Staff Memo

Evaluation of New or Revised Recommended Section 304(a) Criteria for Incorporation into the Basin Plan as Water Quality Objectives

December 2019

1. Introduction

This document addresses revisions to the federal Water Quality Standards (WQS) regulations that require states and authorized tribes to consider for adoption as WQS new or updated water quality criteria recommendations published by the U.S. EPA.

Federal Water Quality Standards (WQS) are contained in 40 C.F.R. Part 131, including requirements for the periodical review of and, as appropriate, modification and adoption of water quality standards applicable to waters of the U.S. In federal terminology, this review of water quality standards is known as the "triennial review."

On August 21, 2015, revisions to the federal WQS regulations at 40 C.F.R. Part 131 went into effect. The final rule addressed certain key WQS program areas including triennial reviews pursuant to Clean Water Act (CWA) section 303(c)(1). Per the final rule, during their next triennial review, states and authorized tribes were to consider for adoption as WQS new or updated CWA section 304(a) water quality criteria recommendations[1] published by the U.S. EPA since May 30, 2000.

In 2018, as part of its 2017-19 triennial review and as a first step towards addressing this requirement, the Los Angeles Water Quality Control Board (Los Angeles Water Board) conducted a preliminary review of the section 304(a) water quality criteria recommendations published by the U.S. EPA since May 30, 2000. The resulting document presented background information on the pollutants, the recommended section 304(a) criteria, as well as the water quality objectives (WQOs) currently applied by the Los Angeles Water Board for each of the 121 pollutants considered.[2]

After this initial review, it was determined that since the U.S. EPA recommendations could apply statewide, consideration of these criteria for adoption as WQOs would be most efficiently undertaken by the State Water Resources Control Board's (State Water Board) Division of Water Quality. Once adopted as amendments to existing statewide water quality control plans, the WQOs would then apply to all waters in the State. Further, given the limited resources of the Basin Planning Program (1.7 PY) and the number of new and updated U.S. EPA recommendations, it would take a significant amount of time for the Los Angeles Water Board to address all these new and updated recommendations through amendments to the Los Angeles Region's Basin Plan.

Indeed, the State Water Board has already addressed or is currently addressing some of the U.S. EPA recommended criteria. For example, the U.S. EPA recommended human

[1] Section 304(a)(1) of the Clean Water Act (CWA) requires U.S. EPA to develop and publish, and from time to time revise, recommended criteria for the protection of water quality that accurately reflect the latest scientific knowledge. U.S. EPA's recommended section 304(a) criteria provide technical information for states and authorized tribes to consider and use in adopting water quality standards that ultimately provide the basis for assessing water body health and controlling discharges of pollutants into waters of the United States.

[2] LARWQCB (March 2018) Evaluation of New or Revised Recommended Section 304(a) Criteria for Incorporation into the Basin Plan as Water Quality Objectives: Preliminary Review. 77 pp. https://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/Triennial_Review/2017-2019/Appendix.pdf

health criteria for pathogens and pathogen indicators were considered during the development of the statewide bacteria provisions adopted by the State Water Board in 2018 (Resolution 2018-0038). Similarly, the State Water Board is currently developing a statewide WQO for biostimulatory substances that will address the U.S. EPA recommended aquatic life nutrients criteria. Furthermore, in addition to ongoing work by the State Water Board, the U.S. EPA is currently developing an aquatic life numeric criterion for selenium specific to the State of California that will supersede its recommended 2016 nationwide criteria in the state, as well as current Basin Plan WQOs.

Once WQOs are adopted by either the State Water Board or promulgated as state water quality standards by the U.S. EPA, potential actions by the Los Angeles Water Board on these items will be considered, if necessary (e.g., aligning the Los Angeles Region's Basin Plan with these updates).

In addition, the Los Angeles Water Board has been taking steps in order to incorporate the U.S. EPA aquatic life ammonia and copper criteria into the Basin Plan as WQOs, including expenditure of contract funds for research which will evaluate their applicability to the region's waters. Stakeholders will have the opportunity to comment on each WQO update prior to its consideration by the Los Angeles Water Board as part of the public notice and comment process for each Basin Plan amendment.

The following sections review in more detail each of the criteria recently considered or being considered by the State Water Board or the U.S. EPA, and the measures that may be taken by the Los Angeles Water Board following their adoption, as well as the criteria that will be directly addressed by the Los Angeles Water Board. The full list of section 304(a) human health and aquatic life water quality criteria recommendations published by the U.S. EPA since May 30, 2000 and applicable WQOs as of December 2019 is presented in the Appendix.

2. Criterion addressed by the U.S. EPA

2.1. Aquatic life Selenium criteria

Selenium is a naturally occurring element present in sedimentary rocks, shales, coal and phosphate deposits and soils that can enter surface waters via weathering and by anthropogenic sources, such as surface mining, coal-fired power plants, and irrigated agriculture. It is a nutritionally essential element for animals in small amounts but becomes toxic at higher concentrations. Selenium bioaccumulates in the aquatic food chain and chronic exposure in fish and aquatic invertebrates can cause reproductive impairments (e.g., larval deformity or mortality), and adversely affect juvenile growth and mortality.

The updated U.S. EPA Aquatic Life Water Quality Criteria as well as current applicable Basin Plan WQOs for selenium in freshwater are shown in table 1. The U.S. EPA published an update of its 1999 recommended national chronic aquatic life criterion for the pollutant selenium in freshwater in 2016. The updated criterion reflects the latest scientific knowledge, which indicates that selenium toxicity to aquatic life is primarily

based on organisms consuming selenium contaminated food rather than by being exposed only to selenium dissolved in water. Consequently, the final criterion is expressed both in terms of fish tissue concentration (egg/ovary, whole body, muscle) and water concentration (lentic, lotic). The U.S. EPA is also currently developing technical support materials to assist states in addressing implementation questions such as fish tissue monitoring.

Meanwhile, in 2013, the Our Children's Earth Foundation and Ecological Rights Foundation ("plaintiffs") sued the U.S. EPA, alleging in part that it had failed to establish selenium criteria in the California Toxics Rule (CTR) consistent with the requirements of the CWA. In August 2014, the U.S. EPA entered into a consent decree with the plaintiffs that required the U.S. EPA to propose selenium criteria for California fresh waters covered by the CTR to protect aquatic life and aquatic-dependent wildlife by November 30, 2018.

Consequently, on November 29, 2018, The U.S. EPA proposed a rule to revise the current federal CWA selenium water quality criterion applicable to certain fresh waters of California. This rule, "Establishment of a Numeric Criterion for Selenium for the State of California", is being proposed to ensure that the criterion is set at a level that protects aquatic life and aquatic-dependent wildlife.

Specifically, the U.S. EPA is proposing a chronic criterion for California based on the U.S. EPA's current CWA 304(a) recommended criterion for selenium. The proposed selenium water quality criterion is comprised of criterion elements of fish tissue, bird tissue, and a performance-based approach for translating the bird and fish tissue elements into site-specific water column thresholds. The U.S. EPA is proposing selenium fish and bird tissue elements because they reflect biological uptake through diet, the predominant pathway for selenium toxicity, and because they are most predictive of the observed biological endpoint of concern, reproductive toxicity.

Currently, the Los Angeles Region's Basin Plan incorporates the CTR criteria for aquatic life for selenium, (40 C.F.R. section 131.38) by reference (Table 1). Therefore, once adopted as part of the CTR, the U.S. EPA selenium criterion developed for California will automatically apply to the Los Angeles Region. In addition, the Basin Plan also contains a narrative Toxicity WQO that applies to toxic substances in general.

Table 1: U.S. EPA Aquatic Life Water Quality Criteria and current applicable Basin Plan numeric aquatic life WQOs for selenium in freshwater.

Criteria/Objective	CMC (acute)	CCC (chronic)
U.S. EPA Criteria	Multi-media criteria	Multi-media criteria
Los Angeles Water Board Basin Plan: CTR criteria[3,4]	20 µg/L	5 µg/L

3. Criteria addressed by the State Water Board

3.1. Human health Pathogen and Pathogen Indicators criteria

Pathogens are microorganisms that include bacteria, viruses, and protozoa. They are often found in human, livestock, and wildlife waste and can enter surface waters via sewage spills or overflows, septic systems, wastewater treatment facility discharges, urban stormwater systems (also known as municipal separate storm sewer systems or MS4s), and nonpoint source runoff from agricultural and natural areas. Waterborne pathogens usually cause symptoms that include skin rashes, upper respiratory illness, headaches, fatigue, and gastrointestinal illness (e.g. diarrhea, nausea, vomiting).

