Where Bird Egg Tissue Targets Not Attained[1,2]		Water Column-based Numeric Target[3]
Bird Egg[4] Tissue	**Fish Tissue**	**Freshwater Water Column**
8 µg Se/g dw	5 µg Se/g dw OR site-specific fish tissue concentration at which the bird egg target is met	5 µg Se/L
Tissue-based Numeric Targets Where Bird Egg Tissue Targets Attained[1,2]		**Water Column-based Numeric Target[3]**
Bird Egg[4] Tissue	**Fish Tissue**	**Freshwater Water Column**
8 µg Se/g dw	8.1 µg Se/g dw	5 µg Se/L

[1] The tissue-based targets are subject to revision upon adoption and approval of revised objectives (e.g., site- specific objectives). Such revisions would require a Basin Plan Amendment.

[2] The applicable fish tissue numeric target depends upon the attainment of the bird egg target.

a. Where the bird egg target is attained, the fish tissue target of 8.1 µg Se/g dw applies. This target serves as a protective target for fish as a separate endpoint.

b. Where the bird egg tissue target is not attained, the fish tissue target of 5 µg Se/g dw, or a site-specific fish tissue concentration at which the bird egg target is met, applies. This target serves as a protective dietary target for aquatic-dependent shorebirds and only applies if the bird egg tissue target is not being attained at a fish tissue concentration of 8.1 µg Se/g dw.

[3] Target is based on CTR criterion for freshwater. This target will no longer be in effect once the CTR freshwater criterion has been replaced by revised objectives (e.g., SSOs).

[4] Aquatic-dependent shorebirds.

Fish Tissue Targets: The SARWQCB chose the 8.1 µg/g dw fish tissue target value from EPA's 2014 draft CWA section 304(a) national recommended freshwater selenium water quality criterion.[4] This whole body fish tissue value is slightly more stringent than EPA's final CWA section 304(a) national recommended freshwater selenium water quality criterion. EPA's final criterion[5] consists of the following elements and is tiered, i.e., where data are available for egg/ovary, whole body or muscle, and water, the tissue data supersedes the water data, and egg/ovary data supersedes whole body or muscle data (see table below, footnotes 2 and 3):

[4] *External Peer Review Draft Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater 2014;* EPA 822-P-14-001; May 2014; U.S. EPA Office of Water; Washington, D.C.

[5] *Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater 2016*; EPA-822-R-16-006, June 2016; U.S. EPA Office of Water; Washington, D.C.

National Recommended Freshwater Selenium Water Quality Criterion for Aquatic Life

Media Type	Fish Tissue[1]		Water Column[4]	
Criterion Element	**Egg/Ovary[2]**	**Fish Whole Body or Muscle [3]**	**Monthly Average Exposure**	**Intermittent Exposure[5]**
Magnitude	15.1 mg/kg dw	8.5 mg/kg dw whole body or 11.3 mg/kg dw muscle (skinless, boneless filet)	1.5 µg/L in lentic aquatic systems; 3.1 µg/L in lotic aquatic systems	$WQC_{int} = \frac{WQC_{30-day} - C_{bkgrnd}(1 - f_{int})}{f_{int}}$
Duration	Instantaneous measurement[6]	Instantaneous measurement[6]	30 days	Number of days/month with an elevated concentration
Frequency	Not to be exceeded	Not to be exceeded	Not more than once in three years on average	Not more than once in three years on average

1. Fish tissue elements are expressed as steady-state.
2. Egg/Ovary supersedes any whole-body, muscle, or water column element when fish egg/ovary concentrations are measured.
3. Fish whole-body or muscle tissue supersedes water column element when both fish tissue and water concentrations are measured.
4. Water column values are based on dissolved total selenium in water and are derived from fish tissue values via bioaccumulation modeling. Water column values are the applicable criterion element in the absence of steady-state condition fish tissue data.
5. Where WQC30-day is the water column monthly element, for either a lentic or lotic waters; C_{bkgrnd} is the average background selenium concentration, and f_{int} is the fraction of any 30-day period during which elevated selenium concentrations occur, with f_{int} assigned a value ≥0.033 (corresponding to 1 day).
6. Fish tissue data provide instantaneous point measurements that reflect integrative accumulation of selenium over time and space in fish population(s) at a given site.

EPA's revised freshwater selenium criterion is based on the same scientific principle as the SARWQCB targets: since selenium bioaccumulates in the food chain, a more direct metric for evaluating reproductive selenium toxicity in wildlife is selenium tissue levels. Since the SARWQCB's numeric whole body fish tissue target of 8.1 µg/g dw for the protection of aquatic life is slightly more stringent than EPA's final national recommended numeric whole body fish tissue value of 8.5 µg/g dw, EPA finds the SARWQCB fish tissue target reasonable and appropriate to protect aquatic life.

The SARWQCB chose the 5 µg/g dw target as a protective dietary target, for areas where the bird egg target is not attained. The U.S. Fish and Wildlife Service (USFWS), Department of the Interior (DOI) recommended this value for the protection of shorebirds in the Newport Bay Watershed (see Staff Report, section 4.1.2).

The Staff Report states at page 4-7:

> As early as 1998, the USDOI's selenium guidelines identified a toxicity threshold range of 4-6 µg Se/g dw (whole body) for fish (USDOI, 1998); a value of 5 µg Se/g dw lies in the middle of that range (J. Skorupa, USFWS, electronic communication dated October 20, 2008).
>
> . . .
>
> Even though there is some uncertainty regarding the sensitivity of shorebirds to selenium, USFWS staff have supported the 5 µg Se/g dw dietary fish tissue concentration as sufficiently protective of the birds foraging in the freshwater areas in the Newport Bay

> watershed, including federally listed species: a shorebird - Ridgway's Rail (*Rallus obsoletus levipes*; formerly known as the Light-footed Clapper Rail), and a piscivorous bird - the California Least Tern (*Stema antillarum brownie*) (J. Skorupa, USFWS, electronic communication, October 20, 2008).

EPA supports the 5 µg/g dw whole body fish tissue target as a dietary value for fish for the protection of aquatic-dependent wildlife, in areas where the bird egg target is not attained. In areas where the bird egg target is attained, the 8.1 µg/g dw target for fish is sufficiently protective. A lower fish tissue value (i.e., more stringent dietary protection) is only necessary in areas where the bird egg target is not being attained. The 5 µg/g dw (prey) fish tissue target (the fish tissue value between 8.1 and 5 µg/g dw, or below 5 µg/g dw, if necessary, that meets the bird egg target), is reasonable and appropriate to protect aquatic-dependent wildlife.

