STAFF REPORT

WETLAND POLICY CLIMATE CHANGE UPDATE PROJECT
NPDES PERMIT CASE STUDIES
USE OF WASTEWATER IN WETLANDS

FINDINGS AND RECOMMENDATIONS

April 2017
[revised August 2018]

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION &
SAN FRANCISCO ESTUARY PARTNERSHIP

This Staff Report was produced by staff of the San Francisco Estuary Partnership (SFEP) with assistance from staff of the San Francisco Bay Regional Water Quality Control Board. SFEP received a grant award from U.S. Environmental Protection Agency (USEPA) in the amount of $90,402 (ABAG/SFEP Cooperative Agreement CD-99T34301-0, Wetlands Protection Development – Wetland Policy Climate - Change Update Project; Project) to work with the Water Board to support the evaluation of existing Water Board regulations and policies governing the permitting of multi-benefit projects designed to address sea level rise. SFEP is a coalition of resource agencies, non-profits, citizens, and scientists working to protect, restore, and enhance water quality and fish and wildlife habitat in and around the San Francisco Bay Delta Estuary. Working cooperatively, SFEP shares information and resources that result in studies, projects, and programs that improve the Estuary and communicate its value and needs to the public.

Minor revisions have been made to this report since its completion in April 2017, mainly consisting of edits to the case studies and the addition of a new case study for Renzel Marsh in Palo Alto.

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SECTION 1: INTRODUCTION

This Staff Report is intended to support a the San Francisco Bay Water Board (Water Board) in its evaluation of regulatory options associated with permitting multi-benefit projects designed to address sea level rise. Climate change is anticipated to affect tidal wetlands through the rate of sea level rise and sediment dynamics and the Water Board is engaged in a review of its regulatory procedures for determining and/or establishing the net environmental benefit of climate adaptation projects. Climate adaptation projects include projects that require filling the Bay to ensure the long term viability of tidal marshes and bay wetlands and projects that use wastewater to create, restore or enhance wetlands. This Staff Report addresses one aspect of that regulatory evaluation, specific to evaluating the ecosystem services of existing treated wastewater wetland projects and the regulatory and legal considerations of increasing the use of treated wastewater in the San Francisco Baylands.

This work was also identified as a high priority basin planning project in the 2015 Triennial Review of the Basin Plan. The regulatory review project entailed several elements. First, the project was identified to explore updating Water Board Resolution No. 94-086 "Policy on the Use of Wastewater to Create, Restore, and/or Enhance Wetlands." This policy is now over 20 years old and much has been learned about wetland restoration over the intervening years and the hydrology and topography of the Bay has been changing as wetland restoration efforts in the Bay expand. The project was also expected to clarify permitting requirements for wastewater discharges into wetlands and develop near-shore permitting strategies for discharges to wetlands and sloughs as part of a climate adaptation, multi-benefit approach.

Using treated wastewater as a source of freshwater for restored wetlands could provide an environmental benefit by increasing the amount of freshwater and brackish wetlands available to birds and wildlife dependent on such habitats. Using treated wastewater in this fashion as a source of freshwater was also identified as a potential climate change response strategy in the ***Baylands Ecosystem Habitat Goals Science Update 2015*** (2015 Goals Report, p. 105)***.*** Sea levels are projected to increase rapidly in the middle decades of this century, with the National Research Council projecting a regional sea-level rise for San Francisco Bay of 12 to 61 centimeters (about 4.5 to 24 inches) by 2050 and 42 to 166 centimeters (about 16.5 to 65 inches) by 2100. The 2015 Goals Report recommends that the Region, "Identify and implement opportunities for taking advantage of treated wastewater and stormwater to create salinity gradients and maximize peat accumulation in the baylands, while protecting water quality and minimizing nutrient loading."

Constructed treatment wetlands are a proven technology for the removal of pollutants in wastewaters and thousands of wetland treatment systems have been constructed worldwide to effectively reduce concentrations of biochemical oxygen demand (BOD), total suspended solids (TSS), nitrogen, phosphorus, pathogens, and trace metals. In the San Francisco Bay Area, constructed treatment wetlands have been successfully

integrated into the wastewater treatment train at multiple sanitation districts to provide a final polishing step after secondary, and (in some cases) tertiary treatment. Most constructed wetlands are operated in a way to provide other functions besides water quality enhancement including providing habitat for fish and wildlife species.

The Oro Loma Sanitary District Wet Weather Equalization and Ecotone Demonstration Project is an also example project studying the application of treated wastewater to create upland ecotone habitats. At the Ora Loma Demonstration Project, a constructed wetland and upland ecotone slope provide polishing of secondary-treated wastewater to remove nutrients and other contaminants. The findings from the Ora Loma Demonstration Project will inform the evaluation of similar adaptation projects.

Changing the way we manage wastewater presents opportunities and regulatory challenges. The East Bay Dischargers Authority (EBDA) currently discharges treated wastewater into San Francisco Bay through a deep water outfall; however, this infrastructure is aging. The EBDA has proposed alternative means of bay discharge, including decentralized discharges of treated wastewater, considering the needs for freshwater inputs to support habitat and species needs along San Francisco Bay (EBDA 2015, p.10). Permitting these types of projects in light of regulatory policies continues to present challenges.

Developing a regional strategy for the permitting of constructed wetlands and/or use of treated wastewater in Bayland environments is critical as many of the wetlands evaluated as case studies in this Staff Report are facing pressures and new water quality concerns that threaten their long-term viability. For example, Hayward Marsh and Moorhen Mash are facing pressures from management and operating costs, competing demands for recycled water and water quality concerns.

The Report included four principal research tasks as follows:

1) Identify case studies and research questions for Bayland wetland projects that receive wastewater for treatment and/or environmental enhancement
2) Conduct interviews with case managers at the Water Board, sanitation districts, and other stakeholders
3) Develop summary report on case studies including findings and recommendations to improve the NPDES permitting process for future climate change adaptation projects
4) Share findings with Water Board staff and incorporating feedback

We anticipate that this Staff Report will include additional chapters as other tasks identified in the Grant are completed. This includes conducting an assessment of constraints and regulatory opportunities with other Water Board regulatory programs including the issuance of Waste Discharge Requirements and Clean Water Act Section 401 Water Quality Certifications for activities involving dredged or fill material. We will also be collaborating with staff of the Engineering Research Center for Re-inventing the Nation's Urban Water Infrastructure (ReNUWIt) conducting research on water

quality improvement benefits of wetlands. ReNUWIt's research findings on the use of wetlands to improve water quality for nutrients, pathogens, and contaminants of emerging concern (CECs) in wastewater could provide direction on determining effluent limitations, treatment standards, and wetland design criteria. This Project is also being coordinated with other resource agency climate change adaption efforts including the Bay Conservation and Development Commission's (BCDC) Policies for a Rising Bay.

SECTION 2: NPDES PERMITTING CONSIDERATIONS

Section 1 provides a summary of the relevant requirements for NPDES permitting. These requirements guided Project research questions and provided a framework to evaluate differences in application in NPDES case study permits.

2.1 DISCHARGE PROHIBITION TO SHALLOW WATERS

Discharge prohibitions can be found in Table 4-1 of the Basin Plan (Water Board 2017; see Appendix A: Basin Plan Waste Discharge Prohibition Language). Discharge Prohibition 1 establishes that wastewater cannot be discharged to shallow water unless it receives a minimum of 10:1 dilution. Discharge prohibitions must be met at all times unless an exception is granted. These exceptions include: 1) an inordinate burden would be placed on the discharger relative to the beneficial use protected, and an equivalent level of environmental protection can be achieved by alternate means; 2) the discharge is part of a reclamation; 3) net environmental benefits will be derived as a result of the discharge; and/or 4) the discharge is approved as part of a groundwater cleanup site. Table 1 provides a summary of the wetland type, discharge prohibition exceptions used in the NPDES permit, and level of treatment.

Table 1: Treatment and Natural Wetlands Utilizing Wastewater in the San Francisco Bay Area.

Wetland Location	Wetland Type	Includes Treatment Wetland	Discharge Prohibition Exception				Level of Treatment
			Inordinate Burden/ Equivalent Level of Protection	Reclamation Project	Net Environmental Benefit	Groundwater Cleanup Site	
Moorhen Marsh	Freshwater and brackish wetland	Yes	X		X		Advanced secondary
Hayward Marsh	Freshwater and brackish wetland	Yes			X		Secondary
Ellis Creek	Freshwater wetland	Exclusively	X	X			Secondary
Bel Marin Keys	Brackish and tidal marsh (to be developed)	Yes		X	X		Secondary
Suisun Marsh	Brackish marsh	No	X		X		Advanced secondary
Napa-Sonoma Marsh	Slough and brackish marsh	No	X	X	X		Tertiary (secondary with additional filtration)
Renzel Marsh	Freshwater pond and saltmarsh	No	X	X			Advanced secondary

2.2 POLICY ON THE USE OF WASTEWATER TO CREATE, RESTORE, AND ENHANCE WETLANDS (RESOLUTION NO. 94-086)

The Water Board adopted Resolution No. 94-086 entitled, *Policy on the Use of Wastewater to Create, Restore, and/or Enhance Wetlands* which includes 11 provisions (see Appendix B: Resolution No. 94-086 Provisions) the Water Board uses in determining whether or not to approve projects involving the use of wastewater to create, restore, and/or enhance wetlands. The provisions include: 1) differentiating between existing wetlands and constructed wetland systems; 2) considerations for determining net environmental benefit waste discharge prohibition exception; and 3) conditions for marsh management including maximizing environmental benefit, addressing vector controls, and developing a management plan[1] acceptable to the Executive Officer which provides detailed information on how compliance with the policy will be achieved. Provision 11 outlines four elements that, at a minimum, should be included in a management plan: 1) facility plan; 2) operations and maintenance plan; 3) monitoring program; and 4) an assessment of anticipated water quality impacts, including a summary of results of any pilot work.

2.3 MINIMUM TREATMENT STANDARDS FOR WASTEWATER DISCHARGES INTO WETLANDS

Clean Water Act Section 301(b) and 40 C.F.R. Section 122.44 require that permits include conditions meeting technology-based requirements, at a minimum, and any more stringent effluent limitations necessary to meet water quality standards. NPDES dischargers must meet minimum federal technology-based requirements based on the secondary treatment standards at 40 C.F.R. Section 133 as summarized in Table 2.

Table 2: Secondary Treatment Standards

PARAMETER	MONTHLY AVERAGE	WEEKLY AVERAGE
Biochemical Oxygen Demand$_5$ [1,2]	30 mg/L	45 mg/L
Carbonaceous Biochemical Oxygen Demand$_5$ [1,2]	25 mg/L	40 mg/L
Total Suspended Solids[2]	30 mg/L	45 mg/L
pH	6.0 – 9.0 standard units	
Unit Abbreviation: mg/L= milligrams per liter Footnotes: [1] Carbonaceous Biochemical Oxygen Demand$_5$ effluent limitations may be substituted for Biochemical Oxygen Demand$_5$ limitations. [2] The monthly average percent removal, by concentration, is not to be less than 85%.		

[1] The NPDES case study permits use the term “marsh management plan” which is equivalent to the term “management plan” used in Resolution No. 94-086.

Basin Plan Section 4.5.5.1 contains additional requirements for certain pollutants (relevant Basin Plan tables are provided in Appendix C: Basin Plan Tables):

- Table 4-2 contains effluent limitations for discharges to inland surface waters and enclosed bays and estuaries within the region.
- Table 4-2a contains both daily maximum and longer-term effluent limitations for bacteriological indicator organisms. All NPDES permits for discharges that contain sanitary waste shall include the applicable effluent limitations from Table 4-2a, except for discharges into Hayward Marsh, for which [Water Contact Recreation] REC-1 is not a designated beneficial use. The water quality-based effluent limitations in Table 4-2a may be adjusted to account for dilution in a manner consistent with procedures in the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (see footnotes 'a' and 'e' in Table 4-2a (p. 4-12) of Appendix C).

2.4 BENEFICIAL USE DESIGNATION AT NEWLY CREATED WETLANDS

Under the Water Code, the Water Boards must develop regional Basin Plans (Section 13240) that define and designate beneficial uses for waters of the State (Section 13050(j)). Beneficial uses define the resources, services, and qualities of aquatic systems with the ultimate goal of protecting and achieving the highest water quality. The Water Code defines beneficial uses as uses of waters that must be protected against quality degradation and "include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Section 13050(f)). Beneficial uses serve as a basis for establishing water quality objectives and discharge prohibitions to protect water quality.

Basin Plan Table 2-3 shows examples of beneficial uses associated with different wetland types (i.e., marine, estuarine, riverine, lacustrine, and palustrine[2]) and Basin Plan Table 2-4 lists and specifies beneficial uses for 34 significant wetland areas within the Region (see Appendix C: Basin Plan Tables). The Basin Plan has not comprehensively identified beneficial uses for all wetlands in the Region and explains:

> Because of the large number of small and non-contiguous wetlands, it is not practical to delineate and specify beneficial uses of every wetland area. Therefore, beneficial uses may be determined site-specifically, as needed. Chapter 4 of this Plan contains additional information on the process used to determine beneficial uses for specific wetland sites (p. 2-11).

[2] Wetland types taken from the Cowardin (Cowardin et al. 1979) wetland classification system.

Under the Clean Water Act, states are required to recognize and protect all existing beneficial uses of waters, even if such uses have not been formally designated in a Basin Plan. Under the Water Code, the Water Boards also designate and protect "potential beneficial uses" in their Basin Plans. The Water Boards are charged with protecting beneficial uses (existing and potential) from pollution and nuisance that can occur as a result of waste discharges in the Regions. In addition, "the beneficial uses of any specifically identified water body generally apply to all its tributaries" (Basin Plan p. 2-8; Tributary Rule). Removal of a designated beneficial use requires the Water Board to conduct a use attainability analysis[3] and amend the Basin Plan (e.g., removing the Water Contact Recreation beneficial use at Hayward Marsh; see Section 2.2.4.1).

SECTION 3: CASE STUDIES

Case studies were completed on wetlands currently utilizing treated wastewater as identified in Table 1. Figure 2.1 in Appendix D shows the locations of all the case study wetlands and Figures 2.2 through 2.8 provide a map of each case study location.

3.1 MOORHEN MARSH

Moorhen Marsh is part of the larger McNabney Marsh wetland complex which is a restored, muted tidal wetland located east of I-680 in Martinez. The 138-acre wetland is jointly owned by Mt. View Sanitary District (MVSD) and the East Bay Regional Park District (EBRPD), with an agreement that gives MVSD full responsibility for its management. McNabney Marsh was historically a brackish tidal marsh, which was subjected to a number of land use changes following diking in the late 1800s. A major railroad was constructed separating McNabney Marsh from the Bay in the 1880s. Hydrology of the site was further altered by construction of roads, dikes, and mosquito abatement ditches. As a result, the site was converted to upland rangelands for close to 100 years. In 1984, in response to new laws regarding discharge from wastewater treatment plants, MVSD purchased 21 acres of land and in lieu of disposing of treated wastewater into the Bay via a deep water outfall established Moorhen Marsh. MVSD was the first wastewater agency on the West Coast to construct and reclaim a wetland using wastewater effluent as the primary water source.

Managing Moorhen Marsh and maintaining the desired ecosystem functions has been a challenge. Over the past decades, the marsh has significantly sunk, and MVSD estimates that as much as three feet of elevation to the marsh plain has been lost. While improvements to the tide gates at Peyton Slough in 2009 have allowed some brackish marsh features to return, an existing box culvert under the Union Pacific Railroad tracks appears to be too small and shallow to allow full tidal flow into McNabney Marsh. This constriction in flow and poor tidal hydrodynamics have

[3] A use attainability analysis is defined in Title 40 Code of Federal Regulations, Part 131.3(g) as a structured scientific analysis of the physical, chemical, biological, and economic factors affecting the attainment of the use.

increased water stagnation, algal blooms, nuisance odors, and decreased ground nesting habitat for waterfowl and shorebirds. Further complicating marsh management are competing demands for recycled water and potential hydrologic changes to the marsh if recycled water is diverted from environmental enhancement use to industrial use.

3.1.1 Facility Description

The MVSD Wastewater Treatment Plant (Plant)[4] provides advanced secondary treatment of domestic, commercial, and some industrial wastewater from unincorporated areas of Martinez and portions of the City of Martinez. The Plant's permitted flow is as follows:

- Facility permitted flow: 3.2 million gallons per day (MGD) average dry weather design capacity
- Facility design flow: 3.2 MGD - average dry weather design capacity; 10.9 MGD - peak wet weather design capacity

Following disinfection, effluent flows to Moorhen Marsh, a 21-acre created wetland where the effluent receives final polishing to remove ammonia and other pollutants before being discharged to Peyton Slough. Peyton Slough flows through an estuarine tidal marsh (McNabney Marsh) and ultimately to Carquinez Strait through a tide gate downstream of McNabney Marsh. The average discharge flow rate to Peyton Slough from July 2014 through June 2015 was 1.27 MGD.

3.1.1.1 Governance Structure

The MVSD and EBRPD co-own McNabney Marsh, the 137 acres upstream of the tide gate, and are the primary agencies responsible for managing it. The MVSD owns approximately 68 acres of the Peyton Slough marsh complex (Peyton Slough and McNabney Marsh), and, through a conservation easement agreement, manages another 69 acres of wetlands owned by EBRPD. The MVSD helps manage McNabney Marsh with advice from the Peyton Slough Wetland Advisory Committee and other entities. The committee is co-chaired by MVSD and the California Department of Fish and Wildlife and is comprised of adjacent land owners, interested regulatory agencies, and other stakeholder organizations and individuals.

3.1.1.2 Wastewater Treatment

The treatment system consists of screening, primary clarification, trickling filtration, ammonia removal nitrification bio-tower, secondary sedimentation, advanced secondary sand filtration, and ultraviolet (UV) disinfection. During periods of elevated wet weather influent flows, flows that exceed the bio-tower capacity are routed around the bio-tower nitrification treatment step.

[44] Applicable permit: Mt. View Sanitary District Wastewater Treatment Plant and its Collection System, Order No. R2-2016-0023, NPDES NO. CA0037770 (Moorhen Marsh NPDES Permit).

3.1.1.3 Recycled Water Program

The MVSD is considering diverting a portion of their discharge from Moorhen Marsh to utilize as recycled water for local industry. The 2013 Marsh Management Plan (MVSD 2013) describes the findings of a preliminary water balance:

> A preliminary water balance assessment was performed to determine the current flow conditions of the Marsh and identify the volume of effluent that could be diverted for reclaimed water without detriment to the Marsh. The water balance results show that current residence time in the ponds under the 1.25 MGD average Plant discharge rate is roughly 11.5 days in the summer and 7.5 days in the winter months, well within the desirable 14 to 21 day turnover rate recommended for maintaining water quality. Under current Marsh conditions a 1.0 MGD diversion would increase pond residence time to almost 30 days during the summer months and would not be a viable option. However, if the proposed levee and pond improvements are implemented, including wetland bench features and wildlife islands, the overall Marsh capacity would be reduced, possibly allowing for a diversion of treated effluent up to 700,000 gallons per day for reclaimed water use (p. 2).

The MVSD is conducting a feasibility study to determine if effluent treated within Moorhen Marsh can be utilized at the nearby Shell Martinez Refinery as cooling water. The effluent would be returned from a point within Moorhen Marsh immediately prior to the existing discharge point to Peyton Slough and retreated to water reuse standards for industrial use. If the MVSD effluent can be economically diverted for this purpose, the recycled water project may be implemented during the upcoming Moorhen Marsh NPDES Permit term (2016–2021).

3.1.2 Ecosystem Services

The Basin Plan does not specifically identify beneficial uses for Peyton Slough or McNabney Marsh, but does identify beneficial uses for Carquinez Strait, to which Peyton Slough is tributary. The beneficial uses identified in the Basin Plan for Carquinez Strait, and applied to Moorhen Mash through the Tributary Rule, are as follows:

- Industrial Service Supply
- Ocean, Commercial, and Sport Fishing
- Fish Spawning
- Estuarine Habitat
- Wildlife Habitat
- Water Contact Recreation
- Non-Contact Water Recreation

- Navigation
- Fish Migration
- Preservation of Rare and Endangered Species

The 21-acre constructed Moorhen Marsh consists of interconnected open water ponds and emergent wetlands that support a broad range of plants, animals, fish, and invertebrates. The diversity of its habitats attracts over 123 species of resident and migratory birds. In particular, the marsh has attracted a large number of river otter, American beaver, and green heron.