The 2012 U.S. EPA Recreational Water Quality Criteria (Tables 2a,b) are intended to protect the public from exposure to harmful levels of pathogens through primary contact recreation by recommending two sets of numeric concentration thresholds depending on the acceptable illness rate considered (32 or 36 illnesses per 1,000 recreators). The U.S. EPA recommends using the fecal indicator bacteria enterococci or *Escherichia coli (E. coli)* as indicators of fecal contamination for fresh water and enterococci for marine water.

On January 26, 2018, the State Water Board adopted statewide Bacteria Provisions (Resolution 2018-0038) as Part 3 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays and Estuaries of California (ISWEBE), and as amendments to the Water Quality Control Plan for Ocean Waters of California (Ocean Plan) (Table 3a-c). Those provisions apply to fresh, estuarine and ocean waters, and establish bacteria water quality objectives for the protection of the Water Contact Recreation (REC-1) beneficial use, using *E. coli* as the indicator of pathogens in freshwater and enterococci as the indicator for estuarine waters and ocean waters, and a risk protection level of 32 illnesses per 1,000 recreators. The Ocean Plan also retains the WQOs for fecal coliform that were in the Ocean Plan prior to 2018 (Table 3c). The Bacteria Provisions also include implementation approaches for these objectives, including reference beach and natural source exclusion approaches that may only be applied within the context of a total maximum daily load (TMDL).

[3] CTR:
CMC = short-term average, not to be exceeded more than once every three years on the average.
CCC = 4-day average, not to be exceeded more than once every three years on the average.
[4] The selenium criteria are expressed in terms of the total recoverable form.

In addition, Part 3 of the ISWEBE (and not the Ocean Plan Amendment) contains implementation approaches that can be applied in a site-specific manner to reflect the attainability of REC-1 beneficial use designations, including a temporary high-flow suspension and a seasonal suspension of the REC-1 beneficial use, and a definition for a limited water contact recreation (LREC-1) beneficial use.

Table 2a. U.S. EPA Human Health Water Quality Criteria for Pathogen and Pathogen Indicators for Recommendation 1 (estimated illness rate 36/1000):

Water Type	**Indicator**	**30-Day Geometric Mean** (colony forming units/100ml)	**Statistical Threshold Value**[5] (colony forming units/100ml)
Freshwater	E. coli	126	410
Freshwater	Enterococcus	35	130
Marine Waters	Enterococcus	35	130

Table 2b. U.S. EPA Human Health Water Quality Criteria for Pathogen and Pathogen Indicators for Recommendation 2 (estimated illness rate 32/1000):

Water Type	**Bacteria Type**	**30-Day Geometric Mean** (colony forming units/100ml)	**Statistical Threshold Value**[6] (colony forming units/100ml)
Freshwater	E. coli	100	320
Freshwater	Enterococcus	30	110
Marine Waters	Enterococcus	30	110

[5] The statistical threshold value (STV) should not be exceeded by more than 10% of the samples taken over a 30-day interval.

[6] The statistical threshold value (STV) should not be exceeded by more than 10% of the samples taken over a 30-day interval.

Table 3a. Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California Plan (ISWEBE Plan) bacteria WQOs for Water Contact Recreation (REC-1) in Fresh and Estuarine Waters.

Salinity	**Indicator**	**6-Week Rolling Geometric Mean, Calculated Weekly** (colony forming units/100ml)	**Statistical Threshold Value**[7] (colony forming units/100ml)
Salinity equal to or less than 1 parts per thousand 95% or more of the time	E. coli	100	320
Salinity greater than 1 part per thousand more than 5% of the time	Enterococci	30	110

Table 3b: Ocean Plan Enterococci bacteria WQOs for Water Contact Recreation (REC-1) in Marine Waters.

Indicator	**6-Week Rolling Geometric Mean, Calculated Weekly** (colony forming units/100ml)	**Statistical Threshold Value** (colony forming units/100ml)
Enterococci	30	110

Table 3c: Ocean Plan Fecal Coliform Bacteria Water Quality Objectives for Water Contact Recreation (REC-1) in Marine Waters

Indicator	**30-day Geometric Mean**	**Single Sample Maximum**
Fecal coliform density	200 per 100 mL	400 per 100 mL

These objectives supersede numeric water quality objectives for the REC-1 beneficial use in the Basin Plan established by the Los Angeles Water Board prior to the effective date of the Bacteria Provisions. While the Bacteria WQOs supersede applicable numeric water quality objectives contained in the Basin Plan prior to the effective date of the Bacteria Provisions, any TMDL associated with a superseded bacteria water quality objective remains in effect. Narrative water quality objectives and numeric site-specific objectives established before or after the effective date of the Bacteria Provisions also remain in effect.

[7] The statistical threshold value (STV) should not be exceeded by more than 10 percent of the samples collected in a calendar month, calculated in a static manner.

Following the adoption of the Bacteria Provisions, applicable objectives contained in the Los Angeles Region's Basin Plan for the protection of the REC-1 beneficial use include WQOs applicable for waters with limited REC-1 uses (Table 4). The Basin Plan also contains the following narrative Toxicity WQO that applies to toxic substances in general and can be used, where necessary, to identify numeric thresholds: "All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life…."

The Los Angeles Water Board is currently preparing to update the Basin Plan to incorporate the statewide Bacteria Provisions adopted by the State Water Board, including WQOs presented in Table 2.

Table 4. Los Angeles Basin Plan numeric WQOs which have not been superseded for bacteria in surface waters:

Type of Objective	Indicator	Type of Measurement	Value (colony forming units/100ml)
WQO for Freshwater with LREC-1 designation	E. coli (cfu/100ml)	30-Day Geometric Mean (minimum 5 samples)	126
WQO for Freshwater with LREC-1 designation	E. coli (cfu/100ml)	Single sample	576

3.2. Human health Methylmercury criteria

Mercury occurs naturally in the environment, usually due to biological activity, however concentrations often exceed background levels because of human activities. The main anthropogenic sources of the metal in the environment are gold and mercury mining and atmospheric deposition from power generation and other industrial and waste disposal activities, and to a lesser extent industrial and municipal wastewater discharges and urban runoff.

Methylmercury is an organic form of mercury resulting from a series of complex chemical transformations of inorganic mercury in the environment. It is easily absorbed into the tissue of aquatic organisms and is not easily eliminated, leading to its bioaccumulation at the top of the food chain. The consumption by humans or other high trophic level consumers of organisms contaminated with high levels of methylmercury can lead to severe neurological damage and even death. Methylmercury also presents dangerous developmental effects for fetuses, interfering with proper neuron growth. All forms of mercury are known to be toxic to the kidneys when exposed to large amounts.

The U.S. EPA Human Health Water Quality Criteria for methylmercury adopted in 2001 describes the maximum advisable concentration of 0.3 mg of methylmercury/kg in freshwater and estuarine fish and shellfish tissue to protect consumers of fish and

shellfish along with the general population. Guidance for implementing the 2001 criteria was released in 2010.

Subsequently, in 2017, the State Water Board adopted Mercury provisions as Part 2 of the statewide ISWEBE Plan (Resolution 2017-0027). The resolution sets methylmercury limits to protect the beneficial uses associated with the consumption of fish by both people and wildlife (Table 5).

Table 5: Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California (ISWEBE Plan) objectives for methylmercury to protect human health and aquatic life:

Beneficial Use	Objective
Sport Fish Objective[8]	0.2 mg/kg in fish tissue within a calendar year
Tribal Subsistence Fishing Objective[9]	0.04 mg/kg in fish tissue within a calendar year
Subsistence Fishing Objective	Waters free of mercury at concentrations which accumulate in fish and cause adverse biological, reproductive, or neurological effects in people
Prey Fish Objective[10]	0.05 mg/kg in fish tissue during the breeding season
California Least Tern Prey Fish Objective[11]	0.03 mg/kg in fish tissue from April 1 through August 31

The Los Angeles Basin Plan contains a narrative toxicity objective that applies to toxic substances in general, and incorporates by reference the California Toxics Rule (CTR) criteria for human health for mercury (40 C.F.R. section 131.38): 0.050 µg/L of mercury for the consumption of water and organisms, and 0.051 µg/L for the consumption of organisms only. The Mercury Provisions adopted by the State Water Board apply to waters in the Los Angeles Region.