Bird Egg Target: The SARWQCB chose the 8 µg/g dw bird egg target after a thorough literature review and analysis of threshold values of selenium reproductive effects in birds, based on selenium concentrations in bird eggs (see Staff Report, section 4.2). Reduced hatching is considered the most sensitive reproductive endpoint for effects, and effect levels in the review ranged from 6-7 µg/g dw to 14 µg/g dw (see Staff Report, page 4-8). The SARWQCB then consulted with USFWS to determine ranges of no-effect concentrations (NECs) and 10% low-effect concentrations (EC_{10}s). USFWS found that the ranges overlapped and recommended a value of 8 µg/g dw. The SARWQCB agreed with the recommended value. The Staff Report at page 4-10 states:

> … The range of plausible EC_{10} values overlaps the true NEC for many datasets. The upper end of this range of possible NECs (8 µg/g Se/g dw) has been judged by USFWS staff to represent sufficient conservatism based on the specific bird species present in the Newport Bay Watershed, including the federally listed California least tern and Ridgway's rail (J. Skorupa, USFWS, electronic communication dated October 20, 2008).

EPA on December 18, 2018 proposed a selenium water quality criterion for freshwaters in California that included a bird egg tissue element based on a review and analysis of reproductive effects on birds, including many species that live in California. EPA proposed a value of 11.2 milligrams per kilogram dry weight (mg/kg dw).[6] See 83 FR 64059, December 13, 2018; Docket ID No. EPA-HQ-OW-2018-0056 at: EPA Docket 2018-0056. The complete literature review and analysis of the derivation of EPA's bird egg element is contained in *DRAFT Aquatic life and Aquatic-Dependent Wildlife Selenium Water Quality Criterion for Freshwaters of California (November 2018)*, US EPA Region 9 and US EPA Office of Water (EPA Technical Support Document, EPA TSD). EPA's value of 11.2 µg/g dw is an EC_{10} value, based on studies of mallard ducks which were determined to be the most sensitive bird species for which sufficient, quality data existed to calculate effects concentrations. See EPA TSD, Part 4, Effects Analysis of Aquatic-Dependent Wildlife.

The SARWQCB bird egg target of 8 µg/g dw was derived using site-specific considerations, and is slightly more protective than EPA's proposed bird egg tissue element of 11.2 µg/g dw for

[6] Mg/kg dw is equivalent to µg/g dw.

freshwaters in California. EPA concurs that the SARWQCB's bird egg target is reasonable and appropriate, and protective of aquatic-dependent wildlife in the Newport Bay Watershed.

Water Column Target: The SARWQCB chose 5 µg/L total recoverable selenium, 4-day average, as a numeric water column target, consistent with the CTR. The CTR contains the currently applicable federal water quality freshwater criterion for aquatic life, 5 µg/L total recoverable selenium, 4-day average (see 40 C.F.R. 131.38 et seq.). EPA concurs that the SARWQCB numeric water column target is reasonable and appropriate for the protection of aquatic life and for inclusion in the TMDL analysis.

EPA concludes that the SARWQCB's bird egg tissue, whole body fish tissue, and water column numeric targets in the TMDL analysis are reasonable and appropriate; EPA finds adequate basis for each of the targets. All targets concurrently apply, and all targets must be achieved through the TMDL. The targets are established at a level necessary to attain and maintain water quality standards.

5. Source Analysis

The SARWQCB conducted a detailed analysis of all sources of selenium in the watershed, and categorized them as either point or non-point sources (see Staff Report, section 5.0 Source Analysis). Loads in pounds (lbs) of total selenium (based on measured or calculated water column concentrations and estimated volumes of flow) were estimated for each source on a subwatershed or total watershed basis if data were not available to determine loads on a subwatershed basis. Point sources included: urban runoff;[7] groundwater dewatering; groundwater dewatering and cleanup; and nursery operations. Groundwater dewatering refers to the City of Irvine's discharge under an amended Time Schedule Order (TSO),[8] in the San Diego Creek Subwatershed. Groundwater dewatering and cleanup refers to the general discharge permit for several dischargers in the San Diego Creek/Newport Bay Watershed, who are now covered under an amended TSO.[9] See Staff Report, sections 5.2.2 and 5.2.3 for a complete history. Nonpoint sources included: agricultural discharges; atmospheric deposition; open space; and rising groundwater.

Load estimates were calculated on an annual basis, and on a seasonal basis if data existed, i.e., during the summer season, April 1 to September 30, and during the winter season, October 1 to March 31. The seasons were chosen to better characterize the seasonal risk to spring-nesting shorebirds and waterfowl.

Urban runoff was estimated using a surrogate site (the Costa Mesa Channel watershed) because of its small size (one square mile), extensive dataset, predominately urban uses, and lack of impacts from groundwater seepage; urban runoff estimates for other areas and watersheds were

[7] Although the SARWQCB calls urban runoff a point source, it is not associated with any permit, and was calculated as an aggregate load in each subwatershed based on area (size).

[8] TSO No. R8-2009-0070 as amended by Order Nos. R8-2013-0061 and R8-2014-0026.

[9] TSO No. R9-2009-0069 as amended by Order Nos. R8-2013-0060 and R8-2014-0025.

calculated using the (surrogate) runoff estimate times the size of the area. Other point and nonpoint source loads were calculated using detailed methods based on appropriate water column concentrations and estimated flow volumes. For each source (i.e., for each set of calculations), the SARWQCB included tables detailing how calculations were made, including tables of parameters and assumptions, and calculation procedure notes.

The SARWQCB included a summary table in the Staff Report, detailing the loads of selenium from each source to the watershed (see Staff Report, Executive Summary, Table ES-2 and Staff Report, section 5, Table 5.21):

Table ES-2 and Table 5.21. Summary of Total Selenium Sources in the Newport Bay Watershed[1]

