Kennedy Jenks

Final Report

PureWater Peninsula Project

May 2024

Prepared for:

San Francisco Water Power Sewer
SVCW Silicon Valley Clean Water
BAWSCA Bay Area Water Supply & Conservation Agency
Redwood City California Founded 1867
City of San Mateo California
City of Foster City Incorporated 1971
California Water Service
MPWD

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FINAL
PureWater Peninsula Project
Basis of Design Report (BODR)

May 2024

Prepared for

Bay Area Water Supply and Conservation Agency
California Water Service Company
City of Redwood City
City of San Mateo
Mid-Peninsula Water District
San Francisco Public Utilities Commission
Silicon Valley Clean Water

KJ Project No. 2268026*00

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Frequently Used Acronyms and Abbreviations

AAR	Alternatives Analysis Report
ACEE	Association for the Advancement of Cost Engineering
ADWF	average dry weather flow
AF	acre-feet
AFY	acre-feet per year
AOP	advanced oxidation process
AWPF	advanced water purification facility
BAC	biological activated carbon
BAF	biologically active filtration
BAWSCA	Bay Area Water Supply and Conservation Agency
BDPL	Bay Division Pipeline

BEM	Bureau of Environmental Management
BODR	Basis of Design Report
BPS	Booster Pump Station
$CaCO_3$	calcium carbonate
Cal Water	California Water Service
CBOD	carbonaceous biochemical oxygen demand
CCF	one-hundred cubic feet
CCP	Critical Control Point
CCPP	calcium carbonate precipitation potential
CCR	California Code of Regulations
CCWD	Coastside County Water District
CDPH	California Department of Public Health
CEC	chemicals of emerging concern
CEQA	California Environmental Quality Act
Cl_2	free chlorine
CO_2	carbon dioxide
CSBRT	Crystal Springs Balancing Reservoir Tunnel
CSPS	Crystal Springs Pump Station
CSR	Crystal Spring Reservoir
CWA	Clean Water Act
DBP	disinfection by-product
DDW	(California) State Board Division of Drinking Water, also see SBDDW
dia	diameter
DiPRRA	direct potable reuse responsible agency
DPR	direct potable reuse
DPS	distribution pump station
DSOD	Division of Safety of Dams
DWDS	Drinking Water Distribution System(s)
EIR	Environmental Impact Report
EPA	United States Environmental Protection Agency
EQ	equalization
ESA	Endangered Species Act
FAT	full advanced treatment
FEMA	Federal Emergency Management Agency
FEPS	Final Effluent Pump Station
fps	feet per second
FRT	failure response time

ft	feet
gfd	gallons/ft^2/day
GIS	geographic information system
gpm	gallons per minute
GRR	Groundwater Replenishment Reuse
HDD	horizontal directional drilling
HDPE	high density polyethylene
HDT	hydraulic residence time
HGL	hydraulic grade line
HHLSM	Hetch Hetchy Local Simulation Model
HP	horsepower
HWL	high water level
Hwy	highway
I&C	instrumentation and controls
IAP	Independent Advisory Panel
IPaC	Information for Planning and Consultation
IPR	indirect potable reuse
JPA	Joint Powers Authority
kV	kilovolt
LF	lineal feet
LRV	log removal value
LSI	Langelier Saturation Index
M	million
Max	maximum
MBR	membrane bioreactor
MCL	maximum contaminant level
MF	microfiltration
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
MND	Mitigated Negative Declaration
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPWD	Mid-Peninsula Water District
MVA	mega volt-amperes
MW	megawatt
MWD	Municipal Water District
NDMA	N-nitrosodimethylamine

NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NL	notification level
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit
O&M	Operations and Maintenance
O_3	ozone
PBR	Pulgas Balancing Reservoir
PCB	polychlorinated biphenyls
PFAS	per- and polyfluoroalkyl substances
PG&E	Pacific Gas and Electric
PLC	programmable logic controller
POC	point(s) of connection
PP	Priority Toxic Pollutants
ppd	pounds per day
PPS	Pulgas Pump Station
PREP	Potable Reuse Exploratory Plan
Project	PureWater Peninsula Project
PRV	pressure reducing valve
psi	pounds per square inch
Pulgas DF	Pulgas Dechloramination Facilities
PVC	polyvinyl chloride
PVDF	polyvinylidene fluoride
PWPS	Purified Water Pump Station
PZ	pressure zone
RESCU	Regional Environmental Sewer Conveyance Upgrade
ResWA	Reservoir Water Augmentation
RIO	remote input/output
	reverse osmosis
ROM	reservoir operations model
ROW	right-of-way
ROWD	Report of Waste Discharge
RSB	Redwood Shores Bay Front
RW	recycled water
RWA	Raw Water Augmentation
RWC	City of Redwood City

RWQCB	Regional Water Quality Control Board or Regional Board
s.u.	standard unit
San Mateo	City of San Mateo
SBDDW	(California) State Board Division of Drinking Water, also see DDW
SCADA	supervisory control and data acquisition
SF Basin plan	Water Quality Control Plan for the San Francisco Bay Basin (SF Bay Basin Plan).
SF Bay	San Francisco Bay
SF Peninsula	San Francisco Peninsula
SFPUC	San Francisco Public Utilities Commission
SFRWS	San Francisco Regional Water System (San Francisco Public Utilities Commission Hetch H System)
SIS	System Impact Study
SMCL	secondary maximum contaminant level
SOP	Standard Operating Procedures
SVCW	Silicon Valley Clean Water
SVWTP	Sunol Valley Water Treatment Plant
SWA	Surface Water Augmentation
SWRCB	State Water Resources Control Board or State Board
SWTR	Surface Water Treatment Rule
TDH	total dynamic head
TDS	total dissolved solids
TM	Technical Memorandum
TMDL	total maximum daily load
TN	total nitrogen
TOC	total organic carbon
TP	total phosphorus
TSS	total suspended solids
TWA	Treated Water Augmentation
UF	ultrafiltration
ug/L	micrograms per liter
USBR	US Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
UV	ultraviolet
V	volts
V/G/C	Virus, *Giardia*, and *Cryptosporidium*
WDR	Waste Discharge Requirement
WIFIA	Water Infrastructure Finance and Innovation Act
WQ	Water Quality

WRF	The Water Research Foundation
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant
YBM	Young bay mud

Acknowledgements

This document has been prepared by Kennedy/Jenks Consultants, Inc. in close collaboration with the **PureWater Peninsula** Parties.

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Executive Summary

ES.1 Project Overview

The **PureWater Peninsula Project** is a regional effort to resolve multiple water supply and wastewater issues, while realizing the benefits of shared infrastructure, asset recovery, economies of scale and a more competitive strategy to pursue funding. The study area includes the San Francisco Mid-Peninsula focused on the service areas and facilities of the following entities, collectively referred to as the PureWater Peninsula Parties:

- San Francisco Public Utilities Commission (SFPUC)
- Silicon Valley Clean Water (SVCW)
- City of San Mateo (San Mateo)
- Bay Area Water Supply and Conservation Agency (BAWSCA)
- California Water Service (Cal Water)
- City of Redwood City (RWC)
- Mid-Peninsula Water District (MPWD)

The PureWater Peninsula Project is a potable reuse project that would create a new source of local sustainable water supply using state-of-the-art technology to purify tertiary effluent from SVCW and the San Mateo Wastewater Treatment Plant (WWTP).

The project would be implemented in two phases:

- **Phase 1** – Indirect Potable Reuse (IPR) via Reservoir Water Augmentation (ResWA) of up to 6 million gallons per day (mgd) of purified water at Crystal Springs Reservoir (CSR).
- **Phase 2** – Direct Potable Reuse (DPR) via Treated Water Augmentation (TWA). Expansion of the advanced water purification facility (AWPF) to produce an additional 6 mgd of purified water, for a total of up to 12 mgd. Up to 6-8 mgd would be available for ResWA at CSR, and 4-6 mgd would be available for TWA to local drinking water distribution systems.

The PureWater Peninsula Project would include:

- **Source water** derived from a blend of up to 8 mgd of tertiary effluent from SVCW and up to 9 mgd of tertiary effluent from the San Mateo WWTP to produce up to 12 mgd of purified water. Additional available tertiary effluent may be used for dilution of reverse osmosis (RO) concentrate, if needed. Future studies would need to further analyze the current water quality in CSR, the expected water quality within the CSR after the addition of various flows of AWPF purified water, and potential mixing zone effects.
- Construction of a new **AWPF** to treat AWPF source water to meet regulatory requirements for IPR in Phase 1 and DPR for the Phase 2 expansion.
- **Conveyance infrastructure** to deliver tertiary effluent to the new AWPF, purified water to the place of use, and brine for discharge via the SVCW outfall.

- A point of connection to SFPUC's **Pulgas Dechloramination Facility (Pulgas DF)**, which is used to manage and control water flow to SFPUC customers on the Peninsula and in the City of San Francisco. The Pulgas DF provides dechloramination or 2ichlorination of all flows prior to CSR augmentation.
- Multiple points of connection to existing tanks and transmission pipelines to deliver purified water to RWC, Cal Water and/or the MPWD **drinking water distribution systems (DWDS).**

The PureWater Peninsula Project concept is depicted in Figure ES-1.

Figure ES-1: PureWater Peninsula Project Concept

Under a separate contract, SFPUC is concurrently exploring DPR-only project alternatives, which would also be considered a PureWater Peninsula Project. It is anticipated that a future Alternatives Analysis Report (AAR) would be prepared to evaluate the preferred approach to implement the PureWater Peninsula Project. This Basis of Design Report (BODR) refers to the hybrid IPR/DPR approach as "PureWater Peninsula Project" or "Project".

The PureWater Peninsula Parties embarked on the project with an objective to identify opportunities to develop new local drought-resilient water supplies to:

1. Increase local water supply on the San Francisco Peninsula to enhance reliability and resiliency
2. Reduce discharge to the San Francisco Bay – helping communities use locally treated water more efficiently and prevent water from becoming a lost resource.
3. Create a multi-agency project with multiple economic, environmental, and social benefits.

Institutional Agreements

The PureWater Peninsula Parties have the required functional and legal capacity to finance and deliver the Project; however, they have not yet developed the partnerships and agreements to define ownership cost sharing and roles and responsibilities. The PureWater Peninsula Parties are committed to continuing to work together to define an institutional arrangement and cost-sharing structure to lead a mutually beneficial regional project.

Regulatory Compliance

The production, discharge, distribution, and potable use of recycled water are subject to federal, state, and local regulations with the primary objective of protecting public health.

Purified water produced by the AWPF would meet all ResWA and TWA regulatory requirements and would be protective of the environment and public health. A Title 22 Engineering Report would be developed for the Project, which would describe the PureWater Peninsula Parties' plan for compliance with the CCR Title 22 Water Recycling Criteria, including ResWA and the recently adopted TWA regulations and to request approval from the California State Board Division of Drinking Water (DDW) for the Project. A monitoring plan would also be developed by the direct potable reuse responsible agency (DiPRRA) to identify all entities who have roles and responsibilities to monitor and identify constituents in the AWPF produced water, CSR, and SVCW/San Mateo WWTP effluent, and to define the procedure and frequency for monitoring and analysis for each location as required by the DPR regulations. A separate monitoring plan for SVCW and San Mateo WWTP effluent would be developed to define the frequency for monitoring and analysis for each location as required for process engineering to optimize operation of the AWPF.

Wastewater generated by the AWPF would be discharged through SVCW's outfall and would adhere to regulatory requirements for discharges to the San Francisco Bay provided in existing and future Waste Discharge Requirements (WDRs) and National Pollutant Discharge Elimination System (NPDES) permits.

ResWA to CSR would also need to meet the requirements set forth in the Water Quality Control Plan for the San Francisco Bay Basin (SF Basin Plan). An additional objective is for the augmented purified water to match or be compatible with background water quality concentrations in CSR. Compliance with California Toxics Rule limits for inland surface waters (e.g., N-Nitrosodimethylamine (NDMA), trihalomethane) would also be required.

Regulatory requirements are further described in **Section 1** and detailed in **Appendix A: Potable Reuse Regulatory Requirements**.

ES.2 Project Definition

The PureWater Peninsula Program is located in the Bay Area of Northern California. This BODR assumes a hybrid IPR/DPR approach, which includes the potential facilities illustrated in Figure ES-2 and listed in Table ES-1. Variations of the PureWater Peninsula Project are being explored by SFPUC under a separate contract, which include some, but not all of the facilities described in this BODR.

Figure ES-2: PureWater Peninsula Project Vicinity

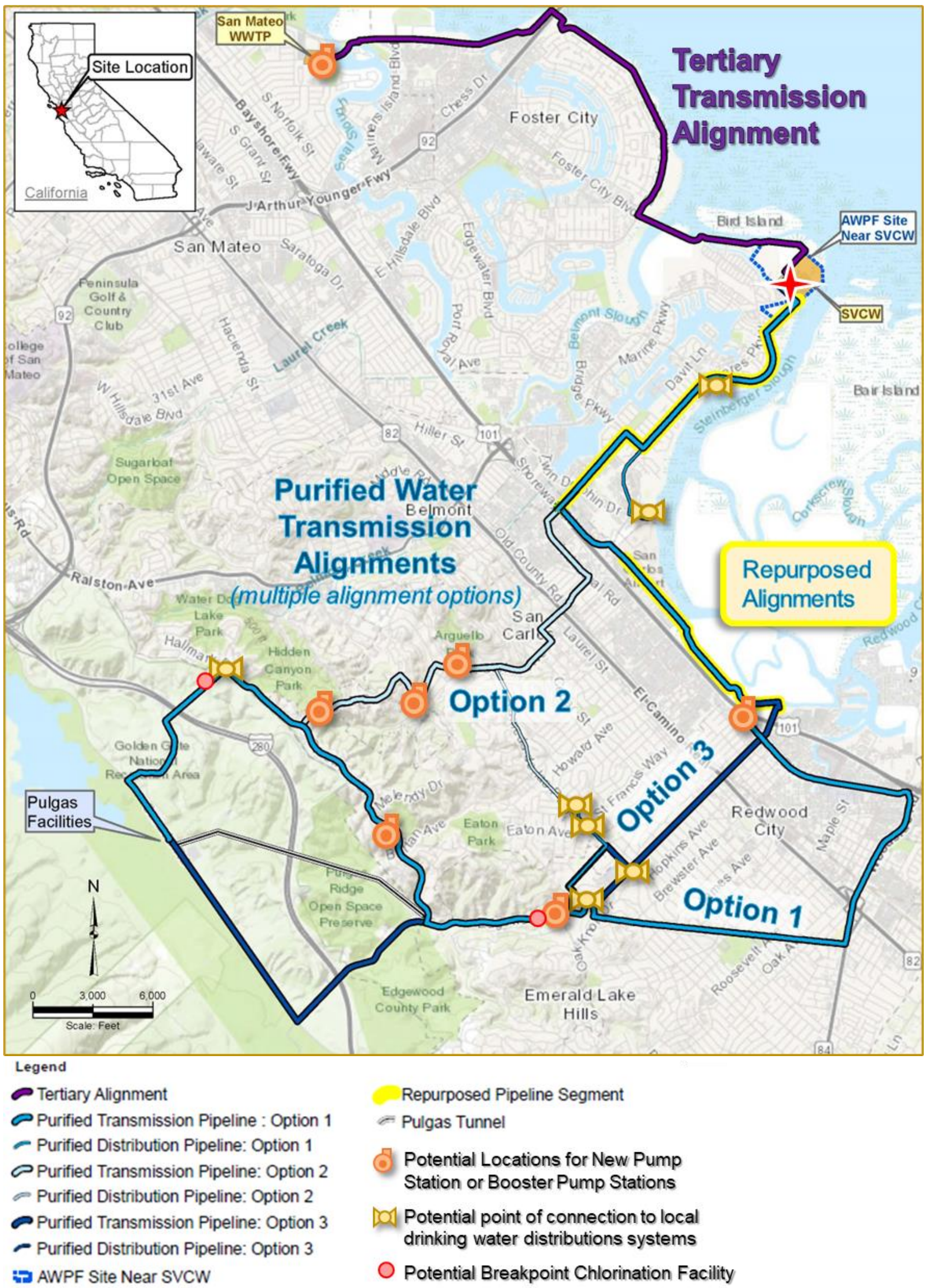
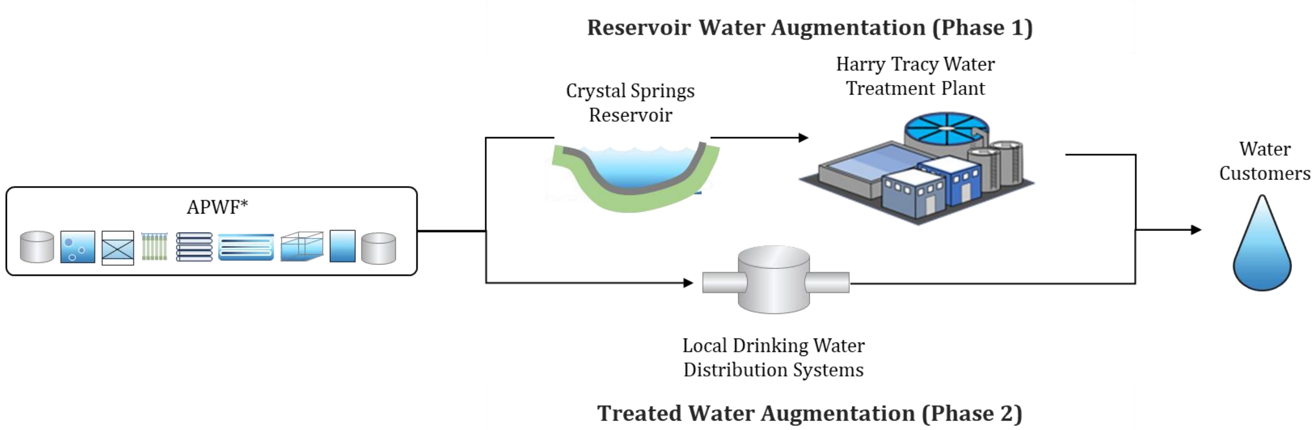


Table ES-1: PureWater Peninsula Project Facilities (IPR/DPR Hybrid Project)

	Phase 1 – IPR (6 mgd)	Phase 2 – IPR and DPR (12 mgd)
Treatment Facilities	• 6 mgd capacity AWPF located near SVCW; water treated to TWA standards. • Associated chemical feed systems, wet wells, inter-process pumps, and other appurtenances.	• Expand unit processes and appurtenances to 12 mgd treatment capacity; water treated to TWA standards. • Breakpoint chlorination facility to provide chemical dosing along the purified transmission pipeline (downstream of final DWDS connection, before Pulgas DF).
Pipelines	• **San Mateo Tertiary Effluent**: ~6 miles of 24"-diameter (dia) source water pipeline from San Mateo WWTP to AWPF sized for up to 9 mgd source water flow. • **SVCW Tertiary Effluent**: <1 mile of 20"-dia source water pipeline from SVCW to AWPF sized for up to 8 mgd source water flow. • **Purified Water to Crystal Springs Reservoir:** 12-16 miles of 24 -dia purified water transmission pipeline from AWPF to CSR, with provisions for future connections to local drinking water distribution systems. The pipeline would be sized for Phase 2 flows of 12 mgd, with up to 8 mgd of that purified water flow reaching CSR in Phase 2. • **AWPF Brine Disposal:** <1 mile of 12"-dia brine pipeline from AWPF to the existing SVCW outfall.	• **Treated Water Distribution System Connections:** ○ 6"-to 18"-dia distribution pipelines from purified water transmission pipeline to potable water system tie-ins (pipe lengths vary by alternative). ○ Potable water system tie-ins to local drinking water distribution system (RWC, Cal Water, and MPWD).
Storage	• **Equalization storage tank (EQ)** for source water, prior to AWPF with potential to convert one of RWC's Recycled Water storage tanks at SVCW for use as equalization. • **Purified water storage tank** for purified water prior to conveyance to CSR.	• Expand source water equalization storage tank capacity for the 12 mgd treatment capacity.
Pump Stations	• **San Mateo Tertiary Pump Station:** convey AWPF source water (tertiary effluent) from San Mateo to the AWPF. • **SVCW Tertiary Pump Station:** convey AWPF source water (tertiary effluent) from SVCW to the AWPF • **RO Concentrate Pump Station:** Convey brine from the AWPF to SVCW Outfall connection. • **Purified Water Pump Station at AWPF:** Convey purified water from AWPF to CSR/DWDS connections. • **Purified Water Booster Pump Stations (BPSs):** Several intermediate BPSs would be required to convey purified water from the AWPF to CSR/DWDS connections.	• Expand number of pumps at each pump station to meet the 12 mgd treatment capacity.
Pulgas	• Connect to the concrete 11' weir at Pulgas DF prior to augmentation into CSR. • Utilize the existing Pulgas Dechlorination operations and Discharge Channel to augment CSR.	No additional modifications.

The PureWater Peninsula Project would use purified water first for ResWA, with a planned expansion for ResWA and TWA in Phase 2, as illustrated in Figure ES-3 and summarized below.

Figure ES-3: PureWater Peninsula Phased Potable Reuse Concept



* Equalization, Ozone ($^{+}O_3$), Biologically Activated Carbon (BAC), Microfiltration (MF), Reverse Osmosis (RO), Ultraviolet Light (UV), Advanced Oxidation Process (AOP), Free Chlorine (Cl^2), Stabilization/Equalization

Reservoir Water Augmentation (ResWA)

ResWA means the planned placement of purified water into a raw surface water reservoir used as a source of domestic drinking water supply for a public water system, as defined in Section 116275 of the Health and Safety Code, or into a constructed system conveying water to such a reservoir. (Previously referred to as IPR via surface water augmentation (SWA)).

In Phase 1, tertiary effluent from SVCW and San Mateo WWTP would be treated at the AWPF and conveyed to CSR where it would be combined with surface water in the reservoir for ResWA. After the required storage retention, water would be transported downstream to SFPUC's Harry Tracy Water Treatment Plant (WTP) for treatment and conveyed to drinking water users through the existing potable water distribution system.

Treated Water Augmentation (TWA)

TWA means the planned placement of advanced purified water directly into a purified water distribution system of a public water system, as defined in Section 116275 of the Health and Safety Code. (Previously referred to as DPR into a potable water supply distribution system downstream of a drinking water treatment plant).

Phase 2 would include an expansion of the AWPF capacity, treating additional tertiary effluent from SVCW and San Mateo WWTP, for both ResWA and TWA. New connections for TWA would be made along the purified water transmission line (constructed in Phase 1) to convey purified water directly to the existing DWDSs operated by Cal Water, RWC, and/or MPWD. The purified water would augment the drinking water in existing storage tanks or transmission pipelines. There would be no additional downstream water treatment, and the purified water would blend with the San Francisco Regional Water System (SFRWS) and local supplies as it is conveyed to drinking water users through the existing potable water distribution system. Potential tie-in locations would consist of potable water storage tanks, distribution lines, and transmission lines owned and operated by RWC, Cal Water and the MPWD. ResWA would continue to be performed in Phase 2, with up to 8 mgd going to CSR via Pulgas.

Project Flows

Anticipated project flows are illustrated in Figure ES-4 with detailed tables provided in **Section 2**. Phase 1 would produce 6 mgd for ResWA at CSR and the additional 6 mgd produced in Phase 2 would feed the treated drinking water distribution systems with up to 8 mgd of purified water being delivered to CSR. RO concentrate would be discharged to the existing SVCW outfall. Other AWPF waste flows, including MF and biologically active filtration (BAF) backwash water, neutralized chemical waste from membrane chemical cleanings, and drains would be returned to the SVCW headworks for treatment of suspended solids through primary and secondary treatment processes. These other AWFP waste flows would make up less than 15% of the wastewater flows entering the SVCW headworks, with 0.6 mgd estimated for Phase 1 and 1.1 mgd estimated for Phase 2. The PureWater Peninsula Project flow diagram is shown in Figure ES-4.

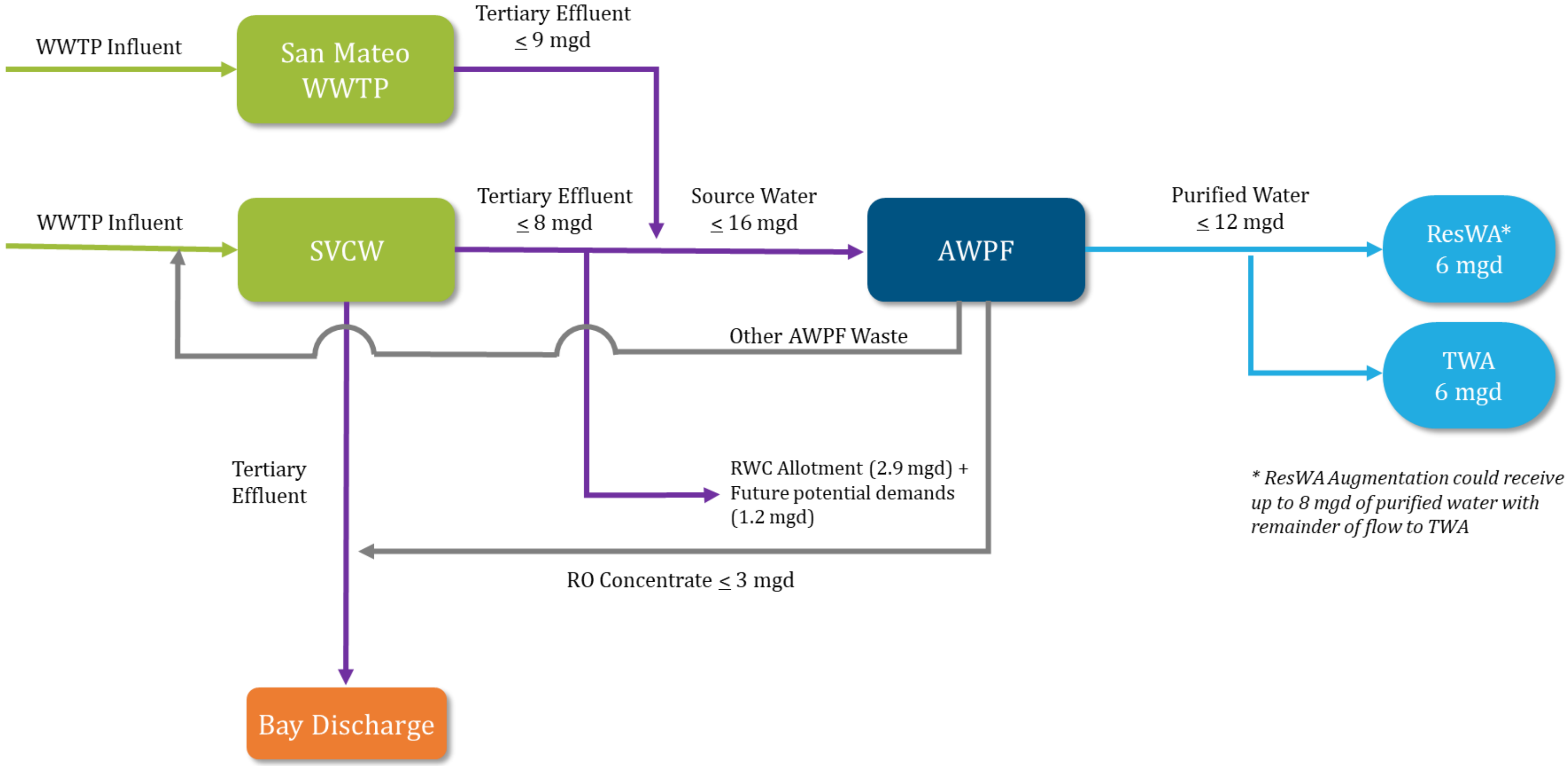
Project Water Quality

The overall water quality goals for the PureWater Peninsula Project are to meet or exceed:

- ✓ DDW regulatory requirements for ResWA and TWA
- ✓ SF Bay Discharge requirements via the SVCW's outfall existing and future NPDES permit
- ✓ SF Basin Plan requirements for CSR
- ✓ California Toxics Rule limits for inland surface waters
- ✓ Ambient water quality in CSR without causing degradation
- ✓ SVCW Treatment Process not negatively impacted by return flows

The project would be designed to meet DPR log removal requirements starting in Phase 1 to demonstrate full treatment capability before buildout and implementation of Phase 2. Early demonstration of treatment ability and documentation of the water quality and pathogen reduction performance of the AWPF during Phase 1 is anticipated to help streamline the future permitting process even though treated drinking water connections would be not made until Phase 2.

Figure ES-4: PureWater Peninsula Project Flow Diagram



** ResWA Augmentation could receive up to 8 mgd of purified water with remainder of flow to TWA*

As discussed earlier, augmentation of CSR would also need to meet local SF Basin Plan and NPDES requirements and aim to meet or exceed background water quality concentrations in the reservoir. For CSR, this includes un-ionized ammonia concentrations controlled by the SF Basin Plan limits and phosphorus concentrations controlled by the background concentrations in Upper CSR. Compliance with California Toxics Rule limits for inland surface waters (e.g., NDMA, trihalomethane) would also be required. In general, the purified water will be treated to the TWA standards for both ResWA and TWA uses in both Phase 1 and 2 which ensures that both standards are met. The expected purified water quality and compatibility with the existing water quality would need to be analyzed further as part of future modeling/piloting efforts. Annual variations in CSR water chemistry would also need to be considered.

The drinking water service areas for this project primarily receive water from the SFRWS, which consists of source water primarily from the Hetch Hetchy watershed (about 85%) blended with source water from local watersheds in the Alameda and San Mateo counties. Purified water stabilization would need to be adjusted to match SFPUC water quality as much as possible to match disinfection and meet customer aesthetic expectations, including taste and odor.

The RO concentrate, blended with remaining tertiary effluent, would need to meet existing and future regulations for discharge at the SVCW outfall to the San Francisco Bay, including nutrient load targets and WDRs for mercury and PCBs to comply with Total Maximum Daily Load (TMDL) requirements.

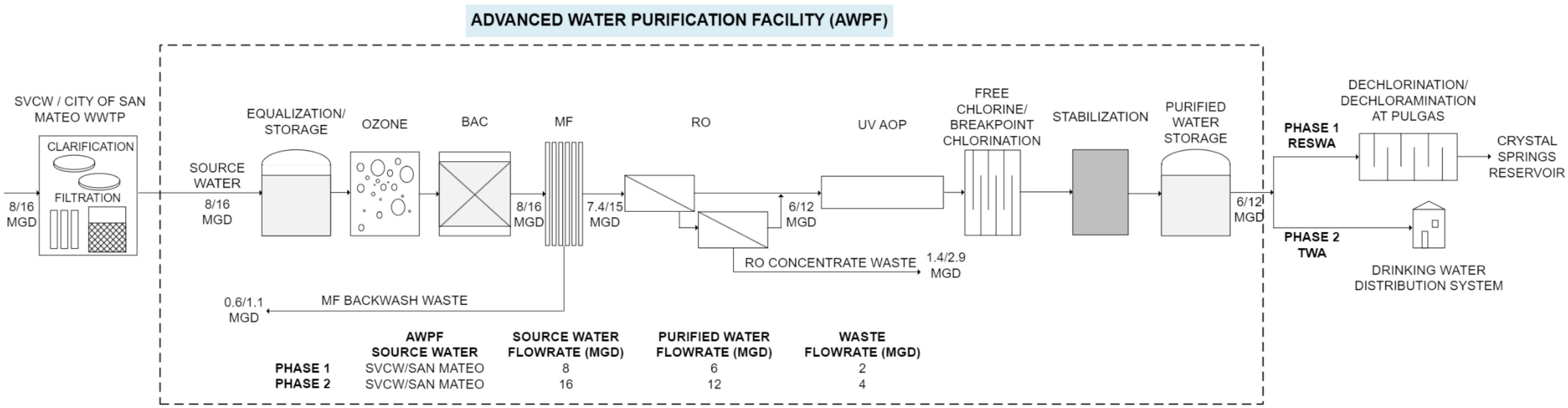
Detailed water quality tables are provided in **Section 2**. Water quality sampling of source water and receiving waters were not conducted as part of this study.

ES.3 AWPF Basis of Design

As part of Phase 1, a 6 mgd capacity APWF located near SVCW would treat to TWA standards, including ozone ($^{+}O_3$), biologically activated carbon (BAC), microfiltration (MF), reverse osmosis (RO), ultraviolet Light (UV), advanced oxidation process (AOP), free chlorine (Cl^2), unit processes and associated chemical feed systems, wet wells, inter-process pumps, stabilization/equalization and other appurtenances. Building facilities would be sized for future 12 mgd treatment capacity. While treated drinking water connections would be not made until Phase 2, early demonstration of treatment ability and documentation of the water quality and pathogen reduction performance of the AWPF during Phase 1 is anticipated to help streamline the future permitting process.

The treatment processes for the proposed AWPF were designed to achieve the project flow capacity and treatment objectives. A simplified process flow diagram of the AWPF is presented in **.** As part of Phase 2, the AWPF capacity would expand from 6 mgd to 12 mgd treatment capacity by expanding the O_3/BAC/MF/RO/UV/AOP unit processes and appurtenances and potable water system tie-ins would be implemented.

Figure ES-5: Proposed AWPF Treatment Process for ResWA and TWA



AWPF Operational Scenarios

Whether the PureWater Peninsula Project is delivering water for ResWA or TWA, the addition of a new source of supply to the SFRWS would either supplement or displace surface water that would otherwise be delivered to the San Francisco Peninsula (SF Peninsula). When there is available SFRWS storage capacity, during the dry summer months or drought years, PureWater Peninsula would augment the SFRWS supply. However, when the SFRWS storage capacity is full, typically during the wet season or wet years, water deliveries from PureWater Peninsula would displace surface water deliveries that would otherwise be delivered from the Hetch Hetchy Reservoir and the reservoir would need to spill the water downstream instead of storing and delivering the water to Bay Area customers. To avoid or minimize this undesirable release, the PureWater Peninsula Project would likely follow seasonal operational guidelines for production in wet years and wet periods, when additional supplies to the SFRWS are not needed. The AWPF seasonal operational scenarios discussed as part of this effort are summarized below. For planning and operational cost estimating purposes, the dry season is assumed to be May through October, and the wet season is assumed to be November through April. Once operational, the AWPF would be operated to meet forecasted system demands and available storage in local reservoirs, and actual production could vary year to year.

- **Seasonal Operational Scenario 1: Continuous AWPF Production** – during dry years the AWPF would continuously operate at the design capacity. Under this operational scenario, "spills" would be infrequent or minimal.
- **Seasonal Operational Scenario 2: Ramped Down AWPF Production –** during normal to wet years, the AWPF would operate at the design capacity during the summer months (May to October) and ramp down to as low as the minimum design flow during winter months (November to April), depending on available storage in the SFRWS. This scenario would allow for the AWPF to maintain purified water production and would avoid the operational complexity associated with a full plant shutdown. Under this operational scenario, a "spill" in the upcountry system could occur. AWPF operations staff would need to continuously coordinate with SFRWS operations to communicate if a full AWPF shutdown is necessary due to SFRWS Water Bank capacity. The AWPF would coordinate with AWPF source water providers, SVCW and San Mateo, to reduce deliveries as appropriate.
- **Seasonal Operational Scenario 3: Seasonal AWPF Shut Down –** during wet to extremely wet years, the AWPF would operate at full capacity during summer months (May to October), followed by a full plant shutdown period during the wet winter months (November to April). Full plant shutdown protocols would be developed during the design of the AWPF and would include an implementation schedule for AWPF operations staff to follow.

The overall operational scheme for the AWPF would be managed in close coordination with the SFRWS operations team, AWPF source water providers (SVCW and San Mateo), as well as local water purveyors. The quantity of purified water produced would be influenced by hydrologic conditions, available storage in the SFRWS Water Bank, ability to maintain seasonal target elevations in the CSR, and forecasted local demands. These would be further refined as part of future design efforts and through development of operational plans for the project.

AWPF Process Descriptions and Design Criteria

As previously noted, the AWPF would be designed to meet ResWA and DPR regulations as well as CSR and SFRWS regulatory and water quality objectives. The proposed pathogen treatment targets for each unit treatment process for the AWPF are summarized in Table ES-2.

Table ES-2: Summary of Potential LRVs for Unit Treatment Processes

Treatment Processes	Potential/Target Process Log Removal / Inactivation Credits							Potential TWA Total Log Removal/ Inactivation	DDW ResWA Required Log Removal/ Inactivation	DDW TWA Required Log Removal/ Inactivation
	WWTP–Tertiary Filtration[1]	Ozone	BAC[2]	MF	RO	UV/ AOP	Free Chlorine			
Virus	2	2	1	1	2	6	6	***20***	9	20
Giardia	2	1	2	4	2	6	2	***19***	8	14
Cryptosporidium	2	0	2	4	2	6	0	***16***	9	15
1-4 Dioxane	0	0	0	0	0	0.5	0	***0.5***	0.5	0.5

Notes:

The ultimate inactivation credit achieved for a given process may be based on site-specific performance and/or a negotiated validation approach with DDW on a case-by-case basis (WateReuse 2016).

[1] Log removal credits up to 2/2/2 V/G/C through sand filtration (Olivieri et al., (2016). MBR systems to be installed at the San Mateo WWTP have not been credited for pathogen removal performance in potable reuse in California

[2] Log removal credits based on a conservative estimate of log removal credits typically achieved using direct filtration treatment technologies at surface water treatment plants based on the Surface Water Treatment Rule Fact Sheet (EPA, 2019).

The major treatment processes unit sizing and preliminary equipment selection are described in **Section 3**, including preliminary design considerations for process mechanical, civil/site layout, structural, architectural, electrical, and instrumentation and controls. Additional details are provided in **Appendix B: TM #1 – AWPF Design Criteria** and in **Appendix F: Drawings**.

The information herein is representative of a ten percent design level based on available information at the time of this BODR. Field investigations, water quality sampling, environmental, noise, and other special studies would be conducted in future design phases to refine assumptions and support a more detailed level of design and environmental documentation. Reservoir modeling, tracer studies and development of a treatment pilot project would likely be needed to demonstrate adherence to regulatory requirements.

ES.4 Conveyance Basis of Design

Conveyance is a critical component of any recycled water system and often accounts for a large percentage of capital costs for a project. The conveyance facilities for the PureWater Peninsula Project include tertiary and purified water pipelines, pipelines within the SVCW fence line, pump stations, booster pump stations (BPS) and points of connection to local drinking water distribution systems (DWDS).

Pipeline alignments to and from the AWPF were developed in earlier iterations of the Project; some of which have been removed from further consideration and others modified through the PureWater Peninsula BODR efforts. A future alternatives analysis study that includes a more detailed look at utility, survey, geotechnical and environmental conditions as well as pumping requirements would be needed to select a preferred alignment to move forward to design.

This preliminary design assumes that conveyance pipelines constructed in Phase 1 would be sized to accommodate Phase 2 flows. Pump stations would be sized for Phase 1 project flows initially with the ability expand to Phase 2 capacities, where appropriate. The following conveyance components are the focus of this BODR:

1. San Mateo Tertiary Pump Station and Pipeline
2. Pipelines within SVCW Fenceline
3. Purified Water Transmission Pipelines and Pump Stations from the AWPF to Pulgas DF
4. Purified Water Distribution Pipelines to DWDS Points of Connection
5. Breakpoint Chlorination Facility and Pulgas Point of Connection

Conveyance Facility Design Criteria

Design criteria for major conveyance components are summarized herein:

San Mateo Tertiary Pump Station and Pipeline: A new pump station and 24-inch diameter pipeline would convey up to 4 mgd (Phase 1) and 9 mgd (Phase 2) of tertiary effluent from the San Mateo WWTP site to the AWPF. The San Mateo tertiary pipeline alignment would run primarily along the Beach Park Boulevard, parallel to the levee, to the new AWPF EQ tanks at the SVCW site. This alignment would include pipeline suspension over the Seal Slough crossing near the San Mateo WWTP and horizontal directional drilling (HDD) under Belmont Slough near the SVCW.

Pipelines within SVCW Fenceline: Pipelines within the SVCW fence line include a short pipeline to convey SVCW's tertiary effluent from an existing 30-inch diameter recycled water pipeline to the new AWPF EQ Tank(s), and a pipeline and to convey RO concentrate from the AWPF to SVCW's existing outfall. Design criteria for inter-process pipelines between AWPF facilities are not detailed as part of the BODR.

Purified Water Transmission Pipelines and BPSs: A new purified water transmission pipeline would convey purified water from the new AWPF purified water pump station (PWPS) to SFPUC's Pulgas DF, where it would be introduced into CSR. Three options for transmission of purified water are currently being considered:

- Option 1: Woodside Road – SFPUC right-of-way (ROW)
- Option 2: San Carlos – Club Drive
- Option 3: Edgewood Road

Each option would require between one and three intermediate BPSs, depending on the alignment. Siting of aboveground facilities, such as BPSs, is expected to be a key project challenge and future studies would need to be performed to confirm the availability and cost of land acquisition. In Phase 1, up to 6 mgd of purified water would be delivered to Pulgas DF for ResWA augmentation. In Phase 2, the pumping capacity would be built out to provide 12 mgd of purified water to both Pulgas and local DWDS as described below. Preliminary hydraulic calculations and BPSs are designed for 12 mgd purified water production capacity for Phase 2 buildout.

Purified Water Distribution Pipelines to DWDS Points of Connection: DWDS connections would be made to local drinking water systems in Phase 2 to deliver purified water from the purified water transmission line to the systems of RWC, Cal Water, and MPWD. With input from each agency, several potential connection points (i.e., existing storage tanks and pipelines) for TWA along each purified transmission alignment are identified. New facilities would include purified water distribution pipelines (ranging from 6-inch to 18-inch diameter), connections to existing storage tanks and potable transmission pipelines, and associated electrical, instrumentation, and controls. Preliminary distribution pipeline sizing is based on available water shortage data; however, additional analysis and modeling is recommended to analyze actual demand at specific points in the DWDSs. It is assumed that the connections to the purified transmission pipeline would be made where adequate head is available to avoid the need to construct additional booster pump stations in congested areas. All tank connections would be made with an air gap. All transmission line connections would be made with a pressure reducing valve (PRV) vault to match existing DWDS pressures. PRV stations would be installed and set to match the system pressures at tie-ins to transmission pipelines. The purified water distribution pipelines and points of connection vary by purified water transmission option.

Breakpoint Chlorination Facility and Pulgas Point of Connection: The purified water transmission pipeline would terminate at the SFPUC Pulgas DF, with a connection to the existing 11-foot weir structure. In Phase 1, no additional treatment would be required between the AWPF and the Pulgas connection. In Phase 2, chloramine disinfectants would be utilized for the purified water and a new breakpoint chlorination facility would be constructed along the purified transmission pipeline to feed chemicals and adjust the pH adjustment prior to reservoir augmentation at CSR. The chemical injection point would be located downstream of the last DWDS connection turnout.

A summary of major conveyance components is provided in Table ES-3.

Table ES-3: Summary of Potential Conveyance Components

Conveyance System	Capacity Ph 1 (mgd)	Capacity Ph 2 (mgd)	Pipeline Length (miles)	Pipeline Diameter / Material	Pump Station(s)	DWDS Points of Connection	Purified Water Distribution Pipelines - Total Length (miles)	Purified Water Distribution Pipelines Diameters/Material
San Mateo Tertiary	4	9	5.5	24"-HDPE	San Mateo Tertiary PS	-	-	-
SVCW Tertiary (Inside SVCW Fenceline)	4	8	<1	20"-HDPE	Existing Redwood City Distribution Pump Station (DPS)	-	-	-
RO Concentrate (Inside SVCW Fenceline)	1.4	2.9	<1	12"-HDPE	RO Concentrate PS	-	-	-
Purified Option 1: Woodside Road – SFPUC right-of-way (ROW)	6	12	15.9	24"-PVC	• AWPF PWPS • BPS 1.1 • BPS 1.2 • BPS 1.3	• RWC: Redwood Shores Tanks; Sequoia Tanks • Cal Water: Station 103 High/Low Pressure Pipelines • MPWD: Hallmark Tanks	2.1	6" to 16" PVC
Purified Option 2: San Carlos – Club Drive	6	12	9.3	24"-PVC	• AWPF PWPS • BPS 2.1	• RWC: Redwood Shores Tanks • Cal Water: Station 103 High/Low Pressure Pipelines • MPWD: Hallmark Tanks	2.7	6" to 16" PVC
Purified Option 3: Edgewood Road	6	12	11.9	24"-PVC	• AWPF PWPS • BPS 3.1	• RWC: Redwood Shores Tanks; Sequoia Tanks • Cal Water: Station 103 High/Low Pressure Pipelines • MPWD: 20-Inch Transmission Pipeline	2.2	6" to 18" PVC

The major conveyance facility unit sizing and preliminary equipment selection are further described in **Section 4**, including preliminary design considerations for mechanical components, civil/site layout, structural, architectural, electrical, and instrumentation and controls. Additional detail provided in **Appendix B: TM #2 – Conveyance Facility Design Criteria**, **TM #5 – Drinking Water Distribution System Design Criteria**, and in **Appendix F: Drawings**.

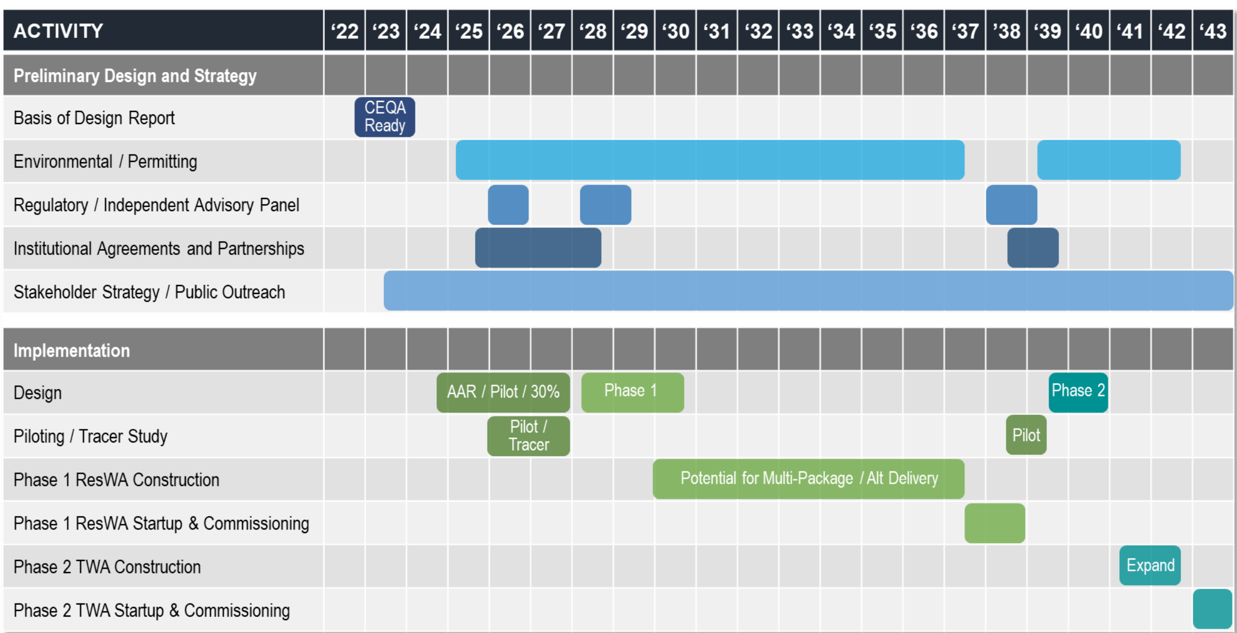
The information herein is representative of a ten percent design level based on available information at the time of this BODR. Survey, utility and geotechnical investigations, environmental, noise and other special studies would be conducted in future design phases to refine assumptions and support a more detailed level of design and environmental documentation.

