Economic Analysis for Proposed Aquatic Life and Aquatic-Dependent Wildlife Criteria for Selenium in the San Francisco Bay and Delta, California

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Contents

Exhibit List

Acronym List

AMEL	Average Monthly Effluent Limit
Basin Plan	Regional Water Quality Control Board Water Quality Control Plan
BAT	Best Available Technology Economically Achievable
BCT	Best Conventional Pollutant Control Technology
BMP	Best Management Practices
CCMP	Comprehensive Conservation and Management Plan
CIWQS	California Integrated Water Quality System
CTR	California Toxics Rule
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
DNQ	Detected, but Not Quantified
DW	Dry-Weight Basis
ECA	Effluent Concentration Allowance
EPA	United States Environmental Protection Agency
gpd	gallons per day
LTA	Long-Term Average discharge condition
MDEL	Maximum Daily Effluent Limitation
MEC	Maximum Effluent Concentration
MEP	Maximum Extent Practicable
µg/L	micrograms per liter
µg/g	micrograms per gram
mgd	million gallons per day
MS4	Municipal Separate Storm Sewer Systems
North Bay	North San Francisco Bay (i.e., Central San Francisco Bay, San Pablo Bay, Carquinez Strait, Suisun Bay, and the western part of the Delta within the SFRWQCB)
NPDES	National Pollutant Discharge Elimination System
NTR	National Toxics Rule
OAL	Office of Administrative Law

O&M	Operations and Maintenance
ppt	parts per thousand
POTW	Publicly Owned Treatment Works
QL	Quantitation Level
Regional Water Board	Regional Water Quality Control Board
RO	Reverse Osmosis
RPA	Reasonable Potential Analysis
SFRWQCB	San Francisco Bay Regional Water Quality Control Board
SIP	State Implementation Policy (*Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California*)
South Bay	South San Francisco Bay, Lower San Francisco Bay, and marine or estuarine tributary waters draining thereto
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WQBELs	Water Quality-Based Effluent Limitations
WQS	Water Quality Standards
WWF	Wet Weather Facilities
WWTP	Wastewater Treatment Plant

Executive Summary

The United States Environmental Protection Agency (EPA) is proposing to update the selenium criteria applicable to marine and estuarine waters of the San Francisco Bay and Delta, to ensure that the criteria are protective of aquatic life and aquatic-dependent wildlife in the Bay and Delta. This report provides estimates of the potential incremental compliance actions and costs that may be associated with the proposed regulation.

Background and Proposed Revised Criteria

The proposed selenium criteria are intended to be protective of aquatic life and aquatic-dependent wildlife, including federally listed threatened and endangered species in the San Francisco Bay and Delta. The currently applicable aquatic life water quality criteria for selenium in the San Francisco Bay and Delta were promulgated as part of the National Toxics Rule (NTR) in 1992. The criteria are based on EPA's 1987 national aquatic life selenium freshwater criteria recommendations.

The proposed selenium criteria include an allowable fish tissue whole body or muscle value, a clam (prey) tissue value, a water column particulate concentration, a water column dissolved concentration, and a water column dissolved intermittent concentration. EPA used the whole body fish tissue criterion and a protective bird-egg tissue value, along with site-specific hydrologic data, to model the bioaccumulation of selenium through the estuary's ecosystem using the United States Geological Survey (USGS) Ecosystem-Scale Selenium Model. EPA used the results of the modeling to determine the protective clam (prey) tissue criterion and the water column particulate and dissolved criteria. The allowable selenium chronic water column dissolved criterion, which serves as the basis for the cost estimates in this document, is 0.2 micrograms per liter (µg/L).

Implementation

Although the proposed rule does not establish any requirements directly applicable to regulated entities or other sources of pollution, state implementation may result in new or revised National Pollutant Discharge Elimination System (NPDES) permit conditions for point source dischargers and additional controls on nonpoint sources of pollutant loadings. This analysis provides information on the potential for incremental costs to be associated with such incremental requirements necessary to assure attainment of state water quality designated uses protected by the criteria in the proposed rule.

This Economic Analysis follows the State of California's established procedures in the State Water Resources Control Board's *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California*, and may result in a conservative evaluation for some point sources. However, the Regional Water Quality Control Boards have substantial discretion to apply other implementing permitting procedures that are consistent with the Policy's requirements, and may elect to follow different methods to determine whether effluent limits are necessary and/or the value of the effluent limitations.

These alternative methods may result in fewer facilities requiring action and/or less stringent permit limitations.

Estimated Compliance Costs

EPA identified 16 point source facilities that potentially could be affected by the rule out of a total population of 51 facilities that discharge to waters subject to the criteria. The remaining facilities are covered by Total Maximum Daily Loads (TMDLs). These TMDLs were developed using stringent translations of narrative criteria, and EPA does not anticipate that facilities affected by them will be affected by the revised criteria in the proposed rule. Of the 16 potentially affected facilities, 14 are classified as major dischargers, and two are minor dischargers. Minor facilities are typically those that discharge less than one million gallons per day (mgd) and do not discharge toxics in toxic amounts. EPA did not evaluate general permits (e.g., for stormwater discharges) for which permit conditions typically focus on best management practices (BMPs) rather than pollutant-specific limits derived from numeric water quality criteria.

Unlike point sources, California typically does not require nonpoint sources and municipal point source stormwater dischargers to achieve numeric water quality-based effluent limitations. The regulatory baseline for evaluating the potential impact of the proposed rule includes some requirements for nonpoint sources and stormwater dischargers to implement BMPs and wasteload allocations as part of currently adopted TMDLs, including already developed and adopted TMDLs for selenium in the Lower San Joaquin River watershed and the North San Francisco Bay. EPA assumes that the proposed rule will not result in the need for additional control action by nonpoint sources.

For the potentially affected point source facilities, EPA evaluated existing baseline conditions and conditions under the proposed rule to project the likelihood that control measures might be required as a consequence of the rule. Analysis of the available data for the affected facilities indicates that there are likely to be exceedances of projected effluent limits for selenium. In instances of exceedances of projected effluent limitations under the proposed rule, EPA determined the likely compliance scenarios and costs. Only compliance actions and costs that would be needed above the baseline level of controls are attributable to the proposed rule. For the population of potentially affected point source facilities, EPA estimates total incremental compliance cost of approximately $16 million per year.

1. Introduction

The EPA is proposing to update the selenium criteria applicable to marine and estuarine waters of the San Francisco Bay and Delta, to ensure that the criteria are protective of aquatic life and aquatic-dependent wildlife in the Bay and Delta. This report provides estimates of the potential incremental compliance actions and costs that may be associated with the regulation.

1.1 Background

The Federal Water Pollution Control Act (as amended through P.L. 107–303, November 27, 2002), also known as the Clean Water Act (CWA), sets the basic structure for regulating pollutant discharges into the waters of the United States. In the CWA, Congress established the national objective to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters,” and to achieve “wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and for recreation in and on the water” (CWA sections 101(a) and 101(a)(2)).

The CWA establishes the basis for the current water quality standards (WQS) regulation and program. CWA section 303 addresses the development of state and authorized tribal WQS, which reflect the CWA national objectives for each water body. The core components of these standards are designated uses, water quality criteria, and antidegradation requirements. Designated uses establish the environmental objectives for a water body, while water quality criteria define the minimum conditions necessary to achieve those environmental objectives. The antidegradation program complements designated uses and criteria by providing a framework for maintaining and protecting water quality.

After states, authorized tribes, territories, and the District of Columbia (hereafter referred to as “states and authorized tribes”) designate the uses of waters under their jurisdiction, they must establish water quality criteria that protect those designated uses. EPA’s regulation at §131.11(a)(1) provides that such criteria “must be based on sound scientific rationale, and must contain sufficient parameters or constituents to protect the designated use.” States and authorized tribes must also adopt antidegradation policies to protect and maintain high quality waters and existing uses of all waters, and identify specific methods to implement those policies (§131.12).

The CWA also requires states and authorized tribes to hold public hearings once every three years for the purpose of reviewing applicable WQS and, as appropriate, modifying and adopting standards. The results of this triennial review must be submitted to EPA, and EPA must approve or disapprove any new or revised standards. CWA section 303(c)(4)(B) authorizes the Administrator to determine, even in the absence of a state submission, that a new or revised standard is needed to meet CWA requirements.

Under CWA section 304(a), EPA periodically publishes national criteria recommendations for states and authorized tribes to consider when adopting water quality criteria for particular pollutants. In establishing numeric criteria, states may adopt criteria based on EPA's CWA section 304(a) criteria, modified 304(a) criteria to reflect site-specific conditions, or other scientifically defensible methods.

EPA has developed national criteria recommendations for ambient waters as water column concentrations that reflect the toxicity of the pollutant to aquatic biota. Authorities can readily implement water column concentrations to control and limit discharges. However, for pollutants like selenium that accumulate in aquatic biota through diet and where toxicity is exhibited through dietary exposure, tissue concentrations can better represent levels of toxicity, particularly for higher order species if the pollutant bioaccumulates through the food chain. Because tissue concentrations may be difficult to implement directly, it is useful to translate tissue concentrations to water column values that reflect the bioaccumulation, i.e., a water column concentration that is related to the tissue concentration of the predator species of concern that is accumulating the selenium. EPA recently published a revised national recommended criterion for selenium (USEPA, 2016). The criterion has several elements, including fish tissue values (egg-ovary, whole body, and muscle) and water column values in dissolved selenium concentrations that reflect the allowable tissue concentrations in lentic and lotic water body systems.

The currently applicable aquatic life water quality criteria for selenium in the San Francisco Bay and Delta are those that EPA promulgated as part of the National Toxics Rule (NTR; 57 FR 60848, December 22, 1992; codified at 40 CFR 131.36). The aquatic life chronic criterion value is 5.0 µg/L (total recoverable). The NTR criteria are based on EPA's 1987 national aquatic life selenium freshwater criteria recommendations,[1] and are represented in terms of water column concentrations.

The revised proposed selenium criteria for the San Francisco Bay and Delta include an allowable fish tissue whole body or muscle value, a clam (prey) tissue value, a water column particulate concentration, a water column dissolved concentration and a water column dissolved intermittent concentration. EPA used the whole body fish tissue criterion and a protective bird-egg tissue value, along with site-specific hydrologic data, to model the bioaccumulation of selenium through the estuary's ecosystem using the USGS Ecosystem-Scale Selenium Model. EPA used the results of the modeling to determine the protective clam (prey) tissue criterion and the water column particulate and dissolved criteria. The allowable selenium chronic water column dissolved criterion is 0.2 µg/L. This value serves as the basis for estimated costs because it is expected to be the primary basis for implementing the criteria.

For determining total recoverable effluent limits in permits, EPA is proposing a translator (the ratio of dissolved to total recoverable metal) of 1 because both the dissolved and particulate forms of selenium may be bioavailable for uptake into the food web in the

[1] Ambient Water Quality Criteria for Selenium - 1987, EPA-440/5-87-008.

estuary. The proposed criteria are applicable to the waters of the San Francisco Bay and Delta that are either marine or estuarine waters, i.e., waters that have a salinity of greater than 1 part per thousand (ppt) 95% or more of the time. These waters are located within the jurisdictions of the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) and the Central Valley Regional Water Quality Control Board (CVRWQCB) of the State of California.

1.2 Purpose and Scope of the Analysis

The purpose of this analysis is to identify, using available water quality and discharge data and information, the incremental compliance actions and costs that publicly owned wastewater treatment works (POTWs) and industrial point source dischargers may incur as a result of EPA's proposed selenium criteria for the Bay and Delta. Although the proposed rule does not establish any requirements directly applicable to regulated entities or other sources of pollution, state implementation may result in new or revised NPDES permit conditions for point source dischargers to incorporate revised water quality-based effluent limits (WQBELs), based on the proposed dissolved water column selenium criterion.

Existing TMDLs in the Lower San Joaquin River watershed and in the North San Francisco Bay (North Bay) i.e., Central San Francisco Bay, San Pablo Bay, Carquinez Strait, Suisun Bay and the western part of the Delta within the SFRWQCB, already address selenium discharges from nonpoint sources, and EPA assumes that no additional incremental controls in the Delta and North Bay are necessary for nonpoint sources based on the proposed selenium criteria because of the stringency of the existing TMDL water quality targets.

The South San Francisco Bay is scheduled for TMDL development by 2019, and as a result there may be incremental controls and costs associated with load allocations for nonpoint sources in the South Bay if necessary to attain standards. However, the data and information needed to evaluate potential control needs for nonpoint sources are very limited, and thus considered outside the scope of this analysis. Sources of selenium in the South Bay appear to originate from naturally occurring selenium in soils.

The TMDL for the North Bay also addresses selenium discharges from point sources, and EPA assumes that no additional incremental controls in the North Bay for point sources are necessary based on the proposed selenium criteria. The TMDL analysis uses fish tissue targets based on EPA's proposed revised national recommended criterion (USEPA, 2015), including a whole body fish tissue target consistent with the proposed whole body fish tissue criterion for the Bay and Delta. The TMDL analysis translates the whole body fish tissue target into a dissolved water column value of 0.5 µg/L. The analysis indicates that because ambient conditions are below 0.5 µg/L, dischargers may continue to discharge at current levels. Because current conditions in the waterbody are at or below 0.2 µg/L, it follows that the TMDL analysis would not need to be revised if a water column target of 0.2 µg/L, consistent with the proposed dissolved water column criterion, is used.

1.3 Organization of Report

This remainder of this report is organized as follows:

Section 2: Baseline for the Analysis describes the current applicable selenium criteria and California State Water Resources Control Board (SWRCB) procedures for implementing the criteria in NPDES permits, sources of selenium to the Bay and Delta, and ongoing efforts to reduce and eliminate them.

Section 3: Proposed Revised Criteria outlines the proposed changes to existing selenium criteria.

Section 4: Method for Estimating Potential Costs: Point Sources describes the method for estimating compliance costs associated with baseline and revised criteria for point sources in terms of revisions to NPDES permits.

Section 5: Method for Identifying Potential Costs: Nonpoint Sources describes the method for identifying potential compliance costs associated with baseline and revised criteria for nonpoint sources.

Section 6: Summary of Results, Uncertainties, and Quality Assurance summarizes cost estimate results for point and nonpoint sources, and discusses the uncertainties associated with the estimates.

Section 7: References provides the references used in the analysis.

Appendices provide data and information on individual point sources analyzed as part of this report, as well as results using alternative discount assumptions.

2. Baseline for the Analysis

This section describes the applicable baseline for evaluating the incremental costs associated with the revised selenium criteria, including current water quality criteria and associated implementation procedures, potential sources of selenium to the Bay and Delta, the current level of impairment, and listing procedures.

2.1 Water Quality Criteria and Implementation Procedures

In California, each Regional Water Quality Control Board (Regional Water Board) adopts a Water Quality Control Plan (hereinafter Basin Plan) that designates beneficial (designated) uses, establishes water quality objectives (criteria), and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan. The proposed criteria for selenium are applicable to the waters of the San Francisco Bay and Delta which are located within the jurisdictions of the SFRWQCB and the CVRWQCB. The Basin Plans applicable in these areas include:

- *Water Quality Control Plan for the San Francisco Bay Basin* (applicable to all parts of San Francisco Bay and the western part of the Delta, including South San Francisco Bay, Lower San Francisco Bay, Central San Francisco Bay, San Pablo Bay, Carquinez Strait, Suisun Bay, and the western portion of the Sacramento-San Joaquin Delta within the SFRWQCB)
- *Water Quality Control Plan for the Sacramento and San Joaquin River Basins* (applicable to eastern portions of the Delta, which includes most of the Delta and the confluences of the Sacramento and the San Joaquin Rivers)

In addition, the SWRCB has adopted water quality control plans and policies to protect the water quality and to control the water resources that affect the beneficial uses of the Bay and Delta Estuary. The *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* supplements the other Basin Plans that cover the Bay and Delta and establishes a comprehensive set of existing beneficial uses for all parts of the Bay and Delta. Existing beneficial uses in the *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* for the protection of aquatic life and aquatic-dependent wildlife include:

- Warm Freshwater Habitat (WARM) – Uses of water that support warm water ecosystems including, but not limited to, preservation of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
- Cold Freshwater Habitat (COLD) – Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancements of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
- Estuarine Habitat (EST) – Uses of water that support estuarine ecosystems, including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish,

shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds), and the propagation, sustenance, and migration of estuarine organisms.

- Fish Migration (MIGR) – Uses of water that support habitats necessary for migration, acclimatization between fresh water and salt water, and protection of aquatic organisms that are temporary inhabitants of waters within the region.
- Preservation of Rare and Endangered Species (RARE) – Uses of waters that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered.
- Fish Spawning (SPWN) – Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
- Wildlife Habitat (WILD) – Uses of waters that support wildlife habitats, including, but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl.

EPA promulgated the NTR on December 22, 1992. The NTR included several aquatic life and/or human health priority toxic pollutant criteria for various waterbodies in California, including aquatic life criteria for selenium in the San Francisco Bay and Delta. On May 18, 2000, EPA promulgated the California Toxics Rule (CTR). The CTR promulgated additional priority toxic pollutant criteria for California and referenced the previously promulgated NTR criteria that were applicable in the State. Although the CTR included criteria for selenium, the criteria were only promulgated for areas of California other than the Bay-Delta. Exhibit 2-1 shows the applicable baseline (i.e., current) criteria for selenium in the San Francisco Bay and Delta that were promulgated in the NTR.