	Annual		Winter Season (October 1 – March 31)		Summer Season (April 1 – September 30)	
	Selenium Load (lbs)	Median Concentration (µg/L)	Selenium Load (lbs)	Median Concentration (µg/L)	Selenium Load (lbs)	Median Concentration (µg/L)
San Diego Creek Subwatershed						
Urban Runoff	102	0.90	95	0.92	7.8	0.89
Groundwater Dewatering (Irvine)[2]	14	29	7.5	28	6.5	30
Groundwater Dewatering (General Permit)[3]	12	35	9	31	3	36
Nursery Operations[4]	--	<10	--	<10	--	<10
Agricultural Discharges	2.6	1.5	--	--	--	--
Open Space	15	3.9	--	--	--	--
Rising Groundwater	757 – 867	--	492-564	--	265-304	--
Atmospheric Deposition	0.3	--	0.1	--	0.2	--
Santa Ana-Delhi Channel Subwatershed						
Urban Runoff	13	0.90	12	0.92	1.0	0.89
Groundwater Dewatering (General Permit)	8.4	35	4.4	31	4.1	36
Rising Groundwater	107 - 128	--	64-77	--	42-51	--
Big Canyon Wash Subwatershed						
Urban Runoff	2.3	0.90	2.2	0.92	0.18	0.89
Rising Groundwater	28-30	--	14-15	--	14-15	--
Newport Bay Watershed[5]						
Agricultural Discharges	2.6	1.5	--	--	--	--
Open Space	15	3.9	--	--	--	--
Atmospheric Deposition	3.8	--	0.8	--	3.0	--

[1] The values are rounded as follows: < 1-10 to the nearest tenth; >10 to the nearest one. Due to the rounding, the individual values do not always sum to the total shown. The uncertainty will also be accounted for within the TMDL margin of safety (MOS).

[2] City of Irvine Culver, Jamboree, and Jeffrey locations.

[3] Special discharge permits were issued for sewered discharges (e.g., Caltrans) and, therefore, this estimated load only corresponds to current discharges to receiving waters.

[4] Not considered a significant source for these selenium TMDLs.

[5] Due to data limitations, assessment for these non-point sources of selenium were conducted at the entire watershed scale (not delineated by subwatersheds). Therefore, the values shown should be considered as upper bound estimates as not all areas of the watershed are subject to these selenium TMDLs.

In addition to the detailed calculations summarized in the table, the SARWQCB made several key conclusions in the BPA and in the Staff Report to clarify important issues (see BPA, page 7-8 and Staff Report, section 5.6):

• Groundwater is the predominant source of selenium in the Newport Bay Watershed. It enters surface waters either through point source discharges (e.g., dewatering operations) or more commonly through NPS rising groundwater. Of these sources, NPS rising groundwater is the major source of selenium in the watershed.

• Urban runoff is not a significant source of selenium. From a load perspective, urban runoff generates a relatively high load. However, this load is driven by volume, not concentration. Urban runoff concentrations are well below the CTR freshwater chronic criterion, with an annual median concentration of 0.90 µg/L, and a maximum concentration of 3.1 µg/L.

• Discharges from the City of Irvine's dewatering operations contain moderate concentrations of selenium (annual median concentration of 29 µg/L), but generate a relatively minor annual load of 14 lbs/year, which has been drastically reduced in recent years.

• General dewatering discharges are highly variable from year to year. Caltrans and Irvine Ranch Water District have consistent dewatering activities, with the Caltrans dewatering accounting for an estimated annual load averaging 51 lbs in the winter season and 52 lbs in the summer season. Caltrans currently sewers the groundwater, but it would otherwise represent both a significant source from a concentration as well as load perspective if discharged to surface waters. However, Caltrans is unlikely to discharge to receiving waters in the future except under exceptional circumstances.

• Other than Caltrans loads, which are sewered, the groundwater dewatering and cleanup selenium loads were not consistent from year to year during the period of record because many are short-term discharges and their loads can be highly variable.

• Atmospheric deposition, agricultural runoff, open space runoff, and nursery discharges are all considered relatively insignificant sources of selenium.

EPA finds the SARWQCB's source analysis (including the detailed calculations for each source, the summary table, and the key conclusions) to be thorough and complete.

6. Linkage Analysis

The linkage analysis establishes the relationship between the pollutant loading and the numeric targets, and defines the TMDL or loading capacity of the receiving waters to determine the reductions needed to attain water quality standards (as expressed by the numeric targets).

The linkage between selenium loading and the numeric tissue selenium targets is complex but direct. The numeric tissue targets are in bird and fish tissue selenium concentrations that are directly linked to reproductive effect levels in aquatic life and aquatic-dependent wildlife (see discussion in section 4. Numeric Targets above; the SARWQCB's Staff Report at section 4.0 Numeric Targets; and EPA's proposed selenium criterion for freshwaters in California, 83 FR 64059, December 13, 2018 and EPA TSD). The water column numeric target is the current water quality criterion for the protection of aquatic life in the CTR (40 C.F.R. 131.38 et seq.). The targets, TMDLs, loading capacity, and allocations are all concentration-based values.

The Linkage Analysis in the Staff Report links the bird and fish tissue concentrations with water column concentration-based TMDLs, loading capacities, and allocations. The SARWQCB used the US Geological Survey (USGS) biodynamic model, the Ecosystem-Scale Selenium Model, which models the fate and transport of selenium through the food chain, to estimate site-specific water column values that directly correspond to the tissue targets. The USGS model, using site-specific ecosystem information, translates tissue selenium concentrations into probable water column selenium concentrations, or alternatively, can translate water column concentrations into probable tissue concentrations. The model uses detailed site-specific water body information and comprehensive site-specific aquatic life and aquatic-dependent wildlife species food chain information to determine probable values.

The USGS first published a selenium fate, transport and biological uptake methodology in *Forecasting Selenium Discharges to the San Francisco Bay-Delta Estuary: Ecological Effects of a Proposed San Luis Drain Extension,* USGS Open-File Report 00-416.[10] This publication was revised and superseded by USGS Professional Paper 1646[11]. As discussed in Professional Paper 1646, the methodology was validated using field data and peer reviewed through the USGS Fundamental Science Practices review process before publication. The methodology outlined in Professional Paper 1646 is the basis of the Ecosystem-Scale Selenium Model, which is explained

[10] U.S. Geological Survey by S.N. Luoma and T.S. Presser. 2000. *Forecasting Selenium Discharges to the San Francisco Bay-Delta Estuary: Ecological Effects of a Proposed San Luis Drain Extension,* USGS Open-File Report 00-416. At: http://pubs.usgs.gov/of/2000/ofr00-416/.

[11] U.S. Geological Survey by T.S. Presser and S.N. Luoma. 2006. *Forecasting Selenium Discharges to the San Francisco Bay-Delta Estuary: Ecological Effects of a Proposed San Luis Drain Extension,* Professional Paper 1646. At http://pubs.usgs.gov/pp/p1646/.

in a published paper by Theresa Presser and Sam Luoma.[12] The model consists of a set of equations which are included in the BPA at pages 8 and 9.