ES.5 Project Implementation

Project Schedule

A high-level potential timeline for implementation of the PureWater Peninsula Project is shown in Figure ES-6. The intent of this timeline is to provide a general and conservative estimate of when major activities would occur over a 20-year period.

Figure ES-6: Potential Timeline for Major Activities to Implement Phased PureWater Peninsula Project



The majority of facilities would be designed and constructed in Phase 1. The AWPF would initially produce 6 mgd of purified water with the ability to expand to 12 mgd. Tertiary and purified transmission pipelines would have the capacity to convey the full Phase 2 flows and pump stations would initially include pumps for Phase 1 flows with available space to add pumps to accommodate Phase 2 flows.

Phase 2 activities would focus on the DWDS points of connection and expansion of the AWPF. Purified water distribution pipelines would extend from the transmission pipelines to the points of connection to tanks and/or pipelines at the local drinking water systems. Additional pumps would be added to pump stations to convey Phase 2 flows.

This preliminary schedule is based loosely on the duration and schedule for other ResWA projects in progress by East County Advanced Water Purification Program and Pure Water Project Las Virgenes-Triunfo, and similarly-sized projects led by SFPUC. The schedule could be reduced by overlapping activities and reducing time between activities, depending on project drivers. In particular, the design and construction period could be streamlined depending on selection of a preferred delivery method (e.g., traditional design-bid-build vs alternative delivery) and the staging of design and construction packages. The earliest anticipated service date for ResWA is 2039 and for TWA is 2043.

There are a number of activities that would be performed leading up to design and construction, such as special studies, piloting and engagement of an independent advisory panel (IAP), all of which are common for potable reuse programs. There are also ongoing activities that would be maintained through the implementation period and beyond, including permitting/monitoring activities and public outreach.

Public Outreach

As part of the BODR effort, the PureWater Peninsula Parties worked with Data Instincts, a public/community relations firm, to prepare and develop a stakeholder/public outreach strategy and gather PureWater Peninsula Parties' input and views regarding certain education and outreach approaches.

Data Instincts conducted in-depth interviews with elected officials, managers, and Public Information Officers representing each of the partnering agencies to develop an understanding of the outreach needs in the affected communities. Key takeaways from those interviews revealed an interest in seeking alternative water supply sources to augment regional Hetch Hetchy supplies, general support for potable reuse with a desire for more education, recognition that outreach with the public and elected leaders is critical for the success of the project, and the need for strong messaging around the need for the water and emphasizing the taste, quality and safety of the water (Data Instincts, 2023a).

As part of the BODR effort, an "Initial Strategic Outreach Plan" (Data Instincts, 2023b) has been developed to provide the PureWater Peninsula Parties with an outreach strategy and recommended communications tools for engaging stakeholders in the PureWater Peninsula partner communities to achieve the PureWater Peninsula public outreach goals. The Plan includes guidance for getting ready for public engagement, crafting key outreach messages, identifying the right communication and outreach tools to employ and then measuring public outreach success. A list of outreach activities is suggested to initiate well before the Project is in the public eye and continue throughout the course of project implementation outreach schedule. The Plan is intended to be a considered a "living document" that is periodically reviewed and adjusted to adapt to the evolution and milestones of the Project and to the outreach needs for the communities involved.

The PureWater Peninsula recognize that outreach is dynamic and must evolve and adapt with the Project. Outreach efforts must remain cognizant of shifts in public opinion and align with project milestones. The outreach strategy must continue to be revisited and adapted to address concerns, maintain trust, and build consensus amongst the various stakeholders. The messages, activities, and tools presented in the Initial Strategic Outreach Plan should therefore be modified as the Project progresses. (Data Instincts, 2023b)

Summary of Costs

Costs are presented at a pre-design level, reflecting an Association for the Advancement of Cost Engineering (AACE) Class 4 level of estimate for concept evaluation and preliminary budget approval, with a fairly wide range of accuracies. The costs to build and operate Phase 1 ResWA and expand to TWA in Phase 2 are summarized based on construction costs, annual costs reflect operations and maintenance (O&M) and life cycle unit costs to deliver purified water.

Construction costs, presented in Table ES-4, are in 2024 dollars based on the midpoint to construction for the phased project implementation timeline presented in Figure ES-6. Annual costs, presented in Table ES-5, reflect O&M cost for energy, chemicals, labor and maintenance and repair. Annualized unit life cycle costs, presented in Table ES-6, reflect the annualized construction costs plus O&M costs divided by the annual delivery volume of purified water.

Table ES-4: Summary of Total Construction Costs (2024 $million)

Cost Component	Phase 1 ResWA	Phase 2 TWA Expansion	TOTAL
Construction Costs	**($M)**	**($M)**	**($M)**
AWPF	$440	$170	$610
Tertiary Pump Station and Pipeline	$145	$2	$147
Breakpoint Chlorination Facility	$1	$8	$9
Purified Water Conveyance[1]	$268	$65	$333
Average Construction Cost[2]	**$854**	**$245**	**$1,098**

Notes:

1. Purified water conveyance costs reflect the average costs for the three options, including costs for transmission and distribution pipelines, booster pump stations and DWDS points of connection.
2. For budgeting purposes, it would be appropriate to apply a range of accuracy of +30 percent to -20 percent to the overall project construction cost to reflect the cost uncertainty associated with a project at a 10% level of design with anticipated construction that is 15 to 20 years out.

Table ES-5: Summary of Annual O&M Costs (2024 $million)

O&M Component[1]	Phase 1	Phase 1 & 2 TOTAL
Annual Costs	**($M/yr)**	**($M/yr)**
AWPF Annual O&M	$8.3	$14.4
Conveyance Annual O&M	$8.5	$16.0
San Mateo Facility Annual O&M	$2.6	$3.2
Total O&M Costs	**$19.5**	**$33.6**

Notes:

1 The project would include new O&M staff for each responsible agency to support new facilities and provide administrative and regulatory support for the program. Appendix E CEQA Checklist Section 9.2 describes staffing for AWPF and conveyance facilities.

Table ES-6: Summary of Life Cycle Unit Costs (2024 $million)

Purified Water Delivered	Phase 1	Total Phase 1 and 2
Flow Delivered (MGD)	**6**	**12**
Flow Delivered (AFY)	**6720**	**13440**
Life Cycle Unit Cost	**($/AFY)**	**($/AFY)**
AWPF	$3,670	$2,880
Conveyance	$3,240	$2,360
Total Life Cycle Unit Costs	**$6,910**	**$5,240**

AFY = acre-feet per year

The life cycle unit costs presented in Table ES-6 reflect life cycle unit costs when the facility is operating continuously, 365 days a year at the design flow. Due to the variability of supplies in the SFRWS, the project may operate under seasonal scenarios where AWPF production is ramped down or shut down during wet months of wet years. Ramp down or shutdown scenarios would occur during a wet year where the demand for recycled water is low and/or the SFRWS is at its maximum water banking capacity. During these operational scenarios, the treatment plant would reduce or cease production of purified water. The rationale for these operational scenarios is based on minimizing the amount of spill from the SFRWS.

The cost impact for a ramp-down and shut-down year would be a decrease in the annual O&M cost due to reduced energy, chemicals and labor, but an overall increase in the life cycle unit cost, due to less purified water delivered. Overall, O&M costs could decrease comparatively to continuous operation by approximately 10 percent to 20 percent for ramp down and shut down operations, respectively. The net impact over the project life would depend on how frequently ramp down and shut down scenarios occur and for how long they are sustained. Based on the assumption of a recuring 6-year dry period and 6-year wet period, the overall life cycle unit costs for the total project could increase by approximately 9 percent to 17 percent for ramp-down and shut-down operations, respectively.

Summary of Risks and Benefits

Implementation of the PureWater Peninsula Project could benefit the San Francisco Bay Area through:

- ✓ Development of a new locally-controlled, reliable supply of high-quality water that is drought-resilient
- ✓ Reduce dependence on imported water and potential to result in reduced diversions from the Tuolumne River
- ✓ Reduction in discharges to the SF Bay
- ✓ Treatment of local wastewater more efficiently and prevention of water from becoming a lost resource.
- ✓ Addressing the unpredictability of climate change.
- ✓ Combined resources and regional institution collaboration to maximize water reuse

There are of course inherent risks and uncertainties that accompany project implementation, such as:

- Operational and water quality challenges in Crystal Springs Reservoir
- Ability to reliably meet Bay discharge requirements
- Construction challenges in constructing alignments along the Bay and through Silicon Valley
- Water supply during non-drought years would impact operations and storage availability in the SFRWS
- Decreasing quantity and quality of source supplies due to conservation and satellite treatment/scalping plants
- Uncertainty related to DPR regulatory requirement rollout once finalized at the end of 2023
- Institutional agreements to share costs and risks
- Uneven distribution of purified water
- High costs
- Community support and acceptance

These, and other challenges, will be addressed as the project progresses.

Section 1 Introduction

Supporting information for this section is provided in:

- Appendix A: Potable Reuse Regulatory Requirements.
- Appendix B: TM #1 – AWPF Design Criteria
- Appendix B: TM #3 – RO Concentrate Disposal
- Appendix C: Modeling and AWPF Operational Scenarios
- Appendix E: CEQA Checklist

1.1 Project Overview

The PureWater Peninsula Project, previously referred to as the Potable Reuse Exploratory Plan (PREP), is a regional effort to resolve multiple water supply and wastewater issues, while realizing the benefits of shared infrastructure, asset recovery, economies of scale and a more competitive strategy to pursue funding.

The study area (Figure 1-1) includes the San Francisco Mid-Peninsula region, focused on the service areas and facilities of the following entities, collectively referred to as the PureWater Peninsula Parties, each with a clear objective for pursuing the PureWater Peninsula project at this time:

- ***Silicon Valley Clean Water (SVCW) and City of San Mateo (San Mateo):*** to support local, regional, and State goals for recycled water use and meet regulatory requirements.

- ***Bay Area Water Supply and Conservation Agency (BAWSCA):*** to identify a potential new water supply to meet the dry-year water supply reliability needs of its member agencies, as documented in BAWSCA's *Long-Term Reliable Water Supply Strategy Phase II Final Report.* BAWSCA consists of the 26 member agencies shown in the figure below.

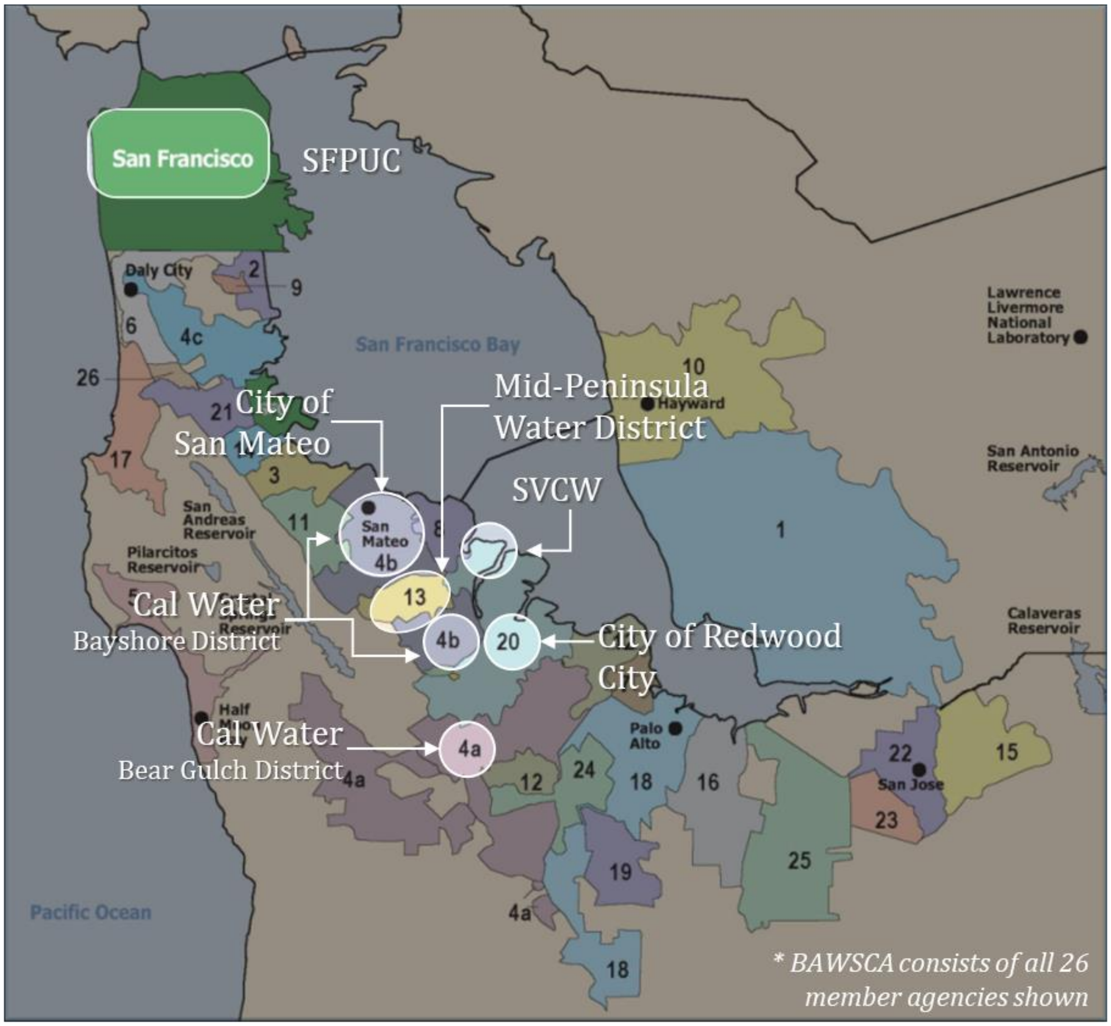
- ***California Water Service (Cal Water):*** to identify potential new local water supply opportunities and capital projects that would deliver water supply reliability to Cal Water's Bayshore District customers.

- ***City of Redwood City (RWC):*** to identify potential new water supplies and enhance the quality of recycled water to promote beneficial uses.

- ***Mid-Peninsula Water District (MPWD):*** to identify potential new water supplies.

- ***San Francisco Public Utilities Commission (SFPUC):*** to identify potential new water supply opportunities to serve existing and new customer demands.

Figure 1-1: Study Area and PureWater Peninsula Parties' Service Areas



Map source: BAWSCA Member Agencies

Legend

1	Alameda County Water District	13	Mid-Peninsula Water District
2	City of Brisbane	14	City of Millbrae
3	City of Burlingame	15	City of Milpitas
4a	CWS – Bear Gulch	16	City of Mountain View
4b	CWS – Mid-Peninsula	17	North Coast County Water District
4c	CWS – South San Francisco	18	City of Palo Alto
5	Coastside County Water District	19	Purissima Hills Water District
6	City of Daly City	20	City of Redwood City
7	City of East Palo Alto	21	City of San Bruno
8	Estero Municipal Improvement District	22	San Jose Municipal Water System
9	Guadalupe Valley MID	23	City of Santa Clara
10	City of Hayward	24	Stanford University
11	Town of Hillsborough	25	City of Sunnyvale
12	City of Menlo Park	26	Westborough Water District

Sources: BAWSCA, San Mateo County General Plan

The majority of the water supply to the study area is provided by SFPUC's Hetch Hetchy Regional Water System (SFRWS), which consists of a complex series of reservoirs, tunnels, pipelines, pump stations, and treatment plants to deliver water from the Sierra Nevada and SF Bay Area watersheds to four counties in the SF Bay Area.

The PureWater Peninsula Project is a potable reuse project that would create a new source of local sustainable water supply using state-of-the-art technology to purify tertiary effluent from SVCW and the San Mateo Wastewater Treatment Plant (WWTP).

The project would be implemented in two phases:

- **Phase 1** – Indirect Potable Reuse (IPR) via Reservoir Water Augmentation (ResWA) of up to 6 million gallons per day (mgd) of purified water at Crystal Springs Reservoir (CSR) for use by SFPUC.
- **Phase 2** – Expanding purified water production to up to 12 mgd and providing of purified water for Direct Potable Reuse (DPR) via Treated Water Augmentation (TWA) for local use by RWC, Cal Water, and/or the MPWD. Up to 6-8 mgd would be available for ResWA at CSR, and 4-6 mgd would be available for TWA to local drinking water distribution systems.

With the implementation of both PureWater Peninsula Project Phases, the project would provide a maximum of 12 mgd of purified water for local use by 2043.

The PureWater Peninsula Project would include:

- **Source water** derived from a blend of up to 8 mgd of tertiary effluent from SVCW and up to 9 mgd of tertiary effluent from the San Mateo WWTP would be combined to produce up to 12 mgd of purified water. Additional available tertiary effluent may be used would be available for dilution of RO concentrate and total flows available is dependent on influent flow availability and RWC's usage.
- Construction of a new **advanced water purification facility (AWPF)** to treat AWPF source water to meet regulatory requirements for IPR in Phase 1 and DPR for the Phase 2 expansion.
- **Conveyance infrastructure** to deliver tertiary effluent to the new AWPF, purified water to the place of use, and brine for discharge via the existing SVCW outfall.
- A point of connection to SFPUC's **Pulgas Dechloramination Facilities (Pulgas DF)**, which is used to manage and control water flow to SFPUC customers on the Peninsula and in the City of San Francisco. The Pulgas DF provides dechloramination or dechlorination of all flows prior to CSR augmentation.
- Multiple points of connection to existing tanks and transmission pipelines to deliver purified water to RWC, Cal Water and/or the MPWD **drinking water distribution systems (DWDS).**

A schematic summary of the PureWater Peninsula Project concept is depicted in Figure 1-2.

Figure 1-2: PureWater Peninsula Project Concept

Under a separate contract, SFPUC is concurrently exploring DPR-only project alternatives, which would also be considered a PureWater Peninsula Project. It is anticipated that a future Alternatives Analysis Report (AAR) will be prepared to evaluate the preferred approach to implement the PureWater Peninsula Project. This Basis of Design Report (BODR) document refers to the hybrid IPR/DPR approach as "PureWater Peninsula Project" or "Project".

1.2 Project Background and Objectives

The PureWater Peninsula Parties have been collaborating for the last eight years on a multi-phased concept-level analysis to explore opportunities for potable reuse on the San Francisco Mid-Peninsula.

This effort was initiated in 2016 as part of SVCW's Long Term Strategic Recycled Water Planning Efforts. The PureWater Peninsula Parties recognized that the continued discharge of wastewater effluent to the San Francisco Bay was not a sustainable practice. Instead, the wastewater effluent could be beneficially reused as a potable water supply and create a new sustainable water supply source for the region.

The PureWater Peninsula Parties embarked on the project with an **objective to identify opportunities to develop new local drought-resilient water supplies to:**

1. Increase local water supply on the San Francisco Peninsula to enhance reliability and resiliency.
2. Reduce discharge to the San Francisco Bay – helping communities use locally treated water more efficiently and prevent water from becoming a lost resource.
3. Create a multi-agency project with multiple economic, environmental, and social benefits.

The power of a regional program makes it more successful in sharing assets, garnering large grants and loans, and sharing costs and benefits over a greater service area. The PureWater Peninsula Parties seek to use multi-agency involvement to find broad mutual benefits.

The PureWater Peninsula initiative is being used to identify alternatives that address regional water supply and discharge challenges through maximizing the utility of the available recycled water supplies, to provide a local, drought-resistant, sustainable water supply that benefits the environment and communities in the region.

1.3 Institutional Agreements

The PureWater Peninsula Parties are committed to continuing to work together to define an institutional arrangement and cost-sharing structure to lead a mutually beneficial regional project that is consistent with their legal authorities and the expected value of the benefits they receive.

The Phase 1 Memorandum of Understanding (MOU) between the initial PureWater Peninsula Parties (formerly known as PREP Parties) to begin this work was a crucial first step in declaring a regional commitment to exploring potable reuse through integrated water management by proactively reducing wastewater discharges and increasing water supply resiliency. In Phase 1, SVCW, SFPUC, BAWSCA, and Cal Water agreed to conduct regional activities in an inclusive manner that improves water supply reliability in the region. Within months of initiating the study, RWC and San Mateo expressed interest in joining the PREP Parties to explore regional solutions that may offer additional economies of scale, and opportunities to share resources and infrastructure.

The MOU was updated to embark on PREP Phase 2, which committed RWC and San Mateo to share in the cost to further define a potable reuse concept. As part of Phase 2, the PREP Parties explored institutional considerations, in parallel to an evaluation of technical and financial evaluations, related to the implementation of a project that augments CSR with purified water. Based on the findings from this effort, it appears possible that (1) a potable reuse project could offer benefits for SF Bay Area water and wastewater utilities, and (2) there are viable options to structure the project's implementation.

A Phase 3 Memorandum of Agreement (MOA) was entered into by the PREP Parties to conduct this feasibility study. The MOA defined general roles and responsibilities of all PREP Parties related to conducting the Phase 3 feasibility study and established cost-sharing allocations for the study.

Even with the most willing partners, regional projects require the development of partnerships and agreements that guarantee cooperation, coordination, and legal support. Based on the survey questionnaires, interviews and a workshop completed as part of PREP Phase 2, collectively, the PureWater Peninsula Parties appear to have the required functional and legal capacity to finance and deliver the project. Therefore, the project is institutionally feasible. Based on these findings, each PureWater Peninsula Party recognizes the need to assess the value of their benefits based on their future role in the project at a later stage.

There are a variety of regional non-potable and potable reuse programs in California, in various stages of implementation and development, that have similarities to the project being considered by the PureWater Peninsula Parties. These programs offer some examples of how complex projects like these can be structured based on their drivers, involved parties, and financing approach. Program leadership is typically driven by one or two primary project sponsor(s), supported by a coalition or series of agreements (e.g., MOUs) with a larger group of project partners and/or stakeholders. Getting the institutional and financial arrangements right, up front, is key to the success of most large programs.

The PureWater Peninsula Parties have the required functional and legal capacity to finance and deliver the project; however, they have not yet developed the partnerships and agreements to define ownership, operational, coordination, and legal responsibilities.

Potential project sponsors that have been discussed include: (1) SFPUC, as the owner and operator of the SFRWS, (2) a joint powers authority (JPA) or (3) similar legal entity, consisting of the water agencies and wastewater agencies that would distribute and supply water for the project (PureWater Peninsula Parties).

1.4 Regulatory and Environmental Compliance

Recycled water begins as wastewater and undergoes a series of treatment steps in the wastewater treatment plant followed by additional treatment through state-of-the-art advanced multi-barrier treatment technologies. The production and use of recycled water must adhere to strict regulations stipulating the levels of treatment, allowable types of reuse, and water quality requirements. The production, discharge, distribution, and use of recycled water are subject to federal, state, and local regulations with the primary objective of protecting public health.

- **Federal requirements** relevant to the discharge of recycled water, or wastewater, and any other liquid wastes to "navigable waters" are contained in the federal Clean Water Act (CWA). The CWA established the National Pollutant Discharge Elimination System (NPDES), a permit system for the discharge of contaminants into navigable waters. NPDES requires that all municipal and industrial dischargers of liquid wastes apply for and obtain a permit before initiating discharge. There are no federal regulations governing water reuse in the United States, thus regulations (or guidelines) for recycled water are developed and implemented at the state government level.
- In the **State of California**, recycled water requirements are administered by the State Water Resources Control Board (SWRCB) - Division of Drinking Water (DDW), formerly under the California Department of Public Health (CDPH), and individual Regional Water

Quality Control Boards (RWQCBs). The regulatory requirements for recycled water projects in California are contained in the California Code of Regulations (CCR) -Title 22 and Title 17[1].

- **Local requirements** vary by county and city and typically provide additional guidance to meet local health agency or public water supplier guidelines and permit/code requirements.

Regulatory requirements for potable reuse and discharges to the San Francisco Bay and CSR are summarized herein. These requirements are further described in **Appendix A: Potable Reuse Regulatory Requirements.**

1.4.1 Potable Reuse Regulatory Requirements

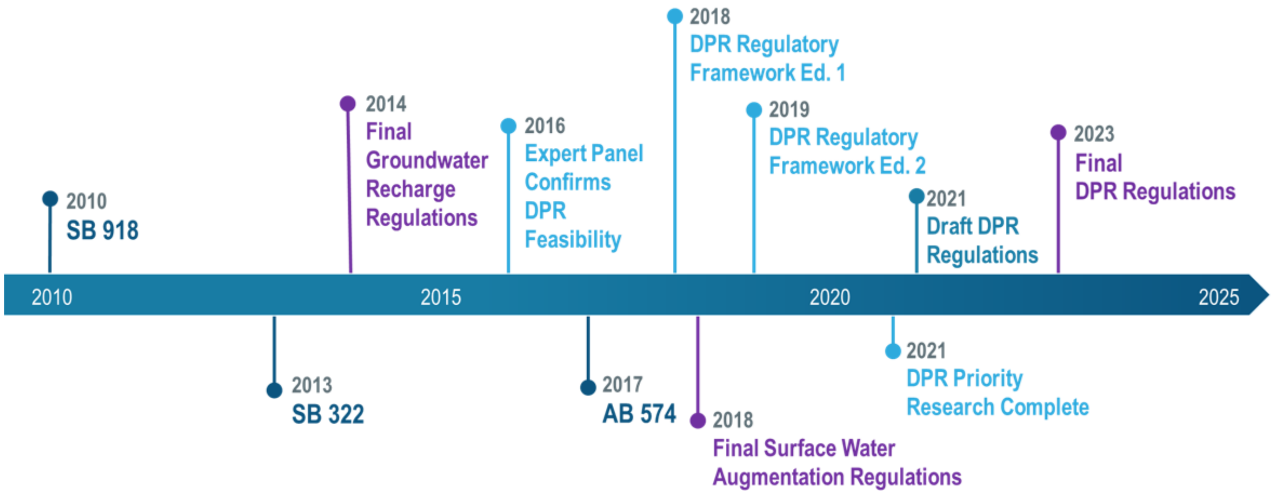
Potable reuse refers to the intended use of advanced treated municipal wastewater to augment a drinking water supply. Potable reuse was first explored in California by the Los Angeles County Sanitation District. The Montebello Forebay Project started surface spreading of recycled water for groundwater replenishment in 1962, at a time when there were no regulations governing groundwater augmentation with recycled water. The first draft Groundwater Replenishment Reuse (GRR) regulations were published over a decade later in 1976, and soon after the Water Factory 21 at Orange County Water District became the first subsurface injection GRR project. These two pioneering projects were instrumental in helping regulators understand the risks and control tools needed for reliable, safe potable reuse. These projects played a significant role in guiding the final GRR regulations, which were published in June 2014.

Figure 1-3 illustrates the progression of potable reuse regulations and legislation. Regulations for groundwater augmentation became effective on June 18, 2014. Final recycling criteria for ResWA were adopted by the State Board on March 6, 2018, and became effective on October 1, 2018. DPR via TWA regulations were adopted December 2023 and are anticipated to be effective in 2024.

Purified water produced by the AWPF would meet all ResWA and TWA regulatory requirements (as defined in SBDDW-16-02 and future DPR Regulations) and would be protective of the environment and public health. A Title 22 Engineering Report would be developed for the Project, which would describe the PureWater Peninsula Parties' plan for compliance with the CCR Title 22 Water Recycling Criteria, including ResWA and future TWA regulations, and the report would be used to request approval from DDW for the project. It is possible the DDW permit may require evaluation of enhanced source control monitoring of wastewater to minimize contaminants. If this is requested by DDW, an enhanced source control monitoring plan would be developed by the direct potable reuse responsible agency (DiPRRA) to identify all entities who have roles and responsibilities in the monitoring, identify constituents that would be monitored in the AWPF-produced water, CSR, and SVCW/San Mateo WWTP effluent, and to define the plan would define the frequency of monitoring and analysis for each location.

[1] State requirements for production, discharge, distribution, and use of recycled water are contained in the California Water Code, Division 7-Water Quality, Sections 1300 through 13999.16 (Water Code); the California Administrative Code, Title 22-Social Security, Division 4 Environmental Health, Chapter 3-Reclamation Criteria, Sections 60301 through 60475 (Title 22); and the California Administrative Code, Title 17-Public Health, Chapter 5, Subchapter 1, Group 4-Drinking Water Supplies, Sections 7583 through 7630 (Title 17).

Figure 1-3: Progression of California Potable Reuse Regulations and Legislation



1.4.2 Bay Discharge Regulatory Requirements

The Water Quality Control Plan for the San Francisco Bay Basin (SF Basin Plan). designates beneficial uses to each receiving water body within the State and establishes waste discharge prohibitions to protect these beneficial uses. Discharge of treated wastewater from SVCW's outfall is regulated under three Waste Discharge Requirements (WDRs) / NPDES permits: (1) SVCW Individual NPDES WDR, (2) SF Bay Watershed WDR for mercury and polychlorinated biphenyls (PCBs) and (3) SF Bay Watershed WDR for nutrients, which establish requirements for the overall water quality-based effluent limitations, mercury and PCBs limitations, and nutrient monitoring requirements. With an AWPF, the combined effluent discharged from SVCW's outfall would consist of the RO concentrate from the AWPF blended with the remaining WWTP effluent. This combined effluent would need to meet the requirements described in the SVCW WDR and NPDES permits.

Appendix B: TM #3 – RO Concentrate Disposal describes the regulatory requirements and establishes the design considerations for the AWPF to discharge RO concentrate to the SVCW outfall while meeting current and future regulatory requirements.

1.4.3 Crystal Springs Reservoir Regulatory Requirements

Any augmentation of CSR would not only need to comply with ResWA requirements, but also would need to, meet the requirements outlined in the SF Basin Plan and adhere to effluent limitations in the SWRCB NPDES permit No. CAG140001. An additional objective is for the augmented purified water to match or be compatible with background water quality concentrations in CSR. For CSR, this includes un-ionized ammonia concentrations controlled by the SF Basin Plan limits, and phosphorus concentrations controlled by the background concentrations in Upper CSR. Compliance with California Toxics Rule limits for inland surface waters (e.g., N-Nitrosodimethylamine (NDMA), trihalomethane) would also be required.

Additional background information on regulatory requirements is provided in **Appendix A: Potable Reuse Regulatory Requirements,** and an evaluation of design requirements and preliminary criteria for the AWPF to meet CSR regulatory requirements is further described in **Appendix B: TM #1 – AWPF Design Criteria,** and also in **Appendix C: Modeling and AWPF Operational Scenarios**, Section C.3 CSR Augmentation Simulations.

1.4.4 Environmental Requirements

The critical path for permitting activities includes the preparation of environmental documentation under the California Environmental Quality Act (CEQA). CEQA documentation is required for projects within the state of California to analyze and disclose potential environmental impacts associated with proposed projects. Any mitigation activities identified by CEQA that relate to water quality would also need to be submitted with the recycled water permit application. CEQA documentation would be required to modify the Report of Waste Discharge (ROWD), as part of the NPDES permit, to implement modifications to the SVCW facility discharge to the SF Bay.

The PureWater Peninsula Parties committed to developing a conceptual-level design and completion of an initial CEQA checklist as part of this design effort to allow the project to move forward with CEQA and to be compared with other projects being explored under SFPUC's Alternative Water Supply Plan (SFPUC, 2023). A preliminary **CEQA Checklist** is included in **Appendix E**.

Since the project would potentially pursue federal funding in the future, either through US Bureau of Reclamation (USBR) Title XVI program or through the United States Environmental Protection Agency (EPA) loan programs (e.g., Water Infrastructure Finance and Innovation Act [WIFIA]), the National Environmental Policy Act (NEPA) process may also be required. NEPA documentation is required for federal projects and/or projects that receive and comply with federal funding requirements.

Compliance with the NEPA would be required before any ground-disturbing activity would begin. Compliance would include submitting a Finding of No Significant Impact, or a Record of Decision completed by the federal NEPA lead agency. To comply with federal environmental laws and regulations, the PureWater Peninsula Project should also evaluate the following federal laws in its NEPA document if required:

- **Federal Endangered Species Act (ESA), Section 7:** The United States Fish and Wildlife Service (USFWS), the United States Department of Commerce National Oceanic and Atmospheric Administration (NOAA), and the National Marine Fisheries Service (NMFS) must be consulted for any project that has the potential to adversely impact a federal special-status species.
- **National Historic Preservation Act (NHPA), Section 106:** The NHPA focuses on federal compliance. Section 106 requires Federal agencies to consider the effects of their undertakings on historic properties. The Section 106 process seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties.
- **Floodplain Management – Executive Order 11988:** Each agency shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains

in carrying out its responsibilities. Before taking an action, each agency shall determine whether the proposed action would occur in a designated floodplain. The generally established standard for risk is the flooding level that is expected to occur every 100 years. If an agency determines or proposes to conduct, support, or allow an action to be located in a floodplain, the agency shall consider alternatives to avoid adverse effects and incompatible development in the floodplains.

- **Clean Water Act Section 404:** Projects, regardless of funding, must get approval for any temporary or permanent disturbance to federal waters and wetlands. Applicants must consult with and obtain a permit from the US Army Corps of Engineers early in the planning process if any portion of the project site contains wetlands or other federal waters.
- **Wild and Scenic Rivers Act:** Projects must address whether there are construction restrictions or prohibitions for projects near or in a designated "wild and scenic river." A listing of designated "wild and scenic rivers" can be obtained at http://www.rivers.gov/rivers/california.php.
- **Safe Drinking Water Act, Source Water Protection:** Projects must comply with the Safe Drinking Water Act and document whether or not a project has the potential to contaminate a sole source aquifer. For projects impacting a listed sole source aquifer, the applicant must identify an alternative project location, or develop adequate mitigating measures in consultation with the EPA.
- **Environmental Justice – Executive Order No. 12898:** Projects must Identify and address any disproportionately high and adverse human health or environmental effects of the project's activities on minority and low-income populations.

1.5 Report Organization

The BODR is organized to provide information in an increasing level of detail to help the reader follow along in the development of this complex project over the last seven years.

The Executive Summary presents an overview of the program, key design considerations for facilities and project implementation considerations including an engineers' opinion of probable costs. The BODR sections provide an overview of the project and then focus on the design considerations for the two major infrastructure components, the AWPF and conveyance facilities. The Appendices dive into greater detail on supporting topics and areas of evaluation, including six technical memoranda (TM) developed in the early stages of the Project to further detail design considerations that fed into the BODR. Finally, 10 percent design drawings provide the basis for the facility descriptions, providing key information for the CEQA checklist and the cost estimate. A summary of each of section and appendices is included herein.

This BODR consists of the following sections:

- **Section 1: Introduction,** providing an overview of the project, background, objectives, institutional agreement, and summarizing regulatory requirements.
- **Section 2: Project Definition,** describing project facilities, the regional potable reuse concept, project flows, and water quality goals.

- **Section 3: AWPF Basis of Design,** describing the treatment processes, operational scenarios, hydraulics, and design considerations for process mechanical, civil, structural, architectural, electrical, and instrumentation and controls (I&C).
- **Section 4: Conveyance Basis of Design,** describing the alignment alternatives and design criteria for conveyance components (pipelines and pump stations), including hydraulics, construction considerations, and mechanical, civil, structural, architectural, electrical, and I&C design considerations.
- **Section 5: Project Implementation,** presents a potential schedule for implementation of Phase 1 and Phase 2, describes interviews conducted to develop and understanding of outreach needs and develop an initial strategic outreach plan and provides an opinion of probable costs for construction, operations and maintenance (O&M), and life cycle unit costs for the Project.

The following appendices are included to provide additional detail and supporting materials as needed:

- **Appendix A: Potable Reuse Regulatory Requirements,** discusses regulations and treatment requirements for recycled water use to protect public health and the environment, providing an overview of the different types of reuse, detailing current and anticipated requirements regulations for ResWA and TWA and providing an overview of the SF Basin Plan and discharge requirements.
- **Appendix B: Technical Memoranda,** six TMs were developed during the initial phases of the PureWater Peninsula Project to solicit feedback from the PureWater Peninsula Parties to support design criteria and the development of operational strategies. These TMs are referenced throughout the BODR. A brief description of each TM is provided in this section.
- **Appendix C: Modeling and AWPF Operational Scenarios,** describes the existing water supply models used to simulate operations of the SFRWS and the development of a Crystal Spring Reservoir Operations Model (CSR ROM) to evaluate the ability to meet ResWA regulatory requirements for retention and dilution. An evaluation of the impact of purified water deliveries from the PureWater Peninsula on the SFRWS is also provided, describing the quantity of "spill" that could potentially occur under different AWPF operational scenarios.
- **Appendix D: Cost Analysis,** representing a 10 percent project definition and a range of accuracy of -30 percent to +20 percent. Assumptions for capital and O&M costs are listed along with detailed cost sheets for major project components.
- **Appendix E: CEQA Checklist**, provides an abbreviated CEQA checklist document, which would allow the project to move forward with CEQA and to be compared with other projects. The checklist is designed to provide the design team assistance in determining the type of information that must be provided to the Bureau of Environmental Management (BEM) for environmental review. The development of the checklist is intended to be iterative as the project is developed, new environmental issues are identified, and additional detail is needed until CEQA certification, and all permits are obtained.

- **Appendix F: Drawings,** includes preliminary drawings at a 10 percent level of design intended to illustrate the location and components for major facilities, support the cost analysis, and fulfill the CEQA checklist requirements. A drawing list is provided in this section.

A brief description of each of the TMs included in **Appendix B** is provided below:

- **TM #1 – AWPF Design Criteria** focuses on the design parameters for use in developing a conceptual design for the AWPF sizing and expanded unit processes as well as conveyance facilities within the SVCW boundary.
- **TM #2 – Conveyance Facility Design Criteria** establishes the design requirements and preliminary criteria for the project pipelines and pump stations beyond the AWPF fenceline, building on the design concepts identified in prior planning efforts.
- **TM #3 – RO Concentrate Disposal** establishes the design requirements for the AWPF to discharge RO concentrate to the SVCW ocean outfall while meeting current and potential future regulatory requirements.
- **TM #4 – Pulgas Disinfectant Residual Alternatives** describes considerations related to the type of disinfectant residual and removal of disinfectant residual prior to ResWA for CSR augmentation via the Pulgas DF.
- **TM #5 – Drinking Water Distribution System Design Criteria** identifies preferred points of connection to introduce purified water into the existing drinking water distribution systems owned and operated by RWC, Cal Water, and MPWD and defines infrastructure requirements and potential operational and hydraulic constraints.
- **TM #6 – AWPF Operational Strategies** summarizes the preliminary operational strategies for both ResWA and TWA to support the development of AWPF design and operational criteria.

A list of the drawings included in **Appendix F** is provided below:

AWPF Conceptual-Level Design Package:

- G-01: Cover, Location & Vicinity Maps, and Drawing Index
- G-02: General Abbreviations
- G-03: General Notes, Legend and Process Symbols
- G-04: Project Flow Diagram, Design Criteria and Pipe Schedule
- G-05: General Process Symbols
- G-06: AWPF Process Flow Diagram - I
- G-07: AWPF Process Flow Diagram - II
- G-08: Hydraulic Profile - AWPF
- C-01: Civil Legend
- C-02: AWPF Site Topography and Yard Piping Plan
- C-03: AWPF Site Plan
- C-04: AWPF Grading Plan

Conveyance Conceptual-Level Design Package:

- G-01: Cover, Location and Vicinity Maps, and Drawing Index
- G-02: General Notes, Abbreviations, and Legend
- G-03: Hydraulic Profile - San Mateo Tertiary and SVCW Tertiary Pipelines
- G-04: Hydraulic Profile - Purified Transmission Pipeline Option 1
- G-05: Hydraulic Profile - Purified Transmission Pipeline Option 2
- G-06: Hydraulic Profile - Purified Transmission Pipeline Option 3
- C-01: San Mateo Tertiary Pump Station Site Plan
- C-02: San Mateo Tertiary Pipeline Plan - Sta 1+00 to AWPF
- C-03: Purified Water Pipeline Option 1 Plan - Sta 1+00 to Sta 360+00
- C-04: Purified Water Pipeline Option 1 Plan - Sta 360+00 to Pulgas
- C-05: Purified Water Pipeline Option 2 Plan - Sta 1+00 to Pulgas
- C-06: Purified Water Pipeline Option 3 Plan - Sta 1+00 to Sta 290+00
- C-07: Purified Water Pipeline Option 3 Plan - Sta 290+00 to Pulgas
- C-08: Purified Water Option 1/2/3 – Enlarged Plans
- C-09: Purified Water Option 1 – Enlarged Plans
- C-10: Purified Water Option 2 – Enlarged Plans
- C-11: Purified Water Option 3 – Enlarged Plans
- M-01: Typical Purified Booster Pump Station Plan

Section 2 Project Definition

Supporting information for this section is provided in:

- Appendix A: Potable Reuse Regulatory Requirements
- Appendix B: TM #1 – AWPF Design Criteria
- Appendix B: TM #4 – Pulgas Disinfectant Residual Alternatives
- Appendix B: TM #5 – Drinking Water Distribution System Design Criteria
- Appendix C: Modeling and AWPF Operational Scenarios

2.1 Project Vicinity and Facilities

The PureWater Peninsula Project is located in the San Francisco Bay Area in Northern California. Major project facilities include the AWPF located near SVCW, pipelines (tertiary and purified), storage and pump stations. One tertiary pipeline alignment and three purified water transmission pipeline options are considered including potential booster pump stations and DWDS points of connection (POC) associated with each transmission pipeline.

The location of major facilities in the PureWater Peninsula Project vicinity is presented in Figure 2-1. The figure shows three options for the purified water transmission pipeline to convey water to CSR, each with its own unique set of potential booster pump stations (BPS) and DWDS POCs. PureWater Peninsula Project facilities are further described in Table 2-1.

Figure 2-1: PureWater Peninsula Project Vicinity

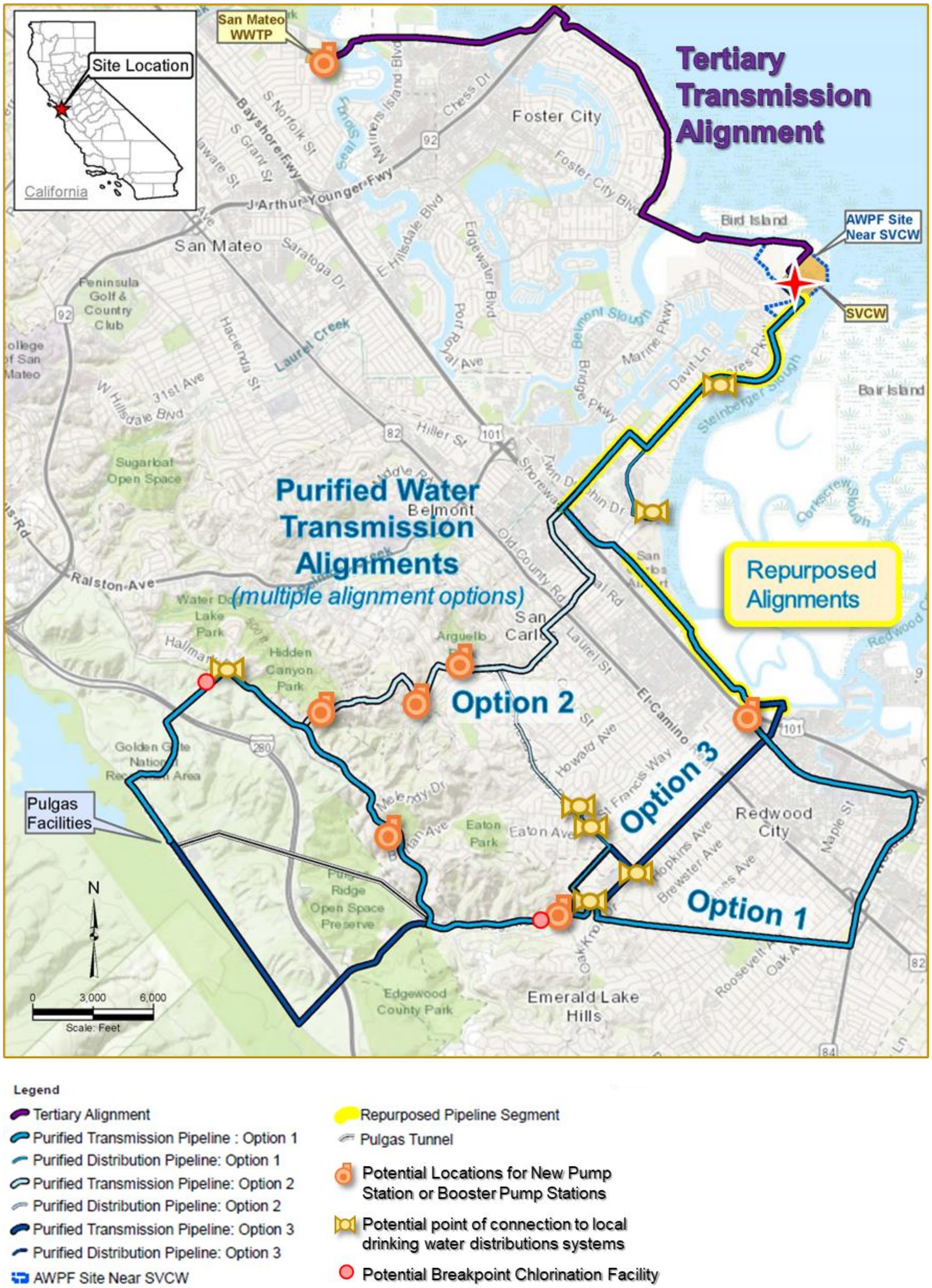


Table 2-1: PureWater Peninsula Project Facilities

<table>
<tr><th></th><th>Phase 1 – IPR (6 mgd)</th><th>Phase 2 – IPR and DPR (12 mgd)</th></tr>
<tr><td>Treatment Facilities</td><td>6 mgd capacity AWPF located near SVCW; water treated to TWA standards.
Associated chemical feed systems, wet wells, inter-process pumps, and other appurtenances.</td><td>Expand unit processes and appurtenances to 12 mgd treatment capacity; water treated to TWA standards.
Breakpoint chlorination facility to provide chemical dosing along the purified transmission pipeline (downstream of final DWDS connection, before Pulgas DF).</td></tr>
<tr><td>Pipelines</td><td>San Mateo Tertiary Effluent: ~6 miles of 24”-diameter (dia) source water pipeline from San Mateo WWTP to AWPF sized for up to 9 mgd source water flow.
SVCW Tertiary Effluent: <1 mile of 20”-dia source water pipeline from SVCW to AWPF sized for up to 8 mgd source water flow.
Purified Water to Crystal Springs Reservoir: 12-16 miles of 24 -dia purified water transmission pipeline from AWPF to CSR, with provisions for future connections to local drinking water distribution systems. The pipeline would be sized for Phase 2 flows of 12 mgd, with up to 8 mgd of that purified water flow reaching CSR in Phase 2.
AWPF Brine Disposal: <1 mile of 12”-dia brine pipeline from AWPF to the existing SVCW outfall.</td><td>Treated Water Distribution System Connections:
6”-to 18” dia Distribution pipelines from purified water transmission pipeline to potable water system tie-ins (pipe lengths vary by alternative).
Potable water system tie-ins to local drinking water distribution system (RWC, Cal Water, and MPWD).</td></tr>
<tr><td>Storage</td><td>Equalization storage tank (EQ) for source water, prior to AWPF with potential to convert one of RWC’s Recycled Water storage tanks at SVCW for use as equalization.
Purified water storage tank for purified water prior to conveyance to CSR.</td><td>Expand source water equalization storage tank capacity for the 12 mgd treatment capacity.</td></tr>
<tr><td>Pump Stations</td><td>San Mateo Tertiary Pump Station: convey AWPF source water (tertiary effluent) from San Mateo to the AWPF.
SVCW Tertiary Pump Station: convey AWPF source water (tertiary effluent) from SVCW to the AWPF
RO Concentrate Pump Station: Convey brine from the AWPF to SVCW Outfall connection.
Purified Water Pump Station at AWPF: Convey purified water from AWPF to CSR/DWDS connections.
Purified Water Booster Pump Stations (BPSs): Several intermediate BPSs would be required to convey purified water from the AWPF to CSR/DWDS connections.</td><td>Expand number of pumps at each pump station to meet the 12 mgd treatment capacity.</td></tr>
<tr><td>Pulgas</td><td>Connect to the concrete 11’ weir at Pulgas DF prior to augmentation into CSR.
Utilize the existing Pulgas Dechlorination operations and Discharge Channel to augment CSR.</td><td>No additional modifications.</td></tr>
</table>

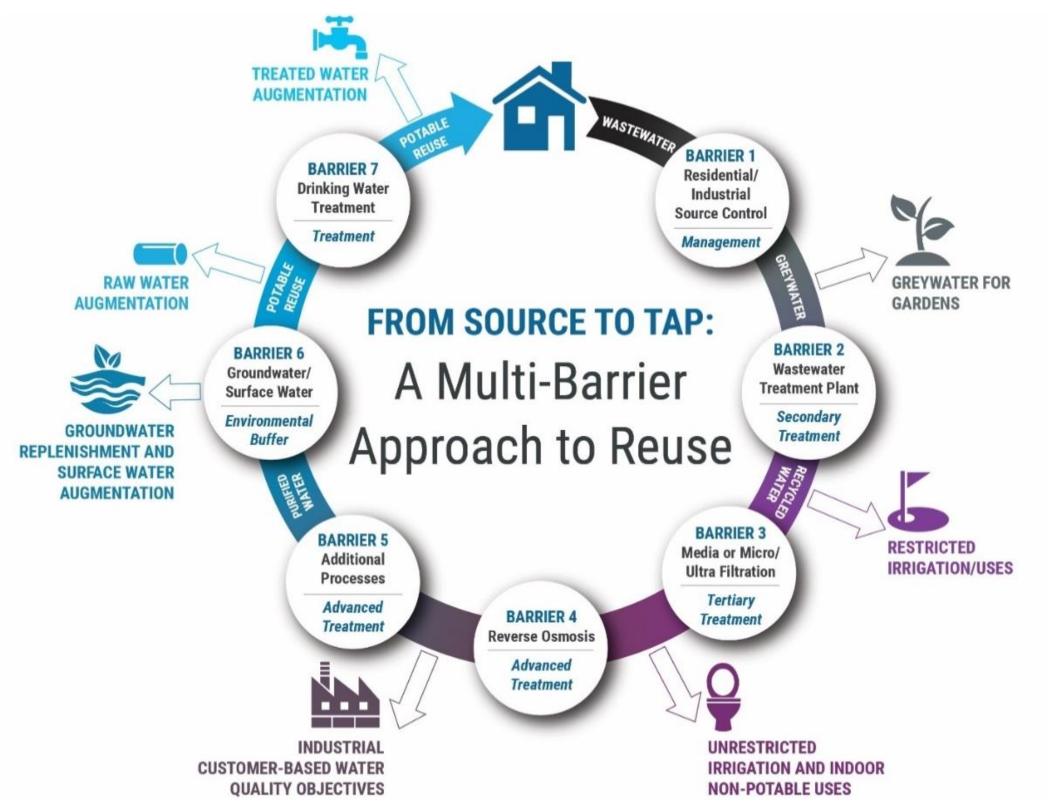
2.2 Regional Potable Reuse Concept

Several agencies on the San Francisco Mid-Peninsula are producing tertiary treated recycled water for non-potable irrigation, commercial, and industrial uses. However, the only existing potable reuse project in northern California currently used to meet potable demand is Monterey One Water's recently implemented groundwater replenishment program.