The Mercury Provisions adopted by the State Water Board were developed in conjunction with the establishment of tribal beneficial uses and sustenance fishing beneficial uses. The Los Angeles Water Board staff are developing options for incorporation of new beneficial uses and related mercury objectives into the Basin Plan.

[8] The objective applies to the wet weight concentration in skinless fillet in trophic level 3 or trophic level 4 fish, whichever is the highest trophic level fish in the water body.

[9] The objective applies to the wet weight concentration in skinless fillet from a mixture of 70 percent trophic level 3 fish and 30 percent trophic level 4 fish.

[10] The objective applies to the wet weight whole fish tissue of any species between 50 to 150 mm in total length during the breeding season.

[11] The objective applies to the wet weight concentration in whole fish less than 50 mm total length.

3.3. Human health Cylindrospermopsin and Microcystins criteria

Cyanobacteria, also known as blue-green algae, are a family of single-celled algae that are commonly found in waterbodies with high nutrient content and warm water, such as ponds, lakes, and slow-moving streams. In waterbodies with an excess of nutrients, cyanobacteria can form algal blooms and release toxins after cell death. Microcystins and Cylindrospermopsin are two types of toxins produced by cyanobacteria and are both toxic to humans and animals. In addition to releasing toxins, algal blooms can also produce unpleasant taste and odor.

When blooms pose a risk to humans, animals, and the environment, they are referred to as harmful algal blooms (HABs). Observations of harmful algal blooms and algal toxins have increased globally in recent years. HABs can affect multiple beneficial uses including recreation, aquatic life, and drinking water by producing potent toxins, but also by reducing aesthetics, lowering dissolved oxygen concentration, causing taste and odor problems.

In May 2019, the U.S. EPA released national recommendations for the Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories (AWQC/SA) for Microcystins and Cylindrospermopsin. These recommendations reflect the latest scientific knowledge on the potential human health effects from recreational exposure to these two cyanotoxins. The recommended AWQC/SA for microcystins and cylindrospermopsin consist of three components (magnitude, duration and frequency) that are considered protective of human health in recreational waters (Table 6). On December 16, 2019, the U.S. EPA released for public comment a Draft Technical Support Document supporting the adoption of the new human health recreational criteria and implementation of the criteria in waterbody assessment and listing programs. The document also addresses how information in the criteria document may be applied to swimming advisory programs.

Table 6: U.S EPA recommended Human Health Recreational Water Quality criteria for Microcystins and Cylindrospermopsin:

Toxin	Magnitude	Duration and Frequency
Microcystin	8 µg/L	**For application as a recreational water quality criterion:** 10-day assessment periods, not a rolling 10-day period, over the course of a recreation season **For application as a swimming advisory:** magnitude not to be exceeded on any single day
Cylindrospermopsin	15 µg/L	**For application as a recreational water quality criterion:** 10-day assessment periods, not a rolling 10-day period, over the course of a recreation season **For application as a swimming advisory:** magnitude not to be exceeded on any single day

Meanwhile, the State Water Board and the nine Regional Water Boards, in partnership with other programs and agencies, have been actively supporting and coordinating a statewide HAB incident response. The Water Boards first began to formally address this issue in 2005 when it formed the Blue Green Algae Work Group, later renamed the California Cyanobacteria Harmful Algal Bloom Network (CCHAB). An initial product of this group was the Blue-Green Algae Voluntary Guidance Document (originally released in 2010, updated in 2016) containing recommendations to post advisory signs based on trigger levels for the following criteria: concentrations of major cyanotoxins in water, cell count of potential toxin producers, and site specific indicators (Table 7). In addition to Mycrocystins and Cylindrospermopsin, advisory levels were developed for a third cyanotoxin, Anatoxin-a. Subsequently, the Surface Water Ambient Monitoring Program (SWAMP) prepared the California Freshwater HAB Assessment and Support Strategy to articulate a coordinated program to assess, communicate and manage HABs in California. The CA HABs Portal acts as an informational resource for the public and a tool to support coordination with statewide partners to address HABs. The Los Angeles Water Board will continue to participate in the efforts lead by the State Water Board to address HABs. As part of these efforts, SWAMP recently contracted the Southern California Coastal Water Research Project (SCCWRP) to conduct a special study aiming to identify toxins present in four lakes of the Los Angeles Region and supplement HAB tracking efforts.

Table 7: State Water Board recommended Trigger Levels to protect human and animal (dogs, livestock) health from cyanobacteria HABs.

	Caution Action Trigger	Warning Tier I	Danger Tier II
Primary Triggers[12]			
Total Microcystins[13]	0.8 µg/L	6 µg/L	20 µg/L
Anatoxin-a	Detection[14]	20 µg/L	90 µg/L
Cylindrospermopsin	1 µg/L	4 µg/L	17 µg/L
Secondary Triggers			
Cell Density (Toxin Producers)	4,000 cells/mL	N/A	N/A
Site Specific Indicators of CyanoHAB	Visible bloom/discoloration, scum, algal mats, satellite imagery.	N/A	N/A

3.4. Aquatic life Cadmium criteria

Cadmium is a naturally occurring metal found in mineral deposits and is distributed widely at low concentrations in the environment. The metal enters the environment through natural and anthropogenic processes, however, human sources, such as mining and industrial runoff, fumes from industrial sites, use of phosphate fertilizers, fossil fuel combustion, and waste incineration and disposal, are responsible for the majority of the cadmium found in surface waters

Cadmium is a non-essential metal with no biological function in aquatic life. Acute exposure causes increased mortality in aquatic organisms, while chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior.

The updated U.S. EPA Aquatic Life Water Quality Criteria as well as current applicable Basin Plan WQOs for cadmium in freshwater and saltwater are shown in tables 8a-b below. The U.S. EPA Aquatic Life Ambient Water Quality Criteria for Cadmium published in 2016 provided an update to the 2001 criteria, mostly by the inclusion of new toxicity studies. The freshwater acute criterion was derived to be protective of aquatic species and was lowered further to protect the commercially and recreationally important rainbow trout. In addition, the duration component of the 2016 acute criterion was changed from a 1-day to a one-hour average.

[12] The primary triggers are met when ANY toxin exceeds the criteria.

[13] Microcystins refers to the sum of all measured microcystin congeners.

[14] Must use an analytical method that detects ≤ 1 µg/L Anatoxin-a.

Table 8a: U.S. EPA Aquatic Life Water Quality Criteria and current applicable numeric WQOs for cadmium in freshwater. The criteria are expressed in terms of the dissolved metal in the water column. The freshwater acute and chronic cadmium criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as CaCO3 to allow the presentation of representative criteria values.

Criteria/Objective	CMC (acute)	CCC (chronic)
U.S. EPA Criteria[15]	1.8 µg/L	0.72 µg/L
Los Angeles Water Board Basin Plan: CTR criteria[16,17]	4.3 µg/L	2.2 µg/L

Table 8b: U.S. EPA Aquatic Life Water Quality Criteria and current applicable numeric WQOs for cadmium in saltwater. The criteria are expressed in terms of the dissolved metal in the water column.

Criteria/Objective	CMC (acute)	CCC (chronic)	6-Month Median	Daily Maximum	Instantaneous Maximum
U.S. EPA Criteria	33 µg/L	7.9 µg/L			
Los Angeles Water Board Basin Plan: CTR criteria[18]	42 µg/L	9.3 µg/L			
California Ocean Plan WQO for Protection of Marine Aquatic Life			1 µg/L	4 µg/L	10 µg/L

The Los Angeles Basin Plan currently incorporates by reference the California Toxics Rule (CTR) criteria for aquatic life for cadmium, (40 C.F.R. section 131.38), and also contains a narrative Toxicity WQO that applies to toxic substances in general. In addition, the California Ocean Plan contains a WQO for the protection of Marine Aquatic life, as well as the following narrative objective under Section E. Biological Characteristics: “The

[15] U.S. EPA Criteria:
CMC = 1-hr average, not to be exceeded more than once every three years on the average.
CCC = 4-day average, not to be exceeded more than once every three years on the average.

[16] CTR:
CMC = short-term average, not to be exceeded more than once every three years on the average.
CCC = 4-day average, not to be exceeded more than once every three years on the average.

[17] The acute and chronic freshwater CTR criteria values are based on a default water-effect ratio (WER) of 1.

[18] The acute and chronic freshwater CTR criteria values are based on a default water-effect ratio (WER) of 1.

concentration of organic materials in fish, shellfish or other marine resources used for human consumption shall not bioaccumulate to levels that are harmful to human health."