Exhibit 2-1. Baseline Bay-Delta Aquatic Life Water Quality Criteria for Selenium[1]

Chronic Aquatic Life (4-day average; μg/L)	Acute Aquatic Life (1-hour average; μg/L)
5	20

μg/L = micrograms per liter

1. Expressed as total recoverable selenium.

On March 2, 2000, the SWRCB adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (hereinafter referred to as the State Implementation Policy, or SIP). The SIP became effective on April 28, 2000, and is used to implement priority pollutant criteria and objectives, including those promulgated for California in the NTR and CTR. The SWRCB adopted amendments to the SIP on February 24, 2005, that became effective on July 13, 2005. The SIP establishes implementation provisions for addressing priority pollutant criteria and objectives in NPDES permits for point sources. These implementation provisions include, in part, specific procedures for assessing the reasonable potential of point source discharges to cause or contribute to exceedances of applicable water quality criteria and objectives, and – in those instances where there is reasonable potential – specific procedures for establishing WQBELs.

2.2 Water Quality in the Bay and Delta

CWA Section 305(b) requires the State to report biennially to EPA on the condition of the surface water bodies throughout the State. Under Section 303(d) of the CWA, the SWRCB and Regional Water Boards assess water quality monitoring data for California's surface waters every two years to determine if pollutants are at levels that exceed applicable WQS. Water bodies and pollutants that exceed protective WQS are placed on the State's 303(d) list. Placement on the 303(d) list of a water body that exceeds applicable WQS for a pollutant indicates a TMDL may be necessary.

EPA has issued guidance to states about integrating the two reports. For California, this combined report is called the California 303(d)/305(b) Integrated Report. In accordance with EPA Integrated Report guidance, the SWRCB classifies each assessed water segment into one of five non-overlapping categories based on whether the beneficial uses are supported in the water segment.

- Category 5 – Available data and/or information indicate that at least one beneficial use is not being supported or is threatened, and a TMDL is needed.
- Category 4 – Available data and/or information indicate that at least one beneficial use is not being supported or is threatened, but a TMDL is not needed.
    - Category 4A – A TMDL is already established.
    - Category 4B – Other required control measures are expected to result in attainment of an applicable water quality standard in a reasonable period of time.
    - Category 4C – A water that is impacted by non-pollutant related cause(s). (e.g., aquatic life use is not supported due to hydrologic alteration or habitat alteration).
- Category 3 – There is insufficient available data and/or information to make any beneficial use support determination.
- Category 2 – Data and/or information are available for some but not all beneficial uses, and where available, indicate that the beneficial uses are supported.
- Category 1 – All beneficial uses are supported, no use is threatened.

In California, the 303(d) list is made up of three of the Integrated Report categories, 5, 4A, and 4B. These categories contain water segments that are not meeting WQS or are not expected to meet WQS.

According to California's 2012 Water Quality Integrated Report (SWRCB, 2012), the San Francisco Bay and Delta were identified as impaired by selenium and listed as Category 5 requiring a TMDL. Exhibit 2-2 lists the specific segments included on the 303(d) list for selenium.

Exhibit 2-2. San Francisco Bay and Delta Segments Listed as Impaired for Selenium[1]

Waterbody Name/Segment	Expected TMDL Completion Date	Potential Sources	Impairment Description
Sacramento San Joaquin Delta	2010[2]	Source Unknown	Affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have made food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks).
San Francisco Bay, Central	2010[2]		
San Francisco Bay, South	2019		
San Pablo Bay	2010[2]		
Suisan Bay	2010[2]		
Carquinez Strait	2010[2]		
Central Basin	2019		
Oakland Inner Harbor	2019		

1. Source: California's 2012 Water Quality Integrated Report (SWRCB, 2012).

On July 24, 2015, the SFRWQCB proposed a TMDL for the North San Francisco Bay. The TMDL covers a small portion of the Sacramento/San Joaquin Delta (within the San Francisco Bay region), Suisun Bay, Carquinez Strait, San Pablo Bay, and Central Bay. On November 18, 2015, the SFRWQCB adopted a Basin Plan amendment that included the TMDL and an implementation plan (Resolution No. R2-2015-0048; Amending the Water Quality Control Plan for the San Francisco Bay Basin to Establish a Total Maximum Daily Load and Implementation Plan for Selenium in North San Francisco Bay; hereinafter, the North Bay TMDL). On March 15, 2016, the SWRCB approved the Basin Plan amendment. The Basin Plan amendment will become effective for CWA purposes upon approval by the State's Office of Administrative Law (OAL), and EPA.

The SFRWQCB has initiated information collection for the development of a TMDL for the South San Francisco Bay. As this TMDL is in its earliest stages, it is not available for EPA to consider as part of the baseline or any other part of this analysis.

Selenium occurs naturally along portions of the west side of the Lower San Joaquin River basin, and as a result of agricultural land use practices, subsurface agricultural drainage discharges from this area are a major source of selenium. The CVRWQCB addressed the selenium through the adoption of a series of selenium TMDLs in the lower basin, including one for selenium in the Lower San Joaquin River. The TMDL is implemented through: 1) prohibitions of discharge of agricultural subsurface drainage water adopted in the Basin Plan Amendment for the Control of Subsurface Drainage Discharges (State Water Board Resolution 96-078); and 2) load allocations in Waste Discharge Requirements.

2.3 Sources of Selenium to the Bay and Delta

According to the North Bay and Lower San Joaquin River selenium TMDLs, selenium in the San Francisco Bay and Delta mainly originates from natural sources. Although selenium can be released into surface waters through natural biological and geological processes, anthropogenic (e.g., refinery and agricultural) activities are also responsible for the dispersal of selenium in the estuary.

2.3.1 Sediment and Soil

Selenium is a naturally occurring element found in marine sediments of the Coast Ranges. Natural sources of selenium include sedimentary rocks, seleniferous soils, and selenium-rich mineral deposits. According to the North Bay TMDL (SFRWQCB, 2015):

> "*Average concentrations of selenium found in sediments and soils usually range from 0.01 to 0.02 mg/kg with most seleniferous soils containing less than 2 mg/kg (USDHHS 2003, Chapter 6). However, Cretaceous and Tertiary marine and sedimentary deposits underlying and surrounding basins such as San Joaquin Valley, and those found in western states are enriched in selenium. Presser (1994) identified seleniferous deposits in the Coast Ranges of California and the Central Valley with concentrations of selenium reaching 45 mg/kg and median values exceeding 6.5 mg/kg.*"

Further, soils data representing the South San Francisco Bay reported in a literature review conducted by Anderson (1998) for the City of San Jose Environmental Services Department included evidence that naturally occurring selenium is found at relatively high levels in bedrock units, soils, and groundwater (see Exhibit 2-3). The author notes that, at the time of publication, no studies on processes controlling selenium transport into the South San Francisco Bay and Lower San Francisco Bay had been conducted. However, based on the presence of marine shale bedrock units which are similar to those which release selenium in the San Joaquin River Valley and on mercury sulfide ores which have been associated with selenium release in other regions, Anderson indicates that selenium migration from bedrock and other deposits to soils and surface water are a possibility.

Exhibit 2-3. Selenium Observations in Soils draining to South and Lower San Francisco Bay (Anderson 1998)

Location	Observation (ppm Se)	Study[1]
Guadalupe River Vicinity	Three samples with detected values (8 ppm, 2 ppm, 2 ppm) and an unspecified number of samples at <1 ppm	Kleinfelder, Inc., 1995
Gilroy	0.7	Boerngen and Shacklette, 1981
Palo Alto	0.4	Boerngen and Shacklette, 1981
Mountain View	0.4	Scott, 1995
U.S. Geometric Mean	*0.26*	*Shacklette and Boerngen, 1984*
San Mateo County	0.1	Boerngen and Shacklette, 1981

Exhibit 2-3. Selenium Observations in Soils draining to South and Lower San Francisco Bay (Anderson 1998)

Location	Observation (ppm Se)	Study[1]

ppm = parts per million

1. As cited in Anderson (1998).

2.3.2 Agriculture

Dry conditions in the Central Valley make irrigation necessary for nearly all commercially grown crops. Irrigation of the soils derived from seleniferous soils and selenium-rich mineral deposits leaches selenium into surface return flows, subsurface drainage, and groundwater.

According to the TMDL for Selenium in the Lower San Joaquin River (CVRWQCB 2001):

> "*Subsurface drainage is produced when farmers drain the shallow groundwater from the root zone to protect their crops. This subsurface agricultural drainage water is high in naturally occurring salts and selenium. Soils and shallow groundwater with the highest concentrations of selenium in the SJR Basin are located in a 97,000-acre area that has alternately been called the Drainage Study Area, Drainage Problem Area, and most recently, the Drainage Project Area (DPA).*"

Further, according to the North Bay TMDL (SFRWQCB 2015):

> "*Enrichment of selenium in soils and groundwater commonly occurs in arid and semi-arid irrigated areas where application of irrigation water accelerates weathering processes and mobilizes naturally elevated levels of selenium in the soil profile. To reduce effects of salinization of agricultural lands in these areas, such as the southern Central Valley, large volumes of water are used to flush the excess salt and selenium that accumulates in the root zone (Seiler et al. 2003). Drainage of excess irrigation water through the system of drains and canals is then necessary to prevent waterlogging of the soils. These drains, however, provide a conduit to carry seleniferous groundwater to surface water bodies and wildlife areas as it was well documented in the case of disposal of agricultural drainage water into the Kesterson Wildlife Rufuge. This agricultural drainwater is eventually conveyed to the San Joaquin River, which delivers large selenium loads into the Delta and North Bay. Reported selenium concentrations detected in irrigation drainage are very high and vary between 75 and 1400 μg/L (Amweg el al. 2003). The arid climate amplifies evaporation-related enrichment that takes place in lakes and wetlands resulting in selenium concentrations potentially reaching toxic levels.*"

The North Bay TMDL, in its discussion of nonpoint sources of selenium to the North Bay and Delta, concluded that "…*the Central Valley selenium TMDLs and restoration of agricultural lands to tidal systems are likely to contribute to continued reduction in selenium loading to the North Bay*…"

2.3.3 Municipal and Industrial Dischargers

The proposed selenium criteria are applicable to marine and estuarine waters of San Francisco Bay and Delta. Marine and estuarine waters are those in which the salinity is greater than 1 ppt 95% of the time. For purposes of this analysis, this includes the waters of San Francisco Bay and the Sacramento-San Joaquin River Delta. Consistent with EPA's November 3, 2015 memorandum regarding "Salinity from Ocean Influence on the San Joaquin River", waters of the Lower San Joaquin River upstream of Vernalis are not considered estuarine and discharges to these waters will not be considered applicable to this analysis. Based on these geographical boundaries, and data contained in the California Integrated Water Quality System (CIWQS), Exhibit 2-4 lists the major and minor NPDES permittees that discharge to San Francisco Bay and Delta.

Exhibit 2-4. NPDES Permitted Dischargers to the San Francisco Bay and Delta

NPDES Permit Number	Permittee	Receiving Water	Discharge Category	Facility Type
CA0005550	Valero, Benicia Refinery	Suisun Bay	Major	Industrial
CA0037958	Novato Sanitary District	San Pablo Bay	Major	POTW
CA0004961	Tesoro, Golden Eagle Refinery	Suisun Bay	Major	Industrial
CA0037851	Las Gallinas Valley Sanitary District	Miller Creek	Major	POTW
CA0037702	East Bay Municipal Utility District	Central San Fran Bay	Major	POTW
CA0038024	Fairfield-Suisun Sewer District	Boynton Slough	Major	POTW
CA0110116	US Navy, Treasure Island	Central San Fran Bay	Major	POTW
CA0038440	East Bay Municipal Utility District, Wet Weather	Richmond Inner Harbor (central San Fran Bay)	Minor	POTW
CA0037621	City Of Sunnyvale	Moffett Channel	Major	POTW
CA0037842	San Jose/Santa Clara	Artesian Slough	Major	POTW
CA0038547	Delta Diablo	New York Slough	Major	POTW
CA0037834	Palo Alto	South San Fran Bay	Major	POTW
CA0038091	Benicia	Carquinez Strait	Major	POTW
CA0037800	Sonoma Valley County Sanitation District	Schell Slough	Major	POTW
CA0038130	South San Francisco-San Bruno	Lower San Fran Bay	Major	POTW
CA0037532	Millbrae	Lower San Fran Bay	Major	POTW

Exhibit 2-4. NPDES Permitted Dischargers to the San Francisco Bay and Delta

NPDES Permit Number	Permittee	Receiving Water	Discharge Category	Facility Type
CA0037885	Crockett Community Services District, Port Costa	Carquinez Strait	Minor	POTW
CA0030058	Bottling Group	Old Alameda Creek	Minor	Industrial
CA0037664	San Francisco, Southeast Plant	Lower San Fran Bay	Major	POTW
CA0037753	Marin County Sanitary District #5, Tiburon	Raccoon Strait in Central San Fran Bay	Minor	POTW
CA0038539	West County Agency	Central San Fran Bay	Major	POTW
CA0037788	Burlingame	Lower San Fran Bay	Major	POTW
CA0038318	San Francisco International Airport, Sanitary Plant	Lower San Fran Bay	Major	Industrial
CA0037541	San Mateo	Lower San Fran Bay	Major	POTW
CA0037711	Sewerage Agency Of Southern Marin	Raccoon Strait in Central San Fran Bay	Major	POTW
CA0005240	C&H Sugar Company	Carquinez Strait	Major	Industrial
CA0038067	Sausalito-Marin City Sanitary District	Central San Fran Bay	Major	POTW
CA0038369	Silicon Valley Clean Water	Lower San Fran Bay	Major	POTW
CA0037796	Pinole	San Pablo Bay	Major	POTW
CA0005789	Shell Oil, Martinez Refinery	Carquinez Strait	Major	Industrial
CA0038628	Central Marin Sanitation Agency	Central San Fran Bay	Major	POTW
CA0037826	Rodeo Sanitary District	San Pablo Bay	Major	POTW
CA0037699	Vallejo Sanitation & Flood Control District	Carquinez Strait	Major	POTW
CA0037648	Central Contra Costa Sanitary District	Suisun Bay	Major	POTW
CA0038008	Livermore	Lower San Fran Bay	Major	POTW
CA0037613	Dublin San Ramon & Livermore-Amador Valley	Lower San Fran Bay	Major	POTW
CA0037869	East Bay Dischargers Authority, Joint Outfall	Lower San Fran Bay	Major	POTW

Exhibit 2-4. NPDES Permitted Dischargers to the San Francisco Bay and Delta

NPDES Permit Number	Permittee	Receiving Water	Discharge Category	Facility Type
CA0038636	East Bay Regional Park District, Hayward Marsh	Hayward Marsh	Major	POTW
CA0005134	Chevron, Richmond Refinery	San Pablo Bay	Major	Industrial
CA0005002	USS-Posco	New York Slough	Major	Industrial
CA0038768	American Canyon	North Slough	Major	POTW
CA0030201	Napa Salt Pond Restoration	Napa Slough	Minor	Industrial
CA0005053	Phillips 66, San Francisco Refinery, Rodeo	San Pablo Bay	Major	Industrial
CA0037427	Marin County Sanitary District #5, Paradise Cove	Central San Fran Bay	Minor	POTW
CA0037575	Napa Sanitation District	Napa River	Major	POTW
CA0037810	Petaluma	Petaluma River	Major	POTW
CA0037770	Mt. View Sanitary District	Peyton Slough	Major	POTW
CA0030198	Exploratorium	San Fran Bay Central Basin	Minor	Industrial
CA0029904	Crockett Cogeneration	Carquinez Strait	Minor	Industrial
CA0006165	ECOSERVICES (Formerly SOLVAY [Formerly RHODIA])	Carquinez Strait	Major	Industrial
CA0004880	GenOn Pittsburg Power Plant	Suisun Bay	Major	Industrial

Exhibit 2-5. Locations of NPDES Permittees Discharging to the San Francisco Bay and Delta

As shown in Exhibit 2-5, there are no point sources that discharge into the portion of the Delta that would be subject to the proposed selenium criteria. Further, according to the TMDL for the Lower San Joaquin River (CVRWQCB, 2001), there are no municipal or industrial sources of selenium.

The North Bay TMDL (SFRWQCB, 2015) states that petroleum refineries are the largest source of selenium in the North Bay among point sources. However, efforts by the petroleum refineries in the "*…1990s and the change in speciation in effluent from more bioavailable selenite to less bioavailable dissolved selenium forms dominated by selenate have significantly lessened the impact of the refineries' discharge on water quality*." Therefore the wasteload allocations for the petroleum refineries require them to discharge no more than their current loadings to the North Bay. Other municipal and industrial point sources are not considered to be a significant source of selenium, and the wasteload allocations for the remaining point sources (other industrial facilities and POTWs) in the North Bay were also established at no more than their current selenium loadings.

As shown in Exhibit 2-4, 14 POTWs and two industrial dischargers are the only point sources discharging into the Lower San Francisco Bay, South San Francisco Bay, and marine or estuarine tributary waters draining thereto (South Bay).