Several of the PureWater Peninsula Parties have been engaged in non-potable reuse projects. For example, the SFPUC began recycling wastewater in the early 1930s to irrigate Golden Gate Park, but the facility was eventually decommissioned in 1981 due to stricter standards for recycled water treatment. Over the years, the SFPUC has supported recycled water projects throughout the SFRWS's services area. Most recently the SFPUC is implementing the Westside Enhanced Water Recycling Project in the City of San Francisco, which would utilize up to 4 mgd of recycled water from the Oceanside Water Pollution Control Plant for non-drinking purposes. RWC has been supplying up to 0.75 mgd of recycled water produced at SVCW to its customers since 2000. Cal Water and San Mateo are currently not producing water for reuse.

Recycled water begins as wastewater that undergoes a series of treatment steps using a multi-barrier approach to remove organic matter and pollutants, as illustrated in Figure 2-2. The production and use of recycled water must adhere to strict regulations stipulating the levels of treatment, allowable types of reuse, and water quality requirements. Figure 2-2 illustrates the multi-barrier approach to reuse, highlighting the increasing level of treatment necessary to produce the right quality of water for the right use.

Figure 2-2: Multi-Barrier Approach to Reuse



The PureWater Peninsula Project seeks to utilize purified water for ResWA and TWA, which are summarized herein. Regulatory requirements for ResWA and TWA are further described in **Appendix A: Potable Reuse Regulatory Requirements.**

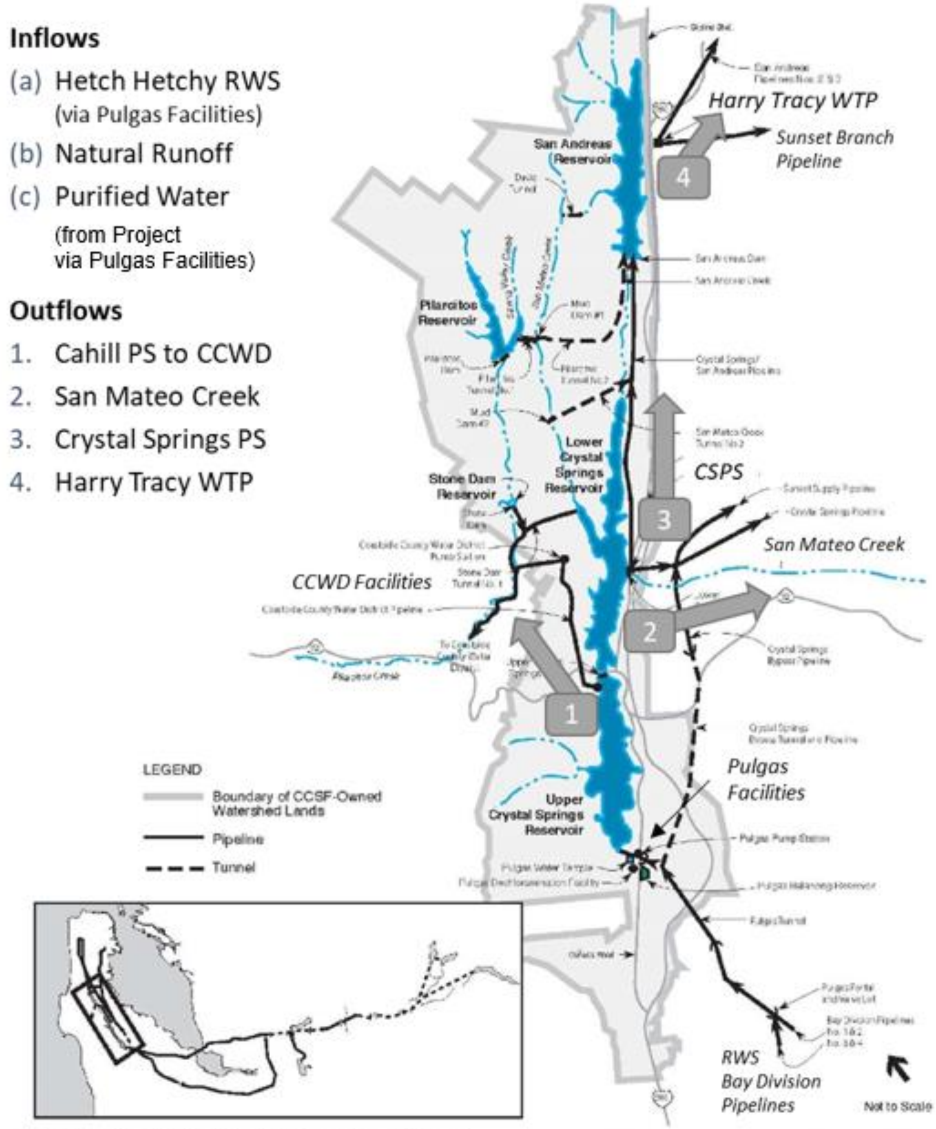
2.2.1 Reservoir Water Augmentation Concept

"Reservoir Water Augmentation (ResWA)"
Definition: The planned placement of recycled water into a raw surface water reservoir used as a source of domestic drinking water supply for a public water system, as defined in Section 116275 of the Health and Safety Code, or into a constructed system conveying water to such a reservoir. *(Previously referred to as IPR via surface water augmentation (SWA)).*

Phase 1 ResWA would treat tertiary effluent from SVCW and San Mateo WWTP at the AWPF and convey purified water to CSR where it would be combined with surface water in the reservoir. After the required storage retention, water would be transported downstream to SFPUC's Harry Tracy Water Treatment Plant (WTP) for treatment and conveyed to drinking water users through the existing potable water transmission system.

The Crystal Springs/San Andres Integrated Reservoir System, consists of Upper CSR, Lower CSR, and San Andreas Reservoir, as illustrated in Figure 2-3. Upper and Lower CSR are hydraulically connected via two culverts and are operated as a single reservoir. Lower CSR is connected to San Andreas Reservoir in the north via the Crystal Springs Pump Station (CSPS) and Crystal Springs–San Andreas pipeline. The two-reservoir system (CSR and San Andreas Reservoir) is owned and operated as part of the SFRWS. The purified water entering the CSR would be delivered via the Pulgas DF, which is located at the southern end of the reservoir.

Figure 2-3: Crystal Springs/San Andres Integrated Reservoir System



SOURCE: PEIR ON SFPUC WATER SYSTEM IMPROVEMENT PROGRAM / 203287

Appendix C: Modeling and AWPF Operational Scenarios describes the existing water supply models used to simulate operations of the SFRWS and reservoir operations for CSR and provides an overview of the Crystal Springs/San Andreas Integrated Reservoir System.

Implementation of a ResWA project may require modifications to SFRWS operations to maintain a retention time of six months, while adhering to other reservoir operation requirements, such as meeting Division of Safety of Dams (DSOD) elevation requirements for San Andreas, summer/winter elevation guide curve criteria, and required water surface elevations for the fountain thistle. Per the Final ResWA Regulations, an initial reservoir retention time of 180 days (6 months) must be demonstrated, with flexibility for an alternative minimum theoretical retention time as low as 60 days (2 months) on a case-by-case basis with State Board approval. The ability to modify outflows at times when there are high local inflows from stormwater runoff in the CSR reservoir would be limited. One option may be to utilize predictive analysis tools that may be useful to anticipate high local inflow events and preemptively release water from CSR or ramp down production of AWPF purified water to account for high local inflows from the SFRWS. Future studies would include hydrodynamic modeling of the reservoir and an assessment of operational practices to avoid dipping below the 6-month minimum. Based on the worst-case historical scenario from an evaluation of data from 1987 to 1998, the retention time would not be below two months.

For reference, and in comparison, to other ongoing ResWA projects, the City of San Diego is pursuing a 30 mgd ResWA project in the 5,800-acre-feet (AF)-capacity Miramar Reservoir, which would have an average retention time of just over two months. The City of San Diego was active in the legislative and regulatory efforts to reduce the minimum required retention time to two months (60 days) so that ResWA at Miramar would be viable for Phase 1 of that program. For the East County Advanced Water Purification Program, Padre Dam Municipal Water District (MWD) is exploring a 15 mgd ResWA project in Lake Jennings (capacity of approximately 9,800 AF), which would have an average retention time of just over 200 days, and a minimum retention time between 1.4 and 2.1 months. Padre Dam MWD is working with the DDW to demonstrate the ability to meet ResWA criteria with specific operational accommodations during emergencies. The Pure Water Project Las Virgenes-Triunfo is moving forward with ResWA to an 8,840 AF volume reservoir, and initial simulations of minimum retention time demonstrate the ability to achieve greater than two months retention.

A ResWA project may also need to demonstrate that the risk of short-circuiting in the reservoir would be minimal or could be controlled. Given the geometry of CSR, with a long fetch between the inlet and outlet, it appears there would be a significant period for purified flows to travel from the point of augmentation at the south end of CSR to the San Andreas Reservoir at the north end of the reservoir system, and then to the Harry Tracy WTP, significantly reducing the risk of short circuiting. Future studies would be performed to evaluate dispersion, mixing characteristics, and water quality in the reservoir, compatibility of ResWA purified water at the inlet using hydrodynamic mixing analyses and/or modeling to refine the ResWA scenarios and confirm the ability to meet regulations.

2.2.2 Treated Water Augmentation Concept

"Treated Water Augmentation (TWA)"
Definition: The planned placement of recycled water directly into a purified water distribution system of a public water system, as defined in Section 116275 of the Health and Safety Code. *(Previously referred to as DPR into a potable water supply distribution system downstream of a drinking water treatment plant)*

Phase 2 TWA would expand the AWPF capacity, treating additional tertiary effluent from SVCW and San Mateo WWTP, and convey purified water to the existing drinking water distribution systems operated by Cal Water, RWC and/or MPWD, where it would combine with drinking water in a storage tank or transmission pipeline. There would be no additional downstream water treatment, and the purified water would blend with SFRWS and local supplies as it is conveyed to drinking water users through the existing potable water distribution system.

Purified water from the AWPF could be directly introduced into the drinking water distribution system for local distribution. Potential tie-in locations would consist of potable water storage tanks, distribution lines, and transmission lines. Several points of connection to the water distribution system in the project vicinity exist as potential options for treated water augmentation.

Two potential points of connection were identified within the RWC service area:

1. **Redwood Shores Tanks:** RWC has two existing storage tanks (one concrete, one steel) located off of Redwood Shores Parkway that serve the Redwood Shores service area. The two tanks have a combined storage capacity of 6.2 MG and typically fill every other day. All three Purified Transmission Pipeline Options would be able to deliver purified water to these tanks.
2. **Sequoia Tanks**: RWC owns two 4-MG concrete tanks located on Bennet Road, near an SFPUC Bay Division Pipeline (BDPL) turnout and Purified Transmission Pipeline Options 1 and 3. The Sequoia Tanks serve the Main City Pressure Zone and undergo filling approximately every other day. Connecting to the Sequoia tanks could distribute purified water to approximately one-third of the customers within that pressure zone. Additional connections to the Sequoia Tanks could be made for Purified Transmission Pipeline Options 1 and 3. There are limited opportunities to connect to the main RWC system from Option 2, as it does not pass by RWC limits.

Potential points of connection were identified within the Cal Water Bayshore service area:

1. **Station 103 White Oaks Site:** Cal Water receives water from the SFRWS via two connections from the BDPLs in Cordilleras Road (SC-02 and SC-03). The water is conveyed to the lower pressure zones and to Station 103 pump station, which then conveys water to other pressure zones in the system. Connecting to these provide optimal points to augment and distribute purified water to a large portion of Cal Water customers in the San Carlos area. It is anticipated that a single connection to the purified water transmission line could be made with two connections, one to serve the higher-pressure zones and one to serve the lower-pressure zones. It may be possible to tie into the 21- and 14-inch transmission mains at Station 103 closer to the BDPL turnouts for Purified Transmission Line Alignments Options 1 and 3.

Earlier phases of the project identified the potential to augment various locations within Cal Water's distribution system in southern San Mateo and northern San Carlos. However, the transmission pipelines near Station 103 were identified as preferred tie-in points due to their ability to provide purified water to much of Cal Water's Bayshore system via existing pipelines and pump stations. These tie-in points would streamline operations compared to having many tie-in points elsewhere in the system.

Two potential points of connection were identified within the MPWD service area:

1. Hallmark Tanks: MPWD owns two 2.5-MG tanks on Hallmark Drive, near the Pulgas Water Temple. The two storage tanks typically provide water to approximately 80 percent of customers by usage and can be operated to serve the full MPWD service area if needed. The Hallmark Tanks are nearby to Purified Transmission Pipeline Options 1 and 2 and would be the preferred tie-in location for ease of operation and the ability to provide purified water to a larger proportion of customers.

2. **Transmission Line in Whipple Avenue/Old County Road:** MPWD owns a 20-inch-diameter transmission line that conveys water from the MPWD BDPL turnout (near the Redwood City Sequoia Tanks) to the MPWD distribution system. This transmission line typically provides water to approximately 20 percent of customers by usage and is usually operated to optimize power consumption, however, MPWD can pump from bottom up if the Hallmark Tanks are offline. A potential point of connection would be at the intersection of E Street and Old Country Road/Stafford Street to provide a viable connection for Purified Transmission Alignment Option 3, which does not pass by the Hallmark Tanks.

To meet the expected TWA flow of 6 mgd, multiple tie-in locations to the local drinking water distribution system would be needed. Potential points of connection for each TWA are further described in **Appendix B**: **TM #5 – Drinking Water Distribution System Design Criteria.**

2.3 Project Flows

Phase 1 (ResWA) and Phase 2 (TWA) project flows are illustrated in the project flow diagram in Figure 2-4 and summarized in Table 2-2, which provides a summary of estimated average flows feeding the AWPF, waste flows leaving the AWPF, and AWPF-product water flows. For the purpose of the BODR, Phase 1 would produce 6 mgd for ResWA at CSR. In Phase 2, the AWPF would be expanded to produce an additional 6 mgd of purified water, for a total of 12 mgd. Up to 6-8 mgd would be available for ResWA at CSR, and 4-6 mgd would be available for TWA to local drinking water distribution systems.

It is assumed that up to 8 mgd could be delivered to CSR in Phase 2. RO concentrate would be discharged to the existing SVCW outfall. Other AWPF waste flows, including backwash water, neutralized chemical waste from membrane chemical cleans, and drains would be returned to the SVCW Headworks.

The influent flows to the AWPF are based on the following:

- San Mateo's average monthly dry weather flow from 2018 to 2022. Currently, the facility treats an average annual flow of 10.2 mgd with an average dry weather flow (ADWF) of approximately 9.3 mgd based on 2018-2022 flow data. The City of San Mateo does not currently have a recycled water program.

- SVCW's average monthly dry weather flow from July 2020 to August 2022, minus recycled water demands and allotments. In July 2020, the Sharon Heights Golf Course began using recycled water, resulting in reduced inflows to SVCW. Flow measurements prior to this date are not included. Based on the allotments and demands summarized in TM #1, a daily average of approximately 7.5 mgd to 9.7 mgd of SVCW effluent could be available for source water supply.
- Note, from 2013-2021, RWC used 0.7 mgd on an average annual basis out of a total allotment of 2.9 mgd of tertiary treated recycled water. For the purposes of this BODR, available effluent range assumes RWC recycled water demands range from 0.7 – 2.9 mgd. However, during summer months, RWC's daily recycled water demand can peak to greater than 9 mgd. It is acknowledged that the source flows available for the AWPF would depend on influent flows to SVCW and RWC's recycled water demand and agreement, and AWPF flows may need to be turned down to accommodate RWC demands/allotments.

Figure 2-4: PureWater Peninsula Project Flow Diagram

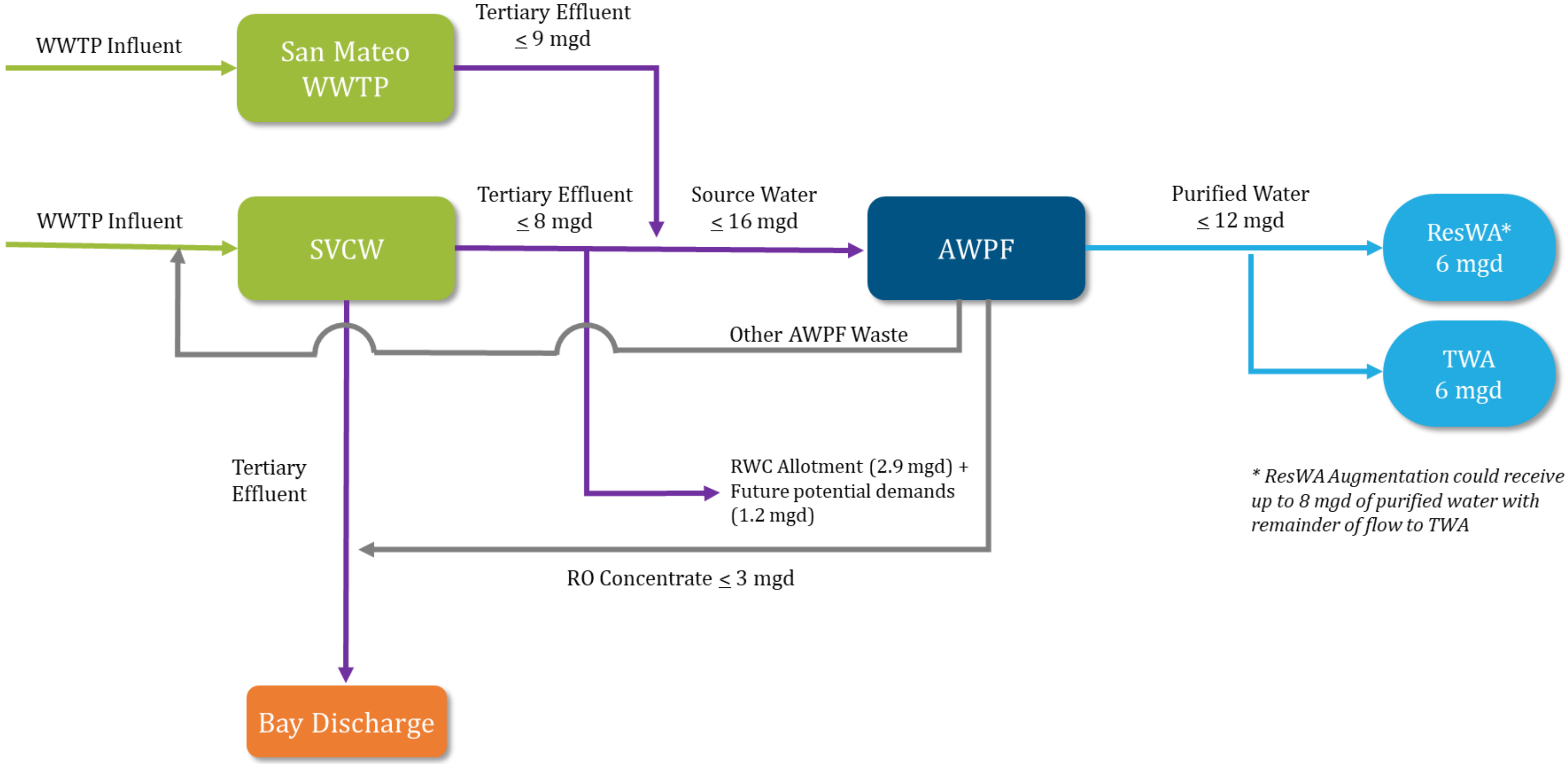


Table 2-2: PureWater Peninsula Project Flows Summary

Flow	Phase 1 Capacity (mgd)	Phase 2 Capacity (mgd)
San Mateo Tertiary Effluent	4.0	9.0[1]
SVCW Tertiary Effluent	4.0	8.0
AWPF Combined Influent	8.0	16.0
RO Concentrate	1.4	2.9
Other AWPF Waste	0.6	1.1
AWPF Purified Water	6.0	12.0
Purified to CSR	6.0	6.0 – 8.0
Purified for TWA	0	4.0 – 6.0

Note:

[1] An AWPF combined influent flow of 16.0 mgd is required to produce 12.0 mgd of AWPF purified water, which would be a blend of water from the San Mateo WWTP and SVCW. It is assumed that up to 8.0 mgd would be available from SVCW and up to 9.0 mgd would be available from San Mateo. The AWPF source water ratio could shift to a higher percentage of San Mateo effluent when needed to supplement SVCW flows and/or to maintain some flows to blend with RO concentrate prior to discharge.

The AWPF average purified water annual flows and RO concentrate flows summarized in Table 2-3 are calculated based on the assumed recoveries for the AWPF process discussed in Section 2.3.1. There are also several return flows from the AWPF EQ basin to the headworks of SVCW, including flows from the membrane filtration backwash process.

Detailed discussion of the project flows is included in **Appendix B: TM #1 – AWPF Design Criteria**. Table 2-3 summarizes the estimated annual average flows through each AWPF unit process based on the following assumed recovery rates:

- Microfiltration (MF) Strainer Recovery Rate = 98%
- MF Recovery Rate = 95%
- RO Recovery Rate = 81%
- Overall Recovery Rate = 75%
- RO Concentrate Disposal Rate = 18%

Table 2-3: AWPF Design Flows

Flow	Phase 1 Average (mgd)	Phase 2 Average (mgd)
AWP Source Water	8.0	16.0
Ozone/BAC Feed	8.0	16.0
MF Feed	8.0	16.0
MF Effluent/RO Feed	7.8	15.6
RO Feed	7.4	14.9
RO Permeate	6.0	12.0
RO Concentrate	1.4	2.9
UV/AOP Effluent	6.0	12.0
Chlorine Contact Tank Effluent	6.0	12.0
AWP Purified Water	6.0	12.0

AOP = advanced oxidation process, BAC = biological activated carbon, UV = ultraviolet

2.3.1 Conveyance Design Flows

Table 2-4 summarizes the estimated minimum and maximum flows for each alignment.

Table 2-4: Conveyance Design Flows

Flow	Phase 1 Min/Max (mgd)	Phase 2 Min/Max (mgd)
Source Water Alignments		
San Mateo Tertiary Pipeline	2/4	4/9
SVCW Tertiary Pipeline	2/4	4/8
Purified Water Alignments		
AWPF Product Water	3/6	6/12
IPR to CSR	3/6	3/8
DPR Flows for TWA	-	0/6

2.3.2 Pulgas Operational Flows

The Pulgas DF is part of the SFRWS. Together with the Pulgas Balancing Reservoir (PBR) and Pulgas Pump Station (PPS), Pulgas DF is used to manage and control water flow to SFPUC customers on the Peninsula and San Francisco Bay (SF Bay). Pulgas DF began operating in February 2004 when SFPUC began using chloramines as the distribution system residual disinfectant. The Pulgas DF operates to provide dechloramination and dechlorination for excess flows from the SFRWS delivered to CSR**.**

Appendix C: Modeling and AWPF Operational Scenarios, Section C.5 provides additional details about Pulgas DF operations. Dechloramination is performed through breakpoint chlorination to oxidize ammonia to nitrogen and dechlorination is performed through contact with sodium bisulfite.

Pulgas DF operates intermittently, based on SFRWS supply and the transmission system demand flows. Due to intermittent operations, fine-tuning facility operations over the years has been challenging, and the facility is unable to perform dechloramination at flows less than 20 mgd. While flows greater than 100 mgd are uncommon, flows less than 20 mgd can occur close to 40% of the time. When low flows occur, Pulgas DF can utilize water from the PBR to supplement flows, if available, to allow dechloramination to occur.

Initially, assumptions considered dechloramination of the purified water at Pulgas DF using the existing infrastructure. However, this would present a significant operational challenge given current Pulgas DF operations do not have the ability to provide dechloramination at the low, continuous flow of purified water provided by the PureWater Peninsula Project. Instead, dechlorination of the purified water can be performed at Pulgas DF utilizing existing Pulgas DF infrastructure with minor upgrades. If adding on or modifying existing dechlorination equipment is not cost effective or significantly impedes existing Pulgas DF operations, then new chemical dosing pumps and independent control systems for continuous dechlorination of the purified water may be evaluated as an alternative.

Additional alternatives for dechloraminating the purified water would need to be implemented. Since the purified water coming from the AWPF would contain disinfectant residual, an evaluation of alternatives is provided in **Appendix B: TM #4 – Pulgas Disinfectant Residual Alternatives** for dechloraminating the purified water prior to the tie in point for Pulgas DF.

For the purposes of this BODR, it is assumed that:

- The purified water would be introduced downstream of the main portion of the Pulgas DF and would bypass the breakpoint chlorination and the contactor processes of the Pulgas DF.
- **For Phase 1 ResWA**, free chlorine would be used for disinfection prior to the augmentation of CSR. This option would be the preferred option because performing dechlorination for the purified water at Pulgas DF requires only minor modifications and potential upgrades to the existing dechlorination system at Pulgas DF.
- **For Phase 2 ResWA with TWA,** the DWDS connection purified water would need to be chloraminated to match the SFRWS water quality in the local DWDS. Thus, the purified water would be dechloraminated after the final DWDS connection point but prior to reaching Pulgas DF connection. Dechloramination by breakpoint chlorination would be performed in the purified water transmission line prior to the Pulgas DF connection. This option requires only one chemical injection system and reduces the need to construct additional infrastructure by utilizing the purified transmission pipeline.

See Section 4.3.4 for additional discussions of the Pulgas DF connection and breakpoint chlorination systems.

2.4 Project Water Quality / Goals

The SFPUC meets much of its existing potable water demands with water from the SFRWS, which is derived from rain and snow runoff captured in Hetch Hetchy Reservoir in Yosemite National Park. Hetchy water is conveyed via a system of natural and artificial channels, tunnels, and pipelines. Hetch Hetchy water is generally of high quality with low alkalinity and low mineral content. Hetch Hetchy water is exempt from state and federal filtration requirements due to its exceptional quality although the water undergoes disinfection, pH adjustment, fluoridation, and chloramination and consistently meets all federal and state water quality standards as reported in the annual Water Quality Report (SFPUC 2022). CSR and the drinking water service areas for this study primarily receive water from the SFRWS, which consists of source water primarily from the Hetch Hetchy watershed (about 85%) blended with source water from local watersheds in the Alameda and San Mateo counties.

Overall water quality goals for the PureWater Peninsula Project are to meet or exceed:

1. DDW regulatory requirements for ResWA and TWA
2. SF Bay Discharge Requirements via the SVCW's outfall NPDES permit
3. SF Basin Plan Requirements for CSR
4. California Toxics Rule limits for inland surface waters
5. Ambient water quality in CSR without causing degradation.

These regulatory requirements are described in greater detail in **Appendix A: Potable Reuse Regulatory Requirements**. This section summarizes anticipated water quality concentrations, goals and other considerations that guide the design criteria for the AWPF and operational considerations for the project.

2.4.1 Source Water Quality

Table 2-5 summarizes the estimated source water quality for a select set of constituents for source water from SVCW tertiary effluent only, San Mateo WWTP tertiary effluent only, and an equal blend from the two WWTPs. The AWPF source water quality has been determined using a combination of data from SVCW NPDES reporting data from 2013-2021, San Mateo WWTP NPDES reporting data from 2013–2021, TDS data for SVCW and San Mateo is from prior PureWater Peninsula studies, and projected data for future San Mateo WWTP operations after the membrane bioreactor (MBR) upgrades, provided by San Mateo's design consultant.

The most significant difference in water quality between SVCW and San Mateo's anticipated tertiary effluent is in nutrient load, as seen in the total ammonia and total phosphorous levels. Higher nutrient levels in the water may lead to increased biofouling/bioaccumulation rates and therefore, increased frequency of backwash/cleaning for the biological activated carbon (BAC) and membrane filtration processes. However, it is noted that some IPR projects have been successfully designed to treat water that has not been fully nitrified, including Monterey Pure Water and Soquel Pure Water. SVCW is also exploring options for nutrient removal which would lower ammonia and phosphorus levels coming into the AWPF in the future. The SPRP project would need to run pilot testing in future design phases to optimize process parameters and verify total phosphorus (TP) and total nitrogen (TN) levels throughout the process.

Table 2-5: Summary of Source Water Quality and Estimated Combined Concentrations

Parameter	Units	SVCW Tertiary Effluent[1]	San Mateo Anticipated Tertiary Effluent	SVCW + San Mateo Combined Tertiary Effluent
TDS[2, 3, 8]	mg/L	1,000	1,900	1,450
TSS[3,4]	mg/L	3.8	0.0	1.9
CBOD[4,5]	mg/L	3.4	1.0	2.2
TOC[6]	mg/L	9.7	2.9	6.3
Turbidity[4]	NTU	3.0	0.25	1.6
Oil and Grease[2]	mg/L	ND	ND	ND
pH[2]	-	7.2	6.9	7.1
Total Ammonia (as N)[4]	mg/L	49	0.03	25
Total Phosphorus[4]	mg/L	4.6	0.03	2.3
Copper[2]	ug/L	5.9	6.0	5.9
Cyanide[2]	ug/L	2.8	ND	1.4
Mercury[2]	ug/L	3.6×10^{-3}	3.8×10^{-3}	3.7×10^{-3}

Notes:

1 SVCW commonly analyzed parameters from 2013-2021 provided to the RWQCB by SVCW to fulfill NPDES general reporting requirements.
2 San Mateo commonly analyzed parameters from 2018-2021 provided to the RWQCB by City to fulfill NPDES general reporting requirements.
3 Total dissolved solids (TDS) and Total suspended solids (TSS) for combined tertiary effluent is shown as an average but is likely to vary based on blending timing and water chemistry.
4 SM WWTP TSS, CBOD, Turbidity, Ammonia, and Phosphorus values are based on the projected water quality values summarized in San Mateo's Final Schematic Design Report - Nutrient Removal and Wet Weather Flow Management Upgrade and Expansion Project (Jan 2018, HDR).
5 CBOD = carbonaceous biochemical oxygen demand.
6 Total organic carbon (TOC) is calculated using a CBOD/TOC conversion factor of 0.35 (Metcalf & Eddy/AECOM, 2014
7 mg/L = milligrams per liter; NTU = nephelometric turbidity unit; ug/L = micrograms per liter.

[8] RO membranes will typically remove 95% of TDS to meet the TDS MCL requirement and match SFPUC water quality.

2.4.2 Purified Water Quality

Water quality goals for the AWPF purified water are summarized in Table 2-6 and are based on the SFPUC drinking water quality regulations discussed in the prior section. Note, further analysis would need to be done to evaluate seasonal variations in temperature, pH, alkalinity, and elemental composition at the CSR to better define water quality goals for compatibility of the AWPF purified water. AWPF purified water post-stabilization goals could be different for Phase 1 (IPR only) vs. Phase 2 (DPR and IPR).

Table 2-6: Water Quality Goals for AWPF Purified Water to Crystal Springs Reservoir

Parameter	Units	Purified Water Quality Goal	Basis
Regulated Constituents			
Primary Drinking Water Standards (maximum contaminant level (MCL))	--	< MCL	Title 22 CCR
Secondary Drinking Water Standards (sMCL)	--	< sMCL	
Notification Level (NL) Contaminants	--	< NL	
Priority Toxic Pollutants (PP)	--	< PP	
Pathogens			
Virus	Log Reduction	See Table 2-7	DDW ResWA and DPR Regulations
Giardia	Log Reduction		
Cryptosporidium	Log Reduction		
Organics			
1,4-Dioxane	Log Treatment with UV/AOP	≥ 0.5-log reduction	Title 22 CCR
NDMA	ng/L	≤ 0.69	California Toxics Rule
Bromodichloromethane	µg/L	≤ 0.56	
Dibromochloromethane	µg/L	≤ 0.21	
per- and polyfluoroalkyl substances (PFAS)	ng/L	< Proposed MCL and < California Notification and Response Levels	Proposed EPA MCL, California Notification and Response Levels
Inorganics[1]			
Un-ionized Ammonia	mg/L as N	< 0.025 (annual median) <0.4 mg/L (maximum)	SF Basin Plan
		0.0 to 0.3	CSR Background water quality (WQ)
Dissolved oxygen	mg/L	<7.0 mg/L	SF Basin Plan
Total Phosphorus	mg/L	< 0.03	CSR Background WQ
Purified Water Stabilization [2]			
Temperature	°C	16 to 24	SFPUC Drinking WQ
pH	--	8.6 to 9.8	
Alkalinity	mg/L as $CaCO_3$	7 to 166	
Langelier Saturation Index (LSI)	--	0.15 to 0.2	Corrosion Minimization
Calcium Carbonate ($CaCO_3$) Precipitation Potential (CCPP)[3]	mg/L as $CaCO_3$	2 to 6	

Notes:

1. Any augmentation into CSR would not only need to comply with ResWA requirements but would also need to meet local SF Basin Plan requirements and match or be compatible with background water quality concentrations in CSR:
   i. Ammonia concentrations are controlled by the SF Basin Plan limits, and
   ii. Phosphorus concentrations are controlled by the background concentrations in Upper CSR. Existing Total P levels in CSR range from 0.03 to 0.3 mg/L. The total P range is based on data from one monitoring point within UCS over a period of time (1998-2022) from data provided by SFPUC.

2 Purified water stabilization targets based on measured ranges from the 2021 SFPUC Drinking Water Quality Report. Final values should be coordinated with SFPUC, which would draw the purified water through Crystal Springs Reservoir for treatment.
3 CCPP is not a main post-stabilization design goal, but the purified water is expected to have a CCPP in the range shown.

The proposed pathogen treatment target for each unit treatment process for the PureWater Peninsula Project needed to meet ResWA and DPR regulations is summarized in Table 2-7. The project would be designed to meet DPR log removal requirements starting in Phase 1 to demonstrate full treatment capability before buildout and implementation of Phase 2. Early demonstration of treatment ability and documentation of the water quality and pathogen reduction performance of the AWPF during Phase 1 is anticipated to help streamline the future permitting process even though treated drinking water connections would be not made until Phase 2.

Table 2-7: Summary of Potential Log Removal Values (LRVs) for Unit Treatment Processes

Treatment Processes	Potential/Target Process Log Removal / Inactivation Credits							Potential Log Removal/ Inactivation	DDW ResWA Required Log Removal/ Inactivation	DDW TWA Required Log Removal/ Inactivation
	WWTP–Tertiary Filtration[1]	Ozone	BAC [2]	MF	RO	UV/ AOP	Free Chlorine			
Virus	2	2	1	1	2	6	6	***20***	9	20
Giardia	2	1	2	4	2	6	2	***19***	8	14
Cryptosporidium	2	0	2	4	2	6	0	***16***	9	15
1-4 Dioxane	0	0	0	0	0	0.5	0	***0.5***	0.5	0.5

Notes:
The ultimate inactivation credit achieved for a given process may be based on site-specific performance and/or a negotiated validation approach with DDW on a case-by-case basis (WateReuse, 2016).
1 Log removal credits up to 2/2/2 V/G/C through sand filtration (Olivieri et al., (2016). MBR systems to be installed at the San Mateo WWTP have not been credited for pathogen removal performance in potable reuse in California
2 Log removal credits based on a conservative estimate of log removal credits typically achieved using direct filtration treatment technologies at surface water treatment plants based on the Surface Water Treatment Rule Fact Sheet (EPA, 2019).

TM #1 includes additional discussion on purified water quality goals, including nutrient considerations for meeting potable reuse requirements in the worst case that all water comes from SVCW.

2.4.3 CSR Water Quality

Any augmentation of CSR would not only need to comply with ResWA requirements but would also need to meet local SF Basin Plan and SWRCB NPDES permit No. CAG140001 requirements. In addition, the background water quality concentrations of the receiving water should also be considered. Regulations and water quality considerations related to augmenting CSR with purified water are summarized in Table 2-8. Ammonia limits are controlled by the SF Basin Plan regulations, which have more stringent water quality limits as compared to the background concentrations in CSR. Phosphorus limits are controlled by background CSR concentrations since there are no SF Basin Plan limits, but anti-degradation provisions apply. **Appendix A: Potable Reuse Regulatory Requirements,** Section A.5 and **Appendix B: TM #1 – AWPF Design Criteria** discuss CSR augmentation and regulatory considerations in more detail. Note, future studies would need to further analyze the current water quality in CSR, the expected water quality within the CSR after the addition of various flows of AWPF purified water, and potential mixing zone effects.

Table 2-8: Summary of Regulations and WQ Considerations for Augmentation of CSR

Regulation / Permit	Key Relevant Items
ResWA Requirements	*Discussed in Section A.1*

SF Basin Plan	**Specific quantitative limits**
	▪ Un-ionized Ammonia
	    ▪ Annual median= 0.025 mg/L as N
	    ▪ Maximum = 0.4 mg/L as N
	    ▪ Dissolved Oxygen – 7.0 mg/L for cold water habitats
	General qualitative limits
	▪ E.g., bioaccumulation, biostimulatory substances, population, and community ecology etc.
	▪ *There are currently no limits for phosphorus*

CSR Background Water Quality Considerations[1]	**Existing Conditions** ▪ Ammonia = 0.0 – 0.3 mg/L as N (0.01 – 0.28 in Upper CSR and 0.0 – 0.3 in Lower CSR) ▪ Total Phosphorus = 0.03 – 0.4 mg/L (0.03 – 0.3 mg/L in Upper CSR and 0.1 to 0.4 mg/L in Lower CSR)

Note: [1] Sources: SFPUC 2020 Watershed Sanitary Survey Update for the Peninsula Watershed (Stantec 2021) for Lower CSR data. Upper CSR data from SFPUC data measured at Sample Point "UCS RES NORTH – 0 ft" measured between Feb 2011 to Jan 2017.

2.4.4 Pulgas DF Water Quality

One of the key goals of Pulgas DF is to remove chlorine and ammonia prior to delivery of water to CSR. The two main regulatory requirements Pulgas DF must meet include:

- **Ammonia:** ammonia discharge to CSR is defined by the SF Basin Plan, which limits un-ionized ammonia discharge to less than 0.025 mg/L as N on an Annual Median basis. Ammonia is removed with dechloramination.
- **Chlorine:** chlorine discharge into CSR is regulated by the SWRCB NPDES No. CAG140001 water quality requirements. The total chlorine residual concentration in the discharge is not to exceed 0.019 mg/L. A field monitoring result with a total residual chlorine concentration greater than or equal to 0.1 mg/L is deemed out of compliance with a chlorine effluent limitation. Chlorine is removed with dechlorination.

To meet these regulatory requirements, two treatment steps must be performed at Pulgas DF:

- **Dechloramination:** chloramines are formed from a combination of chlorine and ammonia. Dechloramination is performed with breakpoint chlorination where free chlorine (from sodium hypochlorite) reacts with free ammonia, often between a 10:1 to 11:1 chlorine to ammonia dosage ratio, to oxidize ammonia to nitrogen gas. The reaction is pH dependent and can be reduced using carbon dioxide (CO_2); the reaction requires 15 to 30 minutes of contact time. During normal Pulgas DF operations, dechloramination process occurs in the 10-ft-diameter pipe contactor between the inlet and outlet boxes at Pulgas DF. As discussed in Section 2.3.2, Pulgas DF operates intermittently, based on SFRWS supply and the system demand flows. Due to intermittent operations, fine-tuning facility operations over the years has been challenging, and the facility is unable to perform dechloramination at flows less than 20 mgd. While flows greater than 100 mgd are uncommon, flows less than 20 mgd can occur close to 40% of the time. When low flows occur, Pulgas DF can utilize water from the

PBR to supplement flows, if available, to allow dechloramination to occur. However, for the PureWater Peninsula Project, dechloramination of the 6 to 8 mgd of purified water cannot be performed using normal Pulgas DF operations because the PBR cannot be used continuously to supplement these low flows. Therefore, alternatives for dechloramination of the purified water must be evaluated such as performing dechloramination in the purified water conveyance pipeline to Pulgas DF as discussed previously.

- **Dechlorination:** chlorine is removed through contact with sodium bisulfite at the outlet box (refer to Section 4.3.4 for additional discussion and schematics related to dechlorination). Existing Pulgas DF dechlorination operations, with potential minor modifications and upgrades, would be used for dechlorination of the purified water. SFPUC may elect to explore additional alternatives analysis of providing an independent dechlorination system upstream of Pulgas DF in future studies. If so, the footprint for this facility would need to be identified in the CEQA checklist.

For the PureWater Peninsula Project, a continuous flow of 6 to 8 mgd would be delivered to CSR in both Phase 1 and 2. Only dechlorination is assumed to be performed at Pulgas DF.

2.4.5 Drinking Water Quality

The drinking water service areas for this project primarily receive water from the SFRWS. Water from the SFRWS Hetch Hetchy source only requires primary disinfection and pH adjustment (using CO_2) for corrosion control in the pipelines and undergoes UV disinfection at the Tesla Treatment Facility; water from the SFRWS Hetch Hetchy source is not required to undergo filtration prior to distribution due to the Filtration Avoidance status. However, SFRWS water from the Alameda System reservoirs are filtered and treated at the Sunol Valley WTP, and water from the Peninsula System reservoirs are treated at Harry Tracy WTP. The filtered and treated water from the two treatment plants is blended with water from the Hetch Hetchy reservoir, and most customers receive this blended water supply. A summary of constituents in the regional water supply is provided in Table 2-9. For Phase 2 Purified water stabilization would need to be adjusted to match SFPUC water quality as much as possible to meet customer aesthetic expectations, including taste and odor.

It is noted that the water quality value ranges reported in Table 2-9assume Hetch Hetchy and SVWTP are both in operation and may differ when Hetch Hetchy or SVWTP is offline. For example, SFPUC plans to take Hetch Hetchy offline for significant periods of time (on the order of two to three months) during the winter to perform maintenance on the upcountry facilities. The water quality parameters required to meet customer taste and odor expectations when both Hetch Hetchy and SVWTP or only SVWTP are in operation would need to be refined as part of a future piloting study.

Table 2-9: SFPUC Water Quality

DETECTED CONTAMINANTS	UNIT	MCL/TT	PHG OR (MCLG)	RANGE OR LEVEL FOUND	AVERAGE OR [MAX]
TURBIDITY					
Unfiltered Hetch Hetchy Water	NTU	5	N/A	0.2 - 0.4 (1)	[3.4]
Filtered Water from Sunol Valley Water Treatment Plant (SVWTP)	NTU	1 (2) Min 95% of samples ≤0.3 NTU (2)	N/A	99.3% - 100%	[2.2]
Filtered Water from Harry Tracy Water Treatment Plant (HTWTP)	NTU	1 (2) Min 95% of samples ≤0.3 NTU (2)	N/A	100%	[0.1]
DISINFECTION BY-PRODUCTS AND PRECURSOR					
Total Trihalomethanes	ppb	80	N/A	11 - 54	[36] (3)
Five Haloacetic Acids	ppb	60	N/A	6.7 - 47	[28] (3)
Bromate	ppb	10	0.1	ND - 1.7	[1.3] (4)
Total Organic Carbon (5)	ppm	TT	N/A	1.3 - 3.9	2.3
MICROBIAL					
Fecal coliform and *E. coli* (6)	-	0 Positive Sample	0	-	[0]
Giardia lamblia	cyst/L	TT	0	0 - 0.04	0.01
ORGANICS					
NDMA	ppt	NA	3 (10)	ND	
INORGANICS					
Nitrate	ppm	10	10	ND	ND (8)
Fluoride (source water) (7)	ppm	2.0	1	ND - 0.8	0.3 (8)
Chloramine (as chlorine)	ppm	MRDL = 4.0	MRDLG = 4	<0.1 - 3.5	[2.7] (4)

CONSTITUENTS WITH SECONDARY STANDARDS	UNIT	SMCL	PHG	RANGE	AVERAGE
Chloride	ppm	500	N/A	<3 - 15	8.7
Color	Unit	15	N/A	<5 - 5	<5
Iron	ppb	300	N/A	<6 - 24	11

LEAD AND COPPER (9)	UNIT	AL	PHG	RANGE	90TH PERCENTILE
Copper	ppb	1300	300	ND - 383	60
Lead	ppb	15	0.2	ND - 190	7.1

NON-REGULATED WATER QUALITY PARAMETERS	UNIT	ORL	RANGE	AVERAGE
Alkalinity (as CaCO3)	ppm	N/A	7.1 - 166	41
Boron	ppb	1000 (NL)	28 - 105	56
Calcium (as Ca)	ppm	N/A	3.2 - 15	9.3
Chlorate	ppb	800 (NL)	45 - 650	147
Chromium (VI)	ppb	N/A	0.22 - 0.27	0.25
Hardness (as CaCO3)	ppm	N/A	9.1 - 49	32
Magnesium	ppm	N/A	0.2 - 4.2	2.9
pH	-	N/A	7.8 - 9.6	9.2
Potassium	ppm	N/A	0.3 - 1	0.7
Silica	ppm	N/A	5 - 5.9	5.5
Sodium	ppm	N/A	3.5 - 21	14
Strontium	ppb	N/A	16 - 159	79

Source: SFPUC annual Water Quality Report (SFPUC 2022) - https://www.sfpuc.org/sites/default/files/documents/SF_WaterQualityReport_CY2022.pdf

Notes:

1. These are monthly average turbidity values measured every 4 hours daily.
2. This is a TT requirement for filtration systems.
3. This is the highest locational running annual average value.
4. This is the highest running annual average value.
5. Total organic carbon is a precursor for disinfection byproduct formation. The TT requirement applies to the filtered water from the SVWTP only.
6. The MCL was changed to E. coli based starting on July 1, 2021 after the SWRCB adopted the Revised Total Coliform Rule.