While the Los Angeles Water Board has not adopted the updated U.S. EPA recommended criteria, the State Water Board is currently working on the development of a statewide revised WQO for cadmium that would supersede the regional Basin Plans. Potential actions by the Los Angeles Water Board will be considered, if necessary, after adoption by the State Water Board.

3.5. Aquatic life Nutrients criteria

Nutrients such as nitrogen and phosphorous occur naturally in aquatic environments. However, only small amounts of nutrients are required in a natural ecosystem and increases in nutrients in natural waters can negatively impact water quality, aquatic habitats and public health. Increased nutrient loads and associated negative effects is called eutrophication. High concentrations of nutrients, primarily caused by human activities, enter aquatic environments through runoff from agricultural practices, wastewater, stormwater, fossil fuels, and the use of household products. Excessive amounts of nutrients introduced to natural waterways can result in the formation of algal blooms. Other issues associated with excessive nutrient enrichment include low dissolved oxygen, fish kills, cloudy murky water, and depletion of desirable flora and fauna.

To address these issues, in 2002, the U.S. EPA adopted recommended nutrient water quality criteria for lakes and reservoirs, and rivers and streams within specific geographic regions (ecoregions) of the United States with the aim of reducing and preventing eutrophication on a national scale. These nutrient criteria specific to each ecoregion were intended as a starting point for states, authorized tribes and others to develop more precise numeric levels for nutrients needed to protect aquatic life and recreational or other uses on a site-specific or subregion-specific basis.

The Los Angeles Basin Plan contains general WQOs for nitrogen (10 mg/L nitrogen as NO_3-N plus NO_2-N, 45 mg/L as NO_3, 10 mg/L as NO_3-N, or 1 mg/L as NO_2-N)[19], as well as site specific objectives for designated water bodies, but those, while protective of drinking water, may not be sufficient to protect aquatic life. However, the Basin Plan also contains a narrative objective for biostimulatory substances, defined as substances, including excess nutrients (nitrogen, phosphorus) and other compounds, that stimulate aquatic growth: "Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses."

The State Water Board is currently developing a statewide water quality objective for biostimulatory substances along with a program of implementation as an amendment (Biostimulatory Substances Amendment or project) to the ISWEBE Plan. The Biostimulatory Substances Amendment could include: a statewide numeric objective or a

[19] NO_3-N refers to Nitrogen (N) present in the nitrate ion NO_3; NO_2-N refers to Nitrogen (N) present in the nitrite ion NO_2

statewide narrative objective (with a numeric translator), and various regulatory control options for point and non-point sources. This project will also include a water quality control policy to establish and implement biological condition assessment methods, scoring tools, and targets aimed at protecting the biological integrity in wadeable streams. Potential actions by the Los Angeles Water Board on these items will be considered, if necessary, after adoption by the State Water Board.

4. Criteria directly addressed by the Los Angeles Water Board

4.1. Aquatic life Ammonia criteria

Ammonia is a naturally forming chemical that is also introduced by humans in roughly equal amounts. It is a vital source of nitrogen for plants and animals, generated in nature by decomposition of organic matter, gas exchange with the atmosphere, forest fires, animal and human waste, and nitrogen fixation processes. Industrial uses of ammonia are primarily fertilizer, but also include the manufacturing of many cleaning products, synthetic fibers, plastics, and explosives.

Ammonia can enter the aquatic environment via direct means such as municipal effluent discharges and the excretion of nitrogenous wastes from animals, and indirect means such as nitrogen fixation, air deposition, and runoff from agricultural lands. When present in water at high enough levels, it is highly toxic to aquatic life, as it is difficult for aquatic organisms to sufficiently excrete the toxicant, leading to toxic buildup in internal tissues and blood, and potentially death. Environmental factors, such as pH and temperature, can affect ammonia toxicity to aquatic animals.

The 2013 revised U.S. EPA recommended water quality criteria for the protection of aquatic life from the toxic effects of ammonia in freshwater (Table 9) are pH, temperature and life-stage dependent, and take into account data for several sensitive freshwater mussel species in the Family Unionidae that had not previously been included in the development of the criteria. As a result, for water temperatures greater than 15.7°C, the acute criterion, or criterion maximum concentration (CMC), is determined primarily by effects of ammonia on freshwater unionid mussels, while at lower temperatures, the CMC is based primarily on effects on salmonids and other fish. The chronic criterion, or criterion continuous concentration (CCC), is determined primarily by the effects on freshwater mollusks, particularly unionid mussels, throughout the temperature range. However, recognizing that unionid mussels may be absent in some waters, the U.S. EPA allows for site-specific criteria to be developed, using recalculation procedures to remove the mussel species from the national criteria dataset to better represent the species present at the site.

Table 9: Recommended U.S. EPA water quality criteria for the protection of aquatic life from the toxic effects of ammonia in freshwater.

Averaging Period	Criteria
1-hour average (CMC) (mg TAN/L)[20]	pH, Temperature and presence of salmonids dependent Not to be exceeded more than once every three years on the average
30-days average (CCC) (mg TAN/L)	pH and Temperature dependent Not to be exceeded more than once every three years on the average
Highest 4-days average within the 30-day period (mg TAN/L)	2.5 times the CCC Not to be exceeded more than once every three years on the average

The WQOs for ammonia in freshwater currently contained in the Los Angeles Region's Basin Plan are presented in Table 10 and are based on the 1999 U.S. EPA recommended criteria. The acute freshwater objective is dependent on pH and fish species (salmonids present or absent), but not temperature. It is assumed that salmonids may be present in waters designated in the Basin Plan as "COLD" or "MIGR" and that salmonids are absent in waters not designated in the Basin Plan as "COLD" or "MIGR," in the absence of additional information to the contrary. The chronic freshwater objective is dependent on pH, temperature, and the presence or absence of early life stages of fish (ELS). In addition, for some of the region's freshwater streams, the Basin Plan ammonia chronic objectives are expressed as Site Specific Objectives (SSOs). In addition to these numeric objectives, the Basin Plan narrative Toxicity WQO applies to toxic substances in general, including ammonia.

Table 10: Los Angeles Basin Plan currently applicable numeric WQOs for ammonia in freshwaters. Note that for some of the Region's freshwater streams, the Basin Plan ammonia objectives are expressed as Site Specific Objectives (SSOs):

Averaging Period	Objective
1-hour average (CMC) (mg un-ionized NH_3/L)	pH and fish species dependent
30-days average (CCC) (mg un-ionized NH_3/L)	pH, Temperature and early-life stages of fish dependent
4-days average (mg un-ionized NH_3/L)	2.5 times the CCC

In order to address the applicability of the revised U.S. EPA criteria to the Los Angeles Region, the presence of unionid mussels in the region's freshwater bodies first needs to

[20] TAN stands for Total Ammonia Nitrogen

be determined. As a first step towards the reconsideration of the freshwater ammonia criteria, in 2016 the Los Angeles Water Board entered into contract with the University of California Santa Barbara to determine whether native unionidae mussels, which have been historically found in the Los Angeles and Ventura County coastal drainages, are currently present. Results of the study, which concluded in March 2019, will be taken into account when incorporating the U.S. EPA's criteria into the Basin Plan.

4.2. Aquatic life Copper criteria

Copper is an abundant trace element that occurs naturally in rock, water, sediment, and soil. It is commonly found in aquatic systems as a result of both natural and anthropogenic sources. Anthropogenic sources of copper in aquatic environments include mining activities, agriculture, metal and electrical manufacturing, sludge from publicly owned treatment works (POTWs), pesticide use and more. A major source of the metal in the marine environment is antifouling paints, used as coatings for ship hulls, buoys, and underwater surfaces, and from decking, pilings and some marine structures that used chromated copper arsenate (CCA) treated timbers.

Although copper is an essential nutrient at low concentrations, it is toxic to aquatic organisms at higher concentrations. In addition to acute effects such as mortality, chronic exposure to copper can lead to adverse effects on survival, growth, reproduction as well as alterations of brain function, enzyme activity, blood chemistry, and metabolism.