The SARWQCB worked directly with USGS (Theresa Presser and Sam Luoma) to apply the model in several areas within the Newport Bay Watershed to translate the bird and fish tissue targets into site-specific water column concentrations. The water column concentrations were then used to develop and set allocations for the sources in each subwatershed (concurrent with the CTR's 5 µg/L water column criterion, the currently applicable water quality criterion).

The Staff Report at page 6-2 summarizes the USGS work:

> USGS adapted the Bay-Delta selenium biodynamic model to the Newport Bay watershed to calculate water column concentrations from tissue-based numeric targets recommended for the protection of fish and aquatic-dependent wildlife in the watershed (Presser and Luoma, 2009). To apply the biodynamic model to the Newport Bay watershed, USGS staff used available site-specific data on seasonal concentrations of selenium in water, waterborne particulates, algae, surficial bed sediment, aquatic invertebrates, fish, and bird eggs as input values into the model. The conceptual model developed for the freshwater areas in the Newport Bay watershed (Section 6.1) provided information used in the biodynamic model on the selenium transfer pathways for the different hydrologic compartments and food webs in the watershed. A discussion of the biodynamic model input parameters, model runs, and results is included in Section 6.2.

A copy of the 2009 USGS report is included in the Staff Report as Appendix J. USGS (Theresa Presser and Sam Luoma) updated the 2009 modeling with data collected through 2014. The revised modeling and results are included in the Staff Report as Appendix O. The revised input parameters (e.g., partitioning coefficients or K_ds and site-specific trophic transfer factors or TTFs for species within the food chains) are described and summarized in section 6.2.4 of the Staff Report. The updated modeling is the basis of the initial tissue-based water column allocations. The BPA at page 11summarizes the results of the updated modeling:

[12] Presser, T.S., and S.N. Luoma. 2010. A Methodology for Ecosystem-Scale Modeling of Selenium. *Integrated Environmental Assessment and Management* 6:4:685-710 (plus Supporting Information).

Ambient Selenium Water Column Concentrations (µg/L) Compared to the Range in Probable Selenium Water Column Concentrations (µg/L) Predicted by the Biodynamic Model Using the Proposed Numeric Tissue Targets for Selenium (predicted water column concentrations are rounded to the nearest whole number)

	San Diego Creek Subwatershed[1]					Santa Ana-Delhi Channel Subwater-shed	Big Canyon Wash Sub-watershed
	Lower San Diego Creek	Peters Canyon Wash	IRWD Constructed Treatment Wetlands	Combined Lower SDC & IRWD Wetlands	San Joaquin Marsh Reserve (UCI Wetlands)		
	Ambient Water Column Concentrations ± 95% confidence interval						
	13.8±0.4	30±1.3	14.4±1.5	14.2	2.3 ±0.7	10.7±0.5	15±1.9
Tissue Target	Predicted Probable Selenium Water Column Concentrations						
8.1 µg Se/g dw[2]	6 - 10	16 - 27	8 - 10	8 - 10	2	16	2 - 3
8 µg Se/g dw[3]	11 - 19		7 - 9	10	2		1
5 µg Se/g dw[4]							1 - 2

[1] For purposes of these proposed selenium TMDLs, allocations are established at the subwatershed or channel scale. The San Diego Creek subwatershed was modeled at a more refined scale to guide management actions.

[2] Numeric Target for protection of fish. Highest confidence in terms of best fit validation.

[3] Numeric Target for the protection of birds. Poorest fit to model because of variable bird species, diets, foraging ranges, and uncertainty in trophic transfer factor from invertebrates to birds to their eggs. Water values are least certain for this target. Probable selenium water column concentrations were not predicted for Santa Ana-Delhi Channel based on the absence of bird data from this area. Probable selenium concentrations were not predicted for Peters Canyon Wash because there is less certainty in establishing a justifiable water column concentration based upon modeling for bird eggs because of the difficulty in validating the model for bird eggs.

[4] Numeric Target for fish – as a dietary item for the protection of aquatic-dependent birds, particularly shorebirds. Where birds meet the bird egg tissue target, the fish tissue-based dietary target is not applicable. Therefore, based upon current data, only the areas where the bird egg tissue target is not being met include probable water concentrations to meet the fish tissue target of 5 µg Se/g dw.

This use of the USGS's Ecosystem-Scale Selenium Model to translate target tissue values into site-specific water column concentrations is consistent with EPA's proposed freshwater selenium criterion for California (83 FR 64059, December 13, 2018), and represents the best scientific approach to determining protective water column concentrations for implementation of tissue criteria (or tissue targets for TMDLs). The USGS model is a mechanistic model and is the basis of the mechanistic method in EPA's document, *Draft Translation of Selenium Tissue Criterion Elements to Site-Specific Water Column Criterion Element for California Version 1*, August 8, 2018 (83 FR 64059, December 13, 2018). This is one of two proposed performance-based methodologies in EPA's proposed rule for California that may be used for determining site-specific water column-based elements associated with the tissue-based elements (the proposed bird egg tissue and fish tissue elements).

The SARWQCB submittal considers detailed site-specific information for the watershed, and employs the best science available for its linkage analysis. EPA concludes the SARWQCB's linkage analysis is reasonable and appropriate.

7. TMDL and Allocations

A TMDL is the calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that pollutant. The TMDL equals the sum of wasteload allocations (WLAs) (from point sources) plus the sum of load allocations (LAs) (from non-point sources) plus a margin of safety (MOS): TMDL = ΣWLA + ΣLA + MOS. TMDLs can be mass-based or concentration-based. Loading capacity or assimilative capacity is the increment between existing quality and what is established by the criterion as necessary to protect uses (see: US EPA Website High Quality Waters).

The TMDLs, loading capacities and allocations for each of the subwatersheds in the Newport Bay watershed are concentration-based. The TMDLs for the subwatersheds are set equal to the loading capacities; the loading capacities are set equal to the allocations. The initial Phase 1[13] allocations include the upper end of the water column selenium concentration range of the site-specific translated tissue-based targets from the Linkage Analysis. The CTR 5 µg/L water column criterion is a concurrent, concentration-based allocation in each of the subwatersheds.

Tissue-Based TMDLs/Loading Capacities/Allocations Adjustments: To allow for minor adjustments in the tissue-based TMDLs (and loading capacities and allocations), the BPA at page 12 states:

> As there is inherent uncertainty with any model, including the biodynamic model, the actual water column concentrations at which the tissue-based targets are attained may differ from the predicted concentrations derived in the Linkage Analysis. **Therefore, once the tissue-based numeric targets are attained, the tissue-based loading capacity/TMDL is equivalent to the water column concentrations that achieve those tissue-based concentrations [emphasis/bold added].**

Since the biodynamic model produces a limited range of predicted water column values associated with each tissue target, the SARWQCB is allowing for minor adjustments to better reflect the value of the translated tissue target: if the fish and/or bird tissue target is attained with a slightly different water column concentration than the initial value chosen from the linkage analysis, then that water column concentration will be the tissue-based TMDL (and loading capacity and allocation). This is an efficient way to allow for minor corrections, when the precise water column value is not known, and initially chosen from a range of translated values.