7 The SWRCB recommended an optimal fluoride level of 0.7 ppm be maintained in the treated water. In 2022, the range and average of the fluoride levels were 0.5 ppm - 0.9 ppm and 0.7 ppm, respectively.
8 Natural fluoride in the Hetch Hetchy source was ND. Elevated fluoride levels in the raw water at the SVWTP and HTWTP were attributed to the transfer of fluoridated Hetch Hetchy water into the local reservoirs.
9 The most recent Lead and Copper Rule monitoring was in August 2021. Three of the 72 site samples collected at consumer taps had lead concentrations above the AL.

2.4.6 RO Concentrate Discharge

The RO concentrate may need to be blended with SVCW's tertiary effluent to meet existing and future regulations for discharge at the SVCW outfall to the SF Bay. This outfall is regulated under three WDRs and NPDES permits:

(1) SVCW Individual WDR,
(2) SF Bay Watershed WDR for mercury and PCBs, and
(3) SF Bay Watershed WDR for nutrients.

Table 2-10 and Table 2-11 summarize the Dry Season effluent limitations for SVCW and San Mateo, respectively, and Table 2-12 summarizes SVCW nutrient load targets. The WDR for mercury and PCBs also requires monitoring of discharges for mercury and PCBs to comply with Total Maximum Daily Load (TMDL) limits adopted in 2006 and 2008, respectively.

Appendix A: Potable Reuse Regulatory Requirements, Section A.5 provides additional discussion about these permits and Bay discharge requirements.

Table 2-10: Summary of SVCW NPDES Dry Season Water Quality Effluent Limits[1]

Permit Source	Parameter	Units	Average Monthly	Average Weekly	Max Daily	Inst. Min	Inst. Max
SVCW Individual NPDES	$CBOD_5$	mg/L	8	12	-	-	-
	TSS	mg/L	8	12	-	-	-
	pH	s.u.[2]	-	-	-	6	9
	Turbidity	NTU	10	-	20	-	-
	Chlorine, Total Residual	mg/L	-	-	-	-	0
	Ammonia, Total	mg/L as N	170	-	250	-	-
	Copper, Total Recoverable	µg/L	52	-	84	-	-
	Cyanide, Total	µg/L	21	-	32	-	-
	Dioxin-TEQ	µg/L	1.4×10^{-8}	-	2.8×10^{-8}	-	-
	Enterococcus	CFU/100ml	290 (6-week geometric mean)				
Regional WDR for Mercury and PCBs	Mercury	µg/L	0.066	0.072	-	-	-
	PCB	µg/L	0.012	-	0.017	-	-

Notes:
1 Discharge of the AWPF RO concentrate via SVCW's existing outfall would require regulatory compliance under a NPDES permit. This may entail a separate NPDES permit by the Owning Entity or a revised NPDES permit by SVCW that allows RO concentrate discharge into the San Francisco Bay waters.
2 s.u. = standard units.

Table 2-11: Summary of San Mateo Dry Season Effluent Limitations

Parameter	Units	Average Monthly	Average Weekly	Max Daily	Inst. Min	Inst. Max
$CBOD_5$	mg/L	15	25	-	-	-
TSS	mg/L	20	30	-	-	-
Oil and Grease[2]	mg/L	10	-	20	-	-
pH[2]	s.u.[1]	-	-	-	6	9
Chlorine, Total Residual[2]	mg/L	-	-	-	-	0
Ammonia, Total[2]	mg/L as N	66	-	120	-	-
Copper, Total[2]	µg/L	51	-	72	-	-
Cyanide, Total[2]	µg/L	20	-	38	-	-
Dioxin-TEQ[2]	µg/L	1.4×10^{-8}	-	2.8×10^{-8}	-	-
Nickel, Total[2]	µg/L	30	-	71	-	-

Notes:
1 s.u. = standard units.
2 Effluent limitations are applicable year-round.

Table 2-12: Waste Load Discharge Targets for Total Inorganic Nitrogen

Discharger	Maximum Dry Season Average *(May 1, 2014 – September 30, 2017)*	2024 Dry Season Average Load Targets *(15% growth buffer)*
City of San Mateo	1,500 kg/d	1,700 kg/d
Silicon Valley Clean Water	2,500 kg/d	2,900 kg/d

TM # 3 evaluates the RO concentrate water quality from three possible source water operating conditions (1) SVCW effluent only, (2) San Mateo effluent only and (3) blended 50/50 mix of SVCW/San Mateo effluent. This evaluation found that while most constituents would meet NDPES limits for each operational scenario, the RO concentrate would exceed the NDPES regulations for the total ammonia limit under the operating condition when only SVCW effluent is used for source water. This operating condition would also result in water with total cyanide levels that are near the NPDES limits. These exceedances could be avoided if source water is only from San Mateo tertiary effluent or a 50/50 mix of the two sources. However, in the operating condition where source water is a 50/50 mix, total ammonia would still be high and could require dilution of the RO concentrate.

Operational strategy shifts to meet NPDES regulations for ammonia and other constituents that approach the NDPES limit, could include:

- Shift the AWPF source water ratio to a higher percentage of San Mateo tertiary effluent
- Dilute RO concentrate with ≥1.5 mgd of SVCW tertiary effluent
- Dilute RO concentrate with ≥1.1 mgd of San Mateo tertiary effluent
- Reduce AWPF production to reserve more effluent for dilution

Alternatively, preventing ammonia level exceedance, specifically, could be taken a step further by adding an additional treatment process specifically for ammonia removal. Potential options for ammonia removal are listed below and described further in **TM #3**.

- Discharge to a horizontal levee, applying a nature-based approach for removing nitrogen from municipal wastewater effluent.
- Nutrient removal upstream of the AWPF, which is currently being explored by SVCW.
- Biological Treatment of RO Concentrate Stream.

Future studies would be needed to further explore these options. Alternatively, the AWPF could go into recirculation mode or shutdown mode to stop producing recycled water if it is anticipated that the blend of source water would result in challenges meeting regulatory requirements.

Section 3 AWPF Basis of Design

Supporting information for this section is provided in:

- Appendix A: Potable Reuse Regulatory Requirements
- Appendix B: TM #1 – AWPF Design Criteria
- Appendix B: TM #2 – Conveyance Facility Design Criteria
- Appendix B: TM #3 – RO Concentrate Disposal
- Appendix B: TM #4 – Pulgas Disinfectant Residual Alternatives
- Appendix B: TM #6 – AWPF Operational Strategies
- Appendix C: Modeling and AWPF Operational Considerations
- Appendix E: CEQA Checklist
- Appendix F: Drawings

The information herein is representative of a ten percent design level based on available information at the time of this BODR. Field investigations, water quality sampling, environmental, noise and other special studies would be conducted in future design phases to refine assumptions and support a more detailed level of design and environmental documentation. Reservoir modeling, tracer studies and development of a treatment pilot project would likely be needed to demonstrate adherence to regulatory requirements.

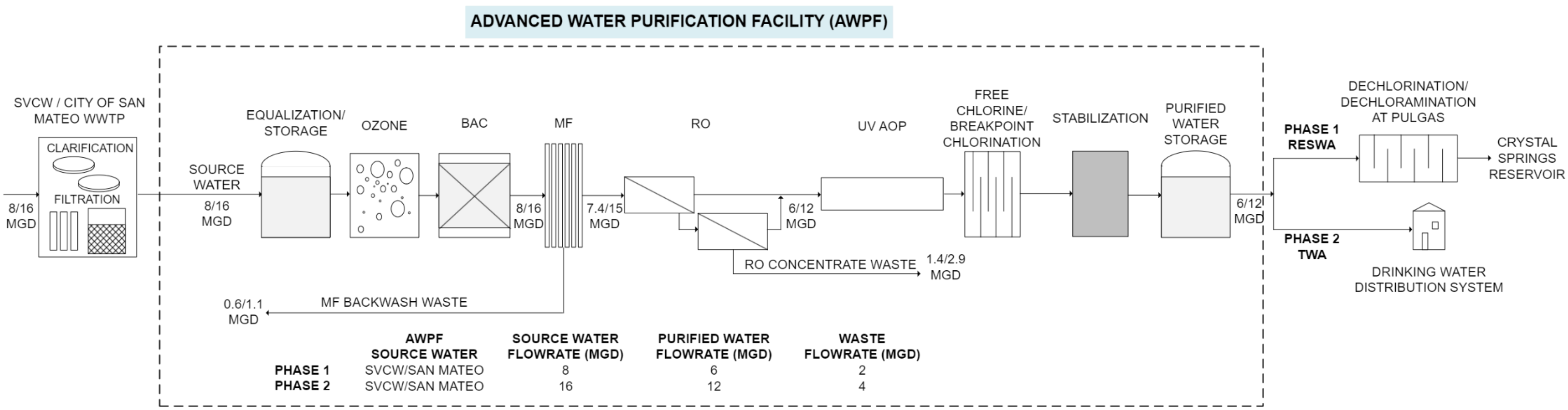
3.1 AWPF Process Flow Diagram

As part of Phase 1, a 6.0-mgd-capacity APWF located near SVCW would treat to TWA standards, including ozone ($^{+}O_3$), biologically activated carbon (BAC), microfiltration (MF), reverse osmosis (RO), ultraviolet light (UV), advanced oxidation process (AOP), free chlorine (Cl^2), unit processes and associated chemical feed systems, wet wells, inter-process pumps, stabilization/equalization and other appurtenances. Building facilities would be sized for future 12 mgd treatment capacity. While treated drinking water connections would be not made until Phase 2, early demonstration of treatment ability and documentation of the water quality and pathogen reduction performance of the AWPF during Phase 1 is anticipated to help streamline the future permitting process.

The treatment processes for the proposed AWPF were designed to achieve the flow capacity and treatment objectives described in Section 2.3 and Section 2.4, respectively. A simplified process flow diagram of the AWPF is presented in Figure 3-1, and a detailed P&ID is included in **Appendix F: Drawings**.

As part of Phase 2, the AWPF capacity would expand from 6 mgd to 12 mgd treatment capacity by expanding the O3/BAC/MF/RO/UV/AOP unit processes and appurtenances and potable water system tie-ins would be implemented.

Figure 3-1: Proposed AWPF Treatment Process for ResWA or TWA



3.2 AWPF Operational Scenarios

Whether the PureWater Peninsula Project is delivering water for ResWA or TWA, the addition of a new source of supply to the SFRWS would either supplement or displace water that would otherwise be delivered to the San Francisco Peninsula (SF Peninsula).

Appendix C: Modeling and AWPF Operational Scenarios, Section C.4 describes an evaluation of the impact of purified water deliveries from the PureWater Peninsula Project on the SFRWS when the Water Bank is full and describes the quantity of "spill" that could potentially occur under different AWPF operational scenarios.

Appendix B: TM #6 – AWPF Operational Strategies summarizes the preliminary operational strategies for both ResWA and TWA to support the development of AWPF design and operational criteria and define operational strategies to address seasonal operations, regulatory requirement alarms, emergency shutdown, source water availability to optimize production based on system demand and minimize risk when responding to alarms or an emergency scenario.

The AWPF seasonal operational scenarios are summarized below:

- **Seasonal Operational Scenario 1: Continuous AWPF Production** – During dry years the AWPF would continuously operate at the design capacity. Under this operational scenario, "spills" would be infrequent or minimal.

- **Seasonal Operational Scenario 2: Ramped Down AWPF Production –** During normal to wet years, the AWPF would operate at the design capacity during the summer months (May to October) and ramp down to as low as the minimum design flow during winter months (November to April), depending on available storage in the SFRWS. This would allow for the AWPF to maintain purified water production, and avoids the operational complexity associated with a full plant shutdown. Under this operational scenario, a "spill" in the upcountry system could occur. Due to the fluctuations in water demand and for other reasons, the SFRWS can limit or cease to accept the discharge of advanced treated water with little advance notice. This uncertainty will be an operational challenge for the AWPF in diverting purified water to other facilities and in the turndown of the advanced treatment facilities. AWPF operations staff would need to continuously coordinate with SFPUC SFRWS operations to communicate if a full AWPF shutdown is necessary due to SFRWS Water Bank capacity. The AWPF would coordinate with AWPF source water providers, SVCW and San Mateo, to reduce deliveries as appropriate.

- **Seasonal Operational Scenario 3: Seasonal AWPF Shut Down –** During wet to extremely wet years, the AWPF would operate at full capacity during summer months (May to October), followed by a full plant shutdown period during the wet winter months (November to April). Full plant shutdown protocols would be developed during the design of the AWPF and would include an implementation schedule for AWPF operations staff to follow.

Alarms and Emergency Shutdowns

- In the event of a regulatory alarm, the AWPF would adjust its operation appropriately to protect end users and to protect the equipment from damage that would occur if a facility is put into a “hard stop”. This is typically done with an automated recirculation loop at a reduced purified water production capacity. A recirculation loop is a permanent bypass that is built into a plant and facilitates water moving “in a circle” versus being sent out as treated water. It is recommended to further define these scenarios and responses with the operations staff during the design of the AWPF.

The DPR regulations require the designation of one direct potable reuse responsible agency (DiPRRA) that would be responsible for complying with the DPR regulations. The DiPRRA is required to be a public water system that is responsible for using the DPR water. Thus, the overall operational scheme for the AWPF would be managed by the DiPRRA in close coordination with the SFPUC SFRWS operations team, AWPF source water providers (SVCW and San Mateo) as well as local water purveyors. The quantify of purified water produced would be influenced by hydrologic conditions, available storage in the SFRWS Water Bank and local demands.

3.3 Hydraulics

This section provides an overview of system process streams, hydraulic calculations and design assumptions to support the conceptual hydraulic profile included in **Appendix F: AWPF Sheet G-06**.

3.3.1 System Overview

The AWPF operates through a series of pressurized and gravity process streams as described below.

- Source water (tertiary effluent) from San Mateo WWTP and/or SVCW is pumped to partially buried AWPF influent EQ tank(s). Influent pumps then convey water from the EQ tank(s) through the ozone contactors/BAC and into the partially buried MF Feed Tank. MF Feed Pumps then deliver water though the MF strainers and MF system, to the partially buried RO Feed Tank.

- The MF filtrate from the RO Feed Tank is pumped via the RO Transfer Pump Station through cartridge filters to the RO Feed Pumps. The RO Feed Pumps boost the pressure to convey water through the RO System to the UV/AOP system. A portion of the RO permeate is also conveyed to the RO Flush Tank.

- The treated water flows from the UV Reactors flow through the free chlorine contactors through the post-treatment CO_2 and lime addition points, and finally to the partially buried purified water tank.

- The below-grade Purified Water Pump Station then conveys the AWP Facility purified water through the AWP pipeline to dechlorination/dechloramination. In Phase 2, the potable reuse water would be conveyed through existing drinking water connections.

3.3.2 Hydraulic Calculations

A hydraulic evaluation has been conducted for the AWPF to determine friction head loss throughout the main treatment process and generate the conceptual hydraulic grade line for the facility. The hydraulic profile is calculated starting at the downstream boundary condition at the purified water pump station (PWPS) and working upstream to the AWPF at the influent equalization tanks. Each treatment process unit is input into a spreadsheet, including approximate pipe sizes and lengths, quantity of units, maximum flow (12 mgd for Phase 2), and estimated process-specific head losses.

Some of the main criteria used in the hydraulic calculations are:

- The overall purified grade elevation at the AWPF site ranges from 102-108 ft. See Section 1.1.1 for additional datum information.
- The AWPF Influent Tank(s) would be fed by the tertiary effluent from SVCW and San Mateo. The combined tertiary effluent flows are referred to as the AWPF source water.
- A freeboard of 3 feet and minimum pump submergence of 6 feet is assumed for the influent equalization tank, filtrate tank, and PWPS.
- The Hazen-Williams coefficient of friction and head loss equations were used to determine major friction losses. The Hazen-Williams friction coefficient is assumed to be C = 145 for cement-mortar-lined welded steel pipes between 6 and 36 inches in diameter (Mays 2011). Pipe material would be determined during detailed design.

3.3.3 Conceptual Hydraulic Profile

The conceptual hydraulic profile provided in **Appendix F: AWPF Sheet G-06** reflects the preliminary evaluation of the anticipated hydraulic grade line (HGL) through the AWPF based on the Phase 2 average flow conditions previously presented in Table 2-3. The hydraulic design assumptions are summarized in **Appendix C: Modeling and AWPF Operational Scenarios,** Section C.6, which lists assumed elevations, high water lines (HWL), and pressures for each treatment process and facility. Specific process unit pressure losses are estimated based on AWPF projects of a similar size and water quality, and professional experiences. Pressure losses may vary based on source water quality, flow rates, and equipment performance and would continue to be evaluated during subsequent design phases and piloting for the Project.

The hydraulic profile is calculated from the downstream end of the AWPF at the PWPS and working upstream to the head of the AWPF at the influent equalization tank. The calculation considers the head loss through each hydraulic element within the AWPF, including major piping, fittings, and equipment, as well as the heads provided by the pump stations.

3.4 Process Mechanical

This section presents a summary of process unit sizing and preliminary equipment selection for the major treatment processes and equipment included for the AWPF. A detailed discussion of the AWPF process sizing is included in **Appendix B: TM #1 – AWPF Design Criteria**.

The **AWPF influent equalization (EQ) and AWPF influent pump station** would equalize source water flows and pressurize water through the ozone/BAC system, respectively. The AWPF influent EQ tank design criteria are presented in Table 3-1. Preliminary design criteria for the influent pump station are presented in Table 3-2 and is based on the hydraulic design assumptions summarized in **Appendix C: Modeling and AWPF Operational Scenarios**, Section C.6.

Table 3-1: AWPF Influent EQ Tank Design Criteria

Parameter	Unit	Phase 1	Phase 2
Type	Partially buried pre-stressed concrete tank		
Number of Tanks	qty	1	2
Design Inlet Flow	mgd	4	8
Design Outlet Flow	mgd	8	16
Differential Flow	mgd	4	8
Target Avg. Operational HDT	hrs	8	8
Target Operational Volume	MG	1.3	2.7
Total Storage Volume, per tank	MG	2.0	2.0
Total Storage Volume, total	MG	2.0	4.0
Tank Diameter	ft	110	110
Total Tank Height	ft	39	39
Working Depth	ft	22	22

HDT = Hydraulic Residence Time

Table 3-2: AWPF Influent PS Design Criteria

Parameter	Unit	Phase 1	Phase 2
Pump Type	-	Vertical turbine	
Number of Pumps (Duty + Standby)	-	2+1	4+1
Design Flow Per Pump	gpm	2,800	
Pump Efficiency	%	80%	
Drive Efficiency	%	90%	
Rated Horsepower (Per Pump)	hp	65	
Calculated Pump Horsepower (Per Pump)	hp	47	
Total Power Required (Pumping Only)	kW	71	141

The **ozone and BAC** filtration pretreatment prior to the RO/AOP process would help reduce low molecular weight compounds as well as other chemicals of emerging concern (CECs) per TWA requirements. The ozone system and BAC design criteria are presented in Table 3-3 and Table 3-4, respectively. The ozone system would be designed to meet safety requirements with appropriate alarm systems for monitoring and notifications.

Table 3-3: Ozone System Design Criteria

Parameter	Unit	Phase 1	Phase 2
Estimated Ozone Dose			
Ozone Feed Maximum Flow	mgd	8.0	16.0
Target Ozone Residual	mg/L	0.5	0.5
Estimated Influent TOC	mg/L	6.3	6.3
Maximum Design Applied Ozone Dose	mg/L	9	9
Maximum Ozone Usage	ppd	625	1,250

Ozone Generator			
Manufacturer		Xylem	
Model		Wedeco SMOevo/PDOevo	
Number of Generators (Duty + Standby)	no.	1+1	2+1
Design Ozone Concentration (%, by weight)	%	10%	10%
Capacity per Generator at 10% Ozone Conc.	ppd	800	800
Oxygen Feed Rate to produce Ozone capacity	scfm	50	100
Duty Ozone Generation Capacity	ppd	800	1,600
% Duty Rating	%	78	78
Ozone Contactor			
Type		Concrete, 5-pass Serpentine	
Number of Contactors	no.	1	2
Width	ft	60	60
Length	ft	50	50
Operational Water Level	ft	14	14
No. of Baffle Walls	-	4	4
L/W Ratio	-	41	41
Contact Volume	ft^3	42,000	84,000
	gal	314,000	627,000
CT Calculations			
Hydraulic Residence Time (HDT)	min.	60	60
Minimum Baffling Factor, T10/HDT	-	0.5	0.5
T10	min.	28	28
Required CT	mg/L-min	0.3	0.3
Calculated CT	mg/L-min	14	14

Table 3-4: BAC System Design Criteria

Parameter	Unit	Phase 1	Phase 2
BAC Feed Maximum Flow	mgd	8.0	16.0
Minimum Required EBCT	min	15	
Design EBCT	min	20	
Filter Media	-	Granular Activated Carbon	
Filter Type	-	Gravity	
Filter Media Uniformity Coefficient	mm	1.5	
Number of BAC Filters (Duty + Standby/Backwash)		4+1	8+1
Filter Length, each	ft	40	
Filter Width, each	ft	20	
Filter Surface Area, each	ft^2	400	
Water Depth Above Media	ft	2	

Parameter	Unit	Phase 1	Phase 2
GAC Filter Media Depth	ft	9.3	
Sand Filter Media Depth	ft	1	
Filter Media Volume, each	ft^3	3,700	
Filter Media Volume, each	gal	27,700	
Filter Loading Rate, Duty Filters	gpm/ft^2	3.5	

The **MF system**, comprising feed strainers, MF racks, and ancillary systems would provide filtration of suspended solids, organics, and pathogens, while providing pretreatment for the downstream RO process. The MF system and MF feed pump station design criteria are presented in Table 3-5.

Table 3-5: MF System Design Criteria

Parameter	Unit	Phase 1	Phase 2
MF Feed Tank			
No. of Tanks	no.	1	
Type	-	Partially buried, pre-stressed concrete tank	
Total Storage Volume	MG	0.4	
Diameter	ft	60	
Total tank height	ft	25	
Max tank sidewall height	ft	19	
Max Water Depth	ft	12	15
Min Water Depth	ft	1.9	1.9
Average Hydraulic Residence Time	min.	40	25
Total Operational Volume	gal	215,000	271,000
MF Feed Pumps			
Pump Type	-	Vertical turbine	
Number of Pumps (Duty + Standby)	-	2+1	4+1
Design Flow Per Pump	gpm	2,800	2,800
Pump Efficiency	%	80%	80%
Drive Efficiency	%	90%	90%
Rated Horsepower (Per Pump)	hp	200	200
Calculated Pump Horsepower (Per Pump)	hp	140	160
Total Power Required (Pumping Only)	kW	210	480
Membrane Description			
Membrane Type/Material	-	Pressure, Polyvinylidene fluoride (PVDF)	

Parameter	Unit	Phase 1	Phase 2
Membrane Modules Manufacturer	-	Toray	
Membrane Modules Model	-	HFU-2020N	
Membrane Classification	-	Microfiltration	
MF Skid Capacity/Sizing			
System Target Usable Capacity	mgd	7.8	15.6
Number of MF Skids (Duty)	no.	3	6
Number of MF Skids (Duty + Standby)	no.	3+1	6+1
Number of Modules per Skid	no.	105	105
Number of Blank Modules/Skid	no.	11	11
Active Membrane Area per Module	ft^2	775	775
Flow/Pressure			
Maximum Design Instantaneous Flux	gfd	40	40
Max Instantaneous Module Prod at Rated Flux	gpm	21.5	21.5
Maximum flow per unit	gpm	2,300	2,300
Maximum System Instantaneous Production	mgd	9.8	19.5
Average Design Transmembrane Pressure	psi	10	10
System Production			
Unit Average Filtering Time Percentage	%	85	85
Minimum System Recovery	%	95	95
Max Unit Usable Production	gpm	1,825	1,825
Max Unit Usable Production	mgd	2.6	2.6
Max System Usable Production	mgd	7.8	15.6

The **RO system**, comprising cartridge filters, RO skids, and ancillary systems would remove dissolved constituents and serve as a pathogen barrier for bacteria, protozoa, and viruses. The RO system, RO transfer pump and RO feed pump design criteria is presented in Table 3-6.

The RO feed tank is sized for Phase 2 flows and will have 7 ft of freeboard at the maximum water depth. The RO transfer and RO feed pump design criteria is based on the hydraulic design assumptions are summarized in **Appendix C: Modeling and AWPF Operational Scenarios,** Table C-5. The RO Concentrate Pump Station design criteria is summarized in Section 4.3.2.

Table 3-6: RO System Design Criteria

Parameter	Unit	Phase 1	Phase 2
RO Feed Tank			
No. of Tanks	no.	1	
Type	-	Partially buried, pre-stressed concrete tank	
Total Storage Volume	MG	0.3	
Diameter	ft	40	
Total tank height	ft	36	
Max tank sidewall height	ft	32	
Max Water Depth	ft	14	25
Min Water Depth	ft	3	3
Average Hydraulic Residence Time	min.	58	29
Total Operational Volume	gal	103,000	206,000
RO Transfer Pumps			
Pump Type	-	Vertical turbine	
Number of Pumps (Duty + Standby)	-	2+1	4+1
Design Flow Per Pump	gpm	2,600	2,600
Pump Efficiency	%	80%	80%
Drive Efficiency	%	90%	90%
Rated Horsepower (Per Pump)	hp	130	130
Calculated Pump Horsepower (Per Pump)	hp	100	100
Total Power Required (Pumping Only)	kW	150	310
RO Feed Pumps			
Type	-	Vertical turbine	
Number of Pumps (one per RO Train)			
Small Trains (2 mgd capacity per train)	no.	4	4
Large Trains (3 mgd capacity per train)	no.	0	2
Pump Efficiency	%	80%	80%
Drive Efficiency	%	90%	90%
Brake Horsepower			
Small Trains	HP	350	350
Large Trains	HP	-	550
Calculated Pump Horsepower			
Small Trains	HP	300	300
Large Trains	HP	-	450

Parameter	Unit	Phase 1	Phase 2
Total Power Required (Pumping Only)	HP	880	1600
Membrane Trains			
Number of Trains			
Small Trains (2 mgd capacity)	no.	3	3
Large Trains (3 mgd capacity)	no.	0	2
Permeate Capacity per Train			
Small Trains	mgd	2	2
Large Trains	mgd	0	3
Permeate Capacity, Total			
Small Trains	mgd	6	6
Large Trains	mgd	0	6
Recovery	%	81	81
RO Membrane Elements			
Total Number of Elements	no.	TBD	TBD
Element Manufacturer	-	ESPA2-LD; or Equal	
Element Type	-	High Rej. PA Composite	
Membrane Type	-	PA Composite	
Element Length	in.	40	40
Element Diameter	in.	8	8
Minimum Surface Area	ft^2	400	400
Average Rejection	%	99.5	99.5
Average Flux at Rated Capacity	gfd	12	12

The **UV-AOP System** provides disinfection and log reduction of all target pathogens. The design criteria for the UV-AOP system are presented in Table 3-7.

Table 3-7: UV-AOP System Design Criteria

Parameter	Unit	Phase 1	Phase 2
Design Capacity	mgd	6	12
Number of UV-AOP Trains (Duty)	no.	4	8
Number of UV-AOP Trains (Duty+Standby)	no.	4+1	8+1
UV Manufacturer	-	Wedeco K series; Trojan UVFlex	
Duty Lamp Banks per Train	no.	2	2
Standby Lamp Banks per Train	no.	2	2
Type/Operating Configuration	-	Lamps perpendicular to the Flow	
Max. Capacity per UV Reactor	mgd	1.5	1.5
Maximum System Capacity with Duty Reactors	mgd	6	12
Lamp Type	-	low pressure high output	

Parameter	Unit	Phase 1	Phase 2
Minimum Virus Inactivation Achieved	log	6	6
Minimum 1,4-Dioxane Reduction Achieved	log	≥ 0.5	≥ 0.5

Breakpoint chlorination would be achieved through chlorine contact tanks and sodium hypochlorite addition to reduce ammonia levels and provide pathogen disinfection. The free chlorine design criteria to achieve breakpoint chlorination is presented in Table 3-8 and conservatively assumes that no ammonia is converted to nitrate during the BAC process. The Project would need to run pilot testing in future design phases to optimize process parameters and verify TN levels throughout the process. The order of disinfection and chemical addition (e.g., alkalinity) would be evaluated as part of a future design phase to determine the optimal water quality and operations to provide the alkalinity and pH required to optimize breakpoint chlorination efficacy and minimize corrosion risk.

Table 3-8: Free Chlorine Design Criteria

Parameter	Unit	Phase 1	Phase 2
Estimated Chlorine Dose			
Chlorine Feed Maximum Flow	mgd	6.0	12.0
Target Total Chlorine Residual	mg/L	1.5-2.0	1.5-2.0
Maximum Design Applied Chlorine Dose	mg/L	25	25
Maximum Chlorine Usage	ppd	1,250	2,500
Maximum Chlorine Feed Rate	gph	42	83
Chlorine Chemical Tank			
Number of Tanks	no.	2	4
Type/Material	-	FRP	
Tank Diameter	ft	12	12
Max Chemical Level	ft	20	20
Capacity per Tank	gal	15,000	15,000
Total Capacity	gal	30,000	60,000
Supply at Average Use	days	30	30
Chemical Contact Tanks			
Type	-	Concrete, 7-pass serpentine	
Number of Contactors	no.	1	1
Width	ft	45	45
Length	ft	80	80
Operational Water Level	ft	14	14
No. of Baffle Walls	-	6	6
L/W Ratio[1]	-	44	44
Contact Volume	ft^3	46,600	46,600
	gal	350,000	700,000
CT Calculations			
Hydraulic Residence Time (HDT)	min.	84	84
Minimum Baffling Factor, T_{10}/HDT	-	0.5	0.5

Parameter	Unit	Phase 1	Phase 2
T_{10}	min.	42	42
Required CT (V/G/C)	mg/L-min	6/35/NA	6/35/NA
Calculated CT	mg/L-min	63	63

Post-treatment for water stabilization consists of partial decarbonation and chemical addition to stabilize the purified water to minimize scaling and corrosion and provide a chloramine disinfection residual. Design criteria for a purified water tank to store water for post-treatment water stabilization is provided in Table 3-9. A **PWPS** would convey the purified water from the AWPF to either the Crystal Springs Reservoir or local DWDS connections. The PWPS design for three conveyance alignment options are discussed in Section 4.3.4.

Table 3-9: Purified Water Tank Clearwell Criteria

Parameter	Unit	Phase 1	Phase 2
Purified Water Tank			
Type		Partially buried pre-stressed concrete tank	
Number of Tanks	qty.	1	
Target Avg. Operational HDT	hrs	2	1
Target Operational Volume	MG	0.5	
Total Storage Volume	MG	0.5	
Dimensions			
Length	ft	90	
Width	ft	80	
Height	ft	20	
Max Water Depth	ft	12	
Minimum Water Depth	ft	2	

3.5 Civil

This section describes considerations for the civil site design, including preliminary information related to the site layouts, datum, grading, drainage, site access, utilities, site lighting and yard piping. The AWPF site layout is presented in **Appendix F: AWPF Sheets C-03 to C-04**. Additional site plan descriptions, both qualitative and quantitative estimates, are provided in Section 2 of the **Appendix E: CEQA Checklist**. Future design phases would provide additional details to refine the concepts presented herein based on land and utility surveys, geotechnical investigations, and other special studies.

3.5.1 References

Civil/site design should conform to the following standards, as specified in this section:

- California Building Code (CBC), Current Edition

- California Fire Code (CFC), Current Edition
- Local Agency of Jurisdiction
- Individual Agencies' Design Guidelines (SFPUC, SVCW, San Mateo)
- State Water Resources Control Board (SWRCB), Construction General Permit (CGP)

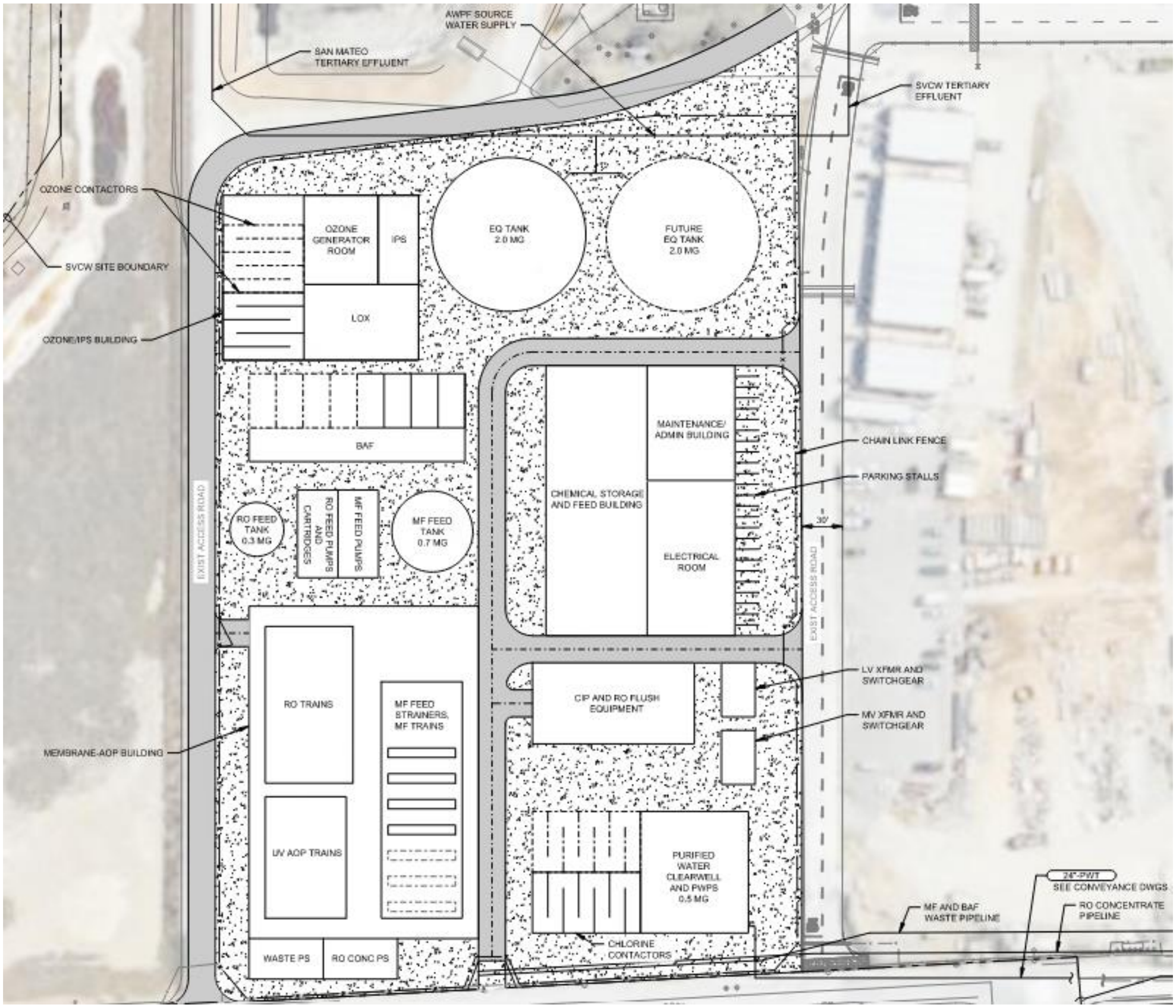
3.5.2 Site Layout and Description

Two potential locations for the new AWPF are both owned by SVCW, as depicted in Figure 3-2. The preferred site is the 5.5-acre SVCW North Pond area, southwest of the existing sludge drying beds. The alternative site is the North Annex parcel located northwest of the SVCW facility. This land is owned by SVCW but is not preferred for AWPF construction since it is a potentially environmentally sensitive area which may require extended negotiations related to permitting and environmental negotiations that could result in significant project schedule delays.

For purposes of the BODR, it is assumed that the AWPF would be located at the SVCW North Pond area, shown in Figure 3-2. At this site location, it is assumed flow would enter the AWPF at the northwest corner from both SVCW and San Mateo. Purified water would leave the AWPF and feed the distribution system via existing pipelines to the southeast. RO concentrate would be diluted and pumped to the existing SVCW outfall connection point as discussed in **Appendix B: TM #3 – RO Concentrate Disposal**. A conceptual site civil design is shown in Figure 3-3.

Figure 3-2: AWPF Site Location Options

Figure 3-3: AWPF Site Layout



3.5.3 Grading and Drainage

The SVCW North Pond Area where the proposed AWPF would be constructed is a relatively flat unpaved area. This area has been used for excess soil stockpiles from Regional Environmental Sewer Conveyance Upgrade (RESCU) construction since 2018. Final disposition of the stockpile volume is unknown at this time. It is anticipated that the site would require significant grading and earthwork to prepare for construction of new AWPF facilities, pipelines and access roads.

Based on available topographic data, the grade slopes away from the center of the AWPF site with an elevation range of approximately 102 to 108 feet. The amount of earthwork and grading required for the construction of the AWPF Process Building, Ozone/IPS Building, Chemical Storage and Feed, Maintenance/Admin, and Electrical Building, and ancillary facilities would require more detailed survey, soil and geotechnical information to accurately estimate. Excavation required for structural piles and other below grade facilities would also require additional field investigations. It is anticipated that there would not be a significant net change to the site surface elevation upon construction completion from current conditions and the existing drainage patterns would be maintained. The topography, grading and site plans for the AWPF site in the North Pond Area is presented in **Appendix F: AWPF Sheet C-03 to C-04.**

The AWP Facility site is not located within the 100-year floodplain based on Federal Emergency Management Agency (FEMA) flood mapping (Map 06081C0186F, effective map date April 05, 2019) and has a current flood hazard designation of Zone X (Area with Reduced Flood Risk due to Levee). Note, in 2020, FEMA notified Redwood City that they must raise and certify the Redwood Shores levees remain outside FEMA flood zone. OneShoreline[2] is currently seeking grant funding to initiate project, and the current flood hazard designation could change as a result. The SVCW facility is currently protected from tidal flooding and tsunami or seismically induced tidal waves by a network of levees that ring the Redwood Shores peninsula. The SVCW plant is vulnerable to 55 inches of sea-level rise and key components have been elevated to protect against possible levee failure (Heberger, 2012).

3.5.4 Site Access

Two existing gates (one at the southeast and another at the southwest corners of the AWPF) and one new gate leading into the middle access road of the AWPF are anticipated to provide truck delivery and visitor access from Radio Road to the chemical facilities and visitor center parking lot via existing and new facility access roads that would run around the perimeter of the AWPF site. A new fence would be installed around the AWPF. This fence would secure the AWPF facility, and the entrance gate configurations would allow chemical delivery trucks to pull off Radio Road while they wait to be admitted onsite.

Visitor parking would be located along the southern border of the site near the Administration Building, with enough space to facilitate the needs of staff, tour groups, and visitors. Parking should be separate from onsite access roads. A minimum of 10 spaces should be provided, including a van accessible parking stall designed to meet the standards of the Americans with Disabilities Act.

3.5.5 Utilities

Existing utilities at SVCW were considered as part of the layout of the new treatment facilities and associated pipelines at the AWPF. There were no notable utilities in the main footprint of the AWPF in the undeveloped North Pond Area, though there are existing buried utilities in the access road adjacent to that area.

Appendix F: AWPF Sheet C-02 shows existing water and wastewater lines at SVCW in the vicinity of the preferred AWPF location. Existing facilities include one 30-inch recycled water line, one 20-inch potable water line, two 4-inch water lines, and communication and electrical lines running along the southern edge of the AWPF site. One existing 42" filtered water line, a storm drain and irrigation lines run parallel to the western edge of the secondary clarifiers and would cross the proposed 20" SVCW tertiary pipeline. There may also be an abandoned recycled water line that previously fed the wastewater stabilization pond prior to construction of RESCU project within the AWPF site. The alignment of the source water supply line to the equalization tank, the RO concentrate line from the RO concentrate pump stations to the SVCW outfall, the MF and biologically active filtration (BAF) waste pipeline and the purified water pipeline are aligned to

[2] https://oneshoreline.org/

avoid and minimize impact on existing utilities. A comprehensive utility survey is required to determine if other main utilities need to be relocated or if an alternative alignment could have a reduced impact.

Pipeline separation requirements area discussed in **Appendix B: TM #2 – Conveyance Facility Design Criteria.** Wherever possible, water and sewer utilities should be separated horizontally by a minimum of 10 feet. Separation and construction of water and sewer utilities should conform at a minimum to SDWAS Standard Drawings WI-01 through WI-03. However, separations between recycled water or purified water pipelines and other non-potable pipelines are not specified in regulations and are looked at by SBDDW on a case-by-case basis. Due to the lack of specific regulations or design requirements, the industry design standard for this scenario generally adheres to the separation requirements between potable water mainlines, non-potable water mains, and sanitary sewer mains.

Electrical utility considerations are discussed in Section 3.8. Construction power supply and location of power poles have not been identified.

3.5.6 Site Lighting

Site lighting for above ground structures would follow existing guidelines and would be similar to existing lighting. Lights would shine downward and not spill into residential areas. Except for safety lighting on the exterior of the facilities, the existing general nighttime character of the sites would be dark with little or no artificial lighting.

3.5.7 Yard Piping

The process yard piping for the AWP Facility would typically be installed below grade and sized to accommodate future phase flow volumes. By oversizing the pipe initially, yard piping would not have to be replaced over the various construction phases. A detailed pipe schedule for the AWPF and provisions for bypass piping and piping redundancy would be developed as part of a future detailed design phase.

3.6 Structural

The project design must abide by the vertical limitations of the site, as dictated by RWC zoning codes. RWC zoning code states that the project site falls within the Redwood Shores Bay Front (RSB) zone. The height restriction for buildings constructed within this zone is 30 feet (ft). Due to potential view obstruction concerns from nearby residents, the site layout criteria were developed to limit process equipment and tank structures to a max elevation of 111 feet to meet the max elevation of the nearby RWC recycled water tanks. Above ground buildings would be limited to a max height of 20 feet above grade or about 134 feet elevation, similar to the elevation of nearby SVCW maintenance building adjacent to the existing dual media filters. This self-imposed height restriction is more conservative than what the RWC zoning code calls for in the neighboring R-2 zone neighborhood where buildings are permitted to be as tall as 28 ft. Table 3-10 lists the structural footprint, assumed above grade height and allowable below grade depth of facilities at the AWPF. Height restrictions can be revisited as part of a future detailed design phase.

Table 3-10: Structural Footprint of AWPF Treatment Facilities

Structural Footprints for AWPF Treatment Facilities	Approx Area (ft²)	Type of Structure (-)	Maximum Height above Grade (ft)	Maximum Depth Below Grade (ft)
SVCW Tertiary PS	1,200	semi buried pump station and wet well	7	≤ 20
Membrane-AOP Building	41,700	above ground building	20	≤10
Maintenance Building	5,600	above ground building	20	≤10
Chemical Storage and Feed Building	15,000	above ground building	20	≤10
Electrical Room	7,500	above ground building	20	≤10
Ozone/IPS Building	17,400	above ground building	20	≤10
BAF/ Ozone Contactors	10,400	semi buried process structures	7	≤30
MF Feed Pumps	2,000	above ground building	7	≤10
RO Feed Pumps and Cartridges	2,000	above ground building	7	≤10
Chlorine Contactors	7,200	semi buried process structures	7	≤10
Waste PS	1,650	semi buried pump station and wet well	7	≤ 20
RO Concentrate PS	1,650	semi buried pump station and wet well	7	≤ 20
AWPF Influent EQ Tank	19,100	semi buried tank	7	≤35
CIP and RO Flush Equipment	7,200	above ground building	25	≤10
LV XFMR and Switchgear	1,000	above ground building	25	≤10
MV XFMR and Switchgear	1,000	above ground building	25	≤10
Product Water Tank Clearwell	80	semi buried tank	7	≤10
MF Feed Tank	2,900	semi buried tank	7	≤30
RO Feed Tank	1,300	semi buried tank	7	≤30
Total	**146,000**			

The AWPF would be constructed on Young Bay Mud (YBM) which is known to compress significantly when structures are built on top, causing structures to sink over time. Due to the consistency of YBM, many structures at SVCW are designed to "float" on top of the mud and shallow ground water with full tanks. To prevent structures from being pushed up out of the mud by buoyant forces, piles would be constructed.

The depth of the piles depends on the specific area on the site and the type of structure the piles are designed to support. In a recent project, SVCW drove piles on center every 8 ft 2 inches underneath structures. Some of these piles were as much as 110 ft deep. It is anticipated that similar piles would be designed for the AWPF. It is assumed that approximately 2,190 piles, approximately 14-inch x 14-inch square, at a depth of 110 ft per pile, would be needed to support the new AWPF facilities.

3.7 Architectural

The approximate footprint (area), type of structures and maximum height above grade for the AWPF treatment facilities are presented in Table 3-10. Information on the planned architecture of above-ground structures at the AWPF have not been determined at this time, however, they would likely be designed to match the aesthetics of SVCW facilities and adhere to local requirements. Facilities on the south and southwest side of the site, that are more visible to the residential areas may require additional considerations to reduce visual impacts through fencing, plantings or other means to screen the facility from view.

3.8 Electrical

SVCW currently receives electrical power to their site from Pacific Gas and Electric Company (PG&E) via a 12 kilovolt (kV) service. The service provides power to an existing 12kV switchgear with a 4000A ampacity rating and 500MVA short circuit rating. Power distribution philosophy around the area is a main-tie-main configuration, which is common among facilities that utilize two sources. The 12kV switchgear is currently supplying double-ended power feeds to multiple transformers around the facility that step-down the voltage to 480V and feed double-ended 480V switchgear. Power from the 480V switchgear is distributed locally in a given process area(s) and stepped down further for auxiliary loads.