The updated U.S. EPA Aquatic Life Water Quality Criteria as well as current applicable Basin Plan WQOs for copper in freshwater are shown in table 11 below. The updated Aquatic Life Ambient Freshwater Quality Criteria for copper adopted by the U.S. EPA in 2007 are calculated using the Biotic Ligand Model (BLM), a metal bioavailability model that uses receiving water body characteristics to develop site-specific water quality criteria. The BLM requires ten input parameters to calculate a freshwater copper criterion: temperature, pH, dissolved organic carbon (DOC), calcium, magnesium, sodium, potassium, sulfate, chloride, and alkalinity. The model is used to derive the criteria, as opposed to the U.S. EPA method used in the CTR which uses a criteria with a post-derivation adjustment based on hardness. This allows the BLM-based criteria to be customized to the particular water body under consideration.

The Los Angeles Basin Plan currently does not apply the 2007 U.S. EPA criteria for copper, but instead incorporates by reference the CTR criteria for aquatic life for copper, (40 C.F.R. section 131.38) (Table 11), and also contains a narrative Toxicity WQO that applies to toxic substances in general. Recognizing the effectiveness of the BLM as a tool to address the site-specific bioavailability of metals such as copper, as it accounts for multiple factors that affect toxicity, the Los Angeles Water Board is currently working on incorporating the BLM based criteria in its Basin Plan.

However, as was the case for the recalculation of the lead water quality objectives for the Los Angeles River adopted in 2015 (R15-004), because the CTR water quality criteria are federally promulgated, further action by the U.S. EPA will likely be necessary in order for the Los Angeles Water Board to apply the BLM based criteria in its regulatory actions.

Table 11: Updated U.S. EPA Freshwater Aquatic Life Water Quality Criteria and current applicable Basin Plan numeric WQOs for copper. The criteria are expressed in terms of the dissolved metal in the water column.

Criteria/Objective	CMC (acute)[21]	CCC (chronic)[22]
U.S. EPA Criteria	BLM	BLM
Los Angeles Water Board Basin Plan: CTR criteria[23,24]	13 µg/L	9 µg/L

5. Summary

This document addresses the revisions to the federal WQS regulations at 40 C.F.R. Part 131 that require states and authorized tribes to consider for adoption as WQS new or updated CWA section 304(a) water quality criteria recommendations published by the U.S. EPA since May 30, 2000.

After review of the 121 pollutants considered by 40 C.F.R. Part 131, Los Angeles Water Board staff determined that consideration of these criteria for adoption as WQOs would be most efficiently undertaken by the State Water Board Division of Water Quality. Once adopted, the WQOs could then apply to all waters in the state, including those in the Los Angeles Region.

The Los Angeles Water Board will consider a limited number of criteria for which work is already ongoing and for which site-specific conditions are particularly important. In addition, the Los Angeles Water Board will consider potential actions on items that have recently been or are being currently addressed by the State Water Board or the U.S. EPA. Overall, the criteria recently developed by, or under development by, the three entities include:

- The human health Pathogen and Pathogen Indicators criteria
- The human health Methylmercury criteria
- The human health Cylindrospermopsin and Microcystins criteria
- The aquatic life Ammonia criteria
- The aquatic life Copper criteria
- The aquatic life Cadmium criteria
- The aquatic life Nutrients criteria
- The aquatic life Selenium criteria

[21] CMC = short-term average, not to be exceeded more than once every three years on the average.

[22] CCC = 4-day average, not to be exceeded more than once every three years on the average.

[23] The freshwater acute and chronic copper criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as calcium carbonate to allow the presentation of representative criteria values.

[24] The acute and chronic freshwater CTR criteria values are based on a default water-effect ratio (WER) of 1. However, site-specific WERs have been derived for a number of waterbodies in the Los Angeles River and Calleguas Creek watersheds.

Stakeholders will have the opportunity to comment on each WQO update prior to its consideration by the Los Angeles Water Board or the State Water Board as part of the public notice and comment process for each individual Basin Plan amendment. Should adoption of additional criteria become a priority to the Los Angeles Water Board staff or stakeholders, those may be considered as part of the 2020-22 triennial review process.

APPENDIX

Section 304(a) Human Health and Aquatic Life Water Quality Criteria Recommendations Published by the U.S. EPA Since May 30, 2000 and Current Applicable Water Quality Objectives

1. Human Health Water Quality Criteria

Table 1: Section 304(a) human health water quality criteria (WQC) recommendations published by the U.S. EPA since May 30, 2000 and current applicable Water Quality Objectives (WQOs) in the Los Angeles Regional Water Board Basin Plan. The ISWEBE Plan stands for the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California Plan.

Chemical	Chemical Abstracts Service Number	EPA Publication Year	*EPA WQC:* Water + Organism (µg/l)	*EPA WQC:* Organism Only (µg/l)	*Basin Plan[(a)]: CTR* Water + Organism (µg/l)	*Basin Plan[(a)]: CTR* Organism Only (µg/l)	*Basin Plan: MCL[(b)]* (µg/l)	*Ocean Plan[(c)] WQOs:* Organism Only (µg/l)	*ISWEBE Plan*
Acenaphthene	83-32-9	2015	70	90	1,200	2,700	N/A	N/A	N/A
Acrolein	107-02-8	2015	3	400	320	780	N/A	220	N/A
Acrylonitrile	107-13-1	2015	0.061	7	0.059	0.66	N/A	0.1	N/A
Aldrin	309-00-2	2015	0.00000077	0.00000077	0.00013	0.00014	N/A	0.000022	N/A
alpha-Hexachlorocyclohexane (HCH)	319-84-6	2015	0.00036	0.00039	0.0039	0.013	N/A	N/A	N/A
alpha-Endosulfan	959-98-8	2015	20	30	110	240	N/A	N/A	N/A
Anthracene	120-12-7	2015	300	400	9,600	110,000	N/A	N/A	N/A
Antimony	7440360	2002	5.6	640	14	4,300	6	1,200	N/A
Benzene	71-43-2	2015	0.58 to 2.1	16 to 58	1.2	71	1	5.9	N/A
Benzidine	92-87-5	2015	0.00014	0.011	0.00012	0.00054	N/A	0.000069	N/A
Benzo(a)anthracene	56-55-3	2015	0.0012	0.0013	0.0044	0.049	N/A	N/A	N/A
Benzo(a)pyrene	50-32-8	2015	0.00012	0.00013	0.0044	0.049	N/A	N/A	N/A
Benzo(b)fluoranthene	205-99-2	2015	0.0012	0.0013	0.0044	0.049	N/A	N/A	N/A

Chemical	Chemical Abstracts Service Number	EPA Publication Year	*EPA WQC:* Water + Organism (µg/l)	*EPA WQC:* Organism Only (µg/l)	*Basin Plan[a]: CTR* Water + Organism (µg/l)	*Basin Plan[a]: CTR* Organism Only (µg/l)	*Basin Plan: MCL[b]* (µg/l)	*Ocean Plan[c] WQOs:* Organism Only (µg/l)	*ISWEBE Plan*
Benzo(k)fluoranthene	207-08-9	2015	0.012	0.013	0.0044	0.049	N/A	N/A	N/A
beta-Hexachlorocyclohexane (HCH)	319-85-7	2015	0.008	0.014	0.014	0.046	N/A	N/A	N/A
beta-Endosulfan	33213-65-9	2015	20	40	110	240	N/A	N/A	N/A
Bis(chloromethyl)ether	542-88-1	2015	0.00015	0.017	N/A	N/A	N/A	N/A	N/A
Bis(2-Chloro-1-Methylethyl) Ether	108-60-1	2015	200	4,000	1,400	170,000	N/A	N/A	N/A
Bis(2-Chloroethyl) Ether	111-44-4	2015	0.03	2.2	0.031	1.4	N/A	0.045	N/A
Bis(2-Ethylhexyl) Phthalate	117-81-7	2015	0.32	0.37	1.8	5.9	4	3.5	N/A
Bromoform	75-25-2	2015	7	120	4.3	360	N/A	N/A	N/A
Butylbenzyl Phthalate	85-68-7	2015	0.1	0.1	3,000	5,200	N/A	N/A	N/A
Carbon Tetrachloride	56-23-5	2015	0.4	5	0.25	4.4	0.5	0.9	N/A
Chlordane	57-74-9	2015	0.00031	0.00032	0.00057	0.00059	0.1	0.000023	N/A
Chlorobenzene	108-90-7	2015	100	800	680	21,000	70	570	N/A
Chlorodibromomethane	124-48-1	2015	0.8	21	0.401	34	(80)	8.6	N/A
Chloroform	67-66-3	2015	60	2,000	N/A	N/A	(80)	130	N/A
Chlorophenoxy herbicide 2,4-D	94-75-7	2015	1,300	12,000	N/A	N/A	70	N/A	N/A
Chlorophenoxy Herbicide (2,4,5-TP) [Silvex]	93-72-1	2015	100	400	N/A	N/A	50	N/A	N/A
Chrysene	218-01-9	2015	0.12	0.13	0.0044	0.049	N/A	N/A	N/A