2.3.4 Urban Storm Water

Stormwater discharges are generated by precipitation and runoff from land, pavements, building rooftops, and other surfaces. Storm water from municipal and industrial areas may contribute toxic pollutants to surface waters. California regulates stormwater discharges from municipal separate storm sewer systems (MS4s) through individual and general permits. Under Phase I, NPDES stormwater permits for medium (serving between 100,000 and 250,000 people) and large (serving 250,000 people) municipalities have been issued by the Regional Water Boards. In several instances, NPDES permits are issued to a group of co-permittees encompassing an entire metropolitan area (e.g., counties).

In 2003 the SWRCB issued a General Permit for the Discharge of Storm Water from Small MS4s (Water Quality Order No. 2003-0005-DWQ) to provide permit coverage for Phase II smaller municipalities (population less than 100,000), including non-traditional small MS4s (e.g., military bases, public campuses). The Phase II Small MS4 General Permit covers Phase II Permittees state-wide. The Phase II General Permit (Order No. 2013-001 DWQ) was reissued in February 2013 by the SWRCB.

In the San Francisco Bay area, the SFRWQCB originally issued county-wide individual NPDES permits to all Phase I MS4s. In 2009, the SFRWQCB reissued all the county-wide municipal stormwater permits as one Municipal Regional Stormwater NPDES Permit to regulate stormwater discharges from municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara counties, and the cities of Fairfield, Suisun City, and Vallejo. On November 18, 2015, the Municipal Regional Stormwater NPDES Permit was reissued by the SFRWQCB.

The CVRWQCB is currently working with Phase I and II permittees to develop a Region-wide MS4 permit (Region-wide Permit) that could address both Phase I and II MS4 permittees within the Central Valley region. Currently, each Phase I MS4 permittee is covered under an individual permit issued by the CVRWQCB. Phase II MS4 permittees are currently covered under the SWRCB Phase II General Order. The single Region-wide MS4 permit would promote greater watershed/drainage shed coordination and water quality measure protections, and promote greater program implementation efficiencies.

The Phase I MS4 permits require the discharger to develop and implement a Stormwater Management Plan/Program with the goal of reducing the discharge of pollutants to the maximum extent practicable (MEP). MEP is the performance standard specified in Section

402(p) of the CWA. The management programs specify what BMPs will be used to address certain program areas. The program areas include public education and outreach; illicit discharge detection and elimination; construction and post-construction; and good housekeeping for municipal operations. In general, medium and large municipalities are required to conduct monitoring.

The SWRCB also regulates the stormwater discharges from industrial and construction sites. In April 2014, the SWRCB adopted the General Permit for Stormwater Discharges Associated with Industrial Activities (Order 2014-0057-DWQ). The Industrial General Permit regulates stormwater discharges associated with several broad categories of industrial activities, and requires the implementation of Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT) to achieve performance standards. The Industrial General Permit also requires permittees to develop a Stormwater Pollution Prevention Plan (SWPPP) and monitoring plan. The SWPPP must identify the site-specific sources of pollutants and describe the measures at the facility applied to reduce stormwater pollution.

In September 2009, the SWRCB adopted the General Permit for Discharges of Storm Water Associated with Construction Activity Construction General Permit (Order 2009-0009-DWQ; as amended by Orders 2010-0014-DWQ and 2012-006-DWQ). Dischargers whose projects disturb one or more acres of soil or whose projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the Construction General Permit. Construction activity subject to this permit includes clearing, grading and disturbances to the ground such as stockpiling, or excavation. The Construction General Permit requires the development and implementation of a SWPPP, including BMPs the discharger will use to protect stormwater runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program, and a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs.

2.3.5 Atmospheric Deposition

According to the North Bay TMDL (SFRWQCB 2015), atmospheric deposition (both wet and dry) is considered a very minor selenium source.

3. Proposed Revised Criteria

The proposed selenium criteria are intended to be protective of aquatic life and aquatic-dependent wildlife, including federally listed threatened and endangered species in the San Francisco Bay and Delta.

The USGS Ecosystem-Scale Selenium Model integrates two general categories of variables: those attributable to species (i.e., general food webs, representative species, critical life stages, diet mixes for representative species, trophic transfer factors, and effect concentrations), and those related to the aquatic environment (i.e., partitioning coefficient, hydrologic water year type/condition, and flow season).

EPA used the Ecosystem-Scale Selenium Model to model two critical food webs present in the estuary, a clam-based web and an insect-based web, to determine protective dissolved, particulate and prey-tissue selenium values. Endpoints included estimated selenium tissue effect concentration values for several important species (or surrogate species) known to be living in the estuary modeled through the species' food web.

The results of EPA's modeling form the basis for the proposed criteria shown in Exhibit 3-1. All criteria are chronic values; the values reflect protective levels of selenium through dietary exposure, which reflects a long term or chronic exposure.

Exhibit 3-1. Proposed Selenium Water Quality Criteria for the San Francisco Bay and Delta

Media Type	Tissue		Water Column[1]		
			Dissolved		Particulate
Criteria	Fish Whole Body or Muscle	Clam	Chronic	Intermittent Exposure[2]	Chronic
Magnitude	8.5 µg/g dw whole body or 11.3 µg/g dw muscle	15 µg/g dw	0.2 µg/L	$WQC_{int} = \frac{0.2\ \mu g/L - C_{bkgrnd}(1 - f_{int})}{f_{int}}$	1 µg/g dw
Duration	Instantaneous measurement	Instantaneous measurement	30 days	Number of days/month with an elevated concentration	30 days
Frequency	Not to be exceeded	Not to be exceeded	Not more than once in three years	Not more than once in three years	Not more than once in three years

dw = dry-weight basis

µg/g = micrograms per gram

µg/L = micrograms per liter

[1] Dissolved and particulate water column values are based on total selenium (includes all oxidation states, i.e., selenite, selenate, organic selenium and any other forms) in water.

[2] C_{bkgrnd} is the average background selenium concentration in µg/L. f_{int} is the fraction of any 30-day period during which elevated selenium concentrations occur. f_{int} is assigned a value ≥0.033 (corresponding to one day).

Note 1: Salt and estuarine waters are define here as those in which the salinity is greater than 1 part per thousand 95% or more of the time.

Note 2: When these criteria are used to derive water-quality based effluent limitations for point sources, a translator of 1 must be used to convert dissolved selenium criteria values into total recoverable selenium values.

4. Method for Estimating Potential Costs: Point Sources

This section describes the method for estimating the potential costs to point sources associated with compliance with the revised selenium criteria. Compliance costs for municipal and industrial point sources may result from changes to NPDES permit requirements and associated effluent limitations.

EPA estimated costs to all potentially affected municipal and industrial dischargers under the proposed criteria. This section describes the identification of potentially affected major and minor dischargers, reasonable potential analysis (RPA), identification of limits under the revised criteria and comparison to existing criteria, and estimation of costs to meet revised criteria. Unless otherwise noted, EPA estimated costs in 2015 dollars, and where necessary, EPA updated cost estimates using the Engineering New Record construction cost index.

4.1 Identification of Potentially Affected Point Source Dischargers

As discussed in Section 3, the proposed selenium criteria are applicable to marine and estuarine waters of San Francisco Bay and Delta. Of the point sources permitted to discharge to these waters (see Exhibit 2-4), only a small share would need to implement incremental controls pursuant to the proposed criteria. Permittees discharging to North San Francisco Bay (a majority of the facilities) are subject to the North Bay TMDL adopted by the SFRWQCB. EPA anticipates that facilities subject to the TMDL will not incur any compliance costs due to the proposed criteria (see Section 2).

EPA also evaluated permittees discharging to the Delta under the jurisdiction of the CVRWQCB for applicability under the proposed criteria. Based on a review of the existing NPDES permits for permittees in this area, EPA determined that in all instances the CVRWQCB had categorized the permittees as freshwater discharges not subject to marine/estuarine criteria. Therefore, these permittees were not included in the costing population of potentially affected point source dischargers.

Permittees discharging to San Francisco Bay who are not regulated under the North Bay TMDL (i.e., dischargers to South Bay which includes all dischargers south of the I-80 bridge) will be subject to the proposed criteria and potentially subject to incremental control costs. Using salinity evaluations conducted by the SFRWQCB and reported in the permittees' existing permits, EPA identified all permittees discharging to these waters meeting the salinity condition of the criteria (i.e., marine or estuarine waters). NPDES permittees discharging to marine or estuarine waters of the Bay and which are not subject to the North Bay TMDL may be affected by the proposed criteria, and EPA included these facilities in the cost estimates described below.

Exhibit 4-1 and Exhibit 4-2 provide a summary of the facilities that EPA identified as potentially affected by the revised selenium criteria. Appendix A provides additional information on these facilities.

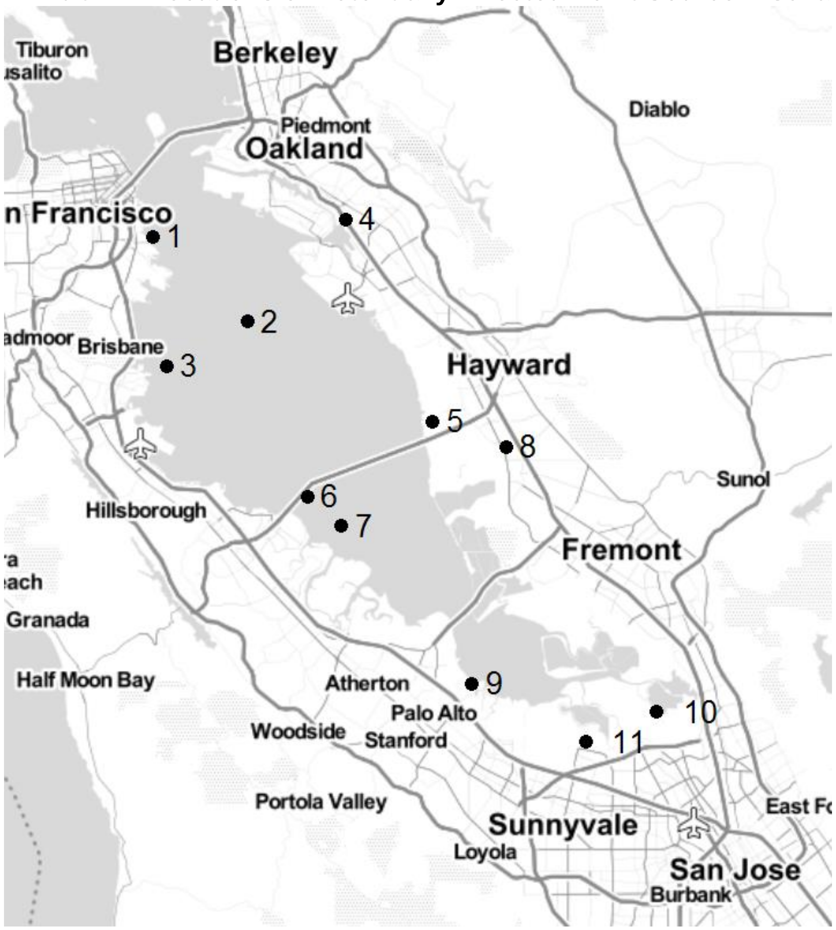
Exhibit 4-1. Summary of Potentially Affected Point Source Dischargers

NPDES Number	Facility Name	Major or Minor	Average Dry Weather Flow (mgd)[1]
	Municipal Facilities		
CA0037621	City of Sunnyvale	Major	29.5
CA0037842	City of San Jose/Santa Clara	Major	167
CA0037834	City of Palo Alto	Major	39
CA0038369	South Bayside System Authority	Major	29
CA0037541	City of San Mateo/Foster City Estero	Major	15.7
CA0038636	East Bay Regional Park District, Hayward Marsh	Major	2.6
CA0037532	City of Millbrae and North Bayside Systems Unit	Major	3
CA0037788	City of Burlingame and North Bayside Systems Unit	Major	5.5
CA0038130	Cities of South San Francisco, San Bruno, and North Bayside Systems Unit	Major	13
CA0038008	City of Livermore and EBDA	Major	8.5
CA0037613	Dublin San Ramon Services District, LAWMA, and EBDA	Major	20.2
CA0037869	East Bay Dischargers Authority, Joint Outfall	Major	107.8
CA0037664	San Francisco Southeast Plant	Major	84.5
CA0038440	East Bay Municipal Utility District, Wet Weather	Minor	158
	Industrial Facilities		
CA0038318	San Francisco International Airport	Major	2.2
CA0030058	Bottling Group, LLC	Minor	0.14

mgd = million gallons per day

1. Average dry weather flow from facility NDPES permit fact sheets.

Exhibit 4-2. Locations of Potentially Affected Point Source Dischargers



1. San Francisco Southeast Plant;
2. City of Livermore and EBDA;
   Dublin San Ramon Services District, LAWMA, and EBDA;
   East Bay Dischargers Authority, Joint Outfall;
3. City of Millbrae and North Bayside Systems Unit;
   City of Burlingame and North Bayside Systems Unit;
   Cities of South San Francisco, San Bruno, and North Bayside Systems Unit;
   San Francisco International Airport;
4. East Bay Municipal Utility District, Wet Weather;
5. East Bay Regional Park District, Hayward Marsh;
6. City of San Mateo/Foster City Estero;
7. South Bayside System Authority;
8. Bottling Group, LLC;
9. City of Palo Alto;
10. City of San Jose/Santa Clara;
11. City of Sunnyvale;

Note: Permittees who share an outfall pipe, or whose outfall pipes are located in close proximity to one another, are displayed as sharing a location.

4.2 Reasonable Potential Analysis

For each facility, EPA conducted an RPA to determine whether there is reasonable potential for the effluent to cause or contribute to an excursion above the water quality criteria for selenium. EPA based this analysis on procedures established in the SIP for evaluating and establishing WQBELs, and on the standard practices utilized at the SFRWQCB.

EPA conducted RPAs for each facility in the costing population using site-specific effluent monitoring data collected from the CIWQS. To best represent current effluent conditions, EPA utilized all available data collected on or after September 1, 2010 (i.e., the most recent five years of data). Typically, less than five years of data were available, in which case, EPA utilized all available data for a facility. If no data were available in CIWQS, EPA performed the RPA using data reported in the permittee's existing permit as of September 1, 2015.

For dischargers to the San Francisco Bay, the SFRWQCB typically evaluates ambient background selenium conditions using data collected by a regional monitoring program. Using the existing permits, EPA identified the ambient monitoring stations utilized for each discharger and collected all available selenium data associated with these stations.

In conformance with the SIP, EPA compared each facility's maximum effluent concentration (MEC) for the period of record and the maximum observed receiving water concentration (B) to the proposed selenium dissolved water column criterion of 0.2 µg/L (using a translator of 1; see Section 4.3). If the MEC exceeds the criterion, then a limitation must be imposed. Additionally, if B exceeds the criterion and selenium is present in the discharge in detectable amounts, then a limitation must be imposed. The SIP also allows the finding of reasonable potential when the permit writer determines that other information indicates a limitation is warranted. As such, EPA reviewed the permittees' existing permits to determine whether any of them have reasonable potential pursuant to this provision; however, EPA did not identify any such cases, and none of the permittees have reasonable potential under the baseline scenario.

Exhibit 4-3 summarizes the results of the RPA for all potentially affected facilities.

Exhibit 4-3. Summary of Selenium Reasonable Potential Analysis

NPDES Number	Facility Name	Max Selenium Conc. (µg/L)		RP?[5]	
		Effluent[1]	Background	Baseline Criteria	Revised Criterion
Municipal Facilities					
CA0037621	City of Sunnyvale	1.66	0.628[2]	No	Yes
CA0037842	City of San Jose/Santa Clara	0.7	0.628[2]	No	Yes
CA0037834	City of Palo Alto	2.6	0.628[2]	No	Yes
CA0038369	South Bayside System Authority	0.77	0.39[3]	No	Yes

Exhibit 4-3. Summary of Selenium Reasonable Potential Analysis

NPDES Number	Facility Name	Max Selenium Conc. (µg/L)		RP?[5]	
		Effluent[1]	Background	Baseline Criteria	Revised Criterion
CA0037541	City of San Mateo/Foster City Estero	0.53[6]	0.39[3]	No	Yes
CA0038636	East Bay Regional Park District, Hayward Marsh	0.55[7]	0.39[3]	No	Yes
CA0037532	City of Millbrae and North Bayside Systems Unit	0.48[6]	0.39[3]	No	Yes
CA0037788	City of Burlingame and North Bayside Systems Unit	1	0.39[3]	No	Yes
CA0038130	Cities of South San Francisco, San Bruno, and North Bayside Systems Unit	2.7	0.39[3]	No	Yes
CA0038008	City of Livermore and EBDA	1.7	0.39[3]	No	Yes
CA0037613	Dublin San Ramon Services District, LAWMA, and EBDA	4.7	0.39[3]	No	Yes
CA0037869	East Bay Dischargers Authority, Joint Outfall	1.2	0.39[3]	No	Yes
CA0037664	San Francisco Southeast Plant	1.2[6]	0.39[3]	No	Yes
CA0038440	East Bay Municipal Utility District, Wet Weather	None; all discharges prohibited			
Industrial Facilities					
CA0038318	San Francisco International Airport	0.1719	0.39[3]	No	Yes
CA0030058	Bottling Group, LLC	<0.2	2.5[4]	No	No

µg/L = micrograms per liter

1. California Integrated Water Quality Information System
2. San Francisco Regional Monitoring Program – Monitoring Station BA30 (Dumbarton Bridge)
3. San Francisco Regional Monitoring Program – Monitoring Station BC10 (Yerba Buena Island)
4. Site-specific monitoring data
5. RP = reasonable potential to cause or contribute to an exceedance of a water quality criterion
6. Detected, but Not Quantified (DNQ); i.e., selenium was detected in the sample but at levels too low to accurately quantify; the reported concentration is a best estimate as determined by the laboratory instrumentation and methodology.
7. No recent data available; effluent data for East Bay Regional Park District, Hayward Marsh, based on monitoring data reported in the 2011 NPDES permit.