The PureWater Peninsula Project is relatively similar in size to the Pure Water Monterey Groundwater Replenishment Project AWPF, recently designed by Kennedy Jenks and currently in service. Field data from that project was utilized to extrapolate the approximate electrical demands, in mega volt-amperes (MVA), for both Phase 1 and Phase 2 demands, as shown in Table 3-11.

Table 3-11: Anticipated AWPF Electrical Demands

AWPF Flow (mgd)	Estimated Demand based on Connected Loads (MVA)	Measured/Projected Demands from AWPF Operation (MVA)
2.5	1.6	1.3
4	2	1.6
5	2.5	2
6*	3.0	2.4
12*	6.0	4.8

* The estimated demands for 6 and 12 mgd represent the extrapolated data from the Pure Water Monterey Groundwater Replenishment Project to provide a conceptual electrical demand load for Phase 1 and Phase 2, respectively.

Based on this load information there are a couple of options to explore when considering the power source for this project. The preferred option would be to coordinate a new PG&E service to the project site and have it served independently of the treatment facility. The other option would be to utilize existing spare circuit breakers in the 12kV switchgear and bring double ended feeders to the project site for distribution to appropriately sized transformers that would serve the various process loads.

Once power demands are refined as part of future design efforts, the lead agency for the facility would coordinate communication with PG&E to start the System Impact Study (SIS) discussion. The SIS would determine the impact on PG&E's existing transmission system and identify alternatives to serve the new energy loads needed for the PureWater Peninsula Project. At this time, it is understood that SVCW had a 1.5-megawatt (MW) capacity prior to construction of SVCW's Front of Plant project, which could go up to 2.0 MW. For estimating purposes, 1 MW of power demand would be equal to approximately 80 percent of the electrical demand (MVA). As shown in Table 3-11, the full scale facility could increase the power demands by approximately 3.8 MW (80 percent x 4.8 MVA).

Future design studies at a 30 percent level would confirm power demands for the AWPF and the conveyance pumping requirements. Future design studies should also consider options for power redundancy, backup power sources, and other measures to ensure reliability of the AWPF. Given the long lead times for bringing in new power loads, discussions with PG&E should be initiated to understand the capacity for and costs associated with power delivery to the AWPF.

3.9 Instrumentation and Controls

The AWPF would require instrumentation and controls (I&C) to communicate with the SVCW, San Mateo, the SFRWS, and Pulgas DF, as well as the drinking water distribution systems of RWC, Cal Water, and MPWD. I&C would be critical to meeting regulatory requirements and optimizing operations.

I&C would be achieved through flow and water quality meters, flow control valves, online sensors, supervisory control and data acquisition (SCADA) system modifications, and other tools for communication. I&C design criteria would be developed in future phases of the design. Some examples of data exchange and communication needs for the AWPF are described below.

- The AWPF would need to relay flow information between SVCW and San Mateo to anticipate source water inflows and be able to provide sufficient effluent to dilute RO concentrate before discharging to SVCW's outfall.
- Communication with SFPUC to manage water balance in the SFRWS. Purified water produced would provide a new input to SFPUC's SFRWS and would essentially displace flows that would otherwise be sent to CSR or to drinking water systems to meet local demands. The PureWater Peninsula Project would allow the SFRWS to store more water when adequate storage exists. However, during wet periods and wet years, when SFRWS storage is full, the AWPF may ramp down or shut down to avoid "spilling" water from the upcountry system. Thus, incorporating the purified water as an input to SFPUC's Hetch Hetchy Local Simulation Model (HHLSM) and overall SFRWS operation control strategies is critical. Control logic to ramp down or stop purified water production would need to be established as part of future operational strategies and procedures, further discussed in **Appendix C: Modeling and AWPF Operational Scenarios**
- The flow rate of the purified water to Pulgas DF would need to be communicated to SFPUC as dechlorination treatment prior to CSR would be needed. **Appendix B: TM #4 – Pulgas Disinfectant Residual Alternatives** provides additional detail about operational considerations at Pulgas DF.
- Monitoring for reliability and process control would be critical to meet and validate regulatory log reduction requirements, monitor and analyze unit process performance, and support reporting. Log reduction credits are validated by evaluating the removal of water quality parameters such as turbidity, UV_{254}, TOC, conductivity, and specific ions (e.g., sulfate, strontium). Additional emerging monitoring technologies such as light scattering

technologies or bacteria ATP monitoring to receive additional log reduction credits may be evaluated and tested in the future.

- I&C are also key to optimizing chemical dosing and mixing to manage costs as well as providing automation to manage labor effort within the AWPF fenceline.

The communication system would be designed to meet, and/or accommodate, SFPUC, SVCW and San Mateo requirements as well as requirements for the local drinking water agencies that receive purified water (RWC, Cal Water and/or MPWD). The communication cabinet for the PureWater Peninsula Project would be equipped with fiber patch panel to accept fiber from an owner-defined point of connection at the plant. Depending upon the configuration of the PureWater Peninsula Project, the communication cabinet may also contain ethernet distribution switches, access switches and stratus server which would serve as distribution of communication to all downstream programmable logic controller (PLC), remote input/output (RIO) control panels and vendor provided communication infrastructure. Data between the different sites could be transmitted over radio, cellular, or fiber (i.e. fiber optic cable) to the main SCADA network. The interconnection of the infrastructure would be required to be in strict accordance with the standards for all PureWater Peninsula parties that require communication for the project.

Section 4 Conveyance Basis of Design

Supporting information for this section is provided in:

- Appendix B: TM #2 – Conveyance Facility Design Criteria
- Appendix B: TM #3 – RO Concentrate Disposal
- Appendix B: TM #4 – Pulgas Disinfectant Residual Alternatives
- Appendix B: TM #5 – Drinking Water Distribution System Design Criteria
- Appendix C: Modeling and AWPF Operational Considerations
- Appendix F: Drawings

The information herein is representative of a ten percent design level based on available information at the time of this BODR. Surveying, utility, and geotechnical field investigations, environmental, noise and other special studies would be conducted in future design phases to refine assumptions and support a more detailed level of design and environmental documentation. Due to the technical and jurisdictional complexity of locating pipelines and pump stations on the SF Peninsula, an Alternatives Analysis Report (AAR) may be conducted as a next step to determine the preferred purified water transmission alignment and identify viable locations for booster pump stations (including space and power) and surge facilities. Detailed surge analyses would be required for future design phases. Future design studies would also need to consider pipeline separation requirements, right-of-way and land acquisition considerations. Future studies would be conducted to confirm connection points to existing facilities to confirm hydraulics, blending, operational implications, and other considerations.

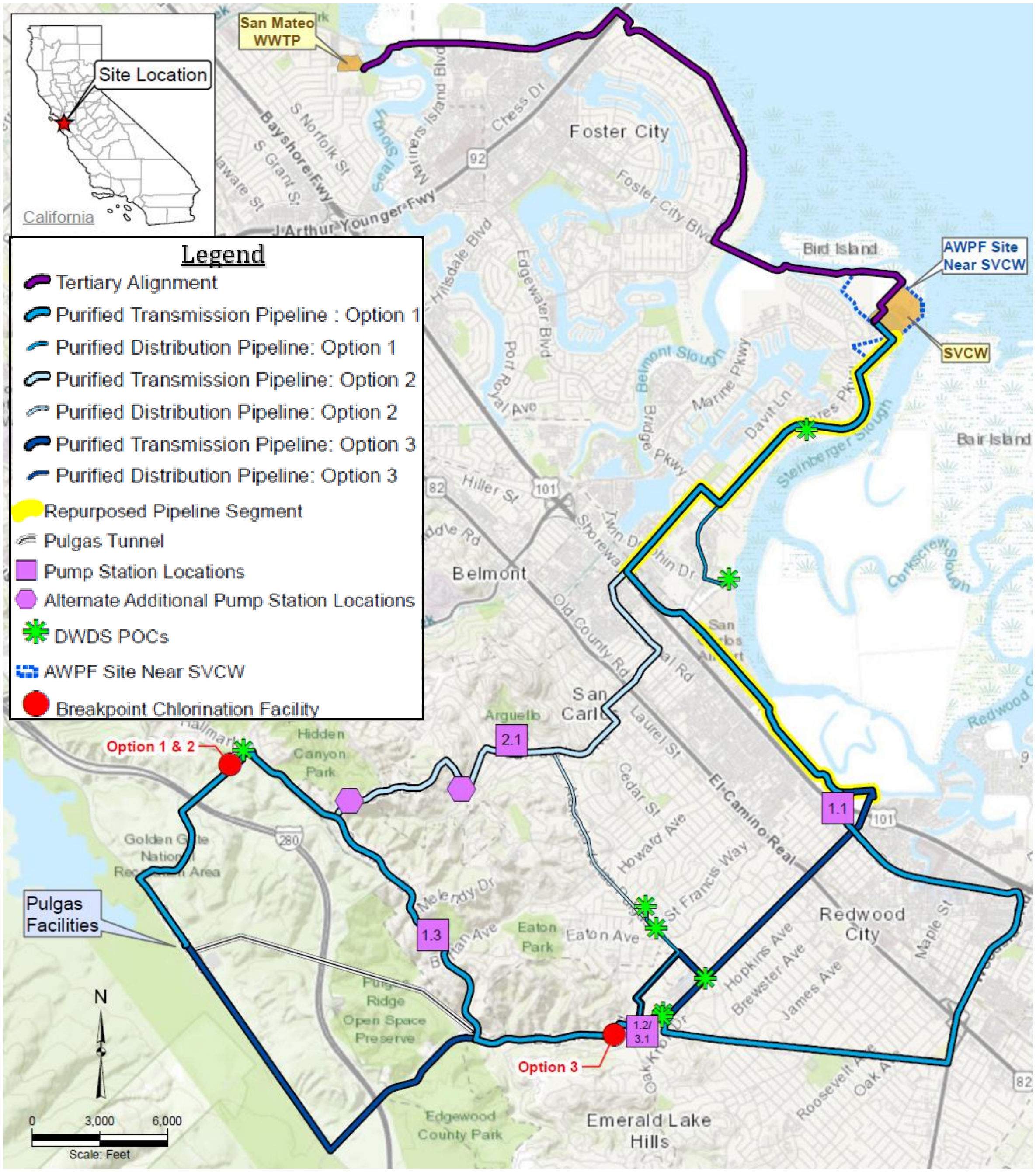
4.1 Alignment Evaluations

Conveyance is a critical component of any recycled water system and often accounts for a large percentage of capital costs for a project. Pipeline alignments to and from the AWPF were developed in earlier iterations of the Project, as shown in Figure 4-1. ***This section describes the alignments that are the focus of this BODR.***

The PureWater Peninsula Parties recognize the need to perform additional evaluation of alignments based on a more comprehensive evaluation of available land for pump stations, geotechnical evaluations, evaluations for trenchless crossings, structural evaluations for bridge crossings, ability to use the right-of-way and a more in-depth evaluation of underground utilities.

Appendix B: TM #2 – Conveyance Facility Design Criteria describes design requirements and preliminary criteria for the project pipelines and pump stations, various trenchless construction methods, and opportunities to repurpose existing decommissioned pipelines that were taken offline as part of SVCW's RESCU Program.

Figure 4-1: Overview of Pipeline Alignments



Note: Pump station locations along the purified alignments indicated by purple boxes are numbered based on the alignment option(s) they are associated with. Refer to Section 4.1.4 for additional details.

4.1.1 San Mateo Tertiary Alignment

A new 24-inch pipeline would be required to deliver up to 9 mgd of tertiary effluent from the San Mateo WWTP to the new AWPF. The tertiary effluents from the San Mateo WWTP and SVCW would be blended in the new AWPF Influent EQ Tanks upstream of the treatment processes.

Initially, two tertiary alignments from the San Mateo WWTP to AWPF were evaluated based on the outcomes of the San Mateo Recycled Water Facilities Planning Study (HydroScience 2017) and discussions with the Cities of San Mateo and Foster City.

The San Mateo Tertiary alignment, shown in Figure 4-1, could be constructed along Beach Park Boulevard, parallel to the levee, to the AWPF. Further investigations and coordination would be needed to confirm viability and requirements for constructing the pipeline near the levee, including groundwater management. The crossing of Belmont Slough would require a trenchless pipe construction method, such as HDD, and shoring for any excavations in the bay front soils. Pipe suspension would be recommended to cross Seal Slough Lagoon, adjacent to the San Mateo WWTP, on a water control feature that spans the slough. **Appendix B: TM #2 – Conveyance Facility Design Criteria** provides additional descriptions of these special crossings. This alignment presents significant environmental permitting challenges and potential community impacts.

An alternative tertiary alignment along Edgewater Boulevard through Foster City was initially conceived to deliver tertiary water to an alternate AWPF site near the San Carlos Airport, which is no longer being considered. This alignment was considered not desirable due to community and environmental sensitivities. In addition, this alignment would require construction in heavily travelled residential streets in this area, which may not have enough lane space and may arouse a vocal response from residents. For these reasons, the option along the Bay is identified as the preferred tertiary alignment to advance for the BODR.

4.1.2 SVCW Tertiary Effluent Conveyance

The SVCW tertiary pump station and pipeline would convey SVCW tertiary effluent to the AWPF Influent EQ Tanks, where it would be blended with San Mateo tertiary effluent. Several tie-in options to the existing facilities may be considered for conveying the SVCW tertiary effluent to the AWPF Influent EQ Tanks. Currently, a portion of the SVCW tertiary effluent supplies the RWC Recycled Water facilities, located at the SVCW site. Remaining effluent is discharged to the bay via SVCW's FEPS and the 66-inch outfall.

RWC has an allotment of an annual average of 2.9 mgd of SVCW tertiary effluent, although daily usage can vary. A portion of SVCW's tertiary effluent is diverted to RWC's onsite recycled water facilities. The effluent goes through dual media filters in the main SVCW building, then continues by gravity through a 42-inch Filtered Water pipeline. The water is chlorinated to meet recycled water standards and achieves contact time in the chlorine contactors. Recycled water is then pumped by the Distribution Pump Station through a 30-inch line out to RWC's recycled water distribution system. The existing permitted production capacity of the RWC treatment system is approximately 9,000 gallons per minute (gpm) (13.0 mgd). The two recycled water storage tanks have a combined capacity of 4.36 MG with a space for a future third tank for a total storage capacity of 6.65 MG.

The existing DPS is designed to supply Title 22, unrestricted-use recycled water to RWC's recycled water distribution system via a 30-inch RW pipeline. The DPS has an instantaneous pumping capacity of 13,100 gpm (18.9 mgd) at 70 psi and is configured for a future build-out of up to 10 vertical turbine canned pumps, including jockey pumps, intermediate pumps, and main pumps. In the initial phase of the construction, only the jockey and intermediate pumps were installed, for a total DPS capacity of about 3.2 mgd. Pumps cans for the future main pumps were installed to facilitate an expansion to approximately 18.8 mgd. The five future main pumps were designed to have a capacity of 3,275 gpm (4.7 mgd) each. It was assumed that one main pump could be installed to supply the PureWater Peninsula tertiary flows of 4 mgd in Phase 1, and a second main pump could be installed for the Phase 2 build-out to 8 mgd.

Actual production and distribution of recycled water varies with RWC's system demand may increase in the future as RWC expands its recycled water system. In periods of high demand, it is expected that the RWC recycled water allotment could use up some or all of the available SVCW effluent. In that scenario, the AWPF would run at a reduced rate using primarily San Mateo tertiary effluent as source water.

New facilities would be required to convey SVCW tertiary effluent to AWPF Influent EQ Tank(s), where it would be blended with tertiary effluent from San Mateo. The following three options for tertiary effluent connection points were considered and are further described in this section:

- SVCW Tertiary Option 1 - Connect to SVCW Outfall
- SVCW Tertiary Option 2 - Connect to RWC 42-Inch Filtered Water Line
- SVCW Tertiary Option 3 - Connect to 30-Inch RWC Recycled Water Line

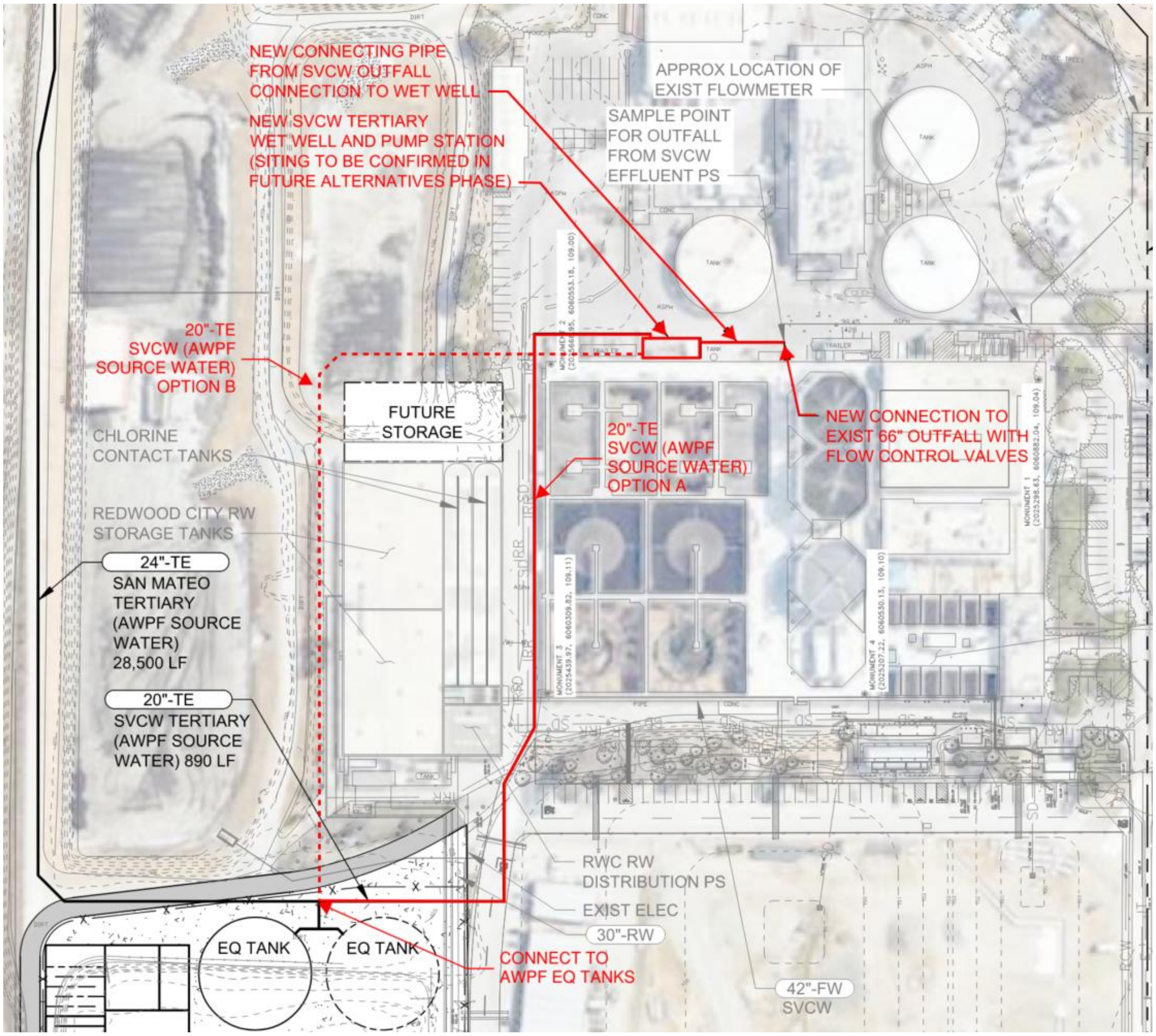
SVCW Tertiary Option 1 - Connect to SVCW Outfall

SVCW is currently upgrading their FEPS, which conveys tertiary effluent directly to the 66-inch outfall. A new connection could be made to the outfall, downstream of the final effluent pumps (see Figure 4-2). A new SVCW Tertiary Pump Station would be required to overcome the static head (due to depth of the outfall) and to convey the water into the AWPF EQ Tanks. It is assumed that the new pump station would include a wet well to break head from the existing low pressure outfall system. The short pipe segment between the outfall and the wet well could be sized large to ensure that water could be conveyed to the wet well using the existing system head. This BODR assumes vertical turbine pumps could be installed, although horizontal or submersible pumps could also be considered. The new wet well could have a flow control valve. It is assumed that flow control would also be required on the existing 66-inch outfall line, so that adequate flow could be directed to the new wet well and pumps.

A key benefit of this approach is that it would have fewer impacts on the operations of the IPSs. Because the Final Effluent Pumps are sized for a maximum capacity of 80 mgd, the pump station has limited turndown. There is limited space in the existing wet pit and FEPS area to install jockey pumps and piping modifications that would likely be required with the other options.

Challenges associated with this option include locating the new wet well / pump station, and constructability challenges to make the new connection to the outfall and install flow control. It would also require a longer pipeline to the AWPF, through congested areas.

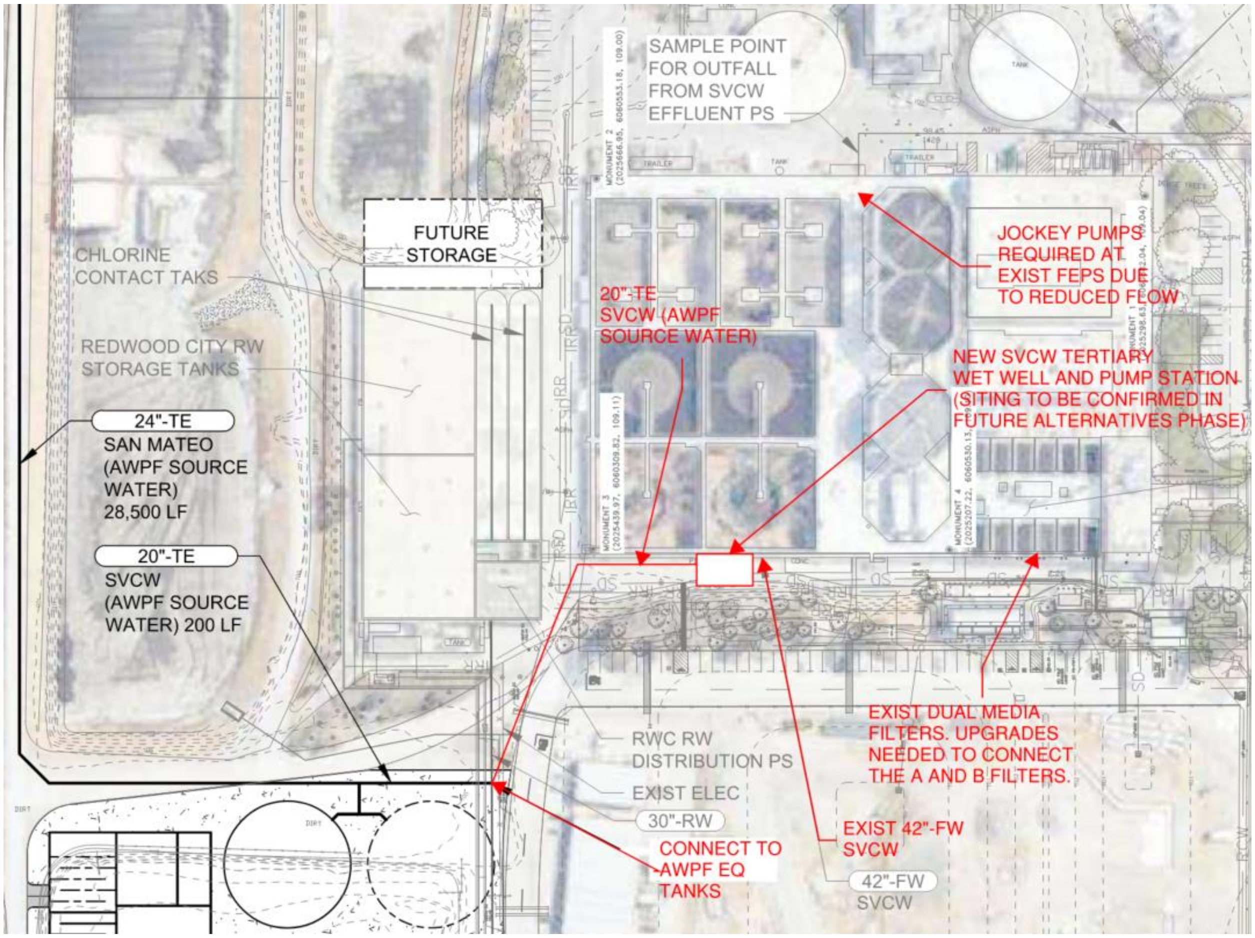
Figure 4-2: SVCW Tertiary Option 1 - Connect to SVCW Outfall



SVCW Tertiary Option 2 - Connect to RWC 42-Inch Filtered Water Line

Connect to existing 42-inch gravity line that conveys water from the dual media filters to the other RWC facilities (see Figure 4-3). This pipeline goes past the AWPF site, which could reduce the pipeline length required. However, a new pump station would be needed to provide head from the gravity line. Given site space constraints, it could be preferable to install a longer length of pipeline. Currently, only half of the dual media filters are operational. The filters would need to be upgrades and a new connection to the existing 42-inch line would be required. Because the existing FEPS has limited turndown, new jockey pumps would be required in the existing FEPS area to handle the lower range of flows to the SVCW outfall.

Figure 4-3: SVCW Tertiary Option 2: Connect to RWC 42-Inch Filtered Water Line



SVCW Tertiary Option 3 - Connect to RWC 30-Inch Recycled Water Line

Connect to existing 30-inch recycled water pipeline downstream of the RWC treatment facilities (see Figure 4-4), resulting in the shortest new pipeline length. Conveyance of SVCW tertiary effluent would be limited by the upstream processes, including the dual media filters and chlorine contactors. This approach would also require all the tertiary effluent to be treated to recycled water standards, regardless of whether it was going to the AWPF or to RWC's recycled water system. While the AWPF processes could treat this water, it would waste chemicals.

Figure 4-4: SVCW Tertiary Option 3 - Connect to 30-Inch Recycled Water Line

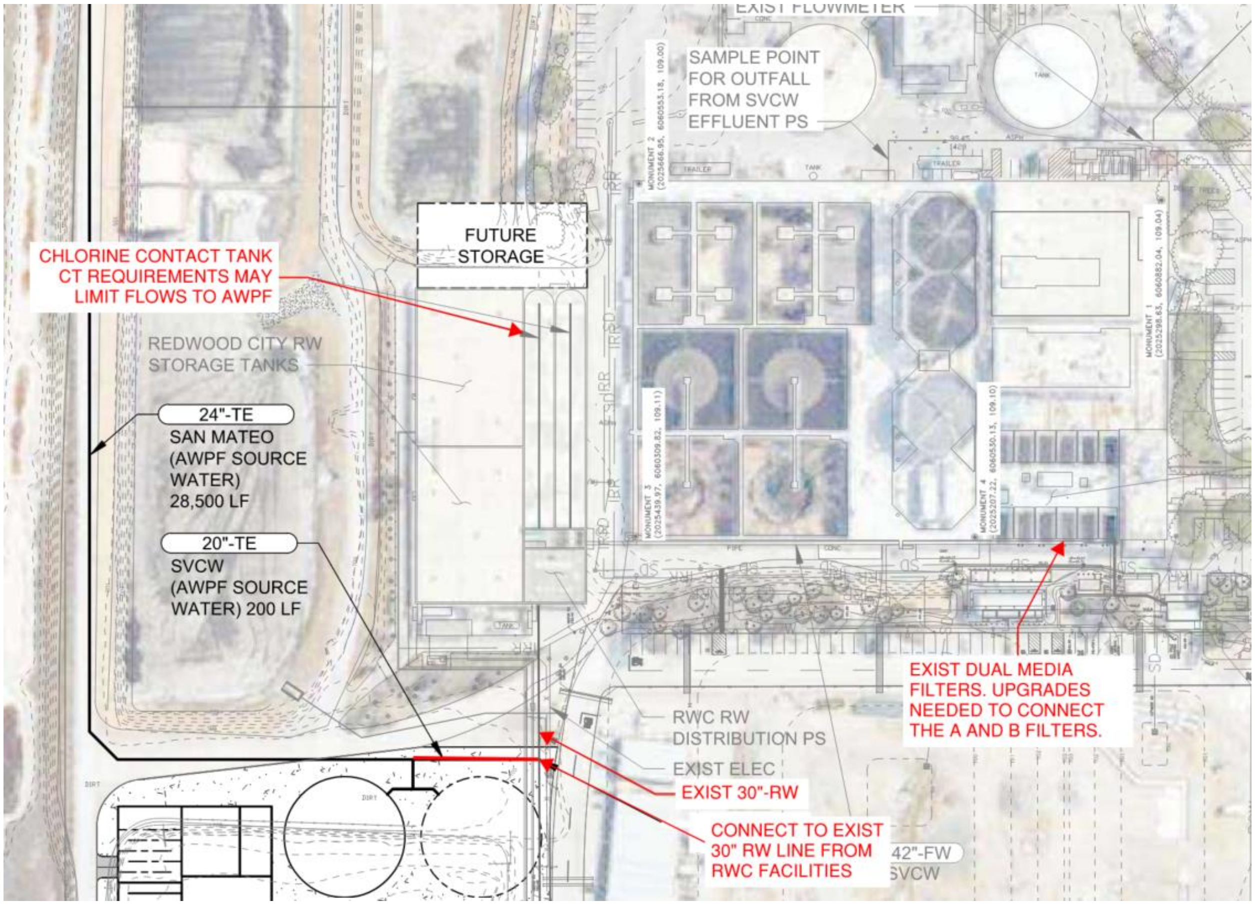


Table 4-1: Comparison of SVCW Tertiary Option Points of Connection

Option	Pros	Cons
Option 1 – Connect to SVCW Outfall	• Fewer impacts to existing SVCW FEPS by connecting to discharge side. • Would operate independently of RWC RW system (with the exception that all the options are indirectly impacted by sharing the same source water as the RWC system).	• Constructability challenges to site a new wet well and pump station. • Constructability challenges to connect to the existing outfall, which is deep, and to install flow control on the existing outfall. • Would likely require installing a new flow control valve on the existing 66-inch outfall line.
Option 2 - Connect to RWC 42-inch Filtered Water Line	• Would not rely on capacity of all RWC RW facilities (compared to Option 2b). • Potential operational benefits of having additional storage in the existing/future recycled water tanks.	• Would require modifications to the SVCW FEPS (jockey pumps to accommodate lower flows). Significant space and constructability challenges. • Would require modifications to dual media filters and connection to existing 42-inch line, which would be

Option	Pros	Cons
		challenging from a constructability standpoint. • Capacity would be limited by dual media filters. • Would require a new pump station since the 42-inch line is gravity-fed. Siting for new pump station could require a longer pipeline. • Would require higher levels of coordination between RWC and SVCW to operate.
Option 3 - Connect to 30-inch Recycled Water Line	• Shortest pipeline alignment. • Could utilize RWC's existing DPS pump station (existing facility includes provisions for future buildout of additional pumps). • Potential operational benefits of having additional storage in the existing/future recycled water tanks.	• Would require modifications to the SVCW FEPS (jockey pumps to accommodate lower flows). Significant space and constructability challenges. • Would require modifications to dual media filters and connection to existing 42-inch line. • Capacity limited by capacity of RWS RW system, including dual media filters and chlorine contact time for RW requirements. • Because 30-inch RW pipeline is shared with RWC recycled water, AWPF Source Water would be treated to recycled water standards (additional chlorine costs). • Would require higher levels of coordination between RWC and SVCW to operate.

For the purpose of this BODR, it is assumed that connecting to the outfall (Option 1) would be the preferred approach. While this option includes constructability and siting challenges for the new facilities, it has fewer impacts to the FEPS operations. It would avoid the need for modifications to upstream processes at SVCW or the RWC facilities, which would present different space and constructability challenges. The routing options and associated upgrades should be considered in greater detail as part of a future detailed alternatives analysis.

This option would require approximately 890 lineal feet (LF) of new 20-inch pipeline to convey SVCW tertiary effluent from the new SVCW Tertiary Pump Station to the AWPF EQ Tanks. Additionally, a short segment of pipeline would be installed between the outfall connection and the wet well. This connecting segment could be larger than 20 inches, such that the head in the outfall could fill the wet well. Flow control valves would be required to modulate flows being sent to the new wet well and to be discharged to the outfall. Further study is recommended to confirm the siting and hydraulic conditions. One likely scenario could be that most of the available SVCW tertiary effluent in the outfall could be used at the AWPF. The design criteria for these facilities are presented in this section and shown in **Appendix F.1: AWPF Drawings.**

4.1.3 RO Concentrate Conveyance

The new 12-inch RO concentrate pump station and pipeline would convey RO concentrate waste from a wet well at the AWPF to SVCW's existing outfall. Several routing options were identified in **Appendix B: TM #3 – RO Concentrate Disposal**. The preferred routing utilizes a segment of the decommissioned 54-inch pipeline, which could reduce site impacts and utility crossings. Note, a portion of this pipeline segment before and after the slip lining of the decommissioned 54-inch pipeline is routed through potentially environmentally sensitive areas, and open cut construction in this area could face environmental permitting and constructability challenges. The design criteria for these facilities are presented in this section and shown in **Appendix F.1: AWPF Drawings.**

4.1.4 Purified Water Transmission Pipeline Alignment Alternatives

In Phase 1, up to 6 mgd of purified water would be delivered from the AWPF to SFPUC's Pulgas DF via the new Purified Water Transmission Pipeline. From the Pulgas DF, the purified water would be introduced into CSR. See Section 4.3.4 for additional details on the Pulgas DF connection. In Phase 2, connections would be made along the purified water transmission line to local drinking water distribution systems (DWDS). In Phase 2, up to 6-8 mgd could be delivered to CSR, with the remaining 4 to 6 mgd going to local systems for TWA. The 24-inch purified transmission pipeline from the AWPF to Pulgas DF would be constructed in Phase 1, with future provisions for the Phase 2 TWA expansion.

Three purified water alignment options from the AWPF to CSR were initially evaluated to explore options to re-use infrastructure, avoid construction disruption in the public right-of-way (ROW) through residential areas of the valley, use SFPUC's ROW, avoid the Pulgas Tunnel, and minimize pipeline length and total lift. A future alternatives analysis study that includes a more detailed look at utility, survey, geotechnical and environmental conditions as well as pumping requirements would be needed to select a preferred alignment to move forward to design. Thus, all three options continue to be studied as part of the BODR and are described in Section 4.3.4. The options include:

1. Option 1: Woodside Road – SFPUC ROW (15.9 miles)
2. Option 2: San Carlos – Club Drive (9.3 miles)
3. Option 3: Edgewood Road (11.9 miles)

4.1.5 Drinking Water Distribution System Connections

In Phase 2, DWDS connections would be made to local drinking water systems to deliver purified water from the purified water transmission line to the systems of RWC, Cal Water, and MPWD. With input from each agency, several potential connection points (i.e., existing storage tanks and pipelines) for treated water augmentation along each purified transmission alignment were identified. New facilities would include approximately 2 to 3 total miles of purified water distribution pipelines (ranging from 6-inch to 18-inch in diameter), connections to existing storage tanks and potable transmission pipelines, and associated electrical, instrumentation, and controls. It is assumed that the connections to the purified transmission pipeline would be made where adequate head is available to avoid the need to construct additional BPSs in congested areas. Flows to individual connection points would be monitored and controlled. PRV stations would be installed and set to match the system pressures at tie-ins to transmission pipelines. Future studies would be needed to confirm connection locations to existing facilities, including hydraulic modeling, blending analyses, and detailed site investigations.

Appendix B: TM #5 – Drinking Water Distribution System Design Criteria identifies preferred points of connection to introduce purified water into the existing DWDSs owned and operated by Cal Water, RWC and the MPWD, estimates purified demands, defines infrastructure requirements, and identifies potential operational and hydraulic constraints. For the purposes of this BODR and CEQA checklist, pipelines were conservatively sized for the maximum anticipated purified water demand based on available data. Additional modeling and analysis should be performed to evaluate demands at the individual tie-in points, and pipeline sizing should be refined based on the total amount of purified water available for delivery (4 to 6 mgd). Connections are shown in **Appendix F: Drawings.**

4.2 Conveyance Design Considerations

This section summarizes general design considerations for the PureWater Peninsula Project pipelines and pump stations that provided the basis for the design efforts for development the Appendix F: Drawings.

Easements & Right of Way: At this time, it is assumed most of the pipeline alignments would be constructed in existing streets and PureWater Peninsula Party Agencies' ROW. The centerline of the alignment requires additional study and is not identified in the BODR.

Utilities: Utility considerations were based upon available record drawings and geographic information system (GIS) data provided by the PureWater Peninsula Parties. Comprehensive utility locating and identification of conflicts are not included in this BODR. It is assumed that trenchless methods, such as jack and bore or microtunneling, would be used in congested corridors to reduce construction disturbances and utility conflicts. Proper separation requirements must be maintained unless approved exceptions are granted.

Booster Pump Station (BPS) Siting: Approximate locations for BPSs along the purified water transmission pipeline alignments were identified based on hydraulic requirements, desktop analysis of open space from Google Earth, and discussions with the PureWater Peninsula Parties. Additional investigations would be required to explore feasibility, including land acquisition, space and power availability, and hydraulics.

Pipeline Material: Several options for pipeline material(s) are being considered, including polyvinyl chloride (PVC), high density polyethylene (HDPE), and welded steel. Each material has benefits and drawbacks, which are discussed in **Appendix B: TM #2 – Conveyance Facility Design Criteria**. Pipe materials and required pressure classes should be evaluated further during detailed design.

For the purposes of this BODR, it has been assumed that the conveyance pipelines would be plastic (PVC and HDPE). Plastic pipe has a relatively low coefficient of friction, which reduces head and pumping energy required, and does not require corrosion control. PVC is recommended for the purified water transmission lines where higher pressures are expected. Fusible PVC is recommended where jointless construction is needed, such as within the pipeline repurposing segments, and could be used for the entire alignment. It is assumed that the San Matero Tertiary pipeline would be HDPE, which is typical for the HDD installations, and adequate for the operating pressures expected (fusible PVC could also be considered). HDPE is preferred for pipelines within the SVCW fenceline.

SFPUC, who could potentially own and operate the purified water transmission pipeline, would need additional resources to operate and maintain the PVC pipelines since its current maintenance program focuses on wielded steel pipelines. Associated costs and space considerations were not considered in this BODR or CEQA Checklist. If welded steel pipe is selected instead, corrosion control would be required along the pipeline and pumping costs would be higher.

Open Trench Construction: Open trench construction is generally less costly than trenchless methods and are therefore assumed for the majority of the pipeline alignments, where feasible. It is anticipated that construction closer to the bay would carry a larger cost due to the likelihood of encountering groundwater and less competent soils, including Young Bay Mud (YBM). Therefore, this BODR includes estimates of the lengths of open trench construction along the bay and other open trench construction where significant groundwater/YBM are not expected. Additional studies would be required to confirm the geotechnical conditions and level of the groundwater table. Work within the SFPUC ROW would mostly not be within city streets but would require coordination with other SFPUC operations and future potential pipeline projects and is also totaled separately.

Pipeline Repurposing in Decommissioned Lines: The RESCU Program, which will be completed in 2024, involves construction of a new tunnel, and the replacement and rehabilitation of 54-inch and 48-inch diameter forcemain pipelines along Redwood Shores Blvd, Bay Shore Freeway, and at the SVCW site (as noted in Figure 4-1). With the new tunnel coming online, there is an opportunity to repurpose some of the existing valuable assets by installing and/or suspending a new pipeline within the decommissioned pipe. Repurposing existing pipelines would reduce community disruption during construction, avoid utility conflicts, and may have lower costs for design and construction. However, reuse of existing pipelines may also be limited by other planned or unknown new projects and the viability and longevity of use would depend on condition assessment of the asset.

Repurposing some or all of these available assets is included in each purified water alignment option, as applicable. It is also assumed that the RO concentrate pipeline at SVCW could be installed within a portion of the decommissioned pipeline. New pipeline would be installed within the decommissioned lines via access pits. It is recommended to grout the annular space to reduce the risk of leaks and damage to the new pipeline if the carrier pipe failed. Additional evaluations would be required to refine the number and locations of access pits. For the purposes of this BODR, it is assumed that access pits would be required at angle points over 20 degrees and/or every 1,000 LF, as shown in **Appendix F: Drawings**. Technical considerations for pipeline repurposing are further discussed in **Appendix B: TM #2 – Conveyance Facility Design Criteria**.

Trenchless Pipeline Construction Methods: It is anticipated that other trenchless pipeline construction methods would be utilized to: (1) cross waterways, highways and railroads, (2) avoid existing utilities in major intersections or congested corridors, (3) mitigate traffic, environmental, and other community impacts. These methods could include Horizontal Directional Drilling (HDD), microtunneling, and jack and bore. A desktop study has been performed to estimate the approximate lengths of various construction methods along each pipeline alignment for cost and CEQA Checklist development.

Supported Crossings on Bridges or Structures: There are several locations along the PureWater Peninsula Project pipelines where it may be feasible to support the pipeline on a bridge or other structure (e.g., the water control structure over Seal Slough). Considerations for supported crossing are included in **Appendix B: TM #2 – Conveyance Facility Design Criteria**. Additional analysis should be performed to evaluate feasibility of such crossings, including whether the structure has space for a new pipeline and can support its weight. Flexible connections should be installed at either end of the bridge or structure.

Surge Considerations: Detailed surge analyses would need to be performed during future design phases to ensure adequate protection of the pipelines and pump stations. General surge considerations and potential mitigation approaches are described in **Appendix B: TM #2 – Conveyance Facility Design Criteria.** Typically, surge tanks are recommended near pump stations. Site constraints, particularly along the purified alignment, may pose a significant project challenge if surge tanks are required. Below grade surge structures could be considered at future phases of study.

4.3 Design Criteria for Conveyance Components

The basis of design for the following primary conveyance components are discussed in this section for the major infrastructure components:

1. ***San Mateo Tertiary Pump Station and Pipeline***
2. ***Pipelines within SVCW Fenceline***
3. ***Purified Water Transmission Pipelines and BPSs from AWPF to Pulgas DF***
4. ***Purified Water Distribution Pipelines to TWA Points of Connection***
5. ***Breakpoint Chlorination Facility and Pulgas DF Point of Connection***

Appendix B: TM #2 – Conveyance Facility Design Criteria establishes the design requirements and preliminary criteria for the project pipelines and pump stations. Design criteria for the primary conveyance components listed above are summarized herein. **Appendix B: TM #2 – Conveyance Facility Design Criteria** also provides additional details on siting considerations and construction methods, which would be further evaluated in a future design effort for the Project. Additional details for each alignment are shown in **Appendix F: Drawings.**

4.3.1 San Mateo Tertiary Water Pump Station and Pipeline

A new pump station and 24-inch pipeline would convey up to 4 mgd (Phase 1) and 9 mgd (Phase 2) of tertiary effluent from the San Mateo WWTP site to the AWPF EQ Tank(s) as shown in Figure 4-1.

The San Mateo tertiary pipeline alignment would run primarily along the Beach Park Boulevard, parallel to the levee, to the new AWPF EQ tanks at the SVCW site The pipeline would be approximately 5.5 miles. It is assumed that this pipeline would be 24-inch HDPE, although fusible PVC could also be considered. Coordination would be required with state and/or local agencies that oversee the levee to ensure the levee's integrity is not undermined by nearby construction activities or installed pipeline operations. Additionally, there would be two special crossings along this alignment. The first crossing along the alignment would be over Seal Slough, which is adjacent to the WWTP site. It is assumed that the pipeline could be supported on the existing water control structure. If future analysis of the structure reveals that a crossing is not feasible (e.g., due to structural or space constraints), microtunneling could be performed. The other special crossing would be that of Belmont Slough near SVCW, which presents environmental and technical challenges. It is assumed that HDD would be required to cross Belmont Slough due to the length of crossing. This conceptual design assumes the pipeline could be staged in Foster City Boulevard prior to being installed via HDD. The receiving end of the HDD installation would be along the levee.

Additional studies are needed to verify the constructability of this approach. SVCW recently completed Gravity Pipeline tunneling job successfully in the Redwood Shores area. It is expected that the soil conditions in Belmont Slough would be similarly well-suited for HDD (upper layer sediments of consolidated YBM, below the weaker YBM layer closest to the surface). HDD requires a soil matrix that will stay open using hydrostatic pressures from drilling muds as multiple passes of successively larger diameter reaming tools are completed from one side of the slough to the other.

Special shoring methods such as sheet piles would likely be required for work in this area. Existing underground pipes may create obstacles for sheet piles and pile driving in this vicinity, requiring further investigation for any new underground facilities. Drilling fluids would also have to be carefully controlled to prevent frac-out under the slough or spills from the pits. The resulting pipeline installation would operate as a siphon, which air valves on either end.

Alternatively, the community park on Whisperwave Circle could be a viable option for the HDD receiving pit. A possible alternative routing that could be considered during future design phases would be to land the HDD at the community park located on Whisperwave Circle. From there, the pipeline could be routed along Whisperwave Circle/The Embarcadero, avoiding the levee. This routing could mitigate concerns and permitting relating to the levee but would have other community impacts, including park and road closures. This routing option was not considered as part of this BODR. Additional geotechnical and siting studies would be required to evaluate the viability and space requirements for construction.

Preliminary design criteria for the San Mateo tertiary pipeline are presented in Table 4-2.

Table 4-2: San Mateo Tertiary Pipeline Design Criteria

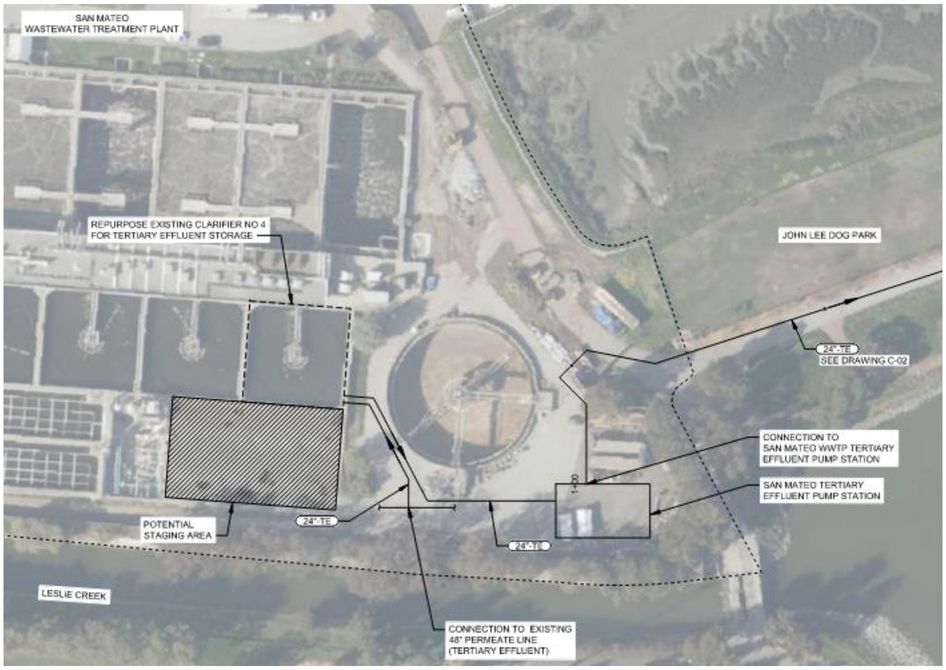
Parameter	Unit	Phase 1	Phase 2
Maximum Design Flow	mgd	4.0	9.0
	gpm	2,778	6,250
Minimum Flow	mgd	2.0	4.0
	gpm	1,386	2,778
Pipe Length	miles	5.5	
	ft	29,100	
Assumed Pipeline Material	-	HDPE	
Pipe Pressure Class	-	DR21	
Pressure Rating	psi	100	
Hazen-Williams Coefficient	-	150	
Nominal Pipe Diameter	in	24	
Inside Pipe Diameter	in	21.58	
Pipe Velocity at Design Max Flow	fps	2.4	5.5
Pipe Velocity at Design Min Flow	fps	1.2	2.4
Static Head	ft	0	0
Design TDH at Max Flow	ft	21	91

Notes:
1. Minor losses assumed to be less than 10% of friction losses.
2. Static head estimated based on approximated tank elevations/levels. Operating conditions within the tanks would need to be further evaluated in detailed design.