Chemical	Chemical Abstracts Service Number	EPA Publication Year	*EPA WQC:* Water + Organism (µg/l)	*EPA WQC:* Organism Only (µg/l)	*Basin Plan[a]: CTR* Water + Organism (µg/l)	*Basin Plan[a]: CTR* Organism Only (µg/l)	*Basin Plan: MCL[b]* (µg/l)	*Ocean Plan[c] WQOs:* Organism Only (µg/l)	*ISWEBE Plan*
Cyanide	57-12-5	2015	4	400	700	220,000	(150)	N/A	N/A
Cylindrospermopsin	143545-90-8	2019	[d]	[d]	N/A	N/A	N/A	N/A	N/A
Dibenzo(a,h)anthracene	53-70-3	2015	0.00012	0.00013	0.0044	0.049	N/A	N/A	N/A
Dichlorobromomethane	75-27-4	2015	0.95	27	0.56	46	(80)	6.2	N/A
Dieldrin	60-57-1	2015	0.0000012	0.0000012	0.00014	0.00014	N/A	0.00004	N/A
Diethyl Phthalate	84-66-2	2015	600	600	23,000	120,000	N/A	33,000	N/A
Dimethyl Phthalate	131-11-3	2015	2,000	2,000	313,000	2,900,000	N/A	820,000	N/A
Di-n-Butyl Phthalate	84-74-2	2015	20	30	2,700	12,000	N/A	3,500	N/A
Dinitrophenols	25550-58-7	2015	10	1,000	N/A	N/A	N/A	N/A	N/A
Endosulfan Sulfate	1031-07-8	2015	20	40	110	240	N/A	N/A	N/A
Endrin	72-20-8	2015	0.03	0.03	0.76	0.81	2	N/A	N/A
Endrin Aldehyde	7421-93-4	2015	1	1	0.76	0.81	N/A	N/A	N/A
Ethylbenzene	100-41-4	2015	68	130	3100	29,000	300	4,100	N/A
Fluoranthene	206-44-0	2015	20	20	300	370	N/A	15	N/A
Fluorene	86-73-7	2015	50	70	1,300	14,000	N/A	N/A	N/A
gamma-Hexachlorocyclohexane (HCH) (Lindane)	58-89-9	2015	4.2	4.4	0.019	0.063	(0.2)	N/A	N/A
Heptachlor	76-44-8	2015	0.0000059	0.0000059	0.00021	0.00021	0.01	0.00005	N/A

Chemical	Chemical Abstracts Service Number	EPA Publication Year	*EPA WQC:* Water + Organism (µg/l)	*EPA WQC:* Organism Only (µg/l)	*Basin Plan[a]: CTR* Water + Organism (µg/l)	*Basin Plan[a]: CTR* Organism Only (µg/l)	*Basin Plan: MCL[b]* (µg/l)	*Ocean Plan[c] WQOs:* Organism Only (µg/l)	*ISWEBE Plan*
Heptachlor Epoxide	1024-57-3	2015	0.000032	0.000032	0.0001	0.00011	0.01	0.00002	N/A
Hexachlorobenzene	118-74-1	2015	0.000079	0.000079	0.00075	0.00077	1	0.00021	N/A
Hexachlorobutadiene	87-68-3	2015	0.01	0.01	0.44	50	N/A	14	N/A
Hexachlorocyclohexane (HCH)-Technical	608-73-1	2015	0.0066	0.01	N/A	N/A	N/A	N/A	N/A
Hexachlorocyclopentadiene	77-47-4	2015	4	4	240	17,000	50	58	N/A
Hexachloroethane	67-72-1	2015	0.1	0.1	1.9	8.9	N/A	2.5	N/A
Indeno(1,2,3-c,d)pyrene	193-39-5	2015	0.0012	0.0013	0.0044	0.049	N/A	N/A	N/A
Isophorone	78-59-1	2015	34	1,800	8.4	600	N/A	730	N/A
Methylmercury	22967-92-6	2001	N/A	N/A	(e)	(e)	N/A	N/A	(f)
Methoxychlor	72-43-5	2015	0.02	0.02	N/A	N/A	30	N/A	N/A
Methyl Bromide	74-83-9	2015	100	10,000	48	4,000	N/A	N/A	N/A
Methylene Chloride	75-09-2	2015	20	1,000	4.7	1,600	(5)	N/A	N/A
Microcystins	101043-37-2	2019	(d)	(d)	N/A	N/A	N/A	N/A	N/A
Nitrobenzene	98-95-3	2015	10	600	17	1,900	N/A	4.9	N/A
Nitrosodibutylamine, N	924-16-3	2002	0.0063	0.22	N/A	N/A	N/A	N/A	N/A
Nitrosidiethylamine, N (NDEA)	55-18-5	2002	0.0008	1.24	N/A	N/A	N/A	N/A	N/A
Nitrosopyrrolidine, N	930-55-2	2002	0.016	34	N/A	N/A	N/A	N/A	N/A

Chemical	Chemical Abstracts Service Number	EPA Publication Year	*EPA WQC:* Water + Organism (µg/l)	*EPA WQC:* Organism Only (µg/l)	*Basin Plan[a]: CTR* Water + Organism (µg/l)	*Basin Plan[a]: CTR* Organism Only (µg/l)	*Basin Plan: MCL[b]* (µg/l)	*Ocean Plan[c] WQOs:* Organism Only (µg/l)	*ISWEBE Plan*
N-Nitrosodimethylamine (NDMA)	62-75-9	2002	0.00069	3.00	0.00069	8.1	N/A	7.3	N/A
N-Nitrosodi-n-Propylamine	621-64-7	2002	0.005	0.51	0.005	1.4	N/A	0.38	N/A
N-Nitrosodiphenylamine	86-30-6	2002	3.3	6.0	5	16	N/A	2.5	N/A
Pathogen and Pathogen Indicators[g][h]	N/A	2012	[i]	[i]	N/A	N/A	N/A	[g]	[g]
Pentachlorobenzene	608-93-5	2015	0.1	0.1	N/A	N/A	N/A	N/A	N/A
Pentachlorophenol	87-86-5	2015	0.03	0.04	0.28	8.2	1	N/A	N/A
Phenol	108-95-2	2015	4,000	300,000	21,000	4,600,000	N/A	N/A	N/A
PCBs [j]	1336-36-3	2002	0.000064	0.000064	0.00017	0.00017	0.5	0.000019	N/A
Pyrene	129-00-0	2015	20	30	960	11,000	N/A	N/A	N/A
Selenium	7782-49-2	2002	170	4,200	N/A	N/A	50	N/A	N/A
Tetrachloroethylene (Perchloroethylene)	127-18-4	2015	10	29	0.8	8.85	5	N/A	N/A
Thallium	7440280	2003	0.24	0.47	1.7	6.3	2	N/A	N/A
Toluene	108-88-3	2015	57	520	6,800	200,000	150	85,000	N/A
Toxaphene	8001-35-2	2015	0.0007	0.00071	0.00073	0.00075	3	0.00021	N/A
Trichloroethylene (TCE)	79-01-6	2015	0.6	7	2.7	81	5	27	N/A
Vinyl Chloride	75-01-4	2015	0.022	1.6	2	525	0.5	36	N/A
Zinc	7440-66-6	2002	7,400	26,000	N/A	N/A	(5,000)	N/A	N/A