Clean Water Act Section 303(d) requires states to identify waterbodies that are not attaining water quality standards and not supporting beneficial uses and to establish Total Maximum Daily Loads (TMDLs) for pollutants causing impairment. McNabney Marsh is not on the 303(d) list, although the marsh does experience water quality concerns due to constrictions in tidal flow. In addition, there is a paucity of information about the fate of nutrients discharged to McNabney marsh.

3.1.3 Wetland Pollutant Removal

Although the Moorhen Marsh NPDES permit does not require additional treatment through Moorhen Marsh, it is believed the marsh provides additional polishing effects improving the water quality of the discharge as it moves through the series of ponds (MVSD 2013).

The MVSD wastewater treatment system includes a bio-filter and bio-tower polishing units to remove ammonia. The bio-filter and bio-tower have to be maintained roughly every two years, during which their operation must normally be stopped for one to two days. The Moorhen Marsh NPDES permit conditionally allowed for bypass during maintenance activities after the MVSD collected receiving water data, including a biological assessment, demonstrating that no lasting adverse impacts occurred from the bypass.

The bio-tower bypass study (Nute 2011) results demonstrated that measurements of ammonia, pH, temperature, dissolved oxygen and salinity in the receiving waters during the 12-hour bypass exhibited no levels of concern for any water quality parameter. During the study, the open water marsh functioned much like an "aerated lagoon" treatment pond, reducing ammonia levels to background levels through natural nitrification and bacterial assimilation processes as well as dilution. The Moorhen Marsh NPDES permit does not consider diverting wastewater around the bio-tower during essential maintenance or process control activities to be a bypass as long as the discharge complies with the effluent and receiving water limits in the NPDES permit. The Moorhen Marsh NPDES permit assumes that when the bio-tower is not operating, the treatment marshes still provide biological treatment. The point of compliance for wastewater effluent is at a point prior to the point of discharge to Moorhen Marsh. However, for ammonia the point of compliance when the bio-filter and

bio-tower is down for maintenance is at a point where treated water is discharged from Moorhen Marsh to Peyton Slough.

3.1.4 NPDES Permitting Considerations

3.1.4.1 Reasonable Potential Analysis

The development of NPDES permits includes an analysis to determine if the effluent poses a reasonable potential to violate water quality standards (reasonable potential analysis) and, if so, water quality based effluent limitations are developed. Reasonable potential was not determined for all pollutants because water quality criteria do not exist for all pollutants and monitoring data are not available for others. The reasonable potential analysis conducted for the current NPDES permit determined that cyanide, copper, benzo(a)anthracene, dioxin-TEQ, and total ammonia demonstrate reasonable potential. Cyanide and copper effluent limits are required by the Basin Plan for all wastewater discharges to ensure water quality protection as part of implementation of Bay site-specific objectives.

3.1.4.2 Compliance with Discharge Prohibition to Shallow Waters

As outlined in Section 2, Discharge Prohibition 1 prohibits discharges not receiving a minimum 10:1 initial dilution or to dead end sloughs, but the Basin Plan allows for exceptions in certain circumstances including if net environmental benefits will be derived as a result of the discharge. The current Moorhen Marsh NPDES Permit grants an exception to Discharge Prohibition 1 citing an inordinate burden, equivalent level of protection, and a net environmental benefit to Moorhen Marsh.

This discharge was originally permitted and granted an exception to the discharge prohibition based on a demonstration that a net environmental benefit was derived from a discharge of up to 3.2 million gallons per day to 89 acres of managed marsh ponds and wetland. The net environmental benefit was for both Moorhen Marsh and waterfront wetlands, which is now referred to as McNabney Marsh.

Avoiding discharge to shallow waters is an inordinate burden because the MVSD would have to build an outfall pipe about two miles in length to reach deep water in Carquinez Strait. The outfall pipe would have to cross public and private properties and would have to go through sensitive wetland habitat. The costs and permitting issues related to such a project would be prohibitive. The Plant provides an equivalent level of protection because the discharge meets the BOD and TSS effluent limits in the Moorhen Marsh NPDES Permit which reflect advanced secondary treatment. This provides a level of protection equivalent to building a deepwater outfall. In addition, the discharge provides a net environmental benefit by providing high quality freshwater to the constructed wetland habitat at Moorhen Marsh that would otherwise not exist. The MVSD operates Moorhen Marsh to provide polishing treatment of plant effluent and wildlife habitat. The marsh provides a diverse freshwater habitat and refuge for an array of migratory and resident wildlife and provides opportunities for bird watching, photography, and other wildlife-related activities.

3.1.4.3 Marsh Management Plan

Resolution No. 94-086 requires the development of a marsh management plan acceptable to the Executive Officer which provides detailed information on how compliance with the *Policy on the Use of Wastewater to Create, Restore, and/or Enhance Wetlands* will be achieved. In 2013, the MVSD developed a Moorhen Marsh Management Plan (Moorhen Marsh Plan; MVSD 2013) which designated five key objectives: understand starting conditions; identify structural and operational improvement needs; develop and implement pond and levee repair and maintenance programs; improve aesthetics and enhance visitor experience; and address noxious weed abatement and habitat improvements. The Moorhen Marsh Plan included implementation of a monitoring program which assessed salinity, dissolved oxygen, temperature, and pH in the marsh, taking into account seasonal fluctuations and tide gate operations.

The 2016 Moorhen Marsh NPDES Permit requires the MVSD to review, and if necessary, update the Moorhen Marsh Plan annually and summarize changes in its annual report. Each of these updates describes any necessary revisions, management activities completed during the previous calendar year (e.g., levee upgrades or vegetation removal), and activities planned for the next year. The updates incorporate plans for monitoring and managing pollutants of concern (e.g., ammonia and nutrients) for Moorhen Marsh, including monitoring locations, monitoring results from the past year, and monitoring plans for the next year. This requirement is necessary to ensure that Moorhen Marsh is operated in a way that prevents nuisance conditions. A McNabney Marsh Plan is currently being developed to address management objectives, roles and responsibilities of all parties, operation of the tide gate, and an implementation strategy, including addressing sea level rise. Once completed, the plan will provide a critical resource for management of the marsh by MVSD and EBRPD.

3.1.5 Marsh Maintenance and Operations

While the surrounding watershed has provided reasonably good seasonally flooded habitat for shorebirds and waterfowl, long-term changes in water depth, period and frequency of inundation, soil salinity, and oxidation-reduction potential, brought about by lack of adequate water control facilities, have caused many areas of the Moorhen Marsh to become barren of vascular plants, or invaded by exotic, weedy, or less desirable plant species. The Marsh Management Plan (MVSD 2013) describes the current condition of Moorhen Marsh:

> The Marsh has been successfully collecting and conveying treated effluent without major incident, and the marsh/pond habitat has been largely self-sustaining, since its creation in 1974. Although there have been few serious issues with infrastructure, the levee and pond conditions within the Marsh are less than ideal because of aging infrastructure, levee erosion, and pond sediment and biomass accumulation since the Marsh's phased construction in 1974 and 1977 (p. 1).

Maintenance to preserve open water areas in the ponds includes dredging to remove wetland plants and restrict the growth of submergent vegetation, and levee repairs to reduce current erosion rates and help alleviate the overall rate of material deposition and accumulation. In October 2015, Water Board staff received several complaints of sporadic but severe odors at McNabney Marsh. MVSD and the Water Board explored the causes of the odor. The likely source was the decomposition of algae, which may have been exasperated by the recent drought conditions and its local effects on circulation, temperature, and redox conditions. Water Board staff recommended that the best solution to address marsh odors is to increase circulation in McNabney Marsh by increasing tidal flows, which should reduce algae decomposition and improve flushing of the marsh. The expansion of the Union Pacific Railroad Bridge over Peyton Slough has been proposed to improve circulation and reduce stagnant water and a revised McNabney Marsh Management Plan is currently in development. Management of the site continues to be controversial and the Water Board is actively involved working with multiple entities on a long-term vision for the marsh.

3.2 HAYWARD MARSH

Hayward Marsh is a 145-acre improved marsh system, including three freshwater marsh basins (85 acres) and two brackish water basins (60 acres). Secondary-treated wastewater from Union Sanitary District's (USD) Alvarado Wastewater Treatment Plant (Plant) flows to the East Bay Dischargers Authority (EBDA) pipeline, where a portion (about 10-15%) of the wastewater is diverted to Hayward Marsh for reclamation.

Originally part of natural tidelands, Hayward Marsh was destroyed in the 19th century when a dike was created to impede tidal action and allow the area to be used for salt evaporation ponds. Commercial salt production ceased during the 1940s, and the area remained in an unused, degraded condition. During the 1970s, the Hayward Area Shoreline Planning Agency was formed to restore the shoreline area. The restoration work was divided into two phases and completed in the early 1980s. The second phase—Hayward Marsh—involved construction of 145 acres of fresh and brackish marshes. Funded by the U.S. Fish & Wildlife Service, the City of Hayward, and a grant from the California Coastal Conservancy (Coastal Conservancy), Hayward Marsh was specifically designed to use secondary-treated wastewater. In 1983, EBDA entered into an agreement with EBRPD for operation and maintenance of the marsh. A key component of this agreement was that EBDA would supply up to 20 MGD of secondary-treated wastewater as the freshwater source for the Marsh. In 1983, EBRPD and EBDA obtained the first NPDES permit for Hayward Marsh (Order No. 83-5). USD and EBDA began supplying effluent to Hayward Marsh in 1988 (Water Board 2011c).

Hayward Marsh has been plagued by levee failures and sedimentation and is especially vulnerable to sea level rise. A 2010 study for the Hayward Shoreline Planning Agency found that since:

> The bayland slopes behind the existing levees are so flat (1:1000) and tidal marsh accretion rates may not be sufficient to keep up with rising sea levels means that the rate of landward migration of the shoreline will be very rapid. For the high-end 2050 projection of 16 inch sea level rise, the shoreline may migrate landward up to 500 yards; in the following 50 years the shoreline may migrate up to a further 1,000 yards to make a total of about 1,500 yards by the end of the century (PWA 2010, p. 36).

In 2012 EBRPD began scoping studies for a restoration project. The full restoration alternative cost $26 million and the EBRPD is actively working with the U.S. Fish and Wildlife Service and U.S. Army Corps of Engineers on a long-term maintenance plan for the Hayward shoreline. EBRPD is seriously considering ceasing discharge at the site and converting the area into marshes with a reduced tidal prism.

3.2.1 Facility Description

The USD owns and operates the Plant in Union City[5] which provides secondary treatment of domestic, industrial, and commercial wastewaters. Most of its treated effluent is transported to an EBDA deepwater outfall where it mixes with treated effluent from other EBDA agencies. The Plant's permitted flow is as follows:

- Facility average daily flow: 2.6 million MGD
- Facility design flow: 20 MGD

Approximately 2.6 million gallons per day of wastewater effluent is used as a freshwater source and discharged to Hayward Marsh, providing all of the marsh's freshwater input. Hayward Marsh has a hydraulic capacity of about 20 MGD. The treated effluent enters the marsh at Basin 1 and is retained before being split and directed into Basins 2A and 2B. From freshwater Basins 2A and 2B, treated effluent enters the mixing channel, where it mixes with saline inflow from San Francisco Bay and becomes brackish. The brackish mixture enters Basins 3A and 3B, providing habitat to numerous species. Finally, flow from Basins 3A and 3B enters the Northwest Channel and then discharges into Lower San Francisco Bay through an earthen channel. The three freshwater marsh basins (Treatment Basins 1, 2A, and 2B) are part of the treatment process, and thus part of the treatment facility and not considered waters of the United States. The two brackish water basins (Basins 3A and 3B) and San Francisco Bay are the receiving waters and waters of the United States.

3.2.1.1 Governance Structure

EBRPD owns and operates Hayward Marsh and USD, in conjunction with EBDA, provides the treated wastewater to the marsh.

[5] Applicable permit: East Bay Regional Park District, Union Sanitary District, and East Bay Dischargers Authority, Hayward Shoreline Marsh, Order No. R2-2011-0058, NPDES No. CA0038636 (Hayward Marsh NPDES permit).

3.2.1.2 Wastewater Treatment

The treatment system consists of screening, primary sedimentation, activated sludge, secondary clarification, and chlorination/disinfection of final effluent.

3.2.1.3 Recycled Water Program

The Hayward Marsh Dischargers (USD, EBDA, and EBRPD collectively) maintain and implement a significant reclamation project. The effluent from the Plant provides a valuable freshwater source for Hayward Marsh. A portion of the marsh is used for wastewater treatment and the entire marsh system provides important wildlife habitat for migrating waterfowl and shorebirds.

3.2.2 Ecosystem Services

The beneficial uses identified in the Basin Plan for Hayward Marsh are as follows:

- Non-Contact Water Recreation
- Wildlife Habitat
- Estuarine Habitat
- Fish Spawning
- Preservation of Rare and Endangered Species

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. The marsh supports a great density of wintering waterfowl and is an important migratory stopover for shorebirds each spring and fall. It is also a refuge for nesting shorebirds and waterfowl, including the Forster's tern, Caspian tern, black skimmer, the federally-threatened western snowy plover, and the California least tern, a federal and State endangered species. Additionally, the area around Hayward Marsh provides important research opportunities related to the use of recycled water in wetland restoration and management. Notable environmental benefits associated with the marsh include:

1. The unique complex of islands within Hayward Marsh protects ground-nesting birds from predation by mainland-based predators, with annual average of 500 nesting pairs of birds in the marsh.
2. The presence of waterfowl year-round provides foraging opportunities for many raptors including peregrine falcons, a state endangered species, and Cooper's hawks and northern harriers, which are species of special concern.
3. The Hayward Marsh discharge creates a salinity transition zone that provides suitable, attractive habitat for the rearing of juvenile bay fish. A 1991 California State University-Hayward study demonstrated a 400% increase in 12 species of juvenile bay fish in the transition habitat compared to more saline areas of the Bay nearby.

See Section 2.2.4.3 below for additional discussion on ecosystem services of the marsh. Hayward Marsh is not on the 303(d) list of impaired waters.

3.2.3 Wetland Pollutant Removal

See Section 2.2.4.1 for information on bacteria removal in treatment basins.

3.2.4 NPDES Permitting Considerations

3.2.4.1 Bacteria Water Quality Objectives and Water Contact Recreation Beneficial Use Designation

Water Board Resolution No. 2011-0057 clarified the beneficial uses of Hayward Marsh by removing the Water Contact Recreation beneficial use designation from Hayward Marsh and adding the Preservation of Rare and Endangered Species beneficial use. The Staff Report for the Resolution states:

> Beneficial uses currently designated in the Basin Plan for wetlands in the Hayward area include REC-1 [Water Contact Recreation beneficial use]. However, REC-1 should not apply in Hayward Marsh because the Marsh was created for the purpose of reusing treated wastewater as a source of freshwater to create wildlife habitat and the Marsh is managed to prevent human disturbance of habitat (Water Board 2011a, p. 5).

Two factors provided a basis for removing the Water Contact Recreation beneficial use from Hayward Marsh pursuant to 40 CFR 131.10(g)(1) and (3):

- Naturally occurring pollutant concentrations prevented attainment of the Water Contact Recreation beneficial use. The waterfowl and other wildlife at Hayward Marsh contribute substantially to bacteria in the marsh.
- Hayward Marsh was created and is sustained using reclaimed wastewater. Therefore, human-caused conditions or sources of pollution prevent attainment of the Water Contact Recreation beneficial use, and these conditions could not be remedied or would have caused more environmental damage to correct than to leave in place.

During adoption of the Resolution the Water Board addressed other concerns about two portions of the marsh closest to the Bay, Basins 3A and 3B and whether the Water Board needed to document how the bacteriological criteria in Basin Plan Tables 3-1 and 3-2 are met within these basins. The Water Board determined that this analysis was not necessary because: (a) the Hayward Marsh Dischargers have effectively limited public access to Hayward Marsh; and (b) the Basin Plan allows for the beneficial uses of wetlands to be determined site-specifically, as needed. There is a fence surrounding nearly all of Hayward Marsh, which includes signs that alert the public to the use of recycled wastewater. In other areas, the public would need to traverse channels and moats to reach areas that receive recycled wastewater.

For treated effluent entering the Marsh, the Hayward Marsh NPDES Permit contains the following water quality-based effluent limits:

- Fecal Coliform Bacteria: The effluent shall not exceed a five day log mean fecal coliform density of 500 most probable number (MPN) per 100 milliliters (mL) and a 90th percentile value of 1,100 MPN/100mL.

These effluent limitations are more stringent then the fecal coliform objectives for REC-2 contained in Table 3-1 of the Basin Plan (mean fecal coliform < 2,000 MPN/100mL and 90$_{th}$ percentile < 4,000 MPN/100mL), but less stringent than REC-1 objectives. A receiving water monitoring study the Hayward Marsh Dischargers conducted in 1994 and 1995 (*Justification for Fecal Coliform Effluent Limitation)* concluded that these fecal coliform limits would protect Hayward Marsh beneficial uses. A more recent bacteriological monitoring study, required under the Hayward Marsh NPDES Permit, reported bacteria levels in San Francisco Bay near the Hayward Marsh discharge in compliance with Basin Plan objectives.

According to *Wastewater Engineering, Treatment and Reuse* by (Metcalf and Eddy 2002 as cited in Water Board 2011b), natural systems are capable of removing almost all major and minor constituents in wastewater, including microorganisms. Specifically, Metcalf and Eddy state, “natural treatment systems are capable of reducing microorganism concentrations by several orders of magnitude but, in general, do not provide sufficient removal to eliminate the need for disinfection where bacterial limits are placed on the system effluent.” With respect to Hayward Marsh, disinfection to a level of 500 MPN/100 mL coupled with several orders of reduction in the constructed wetland has reduced human sources of fecal coliform to levels below the most stringent Basin Plan objective.

3.2.4.2 Reasonable Potential Analysis

Reasonable potential was not determined for all pollutants because water quality criteria do not exist for all pollutants and monitoring data were unavailable for others. The reasonable potential analysis determined that copper, nickel, cyanide, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and ammonia demonstrate reasonable potential.

3.2.4.3 Compliance with Discharge Prohibition to Shallow Waters

The Hayward Marsh NPDES Permit grants an exception to Discharge Prohibition 1 citing the net environmental benefits derived from marsh as required in the Basin Plan and resolved in Resolution No. 94-086. The Hayward Marsh NPDES Permit cites 7 factors used in this determination:

1. Regular monitoring indicates that avian species diversity has increased steadily in the marsh since bird censuses commenced in 1990. The marsh supports a great density of wintering waterfowl, numbering as high as 40,000 ducks each season, and is an important migratory stopover for shorebirds each spring and fall. At least 200 species of birds have used the marsh. There has also been a

trend toward relatively greater numbers of water bird species over land birds, which may be attributable to improved wetland habitat management. The avian diversity and density attracts researchers, recreational bird watchers, and organized environmental groups who visit the marsh regularly.

2. The marsh is a refuge for nesting shorebirds and waterfowl, and provides important nesting habitat for over 25 species of birds. This represents a substantial regional nesting population for waterfowl and shorebirds and at one time also represented one of the largest colonies of nesting snowy egrets and black-crowned night herons in Lower San Francisco Bay.
3. Several bird species of special interest, including the Forster's tern, Caspian tern, black skimmers and the federally-threatened western snowy plover, nest within the marsh.
4. The California least tern, a federal and state endangered species, has nested successfully on an island within the marsh complex since 1990. To support the California least tern, tern habitat was enhanced within the marsh with over 15,000 square feet of new nesting habitat being created. The habitat area was created with the assistance of more than 3,200 volunteers who donated over 13,500 hours of volunteer service. During the 2010 nesting season, there were 53 nests, which produced 91 chicks and approximately 75 fledglings.
5. The Hayward Marsh discharge creates a salinity transition zone that provides suitable and attractive habitat for rearing of juvenile bay fish. An October 2005 aquatic survey indicated that top smelt and rainwater killifish were present in abundance. Estuaries such as Hayward Marsh are often used for spawning and as a nursery area for the young of the year for both species. The top smelt sampled are primarily young of the year fish that were likely to have been spawned in this location. The fish within the marsh are important because the black skimmer, Caspian, Forster's and California least terns forage on small fish that inhabit the waters within the marsh complex.
6. Hayward Marsh provides many onsite educational and interpretive opportunities for local schools and residents. The Hayward Area Recreation and Parks District operates the Hayward Shoreline Interpretive Center, which specializes in educational programs on wetlands, shoreline habitats and the ecology of San Francisco Bay and offers interpretive programs year-round.
7. Hayward Marsh has considerable value as a wetland restoration demonstration site for local, national and international scientists, academics, consultants, engineers, planners, politicians, delegates and other professionals. Visitors from as far as South Korea, Russia, Japan, China, Vietnam and Taiwan have come to tour the Hayward Marsh system and learn about the concept, design, and operation and maintenance.