Hydraulics & Pump Station

The preferred location for the new pump station identified would be in the southeast corner of the San Mateo WWTP site, near the existing Secondary Clarifier No. 4, as shown in Figure 4-5.

Figure 4-5: San Mateo Pump Station and Yard Piping



Based on discussions with San Mateo staff, it is assumed that the existing Secondary Clarifier No. 4, which is slated to be decommissioned as part of ongoing plant upgrades at the WWTP, could be repurposed to serve as a tertiary water storage reservoir. Approximately 300 LF of 24-inch pipeline would be constructed within the WWTP fence line to convey the tertiary water from the plant effluent line (known as the "permeate" line) to the storage reservoir, and from the reservoir to the new pump station. Because the site is underlain by YBM, it is assumed that as many as 45 piles, at a depth of 100 ft per pile, would be needed to support the new tertiary pump station building. There may be a possibility of converting additional clarifiers (Secondary Clarifiers No.1 through No. 3) for tertiary effluent storage. This would provide operational benefits to help regulate flows to the new San Mateo tertiary pump station.

The Bayside Academy and Joinville Park are located across Leslie Creek. Future design phases would include coordination and outreach with the school district and the City of San Mateo to mitigate any noise or other impacts that could affect the school and park communities.

The exact location and layout of the pump station would be identified in future design phases. Alternate pump station locations and pipeline alignments may need to address potential impacts to neighbors, avoid underground utilities or accommodate WWTP operations. This BODR presents one potentially viable option to provide a placeholder for facility costs. Alternative locations should be further investigated in future design efforts and through close coordination with San Mateo staff.

The alignment to the AWPF is relatively flat so the total pumping head could vary greatly with flow. Hydraulics for different operating scenarios should be evaluated further during design to inform pump selection. It may be necessary to install different sized pumps to cover the range of hydraulic scenarios. For the purposes of this BODR, it is assumed that 1+1 smaller pumps would be installed in Phase 1, and 1+1 larger pumps would be installed in Phase 2. Preliminary design criteria for the

San Mateo tertiary pump station are presented in Table 4-3. A preliminary San Mateo tertiary pipeline hydraulic profile is shown in Figure 4-6.

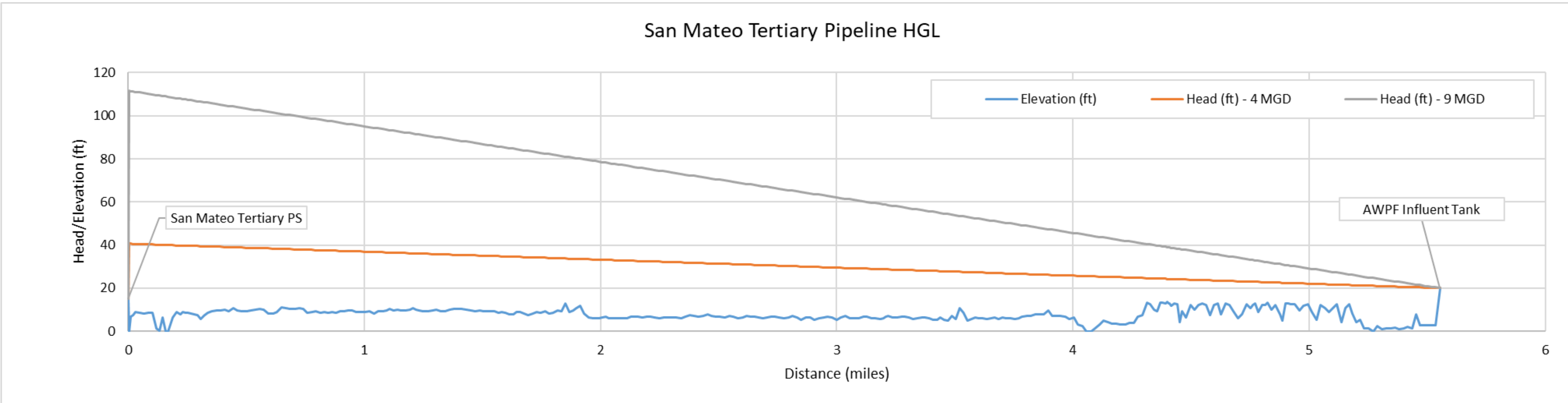
Table 4-3: San Mateo Tertiary Pump Station Design Criteria

Parameter	Unit	Phase 1	Phase 2
Pump Station Design Point at Max Flow	-	2,778 gpm @ 21'	6,250 gpm @ 91'
Small Pumps			
Number of Duty Pumps	-	1	1
Number of Standby Pumps	-	1	1
Design Flow Per Pump (Small)	gpm	2,778	2,778
Pump Type	-	vertical	vertical
Pump Speed	-	VFD	VFD
Pump Efficiency	%	80%	80%
Drive Efficiency	%	90%	90%
Pump Brake Horsepower	hp	18	18
Calculated Pump Horsepower	hp	20	20
Assumed Motor Horsepower Design	hp	30	30
Large Pumps			
Number of Duty Pumps	-	-	1
Number of Standby Pumps	-	-	1
Design Flow Per Pump (Large)	gpm	-	6,250
Pump Type	-	-	vertical
Pump Speed	-	-	VFD
Pump Efficiency	%	-	80%
Drive Efficiency	%	-	90%
Pump Brake Horsepower	hp	-	179
Calculated Pump Horsepower	hp	-	199
Assumed Motor Horsepower Design	hp	-	225
Power Required (Pumping Only)	kW	15	148

Notes:

[1] Design assumes one smaller pump would be used for lower flow scenarios (including Phase 1) and one larger pump would be used for higher flow scenarios in Phase 2. Hydraulic modeling should be performed during detailed design to consider the full range of flow scenarios. Due to the low static lift, it may be necessary to induce head in the system to operate the pump station.

Figure 4-6: San Mateo Tertiary Pipeline Hydraulic Profile



4.3.2 SVCW Tertiary Effluent Pump Station and Pipeline

Conveyance within the SVCW fenceline include the SVCW tertiary effluent pump station and pipeline, and the RO concentrate pump station and pipeline to convey waste to SVCW's existing outfall as shown in Figure 4-7 and Appendix F: Drawings.

Future design studies would need to confirm hydraulic considerations in addition to the physical configuration of each tie in point to the SVCW facility.

As described in Section 4.1.2, a new connection would be made to SVCW's existing outfall to deliver tertiary effluent to a new pump station with a wet well. The SVCW Tertiary Effluent conveyance facilities would include:

- A new connection to SVCW's existing 66-inch outfall. The connection would require flow control valves to direct the flow to either the outfall or the AWPF. The short segment of pipeline connecting the outfall to the new wet well could require a larger pipe diameter to facilitate this flow split and reduce head loss, since the system would rely on head in the outfall to fill the wet well. Hydraulic modeling is recommended to confirm the required size of this short pipe segment, however it was assumed for this BODR to be 36-inch (to reduce headloss). The wet well could operate based off level control, which would modulate the control valves.

- A new SVCW Tertiary Wet Well and Pump Station: Because the existing outfall operates under a wide range of operation conditions (flows, discharge surface level, etc.), a new wet well is recommended to break head. It was assumed that the wet well would be sized for a minimum of 10 minutes of hydraulic retention time in Phase 2. The SVCW Tertiary Pumps would be vertical turbine pumps, however, submersible pumps could also be considered.

- A new 20-inch HDPE SVCW Tertiary Pipeline from the SVCW Tertiary PS to the AWPF. The new pipeline would terminate at the AWPF EQ tanks, where the connection would be made with an air gap. Flow to the AWPF would be controlled using flow control valves and pump VFDs.

The preliminary SVCW tertiary pipeline design criteria are presented in Table 4-4. The SVCW wet well criteria are presented in Table 4-6. The SVCW pump station criteria are presented in Table 4-7. A preliminary SVCW tertiary pipeline hydraulic profile is shown in Figure 4-8.

Figure 4-7: AWPF at SVCW Preliminary Layout and Pipelines

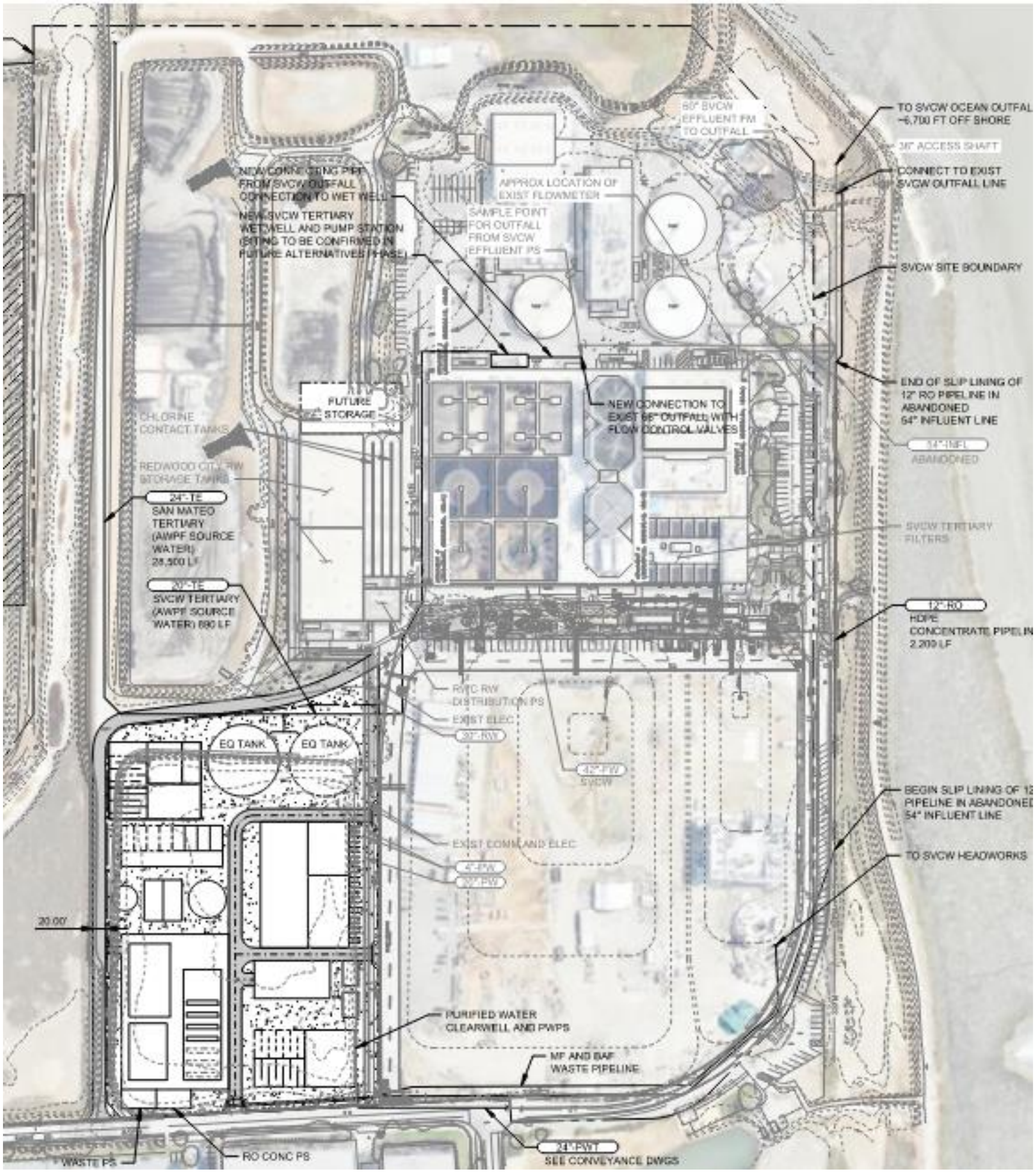


Table 4-4: SVCW Tertiary Pipeline Design Criteria (New Wet Well to AWPF)

Parameter	Unit	Phase 1	Phase 2
Maximum Design Flow	mgd	4.0	8.0
	gpm	2,778	5,556
Minimum Flow	mgd	2.0	4.0
	gpm	1,389	2,778
Pipe Length	miles	0.17	
	ft	890	
Assumed Pipeline Material	-	HDPE	
Pipe Pressure Class	-	DR21	
Pressure Rating	psi	100	
Hazen-Williams Coefficient	-	150	
Nominal Pipe Diameter	in	20	
Inside Pipe Diameter	in	18	
Pipe Velocity at Design Max Flow	fps	3.5	7.0
Pipe Velocity at Design Min Flow	fps	1.8	3.5

Table 4-5: SVCW Tertiary Wet Well Design Criteria

Parameter	Unit	Phase 1	Phase 2
Assumed Connecting Pipeline Dia.	in	36	36
Assumed Length of Connecting Pipeline	ft	50	50
Target Wet Well Hydraulic Retention Time	min	20	10
Target Wet Well Volume	gal	56,000	56,000
	ft^3	7,482	7,482
Assumed Wet Well Length	ft	55	
Assumed Wet Well Width	ft	15	
Assumed Side Water Depth	ft	10	
Assumed Total Depth	ft	15	
Wet Well Volume	ft^3	8,250	

Figure 4-8: SVCW Tertiary HGL

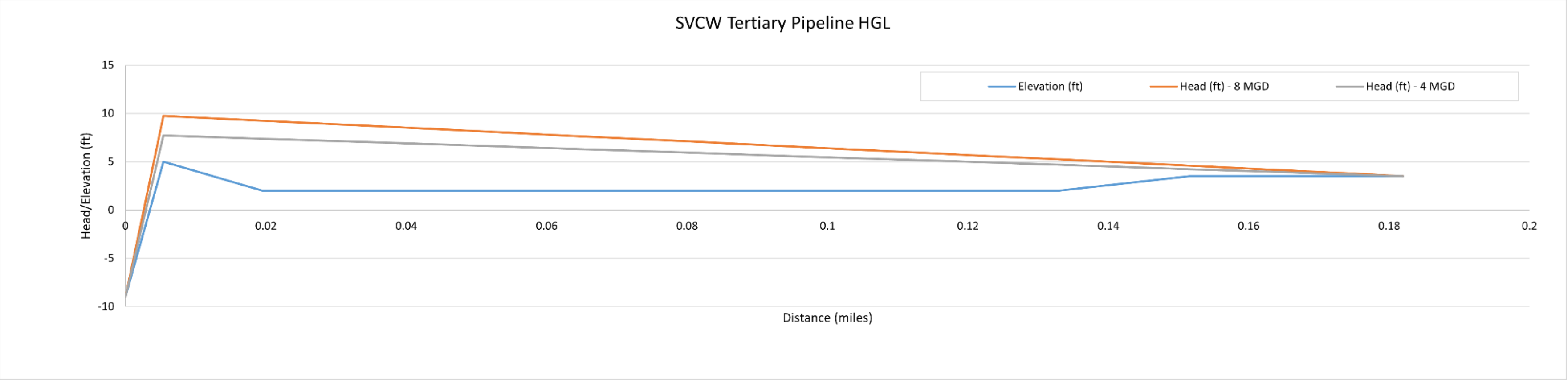


Table 4-6: SVCW Tertiary Pump Station Design Criteria

Parameter	Unit	Phase 1	Phase 2
Design TDH	ft	13	16
Number of Duty Pumps	-	1	2
Number of Standby Pumps	-	1	1
Pump Type	-	vertical turbine	
Speed Control	-	VFD	VFD
Total Design Flow	gpm	2,778	5,556
Design Flow Per Pump	gpm	2,778	2,778
Pump Efficiency	%	80%	80%
Drive Efficiency	%	90%	90%
Brake Horsepower Per Pump	hp	12	14
Calculated Pump Horsepower	hp	13	16
Rated Horsepower (Per Pump)	hp	25	25
Power Required (Pumping Only)	kW	10	24

Notes:

1. Minor losses assumed to be less than 10% of friction losses.
2. Dynamic head estimated for new SVCW tertiary pipeline. Actual headloss and pumping design point would vary depending on the existing DPS/30-inch RW pipeline operations. Additional analysis would be required to identify hydraulic conditions within existing system.

4.3.3 RO Concentrate Pump Station and Pipeline

Conveyance within the SVCW fence line include the SVCW tertiary effluent pump station and pipeline, and the RO concentrate pump station and pipeline to convey waste to SVCW's existing outfall as shown in Figure 4-7 and Appendix F: Drawings.

Future design studies would need to confirm hydraulic considerations in addition to the physical configuration of each tie in point to the SVCW facility.

The RO concentrate pipeline and pump station would convey the RO concentrate from a wet well at the AWPF to SVCW's existing outfall. The RO concentrate wet well would adjacent to the Membrane-AOP Building. Vertical turbine pumps would pump the RO concentrate to SVCW's outfall via a new 12-inch pipeline. The preferred routing runs past the southern end of the SVCW facility and utilizes a portion of the existing decommissioned 54-inch SVCW influent pipeline. The connection to the existing outfall would be downstream of the existing flowmeter via the existing access shaft near the outfall. This option reduces conflicts with existing utilities. A new flowmeter and new sampling point would be required to measure the RO concentrate flowrate and water quality after blending with SVCW tertiary effluent. Locating the connection point downstream of the existing effluent pump station is preferred since it would not have hydraulic impacts to the effluent pump station and upstream chlorine contact tanks. It is assumed that the connection would also be made downstream of the new connection to the SVCW tertiary pump station.

The RO Concentrate pump station design point depends on the pressure and operational characteristics of SVCW's outfall. The RO Concentrate pump station would be designed to achieve a higher pressure in the RO concentrate pipeline at the point of connection to the existing outfall. The

The RO Concentrate pump station design point depends on the pressure and operational characteristics of SVCW's outfall. The RO Concentrate pump station would be designed to achieve a higher pressure in the RO concentrate pipeline at the point of connection to the existing outfall. The RO Concentrate pump station design criteria summarized in Table 4-7 takes into account the predicted maximum system pressure of the FEPS at high tide (Kennedy Jenks 2024). Further analysis and coordination may be needed to understand the system hydraulics since both the recent RESCU Project, and the planned Effluent Pump Station upgrades will change the hydraulic conditions from what they have been historically. The RO Concentrate alignment would have a small negative static lift and relatively low head loss due to its short length, therefore the design should be refined to ensure that small changes in head do not cause large fluctuations in flow. Hydraulics should be evaluated and coordinated further in design to inform pump selection. A check valve and flow control valve could be required.

Conceptual pipeline design criteria are shown in Table 4-7. Conceptual pump station design criteria, based on preliminary assumptions, are presented in notes.

Table 4-7: RO Concentrate Pipeline Design Criteria

Parameter	Unit	Phase 1	Phase 2
Maximum Design Flow	mgd	1.4 (2.9 with dilution[1])	2.9
	gpm	972	2,014
Minimum Flow	mgd	0.7	1.4
	gpm	497	972
Pipe Length	miles	0.4	0.4
	ft	2,200	
Assumed Pipeline Material	-	HDPE	
Pipe Pressure Class	-	DR 21	
Pressure Rating	psi	100	
Hazen-Williams Coefficient	-	150	150
Nominal Pipe Diameter	in	12	12
Pipe Velocity at Design Max Flow	fps	3.0	6.3
Pipe Velocity at Design Min Flow	fps	1.5	3.0

Notes:

1. During Phase 1, up to 1.5 mgd dilution water could be needed to meet NPDES limits for ammonia in the scenario that only AWPF source water from SVCW is available. See TM 3 Section 5.1.2. for additional discussion. During Phase 2, due to limited availability of dilution water at maximum Phase 2 design capacity, it is assumed that the preferred operational strategy to meet NPDES regulations for ammonia and other constituents that approach the NDPES limit would be to shift the AWPF source water ratio to a higher percentage of San Mateo tertiary effluent rather than reducing AWPF production and diverting dilution water to the RO Concentrate PS wet well.

Table 4-8: RO Concentrate Pump Station Design Criteria

Parameter	Unit	Phase 1	Phase 2
Assumed Static Head	ft	-11.1	-11.1
Assumed Headloss at Max Flow	ft	7 (24)	24
Assumed Design Pressure at SVCW Outfall	ft	39	39
Design TDH at Max Flow	ft	35 (52)	52
Number of Duty Pumps	-	1 (2)	2
Number of Standby Pumps	-	1	1
Design Flow Per Pump	gpm	972 (1,007)	1,007
Pump Efficiency	%	80%	80%
Drive Efficiency	%	90%	90%
Brake Horsepower	hp	11 (16)	16
Calculated Pump Horsepower	hp	12 (18)	18
Rated Motor Horsepower (per pump)	hp	25 (25)	25
Power Required (Pumping Only)	kW	9 (27)	27

Notes:
1. Minor losses assumed to be less than 10% of friction losses.
2. Additional analysis recommended to identify hydraulic constraints, including within existing pressurized outfall.
3. Phase 1 design criteria indicates parameters required to pump up to 1.4 mgd without dilution and up to 2.9 mgd with dilution (shown in parentheses).

4.3.4 Purified Water Transmission Pipeline and Pump Stations

A new purified water transmission pipeline would convey water from the new AWPF purified water pump station (PWPS) to SFPUC's Pulgas DF, where it would be introduced into Crystal Springs Reservoir. Three (3) options, shown in Figure 4-1 are currently being considered, which would require between one and three intermediate booster pump stations, depending on the alignment. Siting of aboveground facilities, such as booster pump stations, is expected to be a key project challenge and future studies would need to be performed to confirm the availability and cost of land acquisition.

Preliminary purified water transmission pipeline flow assumptions are shown in Table 4-9 and additional assumptions are listed below.

- Pipelines would be sized for Phase 2 flows:
    - Phase 1: 6 mgd purified water production to CSR.
    - Phase 2: A total of 12 mgd, with up to 8 mgd of purified water going to CSR with the remaining flow used for TWA. Preliminary hydraulic calculations and booster pump stations are designed for 12 mgd, but some pump stations could see lower flowrates depending on demands at DWDS connections.
- It is assumed that the purified water transmission pipeline would be 24-inch PVC. PVC is recommended due to its relatively low coefficient of friction, ability to accommodate expected system pressures, and corrosion resistance. Fusible PVC is recommended for pipeline repurposing segments and could be installed for the entire length of the pipeline.

Refinements to the material, size, and pressure ratings of the selected pipeline should be confirmed in design.

- Booster pump station design criteria assumes production of 6 mgd and 12 mgd for Phases 1 and 2, respectively. The pumps would operate on VFDs to meet system demands. Hydraulics requirements would need to be verified in future design phases. The pump VFD turndown would dictate the minimum flow possible at a pump station. If a seasonal ramp-down operational scenario were enacted, it could require a larger quantity of smaller pumps to meet the full range of operating scenarios. A typical booster pump station layout is included in **Appendix F: Drawings.**
- A desktop study has been performed to identify possible pump station sites, including on PureWater Peninsula Party property/ROW, parking lots, and public parks. Locations are approximate and further evaluation is needed to assess viability in terms of land acquisition and hydraulics. Due to space constraints along the alignments, it is assumed that the booster pump stations would include canned vertical turbine pumps to reduce the Booster Pump Station (BPS) footprints. Below grade pump stations could also be considered, however, this would likely require a different pump type.
- In Phase 1, purified water would be delivered strictly for IPR at Crystal Springs and therefore, chloramination at the AWPF would not be necessary. In Phase 2, a new Breakpoint Chlorination Facility would be constructed along the purified transmission pipeline to feed chemicals for breakpoint chlorination and pH adjustment prior to reservoir augmentation at CSR. The chemical injection point would be located downstream of the last DWDS connection turnout (MPWD Hallmark Tanks for Options 1/2, and near the RWC Sequoia Tanks for Option 3).

Table 4-9: Purified Water Conveyance Design Flows

Parameter	Unit	Phase 1	Phase 2
Purified Water Design Flow (Max)	mgd	6	12
	gpm	4,166	8,333
Purified Water Design Flow (Min)	mgd	3	6
	gpm	2,083	4,166
Purified ResWA Delivery to Pulgas DF (Max)	mgd	6	8
	gpm	4,167	5,555
Purified ResWA Delivery to Pulgas DF (Min)		3	3
	gpm	2,083	4,166
Purified TWA Delivery to DWDS POCs (Max)	mgd	-	6
	gpm	-	4,167
Purified TWA Delivery to DWDS POCs (Min)	mgd	-	3
	gpm	-	1,987

Notes:

1. Pipeline and pump station design parameters are provided for each option in following subsections.
2. Pipeline designed for Phase 2 flows.
3. Conceptual pump station design assumes that each pump station has a capacity of 12 mgd, regardless of whether purified water would be delivered to Pulgas DF or to local DWDSs.

4.3.4.1 Purified Option 1 - Woodside Road – SFPUC ROW

The SFPUC ROW option along Woodside Road (Option 1) is shown in Figure 4-9. This option represents the alignment that maximizes the use of SFPUC ROW and the reuse of infrastructure along Redwood Shores Parkway and Bayshore Road. Option 1 utilizes SVCW's existing decommissioned pipeline infrastructure on Redwood Shores Parkway and Inner Bair Island, which saves cost and reduces environmental/community impacts in those areas. Option 1 primarily follows SFPUC's ROW from the RWC area to CSR, which would avoid construction disruption in public ROWs through residential areas. However, SFPUC is hesitant to allocate its limited ROW space to a smaller pipeline that could instead be installed in the public ROW, where installation of a smaller pipeline in its ROW could impede the installation of a larger SFPUC transmission main in the future. Preliminary pipeline design criteria are presented in Table 4-10.

Figure 4-9: Purified Water Transmission and Distribution Pipelines (Option 1)

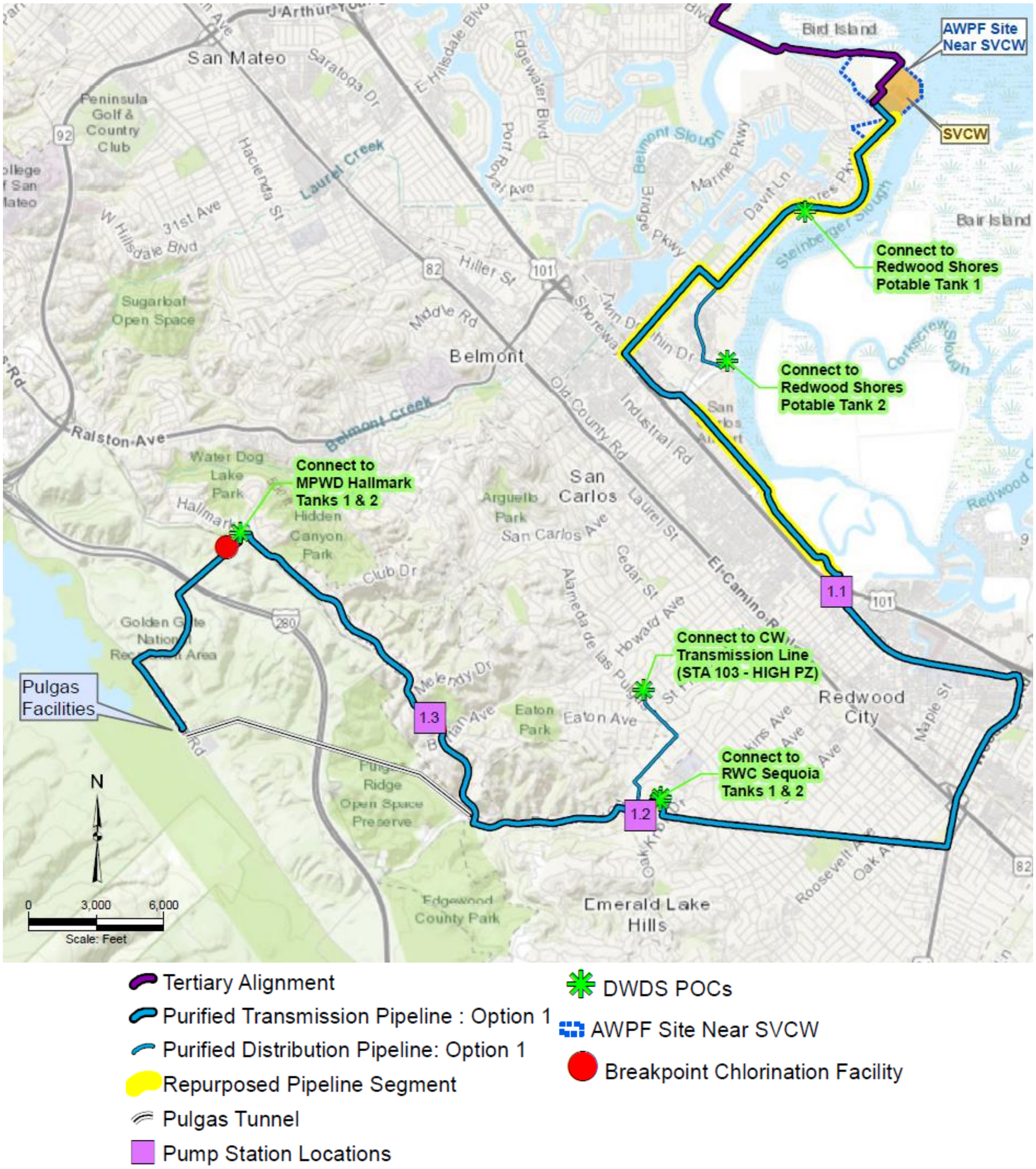


Table 4-10: Purified Water Transmission Option 1 – Pipeline Design Criteria

Parameter	Unit	Phase 1	Phase 2
Pipe Length	miles	15.9	
Pipe Length	ft	83,800	
Pipeline Material	-	PVC	
Nominal Pipeline Diameter	in	24	
Inside Pipeline Diameter	in	24	
Pipeline Velocity at Design Max Flow	fps	3	6
Pipeline Velocity at Design Min Flow	fps	1	3
Total Static Lift	ft	917	917

Note: Additional minor losses assumed to be less than 10% of friction losses.

Hydraulics & Pump Stations

Purified Option 1 is the longest alignment and a relatively high static lift. Option 1 thereby would require more pump stations and would have a higher energy demand than the other two options. The first half of the alignment is relatively flat along the bay front and across the peninsula. The elevation begins rising along Edgewood Road, then sharply increases along Crestview Drive to a high point near Crestview Drive and Los Vientos Way. It is anticipated that Purified Water Option 1 would require three BPSs to deliver purified water to the Pulgas DF, as well as the purified water PS at the AWPF for a total of four pump stations along the alignment. The following potential pump station locations were identified based on a preliminary desktop study:

- AWPF Purified Water Pump Station
- BPS 1.1: Vacant Lot on Veteran’s Boulevard (adjacent to Good Nite Inn)
- BPS 1.2: Redwood City’s Sequoia Tanks Site (same site as BPS 3.1)
- BPS 1.3: Crestview Park

A hydraulic profile of Option 1 is shown in Figure 4-10. The orange triangles represent the head needed at the purified transmission pipeline turnouts to DWDS POC’s in order to reach the point of connection and match existing SFRWS system pressure(s). Turnouts to DWDS connections were located where the purified transmission line hydraulic grade line (HGL) exceeds the required head, meaning that that DWDS connection could be made without installing additional pump stations. In some cases, this results in slightly longer purified water distribution pipelines, but it would reduce the number of aboveground structures required in the congested residential areas. Additional hydraulic analysis and siting studies would be needed to confirm the assumptions. Conceptual pumping design criteria is shown in .

Figure 4-10: Option 1 Hydraulic Profile

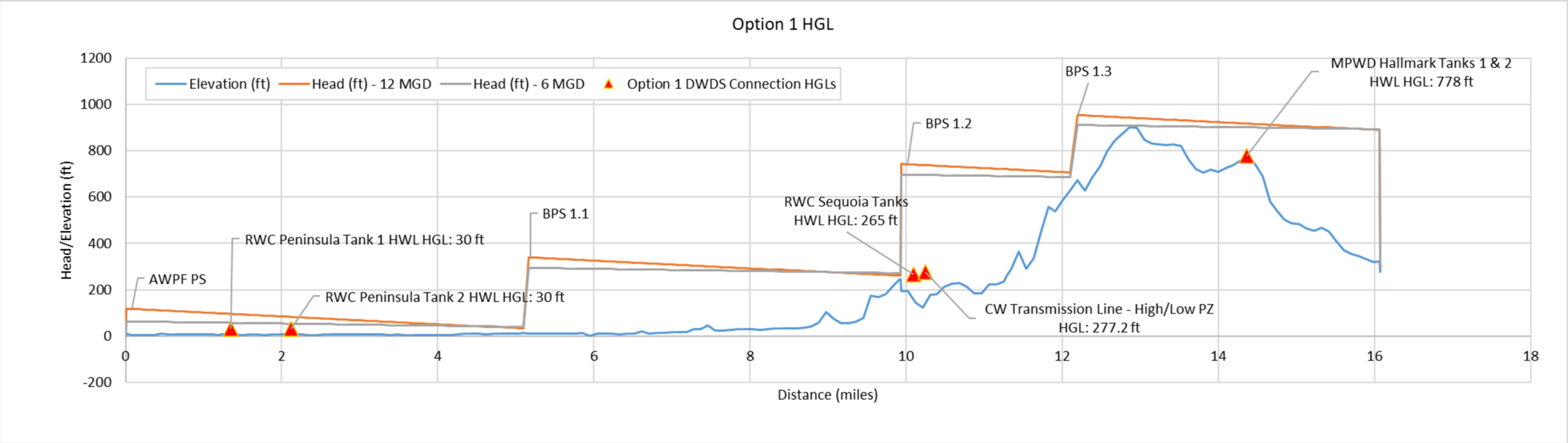


Table 4-11: Purified Pump Stations Summary (Option 1)

Pump Station	TDH (ft)	Flow (mgd)	US Pressure (psi)	DS Pressure (psi)	Flow (gpm)	PS Efficiency (%)	Motor Efficiency (%)	Break HP	Calculated HP	Installed Motor HP	Pump Elevation (ft)
Phase 1											
AWPF PS	65	6	-5	23	4,167	80%	90%	85	95	250	10
BPS 1.1	255	6	12	122	4,167	80%	90%	335	373	500	11
BPS 1.2	425	6	34	218	4,167	80%	90%	559	621	750	194
BPS 1.3	225	6	6	103	4,167	80%	90%	296	329	400	673
							Total HP:	1,276	1,418		
Phase 2											
AWPF PS	120	12	-5	47	8,333	80%	90%	316	351	250	10
BPS 1.1	308	12	9	142	8,333	80%	90%	810	900	500	11
BPS 1.2	483	12	29	238	8,333	80%	90%	1,270	1,412	750	194
BPS 1.3	249	12	14	122	8,333	80%	90%	655	728	400	673
							Total HP:	3,051	3,390		

Notes:

1. US = Upstream; DS = Downstream
2. Conceptual pump station design assumes that each pump station has a capacity of 12 mgd, regardless of whether purified water would be delivered to Pulgas DF or to local DWDSs.
3. It is assumed that BPSs will include 1+1 vertical canned turbine pumps in Phase 1 and 2+1 pumps in Phase 2.

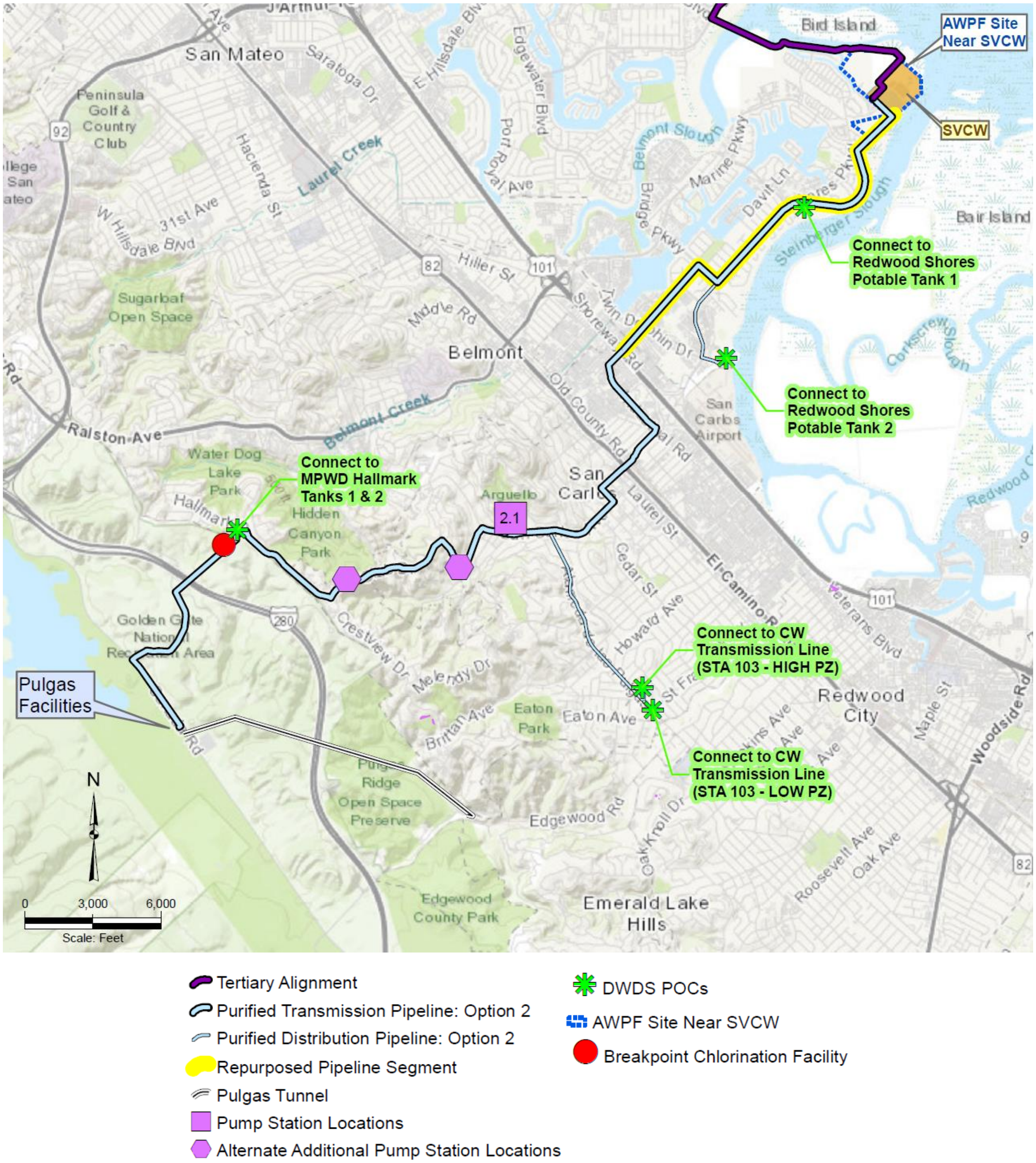
Purified Water Distribution Pipeline(s) and DWDS Connections

Option 1 offers several options for DWDS connection points, including the RWC Redwood Shores Potable Water Tanks, RWC Sequoia Tanks, Cal Water Station 103 Transmission Lines (high- and low-pressure zones), and the MPWD Hallmark Tanks. For Purified Option 1, there would be approximately five turnouts and 2.1 miles of 6-inch to 16-inch purified distribution pipelines required for the Phase 2 TWA expansion. A summary of design criteria for the DWDS connections is included in Section 4.3.6. The DWDS connections and purified distribution pipelines are also described in **Appendix B: TM #5 – Drinking Water Distribution System Design Criteria** and shown in the drawings in **Appendix F: Drawings.**

4.3.4.2 Purified Option 2 – San Carlos – Club Drive

The San Carlos alignment down Club Drive (Option 2) represents the most direct alignment to CSR, as shown in Figure 4-11. This option includes the reuse of the existing SVCW 54-inch-dia decommissioned pipeline along Redwood Shores Parkway, then continues relatively straight across the peninsula. This alignment is approximately 50 percent shorter than Option 1 but would result in more disruption in public ROWs through residential and commercial areas of San Carlos and Belmont.

Figure 4-11: Purified Water Transmission and Distribution Pipelines (Option 2)



Trenchless construction would be needed for crossing highways, railroads, and complex intersections, such as El Camino Real and Holly Street. It is assumed that microtunneling would be required where groundwater is present, or where the crossing exceeds approximately 1,000 LF. Jack-and-bore may be a more cost-effective trenchless construction method where groundwater is not anticipated. Additional costs to account for additional traffic control, public outreach, and pavement repair would also be incurred. Permitting and mitigation requirements would likely impact the construction schedule and cost of this alignment. Based on the preliminary hydraulic calculations, only one BPS would be needed. However, additional potential BPS sites were included in the CEQA documentation given the challenging nature of siting a pump station in the area.

Preliminary pipeline design criteria are presented in Table 4-12.

Table 4-12: Purified Water Transmission Option 2 – Pipeline Design Criteria

Parameter	Unit	Phase 1	Phase 2
Pipe Length	miles	9.3	
	ft	49,300	
Pipeline Material	-	PVC	
Nominal Pipeline Diameter	in	24	
Inside Pipeline Diameter	in	24	
Pipeline Velocity at Design Max Flow	fps	3	6
Pipeline Velocity at Design Min Flow	fps	1	3
Total Static Lift	ft	825	825

Note: Additional minor losses assumed to be less than 10% of friction losses.

Hydraulics & Pump Stations

The initial four (4) miles of the alignment are relatively flat along Redwood Shores to El Camino Real. The pipeline rises to a high point near Crestview Drive and Club Drive. From here, it is anticipated that purified water can flow by gravity down to the Pulgas DF (ground surface elevation approximately 289 ft msl). It is anticipated that purified water Option 2 would require one booster pump station to deliver purified water to the Pulgas DF, resulting in a total of two pump stations:

- AWPF Product Water Pump Station
- BPS 2.1: Near Arundel Elementary School

Additional potential booster pump sites were identified in the CEQA checklist to provide flexibility in future planning efforts given the siting challenges along this alignment. Further hydraulic analysis and BPS siting studies would be needed to confirm hydraulics during detailed design.

A hydraulic profile of Option 2 is shown in Figure 4-12. The orange triangles represent the head needed at the purified transmission pipeline turnouts to DWDS POC's in order to reach the point of connection and match existing SFRWS system pressure(s). Turnouts to DWDS connections were located where the purified transmission line HGL exceeds the required head, meaning that that DWDS connection could be made without installing additional pump stations. In some cases, this results in slightly longer purified water distribution pipelines, but it would reduce the number of aboveground structures required in the congested residential areas. Additional hydraulic analysis and siting studies would be needed to confirm the assumptions. Pumping design criteria is shown in Figure 4-12.

Figure 4-12: Option 2 – Hydraulic Profile

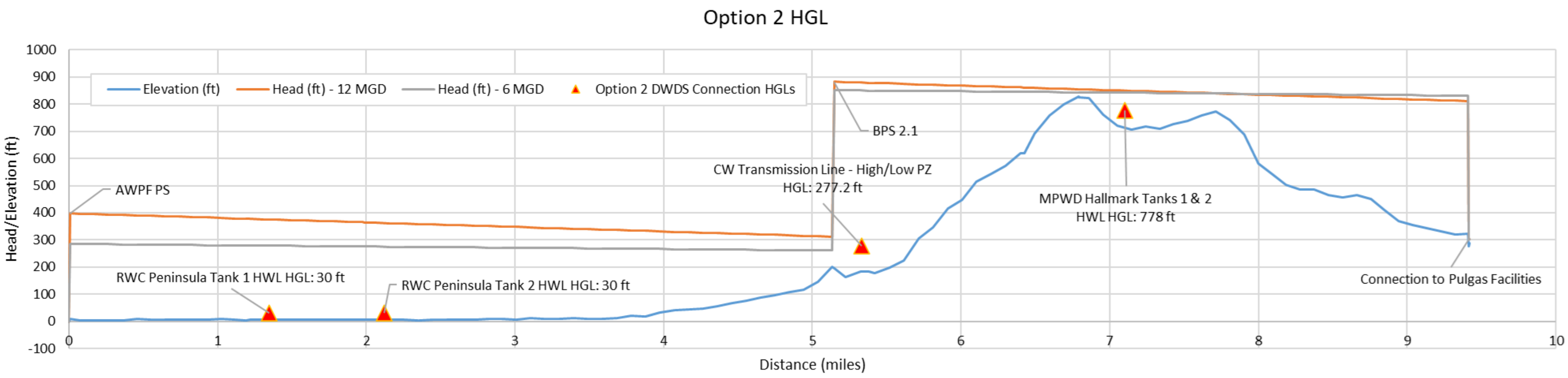


Table 4-13: Option 2 – Pump Stations Summary

Pump Station	TDH (ft)	Flow (mgd)	US Pressure (psi)	DS Pressure (psi)	Flow (gpm)	PS Efficiency (%)	Motor Efficiency (%)	Break HP	Calculated HP	Installed Motor HP	Pump Elevation (ft)
Phase 1											
AWPF PS	287	6	-5	119	4,167	80%	90%	378	419	600	10
BPS 2.1	590	6	28	284	4,167	80%	90%	776	862	1,000	196
							Total HP:	1,154	1,282		
Phase 2											
AWPF PS	400	12	-5	168	8,333	80%	90%	1,052	1,169	600	10
BPS 2.1	470	12	50	297	8,333	80%	90%	1,499	1,666	1,000	196
							Total HP:	2,551	2,835		

Notes:
1. US = Upstream; DS = Downstream
2. Conceptual pump station design assumes that each pump station has a capacity of 12 mgd, regardless of whether purified water would be delivered to Pulgas DF or to local DWDSs.
3. It is assumed that BPSs will include 1+1 vertical canned turbine pumps in Phase 1 and 2+1 pumps in Phase 2.

Purified Water Distribution Pipeline(s) and DWDS connections

Identified TWA tie-in points are illustrated Figure 4-11. The alignment could serve the Redwood Shores service area but would have limited options to connect to RWC's primary distribution system. This alignment option is less desirable from a social equity standpoint and limits the amount of purified water RWC can accept. This alignment option would also require a longer transmission pipeline to connect to Cal Water's Station 103 high- and low- pressure zone connections. Close up maps for each DWDS connection and purified water distribution extensions are shown **Appendix B: TM #5 – Drinking Water Distribution System Design Criteria** and in **Appendix F: Drawings**.