Averaging Periods: To protect during critical conditions and set averaging periods for the water column allocations, the BPA at pages 12 and 13 states:

> Protection of beneficial uses requires consideration of both the periods of highest selenium exposure (dry weather flows) and the periods of greatest potential harm to the beneficial uses (breeding season and periods of embryonic and/or juvenile development). Dry weather conditions with flows occur year-round, and therefore, present potential

[13] The SARWQSB adopted phased TMDLs that include compliance schedule authorizing provisions to attain final allocations and water quality standards. EPA is separately reviewing the compliance schedule authorizing provisions for the TMDLs.

periods of high selenium exposure all year. The period of potential greatest harm due to selenium exposure occurs seasonally (spring and early summer). As a result, consideration of seasonal variations could result in the development of different allocations for different periods of the year or the application of the allocations only during the breeding season. However, to ensure protection of beneficial uses both during the sensitive period and from the higher selenium concentrations that occur during dry weather, a year-round application of the TMDLs and allocations during dry weather conditions is the most protective approach.

Further, to evaluate the influence of seasonality and to provide the most protective assessment of beneficial uses, an averaging period for the WLAs and LAs is appropriate. Averaging periods for the allocations are based on the potential impacts from selenium exposure and variability in observed receiving water data. Since the protection of beneficial uses is linked to chronic not acute selenium conditions, a semi-annual averaging period utilizing an arithmetic mean is appropriate for these TMDLs and allocations. The semi-annual averaging periods are defined as April 1 through September 30 and October 1 through March 31 each year.

For purposes of these selenium TMDLs, wet and dry weather are defined as follows:
Wet weather: Any day with 0.1 inches of rain or more, as measured at the Tustin-Irvine Ranch Rain Gauge Station, and the following three days (72 hrs).
Dry weather: Any non-wet weather day.

The SARWQCB is taking a protective (conservative) approach by applying the TMDLs and allocations year-round to dry weather conditions (periods of highest exposure), and applying a semi-annual averaging period, which includes the spring season, the period of greatest potential harm, to the water column WLAs and LAs. Taking a conservative approach ensures protection during critical conditions.

Tissue-Based Allocations as Equations: The SARWQCB adopts the biodynamic model equations as the tissue-based allocations: footnotes 3, 4 and 5 to the tables of final WLAs and LAs indicate that the allocations are the set of equations used to develop the tissue-based water column values for the subwatersheds (i.e., the equations used in the biodynamic model). This gives the SARWQCB flexibility to adjust the tissue-based water column values based on updated model runs using newer data. Footnote 7 to both tables states that during the TMDL Reconsideration (between phases of the two-part process), the biodynamic model inputs will be reevaluated and updated as necessary, possibly resulting in revised allocations. The BPA at page 15 (and footnote 7) further states that since the allocations are the equations, a revision of any water column value would only need Executive Officer approval, after an appropriate public process.[14] This process includes public notice and input while avoiding the additional work of

[14] The BPA states that the Executive Officer may approve the change under a delegation of authority from the Regional Board, unless a request is made during the public process to bring the modification to the Regional Board for consideration.

adopting a basin plan amendment. This is a reasonable and efficient method to streamline modifications of the tissue-based water column allocations.

Compliance Schedule: The table of final WLAs and the table of final LAs in the BPA include two-sets of allocations: the tissue-based allocations and the CTR-based allocations. Both sets of allocations include footnote 8 which states: The final allocations are to be achieved as soon as possible, but no later than 30 years from the effective date of the reconsidered TMDLs, as discussed in the Implementation Plan.

The SARWQCB submitted a compliance schedule authorizing provision to allow up to a 30-year timeframe to achieve the final WLAs and LAs (and water quality standards) for EPA's review under CWA Section 303(c). These provisions must be approved by EPA before implementation in federal water quality programs. EPA's review and approval is discussed in a separate document. EPA will issue the compliance schedule approval concurrently with the approval of the TMDL.

Summary of Allocations: The SARWQCB adopted the following tables of final WLAs and LAs for the three subwatersheds in the Newport Bay Watershed (see BPA, pages 16-20):

Final WLAs as a Semi-Annual Arithmetic Mean[1] (for Implementation Purposes)

WLAs	Tissue-based Water Column WLAs [2,3,4,5,6,7,8] (Based upon Biodynamic Model) (µg Se/L)			CTR-based Water Column WLAs [2,8,14,16] (µg Se/L)	Conditional Mass based WLAs [15,16] (lbs)
	San Diego Creek Subwatershed [9,12,13,16]	Santa Ana-Delhi Channel Subwatershed [10,12,13,16]	Big Canyon Wash Subwatershed [11,12,13,16]		
MS4 Permittees	10	11	1	5	Optional. Applies when discharger meets the following conditions: a. Participates in approved Offset and Trading Program b. Offsets entirety of discharge (concentration x flow), including any specified offset ratio
Other NPDES Permittees					

(1) Semi-annual arithmetic mean: April 1 through September 30 and October 1 through March 31.
(2) Allocations apply year-round during non-wet weather (i.e. dry) conditions. Wet weather conditions are any day with 0.1 inches of rain or more, as measured at the Tustin-Irvine Ranch Rain Gauge Station, and the following three days (72 hours).
(3) The tissue-based WLAs are based on probable water column concentrations derived from the biodynamic model, as detailed in the **Section 6** of these proposed selenium TMDLs. The biodynamic model is directly incorporated herein to these WLAs and is represented by the following equations:
   (1) Fish tissue target of 8.1 or 5 µg Se/g dw (piscivorous fish): Cwater (µg Se/L) = [((((Cfish target/ TTFpiscivorous fish)/ TTFinvertivorous fish)/TTFinvertebrate)/Kd]*1000;
   (2) Fish tissue target of 8.1 or 5 µg Se/g dw (invertivorous fish): Cwater (µg Se/L) = [(((Cfish target/ TTFinvertivorous fish)/ TTFinvertebrate)/Kd]*1000;
   (3) Fish tissue target of 8.1 or 5 µg Se/g dw (detritivorous fish): Cwater (µg Se/L) = [(Cfish target/ TTFdetritivorous fish)/Kd]*1000;
   (4) Bird egg target of 8.0 µg Se/g dw (piscivorous bird): Cwater (µg Se/L) = [((((Cbird target/TTFbird)/ TTFinvertivorous fish/ TTFinvertebrate)/Kd]*1000;
   (5) Bird egg target of 8.0 µg Se/g dw (invertivorous bird): Cwater (µg Se/L) = [(((Cbird target/TTFbird)/TTFinvertebrate)/Kd]*1000
(4) TTFbird = trophic transfer factor from fish or invertebrates to bird egg, TTFpiscivorous fish = trophic transfer factor from small fish to predatory fish, TTFinvertivorous fish = trophic transfer factor from invertebrates to fish, TTFdetritivorous fish = trophic transfer factor from particulates to fish, TTFinvertebrate = trophic transfer factor from particulates to invertebrates, Kd = partitioning coefficient from dissolved selenium in water to particulates.