3.2.4.4 Marsh Management Plan

In compliance with Resolution No. 94-086, the Hayward Marsh NPDES Permit requires implementation of a Marsh Management Plan to ensure effective management of water

flow, water quality, and vegetation; preservation of salt marsh harvest mouse habitat; and implementation of vector control strategies. The Hayward Marsh Dischargers are required to periodically review and update the Marsh Management Plan, as appropriate, to ensure compliance with the receiving water limitations in the Hayward Marsh NPDES Permit. This review includes exploring how the Hayward Marsh Dischargers will minimize the effects of un-ionized ammonia in Basins 3A and 3B, and ensure that dissolved oxygen levels are not adversely affecting aquatic life. This information is necessary because un-ionized ammonia has the potential to adversely affect aquatic life, and dissolved oxygen may exhibit significant diurnal swings. While the Hayward Marsh Dischargers only collect grab samples for dissolved oxygen, some of these samples exhibit supersaturation, which could be caused by excessive algal growth, which could lead to a quick decline in dissolved oxygen levels in the early morning hours. Avoiding low-oxygen conditions is important to protect aquatic life beneficial uses. At a minimum, the review includes:

- Feasibility of modifying the existing mixing channel to provide more tidal influence, if necessary, to meet water quality standards;
- Analysis of use of vegetation to reduce algal growth; and,
- Evaluation of the need for continuously monitoring portions of Hayward Marsh for dissolved oxygen, pH, temperature, and salinity to better understand diurnal patterns and the effect they may have on aquatic life.

The fraction of total ammonia which is present as unionized ammonia is a function of the pH and temperature of the water at the respective location. In an effort to minimize unionized ammonia levels in Basins 3A and 3B, EBRPD is looking to increase tidal influence in Basins 3A and 3B by dredging. The 2007 Hayward Marsh Management Plan included a discussion regarding the feasibility of removing the most limiting nutrient (nitrogen or phosphorus) to control algae through vegetation management. The *Hayward Marsh Ammonia Reduction Project* report (Reed et al. 1997 as cited in RMC 2012) concluded that it would probably be necessary to cover at least two thirds of Basin 1 and a significant part of the open water in Basins 2A and 2B with plants to achieve control of ammonia in the marsh using vegetation.

In an attempt to implement some of the recommended strategies from the 1997 study, vegetation was planted in Basins 2A and 2B, and wooden stakes were installed to encourage vegetation growth. However, because the soil conditions in the bottom of the marsh do not support marsh plant propagation, the plants did not survive. Similarly, EBRPD staff has not been able to successfully plant vegetation in Basins 3A and 3B because they have yet to find a perennial pond plant that can grow and survive with the brackish salinity levels, low water level fluctuations, and soil conditions in the basins.

Also, using vegetation to reduce algal growth would have significant ecological and habitat impacts. For example, EBRPD staff has observed that floating vegetation clogs pipes, which can severely limit flows through the marsh (RMC 2012). In addition, planting in the shallow areas would eliminate mud flat browsing sites for the birds and animals in the marsh. Hayward Marsh provides significant habitat for nesting birds. Monthly bird surveys show that a minimum of 2,000 birds inhabit the marsh at any one

time, while up to about 15,000 birds can be supported at the marsh during migratory peaks. Floating plant cover on most of Basin 1 and parts of Basins 2A and 2B would significantly reduce the deeper open water areas available to these birds.

The use of vegetation may also affect marsh outbreaks of avian botulism. EBRPD staff suspects that the increasing presence of water pennywort, a floating plant in the *Hydrocotyle* genus, is influencing the magnitude of these outbreaks. Avian botulism is a paralytic, often fatal disease of birds that results when they ingest a toxin produced by the bacterium *Clostridium botulinum*. The toxin can feed off rotting vegetation, such as the decaying detritus of the water pennywort, as a potential source of energy for production. To prevent toxin growth, EBRPD staff performed *Hydrocotyle* removal in October 2012 in Basin 1. EBRPD also works to rehabilitate injured birds, increase influent flows to the marsh to flush out botulism toxins, and remove botulism-infected bird remains that can contribute to outbreak acceleration. Thus, a considerable increase in vegetation is not a favorable plan for the marsh bird habitats (RMC 2012).

EBRPD personnel monitor the number and species of waterfowl using the marsh. Monthly nesting surveys identify the numbers and species of birds nesting and thus indicate how the islands should be managed. The islands in brackish Basins 3A and 3B are managed for shorebirds such as plovers, terns, avocets, black neck stilts, and black skimmers. Shorebirds prefer nesting sites with little or no vegetation, so EBRPD personnel keep the vegetation on these islands low. Islands in freshwater Basins 2A and 2B are managed for waterfowl, which require a different height and type of vegetation. These islands are generally mowed before nesting season, for example, then vegetation is allowed to grow tall.

The large bird populations, and particularly the nesting sites, attract predators, including birds of prey and raccoons. EBRPD personnel trap and remove raccoons from the vegetation bands and the freshwater islands, which the raccoons access from the surrounding levees. The brackish water islands in Basins 3A and 3B are isolated from mainland mammal predators, but are subject to birds of prey, such as hawks, ravens, crows, and gulls. Because special-status species, including western snowy plover and California least tern, nest on the brackish water islands, predatory birds are controlled as necessary by the U.S. Department of Agriculture's Wildlife Service under permit from the U.S. Fish and Wildlife Service.

3.2.5 Marsh Maintenance and Operations

Significant silt deposits had been observed in Hayward Marsh and have been impeding flows into Basin 3B. As of 2016, water had stopped flowing to Pond 3B through the mixing channel (south side of marsh). However, EBRPD continued maintaining a water depth in Pond 3B by manually filling it from the northwest channel (north side of marsh). By the spring of 2013, sedimentation was continuing to build-up in Pond 3B, creating a situation whereby mammals could walk through it. In order to prevent the Forster's terns from nesting in Pond 3B and having predators consume their eggs, EBRPD stopped activating the gates in the northwest channel and Pond 3B dried up.

In 2012, EBRPD began scoping studies for a dredging project including characterizing the physical and chemical properties of the material to be dredged, securing funding and permits for the project, identifying appropriate disposal options, completing any necessary design work, and enlisting one or more contractors. By June 2013 EBRPD realized that with the significant additional changes in Hayward Marsh conditions over the past year, the scope of a restoration project for Hayward Marsh would be beyond its capability. EBRPD in collaboration with USD conducted a feasibility study to identify the estimated cost, scope, and other considerations for these options. The identified options included:

A. Full Restoration of Hayward Marsh: this option must be examined but is expected to be cost-prohibitive due to additional elements needed, such as more dredging than originally anticipated, levee restoration, island restoration or expansion, and increases in levee elevation.

B. Partial Restoration of Hayward Marsh: this option provides for dredging the mixing channel and deep channels inside Basin 3B in order to reestablish flow to Basin 3B and improve bay water inflow to Basins 3A and 3B.

C. Restore Basin 3A or 3B: under this option fresh water would continue to be discharged through Basins 1, 2A, and 2B, and either Basin 3A or 3B would be restored. The other pond could receive the dredging spoils and be converted to a seasonal wetland.

D. Restore Basin 3A (or 3B) Only: under this option Basin 3A (or 3B) would be dredged and Basin 3B (or 3A) would be used for the dredging spoils, the basin being restored would be connected directly to San Francisco Bay and would become salt water habitat. Basins 2A and 2B would be closed. Basin 1 would be used for USD final effluent wet weather storage prior to conveyance to the EBDA pipeline.

E. Restore Both Basins 3A and 3B Only: this option would include full tidal exchange between both Basins 3A and 3B and San Francisco Bay. Basins 2A and 2B would be closed, and Pond 1 would be retained for USD final effluent wet weather storage prior to conveyance to the EBDA pipeline.

F. Cease Operation of Hayward Marsh: USD would seek other options for wet weather storage prior to conveyance to the EBDA pipeline, such as using ponds at the Hayward wastewater treatment plant for wet weather equalization or building influent or effluent flow equalization capacity at the Plant or pump stations.

Restoration of the Hayward Marsh to original condition with additional operational enhancements to Basins 2A and 2B would cost $26 million (Option A). EBRPD has indicated that it will continue to fund ongoing maintenance of whatever portion of the Hayward Marsh is restored. However, Option F—ceasing operation of Hayward Marsh—is under serious consideration.

3.3 ELLIS CREEK

The City of Petaluma (Petaluma) owns and operates the Ellis Creek Water Recycling Facility (Facility) [6] which came on line in May 2009. The site includes constructed treatment wetlands and polishing wetlands; Ellis Creek flows through the site. Unlike other case studies described in this Report wastewater at the Facility is not used as a freshwater resource to wetlands, wastewater that is polished in treatment wetlands is piped to the Petaluma River and discharged into the tidally-influenced portion of the Petaluma River approximately 10 miles upstream of San Pablo Bay. The depth of the river above the top of the outfall pipe varies from 1.6 feet to 8.1 feet, depending on the tide. Petaluma recently discovered significant deterioration in the structural integrity of the outfall pipeline raising concerns that if the pipeline failed during the discharge season Petaluma would not have the ability to discharge during wet weather. Petaluma received authorization to bypass the effluent outfall location in the event of a failure from the Petaluma River to an alternate location in the tidal slough near the Facility. During the anticipated bypass the effluent quality will remain unchanged, and all treatment processes will remain in service. During a bypass event wastewater would provide a freshwater source to the 100 acres of brackish tidal wetlands which are connected to the Petaluma River at high tides.

3.3.1 Facility Description

The Facility treats about 4.5 MGD average dry weather flow of wastewater from the City of Petaluma and adjacent areas. The wastewater is primarily residential, although there are four industrial facilities (Clover Stornetta, Lace House Linen, Petaluma Creamery, and Petaluma Poultry) that contribute about 0.4 MGD to this flow. The Facility permitted flow is as follows:

- Facility average daily flow: 6.7 MGD dry weather flow
- Facility design flow: 6.7 MGD

Flows that are not recycled are directed through a series of oxidation ponds (146 acres) and constructed wetlands (16 acres) for additional biological treatment. After the constructed (treatment) wetlands, the water is chlorinated and then flows to either polishing wetlands (31 acres) or a chlorine contact chamber. Wastewater from the chlorine contact chamber and/or polishing wetlands is dechlorinated and discharged to the Petaluma River, or recycled for irrigation.

3.3.1.1 Governance Structure

Petaluma owns and operates the Facility, its collection system, and the treatment wetlands.

[6] Applicable permit: City of Petaluma Ellis Creek Water Recycling Facility and its collection system, Order No. R2-2016-0014, NPDES NO. CA0037810 (Petaluma NPDES Permit).

3.3.1.2 Wastewater Treatment

Facility influent from the collection system is treated by screening and grit removal, secondary treatment using activated sludge, and secondary clarification. After secondary clarification, some of the water is pumped to Petaluma's tertiary treatment system (flocculation, filtration, and UV disinfection), and subsequently recycled.

3.3.1.3 Recycled Water Program

Each year, Petaluma recycles about 700 million gallons of wastewater. Over the last four years, Petaluma recycled about 35% of the wastewater it treated. Recycled water is used onsite at the Facility (about 7% of the wastewater; used for fire suppression systems, toilet flushing, wash water, pump seal water, and other on-site uses) and offsite on over 1,000 acres of pasture, vineyards, golf courses, schools, and other landscaped areas (about 28% of the wastewater).

In addition to the secondarily treated water reused for irrigation, Petaluma recently installed a tertiary treatment system capable of treating 5 MGD. Petaluma anticipates needing approximately 460 million gallons of tertiary treated water annually by 2025 to offset potable water demand. Petaluma also anticipates needing another 200 million gallons to provide uninterrupted supply during drought years. While numerous potential customers have requested recycled water, Petaluma does not currently have a storage and distribution system to deliver it to them. As of 2016, the Facility is the sole user of tertiary treated water. Petaluma proposes to construct a 2.2 million gallon reservoir to store tertiary treated water and 7,600 linear feet of 20" pipeline to fill the reservoir. Once this project is completed, Petaluma will begin delivering water to 55 parks, playing fields, schools, and golf courses. However, funding for construction has not yet been acquired.

3.3.2 Ecosystem Services

The discharge occurs in the tidally-influenced section of the Petaluma River approximately 10 miles upstream of San Pablo Bay. The beneficial uses identified in the Basin Plan for Petaluma River, and applied to the Ellis Creek treatment ponds through the Tributary Rule, are as follows:

- Cold Water Habitat
- Estuarine Habitat
- Fish Migration
- Preservation of Rare and Endangered Species
- Fish Spawning
- Warm Water Habitat
- Wildlife Habitat
- Water Contact Recreation

- Non-Contact Water Recreation
- Navigation

The wastewater treatment ponds enhance effluent quality while providing environmental benefits, such as critical freshwater habitat for birds, mammals, reptiles, and amphibians including pelicans, egrets, herons, sandpipers, Red-tailed hawks, western pond turtles and marsh wrens.

3.3.3 Wetland Pollutant Removal

No data available.

3.3.4 NPDES Permitting Considerations

3.3.4.1 Reasonable Potential Analysis

Reasonable potential was not determined for all pollutants, because there are not applicable water quality objectives for all pollutants, and monitoring data are not available for others. The reasonable potential analysis determined that copper, cyanide, bis(2-ethylhexyl) phthalate, and dioxin-TEQ demonstrate reasonable potential.

3.3.4.2 Compliance with Discharge Prohibition to Shallow Waters

The Petaluma NPDES Permit grants an exception to Discharge Prohibition 1 citing an inordinate burden and equivalent level of protection, as required in the Basin Plan and resolved in Resolution No. 94-086, and explains:

- At times, avoiding discharge that will not receive a minimum initial dilution of 10:1 is an inordinate burden. There is no feasible alternative to discharge when irrigation fields are saturated during wet weather. Regional Water Board Order No. 96-011 prohibits discharge to the irrigation fields when they are saturated and prohibits runoff from offsite designated reuse areas.[7] The wastewater volume during these times can far exceed the capacity of Petaluma's recycled water distribution and storage system, which consists of 190 MG of storage within the Facility's oxidation ponds.

- An equivalent level of protection is provided because Petaluma provides improved treatment reliability by routing secondary-treated effluent through

[7] Water Board General Water Reuse Requirements Order No. 96-011 (WRR) prohibits recycled water from "escaping a designated use area(s) as surface flow that would either pond and/or enter waters of the state" (Condition A(3)) and "secondary recycled water shall not be applied so as to cause runoff or degradation of any water body or wetland" (Condition 1(5)). However, the WRR also recognizes that the use of recycled water may result in discharges to waters of the State, "the incidental discharge of recycled water to waters of the State shall not unreasonably affect present and anticipated beneficial uses of water, and not result in water quality less than that prescribed in water quality control plans or policies" (Condition A(8)). The WRR does not define "incidental discharge".

oxidations ponds, treatment wetlands, and polishing wetlands. Petaluma's pond system, used for both treatment and storage of wastewater, provides a significant volume of storage capacity that can be used for containment of peak wet weather flows or for emergency storage in the event of a Facility upset. The Petaluma NPDES Permit requires that Petaluma provide equalization of secondary-treated effluent for at least one week in its oxidation ponds or wetlands. This requirement reflects improved treatment reliability for the Facility.

As described above, the improved treatment reliability provides a level of environmental protection equivalent to compliance with Discharge Prohibition 1, while avoiding the inordinate burden that would be placed on Petaluma relative to the beneficial uses protected by complying with the prohibition.

Compliance with the prohibition would require building additional storage for the dry season or installation of a pressurized pipeline from the Facility to the deep waters of San Pablo Bay. This 100,000 foot pipeline would consist of a 60,000 foot overland segment and a 40,000 foot in-Bay segment; preliminary cost estimates for construction alone exceed $107 million. Moreover, the projected pipeline route would cross a variety of habitats where threatened or endangered species are known or suspected to reside. Additionally, construction activities and electricity production needed to drive the pumps that push the effluent through the pipeline would result in both short-term and long-term increases in greenhouse gas emissions. Additional storage would also be an inordinate burden and would consist of over 1,000 MG to store treated wastewater from October 21 through April 30 of each year. This could require that Petaluma purchase over 300 acres of new land, which may also be current habitat for threatened or endangered species.

3.3.4.3 Marsh Management Plan

Resolution No. 94-086 requires the development of a marsh management plan acceptable to the Executive Officer which provides detailed information on how compliance with the Resolution will be achieved. However, the Petaluma NPDES permit has no requirement for a management plan for the wastewater treatment wetlands.

3.3.5 Marsh Maintenance and Operations

As of the date of this Report, the treatment wetlands have been functioning as designed and no regulatory issues have arisen (V. Christian, pers. communication, October 20, 2016).

3.4 BEL MARIN KEYS

The Coastal Conservancy is working on restoration of tidal marsh at Bel Marin Keys Unit V (BMK) that is adjacent to the Hamilton Wetland Restoration Project. Novato Sanitary District (NSD) has proposed relocating its wastewater discharge 1.2 miles

inland to create and support 1,600 acres of new brackish marsh habitat at Bel Marin Keys Unit V. The Water Board's NPDES Permit[8] for NSD includes consideration of this discharge relocation and new marsh creation at BMK and relied on an antidegradation analysis and mixing zone studies to make regulatory compliance determinations. The restoration project is anticipated to involve building a new levee, breaching an existing bayfront levee at the BMK shoreline and allowing tidal waters to inundate the area. The marsh will become part of the Hamilton Wetland Restoration Project and San Pablo Bay, and the new shoreline will move landward by approximately 5,000 feet. Currently the NSD has an outfall that runs the length of the levee separating the Hamilton Wetland Restoration Project from the BMK project and discharges into shallow waters in San Pablo Bay. The Coastal Conservancy is currently moving forward with the first phase of this project to build an inland levee to allow for breaching at the Bayfront in the future, which the Water Board permitted under Waste Discharge Requirements Order no. R2-2018-0007. The project does not formally include relocation of the NSD discharge. The NPDES permit includes conditions that have to be met prior to the discharge commencing, which would be considered in Phase II of the project.

The restoration site, previously known as Marin Meadows, was used as ranch and farm land since it was part of a Mexican Land Grant. In 1932, the U.S. Army Air Corps constructed Hamilton Army Airfield. Military operations began in December 1932, first as a base for bombers, later as a base for transport and fighter aircraft and then for Army and Army Reserve operations and training. In 1988, the property was declared surplus property under the Base Realignment and Closure Act. The Coastal Conservancy (2016) provides a brief history of the BMK and the larger Hamilton Wetland Restoration Project:

> The U.S. Congress authorized the Hamilton Wetland Restoration Project (including the NAF [North Antenna Field) in 1999 and the addition of the BMK property to the project in 2007. The combined project site comprises approximately 2,600 acres, located 25 miles north of San Francisco, along San Pablo Bay, in and adjacent to the City of Novato, Marin County, California…Between 2008 and 2013, approximately 6 million cubic yards of dredged sediment, primarily from the Port of Oakland's Harbor Deepening Project, was placed on the airfield to raise the land surface to elevations suitable for creating tidal marsh. This entailed the largest beneficial reuse of dredged sediment, which would have otherwise been disposed of in the bay or ocean, which has ever occurred previously at a wetland restoration site. In April 2014, the bayfront levee was breached, connecting the former airfield property to the bay for the first time in more than 100 years and enabling the process of ecological succession to tidal marsh. The next major phase of the project is to restore tidal and seasonal wetlands at the NAF and BMK properties, an area three times larger than the restored airfield.

[8] Applicable permit: Novato Sanitary District Wastewater Treatment Plant and its collection system, Order No. R2-2015-0034, NPDES No. CA0037958 (Novato NPDES Permit).

3.4.1 Facility Description

The NSD owns the Novato Sanitary District Wastewater Treatment Plant and its collection system (collectively, the Facility).[9] The Facility permitted flow is as follows:

- Average daily dry weather design flow: 7.0 MGD
- Wet weather secondary treatment design flow: 47 MGD

The Facility discharges wastewater to San Pablo Bay through a multiport diffuser currently located approximately 950 feet offshore.