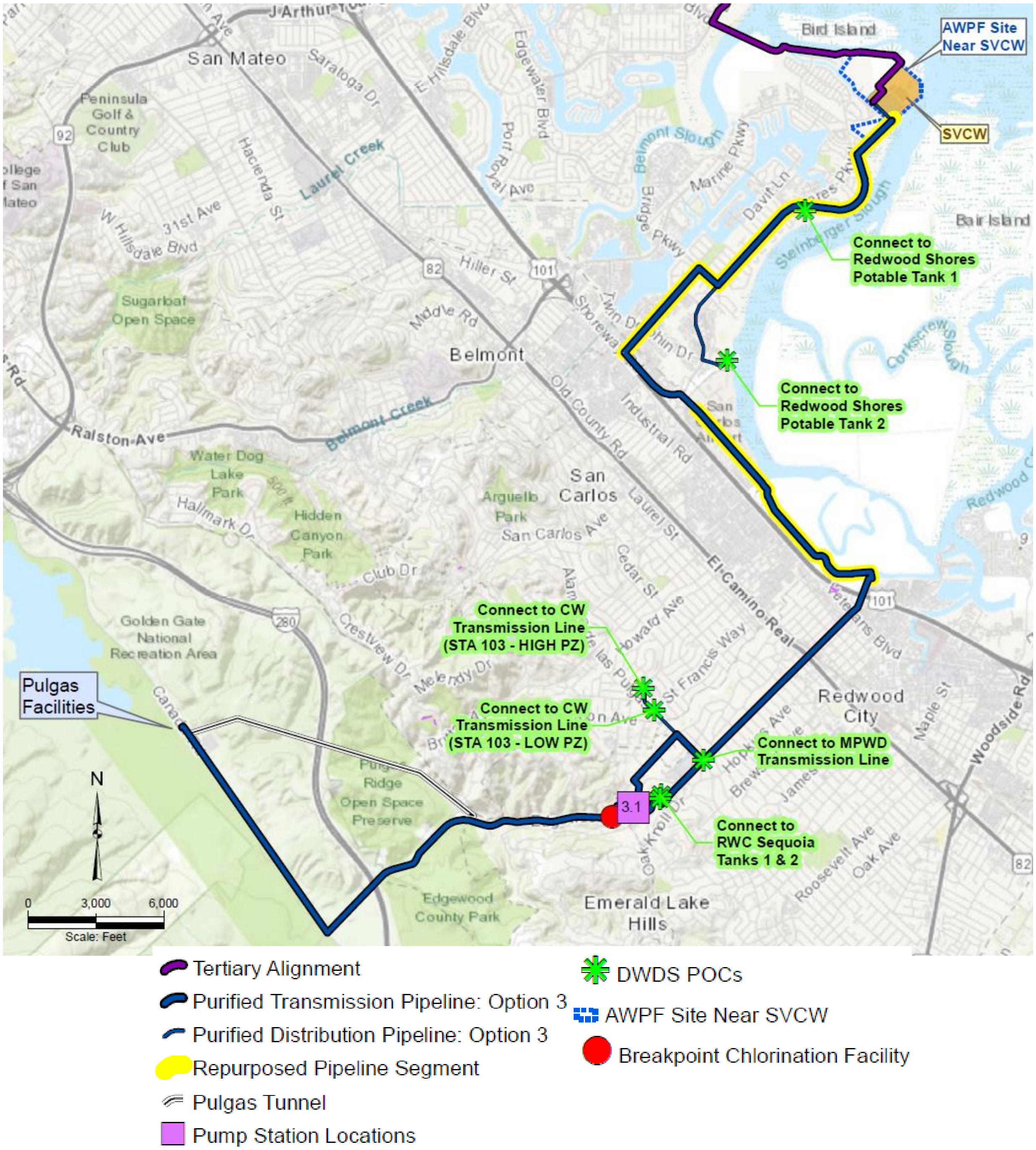
4.3.4.3 Purified Option 3 – Edgewood Road Alignment

Option 3 represents an alternative to the SFPUC ROW alignment with the potential to repurpose a greater portion of infrastructure along Shoreway Road. Microtunneling construction would likely be required when crossing highways, railroads, and complex intersections, except where groundwater is low and jack and bore tunneling is acceptable. Similar to Option 2, higher open trench cost is assumed since the pipeline passes through public ROWs in built-out residential and commercial areas. This alignment, shown in Figure 4-13, also has the lowest amount of lift (i.e., lowest static head), thereby requiring fewer pumping stations and less energy expenditure.

This option utilizes a short segment of SFPUC's BDPL right-of-way along Edgewood Road. The ROW in this location is wider than in some of the areas utilized by Option 1. Due to the lower static lift, pump station siting may be more flexible than in Options 1 and 2.

Trenchless construction is anticipated for crossing highways, railroads, and complex intersections, such as El Camino Real and Whipple Avenue. It is assumed that microtunneling would be required where groundwater is present or where the crossing exceeds approximately 1,000 LF. Jack-and-bore may be a more cost-effective trenchless construction method where groundwater is not anticipated.

Figure 4-13: Purified Water Transmission and Distribution Pipelines (Option 3)



Preliminary pipeline design criteria are presented in Table 4-14.

Table 4-14: Purified Option 3 Pipeline Design Criteria

Parameter	Unit	Phase 1	Phase 2
Pipe Length	miles	11.9	
Pipe Length	ft	62,600	
Pipeline Material	-	PVC	
Nominal Pipeline Diameter	in	24	
Inside Pipeline Diameter	in	24	
Pipeline Velocity at Design Max Flow	fps	3	6
Pipeline Velocity at Design Min Flow	fps	1	3
Total Static Lift	ft	547	547

Note: Additional minor losses assumed to be less than 10% of friction losses.

Hydraulics & Pump Stations

Option 3 has significantly lower static lift than the other options due to remaining on Edgewood Road rather than extending up Crestview Drive. The maximum ground surface elevation of approximately 547 ft msl occurs near the proposed Highway (Hwy) 280 crossing. It is anticipated that purified Option 3 would require only one intermediate booster pump station to deliver purified water to the Pulgas DF for a total of two pump stations:

- AWPF Purified Water Pump Station
- BPS 3.1: Redwood City Sequoia Tanks Site (same site as BPS 1.2)

A preliminary hydraulic profile of Option 3 is shown in Figure 4-14. The orange triangles represent the head needed at the purified transmission pipeline turnouts to DWDS POC's in order to reach the point of connection and match existing SFRWS system pressure(s). Turnouts to DWDS connections were located where the purified transmission line HGL exceeds the required head, meaning that that DWDS connection could be made without installing additional pump stations. In some cases, this results in slightly longer purified water distribution pipelines, but it would reduce the number of aboveground structures required in the congested residential areas. For example, it may be possible to connect to the MPWD 20-inch transmission line in Whipple Avenue, close Option 3 routing. However, it is assumed for the purposes of this BODR that the turnout to the DWDS connection point would be made downstream of the nearby BPS 3.1, to ensure that the SFRWS pressure of 120 psi could be matched at the connection. Additional hydraulic analysis and siting studies would be needed to confirm the assumptions. Pumping design criteria is shown in Table 4-15 STYLEREF 1 \s .

Figure 4-14: Option 3 – Hydraulic Profile

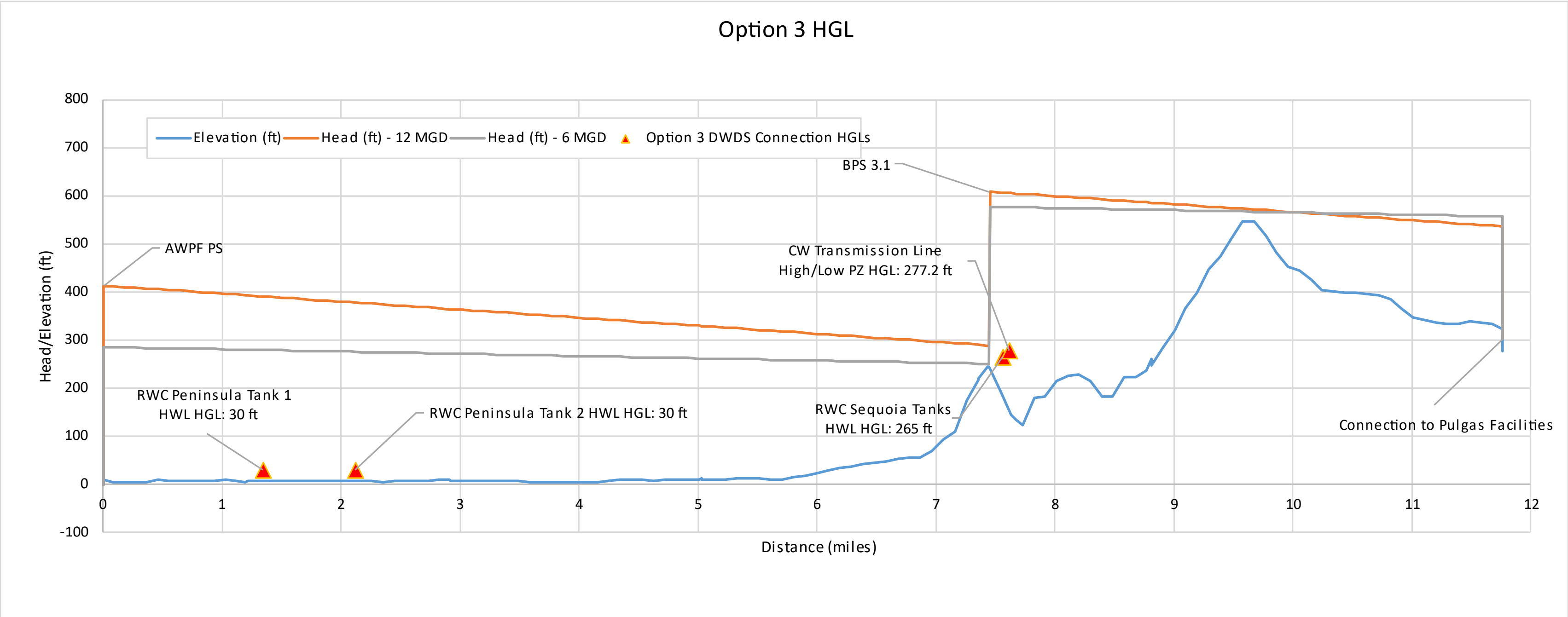


Table 4-15: Option 3 – Pump Station Summary

Pump Station	TDH (ft)	Flow (mgd)	US Pressure (psi)	DS Pressure (psi)	Flow (gpm)	PS Efficiency (%)	Motor Efficiency (%)	Break HP	Calculated HP	Installed Motor HP	Pump Elevation (ft)
Phase 1											
AWPF PS	287	6	-5	119	4,167	80%	90%	378	419	750	10
BPS 3.1	327	6	4	146	4,167	80%	90%	430	478	500	194
							Total HP:	808	897		
Phase 2											
AWPF PS	415	12	-5	175	8,333	80%	90%	1,092	1,213	750	10
BPS 3.1	320	12	21	160	8,333	80%	90%	842	935	500	194
							Total HP:	1,933	2,148		

Notes:

1. US = Upstream; DS = Downstream
2. Conceptual pump station design assumes that each pump station has a capacity of 12 mgd, regardless of whether purified water would be delivered to Pulgas DF or to local DWDSs.
3. It is assumed that BPSs will include 1+1 vertical canned turbine pumps in Phase 1 and 2+1 pumps in Phase 2.

Purified Water Distribution Pipeline(s) and DWDS connections

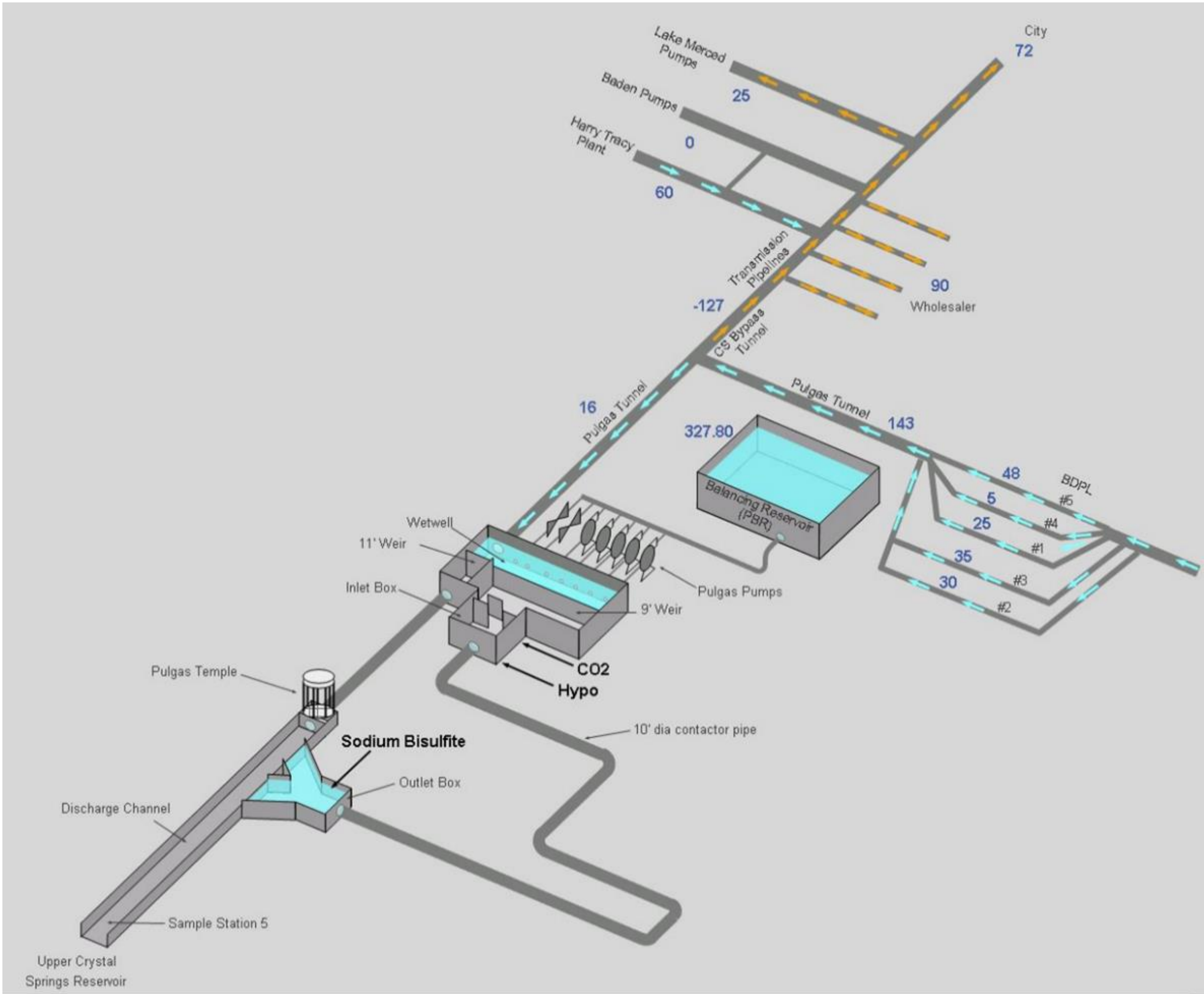
Option 3 is the only alignment that cannot serve the MPWD Hallmark Tanks, so it is assumed a connection would be made to MPWD's 20-in Transmission Line on Whipple Road and Alameda de Las Pulgas. It is assumed that this connection would be made after the nearby BPS 3.1, located at the Redwood City Sequoia Tanks site. Option 3 would also provide purified water the Redwood Shores Potable Tanks, RWC Sequoia Tanks, and Cal Water Station 103 lines. Due to the proximity of DWDS connections near BPS 3.1, it is assumed that a single turnout off of the purified transmission pipeline could serve both the MPWD Transmission Line connection and the Cal Water Station 103 connections.

Close up maps for each DWDS connection, showing the purified water distribution extension from the purified water transmission Option 3 to the Redwood Shores Tanks, MPWD 20-inch Transmission Line, RWC Sequoia Tanks and Cal Water Station 103 are shown **Appendix B: TM #5 – Drinking Water Distribution System Design Criteria** and in **Appendix F: Drawings**.

4.3.5 Breakpoint Chlorination Facility and Pulgas DF Connection

In Phase 1 of the project, all of the 6 MGD of purified water would be delivered to SFPUC's Pulgas DF, where it would be used for ResWA at CSR. The new purified transmission pipeline would terminate at a new connection to the existing 11-foot weir structure at Pulgas DF located at the end of the contact pipeline (see Figure 4-15). The purified water would be introduced downstream of the main portion of the Pulgas DF and would bypass the breakpoint chlorination processes of the Pulgas DF. However, the purified water would mix into the existing dechlorination channel at Pulgas and the purified water would be dechlorinated prior to ResWA at CSR. The purified delivery would not significantly change the operations at Pulgas DF, but some operational changes would be required to accommodate the additional flows. Upgrades to existing chemical systems at the dechlorination station could be required, including new automation systems, chemical pumps, and tanks. These improvements would be designed for Phase 2 buildout, which could include up to 8 MGD of purified deliveries to Pulgas DF.

Figure 4-15: Pulgas DF Facility Layout



In Phase 2 of the project, chloramine disinfectants would be utilized for the purified water. The ammonia from the chloramines must be removed prior to Pulgas DF due to CSR water quality goals and the inability of the existing Pulgas DF to perform breakpoint chlorination on the continuous, low flow of purified water provided by this project. As detailed in Appendix B: TM #4 – Pulgas Disinfectant Residual Alternatives, breakpoint chlorination would be performed in the conveyance line to Pulgas DF after the last DWDS tie-in point. As shown in Figure 4-1, there are two potential locations to site a breakpoint chlorination facility, where chemicals for breakpoint chlorination would be dosed into the conveyance pipeline prior to Pulgas DF. These locations would be after the last DWDS connections for all three TWA options. Of the three DWDS connections, the DWDS connection at the Hallmark tanks are nearest Pulgas DF. The Breakpoint Chlorination Facility would feature a new building (approximately 40 ft by 30 ft) to house chemical tanks and feed equipment for breakpoint chlorination including sodium hypochlorite and pH adjustment (e.g., sulfuric acid or CO_2). The facility would also require paving, site improvements, and access for chemical deliveries.

The reaction time for breakpoint chlorination can be impacted by water quality and can range from 15 to 30 minutes. Based on the 2015 Operations Plan developed for Pulgas DF, the required contact time for breakpoint chlorination at Pulgas DF is 15 minutes assuming a pH of approximately 7.5, a chlorine to nitrogen dosing ratio of 10:1 to 12:1, and adequate mixing in the pipeline. For the PureWater Peninsula Project, the target design contact time for breakpoint chlorination is 30 minutes at the AWPF. Conservatively assuming 8 mgd of purified water would be used for CSR augmentation with IPR via ResWA (design considers a range of 6 to 8 mgd of purified water), a 2-ft-dia pipe, and a distance of 2.3 miles from the closest potential DWDS tie-in point to Pulgas DF (i.e., Hallmark tanks), the calculated contact time is 51 minutes. This exceeds the 15 minutes currently implemented at the Facility and the 30-minute target design contact time for the AWPF. Hence, it is expected that there would be sufficient contact time for breakpoint chlorination to be performed in the conveyance pipeline from the Hallmark tanks to the Pulgas DF. Future studies would be recommended to confirm adequate mixing and contact time would be met. If required, in-line mixers could be installed.

4.3.6 Summary of Purified Water Delivery Design Criteria

Table 4-16 summarizes the tertiary conveyance and purified water transmission infrastructure. Table 4-17 summarizes the DWDS connections and design criteria for each Purified Transmission Pipeline Option. It is assumed that tie-ins to the purified water transmission pipeline would be made where adequate head exists to avoid needing additional booster pump stations to serve the DWDS connections. All tank connections would be made with an air gap. All transmission line connections would be made with a PRV vault to match existing DWDS pressures.

Table 4-16: Summary of Tertiary and Purified Water Transmission Infrastructure

Purified Transmission Alignment Option	Transmission Pipeline		Pump Stations (Phase 1 / Phase 2)			
	Construction Method	Length (miles)	Pump Station	Flow (mgd)	Lift (TDH)	Energy (kW)
Tertiary Pipeline from San Mateo WWTP to SVCW	Open Cut	5.0	Tertiary Effluent PS	4 / 9	21 / 91	15 / 149
	Horizontal Directional Drilling (HDD)	0.4				
	Supported Crossing on Bridge/Structure	0.1				
	Total Length of Pipeline =	**5.5**				
Option 1: Woodside Road – SFPUC ROW	Open Cut	11.0	AWPF Product Water PS	6 / 12	65 / 120	71 / 262
	Jack-and-Bore	0.2	BPS #1.1	6 / 12	155 / 308	278 / 671
	Microtunneling	0.4	BPS #1.2	6 / 12	425 / 483	463 / 1,053
	Pipeline Repurposing (Sliplining)	4.2	BPS #1.3	6 / 12	225 / 249	245 / 543
	Supported Crossing on Bridge/Structure	0.1				
	Total Length of Pipeline =	**15.9**				
Option 2: San Carlos – Club Drive	Open Cut	6.3	AWPF Product Water PS	6 / 12	287 / 400	313 / 872
	Jack-and-Bore	0.1	BPS #2.1	6 / 12	590 / 570	643 / 1,242
	Microtunneling	0.2				
	Pipeline Repurposing (Sliplining)	2.7				
	Total Length of Pipeline =	**9.3**				
Option 3: Edgewood Road	Open Cut	7.0	AWPF Product Water PS	6 / 12	287 / 415	313 / 904
	Jack-and-Bore	0.2	BPS #3.1	6 / 12	327 / 320	356 / 697
	Microtunneling	0.2				
	Pipeline Repurposing (Sliplining)	4.5				
	Total Length of Pipeline =	**11.9**				

Table 4-17: Summary of Purified Water Delivery Infrastructure – Phase 2

Purified Transmission Alignment Option	Agency	DWDS connection Pt.	DWDS Storage Capacity (Existing)	DWDS Transmission Pipeline Size (Existing)	Existing Tank or Pipe Material	Max Assumed Purified Demand		Required Pipe Length	Pipeline Size	DWDS Operating Pressure
			(MG)	(inches)		(mgd)	(gpm)	(ft)	(in)	(psi)
Option 1: Woodside Road – SFPUC ROW	RWC	Redwood Shores Tanks (Tank 1)	3.2	-	concrete	0.5	369	190	6	-
	RWC	Redwood Shores Tanks (Tank 2)	3	-	steel	0.5	347	4,000	6	-
	RWC	Sequoia Tanks 1 and 2	8	-	concrete	3.3	2,292	800	16	-
	CW	Station 103 (Higher & Lower PZs)	-	21 & 14	CCP / AC	4.9	3,403	5,550	16	120
	MPWD	Hallmark Tanks 1 and 2	5	-	steel	1.3	897	350	10	-
	Total	**= 8 (6 tanks; 2 pipelines)**		**Max potential demand (mgd) =**		**10.5**		**2.1**		
Option 2: San Carlos – Club Drive	RWC	Redwood Shores Tanks (Tank 1)	3.2	-	concrete	0.5	369	190	6	-
	RWC	Redwood Shores Tanks (Tank 2)	3	-	steel	0.5	347	4,000	6	-
	CW	Station 103 (Higher & Lower PZs)	-	21 & 14	CCP / AC	4.9	3,403	9,500	16	120
	MPWD	Hallmark Tanks 1 and 2	5	-	steel	1.3	897	350	10	-
	Total	**= 6 (4 tanks; 2 pipelines)**		**Max potential demand (mgd) =**		**7.2**		**2.7**		
Option 3: Edgewood Road	RWC	Redwood Shores Tanks (Tank 1)	3.2	-	concrete	0.5	369	190	6	-
	RWC	Redwood Shores Tanks (Tank 2)	3	-	steel	0.5	347	4,000	6	-
	RWC	Sequoia Tanks 1 and 2	8	-	concrete	3.3	2,292	800	16	-
	CW/MPWD	Shared Distribution Pipeline	-	-	-	-	-	3,350	18	
	CW	Station 103 (Higher & Lower PZs)	-	21 & 14	CCP / AC	4.9	3,403	2,200	16	120
	MPWD	20-in Transmission Line	-	20	CCP	1.3	897	1,300	10	120
	Total	**= 7 (4 tanks; 3 pipelines)**		**Max potential demand (mgd) =**		**10.5**		**2.2**		

Notes:

1. PVC assumed for purified distribution connecting pipelines.
2. Purified distribution pipeline sized based on maximum calculated demands at each DWDS connection. Purified deliveries would be limited to 6 – 8 mgd for all DWDS connections.
3. Option 3 assumes a shared distribution pipeline that would tee off to serve the Cal Water Sta 103 connections and the MPWD 20-inch transmission line connection. It may be possible to serve the MPWD connection directly off of the purified transmission pipeline, which would result in shorter lengths and simpler operations of the distribution pipeline, but hydraulics would need to be confirmed in future design phases to ensure SFRWS pressures could be met under various flow conditions. This approach was assumed for the purpose of this BODR and CEQA due to its more conservative routing.

4.4 Electrical

San Mateo WWTP currently receives its electricity from PG&E. The new San Mateo Tertiary Pump Station would convey water to the AWPF EQ Tanks. The pumping horsepower required would be 25 HP in Phase 1 and 213 HP in Phase 2. Electrical demands would include the pumps and associated instrumentation, controls, valve actuation, and other miscellaneous demands. A new PG&E meter connection or metering system could be installed to track energy use and billing for the new pump station. Several options for the installation of a backup generator for the San Mateo Tertiary PS that could be considered in future design phases are listed below:

- Existing San Mateo WWTP generator could provide backup power to San Mateo Tertiary Pump Station if capacity is available.
- Existing San Mateo WWTP generator could provide backup power to automated valves, and switches to discharge to outfall in an emergency shutdown scenario. San Mateo Tertiary Pump Station pumps would cease delivering water to the AWPF, which would automatically ramp down based on falling AWPF EQ levels/alarm.
- A new permanent or temporary generator could be installed/provided at San Mateo WWTP. For the purposes of this BODR, it is assumed that a new generator at the San Mateo Tertiary Pump Station would be constructed.

The purified conveyance systems include the AWPF Product Water Pump Station, which would be powered at the AWPF site. A discussion of the electrical considerations for conveyance facilities within the SVCW fenceline are discussed in Section 3.8. Each purified option would also include between one and three remote BPSs. It is anticipated that the new remote purified BPSs would receive electricity from PG&E via new service connections. Availability of power would be a significant consideration when evaluating potential pump station sites. For some BPSs, including BPS 1.2/3.1 at the Redwood City Sequoia Tanks site, it could be possible to serve the pump station via an existing connection with a separate meter. A summary of the estimated pumping requirements for the purified water conveyance system options is provided in Table 4-18. Power demands should be further evaluated once pump station locations and hydraulics are confirmed in detailed design.

Table 4-18: Summary of Pumping Energy Required for Purified Options

Conveyance System	Pump Station	Phase 1		Phase 2	
		Flow (mgd)	Pump (Hp)	Flow (mgd)	Pump (Hp)
Purified Option 1	AWPF Product Water PS	6	95	12	351
	BPS 1.1	6	373	12	900
	BPS 1.2	6	621	12	1,412
	BPS 1.3	6	329	12	728
	Total:		**1,418**		**3,390**
Purified Option 2	AWPF Product Water PS	6	419	12	1,169
	BPS 2.1	6	862	12	1,666
	Total:		**1,282**		**2,835**

Conveyance System	Pump Station	Phase 1 Flow (mgd)	Phase 1 Pump (Hp)	Phase 2 Flow (mgd)	Phase 2 Pump (Hp)
Purified Option 3	AWPF Product Water PS	6	419	12	1,213
	BPS 3.1	6	478	12	935
	Total:		**897**		**2,148**

Notes:
1. AWPF Product Water PS values shown would be powered by the new service connection at the SVCW/AWPF site.
2. Values assume 12 mgd would be pumped to Pulgas DF in Phase 2. Actual power consumptions would vary based on demands at DWDS connections along the purified alignment.
3. Table does not include power for pump station instrumentation, controls, valve actuation, or other improvements.

Additional electrical improvements would be needed to provide power to the valves and instruments along the purified water transmission line, purified water distribution lines to DWDS connections, and to at the DWDS connections. These demands are expected to be relatively small loads. It is expected that new motorized valves and instruments at the DWDS connections could be powered through the existing services at each respective site via step-down transformers and low voltage lighting panelboards.

Electrical demands for the new Breakpoint Chlorination Facility would include chemical pumps to feed sodium hypochlorite and pH adjustment chemical (e.g., sulfuric acid), valve actuation, controls, analyzer panels, instrumentation, and typical building electrical draws (e.g., lighting, HVAC). No major electrical draws such as large booster pumps are expected to be needed. It is assumed that this facility would be served by a new PG&E connection. A backup generator supply with automatic power transfer capabilities is recommended.

Coordination with PG&E should be initiated as soon as possible, as new services with PG&E would require a system impact study (SIS) to determine the capacity of the existing infrastructure, any inefficiencies, and what would be needed to meet new service requirements. The BODR scope did not include discussions with local energy providers to initiate new power agreements.

4.5 Instrumentation and Controls (I&C)

As discussed in Section 3.9 for AWPF I&C, the conveyance facilities would require I&C to communicate with SVCW, San Mateo, the SFRWS and Pulgas DF, as well as the drinking water distribution systems of RWC, Cal Water, and MPWD. Instrumentation and controls would be critical to meeting regulatory requirements and optimizing operations. Some additional examples of data exchange and communication needs for the conveyance facilities are described below.

- **Integrated controls between the AWPF and the AWPF Source Water Pump Stations at SVCW and San Mateo.** Communication and control of source water to the AWPF would be important to control purified water inflows and provide adequate effluent flows to dilute the RO concentrate prior to discharge via SVCW's outfall. The levels in the AWPF influent tanks could provide control to the San Mateo and SVCW tertiary effluent pump stations. While communication would be required between multiple agencies, it is expected that the AWPF controls would be independent from the existing controls of other facilities, including San Mateo WWTP and SVCW, to maintain the integrity and security of those facilities' controls and operations. Upgrades to existing plant controls would be required to coordinate existing operations with the new AWPF.

- **Communication between the AWPF, SFPUC's Pulgas DF, and local treated drinking water systems**. Communication and control of purified water flows would inform pump station operations and all recipients of purified water. Pulgas DF operations would need to prepare for the impact of consistent, ramp-down, or shut-down scenarios from AWPF operation. Local drinking water systems (RWC, MPWD and Cal Water) would need to confirm available storage in tanks and transmission pipelines that receive purified water directly. Information would need to be relayed back to the AWPF if purified water could not be accepted, as this would require ramping down, shutting down, cycling or discharging from the AWPF. Control inputs would likely include tank levels, transmission line flows and other operational logic.

I&C would be achieved through flow and water quality meters, flow control valves, pressure regulating valves, online sensors, SCADA system modifications, and other tools for communication. I&C design criteria would be developed in future phases of the design.

Section 5 Project Implementation

Supporting information for this section is provided in:

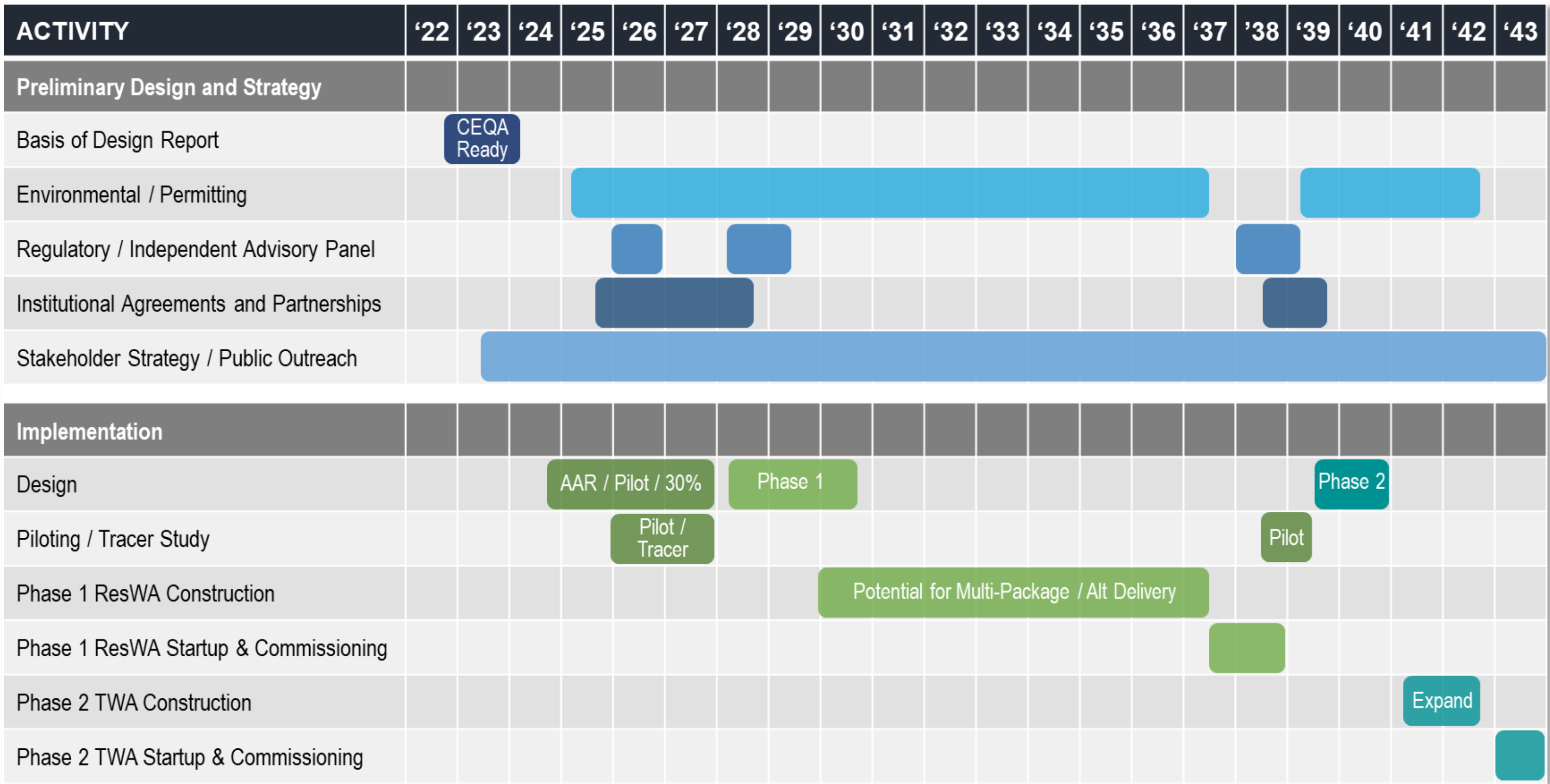
- Appendix B: TM #6 – AWPF Operational Strategies
- Appendix C: Modeling and AWPF Operational Considerations
- Appendix D: Cost Analysis
- Appendix F: Drawings

5.1 Project Schedule

A high-level potential timeline for implementation of the PureWater Peninsula Project is shown in Figure 5-1. The intent of this timeline is to provide a general and conservative estimate of when major activities would occur over a 20-year period. The majority of facilities would be designed and constructed in Phase 1. Phase 2 activities would focus on the drinking water system points of connection and expansion of the AWPF.

This preliminary schedule is based loosely on the duration and schedule for other ResWA projects in progress by East County Advanced Water Purification Program and Pure Water Project Las Virgenes-Triunfo, and similarly-sized projects led by SFPUC. The schedule could be reduced by overlapping activities and reducing time between activities, depending on project drivers. In particular, the design and construction period could be streamlined depending on selection of a preferred delivery method (e.g., traditional design-bid-build vs alternative delivery) and the staging of design and construction packages. The earliest anticipated service date for ResWA is 2039 and TWA in 2043.

Figure 5-1: Potential Timeline for Major Activities to Implement Phased PureWater Peninsula Project



The **intent of this schedule** is to provide a conservative estimate of when major activities would occur over a 20-year period. This timeline could be reduced by overlapping activities, reducing time between activities, and pursuing different project delivery methods, depending on project drivers. This preliminary schedule is based loosely on the duration and schedule for other ResWA projects in progress by Padre Dam and Las Virgenes MWD.

Activities and studies included for the line items in Figure 5-1 may include, but are limited to:

Basis of Design Report (BODR): The completion of this BODR is intended to meet the requirements of SFPUC's definition of CEQA Ready. This document provides a conceptual-level design at or near the 10-percent level and includes the completion of an abbreviated CEQA checklist document, which would allow the project to move forward with CEQA and to be compared with other projects.

Environmental (CEQA/NEPA) / Permitting: Includes development and implementation of strategies for environmental documentation (e.g., NPDES requirement for discharge to CSR and the SF Bay, CEQA/NEPA checklist, potential mitigation requirements, other documentation) and permitting. Includes:

- Development environmental documentation to complete CEQA, environmental impact report (EIR) or mitigated negative declaration (MND), and NEPA for a pilot project (if developed), Phase 1 ResWA and Phase 2 TWA.
- Securing land, right-of-way and construction permits and other approvals necessary to finalize design and move to construction for a pilot project (if developed), Phase 1 ResWA and Phase 2 TWA.

Regulatory / Independent Advisory Panel (IAP): Includes development and implementation of strategies for regulatory compliance to meet ResWA and TWA requirements. An independent advisory panel is required to meet ResWA and TWA, as noted in the Ttitle 22 CCR Sections 64688.30 (f) and 64660.120, respectively. Activities may include:

- Engagement of the State Board Division of Drinking Water (SBDDW)/SWRCB early in the process related to strategies to demonstrate the ability to meet, or validation needed, to meet regulatory requirements for ResWA and TWA.
- Creation of an IAP, consisting of external experts to support initial coordination with regulatory agencies.
  - The IAP could guide the development of demonstration testing and reservoir tracer study concepts, as part of the piloting process.
  - Presentation of project updates to IAP external experts on demonstration testing, reservoir tracer study, and Title 22 Report outcomes to secure preliminary approvals from SBDDW and the RWQCB.
  - The IAP would coordinate with regulatory agencies, in effect providing third-party review and validation of project findings.
  - The IAP could ramp up as-needed to support the distinct phases of the project.
- Activities to meet regulatory requirements, such as completing a Title 22 report (for ResWA and TWA) and any updated studies required for SBDDW drinking water permits and complete RWQCB NPDES and Bay discharge permits, including applicable state and federal water quality standards, policies, provisions, and prohibitions.

Institutional Agreements and Partnerships: Includes development and implementation of strategies for institutional agreements and partnerships, including financial and funding options. Specific activities may include:

- Defining institutional operations and ownership models and roles for partners.
- Development of institutional agreements and terms, which would include a partnership framework to guide contracts, cost sharing, commitments between parties, and other contracts as defined by the framework.
- Finalizing contracts, purchase agreements, and other binding documents, as needed through piloting, and Phases 1 and 2 design and construction.
- Identification of state and federal funding programs that are available to assist agencies with planning, piloting, design, and construction of regional reuse projects.
- Perform rate and workforce impact studies.
- Consideration of alternate delivery and financing approaches (e.g., design-build, design-bid-build, design-build-operate, etc.).
- Applying for design and construction dollars and administer grant/loan if successful.
- Securing financing and/or alternative delivery approach.

Stakeholder Strategy / Public Outreach: Includes development and implementation of strategies for stakeholder and public outreach, continued stakeholder and public engagement activities, which would continue through the different phases to gain support for the project, and address concerns regarding construction and operational activities.

Design: Initial activities include further evaluation of pipeline alignments and the potential to develop a pilot plan to test membrane performance for the blended source waters. The design of Phase 1 ResWA facilities would be informed by initial design efforts, piloting, and other strategies (e.g., regulatory, permitting, institutional, outreach), and may include but not be limited to:

- Source water control evaluations and chemical peak monitoring to identify existing chemical constituent source control and industrial/commercial pretreatment programs and to identify potential modifications, improvements and/or additional programs.
- Bench-scale testing for breakpoint chlorination to validate chemical dosing (e.g., chlorine dosing ratio, pH) needed for purified water.
- Corrosion control studies to ensure purified water is adequately stabilized and to ensure breakpoint chlorination performed in the transmission pipeline to Pulgas DF in Phase 2 will not adversely impact water quality.
- Water quality and disinfectant residual monitoring for blending of the purified water during both Phase 1 IPR via ResWA and Phase 2 DPR via TWA to ensure no adverse impacts to water quality (e.g., corrosion control indices) will occur during blending.
- Development of initial operations and maintenance (O&M) plans for major facilities, including integration with existing operations (e.g., RWC's recycled water system, SFPUC Pulgas DF), treatment facility operation, reservoir operations, management plans, and operator requirements.

- Design of major facilities for treatment, conveyance, discharge, and other infrastructure. Includes evaluation of power availability and needs.
- Development of finalized specifications and preparation of bid documents.
- Development of detailed O&M Plans/Manuals to guide activities for ResWA operational scenarios.
    - Create a contingency plan to respond to potential water quality excursions and to ensure inadequately treated recycled water would not be used for potable purposes.
    - Conduct a Critical Control Points (CCP) study to identify locations to detect treatment lapses (should they occur) and time to implement contingency plans.
    - Demonstrate the ability to provide adequate failure response time (FRT).
    - Develop a Monitoring and Reporting Plan to meet regulatory/permitting requirements (e.g., the frequency and duration of monitoring and reporting would be outlined in the permitting requirements for the project).
- Pre-procurement of treatment equipment, if preferred.

Piloting and Tracer Studies: Includes reservoir modeling and development of a treatment demonstration project, including data gathering, water quality sampling, and validation of outcomes to demonstrate that regulatory requirements would be met. Activities may include:

- Water quality sampling to support:
    - Treatment process evaluation, and ongoing sampling if needed. May include monitoring for specific constituents and surrogates, identifying type and frequency of monitoring, and determining analytical methodology to be used.
    - Calibration of reservoir model or to support baseline surface water quality monitoring and modeling efforts.
    - Perform water quality analysis for blending of purified water directly into local drinking water storage tanks and distribution systems, may include localized water quality sampling and/or water quality modeling.
- Development of a reservoir mixing model to support:
    - Hydrologic, hydraulic, and limnological evaluations.
    - Modeling of the reservoir to confirm assumptions regarding reservoir operations, retention, dilution, and mixing.
    - Work may include an assessment of existing system capacities and infrastructure requirements to use the SFPUC Pulgas DF.
    - Conducing a tracer study and validation modeling to test and validate detention projections and mixing in the reservoir.
- Pilot project
    - To support ResWA and TWA treatment concepts through piloting treatment process technologies to demonstrate strategies for compliance and verify treatment process performance. This may be done in phases to support ResWA and TWA.
    - Includes identification of an appropriate location for the facility, design, and construction activities.

- Utilization of the pilot to identify preferred equipment vendors through evaluation of performance, refine treatment design, and validate performance for log reduction credits.
- Use a demonstration facility as a tool to support public outreach and provide training for treatment plant operators.
- Continue to implement testing concepts to support implementation, such as continued water sampling, water monitoring, and outreach for the source water control program.
- Evaluate and optimize full advanced treatment (FAT) technologies for the purified water:
  - Optimization of ozone dose and BAC empty bed contact time
  - Evaluation of pre-oxidation chemicals to reduce ultrafiltration (UF) membrane fouling
  - Compare different MF/UF membrane modules for performance optimization
  - Evaluate different RO membrane operational configurations for increased recovery and treatment efficiency
  - Compare different RO membrane elements for performance optimization
  - Evaluate efficacy of Cl or H_2O_2 for UV-AOP treatment
  - Validate breakpoint chlorination testing and location in the FAT treatment train (e.g., before or after UV-AOP)

Phase 1 Construction: Includes preparation of information and materials for bid and award and executing construction activities.

Phase 1 Startup and Commissioning: Includes development of Standard Operating Procedures (SOPs) and conducting training for ResWA.

Phase 2 Design: Includes activities to initiate design of the Phase 2 TWA facilities, based on input from initial design efforts, piloting and other strategies (e.g., regulatory, permitting, institutional, outreach), may include but not be limited to:

- Phase 1 treatment evaluations to validate/confirm ability to meet TWA requirements, including identification of potential modifications, improvements and/or additional programs.
- Development of refined operations and maintenance (O&M) plans to deliver water to drinking water systems, including updates to management plans, and operator requirements.
- Design of major facilities for treatment, conveyance, discharge, and other infrastructure. Includes evaluation of power availability and needs.
- Development of finalized specifications and preparation of bid documents.
- Development or refinement of detailed O&M Plans/Manuals to guide activities for TWA operational scenarios.
- Pre-procurement of treatment equipment, if-preferred.

Phase 2 Construction: Includes preparation of information and materials for bid and award and executing construction activities.

Phase 2 Startup and Commissioning: Includes development of Standard Operating Procedures (SOPs) and conducting training for TWA.

5.2 Public Outreach

As part of the BODR effort, the PureWater Peninsula Parties worked with Data Instincts, a public/community relations firm, to prepare and develop a stakeholder/public outreach strategy and gather PureWater Peninsula Parties' input and views regarding certain education and outreach approaches.

Data Instincts conducted in-depth interviews with elected officials, managers, and Public Information Officers representing each of the partnering agencies. The interviews were conducted to gather information from key stakeholders and to develop an understanding of the outreach needs in the affected communities. Key takeaways from those interviews (Data Instincts, 2023a) were:

- All of the interview participants agreed that alternative water supply sources to augment the regional Hetch Hetchy supply should be considered.
- The interviewees were generally supportive of purified water with some wanting more information about the safety and taste of the water.
- Participants agree that a significant amount of education and outreach with the public and elected leaders in the service areas is needed for the success of the Project.
- Due to the prior recent drought years, it has been expressed that the general public in the region generally seem to understand the need for additional water supply. However, they could perceive advanced purified water as an inferior water source compared to Hetch Hetchy water.
- Several respondents emphasized that customers in the region take immense pride in the high quality and "pure" taste of their Hetch Hetchy water. Although there are several successful existing advanced purified water systems in the state and more in the planning stages, there is still the potential for the "yuck" factor reaction to the source water.
- A few respondents noted that the public may view the need for additional water supply as a result of current or planned growth in the community.
- Strong messaging around the need for the water and emphasizing the taste, quality and safety of the water will be critical in the messaging.

All findings and recommendations from the interviews are documented in a "Needs Assessment and Information Gathering for Effective Public Outreach & Education" (Data Instincts, 2023a) report, which has been shared with the PureWater Peninsula Parties.

A Draft "Initial Strategic Outreach Plan" (Data Instincts, 2023b) has been developed to provide the PureWater Peninsula Parties with an outreach strategy and recommended communications tools for engaging stakeholders in the PureWater Peninsula partner communities to achieve the

PureWater Peninsula public outreach goals. This plan is intended to be a considered a "living document" that is periodically reviewed and adjusted to adapt to the evolution and milestones of the Project and to the outreach needs for the communities involved. The Initial Strategic Outreach Plan includes guidance for:

- Getting Ready for Public Engagement
- Key Outreach Messages
- Communication and Outreach Tools
- Measuring Public Outreach Success
- Outreach Schedule

The PureWater Peninsula Project recognizes that outreach is dynamic and must evolve and adapt with the Project. Outreach efforts must remain cognizant of shifts in public opinion and align with project milestones. The outreach strategy must continue to be revisited and adapted to address concerns, maintain trust, and build consensus amongst the various stakeholders. The messages, activities, and tools presented in the Initial Strategic Outreach Plan should therefore be modified as the Project progresses. (Data Instincts, 2023b)

5.3 Summary of Costs

Costs presented herein reflect the cost to build and operate Phase 1 ResWA and expand to TWA in Phase 2. Construction costs are presented in 2024 dollars based on the midpoint to construction for the phased project implementation timeline presented in Section 5.1. Annual costs reflect operations and maintenance (O&M) cost for energy, chemicals, labor and maintenance and repair. Annualized unit life cycle costs reflect the annualized construction costs plus O&M costs divided by the annual delivery volume of purified water.

The costs are presented based on Phase 1 ResWA, Phase 2 TWA expansion, and the total Project cost, as described in the previous sections. Detailed project cost sheets and other supporting information is provided in **Appendix D: Cost Analysis**.