(5) Initial values for all TTFs and Kds are specified in the Linkage Analysis of these selenium TMDLs. TTF values may vary by specific water body. In water bodies where predatory fish are not present, the TTFpredatory fish value should equal 1 to represent that one less step is occurring in the food chain.

(6) During the development of the proposed selenium TMDLs, a range of probable water column concentrations was derived from the tissue-based numeric targets, based on the values assumed for the variables in the equation. The initial WLA values selected are based upon consideration of the most sensitive endpoint in the watershed and existing tissue data. During Phase I of these proposed selenium TMDLs, that endpoint has been identified as fish tissue for the protection of fish (numeric target of 8.1 µg Se/g dw) for the SDC and SADC subwatersheds and as bird egg tissue for the protection of birds (8.0 µg Se/g dw) in BCW.

(7) During the TMDL Reconsideration and during Phase II of these proposed selenium TMDLs, the biodynamic model inputs and resulting probable water column concentrations will be reevaluated and updated as necessary and per the schedule included in Table 6.1. Se.2. Subject to review and written comment via a public participation process, if updates are determined to be appropriate, such revised values will then replace the initial values in the biodynamic model equations, resulting in revised allocations. Such revisions can be made via approval by the Executive Officer, per delegated authority by the Regional Board, unless during the public review process a request is made to bring the modification before the Regional Board for consideration.

(8) The final allocations are to be achieved as soon as possible, but no later than 30 years from the effective date of the reconsidered TMDLs, as discussed in the Implementation Plan.

(9) Assessed in the receiving water at San Diego Creek at Campus Drive for Regulated Parties (as defined in the Implementation Plan other than MS4 Permittees) that opt to implement a BMP Strategic Plan consistent with the Implementation Plan.

(10) Assessed in the receiving water at Santa Ana-Delhi Channel at Irvine Avenue for Regulated Parties (as defined in the Implementation Plan other than MS4 Permittees) that opt to implement a BMP Strategic Plan consistent with the Implementation Plan.

(11) Assessed in the receiving water at Big Canyon Wash at Back Bay Drive for Regulated Parties (as defined in the Implementation Plan other than MS4 Permittees) that opt to implement a BMP Strategic Plan consistent with the Implementation Plan.

(12) Assessed at 'end of pipe' for Individual Action Plan point sources that elect not to pursue an offset. Compliance with allocations will be determined pursuant to the compliance options outlined under the heading "Compliance with WLAs." Such compliance options are directly incorporated herein as part of the assumptions and requirements of these WLAs.

(13) Assessment location for the MS4 permittees (urban runoff) is the Costa Mesa Channel. This location was selected as a surrogate urban runoff site because the subwatershed is approximately 1 square mile in area, it has predominantly urban land uses, and it is outside of the areas impacted by rising groundwater.

(14) The CTR-based water column WLAs will no longer apply to these proposed selenium TMDLs if and when revised objectives (e.g., SSOs) have been approved and are in effect and the current CTR chronic criterion for selenium in freshwater is de-promulgated.

(15) The Offset and Trading Program and any applicable offset ratios, described in the Implementation Plan is incorporated herein to these conditional mass-based WLAs.

(16) Compliance with allocations will be determined pursuant to the compliance options outlined under the heading "Compliance with WLAs." Such compliance options are directly incorporated herein as part of the assumptions and requirements of these WLAs.

Final LAs as a Semi-Annual Arithmetic Mean[1] (For Implementation Purposes)

LAs	Tissue-based Water Column LAs [2,3,4,5,6,7,8] (Based upon Biodynamic Model) (µg Se/L)			CTR-based Water Column LAs[2,8,12] (µg Se/L)
	San Diego Creek Subwatershed[9]	Santa Ana-Delhi Channel[10]	Big Canyon Wash Subwatershed[11]	
Agricultural Discharges	10	11	1	5
Open Space				
Rising Groundwater				

(1) For semi-annual arithmetic mean: April 1 through September 30 and October 1 through March 31.

(2) Allocations apply year-round during non-wet weather (i.e. dry) conditions. Wet weather conditions are any day with 0.1 inches of rain or more, as measured at the Tustin-Irvine Ranch Rain Gauge Station, and the following three days (72 hours).

(3) The tissue-based final LAs are based on probable water column concentrations derived from the biodynamic model, as detailed in the Linkage Analysis of these selenium TMDLs. The biodynamic model is directly incorporated herein to these LAs and is represented by the following equations:

(1) Fish tissue target of 8.1 or 5 µg Se/g dw (piscivorous fish): C_{water} (µg Se/L) = [((($C_{fish\ target}$/ $TTF_{piscivorous\ fish}$)/ $TTF_{invertivorous\ fish}$)/$TTF_{invertebrate}$)/$K_d$]*1000;

(2) Fish tissue target of 8.1 or 5 µg Se/g dw (invertivorous fish): C_{water} (µg Se/L) = [(($C_{fish\ target}$/ $TTF_{invertivorous\ fish}$)/$TTF_{invertebrate}$)/$K_d$]*1000;

(3) Fish tissue target of 8.1 or 5 µg Se/g dw (detritivorous fish): C_{water} (µg Se/L) = [($C_{fish\ target}$/ $TTF_{detritivorous\ fish}$)/$K_d$]*1000;

(4) Bird egg target of 8.0 µg Se/g dw (piscivorous bird): C_{water} (µg Se/L) = [((($C_{bird\ target}$/TTF_{bird})/ $TTF_{invertivorous\ fish}$)/$TTF_{invertebrate}$)/$K_d$]*1000;

(5) Bird egg target of 8.0 µg Se/g dw (invertivorous bird): C_{water} (µg Se/L) = [((($C_{bird\ target}$/TTF_{bird})/$TTF_{invertebrate}$))/K_d]*1000

(4) TTF_{bird} = trophic transfer factor from fish or invertebrates to bird egg, $TTF_{piscivorous\ fish}$ = trophic transfer factor from small fish to predatory fish, $TTF_{invertivorous\ fish}$ = trophic transfer factor from invertebrates to fish, $TTF_{detritivorous\ fish}$ = trophic transfer factor

from particulates to fish, $TTF_{invertebrate}$ = trophic transfer factor from particulates to invertebrates, K_d = partitioning coefficient from dissolved selenium in water to particulates.