3.4.1.1 Governance Structure

The tidal marsh restoration project at BMK will be on a site owned by the Coastal Conservancy.

3.4.1.2 Wastewater Treatment

Treatment processes consist of influent pumping, influent screening, flow measurement and grit removal, primary clarification, activated sludge secondary treatment followed by secondary clarifiers, and UV disinfection. During wet weather, the plant can provide secondary treatment for a sustained 3-hour peak flow of up to 47 MGD.

3.4.1.3 Recycled Water Program

The NSD's reclamation system includes two storage ponds with a combined storage capacity of 180 million gallons, a wildlife pond, an irrigation pump station, and 820 acres of irrigated pasturelands. From June 1 through August 31 (and typically longer), the NSD diverts effluent into the two storage ponds. Effluent from these ponds is used to irrigate the pasturelands, which are used for beef cattle grazing and irrigated hay production. Alternatively, plant effluent is diverted for additional treatment to produce tertiary-treated effluent for golf course irrigation and other uses. Any surplus water in the storage ponds not used for reclamation is discharged to San Pablo Bay. As part of discharge relocation and BKM restoration project, the NSD and the Coastal Conservancy were considering construction of a new recycled water storage pond to increase distribution capacity. It is unclear at this time (August 2018) what the status is of this project or the discharge to phase II of the BMK restoration (Personal Communication with Jeff Melby State Coastal Conservancy).

3.4.2 Ecosystem Services

Since this project is a proposal at this time, there is no existing information on ecosystem services. This section describes the proposed ecosystem services – which are anticipated based on the overall planned project as well as the treated wastewater

[9] Applicable permit: Novato Sanitary District Wastewater Treatment Plant and its collection system, Order No. R2-2015-0034, NPDES No. CA0037958 (Novato NPDES Permit).

discharge. The BKM site, which is currently agricultural diked Baylands, will be restored to a matrix of seasonal and tidal brackish and salt marshes. Once these new marshes at BMK are established, they will provide ecosystem services including habitat for a broad range of fish, plants, and wildlife. The project will also provide new marsh habitat that will be home to a variety of bird and fish species, thereby improving several beneficial uses of San Pablo Bay. The treated wastewater is anticipated to be used beneficially to restore fresh and brackish marsh habitat along the newly constructed levee at the project's western edge. During the dry season, this wastewater is currently applied to spray-fields located between Highway 37 and Novato Creek. The project would change the management of the wastewater to a year-round discharge to the marsh. This change would have the added benefit of making the spray fields available for other public uses (they are owned by Marin County).

NSD and its partners are in the early stages of considering a similar discharge relocation and beneficial re-use strategy within Deer Island Basin, which would facilitate the tidal restoration of over 200 acres of diked Baylands adjacent to the NSD treatment plant. When restored, these wetlands would be expected to support similar ecological services as those at BMK.

3.4.3 Wetland Pollutant Removal

No information is available at this time.

3.4.4 NPDES Permitting Considerations

3.4.4.1 Reasonable Potential Analysis

Reasonable potential was not determined for all pollutants because water quality criteria do not exist for all pollutants and monitoring data were unavailable for others. The reasonable potential analysis determined that copper, cyanide, dioxin-TEQ and ammonia demonstrate reasonable potential.

3.4.4.2 Discharge Relocation

The Novato NPDES Permit considered the discharge relocation and new marsh creation at BMK and relied on an antidegradation analysis and mixing zone studies to make regulatory compliance determinations. The NSD submitted an antidegradation study, *Antidegradation Analysis for Novato Sanitary District Discharge to New Bel Marin Keys Marsh* (September 2014), to the Water Board to demonstrate that conditions following the discharge relocation will comply with federal and State antidegradation policies. The antidegradation study found that discharges through the new outfall will not degrade the new marsh at BMK because the marsh does not presently exist. As for greater San Pablo Bay, the annual effluent flow volume increase will represent only about 0.1% of the total volume of San Pablo Bay. Because the increase will be very small compared to the size of San Pablo Bay, the increase—and related pollutant loads—will not be observable, particularly considering the continuous tidal mixing and the flushing from upstream rivers.

The NSD also conducted mixing zone studies for ammonia and bacteria for the existing and relocated discharge locations. The NSD completed a mixing zone study to justify ammonia mixing zone for the discharge relocation to the new marsh at BMK (*Dilution Analysis of Novato Sanitary District's Proposed Discharge to Bel Marin Keys Unit V*, May 2014). The study demonstrated that a hypothetical mixing zone covering 31 acres corresponds to a dilution ratio of 5:1 and the effluent limitations will be protective of beneficial uses. The NSD conducted a mixing zone study to justify a fecal coliform mixing zone for the discharge relocation (*State Implementation Policy [SIP] Mixing Zone Analysis*, September 2014). The study concluded that: 1) the effluent will receive at least 10:1 dilution within 46 acres of the new outfall; 2) the water quality objectives protective of shellfish harvesting are met beyond these mixing zones; and 3) the 2010 *San Francisco Bay Subtidal Habitat Goals Report* found that no shellfish beds exist within these mixing zones.

3.4.4.3 Compliance with Discharge Prohibition to Shallow Waters

The NPDES Permit allows for year-round discharges to occur after the outfall is relocated and the new marsh at BMK is created by granting an exception to Discharge Prohibition 1 citing a net environmental benefit and expansion of the recycled water program as required in the Basin Plan and resolved in Resolution No. 94-086. The discharge to the new marsh at BMK is anticipated to result in net environmental benefits by creating and sustaining new brackish marsh habitat for fish, plant, and wildlife. The wetlands would also provide storm and flood protection against rising sea levels and provide recreational, scenic, and educational benefits. In conjunction with the proposed discharge relocation, the NSD may also construct a recycled water storage pond to store treated effluent during low reclaimed water demand periods (e.g., winter) for later use during high demand periods (e.g., summer); thereby, expanding their recycled water program.

3.4.4.4 Marsh Management Plan

This is a requirement that is still to be determined

3.4.5 Marsh Maintenance and Operations

Nothing to report; wetlands at BMK have not been developed yet.

3.5 SUISUN MARSH

Suisun Marsh is the largest contiguous brackish water marsh remaining on the west coast of North America. The Fairfield-Suisun Sewer District (FSSD) discharges 13–26 MGD of effluent primarily to Boynton Slough, which is part of the larger Suisun Marsh complex. In the late summer and early fall, FSSD discharges primarily to two privately owned duck clubs. A consortium of agencies developed and now implement the Suisun

Marsh Habitat Management, Preservation, and Restoration Plan (SMP; USFWS 2013b). The SMP is a 30-year comprehensive plan designed to address the various conflicts regarding use of marsh resources, with the focus on achieving an acceptable multi-stakeholder approach to the restoration of tidal wetlands and the management of managed wetlands and their functions. The SMP objectives are "to preserve and enhance the quality and diversity of the Suisun Marsh aquatic and wildlife habitats and to assure retention of upland areas adjacent to the Marsh in uses compatible with its protection." The SMP addresses habitats and ecological process, public and private land use, levee system integrity, and water quality through restoration and managed wetland activities. Implementing agencies of the SMP include U.S. Fish and Wildlife Service, U.S. Department of the Interior, Bureau of Reclamation, California Department of Fish and Wildlife, California Department of Water Resources, National Marine Fisheries Service, Suisun Resource Conservation District, and the Delta Stewardship Council.

3.5.1 Facility Description

The FSSD Wastewater Treatment Plant (Plant) provides advanced secondary treatment of domestic, commercial, and industrial wastewater from the cities of Fairfield and Suisun City and some unincorporated areas of Solano County.[10] The Plant's permitted flow is as follows:

- Facility permitted flow: 23.7 MGD average dry weather effluent flow
- Facility design flow: 23.7 MGD – average daily dry weather effluent design flow; 52.9 MGD – peak daily wet weather effluent design flow

The primary discharge point is to Boynton Slough with annual average effluent flows in 2012 and 2013 of approximately 14 MGD and 13 MGD, with daily maximum flows of approximately 26 MGD and 19 MGD.

3.5.1.1 Governance Structure

Suisun Marsh has been recognized for its value and several resource agencies have developed area-specific plans. The USFWS (2013a, p. 13) summarized these efforts:

> The values of the Marsh have been recognized as important, and several agencies have been involved in its protection since the mid-1970s. In 1974 the Nejedly-Bagley-Z' Berg Suisun Marsh Preservation Act was enacted by the California Legislature to protect the Marsh from urban development. It required California Department of Fish and Game (DFG), which changed their name to California Department of Fish and Wildlife in 2013, and BCDC to develop a plan for the Marsh and called for various restrictions on development in the Marsh boundaries. In 1976, the BCDC developed the Suisun Marsh Protection Plan (SMPP), which defined and

[10] Applicable permit: Fairfield-Suisun Sewer District, Fairfield-Suisun Wastewater Treatment Plant and Wastewater Collection System, Fairfield, Solano County, Order No. R2-2015-0013, NPDES No. CA0038024 (FSSD NPDES Permit).

limited development within the primary and secondary management areas for the "future of the wildlife values."

3.5.1.2 Wastewater Treatment

The Plant provides treatment consisting of preliminary influent screening and grit removal, primary clarification, optional fixed film roughing filters and intermediate clarification, biological activated sludge, secondary clarification, temporary activated sludge effluent storage in flow balancing reservoirs (total volume 12.7 million gallons), advanced secondary dual-media filtration, and UV disinfection. The Plant also has wet weather facilities including a 111-million-gallon equalization storage basin with optional comminution. The Plant is designed to provide containment and advanced secondary treatment of wastewater flows up to the 20-year storm event.

3.5.1.3 Recycled Water Program

The FSSD recycles approximately 5–10% of the Plant's treated effluent for agricultural and landscape irrigation. This totaled approximately 193 million gallons of recycled water in 2012. The Plant also discharges recycled water to a fill-up tank which is trucked to a landfill and used for dust control.

3.5.2 Ecosystem Services

Suisun Marsh is a critical part of the San Francisco Bay/Sacramento-San Joaquin River Delta estuary ecosystem. Table 3 shows the beneficial uses identified in the Basin Plan for waters of Suisun Slough, Suisun Marsh, and Ledgewood Creek.

Table 3: Beneficial Uses of Suisun Slough, Suisun Marsh, and Ledgewood Creek

Receiving Water Name	Beneficial Uses
Boynton Slough (Tributary to Suisun Slough)	Fish Spawning Warm Freshwater Habitat Wildlife Habitat Water Contact Recreation Non-Contact Water Recreation Navigation
Duck Ponds 1 and 2 (Both tributary to Suisun Marsh)	Estuarine Habitat Fish Migration Preservation of Rare and Endangered Species Fish Spawning Wildlife Habitat Water Contact Recreation Non-Contact Water Recreation
Ledgewood Creek	Freshwater Replenishment Cold Freshwater Habitat Fish Migration Fish Spawning Warm Freshwater Habitat Wildlife Habitat Water Contact Recreation Non-contact Water Recreation

Suisun Marsh provides habitat for a variety of special status species including Chinook salmon, longfin smelt, Delta smelt, steelhead, green sturgeon, Ridgway's rail, salt marsh harvest mouse, Suisun shrew, California least tern, soft bird's-beak, and Suisun thistle. The U.S. Fish and Wildlife Service summarized the habitat benefits of the marsh:

> The Marsh encompasses more than 10 percent of California's remaining natural wetlands and serves as the resting and feeding ground for thousands of resident waterfowl as well as birds migrating on the Pacific Flyway. In addition, the Marsh provides essential habitat for more than 221 bird species, 45 mammal species, 16 reptile and amphibian species, and more than 40 fish species. Suisun Marsh supports the state's commercial and recreational salmon fishery by providing important tidal rearing areas for juvenile salmonids (USFWS 2013a, p. 7).

The Suisun Marsh wetlands are listed on the 303(d) list as being impaired by low dissolved oxygen/organic enrichment, mercury, nutrients, and salinity and the Water Board is working on a TMDL to address many of the impairments, excepting salinity.

3.5.3 Wetland Pollutant Removal

Suisun Marsh is not part of FSSD's regulated treatment process; treated wastewater is used in the marsh to enhance plant and wildlife habitat. Minimal data exists on the pollutant removal capacity of the natural marsh ecosystem.

3.5.4 NPDES Permitting Considerations

3.5.4.1 Reasonable Potential Analysis

Reasonable potential was not determined for all pollutants because there are not applicable water quality objectives for all pollutants and monitoring data are unavailable for others. Cyanide and copper exhibited reasonable potential. Dioxin-TEQ exhibits reasonable potential because the receiving water is impaired for dioxins, and dioxins were detected in the effluent.

3.5.4.2 Compliance with Discharge Prohibitions to Shallow Waters and Suisun Marsh

As outlined in Section 2, Discharge Prohibition 1 in the Basin Plan prohibits discharges not receiving a minimum 10:1 initial dilution or to dead end sloughs. Also applicable to the FSSD NPDES Permit is Discharge Prohibition 3 which states:

> It shall be prohibited to discharge any wastewater which has particular characteristics of concern to beneficial uses to Suisun Marsh during the dry weather period of the year. Local irrigation return water is excepted in quantities and qualities consistent with good irrigation practices.

Basin Plan Table 4-1 includes a useful discussion for Discharge Prohibition 3:

> The threat of high concentrations of toxicants, biostimulants, and oxygen demanding substances in Suisun Marsh, an area of low assimilative capacity, great ecological sensitivity and value, and poor dispersion by tidal or freshwater flushing, necessitates such protection for the Marsh for the critical portion of the year when freshwater flows are nonexistent.

The FSSD NPDES Permit grants exceptions to Prohibitions 1 and 3 citing an inordinate burden, equivalent level of protection, and net environmental benefit as required in the Basin Plan and resolved in Resolution No. 94-086. The FSSD NPDES Permit explains:

1. An inordinate burden would be placed on the FSSD relative to the beneficial uses protected to require the discharge to achieve a 10:1 dilution. Constructing and operating a deep water outfall would require construction and operation of a discharge pipe several miles long.
2. The FSSD achieves a level of environmental protection equivalent to strict adherence to the discharge prohibitions by providing advanced secondary treatment, a level of BOD and TSS removal and nitrification that exceeds secondary treatment standards, and meeting the advanced level of treatment required by the FSSD NPDES Permit.

In addition, the FSSD NPDES Permit cites that FSSD added the Ledgewood Creek outfall. This outfall's capacity allows the FSSD to reliably discharge maximum wet-weather flows and improve system redundancy and seismic reliability by providing an alternate discharge point in case one is out of service. Lastly, the FSSD NPDES Permit requires a Reliability Assurance Plan and Status Report that requires the FSSD to conduct routine analyses of its collection and treatment system with attention toward preventing discharges of inadequately-treated wastewater.

The FSSD's *Technical Report on Water Quality, Fairfield-Suisun Sewer District Subregional Wastewater Treatment Plant* evaluated water quality data to determine the impacts of Plant discharges on Boynton Slough and the degree of environmental benefit provided, if any. The 2013 Technical Report Update (RMC 2013) included an analysis of the influence the discharges have on salinity, dissolved oxygen, and trace metals in the receiving water. Key findings included:

- Salinity: Plant effluent has an average salinity of 0.60 parts per thousand (ppt). Due to tidal influence and the location of one of the receiving water stations in Ledgewood Creek, the salinity in the receiving water can range from about 0.1 ppt to about 10 ppt, but is consistently greater than the effluent salinity. The study demonstrated that the effluent continues to serve as a freshwater source for the receiving waters (including Suisun Marsh which is listed as impaired for salinity) thereby helping to maintain health plant and animal populations that rely on lower salinities.
- Dissolved Oxygen: The dissolved oxygen concentration of the effluent is typically higher than the average receiving water concentration.

- Trace Metals: Trace metal concentrations (chromium, copper, nickel and zinc) are well below the water quality objectives and generally below or comparable to concentrations in receiving waters. These results demonstrate that effluent water quality is not impairing the receiving water quality.

The study demonstrated that the FSSD's effluent discharge to Suisun Marsh continues to provide a net environmental benefit to the marsh.

3.5.4.3 Marsh Management Plan

The SMP performs the same function as the marsh management plan required under Resolution No. 94-086.

3.5.5 Marsh Maintenance and Operations

The Suisun Resource Conservation District has been successfully assisting landowners with technical assistance in permitting, water control, and habitat management to ensure the wetland and wildlife values of the Suisun Marsh are sustained and enhanced. As part of efforts supporting the development of the Suisun Marsh TMDL, USEPA has awarded grant funds to the San Francisco Estuary Partnership to manage a Suisun Marsh Managed Wetlands BMP Water Quality Improvement Pilot Project. SFEP in conjunction with Tetra Tech, Inc. and the Suisun Resource Conservation District are implementing a project to: (1) identify constraints, opportunities and recommendations for managed wetlands BMPs in Suisun Marsh that could improve water quality relative to dissolved oxygen and methylmercury (MeHg); (2) build knowledge within the managed wetland landowner community; and (3) develop working relationships amongst and across stakeholders to support attaining long−term TMDL objectives. The Pilot Project will be completed in the fall of 2018.

3.6 NAPA-SONOMA MARSH

The U.S. Army Corps of Engineers, Coastal Conservancy, and the California Department of Fish and Wildlife are implementing the Napa Sonoma Marsh Restoration Project (Napa-Sonoma Marsh Project) to reduce salinity in historic salt ponds and to restore a mosaic of habitats, including tidal marshes and managed ponds. The Sonoma Valley County Sanitation District (SVCSD) discharges wastewater to Schell Slough, two managed wetlands (Wetland Management Unit 1 and 3), and the Napa-Sonoma Marsh. In September 2013, the SVCSD constructed a 3.5 mile pipeline to deliver the recycled water. Recycled water from the SVCSD Wastewater Treatment Plant (Plant) will be combined with waters from adjacent sloughs and slowly released to the wildlife areas as needed to dilute and flush saline pond water and return the ponds to salt marsh habitat. The California Department of Fish and Wildlife is constructing a mixing chamber for bittern dilution which is close to completion.

The Napa-Sonoma Marsh was first diked off from San Pablo Bay during the 1850s for hay production and cattle grazing. Much of the land was converted to ponds for salt

production in the 1950s. The final operator of the salt production facility, Cargill Salt, sold the property to the State of California in 1994. The State assigned ownership and management responsibilities to the California Department of Fish and Wildlife. The Napa-Sonoma Marsh Project will restore 9,456 acres of the marsh complex to a mixture of tidal marsh and freshwater ponds. The Project area includes 7,190 acres of shallow ponds that were used for production of salt by wind/solar evaporation between the 1950s and the early 1990s. The Napa-Sonoma Marsh Project area also includes an additional 2,266 acres of fringing marsh and slough. The Project consists of two primary components: habitat restoration and salinity reduction. Habitat restoration will consist of restoring tidal exchange and constructing starter channels and berms in some of the ponds so that tidal marsh habitat is obtained, and by upgrading the remaining ponds to function as pond habitat. Salinity reduction would be accomplished by discharging accumulated pond water, after pre-dilution by blending of rainfall and recycled water, to the lower portion of the Napa-Sonoma Marsh. The long-term goal is to produce a managed pond habitat that can adjust to naturally occurring changes in physical processes with minimum ongoing intervention.