Chemical	Chemical Abstracts Service Number	EPA Publication Year	*EPA WQC:* Water + Organism (µg/l)	*EPA WQC:* Organism Only (µg/l)	*Basin Plan[a]: CTR* Water + Organism (µg/l)	*Basin Plan[a]: CTR* Organism Only (µg/l)	*Basin Plan: MCL[b]* (µg/l)	*Ocean Plan[c] WQOs:* Organism Only (µg/l)	*ISWEBE Plan*
1,1,1-Trichloroethane	71-55-6	2015	10,000	200,000	N/A	N/A	200	540,000	N/A
1,1,2,2-Tetrachloroethane	79-34-5	2015	0.2	3	0.17	11	1	2.3	N/A
1,1,2-Trichloroethane	79-00-5	2015	0.55	8.9	0.6	42	5	9.4	N/A
1,1-Dichloroethylene	75-35-4	2015	300	20,000	0.057	3.2	6	0.9	N/A
1,2,4,5-Tetrachlorobenzene	95-94-3	2015	0.03	0.03	N/A	N/A	N/A	N/A	N/A
1,2,4-Trichlorobenzene	120-82-1	2015	0.071	0.076	N/A	N/A	5	N/A	N/A
1,2-Dichlorobenzene	95-50-1	2015	1,000	3,000	2,700	17,000	600	N/A	N/A
1,2-Dichloroethane	107-06-2	2015	9.9	650	0.38	99	0.5	28	N/A
1,2-Dichloropropane	78-87-5	2015	0.9	31	0.52	39	5	N/A	N/A
1,2-Diphenylhydrazine	122-66-7	2015	0.03	0.2	0.04	0.54	N/A	0.16	N/A
trans-1,2-Dichloroethylene (DCE)	156-60-5	2015	100	4,000	700	140,000	10	N/A	N/A
1,3-Dichlorobenzene	541-73-1	2015	7	10	400	2,600	N/A	N/A	N/A
1,3-Dichloropropene	542-75-6	2015	0.27	12	10	1,700	0.5	8.9	N/A
1,4-Dichlorobenzene	106-46-7	2015	300	900	400	2,600	5	18	N/A
2,3,7,8-TCDD (Dioxin)	1746-01-6	2002	0.000000005	0.000000005	0.000000013	0.000000014	0.00000003	N/A	N/A
2,4,5-Trichlorophenol	95-95-4	2015	300	600	N/A	N/A	N/A	N/A	N/A
2,4,6-Trichlorophenol	88-06-2	2015	1.5	2.8	2.1	6.5	N/A	0.29	N/A

Chemical	Chemical Abstracts Service Number	EPA Publication Year	*EPA WQC:* Water + Organism (µg/l)	*EPA WQC:* Organism Only (µg/l)	*Basin Plan[a]: CTR* Water + Organism (µg/l)	*Basin Plan[a]: CTR* Organism Only (µg/l)	*Basin Plan: MCL[b]* (µg/l)	*Ocean Plan[c] WQOs:* Organism Only (µg/l)	*ISWEBE Plan*
2,4-Dichlorophenol	120-83-2	2015	10	60	93	790	N/A	N/A	N/A
2,4-Dimethylphenol	105-67-9	2015	100	3,000	540	2,300	N/A	N/A	N/A
2,4-Dinitrophenol	51-28-5	2015	10	300	70	14,000	N/A	4.0	N/A
2,4-Dinitrotoluene	121-14-2	2015	0.049	1.7	0.11	9.1	N/A	2.6	N/A
2-Chloronaphthalene	91-58-7	2015	800	1,000	1,700	4,300	N/A	N/A	N/A
2-Chlorophenol	95-57-8	2015	30	800	120	400	N/A	N/A	N/A
2-Methyl-4,6-Dinitrophenol	534-52-1	2015	2	30	13.4	765	N/A	N/A	N/A
3,3'-Dichlorobenzidine	91-94-1	2015	0.049	0.15	0.04	0.077	N/A	0.0081	N/A
3-Methyl-4-Chlorophenol	59-50-7	2015	500	2,000	N/A	N/A	N/A	N/A	N/A
p,p'-Dichlorodiphenyldichloroethane (DDD)	72-54-8	2015	0.00012	0.00012	0.00083	0.00084	N/A	N/A	N/A
p,p'-Dichlorodiphenyldichloroethylene (DDE)	72-55-9	2015	0.000018	0.000018	0.00059	0.00059	N/A	N/A	N/A
p,p'-Dichlorodiphenyltrichloroethane (DDT)	50-29-3	2015	0.00003	0.00003	0.00059	0.00059	N/A	0.00017	N/A

Table 1 Footnotes

(a). The Basin Plan contains the following narrative toxicity objective: "All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life…." Where necessary, the Water Boards identify numeric thresholds to implement narrative objectives contained in the Basin Plans or statewide water quality control plans such as the California Ocean Plan.

(b). Numbers in parentheses represent MCLs provided by the U.S. EPA, but not part of Title 22 of the California Code of Regulations and therefore not included in the Basin Plan.

(c). The Ocean Plan contains the following narrative objective under E. Biological Characteristics: "The concentration of organic materials in fish, shellfish or other marine resources used for human consumption shall not bioaccumulate to levels that are harmful to human health."

(d). U.S EPA recommended Human Health Recreational Water Quality criteria for Microcystins and Cylindrospermopsin:

Toxin	Magnitude	Duration and Frequency
Microcystin	8 (µg/l)	**For application as a recreational water quality criterion:** 10-day assessment periods, not a rolling 10-day period, over the course of a recreation season **For application as a swimming advisory:** magnitude not to be exceeded on any single day
Cylindrospermopsin	15 (µg/l)	**For application as a recreational water quality criterion:** 10-day assessment periods, not a rolling 10-day period, over the course of a recreation season **For application as a swimming advisory:** magnitude not to be exceeded on any single day

(e). The Los Angeles Basin Plan incorporates by reference the California Toxics Rule (CTR) criteria for human health for mercury (40 C.F.R. section 131.38): 0.050 µg/L of mercury for the consumption of water and organisms, and 0.051 µg/L of mercury for the consumption of organisms only.

(f). Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California (ISWEBE Plan) objective for Methylmercury to protect human health and aquatic life:

Beneficial Use	Objective
Sport Fish Objective	0.2 mg/kg in fish tissue within a calendar year
Tribal Subsistence Fishing Objective	0.04 mg/kg in fish tissue within a calendar year
Subsistence Fishing Objective	Waters free of mercury at concentrations which accumulate in fish and cause adverse biological, reproductive, or neurological effects in people
Prey Fish Objective	0.05 mg/kg in fish tissue during the breeding season
California Least Tern Prey Fish Objective	0.03 mg/kg in fish tissue from April 1 through August 31

The Sport Fish Objective applies to the wet weight concentration in skinless fillet in trophic level 3 or trophic level 4 fish, whichever is the highest trophic level fish in the water body.

The Tribal Subsistence Fishing Objective applies to the wet weight concentration in skinless fillet from a mixture of 70 percent trophic level 3 fish and 30 percent trophic level 4 fish.

The Prey Fish Objective applies to the wet weight whole fish tissue of any specifies between 50 and 150 millimeters in total length during the breeding season.

The California Least Tern Prey Fish Objective applies to the wet weight concentration in whole fish less than 50 millimeters total length.

(g). The State Water Board Provisions adopted on January 26, 2018 apply to fresh, estuarine, and ocean waters, and supersede numeric water quality objectives for the REC-1 beneficial use in the Los Angeles Water Board's Basin Plan established prior to the effective date of the Bacteria Provisions. Narrative water quality objectives and numeric site-specific objectives established before or after the effective date of the statewide Bacteria Provisions remain in effect. The Ocean Plan also retains the WQOs for fecal coliform that were in the Ocean Plan prior to 2018.

Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California Plan (ISWEBE Plan) bacteria WQOs for Water Contact Recreation (REC-1) in Fresh and Estuarine Waters. The statistical threshold value is not to be exceeded by more than 10 percent of the samples collected in a calendar month, calculated in a static manner.

Salinity	**Indicator**	**6-Week Rolling Geometric Mean, Calculated Weekly** (colony forming units/ml)	**Statistical Threshold Value** (colony forming units/ml)
Salinity equal to or less than 1 parts per thousand 95% or more of the time	E. coli	100	320
Salinity greater than 1 part per thousand more than 5% of the time	Enterococci	30	110

Ocean Plan Enterococci bacteria WQOs for Water Contact Recreation (REC-1) in Marine Waters.

Indicator	**6-Week Rolling Geometric Mean, Calculated Weekly** (colony forming units/100ml)	**Statistical Threshold Value** (colony forming units/100ml)
Enterococci	30	110

Ocean Plan Fecal Coliform Bacteria Water Quality Objectives for Water Contact Recreation (REC-1) in Marine Waters

Indicator	**30-day Geometric Mean**	**Single Sample Maximum**
Fecal coliform density	200 per 100 mL	400 per 100 mL

(h). The Basin Plan contains the following applicable water quality objectives for bacteria in surface waters.