4.3 Projecting Effluent Limitations

For the 14 facilities that have reasonable potential to cause or contribute to an exceedance above the proposed selenium criterion, EPA calculated selenium limitations based on the procedures contained in Section 1.4 of the SIP and the proposed criteria. These include an accounting of available dilution—as reported in a permittee's existing NPDES permit—and the variability of selenium concentrations in the permittee's effluent discharge using the coefficient of variation. In conformance with the SIP, the effluent selenium data must meet certain data quality standards (i.e., at least 10 observations and no more than 80 percent of the observations may be non-detect). If these standards were not met, then a coefficient of variation of 0.6 was assumed in the calculation of the limits. Otherwise, EPA computed the coefficient of variation based on the effluent monitoring data.

SIP procedures allow for the establishment of mixing zones and dilution credits under certain circumstances. EPA identified those permittees where the SFRWQCB had established mixing zones using the existing NPDES permits. However, dilution credits may only be applied in circumstances where assimilative capacity exists in the receiving water to incorporate the additional pollutant loading. According to SIP procedures, assimilative capacity is considered to be insufficient when the maximum observed receiving water observation (B) exceeds the criteria of concern. In this circumstance, B exceeds the proposed dissolved water column criterion for all permittees in the costing population as shown in Exhibit 4-3. Therefore, EPA did not apply dilution credits for dischargers in the costing population.

The following demonstrates how WQBELs based on the proposed criterion were established for this analysis**.** The process for developing these limits is in accordance with Section 1.4 of the SIP.

Step 1: For each constituent requiring an effluent limit, identify the applicable water quality criterion or objective. For each, determine the effluent concentration allowance (ECA) using the following steady state equation:

$ECA = C + D (C - B)$; when $C>B$, and

$ECA = C$; when $C \leq B$,

Where

C = The priority pollutant criterion/objective, adjusted if necessary for translators. The applicable translator for selenium in this instance is 1, so no adjustment is necessary.

D = The dilution credit, and

B = The ambient background concentration

For the permittees in the costing population, insufficient assimilative capacity was available for dilution (i.e., C≤ B) and, therefore:

ECA = C

For selenium, the applicable proposed water quality criteria are 0.2 µg/L.

Step 2: For each ECA based on aquatic life criterion/objective, determine the long-term average discharge condition (LTA) by multiplying the ECA by a multiplier factor. The multiplier is a statistically based factor that adjusts the ECA to account for effluent variability. The value of the multiplier varies depending on the coefficient of variation of the data set and whether it is an acute or chronic criterion/objective. Equations to develop the multipliers in place of using values in the tables are provided in Section 1.4, Step 3 of the SIP and will not be repeated here.[2]

$LTA_{acute} = ECA_{acute} \times Multiplier_{acute}$

$LTA_{chronic} = ECA_{chronic} \times Multiplier_{chronic}$

The coefficient of variation for the data set must be determined before the multipliers can be selected and will vary depending on the number of samples and the standard deviation of a data set. If the data set is less than 10 samples, or at least 80% of the samples in the data set are reported as non-detect, the CV shall be set equal to 0.6.

Using the City of Sunnyvale POTW (NPDES No. CA0037621) as an example, the following data were used to develop the chronic LTA based on the procedures in section 1.4 Step 3 of the SIP:

$LTA_{chronic} = ECA_{chronic} \times Multiplier_{chronic} = 0.2\ \mu g/L \times 0.53 = 0.11\ \mu g/L$

In this case, the acute LTA is not applicable

Step 3: Select the most limiting (lowest) of the LTA.

LTA = most limiting of LTA_{acute} or $LTA_{chronic}$

Since the proposed criteria are chronic, the most limiting LTA is the $LTA_{chronic}$

LTA = 0.11 µg/L

Step 4: Calculate the WQBELs by multiplying the LTA by a factor (multiplier). WQBELs are expressed as Average Monthly Effluent Limitations (AMEL) and Maximum Daily Effluent Limitations (MDEL). The multiplier is a statistically based factor that adjusts the LTA for the averaging periods and exceedance frequencies of the criteria/objectives and the effluent limitations. The value of the multiplier varies depending on the probability basis, the coefficient of variation of the data set, the number of samples (for AMEL) and whether it is a

[2] The acute ECA multipliers varied from 0.22 to 0.65, and chronic ECA multipliers varied from 0.40 to 0.80.

monthly or daily limit. Equations to develop the multipliers are provided in Section 1.4, Step 5 of the SIP and will not be repeated here.[3]

$AMEL_{aquatic\ life} = LTA \times AMEL_{multiplier}$

$MDEL_{aquatic\ life} = LTA \times MDEL_{multiplier}$

AMEL multipliers are based on a 95th percentile occurrence probability, and the MDEL multipliers are based on the 99th percentile occurrence probability.

Using the City of Sunnyvale POTW as an example, the following data was used to develop the AMEL and MDEL for aquatic life:

$AMEL_{aquatic\ life} = LTA \times AMEL_{multiplier} = 0.11\ \mu g/L \times 1.55 = 0.16\ \mu g/L$

$MDEL_{aquatic\ life} = LTA \times MDEL_{multiplier} = 0.11\ \mu g/L \times 3.11 = 0.33\ \mu g/L$

Step 5: For the ECA based on human health, set the AMEL equal to the $ECA_{human\ health}$.

However, there are no human health water quality criteria for selenium; therefore, effluent limitations based on human health criteria could not be calculated.

Step 6: Select the lower of the AMEL and MDEL based on aquatic life and human health as the WQBELs.

Since there are no applicable human health criteria for selenium, final limitations for each facility were based on the AMEL and MDEL associated with the aquatic life criterion.

Exhibit 4-4 summarizes the effluent limitations that EPA calculated for each facility based on the proposed water column criterion and effluent variability, according to the procedures described in the SIP. As the AMEL is the most stringent limitation of the AMEL and MDEL, and is the relevant limitation used in the control increment analysis, only the AMEL is reported in Exhibit 4-4.

Exhibit 4-4. Summary of Selenium Effluent Limitations

NPDES Number	Facility Name	MEC (µg/L)	AMEL (µg/L)[1]		Control Increment
			Baseline	Revised	
Municipal Facilities					
CA0037621	City of Sunnyvale	1.66	--	0.16	Yes
CA0037842	City of San Jose/Santa Clara	0.7	--	0.18	Yes
CA0037834	City of Palo Alto	2.6	--	0.19	Yes
CA0038369	South Bayside System Authority	0.77	--	0.17	Yes
CA0037541	City of San Mateo/Foster City Estero	0.53[2]	--	0.18	Yes

[3] The MDEL multipliers varied from 1.53 to 4.48, and the AMEL multipliers varied from 1.16 to 1.85.

Exhibit 4-4. Summary of Selenium Effluent Limitations

NPDES Number	Facility Name	MEC (µg/L)	AMEL (µg/L)[1]		Control Increment
			Baseline	Revised	
CA0038636	East Bay Regional Park District, Hayward Marsh	0.55	--	0.16	Yes
CA0037532	City of Millbrae and North Bayside Systems Unit	0.48[2]	--	0.16	Yes
CA0037788	City of Burlingame and North Bayside Systems Unit	1.0	--	0.17	Yes
CA0038130	Cities of South San Francisco, San Bruno, and North Bayside Systems Unit	2.7	--	0.17	Yes
CA0038008	City of Livermore and EBDA	1.7	--	0.16	Yes
CA0037613	Dublin San Ramon Services District, LAWMA, and EBDA	4.7	--	0.15	Yes
CA0037869	East Bay Dischargers Authority, Joint Outfall	1.2	--	0.17	Yes
CA0037664	San Francisco Southeast Plant	1.17	--	0.16	Yes
CA0038440	East Bay Municipal Utility District, Wet Weather	--	--	--	No
Industrial Facilities					
CA0038318	San Francisco International Airport	0.17	--	0.16	Yes
CA0030058	Bottling Group, LLC	<0.2	--	--	No

AMEL = average monthly effluent limitation

MEC = maximum effluent concentration

µg/L = micrograms per liter

1. The AMEL is the most stringent (i.e., lowest in magnitude) effluent limitation and is the controlling limitation in the cost analysis.

2. Detected, but Not Quantified (DNQ); i.e., selenium was detected in the sample but at levels too low to accurately quantify; the reported concentration is a best estimate as determined by the laboratory instrumentation and methodology.

Minimum levels to be used by permittees when assessing compliance with effluent limitations have been specified in Appendix 4 of the SIP. A minimum level is the lowest quantifiable concentration in a sample based on the proper application of all method-based analytical procedures and the absence of any matrix interferences. The minimum level is also sometimes referred to as the limit of quantitation or the reporting level.

The SIP requires that, when assessing a parameter with an effluent limitation, the permittee must use an analytical method with an approved minimum level below the limitation or—if none satisfy the previous condition—the lowest approved minimum level. The SIP specifies six analytical-method-specific minimum levels for selenium, the lowest of which is 1 µg/L using gaseous hydride atomic absorption. Compliance with effluent limitations at concentrations below the lowest minimum level cannot be ascertained for those permittees currently discharging at detectable levels below the minimum level (i.e., the MEC is less than 1 µg/L). For example, standard language in the Monitoring and Reporting Program section VIII.B.5 for Order R2-2014-0024 for the City of Palo Alto (NPDES No. CA0037834) states that "*the Discharger shall be deemed out of compliance with effluent limitations if the concentration of the priority pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the [minimum level]*."

4.4 Compliance Scenarios and Costs

EPA calculated compliance costs for all dischargers for which a selenium control increment may be needed. As discussed in Section 4.2, 14 point source dischargers may require additional compliance actions in order to comply with the proposed water column criterion. EPA developed likely compliance scenarios and associated incremental costs for each permittee. For a permittee-by-permittee discussion of likely compliance scenarios and associated costs, refer to Appendix A.

4.4.1 Potential Compliance Scenarios

There are a number of potential alternatives for compliance with effluent limits for selenium, including:

- Optimizing treatment processes (e.g., adding chemicals to increase flocculation or filtration efficiency) to increase pollutant removal efficiencies;
- Source control (e.g., pollution prevention program, inflow and infiltration reductions, more stringent pretreatment standards);
- Installing end-of-pipe treatment technology (e.g., reverse osmosis (RO), or chemical precipitation); or
- Alternative compliance mechanisms (e.g., site-specific criteria, dilution credits, TMDL, or variance).

In addition to the above compliance alternatives, the Regional Water Boards may establish compliance schedules for permittees. A compliance schedule provides a discharger with a specific period of time to plan and implement compliance alternatives. A permittee who seeks a compliance schedule must demonstrate to the satisfaction of the Regional Water Board that time is needed to implement actions, such as designing and constructing facilities or implementing new or significantly expanded programs and securing financing, if necessary, to comply with a more stringent permit limitation specified to implement a new or revised water quality criteria.

Process Optimization

The lowest cost option is likely the adjustment of existing treatment (process optimization). This option would be most feasible when relatively low pollutant reductions are needed.

Process optimization usually involves process analysis and process modifications. Process analysis is an investigation of the performance-limiting factors of the treatment process and is a key factor in achieving optimum treatment efficiency. Performance-limiting factors for common wastewater treatment processes (e.g., sedimentation, activated sludge, filtration) may include operator training, response to changes in wastewater quality, maintenance activities, automation, and process control testing. The cost of process analysis includes the cost of additional monitoring throughout the treatment process, and a treatment performance evaluation which encompasses jar testing and an operations analysis.

Process modifications include activities short of adding new treatment technology units (conventional or unconventional) to the treatment train. For increasing pollutant removal efficiencies, process modifications could include adjusting coagulant doses to increase settling, equalizing flow if pollutant concentrations spike during wet weather events, increasing filter maintenance activities or backwash cycles, training operators, and installing automation equipment including necessary hardware and software. Several months of adjustments may be needed to achieve a desired level of process optimization. In practice, the process modifications necessary would be determined by the process analysis study.

Process optimization costs depend on the characteristics of the wastewater being treated and existing unit process and operations. For example, a facility could alter the type or dose of a flocculent aid to increase solids removal, and thus, the removal of selenite adhered to particulates. Or, to the extent practicable, hydraulic residence times could be extended or shortened to produce more favorable treatment outcomes.

The effectiveness of process optimization largely depends on the efficiency of current operations and the types of existing unit processes within the treatment plant. For example, if a facility is already well maintained and operated, implementing process optimization may not result in sufficient incremental selenium removals because the existing treatment processes are already performing at the limits of technical feasibility. Given the available information for the sample facilities, it is generally not possible to determine the reductions achievable with process optimization; rather, a detailed, site-specific study would be necessary.

EPA developed an estimate of the cost necessary to complete a typical process optimization study. This cost estimate assumes 48 wastewater samples will be collected by a POTW operator and analyzed at an off-site laboratory, approximately 20 jar tests will be run in order to assess the effect of varying chemical doses and reaction times, and a process engineer will synthesize the resulting information and develop recommendations for implementing process changes (see Exhibit 4-5). EPA developed costs based on May 2014 Bureau of Labor Statistics mean hourly wage data[4] for a California POTW operator and California

[4] http://www.bls.gov/oes/current/oes_ca.htm; retrieved November 3, 2015.

Environmental Engineer, and publicly available pricing data for laboratory analyses.[5] Due to the site-specific nature of any process optimization plan, EPA is unable to estimate costs for implementing plant operational changes.

Exhibit 4-5. Summary of Process Optimization Study

Activity	Component	No. of Units	Unit Cost[1]	Sub-Total
Sampling	POTW Operator	48 samples	$31.93	$1,533
	Lab Costs	48 samples	$40.00	$1,920
Jar Testing	POTW Operator	20 jar tests	$31.93	$639
	Lab Costs	20 jar tests	$40.00	$800
Engineering Analysis	Environmental Engineer	320 person hours	$144.80[2]	$46,945
			Total	**$51,836**

1. Costs are presented in 2015 dollars.

2. Mean wage has been multiplied by 3.03 to account for overhead, administrative costs, and profit.

Source Controls

The population of permittees that is likely to be subject to selenium control increments is composed of POTWs and the San Francisco International Airport wastewater treatment plant (WWTP). Insufficient information is available to conclusively identify the sources of selenium in these discharges; however, evidence suggests the source could be unusually high levels of selenium present in drinking water sources and ground water sources. A literature review by Anderson (1998) reported high levels of naturally occurring selenium present in bedrock units, soils, ground water, and municipal drinking water supplies in the South San Francisco Bay region.

If the pollutant source is traced back to drinking water sources and municipal service supply, it is unlikely that the control increment could be addressed through source control measures since the maximum contaminant level for selenium in these sources is 50 µg/L. Note that the maximum contaminant level applicable to drinking water sources is substantially greater than either the existing water quality chronic criterion (5 µg/L) or proposed criterion (0.2 µg/L) for the protection of aquatic life and aquatic-dependent wildlife. Addressing contamination through source control activities would necessitate either shifting the locus of control to drinking water treatment plants, which would present regulatory challenges and likely result in equivalent control costs; or changing the source of drinking water, which might not be technically feasible and could be cost prohibitive.

Should the source of selenium be traced to industrial activities, a pollution prevention program or other source control activities may be productively employed to control selenium.

[5] http://www.wtlmd.com/wastewater-testing-pricing-maryland-md-va-dc-de.php; retrieved November 3, 2015.

Common industrial sources of selenium include petroleum refineries, steam-electric generating stations, metals manufacturing, coal mining, and other resource extraction and processing industries (EPA, 1983). In order to identify any industrial discharges to the POTWs, EPA reviewed the existing Fact Sheets for each of the dischargers. The documents did not report any industrial discharges which could be contributing to selenium levels in the POTW discharges. Because available information suggests that, in these cases, industrial sources are unlikely to be a significant source of selenium to the POTWs , EPA has assumed that source control activities are unlikely to be successfully deployed for selenium control at facilities within the costing population.

End-of-Pipe Treatment

If process optimization or source control would not be sufficient for compliance with the revised criterion, alternative discharge options or end-of-pipe treatment technologies may be necessary. However, the proposed criterion approaches the limits of analytical capabilities and falls below California's most stringent required quantification level (QL) for selenium (i.e., 1 µg/L). In addition, the lowest levels achievable through end-of-pipe treatment are highly uncertain due to the fact that dischargers in the United States have not previously been required to treat to such low levels and a demonstrable technical capability to comply with the proposed selenium criterion is not available.

In municipal and industrial wastewaters, selenium occurs in a variety of chemical forms and oxidation states. The various forms of selenium vary in their amenability to removal based on the technology employed—for instance, selenite is much more amenable to iron co-precipitation treatment than selenate. Consequently, successful end-of-pipe treatment control depends on how selenium is speciated within a given facility's waste stream.