3.6.1 Facility Description

The SVCSD Plant provides tertiary treatment (secondary treatment with additional filtration) of all wastewater, except during wet weather when influent flows exceed the hydraulic capacity of the tertiary filters.[11] The Plant's permitted flow is as follows:

- Facility permitted flow: 3.0 MGD
- Facility design flow: 3.0 MGD – average dry weather; 16 MGD – peak wet weather

The Facility discharges wastewater to Schell Slough, two managed wetlands (Wetland Management Unit 1 and 3), and Napa-Sonoma Marsh. During the wet season, when there is little demand for recycled water, typically from November through April, wastewater is discharged into Schell Slough, a tidally-influenced waterbody downstream of Schell Creek. Schell Slough is a dead end slough and is flushed with limited tidal action. During the dry season, from about August through October, recycled water is discharged from recycled water storage ponds to Wetland Management Units 1 and 3 for the purpose of maintaining freshwater marshlands and ponds. The tide gates connecting the management units to Hudeman Slough are closed during the dry season, but open during the rest of the year when adequate freshwater is available from rainfall. The SVCSD created the ponds in 1990 as mitigation to compensate for possible negative impacts from its discharge of wastewater into wetlands. The marshlands and ponds attract thousands of overwintering and migratory birds. The California Department of Fish and Wildlife

[11] Applicable permits: 1) Sonoma Valley County Sanitation District Wastewater Treatment Plant and its Wastewater Collection System, Order No. R2-2014-0020, NPDES No. CA0037800 (Sonoma Valley NPDES Permit); 2) Napa River Salt Marsh Restoration Project, Ponds 7, 7A and 8, Order No. R2-2011-0035, NPDES No. CA0030201; and 3) Waste Discharge Requirements and Water Quality Certification for the California Department of Fish and Game Napa River Salt Marsh – Lower Ponds Restoration Project (Order No. R2-2004-0063 as amended).

manages these ponds with SVCSD support. In the future, recycled water may be discharged to Fly Bay or to a constructed mixing chamber for the restoration of 9,460 acres of saline ponds in the Napa River Unit of the Napa-Sonoma Marsh Project.

3.6.1.1 Governance Structure

The U.S. Army Corps of Engineers, Coastal Conservancy, and the California Department of Fish and Wildlife are implementing the Napa-Sonoma Marsh Project. The California Department of Fish and Wildlife manages wetland Management Unit 1 and 3 with SVCSD support.

3.6.1.2 Wastewater Treatment

The Plant provides tertiary treatment (secondary treatment with additional filtration) of all wastewater, except during wet weather when influent flows exceed the hydraulic capacity of the tertiary filters (16 MGD or a maximum hydraulic loading rate of 6 gallons per minute/ft^2). Influent is treated by the following processes in succession: debris removal using bar screens; grit removal using a vortex tank; primary treatment and flow equalization using aerated equalization basins; secondary treatment using aeration basins; solids removal using secondary clarifiers; tertiary treatment using cloth media filtration; chlorination using chlorine contact chambers; and dechlorination using sulfur dioxide.

3.6.1.3 Recycled Water Program

The SVCSD maintains a recycled water program. The effluent from the Plant is used for environmental enhancement of wetland habitats (see above). In 2014, the SVCSD treatment plant effluent totaled 3,349 acre-feet, of which 2,022 acre-feet (60.4%) was reused. Vineyard irrigation accounted for approximately 49.1% and pasture irrigation approximately 25% of the total recycled water used in 2014 and 0.001% went towards trucked water for dust control and fire suppression. The remaining 25.8% was used for environmental enhancement at management units and the salt marsh.

3.6.2 Ecosystem Services

The Basin Plan identifies the beneficial uses of Schell Slough, and while it does not identify the beneficial uses of Wetland Management Unit 1 and 3, and Napa-Sonoma Marsh, it does identify beneficial uses of estuarine wetlands and San Pablo Bay, to which all these waters are tributary. The beneficial uses applicable to the Plant's receiving waters under the Tributary Rule are as follows:

- Estuarine Habitat
- Ocean Commercial and Sport Fishing
- Agricultural Supply
- Groundwater Recharge
- Industrial Supply

- Shellfish Harvesting
- Fish Migration
- Preservation of Rare and Endangered Species
- Fish Spawning
- Wildlife Habitat
- Water Contact Recreation
- Non-Contact Water Recreation
- Navigation

The Napa-Sonoma Marsh provides a mosaic of diverse habitats that will benefit a broad range of fish, wildlife, and plant species, endangered and threatened species, fish and other aquatic species, and migratory shorebirds and waterfowl including salmonids, delta smelt, clapper rail, Sacramento splittail, and long-fin smelt.

Schell Slough, Management Unit 1, Management Unit 3, Fly Bay, and Napa-Sonoma Salt Marsh discharge to San Pablo Bay through a series of other sloughs.

3.6.3 Wetland Pollutant Removal

The Napa-Sonoma Marsh is not used as a treatment wetland; wastewater effluent is used in the marsh to enhance wildlife habitat. Minimal data exists on the pollutant removal capacity of the natural marsh ecosystem.

3.6.4 NPDES Permitting Considerations

3.6.4.1 Reasonable Potential Analysis

Reasonable potential was not determined for all pollutants because there are not water quality objectives for all pollutants, and monitoring data are unavailable for others. The pollutants that exhibit reasonable potential are copper, lead, nickel, cyanide, and dioxin-TEQ.

3.6.4.2 Discharge Prohibition to Schell Slough

The Sonoma Valley NPDES Permit Discharge Prohibition 3.B states “no discharge to Schell Slough except when recycled water storage capacity exceeded.” This prohibition is based on the Basin Plan and the State Water Board Resolution No. 2009-001, *Policy for Water Quality Control for Recycled Water* (Recycled Water Policy). Basin Plan Prohibition 1 prohibits discharges to dead-end sloughs except under certain conditions. Schell Slough is a dead-end slough that receives limited tidal flushing, except during the wet season, when demand for recycled water is low. The Sonoma Valley NPDES Permit allows exceptions for Schell Slough discharges when Plant inflow exceeds the effective utilization capacity of the recycled water storage system, that is when Plant inflow exceeds 6 MGD (twice the permitted average dry weather flow) and the recycled

water storage ponds exceed 50% of their capacity. These conditions are most likely to occur during wet weather when upstream freshwater provides some flushing of Schell Slough. The Recycled Water Policy requires Water Boards to exercise their authority to the maximum extent possible to encourage water recycling to meet state water recycling goals. This prohibition encourages water recycling.

3.6.4.3 Compliance with Discharge Prohibition to Shallow Waters

The Sonoma Valley NPDES Permit grants an exception to Discharge Prohibition 1 citing an inordinate burden, equivalent level of protection, net environmental benefit, and implementation of a reclamation project as required in the Basin Plan and resolved in Resolution No. 94-086. The Sonoma Valley NPDES Permit describes these exceptions.

- Inordinate Burden: Prohibiting all discharges would place an inordinate burden because it would require construction of a 15-mile effluent pipeline and a diffuser in San Pablo Bay. Such a burden would be disproportional to the beneficial uses protected because of the NPDES permit requirements to protect all beneficial uses.
- Equivalent Level of Protection: A level of protection equivalent to implementing the prohibition is achieved by alternate means including requiring the SVCSD to take specific precautions to ensure treatment reliability for discharges of secondary-treated wastewater at Schell Slough, and the SVCSD provides additional protection by tertiary-treating and nitrifying all other discharges.
- Reclamation Project: The discharges occur as part of a water reclamation project.
- Net Environmental Benefit: Tertiary-treated and ammonia-removed effluent is discharged to maintain healthy perennial freshwater marsh ponds which attract thousands of birds. Tertiary-treated and ammonia-removed effluent is discharged to dilute bittern pond water and rehabilitate the Napa-Sonoma Salt Marsh. Both these efforts provide a net environmental benefit.

3.6.4.4 Marsh Management Plan

The Waste Discharge Requirements and Water Quality Certification for the California Department of Fish and Game Napa River Salt Marsh – Lower Ponds Restoration Project (Order No. R2-2004-0063 as amended) required implementation of a Monitoring and Adaptive Management Plan and the development of a Long-Term Habitat Monitoring and Adaptive Management Plan. These plans perform the same function as the marsh management plan required under Resolution No. 94-086.

3.6.5 Marsh Maintenance and Operations

Restoration of the Napa-Sonoma Marsh Project is progressing in phases. The current phase is removing “bittern” (a byproduct of salt production) from former salt ponds and improving water circulation and the ability to manage water levels within the ponds to

benefit shorebirds and waterfowl. The SVCSD is in the process of constructing a mixing chamber for bittern dilution and has not begun discharging to the former salt ponds.

3.7 RENZEL MARSH

Renzel Marsh refers to a 15-acre freshwater pond within a large saltmarsh complex in the Palo Alto Baylands that receives advanced secondary treated wastewater from the Palo Alto Regional Water Quality Control Plant (RWQCP). The freshwater pond was constructed by the RWQCP in 1992 in response to suggestions from the Water Board to evaluate alternative discharge locations for the RWQCP that would increase beneficial uses in the South Bay such as enhanced wildlife habitat and reduced pollutant loading at the existing RWQCP discharge location. As part of the same project, the RWQCP also restored the adjacent historical salt marsh that had been diked since 1921 to enhance habitat for endangered species found in the area. The freshwater pond was also designed to mitigate saltwater influx into Matadero Creek from the restored salt marsh. The freshwater pond and restored salt marsh are located on 152 acres of City-owned land; 37 acres of that land was leased to KSF World Communication for use as a maritime radio communication facility until 2017 and the remainder of the property remains undeveloped as part of the Palo Alto Baylands. With a constructed berm around the pond to prevent any stormwater inflows, treated effluent is the only flow to the pond. The freshwater pond provides habitat for shorebirds and waterfowl; adjacent salt marsh provides habitat for the federally and state listed salt marsh harvest mouse. The freshwater-salt marsh complex is bounded to the north by the RWQCP and commercial development along Embarcadero Road, to the east by Palo Alto Baylands Park, to the south by Adobe Creek, and to the west by Highway 101.

3.7.1 Facility Description

The City of Palo Alto owns the RWQCP and its associated collection system, which serves a population of approximately 220,000 people. The plant receives wastewater from the City as well as the East Palo Alto Sanitary District, Stanford University, and the cities of Mountain View, Los Altos, and Los Altos Hills. The plant's permitted and design flows are 39 mgd, which is the average dry weather flow design capacity with advanced secondary treatment. The plant is also designed to accommodate a peak wet weather flow of 80 mgd with only secondary treatment. From June 2010 through May 2013, the plant's average daily flow rate was 21 mgd, and the maximum daily flow rate was 38.5 mgd.

Renzel freshwater pond receives continuous effluent flows from the RWQCP on the order of approximately 1 mgd, or 5% of the total RWQCP discharge. This effluent moves through the pond before being discharged into tidally-influenced Matadero Creek. Matadero Creek flows into Mayfield Slough within the Palo Alto Flood Basin, which then flows into South San Francisco Bay through the Flood Basin's tidegates. The hydraulic residence time (HRT) of the marsh is roughly between 5 to 11 days. The

pond was originally designed to have depths of between 1 and 4 ft, but sedimentation and the development of a thick, robust plant community (primarily cattails) over the past 20+ years has reduced pond depths to approximately 1 to 2.5 ft. which is now undergoing maintenance to address these issues.

3.7.1.1 Governance Structure

The City of Palo Alto owns and operates Renzel Marsh, and provides treated wastewater from the RWQCP.

3.7.1.2 Wastewater Treatment

The treatment system consists of screening and grit removal, primary sedimentation, biological treatment (fixed film reactors and activated sludge), secondary clarification, filtration (dual media filter), and disinfection.

3.7.1.3 Recycled Water Program

Approximately 850 acre-feet per year or 0.76 mgd of final effluent undergoes additional filtration and chlorination prior to distribution as tertiary unrestricted recycled water. The Discharger sends this water to the Palo Alto Golf Course, Palo Alto parks, the California Department of Transportation, and the City of Mountain View recycled water system. The water is also distributed by truck for landscape irrigation, dust control, soil compaction, and collection system cleaning. These reclamation activities are regulated under Regional Water Board Order No. 93-160.

3.7.2 Ecosystem Services

The Basin Plan does not identify beneficial uses specifically for Renzel Marsh, but does identify beneficial uses for saltmarshes in general in Santa Clara County.

- Estuarine Habitat
- Commercial and Sport Fishing
- Fish Migration
- Preservation of Rare and Endangered Species
- Fish Spawning
- Wildlife Habitat
- Non-Contact Recreation
- Contact Recreation

In this case the Renzel freshwater pond discharges directly to Matadero Creek and would be required to protect those uses as well.

During marsh draining/maintenance activities in spring 2018, the City of Palo Alto moved over 200 fish from the marsh to Matadero Creek.

3.7.3 Wetland Pollutant Removal

The RWQCP's NPDES permit (No. CA0037834, R2-2014-0024) does not consider Renzel Marsh to be part of the plant's treatment system. As part of efforts to comply with the Nutrient Watershed NPDES Permit (No. CA0038873, Order R2-2014-0014), the RWQCP is evaluating options for increased nutrient removal through optimization of current treatment works. One option under consideration is utilizing Renzel freshwater pond to increase nutrient removal from the RWQCP's effluent, by increasing flow through the marsh (Engelage 2015).

A 2014 study of nutrient removal in the freshwater pond (Engelage 2015) indicated that it acts as a sink for nitrogen and is capable of reducing influent total nitrogen concentrations by 40% via denitrification and cellular uptake. The pond removed 51% of NO_3-N; the absence of a statistically significant increase in NH_3-N or NO_2-N indicated that removed NO_3-N was either reduced to nitrogen gas via denitrification or transformed into organic nitrogen through uptake by plants and mircoorganisms. Although not statistically significant, NO_2-N concentrations increased in the marsh while NH_3-N data decreased, further supporting the conclusion that denitrification is occurring within the marsh. The observed significant increase in organic nitrogen concentrations (more than 1000%) indicates that likely much of the NO_3-N was taken up by marsh microorganisms and/or aquatic plants for cellular growth.

The 2014 study also indicated that that the pond acts as a sink for phosphorus, and can reduce influent total phosphorus concentrations by 4%. The data demonstrated that the majority of phosphorus transformed within the marsh is from inorganic (e.g., phosphates) to organic forms, indicating cellular uptake of phosphorus. Accordingly, the RWQCP final effluent was comprised of on average 99% inorganic phosphorus, while effluent samples were comprised of 93% inorganic phosphorus.

Mass load analysis in the 2014 study demonstrated that total nitrogen load decreased in the pond, resulting in decreases in the RWQCP's overall discharge by an average of 2%. The study estimated that if flow to the pond increased to 2 mgd, it could decrease the RWQCP's overall total nitrogen load by 4%, assuming that the pond could accommodate additional flow without significantly impacting its treatment ability. A follow-up study by the City of Palo Alto in 2015 could only increase flow to the pond to 1.26 mgd (below the goal of 2 mgd) due to unanticipated infrastructure constraints (Campbell 2015). Nutrient monitoring in the 2015 study indicated that the flow increase resulted in an approximate 10% decrease in total nitrogen removal compared to the 2014 study, hypothesized to be due to the increase in flow and resultant decrease in hydraulic residence time.

3.7.4 NPDES Permitting Considerations

Currently the pond is not included in the wastewater treatment process; it is considered a receiving water with the current NPDES permit final effluent compliance sampling occurring upstream (Discharge Point 002).

3.7.4.1 Reasonable Potential Analysis

Reasonable potential was not determined for all pollutants because there are not applicable water quality objectives for all pollutants and monitoring data are unavailable for others. The reasonable potential analysis determined that copper, nickel, cyanide, dioxin-TEQ, and ammonia demonstrate reasonable potential.

3.7.4.2 Discharge Prohibitions

Surrounded by an extensive network of mudflats, sloughs, marshes, and salt ponds, South San Francisco Bay is generally confined and shallow, except for a deep central channel, and does not receive a minimum initial dilution of 10:1. Likewise, Matadero Creek discharges do not receive 10:1 initial dilution. In 1988, the Regional Water Board granted an exception to the prohibition based on the discharge providing a net environmental benefit. In 1990, the State Water Board overruled the Regional Water Board by concluding that the Discharger had failed to demonstrate a net environmental benefit. Nonetheless, it acknowledged that relocating the discharge north of the Dumbarton Bridge was not economically or environmentally sound. It also concluded that an exception to the prohibition could be granted on the basis of "equivalent protection" provided that certain conditions were met.

Order R2-2014-0024 continues to grant an exception based primarily on "equivalent protection" as follows:

a. Moving the RWQCP outfall to deep water (i.e., north of the Dumbarton Bridge) would be an inordinate burden because such relocation would require pipeline construction through protected wetlands, which would be costly and disturb wetland habitats.
b. The requirements of the Order (i.e., its prohibitions, limitations, and provisions) implement applicable water quality objectives and protect all relevant beneficial uses.
c. The RWQCP continues to provide an equivalent level of environmental protection by providing advanced secondary treatment through a higher level of BOD and TSS removal and nitrification and maintaining its pretreatment and pollution prevention programs.
d. Compliance with Provision VI.C.5.a of the Order provides additional environmental protection by ensuring facility reliability by requiring an updated Facility Reliability Assurance Plan. For the past four years, the RWQCP has dedicated $2.5 million annually to ensure the plant's treatment reliability and prevent discharges of inadequately treated effluent. In the future, the RWQCP plans to continue investing substantially in additional upgrades and treatment facility maintenance, as described in section II.E of this Fact Sheet.

To further justify an exception, the RWQCP continues to pursue wastewater reclamation projects to reduce its discharge volumes. The recycled water it produces has increased from 129 million gallons in 2008 to 222 million gallons in 2017.

Moreover, the Discharger continues to provide environmental benefits by maintaining Renzel Marsh Pond to support freshwater marsh habitat and provide resting habitat for migratory and local birds. The discharge from Renzel Marsh Pond into Matadero Creek also mitigates flows from adjacent Renzel Salt Marsh into the creek and supports habitat for the salt marsh harvest mouse and clapper rail.

3.7.5 Marsh Maintenance and Operations

Renzel Marsh Pond must be properly maintained by the RWQCP to achieve compliance with the City's NPDES permit. Specifically, flow through the pond must be maintained to ensure that: 1) discharge occurs from Point 002 to Matadero Creek and offsets the salinity from the downstream salt marsh, as required, 2) the pond continues to provide a resting place for migrating birds, and 3) open water portions of the marsh do not become stagnant and breed mosquitoes.

As previously discussed in Section 3.7.1, since the pond was constructed in 1992, its depth and capacity have decreased significantly due to infilling by sediment and cattails. In April 2018, the City initiated efforts to remove cattails in the pond, repair damaged portions of its berm, and improve the flow-through capacity of the pond (City of Palo Alto 2018). These actions are scheduled to be complete by the end of summer 2018.

SECTION 4: FINDINGS

The findings from the NPDES case studies have resulted in four general regulatory opportunities/alternatives. These alternatives could also be used to address regulatory constraints and opportunities identified in other Water Board regulatory programs such as wetland fill and the issuance of Clean Water Act Section 401 Water Quality Certifications and Waste Discharge Requirements (WDRs). The alternatives are:

1. Create a Water Board resolution to guide the future permitting of multi-benefit projects designed to address sea level rise. The resolution could cover both: 1) treatment wetlands and the use of wastewater to enhance existing wetlands; and 2) the application of the No Net Loss Policy[12] and wetland permitting to Bayland wetland projects that involve "beneficial fill." The resolution could be based, in part, on updates to Resolution No. 94-086 to reflect current use of treatment wetlands and projected future use of wastewater as a resource in Bayland wetlands.
2. Develop a general NPDES permit and WDRs for the discharge of treated wastewater to Bayland wetlands.
3. Develop general WDRs and Water Quality Certification for discharges of dredged or fill material in Bayland wetlands.

[12] California Wetlands Conservation Policy (Executive Order W-59-1993)

4. Develop an amendment to the Basin Plan with updates to reflect current practices with regards to: designation of beneficial uses at wetlands; discharge prohibitions and exceptions; treatment standards; and application of the No Net Loss to Bayland climate change adaptation projects.

The identification of a preferred alternative(s) will need to consider such factors as feasibility, level of effort to advance, benefit, ability to meet project objectives, etc. Table 6 summarizes some of the pros and cons with each four alternatives. For example, while California Environmental Quality Act (CEQA) analysis is not required for NPDES permits (Water Code Section 13389), General WDRs require CEQA analysis. The scope and responsibility of any CEQA analysis can also be refined to match the available resources. The definition of CEQA project can be limited such that the analysis can be feasibly accomplished with the caveat that projects outside of the scope would need to conduct a separate CEQA analysis. Any CEQA analysis would need to consider that certain types of climate change adaptation projects could be considered an activity exempt from CEQA under Sections 15307 (protection of natural resources) and 15308 (protection of the environment); although such projects may still need to prepare a Categorical Exclusion, Initial Study, or Mitigated Negative Declaration. Another alternative is to have the CEQA analysis performed by project proponents instead of the Water Board who is acting as the lead agency (or a responsible agency). If there was enough demand for a general permit, a local district or consortium of stakeholders could develop the CEQA analysis for certification by the Water Board when the general permit was adopted by the Board. Further inquiry (including input gathered from stakeholder outreach) into the pros and cons of each alternative will need to take place before a preferred alternative can be chosen.