(5) Initial values for all TTFs and K_ds are specified in the Linkage Analysis of these selenium TMDLs. TTF values may vary by specific water body. In water bodies where predatory fish are not present, the $TTF_{predatory\ fish}$ value should equal 1 to represent that one less step is occurring in the food chain.

(6) During the development of the proposed selenium TMDLs, a range of probable water column concentrations was derived from the tissue-based numeric targets, based on the values assumed for the variables in the equation. The initial LA values selected are based upon consideration of the most sensitive endpoint in the watershed and existing tissue data. During Phase I of these proposed selenium TMDLs, that endpoint has been identified as fish tissue for the protection of fish (numeric target of 8.1 µg Se/g dw) for the San Diego Creek and Santa Ana-Delhi Channel subwatersheds, and bird egg tissue for the protection of birds (numeric target of 8.0 µg Se/g dw) for the Big Canyon Wash subwatershed.

(7) During the TMDL Reconsideration and during Phase II of these selenium TMDLs, the biodynamic model inputs and resulting probable water column concentrations will be reevaluated and updated as necessary and per the schedule included in **Table 6.1. Se.2**. Subject to review and written comment via a public participation process, if updates are determined to be appropriate, such revised values will then replace the initial values in the biodynamic model equations, resulting in revised allocations. Such revisions can be made via approval by the Executive Officer, per delegated authority by the Regional Board, unless during the public review process a request is made to bring the modification before the Regional Board for consideration.

(8) The final allocations are to be achieved as soon as possible, but no later than 30 years from the effective date of the reconsidered TMDLs, as discussed in the Implementation Plan.

(9) Assessed in the receiving water at San Diego Creek at Campus.

(10) Assessed in the receiving water at Santa Ana-Delhi Channel at Irvine Ave.

(11) Assessed in the receiving water at Big Canyon Wash at Back Bay Drive.

(12) The CTR-based water column LAs will no longer apply to these selenium TMDLs if and when revised objectives (e.g., SSOs) have been approved and are in effect and the current CTR chronic criterion for selenium in freshwater is de-promulgated.

The WLAs apply to the watershed's point sources that are permitted under the National Pollutant Discharge Elimination System (NPDES). These include "[m]unicipal separate storm sewer system (MS4) permittees and all other NPDES permitted discharges that discharge groundwater to surface water as part of dewatering, treatment, or similar operations in the watershed" (see BPA, page 15). A list of these NPDES permittees is included in the Staff Report at Table 8.1:

Table 8.1. Existing Regional Board Orders and Permits Regulating Discharges in the Newport Bay Watershed.

Permit Title	Order No.	NPDES No.
Time Schedule Order for the City of Irvine, Groundwater Dewatering Facilities, Order No. R8-2005-0079, NPDES No. CA8000406	R8-2009-0070 as amended by R8-2013-0061 and R8-2014-0026	NA
Time Schedule Order for Dischargers Enrolled in Order No. R8-2007-0041, NPDES No. CAG918002, General Discharge Permit for Discharges to Surface Waters of Groundwater Resulting from Groundwater Dewatering Operations and/or Groundwater Cleanup Activities at sites within the San Diego Creek/Newport Bay Watershed Polluted by Petroleum Hydrocarbons, Solvent, Metals and/or Salts	R8-2009-0069 as amended by R8-2013-0060 and R8-2014-0025	NA
Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the Incorporated Cities of Orange County within the Santa Ana Region - Area-wide Urban Storm Water Runoff - Orange County	R8-2009-0030 as amended by R8-2010-0062	CAS618030
General Waste Discharge Requirements for Discharges to Surface Waters that Pose an Insignificant (De Minimus) Threat to Water Quality	R8-2015-0004	CAG998001

General Discharge Permit for Discharges to Surface Waters of Groundwater Resulting from Groundwater Dewatering Operations and/or Groundwater Cleanup Activities at Sites Within the San Diego Creek/Newport Bay Watershed Polluted by Petroleum Hydrocarbons, Solvents, Metals and/or Salts	R8-2007-0041, as amended by R8-2009-0045	CAG918002
General Waste Discharge Requirements for the Re-injection/percolation of Extracted and Treated Groundwater Resulting from the Cleanup of Groundwater Polluted by Petroleum Hydrocarbons, Solvents and/or Petroleum Hydrocarbons Mixed with Lead and/or Solvents within the Santa Ana Region	R8-2002-0033, as amended by R8-2003-0085 and R8-2013-0020	CAG918001
Waste Discharge Requirements for City of Irvine, Groundwater Dewatering Facilities, Irvine, Orange County	R8-2005-0079	CA8000406
Waste Discharge Requirements for Nakase Bros. Wholesale Nursery, Orange County	R8-2005-0006	NA

The Staff Report at section 7.4, Compliance with WLAs, describes several options for permittees to choose, to achieve compliance with the allocations. The Staff Report at section 8, Implementation Plan, outlines in more detail how the SARWQCB intends to oversee implementation of the compliance options to achieve water quality standards.

Site Specific Objectives (SSOs): The SARWQCB states in several places, including the BPA at page 6, that the CTR numeric water column target of 5 µg/L "will no longer be in effect once the CTR freshwater criterion has been replaced by revised objectives (e.g., SSOs)." Similarly, the SARWQCB states in several places that the CTR-based water column WLAs and LAs will no longer apply when revised objectives (e.g., SSOs) have been approved and are in effect and the current CTR freshwater chronic criterion is depromulgated (see BPA, pages 12, 14, footnote 14 in the table of final WLAs, footnote 8 in the table of final LAs, and throughout the Staff Report).