Selenite—the reduced form of selenium—is amenable to removal by conventional chemical treatment technologies. The effectiveness of these technologies can be enhanced when paired with the addition of an iron salt. The addition of iron can, under certain pH conditions, encourage the formation of precipitates which are relatively insoluble, readily removable, and adsorb selenite to their surfaces. Chemical precipitation of selenite as part of a coagulation and filtration process is currently among EPA's Best Available Technologies for selenium removal in water treatment plants.

Selenate, however, is largely resistant to conventional chemical precipitation techniques. Selenate can be removed via ion exchange resins, though the effectiveness of this application is inhibited by the presence of phosphates—a common constituent of municipal wastewaters. Alternatively, selenate can be reduced to the more readily removable selenite through chemical (i.e., addition of elemental iron) or biological means. Both reduction processes will be hindered by the presence of sulfates or nitrates. Data on the presence of nitrates and sulfates are not available for most Bay area plants; however, most of these facilities are required to comply with stringent ammonia water quality criteria and, consequently, it is very likely that nitrates are present at high levels in most treatment plant effluents.

Biological reduction of selenate is an application of biological treatment processes and has been implemented at relatively small scales at various industrial facilities around the United States over the past 10 to 20 years. Typically, this involves the construction of a biofilter, slow sand denitrification filter, or anoxic tank. In principle, the same biological treatment processes utilized in municipal WWTPs to remove nitrates could be used to reduce selenate to selenite, rendering it amenable to removal using chemical precipitation with iron salts. However, since nitrates are likely to be present in large quantities in the municipal wastewaters and because nitrates inhibit selenate reduction, full nitrogen removal would likely be necessary in order to encourage selenate reduction in a POTW treatment train.

Another treatment option would be use of RO to remove all selenium species. Similar to the other technologies discussed herein, selenium treatability below the proposed criterion has not been definitively demonstrated. However, successful control using RO is likely, due to RO's ability to remove nearly all ions from treated water, including selenium species. However, due to the scale of implementation that would be required, EPA assumes it is unlikely municipal WWTPs would ultimately utilize this technology due to its prohibitive expense.

Exhibit 4-6 summarizes the end-of-pipe treatment technologies that may be used to remove selenium.

Exhibit 4-6. Summary of Potential End-of-Pipe Treatment Technologies

Technology	Pollutants Removed
Chemical precipitation with iron salts	Selenite removed
Biological reduction	Selenate transformed to selenite
Reverse osmosis	All selenium species removed

For this analysis, and as documented in the facility analyses in Appendix A, EPA assumed that permittees requiring end-of-pipe treatment to meet selenium limitations will utilize chemical precipitation with iron salts paired with sand filtration. Given the limited treatment data testing using analytical methods at or below the proposed criterion, and the uncertainty regarding the selenium speciation within the wastewaters, EPA has assumed the use of conventional treatment technologies (i.e., chemical precipitation and filtration) to achieve compliance. Chemical precipitation paired with filtration is a widely adopted technology which has been demonstrated to achieve low effluent concentrations (i.e., less than 1 µg/L; EPA, 1983).

EPA was unable to identify studies which have documented treatment capabilities for any treatment technology at the levels of the proposed water column criterion (i.e., 0.2 µg/L) or the estimated effluent limitations, as most studies utilize analytical methods with detection levels well in excess of the criterion. Therefore, EPA cannot state with certainty that the proposed treatment alternatives will result in compliance with effluent limitations in all cases, as the existing literature has not heretofore utilized analytical methods of sufficient sensitivity to detect the pollutant at these concentrations.

However, EPA has identified data (EPA, 1983; Kapoor, et al., 2007) which document effluent treatment levels for chemical treatment methods at levels equal to or below the minimum quantification level required under California's adopted implementation procedures (i.e., 1 µg/L) without sand filtration. By pairing this performance with sand filtration, there is a reasonable likelihood that effluent treatment consistent with the proposed criterion may be achievable.

Utilizing facility descriptions and treatment process flow diagrams enclosed in the existing permits, EPA evaluated whether each of the following unit operations were present for each facility: iron salt coagulation and flocculation, and sand filtration. If one or both of the items were not present, EPA estimated costs to install the process.

EPA developed cost curves fitted to costs developed for four model treatment trains: 1 mgd, 10 mgd, 100 mgd, and 200 mgd. Costs for each treatment train were developed as follows. For coagulation flocculation costs, costs were developed on the basis of installing a ferric sulfate feed system and chemicals, a polymer feed system and chemicals, a rapid mixer, a flocculation basin, and a tertiary clarifier. Capital costs, and operations and maintenance costs (O&M) were developed for each unit process using cost curves developed by EPA (1979). Costs for sand filters included down flow filter and media costs and were based on cost estimates developed using CapdetWorks™ construction cost estimating software. Capital and O&M costs were escalated to 2015 dollars using the Engineering News Record construction cost index. Using the resultant cost curves for coagulation/flocculation and for media filtration, EPA estimated costs for each permittee.

EPA assumed the indirect costs listed in Exhibit 4-7 in all construction cost estimates. Cost curves are presented in Exhibit 4-8.

Exhibit 4-7. Summary of Potential End-of-Pipe Treatment Technologies

Indirect Cost	Percentage of Direct Capital Costs
Mobilization	6%
Site Preparation	7%
Site Electrical	16%
Yard Piping	11%
Instrumentation and Control	8%
Legal Costs	2%
Engineering Design Fee	15%
Inspection Cost	2%
Contingency	15%
Profit	15%

Exhibit 4-8. Summary of Potential End-of-Pipe Treatment Unit Cost Curves[1]

Treatment Addition	Capital Costs	O&M Costs
Chemical Treatment	$1,922,907 + $284,871/mgd x Q	$63,681 + $7,771/mgd x Q
Sand Filtration	$1,661,321 + $189,620/mgd x Q	$100,945 + $9,872/mgd x Q
Chemical Treatment and Sand Filtration	$3,584,229 + $474,491/mgd x Q	$164,627 + $17,643/mgd x Q

Q = System flow capacity in million gallons per day (mgd).

1. All costs are reported in 2015 dollars. Capital costs include both direct and indirect costs.

Given the uncertainties surrounding the capability of achieving effluent compliance with conventional treatment technologies, EPA has performed a sensitivity analysis of this cost estimate. For additional details on this analysis, refer to Section 6**.**

Alternative Compliance Mechanisms

If none of the control options discussed above would result in compliance with effluent limitations, or if the costs would be prohibitive, dischargers would likely need some form of relief from the requirements.

Site-Specific Criteria

If dischargers suspect that the conditions in the vicinity of their discharge warrant alternative (i.e., site-specific) criteria values that would result in less stringent effluent limitations in their permit, they may work to collect data to develop site-specific criteria. The Water Board may also develop site-specific criteria as part of a TMDL process (i.e., identifying the appropriate target value). EPA must review and approve site-specific criteria prior to implementation.

Because additional data are required to assess the appropriateness of site-specific criteria at a particular location, the extent of use of this mechanism by dischargers is uncertain. However, consideration within the context of a TMDL is likely, and may or may not reflect an incremental increase in effort above that associated with current TMDLs (this type of data collection and evaluation may already be a part of TMDL development efforts).

Intake Credits

Under California's WQS implementation provisions, Water Boards may establish intake credits for intake water taken from municipal supply, or intake water that is taken from and discharged to the same waterbody. EPA has insufficient information at this time to evaluate the sources of selenium in the permittees' influents. In addition, it is unclear whether selenium sources which may originate from groundwater or domestic supply and used municipally would qualify for credits under this provision. Therefore, EPA has conservatively assumed that intake credits are unlikely to serve as a valid compliance action for the proposed selenium criterion.

Dilution Credits

Under California's WQS implementation provisions, Water Boards may implement mixing zones and associated dilution credits in NPDES permits. As discussed above, EPA evaluated currently implemented mixing zones when calculating WQBELs for the facilities. Due to the lack of available assimilative capacity in the receiving waters, EPA assumed that dilution credits are an unlikely compliance approach.

4.4.2 Summary of Facility Control Costs

For plants discharging at levels above the QL, EPA assumed that they will pursue conventional treatment methods to comply with the projected effluent limitations. EPA based unit costs for end-of-pipe treatment on cost curves previously developed by EPA (1979), unit process costs estimated using CapdetWorks™ cost estimating software, and indirect cost assumptions. EPA updated these costs to reflect local labor rates and escalated to 2015 dollars using the Engineering News Record Construction Cost Index.

Facilities operating below the QL are discharging near the projected limitations and EPA has assumed that compliance is likely to be achievable using process optimization methods. EPA developed costs associated with process optimization special studies as described in Section 4.4.1.

To calculate annual costs for the main analysis, EPA discounted all one-time and capital costs over 20 years using a 3 percent discount rate. Results using a 7 percent discount rate are provided in Appendix B.

Exhibit 4-9 summarizes the unit costs utilized in the sample facility compliance cost analyses.

Exhibit 4-9. Estimated Unit Costs of Compliance Mechanisms (2015$)

Compliance Mechanism	One-Time Cost Estimate	O&M Cost Estimate
Process Optimization	$52,000	--
Chemical Treatment	$1,922,907 + $284,871/mgd x Q	$63,681 + $7,771/mgd x Q
Sand Filtration	$1,661,321 + $189,620/mgd x Q	$100,945 + $9,872/mgd x Q
Chemical Treatment and Sand Filtration	$3,584,229 + $474,491/mgd x Q	$164,627 + $17,643/mgd x Q

Q = Plant capacity in million gallons per day (mgd).

Exhibit 4-10 summarizes the one-time (capital or process optimization) costs, O&M costs, and total annual cost for each of the identified facilities likely to have a control increment under the proposed selenium criterion. See Appendix A for facility-specific descriptions of the cost estimates.

Exhibit 4-10. Treatment and Estimated Cost Increment for Affected Facilities[1]

NPDES Number	Facility Name	Capacity (mgd)	MEC (µg/L)	AMEL (µg/L)	One-Time Cost	O&M Cost	Total Annual Cost[2]
Municipal Facilities							
CA0037621	City of Sunnyvale	29.5	1.66	0.16	$10,327,000	$293,000	$987,000
CA0037842	City of San Jose/Santa Clara	167	0.7	0.18	$52,000	--	$3,500
CA0037834	City of Palo Alto	39	2.6	0.19	$13,033,000	$367,000	$1,243,000
CA0038369	South Bayside System Authority	29	0.77	0.17	$52,000	--	$3,500
CA0037541	City of San Mateo/Foster City Estero	15.7	0.53[3]	0.18	$52,000	--	$3,500
CA0038636	East Bay Regional Park District, Hayward Marsh	2.6	0.55	0.16	$52,000	--	$3,500
CA0037532	City of Millbrae and North Bayside Systems Unit	3	0.48[3]	0.16	$52,000	--	$3,500
CA0037788	City of Burlingame and North Bayside Systems Unit	5.5	1	0.17	$6,194,000	$262,000	$678,000
CA0038130	Cities of South San Francisco, San Bruno, and North Bayside Systems Unit	13	2.7	0.17	$4,126,000	$229,000	$506,000
CA0038008	City of Livermore and EBDA	8.5	1.7	0.16	$7,617,000	$315,000	$827,000
CA0037613	Dublin San Ramon Services District, LAWMA, and EBDA	20.2	4.7	0.15	$13,169,000	$521,000	$1,406,000
CA0037869	East Bay Dischargers Authority, Joint Outfall	107.8	1.2	0.17	$54,734,000	$2,067,000	$5,746,000
CA0037664	San Francisco Southeast Plant	84.5	1.2[3]	0.16	$43,679,000	$1,655,000	$4,591,000
CA0038440	East Bay Municipal Utility District, Wet Weather	158	--	--	$0	$0	$0
				Subtotal	**$153,139,000**	**$5,709,000**	**$16,001,500**
Industrial Facilities							
CA0038318	San Francisco International Airport	2.2	0.1719	0.16	$52,000	--	$3,500
				Subtotal	**$52,000**	**--**	**$3,500**
				Total	**$153,191,000**	**$5,709,000**	**$16,005,000**

Exhibit 4-10. Treatment and Estimated Cost Increment for Affected Facilities[1]

NPDES Number	Facility Name	Capacity (mgd)	MEC (µg/L)	AMEL (µg/L)	One-Time Cost	O&M Cost	Total Annual Cost[2]

mgd = million gallons per day

µg/L = micrograms per liter

1. For plants discharging at levels above the most stringent quantitation level (1 µg/L), EPA assumed that facilities will pursue conventional treatment methods to comply with the projected effluent limitations. Facilities operating below the quantitation level are discharging near the projected limitations and EPA has assumed that compliance is likely to be achievable using process optimization methods.
2. One-time costs annualized over 20 years using a 3 percent discount rate; for costs annualized using a 7 percent discount rate, see Appendix B.
3. Detected, but Not Quantified (DNQ); i.e., selenium was detected in the sample but at levels too low to accurately quantify; the reported concentration is a best estimate as determined by the laboratory instrumentation and methodology.

5. Methods for Identifying Potential Costs: Nonpoint Sources

Unlike point sources, California typically does not require nonpoint sources and municipal stormwater dischargers to achieve numeric WQBELs. The regulatory baseline for evaluating the potential impact of the revised criteria includes some requirements for nonpoint sources and stormwater dischargers to implement BMPs and wasteload allocations as part of TMDLs (see Section 2). The CVRWQCB and SFRWQCB have already developed TMDLs for selenium in the Lower San Joaquin River and the North Bay, and EPA assumes that the proposed selenium criteria will not result in the need for additional controls by nonpoint sources in those areas.

The San Francisco Estuary Project, a federal-state-local partnership established in 1987 under the National Estuary Program, is responsible for developing and implementing a Comprehensive Conservation and Management Plan (CCMP). According to the 2007 CCMP Update (San Francisco Estuary Project 2007), and as it relates to controlling nonpoint sources of selenium to the Bay:

> *"The control strategy should include management practices and waste discharge requirements as necessary to limit selenium in agricultural subsurface drainage to reduce selenium loadings to the Delta and attain water quality objectives for selenium in the San Joaquin River."*

The SFRWQCB has begun developing a TMDL for selenium for the South San Francisco Bay. It is uncertain as to the extent nonpoint sources contribute to the overall selenium loading to the South Bay, and, as described in Section 2.3.1, naturally-occurring selenium may be the primary source of selenium loadings to the South Bay. Although the extent of incremental controls that could be required under the potential revised criteria for selenium is uncertain, it is expected to be insignificant.

6. Summary of Results, Uncertainties, and Quality Assurance

This section summarizes the potential costs to point sources and nonpoint sources, and discusses the limitations and uncertainties associated with the analyses.

6.1 Point Sources

Incremental costs associated with the proposed dissolved selenium criterion represent the costs of any additional actions or controls needed for compliance with revised WQBELs under the proposed rule, beyond the actions or controls needed to meet the existing criteria under the baseline.[6] For compliance with revised WQBELs under the proposed rule, for the 51 dischargers within the confines of San Francisco Bay and Delta, EPA estimates the total annual social cost to be approximately $16 million across 14 facilities. Of these costs, nearly all are attributable to municipal dischargers.

6.2 Nonpoint Sources

Potential costs for compliance with the proposed criterion include costs to nonpoint sources (e.g., agricultural and forest operations; contamination from historic mining sites), and municipal stormwater sources associated with implementation of existing programs and TMDLs. Incremental costs associated with compliance with the proposed revised criteria represent the costs of any actions or controls above and beyond those needed to meet baseline requirements. The CVRWQCB and SFRWQCB have already developed TMDLs for selenium in the North Bay and in the Lower San Joaquin River which flows into the Delta in order to control the primary nonpoint sources of selenium to the Delta and northern parts of the Bay. Therefore, as discussed in Section 5, additional measures to control the secondary nonpoint sources of selenium are unlikely to be necessary. However, if nonpoint sources in the South San Francisco Bay are found to be a significant source of selenium, controls could include the development and implementation of TMDLs for that part of the Bay.

6.3 Sensitivity Analysis, Sources of Uncertainty, and Quality Assurance

The proposed rule does not establish any requirements directly applicable to regulated entities or other sources of pollution. State implementation of the proposed rule may result in new or revised NPDES permit conditions for point source dischargers, and incremental control requirements for nonpoint sources. For point sources, EPA has estimated facility-

[6] Since the effluent data used by EPA to determine reasonable potential, effluent limitations, and compliance actions and costs may be more recent than the effluent data used to develop the existing permits, there may be some cases where EPA's analysis indicates some requirements and costs for a facility under the baseline scenario that are not reflected in the existing permit for the facility. Such costs would not be attributable to the proposed revised criteria, but rather would be baseline costs attributable to the existing criteria. However, in this analysis, there are no such baseline costs, and all costs estimated by EPA represent incremental costs attributable to the proposed revised criteria.

specific costs to reach compliance with the proposed dissolved water column criterion. However, there is substantial uncertainty associated with actual state implementation of the proposed rule.