Table 4: Summary of Pros and Cons with Each Alternative

ALTERNATIVE	PROS	CONS
Resolution	- No CEQA analysis - Could cover a variety of activities - Lower level of effort compared to other alternatives	- Level of benefit unclear
General NPDES Permit	- No CEQA analysis except for a new source - Potentially high benefit	- Limited to wastewater discharges - High level of effort - Difficult to incorporate site-specific conditions such as mixing zones
General WDRs	- Potentially high benefit	- CEQA analysis required - High level of effort

Basin Plan Amendment	- Could cover a variety of activities	- CEQA analysis for certified regulatory programs would be required - Peer review could be required - Potentially high level of effort

4.1 DISCHARGE PROHIBITION EXCEPTION: NET ENVIRONMENTAL BENEFIT

To increase regulatory certainty there could be value in providing direction to dischargers on how Water Board staff will evaluate qualification for net environmental benefit. The FSSD NPDES Permit required FSSD to conduct a study to evaluate the impacts of treatment plant discharges on adjacent waters of the State and demonstrate discharges to Suisun Marsh were providing a net environmental benefit. As necessary, in order to qualify for or continue to qualify for the net environmental benefit discharge prohibition exception, discharges should be required to conduct studies such as an evaluation of impacts of discharges to adjacent waters of the State. Other studies could include an analysis of the functions provided by the marsh system for wildlife habitat, pollutant removal, or sea level rise adaptation.

In general, to qualify for the net environmental benefit exception the discharger must demonstrate, "that the existing wetlands are unlikely to be restored by other means, and that the resulting discharge to the wetland will both maintain existing beneficial uses and create new beneficial uses" (Resolution No. 94-086 p. 3). Discharges to Hayward Marsh and Moorhen Marsh may be reduced or eliminated in the future due to wetland maintenance costs, recycled water demands, or challenges with infrastructure maintenance. While NPDES permits may not be the appropriate mechanism to force the management of wetland systems in perpetuity, the application of net environmental benefit exception should consider the long-term likelihood of success of wetland systems.

While the Water Board does not grant net environmental benefit only through the creation of a wastewater treatment wetland (e.g., Ellis Creek), the Water Board has applied net environmental benefit to a whole wetland system (e.g., Moorhen Marsh with both constructed treatment wetlands and waters of the State). Consideration should be given for the application of the net environmental benefit exception for creation-only projects if the project benefits Regional climate change adaptation goals.

Recommendation: In a resolution or Basin Plan amendment, outline factors to determine net environmental benefit including:

1. *Require an evaluation of impacts of treatment plant discharges on adjacent waters of the State.*

2. *Require other studies or demonstration of wetland functions for wildlife habitat, mitigating impacts of sea level rise, pollutant removal, etc.*
3. *Incorporate likelihood of success and considerations for long-term management of marsh systems.*
4. *Statement that each NPDES permit is an opportunity to reevaluate net environmental benefit exception and successive permit may include more stringent effluent limits, monitoring, or adaptive management.*
5. *Identify circumstances (if any) where only the creation of treatment wetlands would qualify for net environmental benefit.*

4.2 DISCHARGE PROHIBITION EXEPTION: EQUIVALENT LEVEL OF PROTECTION

4.2.1 Treatment Reliability

Section 4.2 of the Basin Plan establishes discharge prohibitions that apply throughout the Region and lists factors that the Board may consider in granting exceptions to the prohibitions (see Section 2). One of the factors listed is if compliance with the prohibition causes an inordinate burden relative to the beneficial uses protected, then an exception may be granted provided there is an equivalent level of environmental protection through alternate means such as improved treatment reliability.

The exceptions to discharge prohibition Basin Plan language was crafted in 1982, and since that time municipal wastewater treatment technologies have matured along with required pretreatment measures that prevent treatment upsets. The Water Board now expects reliable treatment as one minimum requirement for all wastewater treatment facilities. This approach has not been applied consistently. Table 5 shows which NPDES case study permits still reference treatment reliability as one consideration for granting an exception to Discharge Prohibition 1.[13] Reliable treatment has become a minimum expectation of all wastewater treatment facilities rather than as an achievement deserving of special privilege.

Table 5: NPDES Case Study Permits Using Treatment Reliability for Exception to Discharge Prohibition 1

DISCHARGER	WETLAND	TREATMENT RELIABILITY USED	REQUIREMENT
Mt. View Sanitary District	Moorhen Marsh	No	NA

[13] These NPDES case study permits also reference other measures for granting exceptions (e.g., net environmental benefit).

East Bay Regional Park District, Union Sanitary District, and East Bay Dischargers Authority	Hayward Marsh	No	NA
City of Petaluma	Ellis Creek	Yes	Equalize treated wastewater for at least one week (see Petaluma NPDES permit p. 5).
Novato Sanitary District	Bel Marin Keys	Yes	Reliability Assurance Plan and Status Report submitted annually (see Novato NPDES Permit pp. 15, 65, 87)
Fairfield-Suisun Sewer District	Suisun Marsh	Yes	Reliability Assurance Plan and Status Report submitted annually (see FSSD NPDES Permit pp. 18, 70, 95)
Sonoma Valley County Sanitation District	Napa-Sonoma Marsh	Yes	Plant Reliability Report Status Reports annually (see Sonoma Valley NPDES Permit pp. 14, 67, 89)

Recommendation: Update Basin Plan Section 4.2 to either: 1) remove "improved treatment reliability" as a means of providing equivalent protection; or 2) update to reflect current advancements in treatment technology and Water Board end goals for wastewater treatment plant and collection system performance.

4.2.2 Treatment Standards, Effluent Limitations, and Site-Specific Objectives

Stakeholders (e.g., EBDA) have requested that the Water Board consider NPDES treatment standards (as yet to be determined) for discharges to qualify for the equivalent level of protection exception to Discharge Prohibitions 1 and 3. Treatment standards (technology-based effluent limitations) could take the form of a definition of "advanced secondary treatment" with corresponding limits for various water quality parameters.[14] The Water Board could consider developing water quality based effluent limitations that incorporate treatment wetland pollutant removal capacity and allowable dilution credits through wetland environments. Alternatively, site-specific objectives could be developed for Bayland wetland environments to allow for direct discharges that meet the receiving water limits specified in the objectives. Table 6 summarizes the results of reasonable potential analyses and development of water-quality based effluent limitations (including the use of mixing zones and dilution credits) for the NPDES case studies. Attention should be given towards the pollutant removal capacity of treatment wetlands for these pollutants (as well as CECs).

Table 6: Summary of Reasonable Potential Analysis for NPDES Case Studies

Wetland Location	Pollutant									Mixing Zone
	Cyanide	Copper	Nickel	Lead	Benzo(a) anthracen	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Dioxin-TEQ	Ammonia	
Moorhen Marsh	X	X			X			X	X	N
Hayward Marsh	X	X	X		X	X	X		X	Y (copper, nickel, ammonia)
Ellis Creek	X	X						X		N

[14] For example, BOD average monthly effluent limitation (AMEL) = 15 mg/L; TSS AMEL = 20 mg/L; BOD average weekly effluent limitation (AWEL) = 25 mg/L; and TSS AWEL = 30 mg/L.

Bel Marin Keys	X	X						X	X	Y (cyanide and ammonia)
Suisun Marsh	X	X						X		Y (cyanide)
Napa-Sonoma Marsh	X	X	X	X				X		Y (cyanide)

The following are some considerations related to treatment standards, effluent limitations, and site-specific objectives:

Treatment Standards

- When setting a definition of advanced secondary treatment consideration of the available technology and other case-by-case technological factors could drive definition to the lowest (i.e., less stringent) denominator.
- The FSSD NPDES permit provides an example of advanced secondary treatment standards, and levels of BOD and TSS removal and nitrification, that have been used to justify exception to Discharge Prohibition 1.

Effluent Limitations

- Consider augmenting the procedures for determining dilution credits (including SIP Section 1.4.2.2(A) Mixing Zone Conditions) in the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (SIP) to incorporate current understanding on wetland hydrology and estuarine tidal flow mixing.
- Consider adding a provision for less stringent effluent limitations and allowance for shallow water discharges for dischargers implementing a project that utilizes treated wastewater to enhance wetland environments. Under this provision the Water Board could consider inclusion of an effluent limitation greater than that calculated from water quality objectives when: 1) the increase in concentration is caused by implementation of a wetland enhancement project that utilizes treated wastewater as a freshwater source for a marsh; 2) the increase in the effluent limitation does not result in an increase in the mass loading; and 3) water quality objectives will not be exceeded outside the zone of initial dilution.
- Consider spatial differences in water quality and treatment wetland pollutant removal capacity when setting points of compliance and effluent limitations to meet receiving water limits for dissolved oxygen, dissolved sulfide, BOD, TSS, oil and grease, pH, enterococcus, and fecal coliform, nutrients, unionized ammonia, and any applicable water quality standards approved as part of a

TMDL, or any narrative water quality objective.[15] Consider different effluent limitation compliance points for pollutants depending on fate and transport mechanisms, mixing zones for some pollutants, etc. For example, treatment wetlands remove nutrients so point of compliance should be at the end of the wetland. Conversely, some treatment wetlands attract wildlife which adds fecal coliform and favors a different point of compliance.

- Extensive efforts have been undertaken to gather and assess data and information about the performance of constructed wetlands to treat conventional parameters, particularly phosphorus and nitrogen. Pollutant removal rates are generally predictable and reproducible between differing treatment wetland designs and geographical locations. Based on assessment of treatment removal mechanisms and actual performance data, design criteria and design models have been fairly well established for conventional parameters. Treatment wetlands also hold promise as a means of removing other wastewater-derived contaminants, such as trace organic contaminants and pathogens. However, concerns about variations in treatment efficacy of these pollutants, coupled with an incomplete mechanistic understanding of their removal in wetlands, hinder the widespread adoption of constructed wetlands for these two classes of contaminants. Research is needed to better understand the performance of wetlands for removal of trace contaminants and for extrapolation to other unstudied compounds. Research findings can help wetland design criteria for such parameters as sizing, residence time of water, proportion of open-water unit process cells vs. vegetated wetland cells, etc. A more complete understanding of optimal design and variations in treatment efficacy is needed before widespread dissemination of standard design criteria to meet effluent limitations.
- Both the Moorhen Marsh and Novato NPDES permits recognize that even though the wastewater treatment plants are operating to treat ammonia concentrations below Basin Plan objectives, without regulatory assurance that nitrification will continue, there is still a reasonable potential that the un-ionized ammonia in the effluent could increase and cause or contribute to toxicity outside of the designated mixing zones. The Napa-Sonoma Salt Marsh NPDES Permit includes regulatory assurance through a performance-based effluent limitation for total ammonia. The limit was derived using the method described in Section 3.3.2 of USEPA's *Technical Support Document for Water Quality-based Toxic Controls* (USEPA 1991) and provides the necessary regulatory assurance to ensure that the SVCSD Plant maintains nitrification treatment. Treatment

[15] Examples of narrative water quality objectives include: a) No visible floating, suspended, or deposited oil or other products of petroleum origin; b) No floating, suspended, or deposited macroscopic particulate matters or foam of sewage origin; c) No bottom deposits or aquatic growths to the extent that such deposits or growths cause nuisance or adversely affect beneficial uses; d) No toxic or other deleterious substances to be present in concentrations or quantities that cause deleterious effects on wildlife, waterfowl, or other aquatic biota, or render any of these unfit for human consumption, either at levels created in the receiving waters or as a result of biological concentration; and e) Alteration of temperature, turbidity, or apparent color beyond present natural background levels.

wetland performance could be used to provide regulatory assurance for sufficient nitrification to meet the ammonia water quality objective.

Site-Specific Objectives

- A Region-wide framework to develop site-specific objectives for Bayland wetland environments for constituents of concern will more accurately reflect local conditions in Bayland wetlands and could facilitate direct discharge of wastewater to wetlands. However, developing Region-wide framework for site-specific objectives is onerous and out of the scope of this Project.

Recommendations:

1. *Present findings and alternatives to ReNUWIt for discussion focusing on how ReNUWIt's research findings can be used to answer the following: 1) What level of treatment should be required for direct discharge to waters of the State? 2) Could water quality based effluent limitations incorporate treatment wetland pollutant removal capacity? 3) What is the pollutant removal capacity of wetlands for CECs; can these findings be extrapolated for NPDES permitting application; and what are the established thresholds for CECs?*
2. *Integrate findings of ReNUWIt treatment wetland design guidance into the Project (to be completed summer 2016).*
3. *As necessary, pursue pilot project with a sanitation district and funding entity to evaluate the effectiveness of constructed wetlands for polishing of individual trace organic contaminants and for extrapolation to other unstudied compounds. Study design should inform the development of treatment wetland design criteria, treatment standards, etc.*
4. *As appropriate, add language to a resolution, Basin Plan amendment, or general NPDES permit to allow for flexibility in developing effluent limitations for Bayland projects that utilize treatment wetlands.*

4.3 RESOLUTION NO. 94-086

Resolution No. 94-086 is now over 20 years old and needs to be replaced with a new resolution that incorporates current science and approaches to wetland design and NPDES permitting to facilitate permitting and incentivize multi-benefit sea level rise adaptation projects.

Recommendation: Create a new resolution based, in part, on updates to Resolution No. 94-086 to guide future permitting of NPDES projects that use wastewater as a resource in sea level rise adaptation wetlands.

4.3.1 Marsh Management Plan

As required by Resolution No. 94-086, most of the case study NPDES permits require a marsh management plan (Petaluma and Novato NPDES Permits do not). These plans vary in detail but, in general, include management objectives; roles and

responsibilities of parties; implementation strategy; water quality control plan; and adaptive management. Examples include the Moorhen and McNabney Marsh Management Plans developed by the MVSD in collaboration with the EBRPD who co-own and co-manage the marsh system. These plans should be used to ensure that receiving water limits are met and that the marsh is operated in a way that maximizes wildlife habitat and prevents nuisance conditions such as odor and algae. Another example is the Suisun Marsh Habitat Management, Preservation, and Restoration Plan (SMP; USFWS 2013b). The SMP is a 30-year comprehensive plan designed to address the various conflicts regarding use of marsh resources, with the focus on achieving an acceptable multi-stakeholder approach to the restoration of tidal wetlands and the management of managed wetlands and their functions. Resolution No. 94-086 includes minimum required elements for a marsh management plan and these elements are covered, at least in part, in the case study plans. As described above, Resolution No. 94-086 is over 20 years old and should be updated to address sea level rise adaptation and incorporate lessons learned from Hayward Marsh and Moorhen Marsh on abandoning discharges to wetland systems (as yet to be realized) due to competing demands for recycled water or costs of long-term management of treatment systems.

Recommendation: Create a new resolution based, in part, on updates to Resolution No. 94-086 with a list of minimum required elements that must be included in a marsh management plan including sea level rise planning, participation in regional monitoring efforts (see Section 3.7), and adaptive management.

4.4 NPDES NUTRIENT PERMIT

The Waste Discharge Requirements for Nutrients from Municipal Wastewater Discharges to San Francisco Bay (Order NO. 2014-0014, NPDES No. CA0038873; NPDES Nutrient Permit) recognizes that, “it may also be possible to use wetlands or other treatment upgrades to remove nutrients while also providing habitat, including habitat for endangered species; protecting against sea level rise; and removing constituents of emerging concern, such as pharmaceuticals” (p. 34). The NPDES Nutrient Permit requires that dischargers evaluate potential nutrient discharge reduction strategies such as alternate discharge scenarios using wetlands. This evaluation will identify any institutional barriers and include proposals for overcoming such barriers. This first status report on this requirement (Provision C(2)b) is due July 1, 2016 (a final report is due July 1, 2018).

The NPDES Nutrient Permit is an element of the San Francisco Bay Nutrient Management Strategy which also includes the development of Nutrient Numeric Endpoints (NNEs) by the Regional and State Water Boards. The NNE will rely on models that link response indicators to nutrient loads and other management controls for a range of potential future conditions in the Bay. The NNE framework is intended to serve as numeric guidance to translate the Basin Plan’s narrative objective for biostimulatory substances into water quality-based effluent limits in NPDES permits. The NNE framework should consider the pollutant removal capacity of treatment

wetlands in the model used to develop effluent limits (see Section 3.2.2 for discussion of effluent limitations).

Recommendations: Integrate findings from nutrient reduction strategies status report and coordinate with discharges pursuing treatment wetlands as part of Project stakeholder outreach. Incorporate ReNUWIt findings on treatment wetland design guidance into NNE framework (see Section 3.2.2 recommendations).

4.5 BENEFICIAL USE DESIGNATIONS

As discussed in Section 2.2.4.1, the Water Board removed the Water Contact Recreation beneficial use designation from Hayward Marsh. Conducting a use attainability analysis and amending the Basin Plan to remove the Water Contact Recreation beneficial use may be necessary again in the future for projects that discharge treated wastewater to Bayland wetlands. Otherwise, the Water Contact Recreation beneficial use would be presumed, and stringent bacteria effluent limits would be necessary. Amending the Basin Plan to clarify that wetland beneficial uses do not always apply would facilitate the permitting of climate adaptation projects in the future.

Many of the case studies (i.e., Moorhen Marsh, Ellis Creek, Napa-Sonoma Marsh) applied the Tributary Rule (see Section 1.4) to determine applicable beneficial uses where none had been designated in the Basin Plan. The Basin Plan allows beneficial uses to be determined through the Tributary Rule or on a site-specific basis. This is consistent with two approaches (i.e., general approach and class specific approach) described by USEPA (1990, p. 8):

> When designating uses for wetlands, States may choose to use their existing general and water specific classification systems or they may set up an entirely different system for wetlands. Each of these approaches has advantages and disadvantages, as discussed below.
>
> [*General Approach*:] Some States stipulate that wetlands are designated for the same uses as the adjacent waters. States may also apply their existing general classification system to designate uses for specific wetlands or groups of wetlands. The advantage of these approaches is that they do not require States to expend additional effort to develop specific wetland uses, or determine specific functions and values, and can be generally used to designate the CWA [Clean Water Act] goal uses for wetlands. However, since wetland attributes may be significantly different than those of other waters, States with general wetland use designations will need to review the uses for individual wetlands in more detail when assessing activities that may impair the specific "existing uses" (e.g., functions and values). In addition, the "adjacent" approach does not produce uses for "isolated" wetlands.

> [*Wetland Class Specific Approach*:] Due to these differences in attributes, States should strongly consider adopting a separate use classification system for wetlands based on wetland type and/or beneficial use (function and value). This approach initially requires more effort in developing use categories (and specific criteria [16] that may be needed for them), as well as determining what uses to assign to specific wetlands or groups of wetlands. The greater the specificity in designating uses, however, the easier it is for States to justify regulatory controls to protect those uses. States may wish to designate beneficial uses for individually named wetlands, including outstanding wetlands…, although, this approach may be practical only for a limited number of wetlands. For the majority of their wetlands, States may wish to designate generalized uses for groups of wetlands based on region or wetland type.
>
> Two basic pieces of information are useful in classifying wetland uses: (1) the structural types of wetlands and (2) the functions and values associated with such types of wetlands. The functions and values of wetlands are often defined based upon structural type and location within the landscape or watershed. The understanding of the various wetland types within the State and their functions and values provides the basis for a comprehensive classification system applicable to all wetlands and all wetland uses. As with other waters, both general and waterbody-specific classifications may be needed to ensure that uses are appropriately assigned to all wetlands in the State. Appropriate and definitive use designations allow water quality standards to more accurately reflect both the "existing" uses as well as the States' goals for their wetland resources, and allow standards to be a more powerful tool in protecting State wetlands.

In the future, the more refined approach of determining beneficial uses of wetlands on a site-specific basis should be implemented. This will result in the application of appropriate water quality objectives based on the site-specific designated beneficial uses.

The application of beneficial uses in estuarine environments is also governed by the Water Quality Control Plan: Ocean Waters of California (California Ocean Plan). California Ocean Plan Section II.B.l.a(1) restricts effluent limits intended to protect the Water Contact Recreation beneficial use to a zone bounded by the shoreline and a distance of 1,000 feet from the shoreline or the 30-foot depth contour and any area designated with the Water Contact Recreation beneficial use by a Regional Water Board. Changes to the Basin Plan would need to avoid any conflicts with the California Ocean Plan.

[16] Under federal terminology, water quality standards include water quality objectives and beneficial uses. Beneficial uses are synonymous with “designated uses” in the Clean Water Act and water quality objectives are synonymous with “water quality criteria.”