Type of Objective	**Indicator**	**Type of Measurement**	**Value** (colony forming units/ml)
WQO for Freshwater with LREC-1 designation	E coli	30-Day Geometric Mean (minimum 5 samples)	126
WQO for Freshwater with LREC-1 designation	E coli	Single sample	576

(i). Updated U.S. EPA Human Health Water Quality Criteria for Pathogen and Pathogen Indicators for Water Contact Recreation

Recommendation 1 (estimated illness rate 36 of 1000 water contact recreators). The statistical threshold value should not be exceeded by more than 10 percent of the samples taken over a 30-day interval.

Water Type	**Indicator**	**30-Day Geometric Mean** (colony forming units/ml)	**Statistical Threshold Value** (colony forming units/ml)
Freshwater	E coli	126	410
Freshwater	Enterococcus	35	130
Marine Waters	Enterococcus	35	130

Recommendation 2 (estimated illness rate 32 of 1000 water contact recreators). The statistical threshold value should not be exceeded by more than 10 percent of the samples taken over a 30-day interval.

Water Type	**Indicator**	**30-Day Geometric Mean** (colony forming units/ml)	**Statistical Threshold Value** (colony forming units/ml)
Freshwater	E coli	100	320
Freshwater	Enterococcus	30	110
Marine Waters	Enterococcus	30	110

(j). The Basin Plan contains the following regional water quality objective for polychlorinated biphenyls (PCBs):

The purposeful discharge of PCBs (the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260) to waters of the Region, or at locations where the waste can subsequently reach waters of the Region, is prohibited.

Pass-through or uncontrollable discharges to waters of the Region, or at locations where the waste can subsequently reach water of the Region, are limited to 70 pg/L (30 day average) for protection of human health and 14 ng/L and 30 ng/L (daily average) to protect aquatic life in inland fresh waters and estuarine waters respectively.

2. Aquatic Life Water Quality Criteria

Table 2a. Section 304(a) acute (CMC) and chronic (CCC) aquatic life **freshwater** quality criteria recommendations published by the U.S. EPA since May 30, 2000 that are part of the current applicable Water Quality Objectives (WQOs) in the Los Angeles Regional Water Board Basin Plan.

Chemical	Chemical Abstracts Service Number	**EPA Publication Year**	***EPA WQC*** **CMC (µg/l)**	***EPA WQC*** **CCC (µg/l)**	***Basin Plan[a] WQO: CTR Criteria*** **CMC (µg/l)**	***Basin Plan[a] WQO: CTR Criteria*** **CCC (µg/l)**
Acrolein	107028	2009	3	3	N/A	N/A
Aluminum	7429-90-05	2018	Aluminum Criteria Calculator[b]	Aluminum Criteria Calculator[b]	N/A	N/A
Ammonia	7664417	2013	[c]	[c]	[d]	[d]
Cadmium[e][f]	7440-43-9	2016	1.8	0.72	4.3[g]	2.2[g]
Carbaryl	63252	2012	2.1	2.1	N/A	N/A
Copper[f]	7440508	2007	BLM[h]	BLM[h]	13[f] [g]	9[f] [g]
Diazinon	333415	2005	0.17	0.17	N/A	N/A
Nonylphenol	84852153	2005	28	6.6	N/A	N/A
Nutrients	N/A	2003	Ecoregional criteria[i]	Ecoregional criteria[i]	N/A	N/A
Selenium	7782-49-2	2016	Multi-media criteria[j]	Multi-media criteria[j]	20[k]	5[k]
Tributyltin (TBT)	N/A	2004	0.46	0.072	N/A	N/A

Table 2b. Section 304(a) acute (CMC) and chronic (CCC) aquatic life **saltwater** quality criteria recommendations published by the U.S. EPA since May 30, 2000 that are part of the CTR and current applicable Water Quality Objectives (WQOs) in the Los Angeles Regional Water Board Basin Plan and California Ocean Plan.

Chemical	Chemical Abstracts Service Number	**EPA Publication Year**	***EPA WQC*** **CMC (µg/l)**	***EPA WQC*** **CCC (µg/l)**	***Basin Plan[a] WQO:*** ***CTR Criteria*** **CMC (µg/l)**	***Basin Plan[a] WQO:*** ***CTR Criteria*** **CCC (µg/l)**	***Ocean Plan[l] WQO:*** **6-Month Median**	***Ocean Plan[l] WQO:*** **Daily Max**	***Ocean Plan[l] WQO:*** **Instantaneous Max**
Acrolein	107028	2009	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aluminum	7429-90-05	2018	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ammonia	7664417	2013	[m]	[m]	[d]	[d]	600	2,400	6,000
Cadmium[e]	7440-43-9	2001	33	7.9	42[g]	9.3[g]	1	4	10
Carbaryl	63252	2012	1.6	N/A	N/A	N/A	N/A	N/A	N/A
Copper[e]	7440508	2007	(4.8)[n]	(3.1)[n]	4.8[g]	3.1[g]	3	12	30
Diazinon	333415	2005	0.82	0.82	N/A	N/A	N/A	N/A	N/A
Nonylphenol	84852153	2005	7	1.7	N/A	N/A	N/A	N/A	N/A
Nutrients	N/A	2003	Ecoregional criteria[i]	Ecoregional criteria[i]	N/A	N/A	N/A	N/A	N/A
Selenium[e]	7782-49-2	2016	(290) [o]	(71) [o]	290[g]	71[g]	15	60	150
Tributyltin (TBT)	N/A	2004	0.42	0.074	N/A	N/A	N/A	N/A	N/A

Footnotes for Tables 2a and 2b

(a). The Basin Plan contains the following narrative toxicity objective: "All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life…." Where necessary, the Water Boards identify numeric thresholds to implement narrative objectives contained in the Region's Basin Plan or statewide water quality control plans such as the California Ocean Plan.

(b). The freshwater aluminum criteria apply to pH 5.0 to 10.5, and are based on the water chemistry data (for pH, hardness and dissolved organic carbon) entered into the criteria calculator for a given location.

(c). Recommended U.S. EPA water quality criteria for the protection of aquatic life from the toxic effects of ammonia in freshwater, measured in milligrams of Total Ammonia Nitrogen per Liter (mg TAN/L).

Averaging Period	Criteria
1-hour average (CMC) (mg TAN/L)	pH, T and presence of Oncorhynchus dependent Not to be exceeded more than once every three years on the average
30-days average (CCC) (mg TAN/L)	pH and T dependent Not to be exceeded more than once every three years on the average
Highest 4-days average within the 30-day period (mg TAN/L)	2.5 times the CCC Not to be exceeded more than once every three years on the average

(c). The Basin Plan contains the following regional ammonia water quality objectives for inland surface waters. Note that for some of the Region's freshwater streams, the Basin Plan ammonia objectives are expressed as Site Specific Objectives (SSOs).

Averaging Period	Freshwater Quality Objectives	Saltwater/Brackish Water Quality Objectives (mg un-ionized NH_3/L)
1-hour average (CMC)	pH and fish species dependent	0.233
30-day average (CCC)	pH, T and early-life stages of fish dependent	N/A
4-day average	2.5 times the 30-day average objective	0.35

(e). Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column.

(f). The freshwater acute and chronic criteria for cadmium and copper are hardness-dependent and were normalized to a hardness of 100 mg/L as calcium carbonate to allow the presentation of representative criteria values.

(g). The acute and chronic freshwater CTR criteria values are based on a default water-effect ratio (WER) of 1.

(h). The freshwater copper criteria are calculated using the Biotic Ligand Model (BLM).

(i). The EPA nutrient criteria are expressed as ecoregional criteria for Total Phosphorus, Total Nitrogen, Chlorophyll a and Water Clarity (Secchi depth for lakes; turbidity for streams and rivers) (& Level III Ecoregional criteria).

(j). The freshwater selenium criterion is expressed both in terms of fish tissue concentration (egg/ovary, whole body, muscle) and water concentration (lentic, lotic).

(k). The selenium criteria are expressed in terms of the total recoverable form.

(l). The Ocean Plan contains the following narrative objective under E. Biological Characteristics: “Marine communities, including vertebrate, invertebrate, algae, and plant species, shall not be degraded.”

(m). Saltwater Ammonia Criteria are pH and temperature dependent. Saltwater Ammonia Criteria were established in 1989, and are therefore not part of this review; however they are included as WQOs in the Basin Plan.

(n). The EPA water quality criteria for copper in saltwater were established in 1995, and are therefore not part of this review.

(o). The EPA water quality criteria for selenium in saltwater were established in 1999, and are therefore not part of this review.