In addition, the existing body of selenium treatment performance data was developed using analytical methods that exceed the level of the criterion. As with other economic analyses of proposed WQS rules, EPA assumes that facilities will deploy mechanisms to achieve the greater of permit limit or the level of detection. This introduces a level of uncertainty into the technological achievability of the proposed selenium criterion using existing technologies. Given this, EPA has performed a supplementary sensitivity analysis of the end-of-pipe treatment costs. If applicable analytical detection limits should come to reach a level comparable to projected effluent limits, then it is possible that costs would increase. In the case of selenium, EPA has a means to evaluate this contingency. As discussed in Section 4.4, the POTW effluent selenium load is composed of multiple selenium species. Two of the most abundant are selenite and selenate. The proposed conventional end-of-pipe treatment technologies are effective at removing selenite, but are less effective at removing selenate.

Limited data are available on selenium speciation within municipal WWTPs within the San Francisco Bay region. A Bay area study dating to the 1980's (Cutter and San Diego-McGlone, 1990) indicated that post-treatment municipal effluent was composed of 70 to 90 percent selenate with the remainder primarily composed of selenite. A similar 2011-2012 study (Yee, 2012) found that selenium species partitioning was variable from plant-to-plant. However, for most plants, selenate was the dominant effluent, followed by organic selenium species and selenite.

This sensitivity analysis assumes that all plants requiring end-of-pipe treatment will need to install denitrification filters in addition to the previously proposed coagulation/filtration units. Denitrification filters will be used to create reducing conditions which will encourage the transformation of selenate to selenite. In order to reduce selenate, the denitrification filters must first remove a large fraction of any nitrates in the wastestream—resulting in partial nitrogen removal as a potential secondary benefit of the approach. By converting selenate to selenite, a greater fraction of the selenium load is rendered amenable to conventional treatment and is likely to achieve a commensurate improvement in treatment performance.

EPA estimated direct costs for denitrification filters based on the capital ($0.91/gallons per day (gpd)) and O&M ($0.064/gpd) unit costs for installing a denitrification filter retrofit to a 10 mgd plant (EPA, 2008; unit costs are reported in 2015 dollars). This unit capital cost was developed with CapdetWorks™ software and represents the total installed cost (i.e., indirect costs are included); however, the reference includes neither a total, nor a component breakdown of the indirect costs used. Therefore, EPA has assumed that the indirect costs used are approximately comparable to those used in EPA's cost analysis (see Section 4.4). Using the resulting flow-normalized unit cost, EPA extrapolated costs for the permittees on the basis of each permittee's flow rate. Due to expected returns to scale, these unit costs are likely to result in conservative estimates since most plants requiring end-of-pipe treatment have capacities greater than 10 mgd.

Exhibit 6-1 summarizes the results of the sensitivity analysis.

Exhibit 6-1. End-of-Pipe Treatment Costs Sensitivity Analysis

NPDES Number	Facility Name	Total Annual Cost[1]	
		Original[2]	Including Denitrification Filter
	Municipal Facilities		
CA0037621	City of Sunnyvale	$987,000	$4,692,000
CA0037842	City of San Jose/Santa Clara[3]	$3,500	$3,500
CA0037834	City of Palo Alto	$1,243,000	$6,141,000
CA0038369	South Bayside System Authority[3]	$3,500	$3,500
CA0037541	City of San Mateo/Foster City Estero[3]	$3,500	$3,500
CA0038636	East Bay Regional Park District, Hayward Marsh[3]	$3,500	$3,500
CA0037532	City of Millbrae and North Bayside Systems Unit[3]	$3,500	$3,500
CA0037788	City of Burlingame and North Bayside Systems Unit	$678,000	$1,369,000
CA0038130	Cities of South San Francisco, San Bruno, and North Bayside Systems Unit	$506,000	$2,139,000
CA0038008	City of Livermore and EBDA	$827,000	$1,895,000
CA0037613	Dublin San Ramon Services District, LAWMA, and EBDA	$1,406,000	$3,943,000
CA0037869	East Bay Dischargers Authority, Joint Outfall	$5,746,000	$19,285,000
CA0037664	San Francisco Southeast Plant	$4,591,000	$15,204,000
CA0038440	East Bay Municipal Utility District, Wet Weather	$0	$0
	Subtotal	**$16,001,500**	**$54,685,500**
	Industrial Facilities		
CA0038318	San Francisco International Airport[3]	$3,500	$3,500
	Subtotal	**$3,500**	**$3,500**
	Total	**$16,005,000**	**$54,689,000**

1. One-time costs annualized over 20 years using a 3 percent discount rate; for costs annualized using a 7 percent discount rate, see Appendix B.
2. For plants discharging at levels above the most stringent quantitation level (1 µg/L), EPA assumed that facilities will pursue conventional treatment methods to comply with the projected effluent limitations. Facilities operating below the quantitation level are discharging near the projected limitations and EPA has assumed that compliance is likely to be achievable using process optimization methods.
3. End-of-pipe treatment (including denitrification filter) is unnecessary for this facility, even considering alternative analytical detection limits.

The above analysis evaluates the sensitivity of the cost estimate to assumptions regarding the dissolved selenium speciation within the influent of each plant. It shows that making a substantially more conservative assumption regarding selenium speciation (i.e., the selenate fraction within the influent is significant) still results in cost estimate results which are on the same order of magnitude.

Exhibit 6-2 summarizes additional uncertainties and limitations in the analysis.

Exhibit 6-2. Uncertainties in Analysis of Costs

Uncertainty/Assumption	Effects on Cost Estimate	Notes
Effluent limitations based on the proposed criteria cannot be met via source control	Overestimate	Assumption could result in an overestimate depending on the nature of the selenium source (i.e., selenium can be diverted from certain waste streams), or it may result in transferring the cost of treatment from the municipal dischargers to indirect industrial dischargers.
Control increment cannot be met via intake credits	Overestimate	Should additional data and information indicate intake credits are a viable regulatory pathway to meeting the control increment for municipal dischargers, EPA expects costs would decrease substantially for those permittees able to qualify for credits.
Assumed no compliance schedules will be used	Overestimate	Facilities subject to the proposed criteria requiring additional treatment could be provided with compliance schedules by the Regional Water Boards. A compliance schedule would provide an extended period (i.e., ten years) within which a permittee may pursue compliance without being subject to penalties for exceedances of the limitation. A compliance schedule would provide permittees with additional time to research and develop more cost-effective treatment alternatives than are currently available.
Assumed current South Bay urban stormwater controls are adequate, consistent with the analysis contained in the North Bay TMDL	Underestimate	It is possible that urban non-point sources in the South Bay are of a different character from other sources in the region (i.e., urban nonpoint sources in the North Bay) with respect to selenium, and could require incremental control measures and a TMDL.

In order to mitigate sources of uncertainty in the analysis, EPA conducted quality assurance checks on the data, analyses, and results, consistent with the programmatic and project-specific quality assurance plans. In addition, EPA used California-based permit-writing tools to ensure consistency with state permitting approaches and calculations. EPA also used California-specific data sources as available, and for all data entry, EPA confirmed the accuracy of data sources and documentation following procedures described in the quality assurance plans. These procedures include checks on all inputs and calculations, and using multiple approaches to confirm results.

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Appendix A – Facility Analyses

This appendix provides detailed analyses for the 16 sample facilities in alphabetical order, with municipal dischargers first followed by industrial dischargers. For each facility, under the baseline scenario (i.e. using the current criteria) and the revised criteria scenario, EPA conducted an RPA, identified potential compliance scenarios, and estimated the associated costs. Since the effluent data used by EPA to determine reasonable potential, effluent limitations, and compliance actions and costs may be more recent than the effluent data used to develop the existing permits, there may be some cases where EPA's analysis indicates some requirements and costs for a facility under the baseline scenario that are not reflected in the existing permit for the facility. Such costs would not be attributable to the proposed revised criteria, but rather would be baseline costs attributable to the existing criteria. Only compliance actions and costs that would be needed above the baseline level of controls are attributable to the proposed revised criteria.

A.1 City of Burlingame and North Bayside Systems Unit

The treatment facility for the City of Burlingame and North Bayside Systems Unit (Plant; NPDES permit No. CA0037788) is located south of the San Francisco International Airport and northeast of the City of Burlingame. The Plant provides secondary treatment of domestic and commercial wastewater for the City of Burlingame, a portion of the Town of Hillsborough, and the Burlingame Hills Sewer maintenance District, a total population of approximately 37,000. No significant industrial users discharge to the Plant. The Plant design average daily dry weather flow is 5.5 mgd and the peak wet weather capacity, based on the engineered contractual limit for the North Bayside System Unit (NBSU) forcemain, is 16 mgd. The Plant discharges to Lower San Francisco Bay.

Treatment Processes

Treatment consists of screening, grit removal, primary sedimentation, secondary biological treatment, secondary clarification, and chlorine disinfection. Treated water undergoes dechlorination at the South San Francisco and San Bruno Water Quality Control Plant prior to discharge to Lower San Francisco Bay.

During wet weather, primary effluent flows in excess of 13 mgd are directed to the Facility's 2.38 million gallon onsite temporary storage units. When the storage units reach their maximum capacity, primary effluent flows in excess of 13 mgd are blended with secondary effluent, disinfected, and discharged to the NBSU forcemain. Stored water from the temporary storage facilities is returned to the primary clarifier for full treatment after the influent flow subsides to a level protective of secondary treatment processes. The Plant is permitted to discharge an average dry weather flow of 5 mgd.

Effluent Data

Exhibit A- 1 summarizes selenium effluent data for the treated wastewater between September 2011 and September 2015.

Exhibit A- 1. Summary of Selenium Effluent Data: City of Burlingame WWTP

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
23	5	0.534	0.407	0.217	1

Source: California Integrated Water Quality System
CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.

Receiving Water

The facility discharges to Lower San Francisco Bay. The SFRWQCB utilized the Yerba Buena Island monitoring station (station number BC 10) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.39 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on the existing criteria to confirm that no baseline WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third "trigger" which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 1 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the proposed water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 1. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed water column criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.17 µg/L and MDEL of 0.30 µg/L.

Since the MEC is above the QL, EPA assumed that the Plant will need to pursue conventional treatment methods to comply with the projected effluent limitations (see Section 4.4). According to the existing permit, the Plant does not currently use iron salt chemical addition or media filtration unit processes. Therefore, EPA has developed a cost estimate to install a chemical treatment system and sand filters using the cost curves described in Section 4.4. Using a flow rate of 5.5 mgd, the estimated installed capital cost for the Plant is approximately $6.2 million and the estimated annual O&M cost is $260,000.

A.2 City of Livermore and EBDA

The WWTP for the City of Livermore and EBDA (Plant; NPDES Permit No. CA0038008) serves approximately 83,600 people from the City of Livermore. The Plant provides secondary treatment for up to 8.5 mgd. During high flow events, a side flow weir in the influent manhole structure diverts peak untreated wastewater flows to a 15 million gallon emergency holding basin. Additionally, an average of 1.3 mgd of wastewater receives tertiary treatment and is used as recycled water and sent to the Zone 1 Distribution System. The Plant has a current permitted average dry weather design flow of 8.5 mgd, a future average dry weather design flow of 11.1 mgd, and a contractual peak wet weather design flow of 12.4 mgd. The Plant discharges to Lower San Francisco Bay.

Treatment Processes

The 2012 Permit fact sheet reports that treatment consists of screening, grit removal, pre-aeration, primary clarification with ferric chloride addition for hydrogen sulfide control in the digestion process, activated sludge, secondary clarification and disinfection using sodium hypochlorite. The tertiary treated wastewater is diverted after the secondary clarifiers and routed through in-line granular media filtration and ultraviolet disinfection. Sludge is anaerobically digested, dewatered using belt filter presses, and trucked offsite.

Effluent Data

Exhibit A- 2 summarizes selenium effluent data for the treated wastewater between March 2011 and July 2015.

Exhibit A- 2. Summary of Selenium Effluent Data: City of Livermore Water Reclamation Plant

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
53	50	0.567[1]	0.501	0.284	1.7

Source: California Integrated Water Quality System
CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.
1. A CV of 0.6 was used to calculate Water Quality-Based Effluent Limitations due to the limited number of detected observations.

Receiving Water

The facility discharges to Lower San Francisco Bay. The SFRWQCB utilized the Yerba Buena Island monitoring station (station number BC 10) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.39 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on the existing criteria to confirm that no baseline WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third "trigger" which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 1.7 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the proposed water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 2. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.16 µg/L and MDEL of 0.33 µg/L.

Since the MEC is above the QL, EPA assumed that the Plant will need to pursue conventional treatment methods to comply with the projected effluent limitations (see Section 4.4). According to the existing permit, the Plant does not currently use iron salt chemical addition or media filtration unit processes. Therefore, EPA has developed a cost estimate to install a chemical treatment system and sand filters using the cost curves described in Section 4.4. Using a flow rate of 8.5 mgd, the estimated installed capital cost for the Plant is approximately $7.6 million and the estimated annual O&M cost is $310,000.

A.3 City of Millbrae and North Bayside Systems Unit

The WWTP for the City of Millbrae and North Bayside Systems Unit (Plant; NPDES Permit No. CA0037532) provides primary and secondary treatment of wastewater for the City of Millbrae and serves a population of about 21,500. The Plant has a permitted average dry weather design capacity of 3.0 mgd and can process up to 9.0 mgd of wastewater during wet weather. The Plant discharges to Lower San Francisco Bay.

Treatment Processes

The 2013 permit fact sheet reports that treatment processes include a headworks with coarse and fine bar screens and grit removal, primary sedimentation in rectangular clarifiers, biological activated sludge treatment, secondary clarification, disinfection with sodium hypochlorite, and final effluent skimming. Effluent is dechlorinated prior to discharge into Lower San Francisco Bay.

Effluent Data

Exhibit A- 3 summarizes selenium effluent data for the treated wastewater between November 2011 and November 2014.

Exhibit A- 3. Summary of Selenium Effluent Data: City of Millbrae and North Bayside Systems Unit

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
7	2	0.316[1]	0.353	0.112	0.48[2]

CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.
1. A CV of 0.6 was used to calculate Water Quality-Based Effluent Limitations due to the limited number of detected observations.
2. The max result was detected but not quantified (DNQ; i.e., selenium was detected in the sample but at levels too low to accurately quantify—the reported concentration is a best estimate).

Receiving Water

The facility discharges to Lower San Francisco Bay. The SFRWQCB utilized the Yerba Buena Island monitoring station (station number BC 10) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.39 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline

WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third "trigger" which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 0.48 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the proposed water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 3. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.16 µg/L and MDEL of 0.33 µg/L.

Since the MEC for the Plant is below the QL, EPA assumed that it is discharging near the projected limitations and that compliance is likely to be achievable using process optimization methods (see Section 4.4). EPA developed one-time costs for implementing a process optimization study of $52,000.

A.4 City of San Mateo/Foster City Estero

The WWTP for the City of San Mateo/Foster City Estero Municipal Improvements District (Plant; NPDES Permit No. CA0037541) provides secondary and advanced secondary treatment of domestic, commercial, and industrial wastewater for the City of San Mateo, the City of Foster City, the Town of Hillsborough, and portions of the City of Belmont and unincorporated San Mateo County. The Plant serves a population of approximately 139,000, and has an average daily dry weather design flow of 15.7 mgd and a peak wet weather design flow for secondary treatment of 40 mgd. The Plant discharges to Lower San Francisco Bay.

Treatment Processes

The 2013 permit fact sheet states that treatment at the Plant consists of primary sedimentation, secondary biological treatment through aeration basins, secondary clarification, chlorine disinfection, and dechlorination using sodium bisulfite, as well as the option of pressure filters when necessary to comply with effluent limitations.

Effluent Data

Exhibit A- 4 summarizes selenium effluent data for the treated wastewater between June 2011 and March 2015.

Exhibit A- 4. Summary of Selenium Effluent Data: City of San Mateo WWTP

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
44	2	0.578	0.215	0.124	0.53[1]

CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.
1. The max result was reported as detected but not quantified (DNQ; i.e., selenium was detected in the sample but at levels too low to accurately quantify—the reported concentration is a best estimate).

Receiving Water

The facility discharges to Lower San Francisco Bay. The SFRWQCB utilized the Yerba Buena Island monitoring station (station number BC 10) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.39 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third "trigger" which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 0.53 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the proposed water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 4. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.18 µg/L and MDEL of 0.29 µg/L.

Since the MEC for the Plant is below the QL, EPA assumed that it is discharging near the projected limitations and that compliance is likely to be achievable using process optimization methods (see Section 4.4). EPA developed one-time costs for implementing a process optimization study of $52,000.

A.5 Dublin San Ramon Services District

The WWTP for the Dublin San Ramon Services District (Plant; NPDES Permit No. CA0037613) serves the City of Dublin, the city of Pleasanton, and the southern portion of the City of San Ramon, a service area population of approximately 131,900 people. The Plant has an average dry weather flow design capacity of 17 mgd from the Dublin San Ramon Services District, plus 3.2 mgd of Zone 7 groundwater RO reject flow (i.e., a total of 20.2 mgd). Treated effluent is discharged to Lower San Francisco Bay.

Treatment Processes

The 2012 Permit fact sheet reports that treatment consists of screening, grit removal, primary clarification, activated sludge, secondary clarification, and disinfection using sodium hypochlorite.

Effluent Data

Exhibit A- 5 summarizes selenium effluent data for the treated wastewater between March 2011 and July 2015.