Recommendation: amend Basin Plan Section 2.2.3 and Table 2-4 to clarify that wetland beneficial uses do not necessarily include all those listed. For instance, it should not be assumed that newly created wetlands have the Water Contact Recreation beneficial use. Evaluate necessary changes to the California Ocean Plan to align beneficial use applicability between plans.

4.6 REGIONAL MONITORING SYSTEM

Each case study NPDES permit includes a monitoring and reporting program that includes influent monitoring, effluent monitoring, whole effluent toxicity testing, and receiving water monitoring requirements. The Water Board has also developed regional standard provisions, and monitoring and reporting requirements which are included as an attachment to each NPDES permit. Monitoring programs can also be included in marsh management plans in compliance with Resolution No. 94-086. Staff Management Plan Recommendations for Resolution No. 94-086 identifies broad categories which should be monitored for—sediment, water column, flow patterns, vegetation, and wildlife.

A more coordinated monitoring approach could be used to assess projects and inform future management decisions. This could include a regional Baylands monitoring network to track trends in wetland extent and condition similar to the approach taken with the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP). A plan for regional monitoring is incorporated in the state's Wetland and Riparian Monitoring Program (WRAMP) and could be coordinated with the California Wetland Monitoring Workgroup. A regional monitoring system could be implemented through various state and federal resource agency permits and be used to assess the long-term success of projects funded under the San Francisco Bay Restoration Authority "Clean and Healthy Bay" Parcel Tax (Measure AA).

Recommendation: coordinate with the California Wetland Monitoring Workgroup, the Restoration Authority of the San Francisco Bay, and state and federal resource agencies with concurrent jurisdiction over Bayland wetlands to develop a regional Baylands monitoring system.

4.7 GOVERNANCE STRUCTURE

Hayward Marsh and Moorhen Marsh provide insights into how marsh management and governance can affect the long-term viability of wetlands that utilize wastewater as a freshwater resource. EBRPD acquired the Hayward Marsh by purchasing lands using public funds (e.g., 1980 California Parklands Act, a grant from the Coastal Conservancy) and through long-term leases with public agencies. EBRPD is considering ceasing discharge at the site and converting the area into marshes with a reduced tidal prism. This change in marsh management is not consistent with the original goals and objectives of Hayward Marsh. Nonetheless, it appears that the decision on the future of Hayward Marsh is solely in the hands of EBRPD with the

public having no recourse to the decision-making on a publicly-funded project. Furthermore, the Hayward Marsh NPDES permit has no provisions that would prevent EBRPD from eliminating the discharge to Hayward Marsh. At Moorhen Marsh, MVSD is considering diverting the recycled water that is currently used as a freshwater input to Moorhen Marsh and instead using it for industrial use at the nearby Shell Martinez Refinery. While the State Water Board Recycled Water Policy requires Regional Water Boards to exercise their authority to the fullest extent possible to encourage the use of recycled water, it does not describe how decisions should be made regarding competing demands. The Regional Water Board's General Water Reuse Requirements Order No. 96-011 (General WRR) does not include any direction either.[17]

Recommendation: develop a model provision to include in future NPDES permits that requires continued management of treatment wetlands that provide a net environmental benefit. Coordinate with funding agencies (e.g., USEPA, Coastal Conservancy) to include provisions in grant award contracts for long-term management and site protection instruments. Consider amending the Recycled Water Policy and/or General WRR to provide the Water Board more discretion in determining how recycled water should be used to provide the maximum benefit to people of the state.[18]

17 Nor does the State Water Board Order WQ 2016-0068-DDW Water Reclamation Requirements for Recycled Water Use.

[18] This could be done using authorities in the Antidegradation Policy (State Water Board Resolution No. 68-16 Statement of Policy with Respect to Maintaining High Quality of Waters in California) where changes in water quality must be, "consistent with maximum benefit to the people of the state." Water Code Section 13000 also provides allowances for regulatory decisions with competing demands: "The Legislature further finds and declares that activities and factors which may affect the quality of the waters of the state shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible."

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APPENDIX A: BASIN PLAN WASTE DISCHARGE PROHIBITION LANGUAGE

Discharge Prohibition 1 is applied in all of the NPDES case study permits. It reads:

> It shall be prohibited to discharge any wastewater which has particular characteristics of concern to beneficial uses at any point at which the wastewater does not receive a minimum initial dilution of at least 10:1, or into any nontidal water, dead-end slough, similar confined waters, or any immediate tributaries thereof.

Basin Plan Table 4-1 includes useful discussion for Discharge Prohibition 1:

> Waste discharges will contain some levels of pollutants regardless of treatment. This prohibition will require that these pollutants, when of concern to beneficial uses, be discharged away from areas such as nontidal waters and dead-end sloughs. This prohibition will (a) provide an added degree of protection from the continuous effects of waste discharge, (b) provide a buffer against the effects of abnormal discharges caused by temporary Plant upsets or malfunctions, (c) minimize public contact with undiluted wastes, and (d) reduce the visual (aesthetic) impact of waste discharges.

Basin Plan Section 4.2 provides for exceptions to Discharge Prohibition 1 (and 2 and 3) under certain circumstances:

- An inordinate burden would be placed on the discharger relative to beneficial uses protected and an equivalent level of environmental protection can be achieved by alternate means, such as an alternative discharge site, a higher level of treatment, and/or improved treatment reliability; or
- A discharge is approved as part of a reclamation project; or
- It can be demonstrated that net environmental benefits will be derived as a result of the discharge; or
- A discharge is approved as part of a groundwater clean-up project, and in accordance with Resolution No. 88-160 "Regional Board Position on the Disposal of Extracted Groundwater from Groundwater Clean-up Projects," and it has been demonstrated that neither reclamation nor discharge to a POTW is technically and economically feasible, and the discharger has provided certification of the adequacy and reliability of treatment facilities and a plan that describes procedures for proper operation and maintenance of all treatment facilities. (The Water Board recognizes the resource value of extracted and treated groundwater and urges its utilization for the highest beneficial use for which applicable water quality standards can be achieved.)

The Basin Plan further states:

> In reviewing requests for exceptions, the Water Board will consider the reliability of the discharger's system in preventing inadequately treated

wastewater from being discharged to the receiving water and the environmental consequences of such discharges.

APPENDIX B: RESOLUTION NO. 94-086 PROVISIONS

1. In order to be granted an exception to the Water Quality Control Plan [Basin Plan] waste discharge prohibition, a discharger must demonstrate that a net environmental benefit will be derived as a result of the discharge.
2. In order to demonstrate net environmental benefit, it will be necessary for the applicant to demonstrate that (1) full and uninterrupted protection will be given to all beneficial uses which could be made of the receiving water, including groundwater, in the absence of wastewater discharges and (2) that new beneficial uses will result from wetland creation, or, in rare cases, fuller realization of existing or potential uses will result from wetland restoration or enhancement beyond that which would occur in the absence of point source discharges.
3. The Regional Board will consider exceptions to the waste discharge prohibition in cases where the wetlands are constructed systems. Generally, this policy will not permit the enhancement or restoration of existing wetlands with wastewater. In exceptional cases, enhancement or restoration of existing wetlands may be considered. However, the discharger will be required to demonstrate that the existing wetlands are unlikely to be restored by other means, and that the resulting discharge to the wetland will both maintain existing beneficial uses and create new beneficial uses. In no cases will the Regional Board consider the use of existing wetlands as treatment systems.
4. Wetlands created using wastewater shall be considered on a case-by-case basis to determine whether they are waters of the United States, as defined in 40 CFR Part 122.2, or treatment systems. Should portions of the wetland be determined to be treatment systems, the portions of the wetland that are designated waters of the United States will be the sole determinants of the net environmental benefit derived from the discharge. Portions of the wetland that are designated waters of the United States will be subject to Basin Plan water quality objectives. Portions of the wetland that are upstream of the point of compliance - and therefore part of the treatment process -will be subject to the best management practices specified in the NPDES permit. In all cases, the wetland system, consisting of treatment and nontreatment portions, will be subject to conditions specified in the NPDES permit or waste discharge requirements.
5. The Regional Board will require that the maximum benefit be derived from the quantity and quality of water that is available.
6. The Regional Board will require the applicant to demonstrate (1) a commitment of an adequate amount of land to make optimum use of the water to be committed to wetland creation, restoration and/or enhancement, (2) a commitment to manage the wetland to provide for maximum environmental benefit with a minimum of adverse conditions, and (3) the availability of acceptable reclamation or disposal facilities for any wastewaters not committed to wetland creation, restoration, or enhancement.

7. The Regional Board will require the applicant to demonstrate that the wetland will be managed so as not to create vector problems and nuisance, and so as to minimize the occurrence of avian botulism and other infectious diseases. The Regional Board will also require demonstration in the form of detailed monitoring that pollutants and other substances transferred to the wetland do not harm wildlife due to direct toxicity or bioaccumulation in the food chain. This provision applies to the entire wetland system, including sections dedicated to treatment as well as sections dedicated to demonstration of a net environmental benefit.

8. The project design should consider the most important functions and values to create in order to demonstrate a net environmental benefit. Priority will be given to proposals which reflect, to the greatest extent feasible, the wetland types which were historically present at the site or are consistent with ongoing regional wetlands planning efforts. Wetlands created, restored or enhanced as exceptions to the waste discharge prohibition should not be based on the most convenient wetland type available due to financial or land area limitations.

9. Generally, dischargers that are granted an exception to the Water Quality Control Plan waste discharge prohibition based on the creation, restoration or enhancement of wetlands may not use these wetlands to satisfy mitigation requirements pursuant to any program within the purview of the Regional Board including, but not limited to, Sections 401 and 404 of the Clean Water Act, or any other regional or local jurisdiction. In exceptional cases, mitigation projects with wastewater may be considered. However, the applicant must demonstrate that the project is primarily a mitigation project, and not solely an effort to obtain an exception to the waste discharge prohibition. In addition, mitigation wetlands are waters of the United States and, as such, all discharges of water to the wetland must meet Basin Plan shallow water effluent limits. Mitigation projects approved under this policy by the Regional Board will be for wetland creation rather than restoration or enhancement unless the applicant fulfills requirements of Provision 3 for modification of an existing wetland.

10. Pilot investigations will be required to determine the information necessary to develop a functional wetland unless the applicant can provide the information without such investigations. The necessity for pilot work, however, will not be allowed to interfere with the implementation of necessary wastewater facilities [facility's] programs. In those cases where pilot work would unduly delay a facilities planning effort, wetland creation must be considered as a "second phase" and work must proceed on disposal alternatives as the first phase. In all cases where pilot work is being performed, options for disposal must be kept open in case the wetland creation project is not approved. The information to be provided will be determined by the Executive Officer of the Regional Board in cooperation with agencies designated in Provision 11.

11. Prior to granting an exception to the Water Quality Control Plan waste discharge prohibition, the Regional Board will require the applicant to develop a management plan acceptable to the Executive Officer that provides detailed information on how compliance with provisions 1 through 10 is to be achieved. The management plan should contain the following information, at a minimum:

a. A facility plan, including a description of: the treatment works prior to discharge to the wetland; the physical facilities to be provided in the wetland area; the physical layout of the wetland including all points of discharge to and from the wetland; adjacent waters; available disposal alternatives (if any); and how the land is to be committed to this use. The facility plan must also include an explanation of the project purpose and objectives, a description of site selection and sampling, and a description of planning and design elements, including wetland design criteria.

b. An operations and maintenance plan, including a vector control program and system contingency plans.

c. As part of the operations and maintenance plan, a detailed monitoring plan to monitor parameters such as pollutants, habitat diversity, wildlife use, and vector populations.

d. A description of the anticipated water quality impacts of the proposed project including the anticipated quality of the discharge to the wetland; the anticipated quality of water in the wetland; the anticipated quantity and quality of water discharged from the wetland; and the anticipated impact of that discharge on adjacent waters. This description should include a summary of the results of any pilot work or other data on which the proposal is based.

APPENDIX C: BASIN PLAN TABLES

Table 2-3 Examples of Existing and Potential Beneficial Uses of Selected Wetlands

	TYPE OF WETLAND				
BENEFICIAL USE	MARINE	ESTUARINE	RIVERINE	LACUSTRINE	PALUSTRINE
AGR		o	o	o	o
COLD			o	o	o
COMM	o	o			
EST		o			
FRESH			o	o	o
GWR	o	o	o	o	o
IND		o	-	-	
MAR	o				
MIGR	o	o	o	o	
NAV	o	o	o	o	o
PROC					
REC-1	o	o	o	o	o
REC-2	o	o	o	o	o
SHELL	o	o	o		
SPWN	o	o	o	o	o
WARM			o	o	o
WILD	o	o	o	o	o
RARE	o	o	o	o	o

NOTE:
o Existing beneficial use
- Potential beneficial use

Table 2-4 Beneficial Uses of Wetland Areas

Basin/Marsh Area	*Wetland Types*			*Beneficial Uses*								
	Fresh	Brackish	Salt	EST	MAR	MIGR	COMM	RARE	REC1	REC2	SPWN	WILD
Alameda County												
Arrowhead			•	•				•	•	•	•	•
Coyote Hills			•	•				•	•	•	•	•
Emeryville Crescent			•	•				•	•	•	•	•
Hayward (e.g., Cogswell, Hayward Area Recreation District, Oro Loma, & Triangle marshes)			•	•					•	•	•	•
Hayward Marsh		•		•				•		•	•	•
Contra Costa County												
North Contra Costa		•	•	•				•	•	•	•	•
Point Edith		•		•				•		•	•	•
San Pablo Creek			•	•				•	•	•	•	•
Wildcat Creek				•				•	•	•	•	•
Marin County												
Abbotts Lagoon			•		•				•	•		•
Bolinas Lagoon			•		•				•	•		•
Corte Madera			•	•				•	•	•	•	•
Drakes Estero			•						•	•	•	•
Gallinas Creek		•	•	•				•	•	•	•	•
Limantour Estero			•		•				•	•		•
Corte Madera Ecological Reserve			•	•					•	•		•
Novato Creek		•	•	•		•		•	•	•	•	
Richardson Bay			•	•				•	•	•	•	•
Rodeo Lagoon			•		•				•	•		•
San Pedro		•	•	•			•	•		•	•	•
San Rafael Creek		•	•	•				•	•	•		•
Tomales Bay			•		•	•			•	•	•	•
Napa County												
Mare Island			•	•						•		•
Napa		•		•		•	•	•	•	•	•	
San Pablo Bay			•	•		•	•	•	•	•	•	•
San Mateo County												
Bair Island			•	•				•	•	•		•
Belmont Slough			•	•				•	•	•	•	•
Pescadero	•		•		•	•		•	•	•	•	•
Princeton		•	•						•	•		•
Redwood City Area				•				•	•	•		•
Santa Clara County												
South San Francisco Bay			•	•		•	•	•	•	•	•	•
Solano County												
Southhampton Bay			•	•				•	•	•	•	•
Suisun	•	•		•		•		•	•	•	•	•
White Slough			•	•		•		•	•	•	•	•
Sonoma County												
Petaluma		•		•		•	•	•	•	•	•	•

Table 4-1: Discharge Prohibitions

No.	It shall be prohibited to discharge:	Discussion
1	Any wastewater which has particular characteristics of concern to beneficial uses at any point at which the wastewater does not receive a minimum initial dilution of at least 10:1, or into any nontidal water, dead-end slough, similar confined waters, or any immediate tributaries thereof.	Waste discharges will contain some levels of pollutants regardless of treatment. This prohibition will require that these pollutants, when of concern to beneficial uses, be discharged away from areas such as nontidal waters and dead-end sloughs. This prohibition will (a) provide an added degree of protection from the continuous effects of waste discharge, (b) provide a buffer against the effects of abnormal discharges caused by temporary plant upsets or malfunctions, (c) minimize public contact with undiluted wastes, and (d) reduce the visual (aesthetic) impact of waste discharges.
2	Any wastewater which has particular characteristics of concern to beneficial uses to San Francisco Bay south of the Dumbarton Bridge.	This prohibition is consistent with the 1974 Bays & Estuaries Policy. This area is one that has experienced chronic water quality problems.
3	Any wastewater which has particular characteristics of concern to beneficial uses to Suisun Marsh during the dry weather period of the year. Local irrigation return water is excepted in quantities and qualities consistent with good irrigation practices.	The threat of high concentrations of toxicants, biostimulants, and oxygen-demanding substances in Suisun Marsh, an area of low assimilative capacity, great ecological sensitivity and value, and poor dispersion by tidal or freshwater flushing, necessitates such protection for the Marsh for the critical portion of the year when freshwater flows are nonexistent.
4	Any wastewater which has particular characteristics of concern to beneficial uses to Alameda Creek when no natural flow occurs.	The threat of dissolved solids, stable organics, and other pollutant accumulation in the groundwater of the basins recharged with waters of Alameda Creek is critical in the dry weather period when wastewater could account for much of the water percolating to the basin.
5	Any wastewater which has particular characteristics of concern to beneficial uses to Tomales Bay, Drakes Estero, Limantour Estero, Bolinas Lagoon, or Richardson Bay (between Sausalito Point and Peninsula Point).	Tomales Bay, Drakes Estero, and Limantour Estero are nearly pristine bodies of water and of great value for wildlife habitat and as recreational and scientific study areas. Bolinas Lagoon and Richardson Bay both have poor dispersion capability and low assimilative capacity. They have experienced high coliform, nutrient, and algal concentrations. This prohibition will provide protection for the intensive recreational beneficial uses of these water bodies.
6	All conservative toxic and deleterious substances, above those levels which can be achieved by a program acceptable to the Regional Board, to waters of the Basin.	The intent of the prohibition is to minimize the discharge of persistent toxicants into waters, thus protecting aquatic life and public water supplies. The prohibition recognizes that these substances can be most economically reduced at their source.

No.	It shall be prohibited to discharge:	Discussion
7	Rubbish, refuse, bark, sawdust, or other solid wastes into surface waters or at any place where they would contact or where they would be eventually transported to surface waters, including flood plain areas.	The prohibition is intended primarily to protect recreational uses, including boating and navigation. Floating rubbish can also impair suitability of waters for industrial cooling and other diversions by endangering pumps. This prohibition is in conformance with the Bays and Estuaries Policy.
8	. Floating oil or other floating materials from any activity in quantities sufficient to cause deleterious bottom deposits, turbidity or discoloration in surface waters.	The prohibition is intended to protect birds and other wildlife from the possible toxic effects of floating oil or oil deposits. Waterfowl and shorebirds in particular can be affected through coating of feathers and loss of thermal insulation. This prohibition is also intended to prevent visual nuisance that would be caused by floating oil or by its deposition on shore or on structures and to protect recreational uses which would be impaired by oil deposited on boats, other equipment, or persons.
9	Silt, sand, clay, or other earthen materials from any activity in quantities sufficient to cause deleterious bottom deposits, turbidity or discoloration in surface waters or to unreasonably affect or threaten to affect beneficial uses.	This is in conformance with the Bays and Estuaries Policy. The intent of this prohibition is to prevent damage to the aquatic biota by bottom deposits which can smother non-motile life forms, destroy spawning areas, and, if putrescible, can locally deplete dissolved oxygen and cause odors. The prohibition would also prevent discoloration and/or turbidity that can be caused by silt and earth. As one measure of compliance with this prohibition, design and maintenance of erosion and sediment control structures should comply with accepted engineering practices as identified in ABAG's *Manual of Standards for Erosion and Sediment Control Measures*. Turbidity or discoloration caused by dredging is covered by the Regional Board's policy on dredging (see section under nonpoint source control).
10	Sludges of municipal or industrial waste origin and sludge digester supernatant, centrate, or filtrate directly to surface waters without adequate treatment in conformance with waste discharge requirements.	The intent of this prohibition is to preclude a major potential source of bottom deposits, which could smother aquatic biota and cause localized dissolved oxygen depletion. Some sludges contain floatable material which would cause visual nuisance. Some industrial sludges contain persistent toxic matter. If discharged without adequate treatment, digester supernatant, centrate, and filtrate are generally septic and would cause odors, discoloration, and dissolved oxygen depletion.
11	Biocides of a persistent or cumulative form which have particular characteristics of concern to beneficial uses when applied where direct or indirect discharge to water is threatened except where net environmental benefit can be demonstrated to the satisfaction of the Regional Board. A management plan for the use and control of biocides in these cases must be approved by the Regional Board.	It is the intent of this prohibition to prevent, as much as practicable, the entrance into the aquatic environment of persistent and/or cumulative biocides (pesticides, herbicides, copper, etc.). This is necessary to minimize the toxic effects of these substances on the aquatic biota.