The SARWQCB is intending to adopt freshwater selenium tissue-based SSOs for the Newport Bay Watershed, and is allowing for an automatic adjustment of targets and allocations to occur, if EPA approves the SSOs and depromulgates the applicable federal criteria for those waterbodies. EPA finds this to be an efficient way to incorporate a water quality standards change into the TMDL, if the SSOs are adopted, and EPA approves the SSOs and depromulgates the applicable CTR freshwater criterion.

Summary: The TMDLs for Newport Bay Watershed are assigned by subwatershed, and are equal to the loading capacities and allocations within each subwatershed. The TMDLs, loading capacities and allocations are concentration-based water column values. Allocations for each subwatershed include tissue-based values and a CTR-based water column value, all of which equally apply. The tissue-based water column allocations are a better estimate of the associated water column conditions that will result in achieving the tissue targets; however, until the current CTR water column criterion is changed, both sets of allocations must be achieved in each of the subswatersheds.

The SARWQCB's allocations are reasonable and appropriate. EPA concurs with the SARWQCB's analysis and concludes the TMDLs are set at levels necessary to attain applicable

water quality standards. EPA concludes the SARWQCB's submittal includes WLAs and LAs that are consistent with the provisions of the CWA and federal regulations.

8. Margin of Safety

A margin of safety (MOS) can be implicit (incorporated into the TMDL analysis through conservative assumptions) or explicit (expressed in the TMDL as a portion of the loadings) or a combination of both. The SARWQCB includes a discussion of the MOS for the Newport Bay Watershed TMDLs in the BPA, and describes the MOS as implicit.

Conservative assumptions were used to develop the tissue-based numeric targets, which were then translated to water column values using the biodynamic model to set the TMDLs, loading capacities, and allocations. The SARWQCB argues that the use of conservative tissue-based numeric targets for the protection of both aquatic life and aquatic-dependent wildlife are more protective than the CTR-based numeric water column target for the protection of aquatic life (the applicable water quality criterion). In addition, the tissue-based targets protect at a lower (more conservative) risk level than the CTR-based target: the bird egg tissue target is a no-effect concentration (NEC) and the fish tissue target is a low-effect concentration (EC_{10} value) based on dietary routes of exposure, while the CTR-based target does not protect for dietary exposure, and does not protect at a NEC level (see BPA, page 20).

The Newport Bay Watershed fish tissue targets of 8.1 and 5 µg/g dw are both more protective than EPA's current CWA 304(a) fish tissue element of 8.5 µg/g dw. The bird egg tissue target of 8 µg/g dw is also more protective than the proposed bird egg tissue target of 11.2 µg/g dw in EPA's proposed rule for freshwaters in California (83 FR 64059, December 13, 2018). The SARWQCB and USFWS believe the bird-egg target reflects a NEC value, and the fish-tissue target a low-effect concentration.

The use of allocations based on both the tissue targets and the CTR-based water column target provides for an implicit, reasonable MOS. The tissue targets are slightly more protective than EPA's national recommended and proposed tissue elements for California, and provide an implicit MOS. EPA finds the SARWCB's analysis to be reasonable.

9. Seasonal Variations and Critical Conditions

TMDLs must consider seasonal variation and critical conditions. Seasonable variation and critical conditions were taken into account in the development of the TMDLs for the Newport Bay watershed. As described above in section 7. TMDLs and Allocations, in the discussion of averaging periods, the SARWQCB considered the periods of highest selenium exposure (during dry weather flows) and periods of greatest harm (during the wildlife [shorebird] breeding season and during times of juvenile or embryonic development). The SARWQCB applies the allocations during dry weather conditions, and applies them seasonally to capture the spring and early summer period, the period of greatest potential harm.

EPA finds the SARWQCB's seasonal variation and critical condition analysis to be reasonable.

10. Public Participation

The SARWQCB published a public notice and opportunity for public comment on the proposed TMDL package on March 15, 2017, posted the TMDL and supporting documents at their website on March 20, 2017, and took public comment through May 1, 2017. The SARWQCB addressed the questions and comments received on the proposed TMDL package in a Response to Public Comments document dated July 19, 2017. The SARWQCB adopted the TMDL package on August 4, 2017. The SWRCB approved the TMDL package on September 20, 2018, after another public notice and opportunity for public comment.

The SARWQCB started working on the package in approximately 2008. Since then, the SARWQCB has held several informal workshops with stakeholders to work with them on the development of the package, in addition to the formal public notices and opportunities for comment.

EPA finds the SARWQCB provided sufficient public notice and opportunities for public comment, and adequately responded to public comments.

11. Technical Analysis

The technical analyses to support the BPA for the TMDL package are contained in the Staff Report, *Total Maximum Daily Loads for Selenium in Freshwater: Newport Bay Watershed, Orange County, California,* dated July 2017. This document (and its supporting documents and appendices) provide a detailed and appropriate level of technical analysis to support all TMDL elements including: the numeric targets; the source analysis; the linkage and loading capacity analysis; the load and wasteload allocations; the TMDLs; a margin of safety analysis; and a seasonal variation/critical conditions analysis.

EPA finds the SARWQCB TMDL submittal provides an appropriate level of technical analysis supporting all TMDL elements.

12. Reasonable Assurances and Trading Program

WLAs will be enforced through applicable NPDES permit conditions, as described in the BPA in the section on TMDLs and Allocations, in the subsection, Compliance with WLAs. Options for compliance are enumerated and described (see BPA, pages 17 – 19). The BPA also contains a section on Implementation Plans which describes in detail how the SARWQCB will ensure the WLAs and LAs will be implemented (see BPA, pages 20 – 31).

In addition to ensuring compliance with the WLAs and LAs, the SARWQCB is interested in supporting potential interest from NPDES permittees in applying water quality trading approaches to assist in future TMDL implementation actions. The Final WLA table in the BPA (at page 16) includes a column of WLAs entitled, "Conditional Mass-based WLAs." The table describes the WLAs as "Optional. Applies when discharger meets the following conditions: a. Participates in approved Offset and Trading Program; b. Offsets entirety of discharge

(concentration x flow), including any specified offset ratio." The Offset and Trading Program is described in detail in the BPA at pages 27 – 31.

To help facilitate development and implementation of water quality trading-based implementation approaches, the SARWQCB included the Offsets and Trading provision in the BPA. To implement trading that affects point source discharges addressed by this TMDL, EPA expects the SARWQCB to ensure that clearly articulated and enforceable trading provisions are incorporated in existing and/or future NPDES permits with numeric effluent limitations consistent with the terms, conditions and assumptions with the approved TMDL. In addition, EPA expects the SARWQCB to work with partners taking part in trading arrangements to ensure that the legal framework for trading is consistent with applicable federal, State and local regulations and policies.