Exhibit A- 5. Summary of Selenium Effluent Data: Dublin San Ramon Services District WWTP

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
53	12	0.896	1.218	1.091	4.7

CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.

Receiving Water

The facility discharges to Lower San Francisco Bay. The SFRWQCB utilized the Yerba Buena Island monitoring station (station number BC 10) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.39 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third “trigger” which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 4.7 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the proposed water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 5. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.15 µg/L and MDEL of 0.36 µg/L.

Since the MEC is above the QL, EPA assumed that the Plant will need to pursue conventional treatment methods to comply with the projected effluent limitations (see Section 4.4). According to the existing permit, the Plant does not currently use iron salt chemical addition or media filtration unit processes. Therefore, EPA has developed a cost estimate to install a chemical treatment system and sand filters using the cost curves described in Section 4.4. Using a flow rate of 20.2 mgd, the estimated installed capital cost for the Plant is approximately $13.2 million and the estimated annual O&M cost is $520,000.

A.6 East Bay Dischargers Authority, Joint Outfall

East Bay Dischargers Authority (EBDA; NPDES No. CA0037869) is a Joint Exercise of Power Agency, the members of which separately own and operate collection and treatment facilities for domestic, commercial, and industrial wastewater. EBDA is comprised of five member agencies: City of Hayward, Oro Loma Sanitary District, Castro Valley Sanitary District, City of San Leandro, and Union Sanitary District. EBDA conveys treated wastewater from its member agencies’ three treatment facilities together with treated wastewater from the Livermore-Amador Valley Water Management Agency’s treatment plant, which is comprised of treated wastewater from the City of Livermore, to a dechlorination station near the San Leandro Marina (collectively, these treatment plants will be referred to as the Plants, hereinafter). The total permitted average dry weather flow to be discharged at the EBDA Common Outfall is 107.8 mgd, and the total peak daily wet weather flow is 189.1 mgd. EBDA discharges to Lower San Francisco Bay.

Treatment Processes

The 2012 Permit fact sheet reports that treatment consists of dechlorination of the combined treated wastewater by sodium bisulfite before discharge from the common outfall to Lower San Francisco Bay. Treatment at the City of Wayward Water Pollution Control Facility consists of comminution, grit removal, primary sedimentation, flow equalization, high-rate trickling filtration, secondary clarification, and chlorination. Treatment at the Oro Loma and Castro Valley Sanitary Districts' treatment facility consists of screening, grit removal, primary sedimentation, activated sludge, secondary clarification, and chlorination. Treatment at the San Leandro Water Pollution Control Plant grinding, primary sedimentation, trickling filter, activated sludge, secondary clarification, and disinfection by sodium hypochlorite. Treatment at the Union Sanitary District consists of screening, primary sedimentation, activated sludge, secondary clarification, and chlorination

Effluent Data

Exhibit A- 6 summarizes selenium effluent data for the treated wastewater between April 2011 and July 2015.

Exhibit A- 6. Summary of Selenium Effluent Data: East Bay Dischargers Authority Common Outfall

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
53	9	0.575	0.523	0.301	1.2

CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.

Receiving Water

The facility discharges to Lower San Francisco Bay. The SFRWQCB utilized the Yerba Buena Island monitoring station (station number BC 10) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.39 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline

WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third "trigger" which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 1.2 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the proposed water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 6. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.17 µg/L and MDELof 0.30 µg/L.

Since the MEC is above the QL, EPA assumed that the facility will need to pursue conventional treatment methods to comply with the projected effluent limitations (see Section 4.4). The Joint Outfall services a number of dischargers and the available information on their treatment processes indicated that none of the plants utilized iron salt chemical addition or media filtration. Therefore, EPA has developed a cost estimate to install a chemical treatment system and sand filters using the cost curves described in Section 4.4 at each of the plants. Since the cost curves are based on a linear trend of the costs for EPA's model treatment trains, costs may be estimated using an aggregate flow rate for the Joint Outfall (i.e., cost based on an aggregate flow rate will be equal to that estimated based on individual contributing systems). Using a flow rate of 107.8 mgd, the estimated installed capital cost for the Plants is approximately $54.7 million and the estimated annual O&M cost is $2.1 million.

A.7 East Bay Municipal Utility District, Wet Weather Facilities

East Bay Municipal Utility District, Special District No. 1 is the owner and operator of three wet weather facilities (WWF) known as the Point Isabel WWF, the San Antonio Creek WWF, and the Oakport WWF (collectively, the Facility, NPDES Permit No. CA0038440). The WWFs are connected to an interceptor system with a hydraulic capacity of 760 mgd and a million-gallon wet weather storage basin along one of the interceptors.

Treatment Processes

If influent flows at the Point Isabel WWF persist to the point of taking up the storage capacity of the units, the WWF provides treatment consisting of coarse screens, bar screens, grit chambers, and sedimentation/disinfection basins.

Treatment at the San Antonio Creek WWF consists of grit removal, fine screening, and disinfection.

If influent flows persist to the point of taking up the storage capacity of the units, the Oakport WWF provides treatment consisting of coarse screens and sedimentation/disinfection basins.

Effluent Data

As of 2009, discharge from this Facility has been prohibited. This prohibition is included in the existing permit (Permit No. R2-2014-0044; NPDES Permit No. CA0038440). As such effluent data for the Facility is not available.

Receiving Water

All discharges from the Facility are prohibited, and as such there is no applicable receiving water.

Baseline Scenario

All discharges from the Facility are prohibited and, therefore, no effluent limitations are applicable under the baseline scenario.

Proposed Criteria Scenario

All discharges from the Facility are prohibited and, therefore, no effluent limitations are applicable under the proposed criteria, and the facility would incur no costs.

A.8 East Bay Regional Park District, Hayward Marsh

The WWTP for the Regional Park District, Union Sanitary District, and East Bay Dischargers Authority at Hayward Marsh (Plant; NPDES Permit No. CA0038636) is a 145-acre improved marsh system which includes three freshwater marsh basins (85 acres) and two brackish water basins (60 acres) adjacent to Lower San Francisco Bay. Approximately 2.6 mgd is diverted from the Alvarado WWTP in Union City as the freshwater source for the Marsh. The three freshwater marsh basins are part of the treatment process, and thus part of the treatment facility. The two brackish water basins and San Francisco Bay are the receiving waters and waters of the United States within the South San Francisco Bay Basin watershed. The Marsh has a hydraulic capacity of 20 mgd. Hayward Marsh is operated to enhance the beneficial uses of reclaimed wastewater, to derive net environmental benefits, and as a research site to better understand development and management of a marsh using reclaimed wastewater.

Treatment Processes

Treatment at the Plant consists of screening, primary sedimentation, activated sludge, secondary clarification, and chlorination/disinfection of final effluent. Sludge is anaerobically digested, dewatered using centrifuge processes, and disposed of at an authorized disposal site. Most of the treated effluent is transported to the East Bay Dischargers pipeline where it mixes with treated effluent from other EBDA agencies and is transported to a dechlorination station near the San Leandro Marina. This treated effluent is transported to EBDA's deepwater outfall in Lower San Francisco Bay west of the Oakland Airport. That discharge is regulated under NPDES Permit No. CA0037869. Approximately 2.6 mgd is diverted to Hayward Marsh and is regulated under the permit in question (NPDES No. CA0038636). Secondary effluent enters a system of three freshwater marsh basins and two brackish water basins. The hydraulic capacity of the marsh system is 20 mgd. The brackish water basins discharge the final effluent into Lower San Francisco Bay.

Effluent Data

Recent effluent data for this permittee was not available for analysis. Instead, EPA utilized the MEC and effluent descriptive statistics reported in the discharger's 2011 permit (Permit No. R2-2011-0058; NPDES No. CA0037834). Exhibit A- 7 summarizes the information reported in the 2011 permit.

Exhibit A- 7. Summary of Selenium Effluent Data: East Bay Regional Park District

No. of Observations		Effluent Summary (µg/L)			
Total	**Nondetect**	**CV**	**Average**	**Standard Deviation**	**Max**
N/A	N/A	N/A[1]	N/A	N/A	0.55

N/A = Not Available
CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.
1. A CV of 0.6 was used to calculate Water Quality Based Effluent Limitations due to the limited number of detected observations.

Receiving Water

The facility discharges to Lower San Francisco Bay. The SFRWQCB utilized the Yerba Buena Island monitoring station (station number BC 10) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.39 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline

WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criterion. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third “trigger” which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 0.55 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 7. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.16 µg/L and MDEL of 0.33 µg/L.

Since the MEC for the Plant is below the QL, EPA assumed that it is discharging near the projected limitations and that compliance is likely to be achievable using process optimization methods (see Section 4.4). EPA developed one-time costs for implementing a process optimization study of $52,000.

A.9 Palo Alto Regional Water Quality Control Plant

The Palo Alto Regional Water Quality Control Plant and the City of Palo Alto wastewater collection system (collectively, the facility; NPDES Permit No. CA0037834) provides advanced secondary treatment of domestic, commercial, and industrial wastewater collected from the cities of Los Altos, Los Altos Hills, Palo Alto, and Mountain View; the East Palo Alto Sanitary District; and the unincorporated area of the Stanford University Campus. The service area population is approximately 220,000, and the Facility’s design flow rate is 39 mgd. Approximately 95% of the treated final effluent that is not recycled is discharged to an unnamed channel that leads to South San Francisco Bay. The remaining 5% is discharged to Matadero Creek, which flows into Mayfield Slough and then into South San Francisco Bay at the Flood Basin tide gates.

Treatment Processes

The 2014 Permit Fact Sheet reports that treatment processes include screening and grit removal, primary sedimentation, biological treatment, secondary clarification, filtration, and disinfection.

Effluent Data

Exhibit A- 8 summarizes selenium effluent data for the treated wastewater between March 2011 and June 2015.

Exhibit A- 8. Summary of Selenium Effluent Data: Palo Alto Regional Water Quality Control Plant

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
58	0	0.418	1.456	0.608	2.6

CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.

Receiving Water

The facility discharges to South San Francisco Bay. The SFRWQCB utilized the Dumbarton Bridge monitoring station (station number BA 30) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.628 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third “trigger” which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 2.6 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 88. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.19 µg/L and MDEL of 0.25 µg/L.

Since the MEC is above the QL, EPA assumed that the facility will need to pursue conventional treatment methods to comply with the projected effluent limitations (see Section 4.4). According to the existing permit, the facility does not currently use iron salt chemical addition but does have a media filtration unit process. Therefore, EPA has developed a cost estimate to install a chemical treatment system using the cost curves described in Section 4.4. Using a flow rate of 39 mgd, the estimated installed capital cost for the Plant is approximately $13.0 million and the estimated annual O&M cost is $370,000.

A.10 Cities of San Jose and Santa Clara

The WWTP for the Cities of San Jose and Santa Clara (Plant; NPDES Permit No. CA0037842) provides advanced-secondary treatment of wastewater from domestic, commercial, and industrial sources. Ownership of the Plant by the City of San Jose and City of Santa Clara was established under the original Joint Powers agreement. Through a series of additional "Master Agreements for Wastewater Treatment," five additional satellite collection systems obtained rights to a share of the treatment capacity to treat their discharged sewage, including the City of Milpitas, Burbank Sanitation District, Cupertino Sanitation District, West Valley Sanitation District, and Santa Clara County Sanitation Districts Nos. 2 and 3. The Plant serves a population of approximately 1.4 million and has an average daily dry weather design flow of 167 mgd and a peak daily wet weather design flow of 261 mgd. The Plant discharges to the Artesian Slough.

Treatment Processes

The 2013 Permit Fact Sheet reports that the Plant provides treatment consisting of influent screening and grit removal; primary clarification; secondary treatment with an activated sludge process with two parallel aeration basin treatment trains configured and operated for biological nutrient removal (BNR); secondary clarifiers; dual media gravity filtration; and disinfection with chlorine, ammonia removal, and dechlorination using sulfur dioxide.

Effluent Data

Exhibit A- 9 summarizes selenium effluent data for the treated wastewater between November 2011 and November 2014.

Exhibit A- 9. Summary of Selenium Effluent Data: San Jose/Santa Clara Water Pollution Control Plant

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
52	0	0.486	0.474	0.231	0.7

CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.

Receiving Water

The facility discharges to South San Francisco Bay. The SFRWQCB utilized the Dumbarton Bridge monitoring station (station number BA30) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.628 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third "trigger" which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 0.7 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 9. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.18 µg/L and MDEL of 0.26 µg/L.

Since the MEC for the Plant is below the QL, EPA assumed that it is discharging near the projected limitations and that compliance is likely to be achievable using process optimization methods (see Section 4.4). EPA developed one-time costs for implementing a process optimization study of $52,000.

A.11 South Bayside System Authority, Wastewater Treatment Plant

The South Bayside System Authority WWTP (Plant; NPDES Permit No. CA0038369) provides advanced secondary treatment of domestic, commercial, and industrial wastewater for the cities of Belmont, San Carlos, Redwood City, and Woodside; and for the service area of the west Bay Sanitary District, which collects wastewater from the cities of Menlo Park, Atherton, and Portola Valley, and areas of East Palo Alto, Woodside, and unincorporated San Mateo and Santa Clara counties. The service area population is approximately 199,000. The Plant has an average dry weather design flow of 29 mgd, and a peak wet weather design flow of 71 mgd, and discharges to Lower San Francisco Bay.

Treatment Processes

The 2012 Permit fact sheet reports treatment processes consist of primary sedimentation, secondary biological treatment through fixed film reactors and aeration basins, secondary clarification, mono- or dual-media filtration, chlorine disinfection, and dechlorination using sodium bisulfite.

Effluent Data

Exhibit A- 10 summarizes selenium effluent data for the treated wastewater between January 2011 and December 2014.

Exhibit A- 10. Summary of Selenium Effluent Data: South Bayside System Authority WWTP

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
35	1	0.591	0.317	0.187	0.77[1]

CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.
1. The max result was detected below the method quantification level and reported as an estimated concentration.

Receiving Water

The facility discharges to Lower San Francisco Bay. The SFRWQCB utilized the Yerba Buena Island monitoring station (station number BC 10) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.39 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third "trigger" which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 0.77 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 10. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.17 µg/L and MDEL of 0.30 µg/L.

Since the MEC for the Plant is below the QL, EPA assumed that it is discharging near the projected limitations and that compliance is likely to be achievable using process optimization methods (see Section 4.4). EPA developed one-time costs for implementing a process optimization study of $52,000.

A.12 Cities of South San Francisco, San Bruno, and the North Bayside Systems Unit

The WWTP for the Cities of South San Francisco, San Bruno, and the North Bayside Systems Unit (Plant; NPDES No. CA0038130) provides primary and secondary wastewater treatment. The Plant serves an approximate population of 110,500, and has an average daily dry weather design flow of 13 mgd. The Plant discharges to Lower San Francisco Bay.

Treatment Processes

The 2014 Permit fact sheet reports that treatment consists of bar screens and two grit removal systems, and, during dry weather, treatment with ferric chloride and polymer for flocculation and primary clarifiers for removal of grease, floating solids, and settable solids. Further treatment includes aeration basins and secondary clarifiers, disinfection with sodium hypochlorite, blending with chlorinated effluent, and chlorine neutralization with sodium bisulfite. During wet weather, when influent flow greatly exceeds the peak secondary treatment capacity (30 mgd design capacity), primary effluent may be routed around the aeration basins and secondary clarifiers and blended with secondary-treated effluent.

Effluent Data

Exhibit A- 11 summarizes selenium effluent data for the treated wastewater between June 2011 and July 2015.

Exhibit A- 11. Summary of Selenium Effluent Data: South San Francisco/San Bruno Water Quality Control Plant

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
52	1	0.659	1.219	0.804	2.7

CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.

Receiving Water

The facility discharges to Lower San Francisco Bay. The SFRWQCB utilized the Yerba Buena Island monitoring station (station number BC 10) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.39 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third “trigger” which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 2.7 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 11. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.17 µg/L and MDEL of 0.32 µg/L.

Since the MEC is above the QL, EPA assumed that the Plant will need to pursue conventional treatment methods to comply with the projected effluent limitations (see Section 4.4). According to the existing permit, the Plant does not currently use media filtration but does use iron salts addition in their treatment process. Therefore, EPA has developed a cost estimate to install a media filtration system using the cost curves described in Section 4.4. Using a flow rate of 13 mgd, the estimated installed capital cost for the Plant is approximately $4.1 million dollars and the estimated annual O&M cost is $230,000.

A.13 San Francisco Southeast Plant

The City and County of San Francisco is the owner and operator of the Southeast Water Pollution Control Plant (Southeast Plant), North Point Wet Weather Facility (North Point Facility), Bayside Wet Weather Facilities, and the wastewater collection system (collectively Facility; NPDES Permit No. CA0037664). The Facility serves eastern San Francisco and portions of Brisbane and Daly City, and has a service population of approximately 580,000. The Southeast Plant provides primary and secondary treatment of combined wastewater and storm water, and has an average dry weather design flow capacity of 85.4 mgd and a wet weather design flow capacity of 250 mgd. The North Point Facility provides primary treatment of combined wastewater and storm water during wet weather and has a wet weather design flow capacity (primary treatment only) of 150 mgd. The Bayside Wet Weather Facilities provide equivalent-to-primary treatment during wet weather. The Facility discharges to San Francisco Bay.