No.	It shall be prohibited to discharge:	Discussion
12	Radiological, chemical, or biological warfare agents or high level radioactive waste.	The intent of the prohibition is to protect human and aquatic life from the adverse effects of these materials.
13	Oil or any residuary product of petroleum to the waters of the state, except in accordance with waste discharge requirements or other provisions of Division 7, California Water Code.	Discharge of oil or residuary products of petroleum is also prohibited under the Fish and Game Code.
14	Sewage-bearing wastewater to individual leaching or percolation systems in the Stinson Beach area of Marin County, the Glen Ellen area of Sonoma County, and the Emerald Lake Hills and Oak Knoll Manor areas of San Mateo County, as specified in Regional Board Resolutions (Chapter 5) and sections in this chapter on groundwater protection and on-site wastewater systems.	The intent of this prohibition is to prevent degradation of groundwater from septic systems in these areas.
15	Raw sewage or any waste failing to meet waste discharge requirements to any waters of the Basin.	The intent of this prohibition is to protect the public and the aquatic environment from the effects of raw or inadequately treated waste discharges.
16	Waste that is not a sufficient distance from areas designated as being of special biological significance to assure maintenance of natural water quality conditions in these areas.	The intent of this prohibition is to protect the relatively pristine nature of these special areas.
17	Waste so as to alter the total dissolved solids or salinity of waters of the state to adversely affect beneficial uses, particularly fish migration and estuarine habitat.	The intent of this prohibition is to prohibit the discharge of excessively salty water to streams and the Bay-Delta system.
18	Sewage, whether treated or untreated, from any vessel into that portion of Richardson Bay bounded by the shore and by a line bearing 257 degrees from Peninsula Point to the shore at Sausalito, in Marin County.	The intent of this prohibition is to prevent high bacteriological counts in Richardson Bay due to significant sewage discharges from vessels.

Table 4-2: Effluent Limitations for Conventional Pollutants

(All units in MG/L, except as otherwise noted)

Parameters	30-Day Average	7-Day Average	Daily Maximum	Instan-taneous Limit	Seven-Sample Medium	Five-Sample Medium
Biochemical Oxygen Demand (BOD5)[a,b]	30	45				
Suspended Solids (SS)[a]	30	45				
85% removal of BOD5 and SS[a,c]						
Total Coliform Organisms[a,d] (in MPN/100ml)						
Shallow Water Discharge[e] (in immediate vicinity of public contact or shellfish harvesting)			240		2.2	
Deep Water Discharge			10,000			240
pH[f] (in pH units)						
Shallow Water Discharge				6.5-8.5		
Deep Water Discharge				6.0-9.0		
Residual Chlorine[f] (free chlorine plus chloramines)				0.0		
Settleable Matter[f,g] (in ml/l-hr)	0.1		0.2			
Oil & Grease[f]	10		20			

NOTES:

a. These effluent limitations apply to all sewage treatment facilities that discharge to inland surface waters and enclosed bays and estuaries. The Board may also apply some of these limitations selectively to certain other non-sewage discharges, but they will not be used to preempt Effluent Guideline Limitations established pursuant to Sections 301, 302, 304, or 306 of the federal Water Pollution Control Act, as amended. (Such Effluent Guideline Limitations are included in NPDES permits for particular industries.)

b. The federal regulation allows the parameter BOD to be substituted with carbonaceous BOD at levels that shall not exceed 25 mg/l as a 30-day average, nor 40 mg/l as a 7-day average.

c. The arithmetic mean of the biochemical oxygen demand (5-day, 20^{o}C) and suspended solids values, by weight, for effluent samples collected in any month shall not exceed 15 percent of the arithmetic mean of the respective values, by weight, for simultaneous influent samples.

d. (1) The Regional Board may consider substituting total coliform organisms limitations with fecal coliform organisms limitations provided that it can be conclusively demonstrated through a program approved by the Regional Board that such substitution will not result in unacceptable adverse impacts on the beneficial uses of the receiving water.
(2) The Regional Board may consider establishing less stringent requirements for any discharges during wet weather.

e. Exceptions to these requirements may be granted by the Regional Board where it is demonstrated that beneficial uses will not be compromised by such an exception. Discharges receiving such exceptions shall not exceed a five-sample median of 23 MPN/100 ml nor a maximum of 240 MPN/100 ml during dry weather.

f. These effluent limitations apply to all treatment facilities.

g. Discharges from sedimentation and similar cases should generally not contain more than 1.0 ml/l-hr of settleable matter. Design and maintenance of erosion and sediment control structures shall comply with accepted engineering practices as identified in the Association of Bay Area Government's *Manual of Standards for Erosion and Sediment Control Measures*.

TABLE 4-2A EFFLUENT LIMITATIONS FOR BACTERIOLOGICAL INDICATORS

(ALL UNITS IN MPN/100ml)

PARAMETERS:	DAILY MAXIMUM	SEVEN SAMPLE MEDIAN	5 SAMPLE MEDIAN OR GEOMETRIC MEAN
Enterococcus[a,b]			35 (as geometric mean)
Total Coliform Organisms [b,c]			
Shallow Water Discharge [d] (in immediate vicinity of public contact or shellfish harvesting)	240	2.2	
Deep Water Discharge[e]	10,000		240 (as median)

NOTES:

a. This water quality-based effluent limitation shall be implemented as a geometric mean of a minimum of 5 effluent samples spaced over a calendar month. Fewer samples may be used on a case-by-case basis if allowed in the waste discharge requirements. Equivalent test results based on other analytical methods applicable to enterococcus approved in 40 CFR 136.3(a) are acceptable.

b. For discharges into marine and estuarine receiving waters with the water contact recreation beneficial use, the Water Board will implement the enterococcus effluent limitation. For such discharges, on a case-by-case basis, the Water Board may implement the total coliform effluent limitation in place of the enterococcus effluent limitation. This may occur, for example, when wastewater treatment plants are required by the Water Board or another agency to monitor routinely for total coliform (e.g., for recycled/reclaimed water).

   For discharges to receiving waters with the shellfish harvesting beneficial use, or to receiving water designated as freshwater, the Water Board will implement the total coliform effluent limitations.

   For intermittent discharges that occur only during wet weather, the Water Board will implement the total coliform maximum daily effluent limitation.

   For combined sewer overflows, notwithstanding any other provisions of this plan, discharges from the City of San Francisco's combined sewer system are subject to the U.S. EPA's Combined Sewer Overflow Policy.

   Furthermore, the Water Board may apply these limitations selectively to non-sewage discharges, but these limitations shall not preempt Effluent Guideline Limitations established pursuant to Sections 301, 302, 304, or 306 of the federal Water Pollution Control Act, as amended.

c. (1) The Water Board may consider substituting total coliform organisms limitations with fecal coliform organisms limitations provided that it can be conclusively demonstrated through a program approved by the Water Board that such substitution will not result in unacceptable adverse impacts on the beneficial uses of the receiving water.
   (2) The Water Board may consider establishing less stringent requirements for any discharges during wet weather.

d. The Water Board may grant exceptions to these requirements where it is demonstrated that beneficial uses will not be compromised by such an exception. Discharges receiving such exceptions shall not exceed a five-sample median of 23 MPN/100 ml nor a maximum of 240 MPN/100 ml during dry weather.

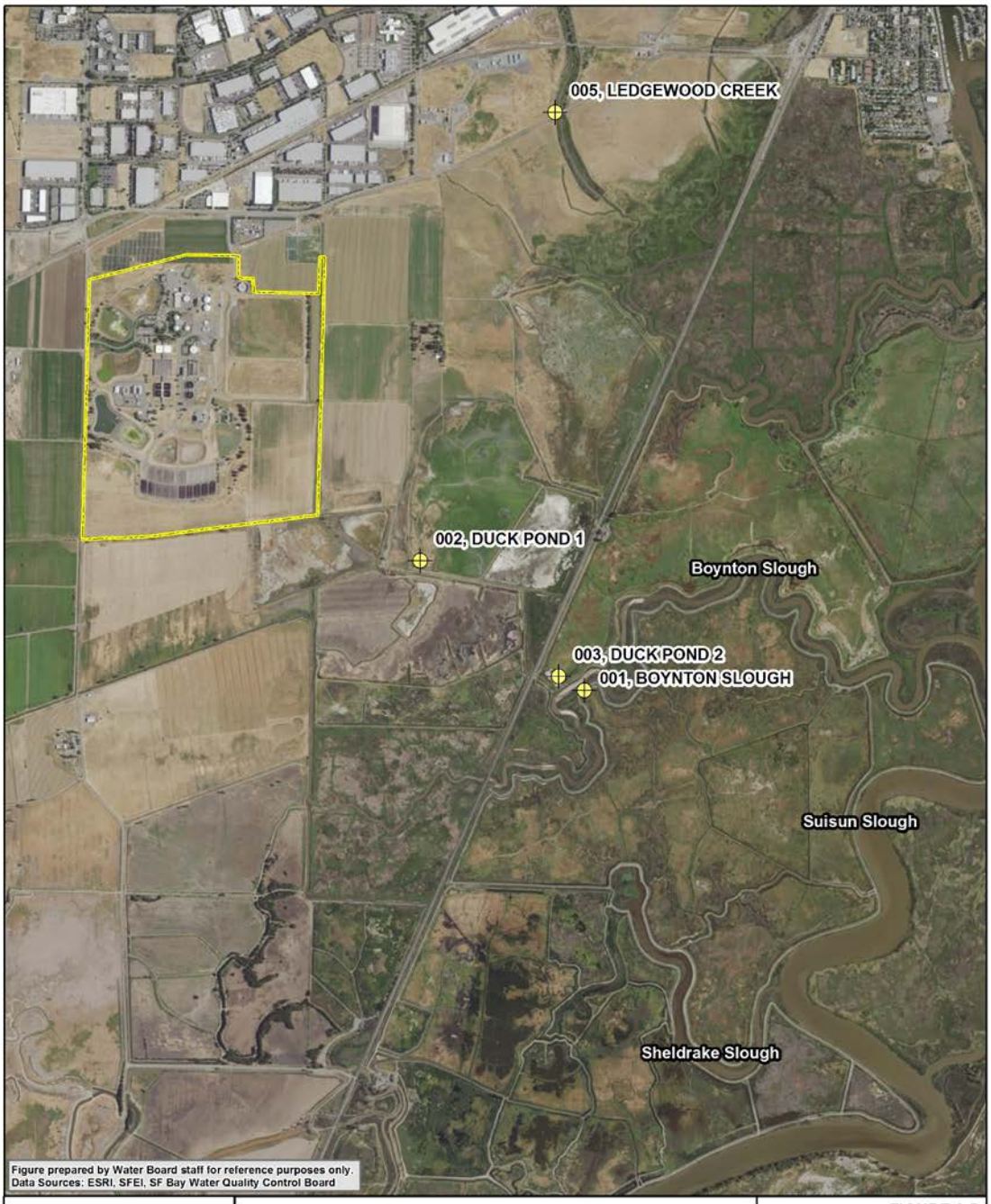
e. The deep water discharge total coliform effluent limitation is a water quality-based effluent limitation.

APPENDIX D: FIGURES 2.1 THROUGH 2.8 LOCATIONS OF CASE STUDIES


NAPA-SONOMA MARSH
ELLIS CREEK
SUISUN MARSH
Petaluma River
Grizzly Bay
San Pablo Bay
Napa River
BEL MARIN KEYS MARSH
Suisun Bay
Carquinez Strait
MOORHEN MARSH
San Francisco Bay
Renzel Marsh in Palo Alto is not shown.
Figure prepared by Water Board staff for reference purposes only.
NPDES denotes National Pollutant Discharge Elimination System
Data Sources: ESRI, SF Bay Water Quality Control Board
Coordinate System: GCS_North_American_1983
Projection: NAD_1983_California_Teale_Albers
South San Francisco Bay
HAYWARD MARSH
LEGEND
NPDES Case Study Site
SAN FRANCISCO BAY REGIONAL
WATER QUALITY CONTROL BOARD
NPDES PERMIT CASE STUDIES
FIGURE 2.1
0 2.5 5
Miles
N
1 in = 5 miles
April 2017


Marsh Inlet
E-1
Basin 1
Basin 3A
2AE
Basin 2A
Basin 3B
E-3
2BE
Basin 2B
San Francisco Bay
State Highway 92
San Mateo
HAYWARD MARSH
Eden Landing
Ecological Preserve
ALVARADO WWTP
0 0.75 1.5 Miles
Figure prepared by Water Board staff for reference purposes only.
Location of outfall E-3 is approximate.
Data Sources: ESRI, SFEI, SF Bay Water Quality Control Board
Document Path: C:\Users\meguntert\Desktop\SFEP\GIS\EPA Wetland Grant\Hayward_Marsh.mxd
LEGEND
NPDES Outfall
Hayward Marsh
SAN FRANCISCO BAY REGIONAL
WATER QUALITY CONTROL BOARD
NPDES PERMIT CASE STUDIES
HAYWARD MARSH
FIGURE 2.3
0 500 1,000
Feet
1 in = 1,000 feet
N
April 2017


State Highway 116
Petaluma River
001
Figure prepared by Water Board staff for reference purposes only.
Data Sources: ESRI, SF Bay Water Quality Control Board, SFEI
NPDES Outfall
Ellis Creek WRF
Treatment Pond
Treatment Wetland
SAN FRANCISCO BAY REGIONAL
WATER QUALITY CONTROL BOARD
NPDES PERMIT CASE STUDIES
ELLIS CREEK
FIGURE 2.4
0 500 1,000
Feet
1 in = 1,000 feet
N
April 2017
Document Path: C:\Users\meguntert\Desktop\SFEP\GIS\EPA Wetland Grant\Ellis_Creek.mxd


005, LEDGEWOOD CREEK
002, DUCK POND 1
Boynton Slough
003, DUCK POND 2
001, BOYNTON SLOUGH
Suisun Slough
Sheldrake Slough
Figure prepared by Water Board staff for reference purposes only.
Data Sources: ESRI, SFEI, SF Bay Water Quality Control Board
LEGEND
NPDES Outfall
Fairfield-Suisun SD WWTP
SAN FRANCISCO BAY REGIONAL
WATER QUALITY CONTROL BOARD
NPDES PERMIT CASE STUDIES
SUISUN MARSH
FIGURE 2.5
0 1,000 2,000
Feet
1 in = 2,000 feet
N
April 2017
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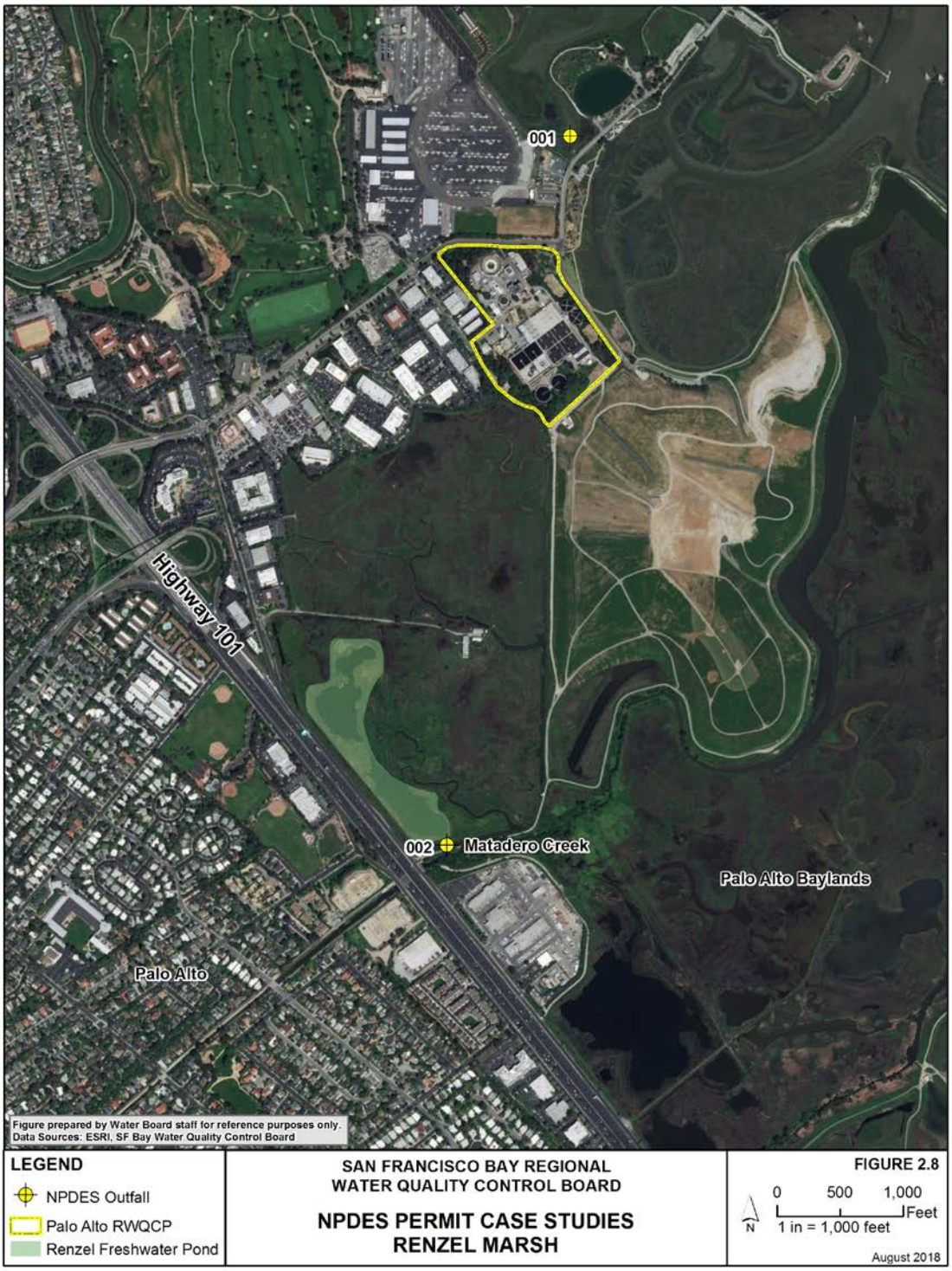
State Highway 12
001, SCHELL SLOUGH
Recycled Water Storage Pond R1
Recycled Water Storage Pond R2
005, MANAGEMENT UNIT 1
004, MANAGEMENT UNIT 3
007, FLY BAY
006, NAPA-SONOMA SALT MARSH
State Highway 121
Napa Slough
Napa River
Skaggs Island
Figure prepared by Water Board staff for reference purposes only.
Data Sources: ESRI, SFEI, SF Bay Water Quality Control Board
LEGEND
NPDES Outfall
Sonoma Valley SD WWTP
SAN FRANCISCO BAY REGIONAL
WATER QUALITY CONTROL BOARD
NPDES PERMIT CASE STUDIES
NAPA-SONOMA MARSH
FIGURE 2.6
0 0.5 1 Miles
N
1 in = 1 miles
April 2017


Land Disposal Site
Sludge Lagoons
State Highway 37
United States Highway 101
002, Proposed -Bel Marin Keys Marsh to San Pablo Bay
001, San Pablo Bay
San Pablo Bay
Figure prepared by Water Board staff for reference purposes only.
Data Sources: ESRI, SF Bay Water Quality Control Board
LEGEND
NPDES Outfall
Novato SD WWTP
Bel Marin Keys Marsh
SAN FRANCISCO BAY REGIONAL
WATER QUALITY CONTROL BOARD
NPDES PERMIT CASE STUDIES
BEL MARIN KEYS MARSH
FIGURE 2.7
0 1,500 3,000
Feet
1 in = 3,000 feet
N
April 2017


001
Highway 101
002
Matadero Creek
Palo Alto Baylands
Palo Alto
Figure prepared by Water Board staff for reference purposes only.
Data Sources: ESRI, SF Bay Water Quality Control Board
LEGEND
NPDES Outfall
Palo Alto RWQCP
Renzel Freshwater Pond
SAN FRANCISCO BAY REGIONAL
WATER QUALITY CONTROL BOARD
NPDES PERMIT CASE STUDIES
RENZEL MARSH
FIGURE 2.8
0 500 1,000
Feet
N
1 in = 1,000 feet
August 2018