Treatment Processes

During dry weather, the Southeast Plant provides secondary wastewater treatment. The treatment processes include a headworks with coarse and fine bar screens, and grit removal; primary sedimentation tanks; pure oxygen aeration basins; secondary clarifiers; and chlorine contact basins for chlorination using sodium hypochlorite and dechlorination using sodium bisulfite. During wet weather up to 150 mgd receives both primary and secondary treatment; the remaining flow (up to 100 mgd) receives only primary treatment. The entire volume is disinfected prior to discharge.

The North Point Facility discharges only during wet weather. The treatment consists of bar screens, sedimentation tanks equipped with skimmers, sodium hypochlorite injection, and dechlorination using sodium bisulfite addition.

During dry weather the Bayside Wet Weather Facilities transport wastewater to the Southeast Plant. During wet weather, these structures transfer combined wastewater to the Southeast Plant and, if necessary, the North Point Facility. They also provide storage for more than 120 million gallons of combined wastewater. In the event that the capacities of the Southeast Plant, North Point Facility, and storage/transport structures are exceeded, the combined wastewater receives the equivalent of primary treatment consisting of settling solids with a series of baffles and weirs that also remove floatable materials prior to discharge.

Effluent Data

Exhibit A- 12 summarizes selenium effluent data for the treated wastewater between January 2011 and December 2014.

Exhibit A- 12. Summary of Selenium Effluent Data: San Francisco Southeast Plant

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
49	3	0.679	0.251	0.171	1.169[1]

CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.
1. The max result was detected below the method quantification level and reported as an estimated concentration.

Receiving Water

The facility discharges to Lower San Francisco Bay. The SFRWQCB utilized the Yerba Buena Island monitoring station (station number BC 10) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.39 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third “trigger” which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 1.169 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 12. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.16 µg/L and MDEL of 0.33 µg/L.

Since the MEC is above the QL, EPA assumed that the Plant will need to pursue conventional treatment methods to comply with the projected effluent limitations (see Section 4.4). According to the existing permit, the Plant does not currently have an iron salts addition or media filtration unit processes. Therefore, EPA has developed a cost estimate to install chemical treatment and a media filtration system using the cost curves described in Section 4.4. Using a flow rate of 84.5 mgd, the estimated installed capital cost for the Plant is approximately $43.7 million and the estimated annual O&M cost is $1.7 million.

A.14 City of Sunnyvale

The Sunnyvale Water Pollution Control Plant (Plant; NPDES Permit No. CA0037621) provides advanced-secondary treatment of wastewater from domestic, commercial, and industrial sources from the City of Sunnyvale, Rancho Rinconada, and Moffett Field. The Plant serves a population of approximately 146,000, and has an average dry weather design flow capacity of 29.5 mgd and a peak wet weather design flow of 40 mgd. The Plant discharges to the Moffett Channel, which flows to South San Francisco Bay via Guadalupe Slough.

Treatment Processes

The 2014 Permit fact sheet reports that treatment includes grinding and grit removal, primary sedimentation, secondary treatment through the use of oxidation ponds, fixed-growth reactor nitrification, dissolved air flotation, dual media filtration, disinfection with chlorine gas, and dechlorination with sodium bisulfite.

Effluent Data

Exhibit A- 13 summarizes selenium effluent data for the treated wastewater between April 2011 and July 2015.

Exhibit A- 13. Summary of Selenium Effluent Data: Sunnyvale Water Pollution Control Plant

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
70	60	0.629[1]	0.407	0.256	1.66[2]

CV = Coefficient of Variation
µg/L = micrograms per liter
Concentrations are total recoverable form.
1. A CV of 0.6 was used to calculate Water Quality-Based Effluent Limitations due to the limited number of detected observations.
2. The max result was detected below the method Quantification Level and reported as an estimated concentration.

Receiving Water

The facility discharges to South San Francisco Bay. The SFRWQCB utilized the Dumbarton Bridge monitoring station (station number BA 30) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.628 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third "trigger" which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 1.66 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the water quality criterion.

Water quality-based effluent limitations were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A-13. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criterion, the discharger would have to meet an AMEL of 0.16 µg/L and MDEL of 0.33 µg/L.

Since the MEC is above the QL, EPA assumed that the Plant will need to pursue conventional treatment methods to comply with the projected effluent limitations (see Section 4.4). According to the existing permit, the Plant does not currently use iron salts addition but does have media filter in their treatment process. Therefore, EPA has developed a cost estimate to install a chemical treatment system using the cost curves described in Section 4.4. Using a flow rate of 29.5 mgd, the estimated installed capital cost for the Plant is approximately $10.3 million and the estimated annual O&M cost is $290,000.

A.15 Bottling Group, LLC

The Bottling Group, Hayward Plant (Plant; NPDES Permit No. CA0030058) manufactures, bottles, and distributes drinking water and soft drinks. The Plant uses potable water supplied by the City of Hayward, which undergoes additional treatment in the manufacturing process. The treatment system is capable of treating up to 900,000 gallons of supply water with an 80% recovery rate. The 20% of supply water not recovered is discharged in the RO concentrate stream. The Plant has a maximum design treatment capacity of 900,000 gallons per day, and a permitted average monthly discharge rate of 143,000 gallons per day. The Plant discharges RO concentrate to the Alameda County Besco Pump Station, which pumps the effluent to the Alameda County flood control and Water Conservation District Flood Channel (the tidally-influenced downstream section of Old Alameda Creek) which flows to Lower San Francisco Bay.

Treatment Processes

The 2013 Permit fact sheet reports that treatment to filter supply water consists of anthracite and greensand filters to remove iron and manganese, 5-micrometer cartridge-filters, and finally RO membranes. The Plant adds chemical scale and fouling inhibitors to prevent fouling of the RO membranes and a dechlorinating agent.

Effluent Data

Exhibit A- 14 summarizes selenium effluent data for the treated wastewater from April 9, 2015.

Exhibit A- 14. Summary of Selenium Effluent Data: Bottling Group, Hayward Plant

No. of Observations		Effluent Summary (µg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
1	1	N/A[1]	<0.2	N/A	<0.2

CV = Coefficient of Variation
N/A = Not Available
µg/L = micrograms per liter
Concentrations are total recoverable form.
1. A CV of 0.6 was used to calculate Water Quality Based Effluent Limitations due to the limited number of detected observations.

Receiving Water

The facility discharges to Alameda Creek, which flows into San Francisco Bay. The Discharger collects grab samples from Alameda Creek immediately upstream of the discharge location for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from Alameda Creek on April 9, 2015. The total recoverable selenium concentration observed during this period was 2.5 µg/L.

Baseline Scenario

The permit does not include any WQBELs based on the existing chronic aquatic life selenium criterion (i.e., 5 µg/L) and the existing acute aquatic life selenium criterion (i.e., 20 µg/L). EPA performed an RPA based on existing criteria to confirm that no baseline WQBELs would be needed based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third "trigger" which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column aquatic life selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. Selenium was not detected in the available effluent monitoring data. Additionally, since there are no existing selenium WQBELs for this facility, EPA assumes that there is no reasonable potential under the third "trigger" which is activated when a review of other information (beyond the maximum effluent and ambient concentrations) suggests that limits are needed to protect beneficial uses. As such, EPA assumed that the facility would incur no costs under the proposed criteria.

A.16 San Francisco International Airport

The San Francisco International Airport, Mel Leong Treatment Plants (Plants; NPDES Permit No. CA0038318) include the Industrial Plant, which treats industrial wastewater from maintenance shops and vehicle washing, and first-flush stormwater runoff from industrial areas; and the Sanitary Plant, which includes a collection system and treats sanitary wastewater from airplanes and airport facilities, including terminal restrooms, hangars, restaurants, and shops. In emergency situations, either plant may be used to store or treat flows, spills, or overflows that would normally flow to the other plant to ensure that all wastewater is adequately treated. The service population for the Plants is estimated at 10,000. The Plants have a combined facility design flow of 2.2 mgd, and discharge to the Lower San Francisco Bay.

Treatment Processes

The Sanitary Plant treatment operations consist of punched plate bar screens, grit removal, flow equalization, and chlorination. Solids from the Sanitary Plant are treated by gravity belt thickening and anaerobic digestion before dewatering by belt filter presses or air drying using sludge drying beds.

Treatment from the Industrial Plant includes flocculating the combined industrial wastewater and any incoming first flush storm water, dissolved air floatation, pH adjustment (as needed), aerobic biological treatment via trickling filter, secondary clarification, and chlorination. The Plant can divert up to 0.72 mgd of the effluent from the chlorination tank to tertiary filters. Sludge and scum are pumped to sludge beds for dewatering, and filtrate drained form the sludge is pumped back to the trickling filter for treatment.

Chlorinated wastewater from both plants is combined for dechlorination at the South San Francisco Wastewater Treatment Facility

Effluent Data

Exhibit A- 15 summarizes the available selenium effluent data for the treated wastewater between December 2010 and October 2015.

Exhibit A- 15. Summary of Selenium Effluent Data: San Francisco International Airports, Mel Leong Treatment Plants

No. of Observations		Effluent Summary (μg/L)			
Total	Nondetect	CV	Average	Standard Deviation	Max
2	0	0.168[1]	0.165	0.028	0.172

CV = Coefficient of Variation
μg/L = micrograms per liter
Concentrations are total recoverable form.
1. A CV of 0.6 was used to calculate Water Quality Based Effluent Limitations due to the limited number of detected observations.

Receiving Water

The facility discharges to Lower San Francisco Bay. The SFRWQCB utilized the Yerba Buena Island monitoring station (station number BC 10) for purposes of background receiving water characterization. The available ambient receiving water monitoring data was collected from the Yerba Buena Island monitoring station between 1993 and 2013. The maximum total recoverable selenium concentration observed during this period was 0.39 μg/L.

Baseline Scenario

The existing permit (Permit No. R2-2013-0011; NPDES Permit No. CA0038318) includes an AMEL of 2.9 μg/L and a MDEL of 8.8 μg/L based on the existing chronic aquatic life selenium criterion (i.e., 5 μg/L) and the existing acute aquatic life selenium criterion (i.e., 20 μg/L). EPA performed an RPA based on existing criteria using more recent data based on the analytical approaches described in Section 4.2. As neither the maximum effluent nor receiving water concentration exceed the existing criteria, this facility does not have reasonable potential to exceed the existing selenium criteria. Since EPA found no reasonable potential using the most recent data and because the monitoring data demonstrated performance well below the existing WQBELs, EPA assumed that the facility would incur no costs under the baseline scenario.

Proposed Criteria Scenario

EPA performed an RPA based on the proposed water column selenium criterion (0.2 µg/L). As with the baseline scenario, EPA based the analysis on the analytical approaches described in Section 4.2. The MEC (i.e., 0.172 µg/L) exceeds the proposed criterion and, therefore, the discharge has reasonable potential to cause or contribute to the exceedance of the water quality criterion.

WQBELs were calculated according to the procedures described in Section 4.3 and using the effluent coefficient of variation described in Exhibit A- 15. Due to an absence of assimilative capacity (i.e., the B exceeded the proposed criterion), EPA did not consider dilution, and instead calculated end-of-pipe limitations. Under the proposed criteria, the discharger would have to meet an AMEL of 0.16 µg/L and MDEL of 0.33 µg/L.

Since the MEC for the Plants is below the QL, EPA assumed that it is discharging near the projected limitations and that compliance is likely to be achievable using process optimization methods (see Section 4.4). EPA developed one-time costs for implementing a process optimization study of $52,000.

Appendix B - Potential Compliance Costs, 7% Discount Rate

This appendix summarizes the point source compliance costs using a 7 percent discount rate as an alternative to the main analysis, presented in Section 4.4.2, which uses a 3 percent discount rate. For more details on the methodology for these analyses, see Section 4.

Exhibit B-1 summarizes the one-time (capital or process optimization) costs, O&M costs, and total annual cost for each of the identified facilities likely to have a control increment under the proposed selenium criterion. Exhibit B-2 summarizes the results of the sensitivity analysis (which includes additional costs for denitrification filters; as described in Section 6.3).

Exhibit B-1. Treatment and Estimated Cost Increment for Affected Facilities, 7% Discount Rate

NPDES Number	Facility Name	Capacity (mgd)	MEC (µg/L)	AMEL (µg/L)	One-Time Cost	O&M Cost	Total Annual Cost
Municipal Facilities							
CA0037621	City of Sunnyvale	29.5	1.66	0.16	$10,327,000	$293,000	$1,268,000
CA0037842	City of San Jose/Santa Clara	167	0.7	0.18	$52,000	--	$4,900
CA0037834	City of Palo Alto	39	2.6	0.19	$13,033,000	$367,000	$1,597,000
CA0038369	South Bayside System Authority	29	0.77	0.17	$52,000	--	$4,900
CA0037541	City of San Mateo/Foster City Estero	15.7	0.53[2]	0.18	$52,000	--	$4,900
CA0038636	East Bay Regional Park District, Hayward Marsh	2.6	0.55	0.16	$52,000	--	$4,900
CA0037532	City of Millbrae and North Bayside Systems Unit	3	0.48[2]	0.16	$52,000	--	$4,900
CA0037788	City of Burlingame and North Bayside Systems Unit	5.5	1	0.17	$6,194,000	$262,000	$847,000
CA0038130	Cities of South San Francisco, San Bruno, and North Bayside Systems Unit	13	2.7	0.17	$4,126,000	$229,000	$618,000
CA0038008	City of Livermore and EBDA	8.5	1.7	0.16	$7,617,000	$315,000	$1,034,000
CA0037613	Dublin San Ramon Services District, LAWMA, and EBDA	20.2	4.7	0.15	$13,169,000	$521,000	$1,764,000
CA0037869	East Bay Dischargers Authority, Joint Outfall	107.8	1.2	0.17	$54,734,000	$2,067,000	$7,234,000
CA0037664	San Francisco Southeast Plant	84.5	1.2[2]	0.16	$43,679,000	$1,655,000	$5,778,000
CA0038440	East Bay Municipal Utility District, Wet Weather	158	--	--	$0	$0	$0
				Subtotal	**$153,139,000**	**$5,709,000**	**$20,164,000**
Industrial Facilities							
CA0038318	San Francisco International Airport	2.2	0.1719	0.16	$52,000	--	$4,900
				Subtotal	**$52,000**	**--**	**$4,900**
				Total	**$153,191,000**	**$5,709,000**	**$20,169,000**

Exhibit B-1. Treatment and Estimated Cost Increment for Affected Facilities, 7% Discount Rate

NPDES Number	Facility Name	Capacity (mgd)	MEC (µg/L)	AMEL (µg/L)	One-Time Cost	O&M Cost	Total Annual Cost

mgd = million gallons per day

µg/L = micrograms per liter

1. One-time costs annualized over 20 years using a 7 percent discount rate; see Section 4.4.2 for annualized results using a 3 percent discount rate.
2. Detected, but Not Quantified (DNQ); i.e., selenium was detected in the sample but at levels too low to accurately quantify; the reported concentration is a best estimate as determined by the laboratory instrumentation and methodology.

Exhibit B-2: End-of-Pipe Treatment Costs Sensitivity Analysis, 7% Discount Rate

NPDES Number	Facility Name	Total Annual Cost[1]	
		Original[2]	Including Denitrification Filter
Municipal Facilities			
CA0037621	City of Sunnyvale	$1,268,000	$5,704,000
CA0037842	City of San Jose/Santa Clara[3]	$4,900	$4,900
CA0037834	City of Palo Alto	$1,597,000	$7,461,000
CA0038369	South Bayside System Authority[3]	$4,900	$4,900
CA0037541	City of San Mateo/Foster City Estero[3]	$4,900	$4,900
CA0038636	East Bay Regional Park District, Hayward Marsh[3]	$4,900	$4,900
CA0037532	City of Millbrae and North Bayside Systems Unit[3]	$4,900	$4,900
CA0037788	City of Burlingame and North Bayside Systems Unit	$847,000	$1,674,000
CA0038130	Cities of South San Francisco, San Bruno, and North Bayside Systems Unit	$618,000	$2,573,000
CA0038008	City of Livermore and EBDA	$1,034,000	$2,312,000
CA0037613	Dublin San Ramon Services District, LAWMA, and EBDA	$1,764,000	$4,801,000
CA0037869	East Bay Dischargers Authority, Joint Outfall	$7,234,000	$23,444,000
CA0037664	San Francisco Southeast Plant	$5,778,000	$18,484,000
CA0038440	East Bay Municipal Utility District, Wet Weather	$0	$0
	Subtotal	**$20,164,000**	**$66,477,500**
Industrial Facilities			
CA0038318	San Francisco International Airport[3]	$4,900	$4,900
	Subtotal	**$4,900**	**$4,900**
	Total	**$20,169,000**	**$66,482,400**

1. For plants discharging at levels above the most stringent quantitation level (1 µg/L), EPA assumed that POTWs will pursue conventional treatment methods to comply with the projected effluent limitations. POTWs operating below the quantitation level are discharging near the projected limitations and EPA has assumed that compliance is likely to be achievable using process optimization methods.
2. One-time costs annualized over 20 years using a 7 percent discount rate; for costs annualized using a 3 percent discount rate, see Section 6.3.
3. End-of-pipe treatment (including denitrification filter) is unnecessary for this facility, even considering alternative analytical detection limits.