5.3.1 Engineers' Opinion of Probable Construction Costs

This section describes the engineer's opinion of probable construction costs developed for the PureWater Peninsula Project, as presented in Sections 1 through 4 and in **Appendix F: Drawings**.

The costs provided herein represent a pre-design level, with 1 to 15 percent project definition and a range of accuracy of +30 percent to -20 percent. These represent the Association for the Advancement of Cost Engineering (AACE) Class 4 level of estimates, which are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval.

A summary of facility construction costs for major project components, including the three purified water conveyance options, is presented in Table 5-1. Conveyance costs are presented for each of the three purified water options and include the cost for transmission pipelines with the associated AWPF and BPSs, distribution pipelines and DWDS points of connection.

The engineer's opinion of probable construction costs (OPCC) includes major facilities, site preparation, electrical, instrumentation and controls accounting for materials, installation, subcontractor costs based on recently bid projects and professional experience. Taxes, contractor markups, overhead and profit, and an escalation to the midpoint of construction is applied to get to an estimated construction cost in 2024 dollars. Additional details about cost assumptions are provided in **Appendix D: Cost Analysis,** including detailed opinion of probable costs for each project component.

Table 5-1. Summary of Total Construction Costs (2024 $million)

Cost Component	Phase 1 ResWA	Phase 2 TWA Expansion	TOTAL
Construction Costs	**($M)**	**($M)**	**($M)**
AWPF	$440	$170	$610
Tertiary Pump Station and Pipeline	$145	$1.7	$146.7
Breakpoint Chlorination Facility	$1	$7.9	$8.9
Purified Conveyance Options [1]			
Purified Option 1	$326	$56.7	$382.7
Purified Option 2	$231	$74	$305
Purified Option 3	$247	$62	$309
RANGE of COSTS in $MIL[2]	**$817 to $912**	**$236.5 to $253.8**	**$1070.8 to $1148.5**

Notes:
1. Each purified water conveyance option includes costs for transmission and distribution pipelines, booster pump stations and TWA points of connection.
2. A range of accuracy is applied to the minimum and maximum overall project construction cost to reflect the cost uncertainty associated with a project at a 10% level of design with anticipated construction that is 15 to 20 years out.

The following bullets explain some of the nuances that contributed to the phased costs and total costs:

- The majority of the AWPF facility infrastructure and buildings would be constructed in Phase 1. Phase 2 construction would include expansion of the chlorine contactors, chemical and ozone systems, the additional MF/UF and RO modules and an additional UV-AOP train with interconnecting pipeline/fittings and valves for all above. Additional pumps would be added to major pump stations and electrical and I&C would be upgraded to accommodate the additional flow.
- The tertiary pipeline and pump station to convey San Mateo WWTP effluent to the AWPF would be constructed during Phase 1 to allow for blending of sources water from San Mateo and SVCW at the start of the project.
- The conveyance costs for the purified water options include the cost for transmission pipelines with the associated BPSs, distribution pipelines and TWA points of connection. The purified transmission pipelines would be constructed in Phase 1, and the purified distribution pipelines and DWDS connections would be constructed in Phase 2.

  - Purified Water Option 1 would have the highest cost. This is the longest transmission pipeline option with the three BPSs and 2.1 miles of purified distribution pipelines.
  - Purified Water Option 2 would have the lowest cost. This is the shortest transmission pipeline, with one BPS. Since there are fewer DWDS points of connection, this option has limited TWA demand, and requires 2.7 miles of distribution pipelines to reach the identified POCs.
  - Purified Water Option 3 would be in the middle range of cost of the three options. This alignment is longer than Option 2, has one BPS, and 2.2 miles of purified distribution pipelines.
- Major upgrades to Pulgas DF are not anticipated, but a new Breakpoint Chlorination Facility would be constructed in Phase 2. In Phase 1, the purified transmission pipeline would terminate at Pulgas DF. Improvements at Pulgas DF could include upgrades to existing chemical systems and electrical, I&C, but significant changes to Pulgas DF operations are not anticipated. In Phase 2, breakpoint chlorination would occur in the purified transmission pipeline between the last DWDS point of connection and the point of connection to Pulgas DF for any Purified Water Option. The Breakpoint Chlorination Facility would include a new building, chemical feed systems, and associated electrical, I&C and analyzers.
- All costs include escalation to midpoint of construction at 4.5 percent per year inflation. Phase 1 ResWA is assumed to begin construction in 2030 and end in 2037 (51 percent escalation applied). Phase 2 TWA is assumed to begin construction in 2041 and end in 2043 (88 percent escalation applied based on 4.5 percent per year inflation).

5.3.2 Opinion of Probable O&M Costs

Annual O&M costs for Phase 1 and 2, irrespective of the purified water transmission options, are summarized in Table 5-2.

- AWPF O&M costs reflect costs for energy, chemicals, labor and maintenance and repair of all facilities, including major pump stations within the AWPF fence line. A contingency is applied to all O&M costs.
- The project operations would shift some of the operational protocol at Pulgas DF and CSR.
- Additional staff would be required to operate and maintain the new AWPF and to coordinate and manage PureWater Peninsula Project operations in conjunction with operations at the San Mateo WWTP, SVCW and each of the DWDS receiving purified water. Appendix E CEQA Checklist Section 9.2 describes staffing for AWPF and conveyance facilities.
- Conveyance O&M costs are dominated by energy costs for pumping and labor costs for maintenance and repair of infrastructure. Costs for breakpoint chlorination at Pulgas DF are included in Phase 2 conveyance O&M costs only.
- San Mateo O&M costs reflect lower costs in Phase 1 due to the lower flow than in Phase 2. Chemical costs are not anticipated at this facility.

Table 5-2. Summary of Annual O&M Costs (2024 $million)

O&M Component	Phase 1	Phase 1 & 2 TOTAL
Annual Costs	**($M/yr)**	**($M/yr)**
AWPF		
Energy Costs	$2.2	$4.4
Chemicals	$1.5	$3.1
Labor Costs[1]	$2.3	$2.8
Maintenance	$1.6	$2.8
Contingency @ 10%	$0.8	$1.3
AWPF Annual O&M	**$8.3**	**$14.4**
Conveyance		
Energy Costs	$2.0	$6.9
Chemicals	$0.095	$0.383
Labor Costs[1]	$0.7	$1.4
Maintenance	$4.9	$5.9
Contingency @ 10%	$0.8	$1.5
Conveyance Annual O&M	**$8.5**	**$16.0**
San Mateo Facility		
Energy Costs	$0.03	$0.3
Chemicals	$0	$0
Labor Costs	$0.2	$0.4
Maintenance	$2.2	$2.2
Contingency @ 10%	$0.2	$0.3
San Mateo Facility Annual O&M	**$2.6**	**$3.2**
Total O&M Costs	**$19.5**	**$33.6**

[1] See Section 9.2 in Appendix E for staffing details.

5.3.3 Annual Life Cycle Unit Costs

The OPCC costs are converted to annualized lifecycle costs using basic assumptions about discount rates (estimated at 4 percent) and the life expectancy of project components (30-years for process, electrical, I&C; 50 years for Pump Station/storage; 75 years for structures; and 100 years for pipelines). Total annualized costs are divided by the purified water delivered over the life of the project to obtain a uniformly derived unit cost of water in dollars per acre-foot ($/AF), dollars per million gallons ($/MG) and dollars per one-hundred cubic feet ($/CCF). The life cycle unit costs for Phase 1, Phase 2 and the total PureWater Peninsula Project are summarized in Table 5-3.

Table 5-3. Summary of Life Cycle Unit Costs (2024 $million)

Purified Water Delivered	Phase 1	Total Phase 1 and 2
Flow Delivered (mgd)	**6**	**12**
Flow Delivered (acre-feet per year)	**6,720**	**13,440**
Annualized Unit Construction Cost	**($/AFY)**	**($/AFY)**
AWPF	$2,430	$1,810
Conveyance	$1,970	$1,170
Annual Unit O&M Cost	**($/AFY)**	**($/AFY)**
AWPF	$1,240	$1,070
Conveyance	$1,270	$1,190
Life Cycle Unit Cost	**($/AFY)**	**($/AFY)**
AWPF	$3,670	$2,880
Conveyance	$3,240	$2,360
Total Life Cycle Unit Costs	**$6,910**	**$5,240**

Note: Annualized unit construction costs represent the average cost to construct options 1, 2 and 3. The range of Total Life Cycle Unit Costs for Phase 1 and 2 would be $5,200 to $5,400 if all three options were considered.

The costs presented in Table 5-3 reflect life cycle unit costs when the facility is operating continuously, 365 days a year at the design flow. As discussed in Section 3.2 and **Appendix B: TM #6 – AWPF Operational Strategies** the project may operate under seasonal scenarios where AWPF production is ramped down or shut down during wet months of wet years. Ramp down or shutdown scenarios would occur during a wet year where the demand for recycled water is low and/or the SFRWS is at its maximum water banking capacity. During these operational scenarios, the treatment plant would reduce or cease production of purified water. The rationale for these operational scenarios is based on minimizing the amount of spill from the SFRWS, which is further described in **Appendix C: Modeling and AWPF Operational** Scenarios, Section C.4.

The major change to O&M costs due to ramping down and shutting down operations would be reduced costs associated with energy, chemicals and labor because the plant would be operating at below capacity. However, the greater impact would be to life cycle unit costs, which are directly proportional to the annual delivery of purified water. **Appendix D: Cost Analysis**, Section D.3 provides a summary of ramp down and shutdown cost assumptions.

The cost impact for a ramp-down and shut-down year would be a decrease in the annual O&M cost due to reduced energy, chemicals and labor, but an overall increase in the life cycle unit cost, due to less purified water delivered. Overall, O&M costs for plant shut down could decrease by approximately 10 percent to 20 percent for ramp down and shut down operations, respectively. The net impact over the project life would depend on how frequently ramp down and shut down scenarios occur and for how long they are sustained. Based on the assumption of a recuring 6-year dry period and 6-year wet period, the overall life cycle unit costs for the total project could increase by approximately 9 percent to 17 percent for ramp-down and shut-down operations, respectively.

5.4 Summary of Benefits and Risks

Implementation of the PureWater Peninsula Project could benefit the San Francisco Bay Area through:

- ✓ Development of a new locally-controlled, reliable supply of high-quality water that is drought-resilient
- ✓ Reduce dependence on imported water and potential to result in reduced diversions from the Tuolumne River
- ✓ Reduction in discharges to the SF Bay
- ✓ Treatment of local wastewater more efficiently and prevention of water from becoming a lost resource.
- ✓ Addressing the unpredictability of climate change.
- ✓ Combined resources and regional institution collaboration to maximize water reuse.

There are of course inherent risks and uncertainties that accompany project implementation, such as

- Operational and water quality challenges in Crystal Springs Reservoir
- Ability to reliably meet Bay discharge requirements
- Construction challenges in constructing alignments along the Bay and through Silicon Valley
- Water supply during non-drought years would impact operations and storage availability in the SFRWS
- Decreasing quantity and quality of source supplies due to conservation
- Uncertainty related to DPR regulatory requirement rollout once finalized at the end of 2023
- Institutional agreements to share costs and risks
- Equity in distribution of purified water and costs
- Community support and acceptance

These, and other challenges, will be addressed as the project progresses.

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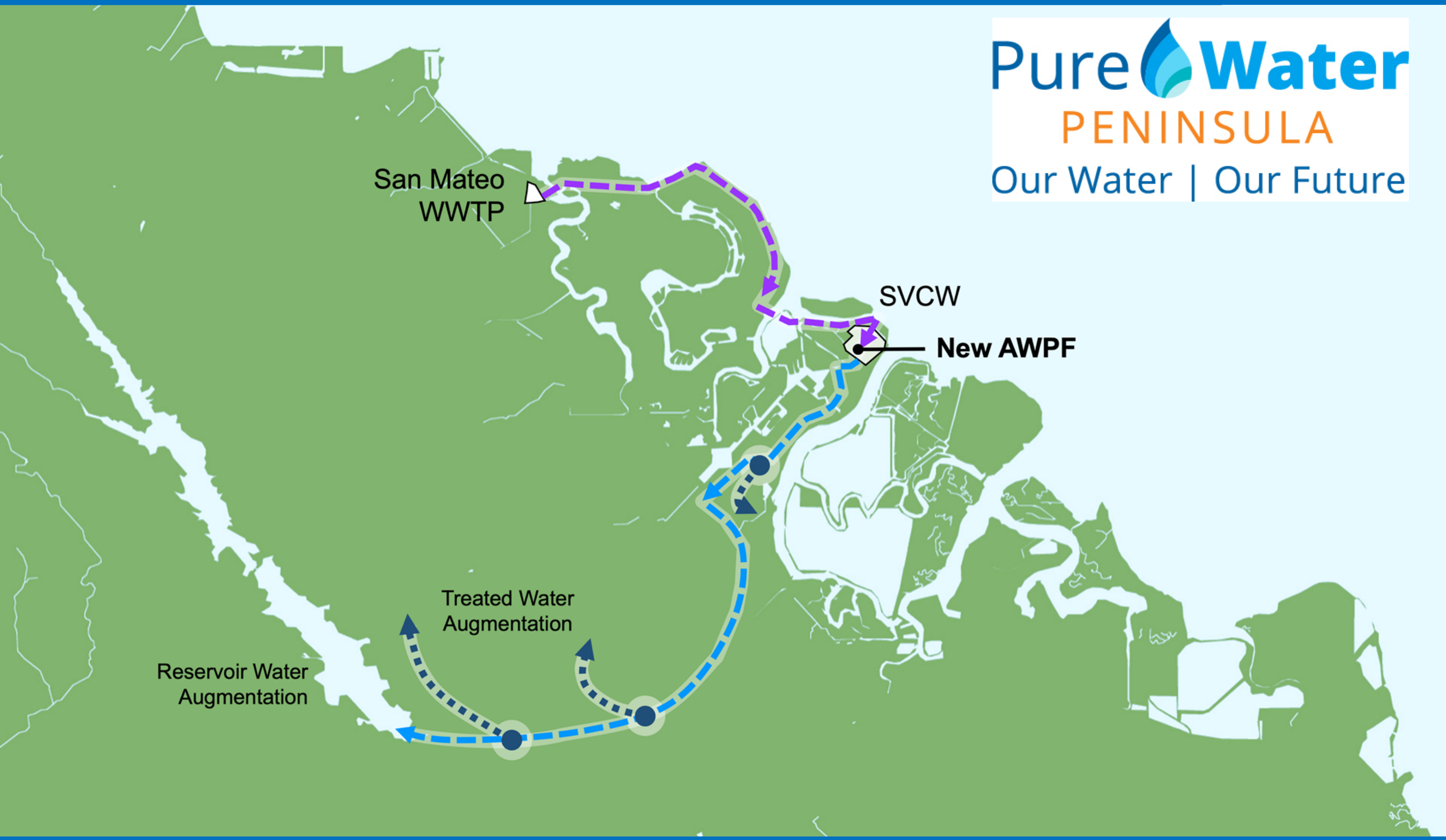
Kennedy Jenks

Final Appendices

PureWater Peninsula Project

May 2024



Prepared for:

San Francisco Water Power Sewer

SVCW Silicon Valley Clean Water

BAWSCA Bay Area Water Supply & Conservation Agency

Redwood City California

City of San Mateo California

City of Foster City Incorporated 1971

California Water Service

MPWD

Appendices

Appendix A Regulatory Requirements

This Appendix discusses regulations and treatment requirements for recycled water use to protect public health and the environment, providing an overview of the different types of reuse, detailing current and anticipated requirements regulations for ResWA and TWA and providing an overview of SF Basin Plan and discharge requirements.

A.1 Reservoir Water Augmentation (ResWA) Requirements

A.1.1 ResWA Regulatory Requirements

In the state of California, a reservoir water augmentation project is defined as a project that plans to use purified recycled water from a municipal wastewater facility for augmenting a reservoir that is designated as a source of domestic water supply, commonly known as DPR. The (California) State Board was charged with proposing DPR regulations, discussed above, and in partnership with an expert panel, set forth the following proposed requirements:

1) An initial minimum theoretical retention time of no less than 180 days (calculated as total monthly volume divided by total monthly outflow); however, an alternative minimum theoretical retention time of no less than 60 days may be considered for approval.

2) A dilution requirement in the reservoir of 100:1 (one percent by volume), or 10:1 (ten percent by volume) with an additional 1-log microbial pathogen treatment, to demonstrate the percent of recycled water withdrawn from the reservoir, by volume, during any 24-hour period.

3) The expert panel charged with ensuring the State Board's proposed DPR regulations are protective of public health, have mandated that for all DPR treatment technologies, Ozone BAC go before reverse osmosis.

Unique to the State of California is an "alternatives clause," similar to the groundwater augmentation regulations. The intent of an "alternatives clause" is to provide adaptability to offer alternative permitting pathways for innovative projects that build off the expanding knowledge base (Trussell 2016). Alternative approaches could apply to the treatment train, monitoring plan, or approaches used to demonstrate meeting minimum retention time (as noted in item 1 above). The Final ResWA Regulations include language that allows for alternative approaches if it can be demonstrated to the State Board that the proposed alternative provides equivalent or better performance. Written approval from the State Board would be requested prior to implementation, and in some cases a public hearing may be required.

In addition, the Final ResWA Regulations establish requirements for:

- Recycled water source control
- Treatment and pathogen removal
- Demonstration testing
- Operations and maintenance
- Effluent and process monitoring and reporting
- Reliability and redundancy
- Identification and responses to failure events
- Reservoir dilution, retention, tracer studies, and monitoring
- Public comment and notification

A ResWA project would likely be implemented within two key permits:

- State Board Division of Drinking Water (SBDDW) drinking water supply permit
- NPDES permit issued by the RWQCB on behalf of the U.S. Environmental Protection Agency (EPA)

Current SBDDW drinking water supply permits specify applicable state and federal drinking water requirements and establish conditions under which a water supplier acquires, stores, treats, monitors, and distributes to a drinking water supply to the public. Modification of the drinking water supply permit would be required as part of implementing a ResWA project.

The RWQCB regulates discharges of recycled water to surface waters on behalf of the EPA through the issuance of NPDES permits. NPDES permits implement applicable state and federal water quality standards, policies, provisions, and prohibitions. NPDES permits would also incorporate applicable SBDDW recycled water and ResWA requirements.

A.1.2 ResWA Treatment Requirements

The treatment requirements for ResWA require recycled water to be treated by full advanced treatment (e.g., reverse osmosis [RO] and an advanced oxidation process [AOP]) prior to delivery to a reservoir. The treatment train must achieve a minimum of 8/7/8 microbial log-removal for virus, *Giardia*, and *Cryptosporidium* (V/G/C), with at least two separate treatment processes credited with no less than 1.0-log removal, and no separate treatment process credited with more than 6-log removal. The ResWA Regulations require that any 24-hour input of recycled water into a reservoir must be mixed such that water withdrawn for use as drinking water never contains more than 1 percent recycled water.

For those projects where recycled water delivered to a reservoir during any 24-hour period makes up 10 percent of water withdrawn for use as drinking water, the recycled water treatment train must achieve an additional 1-log removal (i.e., 9/8/9) with at least three separate treatment processes credited with no less than 1.0-log removal. In addition, although alternative minimum reservoir retention times as low as 60 days may be considered, ResWA projects with minimum retention times of less than 120 days must provide an additional 1-log treatment. The ResWA criteria and treatment requirements are summarized in Table A-1.

Table A-1: ResWA Criteria and Treatment Requirements

Retention Time (days)[1]	Dilution (Volume:Inflow$_{day}$)[2]	Log Removal at AWPF (V/G/C)[3]	# of Treatment Processes
≥ 120	100:1	8/7/8	2
	10:1	9/8/9	3
≥ 60	100:1	≥ 9/8/9	2

Notes:

1 Retention time is calculated as total volume divided by total outflow

2 Dilution of 100:1 = one percent, by volume, of purified water delivered to the surface water reservoir during any 24-hour period. Dilution of 10:1 = ten percent, by volume, of purified water delivered to the surface water reservoir during any 24-hour period

3 Log reduction credits at a drinking water treatment plant (4/3/2 V/G/C) were previously included in the total log removal values (LRV) requirement in prior versions of the Draft ResWA Regulations but are not included in the Final ResWA Regulations.

Anticipated pathogen removal credits for treatment train processes are discussed in **Appendix C: Modeling and AWPF Operational Scenarios**. The ultimate inactivation credit achieved may be based on site-specific performance and/or a negotiated validation approach with SBDDW on a case-by-case basis. For example, the tertiary treatment process prior to the Advanced Water Purification Facility (AWPF) may receive additional inactivation credits for V/G/C and multiple disinfection processes, such as ozone and free chlorine in addition to UV-AOP, could provide for an additional 4 to 6 virus inactivation credits, respectively. Critical control points identified between individual treatment processes can provide both process control and be used to establish log reduction credits (WateReuse 2016). A proposed treatment train for ResWA is also presented in **Appendix C**.

A.2 Treated Water Augmentation (TWA) Requirements

A.2.1 TWA Regulatory Requirements

The final DPR regulations require the designation of one direct potable reuse responsible agency (DiPRRA) that would be responsible for complying with the DPR regulations. The DiPRRA is required to be a public water system that is responsible for using the DPR water. Responsibilities for the DiPRRA include:

- Demonstrating that all treatment processes are designed, installed, and operated in compliance with the DPR regulations and an approved Operations Plan
- Compliance with the California Waterworks Standards, Title 22, Division 4, Chapter 16
- Subjecting its facilities and operations to an annual inspection to evaluate
    - Source(s) and treatment
    - Cross-connection control program
    - Enhanced source control program
    - Technical, managerial, and financial capacity and that of its partner agencies
    - Operations Plan, Monitoring Plan and Water Safety Plans

A.2.2 Source(s) and Treatment Requirements

The DPR criteria include a minimum microbial log removal value (LRV) requirement of 20/14/15 for virus, *Giardia*, and *Cryptosporidium* (V/G/C), which must be achieved using multiple treatment processes, providing multi-barrier protection. If the product water falls below the specified LRV within a 4-log buffer (16/10/11), DiPRRA would have 24 hours to get the system back into the regulated range before they are required to discontinue delivery. Other criteria and considerations include:

- Need for at least four (4) separate treatment processes credited with no less than 1.0-log removal and no more than 6-log removal for each pathogen in order to promote multiple barriers of treatment. A single process may receive log reduction credits for multiple pathogens.
- Treatment train is required to have at least three (3) diverse treatment mechanisms that have been demonstrated to be effective for IPR including UV disinfection, physical separation, and chemical disinfection. Each treatment mechanism must achieve at least 1.0-log reduction for each virus, *Giardia*, and *Cryptosporidium.*
- Inclusion of an ozone / biological activated carbon (BAC) process in the treatment sequence is required unless there is sufficient blending of wastewater with other water (e.g., potable water or raw water) to dilute wastewater contaminants. In order for blending to supplement the ozone/BAC process, the wastewater contribution (WWC) cannot exceed 10%. It is likely that the blending attained in this project would resonate with a 50/50 blending ratio (wastewater: surface water). Thus, the augmentation of blending for ozone/BAC is not applicable in this project due to the limited available surface water inputs that can be used for blending. The ozonation process must be designed to achieve a 1-log

reduction in carbamazepine and sulfamethoxazole. DDW states that the ozone dosage should resonate with a ratio of at least 1 given the design feed water total organic carbon (TOC) concentration (ozone:TOC). The BAC process must achieve a 1-log reduction in formaldehyde and acetone. DDW requires a BAC empty bed contact time (EBCT) to be 15 minutes. A demonstration to the State Board that the ozone/BAC performance criteria is achieved must be completed prior to the operation of the DPR project. A different ozone dosage and BAC EBCT can be used if the process is able to demonstrate that the performance criteria is met.

- Reverse osmosis (RO) process is required sequentially after ozone/BAC treatment. The permeate recovery must exceed 15 percent while maintaining an influent pH greater than 6.5 and less than 8.0.
- Inclusion of advanced oxidation process (AOP) is required after RO in the treatment sequence. This process must achieve at least a 0.5-log removal of 1,4-dioxane. Similar to the ozone/BAC process, a demonstration must be conducted to show compliance to the State Board along with a testing protocol.
- The entire treatment train must provide sufficient mixing such that the system is able to attenuate a one-hour elevated concentration by a factor of ten in between the wastewater treatment plant inlet chamber and the DPR project purified water. An additional 2-log reduction can be applied if the purified water is stored in a reservoir or used for groundwater recharge in order to capture the benefits provided by systems that have these additional protections.

The DPR pathogen control treatment requirements are summarized in Table A-2.

Table A-2: Summary of DPR Pathogen Control Treatment Requirements

Sum of LRVs for DPR Treatment Train at AWPF (V/G/C)	Minimum # of Treatment Processes with >1 log-removal	Minimum # of Diverse Treatment Processes[1]	Minimum Typical Treatment Train Requirements
20/14/15	4	3	• Ozone/BAC • RO • UV-AOP

[1] Includes: UV disinfection, physical separation, chemical disinfection

The potential pathogen LRV credits for each treatment process are summarized in Table A-3.

Table A-3: Potential Pathogen LRV Credits per Treatment Process for DPR with Full Advanced Treatment.

Pathogen	Ozone	BAC	MF	RO	UV/ AOP	Free Chlorine	Total[1]
Virus	1-6	unknown	0-4	1.5-3.5	6	4-6	12.5-25.5
Giardia	1-6	unknown	4	1.5-3.5	6	0-3	12.5-22.5
Cryptosporidium	1-3	unknown	4	1.5-3.5	6	0	12.5-16.5

[1] This table does not include the potential LRV credits for tertiary filtration, which could add up to 2/2.5/2 credits if approved by DDW.

As previously discussed for ResWA, the ultimate inactivation credit achieved for each treatment process may be based on site-specific performance and/or a negotiated validation approach with DDW on a case-by-case basis.

In addition to the treatment requirements for DPR regulations, drinking water distribution system requirements would also need to be met. Currently, there are no federal regulations directly addressing potable water reuse, which is why the State Board has mandated all generally applicable Safe Drinking Water Act (SDWA), Clean Water Act (CWA) and other state regulations specific to water reuse are met. Some of the SDWA aspects that are applicable to the PureWater Peninsula Parties projects that may apply include, but are not limited to:

- **Lead and Copper Rule** – to demonstrate optimized corrosion control, appropriate water quality parameter monitoring and adherence to action levels
- **Total Coliform Rule** – to control bacterial growth through monitoring, investigation, and notifications
- **Surface Water Treatment Rules** – to maintain disinfectant residuals through monitoring, investigation, and notifications
- **Disinfectants/Disinfection Byproduct (DBP) Rules** – to control DBP formation, identify potential hot spots, implement monitoring plans and treatment techniques for disinfection byproduct precursors control (e.g., TOC reduction requirements)
- **Other regulations governing distribution systems** – including California Waterworks Standards for materials, installation, separation requirements, meters, flushing, isolation/release valves and other requirements and Water System Operations and Maintenance Plan requirements, if directed by DDW.

A.2.3 Enhanced Source Control Program Requirements

Source control may be the responsibility of the sanitation district and not necessarily DiPRRA. At the minimum, DiPRRA must implement a surveillance program to identify early warnings of potential occurrences that can adversely affect DPR treatment. DDW requires that a monitoring system be implemented in which the system can indicate a chemical peak, coordinate with the pretreatment program about the spike as well as monitor the local surveillance programs to identify potential community disease outbreaks. In addition, the State Board requires that the monitoring of specified chemicals and contaminants be conducted periodically, specified in Section A.2.5.

A.2.4 Technical, Managerial, and Financial Capacity Requirements

The partnering agencies in the Joint Plan must demonstrate adequate technical, managerial and financial capability. The partnering agencies include those that participate in wastewater collection, treatment, monitoring or control of the DPR project prior to purified water distribution. The technical, managerial and financial capacity must be captured in the Engineering Report that would be submitted to the State Board for approval prior to the operation of the DPR project. Details of the facilities, staffing, and support services must be included in the report as well as associated costs, reliable and continuing funding sources and managerial practices.

A.2.5 Operations Plan, Monitoring Plan and Water Safety Plans Requirements

The State Board requires the Operations Plan, Corrosion Control and Stabilization Plan, Monitoring Plan, Pathogen and Chemical Control Point Monitoring and Response Plan, and Water Safety Plan be prepared prior to DPR project operation for approval. These plans should be updated as needed and maintained throughout the DPR project.

The DiPRRA is required to work collaboratively with the public water system receiving purified water to jointly address potential impacts resulting from the introduction of advanced treated water into a water treatment plant and/or introduction of purified water into a drinking water distribution system and submit necessary plans and reports. There must be one chief and shift operator that are advanced water treatment operator (AWTO) grade 5 certified. One must accompany AWTO certified operators at all times except for specific circumstances. Similar to IPR, the product water from the DPR project must meet the drinking water criteria including MCLs, NLs, etc. Prior to operation, the feed water must monitor regulated contaminants, priority pollutants, NLs, solvents, DBPs and their precursors monthly for at least 24 months. Various constitutes such as total organic carbon (TOC), nitrate, and nitrite require periodic monitoring post RO treatment. Additional TOC monitoring is required after drinking water treatment prior to distribution every 15 minutes with a maximum concentration limit of 0.5 ppm. The system must also have sufficient mixing in order to attenuate a one hour elevated chemical concentration by a factor of 10. Sufficient mixing can be demonstrated at any point throughout the system before distribution. A water safety plan is required in which risk assessments and management are discussed. The plan must be reviewed by the Independent Advisory Panel (IAP) where they would provide recommendations prior to implementation. This plan is requested by DDW to be every 5 years to ensure that all hazards are considered.

A.3 Latest DPR Updates

DPR regulations were adopted on December 2023 and are anticipated to be effective in 2024. Some revisions that were discussed compared to the draft DPR regulations include increasing flexibility with BAC EBCT such that the agencies can specify the ozone dose and EBCT if the treatment process can demonstrate that it would meet the required removal. The TOC monitoring was also adjusted from the original 5-minute monitoring frequency to 15-minute monitoring frequency. For small reservoirs and groundwater recharge, 2 additional logs are allowed. Other revisions include waivers for reduced monitoring for non-detect chemicals, allowing for "groups" of agencies to conduct Quantitative Risk Assessments jointly, "early warning" monitoring instead of sewershed monitoring in the collection system and AWTO requirement applying to chemical control processes.

Areas that had no associated revisions include DiPRRA specific regulations and the alternative clause. The alternative clause remains specific to the chemical control options with no intended expansion to pathogen control options.

A.4 Bay Discharge Requirements

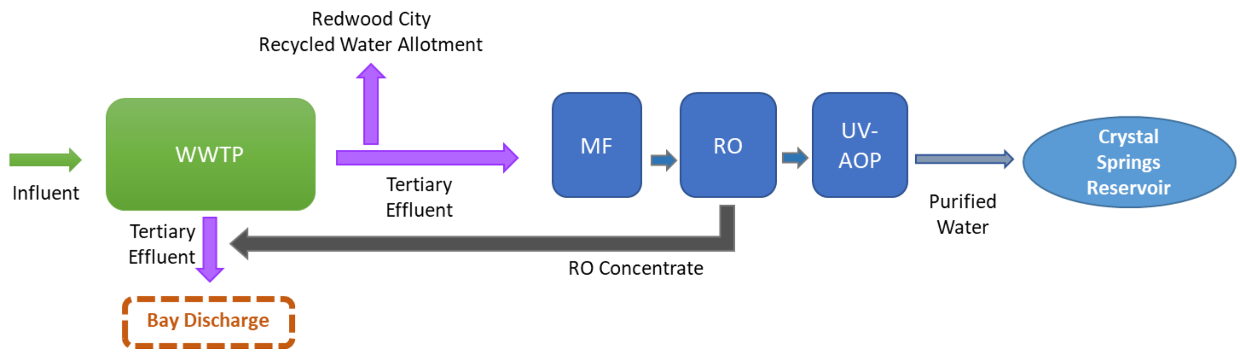
Discharge of treated wastewater from SVCW's outfall is regulated under three (3) Waste Discharge Requirements (WDRs) and National Pollutant Discharge Elimination System (NPDES) permits, as summarized in Table A-4, and illustrated in Figure A-1.

These permits establish requirements for the overall water quality-based effluent limitations, mercury and polychlorinated biphenyls limitations, and nutrients monitoring requirements, respectively. With an AWPF, the combined effluent discharged from SVCW's outfall would consist of the RO concentrate from the AWPF blended with the remaining effluent. This combined effluent would need to meet the requirements described in the WDR/NPDES permits.

Table A-4: Summary of Existing and Future Regulations at SVCW Outfall to SF Bay

Permit	Permit Type	Key Relevant Items
SVCW WDR ORDER No. R2-2018-0005 NPDES No. CA0038369	**Individual**	**Dry Season (May 1 to Sept 30) Effluent Limits**
WDR for Mercury and PCBs ORDER No. R2-2017-0041 NPDES No. CA0038849	**SF Bay Watershed**	**Year-Round Effluent Limits** Average annual – by mass Monthly and weekly – by concentration
WDR for Nutrients ORDER No. R2-2014-0014 NPDES No. CA0038873	**SF Bay Watershed**	**Focus on Nutrients** 2014 – 2018: Concentration and load monitoring 2019 – 2024: Load targets 2025 onwards: Potential load caps

Figure A-1: Flow Diagram Highlighting Bay Discharge Contributions



A.4.1 Existing SVCW NPDES Permit

This individual NPDES permit is specific to SVCW and includes effluent limitations, discharge specifications, and monitoring requirements. Effluent limitations include monthly, weekly, daily, and instantaneous limits on CBOD, total suspended solids (TSS), turbidity, total chlorine residual, ammonia, and whole effluent acute toxicity, as shown in Table A-5. In general, the dry season limits are more stringent than the wet season limits. Receiving water limitations include limits on floating material, temperature changes, and suspended material or coloration that cause a nuisance. These limits are generally developed based on the Water Quality Control Plan for the San Francisco Bay Basin (SF Basin Plan). Monitoring of constituents at one influent location, three effluent locations, and one biosolids location is also described in this NPDES permit.

Table A-5: Summary of SVCW Dry Season Effluent Limitations

Parameter	Units	Average Monthly	Average Weekly	Max Daily	Inst. Min	Inst. Max
$CBOD_5$	mg/L	8	12	-	-	-
TSS	mg/L	8	12	-	-	-
Oil and Grease	mg/L	10	-	20	-	-
pH	s.u.[1]	-	-	-	6	9
Turbidity	NTU	10	-	20	-	-
Chlorine, Total Residual	mg/L	-	-	-	-	0
Ammonia, Total	mg/L as N	170	-	250	-	-
Copper, Total Recoverable	µg/L	52	-	84	-	-
Cyanide, Total	µg/L	21	-	36	-	-

Note:

1. s.u. = standard units.

A.4.2 Existing San Mateo NPDES Permit

The City of San Mateo Wastewater Treatment Plant also has an individual WDR permit (Order No. R2-2018-0016, NPDES No. CA0037541), which defines effluent limitations, monitoring requirements as well as additional qualitative limitations on receiving water (San Francisco Bay). Effluent limitations include monthly and weekly limits on CBOD and TSS for wet and dry seasons, and year-round limits on oil and grease, pH, total chlorine residual, total ammonia, copper, cyanide, nickel, and dioxins, as shown in Table A-6. Receiving water limitations include limits on floating material, turbidity, temperature changes, suspended materials, and coloration. These limits are also generally developed based on the Water Quality Control Plan for the SF Basin Plan. The permit also outlines monitoring requirements for one influent location, two effluent locations and one biosolids location.

For this study, the ability to meet the more stringent dry season effluent limitations is evaluated. Compliance with other limitations and discharge specification would be assessed during future phases.

Table A-6: Summary of San Mateo Dry Season Effluent Limitations

Parameter	Units	Average Monthly	Average Weekly	Max Daily	Inst. Min	Inst. Max
$CBOD_5$	mg/L	15	25	-	-	-
TSS	mg/L	20	30	-	-	-
Oil and Grease[2]	mg/L	10	-	20	-	-
pH[2]	s.u.[1]	-	-	-	6	9
Chlorine, Total Residual[2]	mg/L	-	-	-	-	0
Ammonia, Total[2]	mg/L as N	66	-	120	-	-
Copper, Total[2]	µg/L	51	-	72	-	-
Cyanide, Total[2]	µg/L	20	-	38	-	-
Dioxin-TEQ[2]	µg/L	1.4×10^{-8}	-	2.8×10^{-8}	-	-
Nickel, Total[2]	µg/L	30	-	71	-	-

Notes:
1 s.u. = standard units.
2 Effluent limitations are applicable year-round.

A.4.3 Existing Mercury and PCBs NPDES Permit

This order specifies the waste load allocations and implementation requirements of the SF Bay mercury and PCBs Total Maximum Daily Load (TMDL) adopted in 2006 and 2008, respectively. This watershed permit applies to both municipal wastewater and industrial wastewater discharges to SF Bay. It requires them to monitor discharges for mercury and PCBs and comply with concentration and mass loading limits. Compliance with this NPDES permit would need to be assessed during future phases.

A.4.4 Existing and Future Nutrients NPDES Permit

The nutrient permit is another region-wide SF Bay watershed permit applicable to discharges to SF Bay. This permit addresses municipal wastewater discharges of nutrients, such as nitrogen and phosphorus, into the SF Bay. Similar to the Mercury and PCBs watershed NPDES permit, the nutrient watershed permit complements SVCW's individual NPDES permit and stipulates additional requirements that relate to nutrients. The first nutrient watershed permit, the 2014 nutrient permit, did not include water quality-based limits for nutrients since the Water Board determined that there was insufficient evidence to conclude that nutrients contribute to bio-stimulation in the SF Bay. Effluent limitations for ammonia continue to be specified in individual WWTP NPDES permits.

The new 2019 nutrient watershed permit, effective on May 8, 2019, and effective on July 1, 2019, similarly does not specify effluent limitations for nutrients. This 2019 permit includes effluent monitoring requirements for ammonia, nitrate-nitrite, total inorganic nitrogen, and total phosphorus.

While the 2019 nutrient watershed permit does not include effluent limitations, it includes 2024 load targets for inorganic nitrogen for each discharger. Since the growth-limiting nutrient for phytoplankton in the SF bay is nitrogen, only inorganic nitrogen load targets are included; there are no phosphorus load targets. The 2024 load targets are based on the historical 2014 – 2017 maximum dry season average loads, escalated to include a 15 percent population growth buffer. It is anticipated that these load targets would turn into load caps during the 2024 permit cycle. It is also anticipated that the load caps would be implemented on a sub-embayment basis, with the potential for nutrient credit trading to meet compliance. In the meantime, municipal wastewater discharges described in the permit have and would continue to fund scientific studies to determine what nutrient load reductions are necessary to protect the SF Bay. A summary of SVCW's nutrient loads is shown in Table A-7.

Table A-7: Summary of SVCW Nutrient Load Targets

Parameter	Inorganic Nitrogen
2014 – 2017 Max Dry Season Average Load	2,500 kg/day
2024 Dry Season Average Load Target	2,900 kg/day

*Dry Season = May 1 – Sept 30
Source: Table F-5 of San Francisco Bay Nutrient Watershed Permit, R2-2019-0017

It should be noted that these load targets and load caps are mass-based and not concentration-based. Thus, the RO concentrate from an AWPF would not negatively impact compliance with a potential new effluent nutrient limit that is load based. On the other hand, unlike a tertiary effluent recycled water project that removes nutrients from the discharge to SF Bay by allowing beneficial reuse, a potable reuse project that uses RO conveys the nutrients in the form of the RO concentrate back to the outfall and would not reduce the overall nutrient loading to the SF Bay. However, toxicity in RO concentrate is a key parameter that would warrant additional evaluation in future studies, particularly during summer months when the RO concentrate dominates the outfall discharge flow.

A.5 CSR Augmentation Regulatory Considerations

Any augmentation of CSR would not only need to comply with ResWA requirements but would also need to meet local SF Basin Plan requirements. In addition, the background water quality concentrations of the receiving water should also be considered. Regulations and water quality considerations related to augmenting CSR with purified water are summarized in Table A-8 and illustrated in Figure A-2. Ammonia limits are controlled by the SF Basin Plan regulations, which have more stringent water quality limits as compared to the background concentrations in CSR. Phosphorus limits are controlled by background CSR concentrations since there are no SF Basin Plan limits, but anti-degradation provisions apply.

The following sections discuss these requirements and considerations in more detail.

Table A-8: Summary of Regulations and Water Quality Considerations for Augmentation of CSR

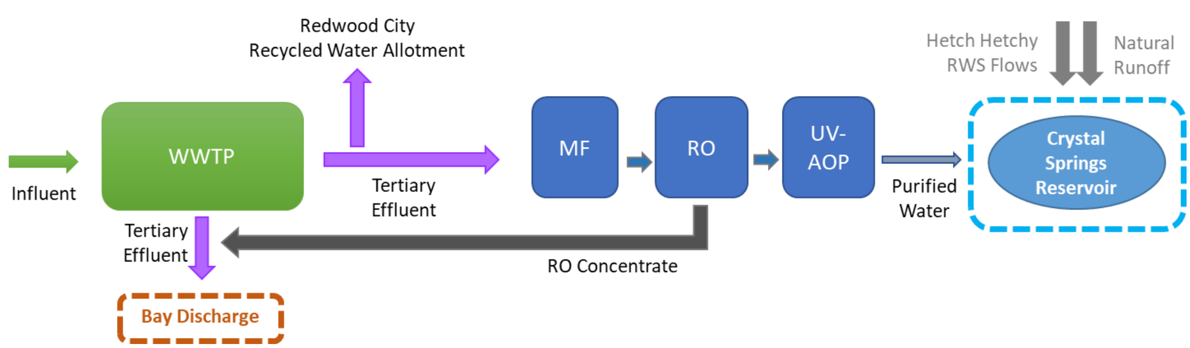
Regulation / Permit	Key Relevant Items
ResWA Requirements	*Discussed in Section 4.2*

SF Basin Plan	**Specific quantitative limits**
	▪ Un-ionized Ammonia
	    ▪ Annual median= 0.025 mg/L as N
	    ▪ Maximum = 0.4 mg/L as N
	    ▪ Dissolved Oxygen – 7.0 mg/L for cold water habitats
	▪ **General qualitative limits**
	    ▪ E.g., bioaccumulation, biostimulatory substances, population, and community ecology etc.
	▪ *There are currently no limits for phosphorus*

CSR Background Water Quality Considerations[1]	**Existing Conditions** ▪ Ammonia = 0.0 – 0.3 mg/L as N (0.01 – 0.28 in Upper CSR and 0.0 – 0.3 in Lower CSR) ▪ Total Phosphorus = 0.03 – 0.4 mg/L (0.03 – 0.3 mg/L in Upper CSR and 0.1 to 0.4 mg/L in Lower CSR)

[1] Sources: SFPUC 2020 Watershed Sanitary Survey Update for the Peninsula Watershed (Stantec 2021) for Lower CSR data. Upper CSR data from Phase 2.

Figure A-2: Flow Diagram Highlighting CSR Augmentation Contributions



A.5.1 SF Basin Plan Requirements

The SF Basin Plan includes specific quantitative and general qualitative limits related to the discharge of water into CSR; these limits would be implemented through the permit process. CSR is part of the South Bay Basin. Relevant quantitative limits include limits on un-ionized ammonia and dissolved oxygen; there are no quantitative limits for phosphorus. Qualitative limits include limits on bioaccumulation, biostimulatory substances, population, and community ecology, etc. Purified water that is added to CSR would have to meet these regulatory limits.

A.5.2 CSR Background Water Quality Considerations

Phosphorus limits are controlled by background CSR concentrations since there are no SF Basin Plan limits, but antidegradation provisions apply. Some of the background water quality parameters that could be potentially impact CSR include ammonia and phosphorus. Increasing nitrogen loads in CSR could potentially increase risk of algal blooms, which in turn raises the risk of cyanotoxins, and/or taste and odor compounds, occurring in the reservoir during the summer months. Since there are no phosphorus limits in the SF Basin Plan, background phosphorus levels in CSR would form the basis for purified water quality evaluation for reservoir water augmentation at CSR. At this level of planning, it would be conservative to assume that the water quality of augmented water would need to match or be compatible with the background levels. Future studies would need to further analyze the current water quality in CSR, the expected water quality within the CSR after the addition of various flows of AWPF purified water, and potential mixing zone effects.

See **Appendix B: TM #1 – AWPF Design Criteria,** Section 3.3 for more discussion.

Appendix B Technical Memorandum

The following Technical Memorandum (TM) were developed during the initial phases of the PureWater Peninsula Project to solicit feedback from the PureWater Peninsula Parties to support design criteria and the development of operational strategies. These TMs are referenced throughout the BODR and memorialized in this Appendix.

Some of the information contained within the TMs may be superseded by BODR content, reflecting updates to the technical evaluation after TM completion.

B.1 TM #1 – AWPF Design Criteria

B.2 TM #2 – Conveyance Facility Design Criteria

B.3 TM #3 – RO Concentrate Disposal

B.4 TM #4 – Pulgas Disinfectant Residual Alternatives

B.5 TM #5 – Drinking Water Distribution System Design Criteria

B.6 TM #6 – AWPF Operational Strategies

May 2024

Final Technical Memorandum (TM) #1 –Advanced Water Purification Facility (AWPF) Design Criteria

To:	PureWater Peninsula Parties
From:	Kristine Tolentine, EIT, Kennedy Jenks Rita Newman, PE, Kennedy Jenks
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Subject:	Advanced Water Purification Facility Design Criteria PureWater Peninsula Project – Basis of Design Report

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The **PureWater Peninsula Project**, previously referred to as the Potable Reuse Exploratory Plan (PREP), is a regional effort to resolve multiple water supply and wastewater issues, while realizing the benefits of shared infrastructure, asset recovery, economies of scale and a more competitive strategy to pursue funding. **PureWater Peninsula Parties** include the Bay Area Water Supply and Conservation Agency (BAWSCA), California Water Service (Cal Water), San Francisco Public Utilities Commission (SFPUC), Silicon Valley Clean Water (SVCW), City of San Mateo, City of Redwood City (RWC), and the Mid-Peninsula Water District (MPWD).

This **Technical Memorandum (TM) #1 – Advanced Water Purification Facility (AWPF) Design Criteria** focuses on the design parameters for use in developing a conceptual design for the AWPF sizing and expanded unit processes as well as conveyance facilities within the SVCW boundary, building on the design concepts identified in the PREP Phase 3 Title XVI Feasibility Study (Kennedy Jenks, 2022).

This TM is organized into the following sections:

1. PureWater Peninsula Project Overview
2. Source Water Facilities
3. Regulatory Requirements
4. Conceptual Treatment Process Design Criteria
5. Conceptual Facility Design Criteria
6. Preliminary Operational Strategies

Additional TMs that support this work include:

- **TM #2 – Conveyance Facility Design Criteria** establishes the design requirements and preliminary criteria for the project pipelines and pump stations beyond the AWPF fenceline, building on the design concepts identified in prior planning efforts.
- **TM #3 – Reverse Osmosis (RO) Concentrate Disposal** establishes the design requirements for the AWPF to discharge RO concentrate to the SVCW ocean outfall while meeting current and potential future regulatory requirements.
- **TM #4 – Pulgas Disinfectant Residual Alternatives** describes considerations related to the type of disinfectant residual and removal of disinfectant residual prior to Reservoir Water Augmentation (ResWA) for Crystal Springs Reservoir (CSR) augmentation via the Pulgas Dechloramination Facilities (Pulgas DF).
- **TM #5 – Drinking Water Distribution System Design Criteria** identifies preferred points of connection to introduce purified water into the existing drinking water distribution systems owned and operated by RWC, Cal Water, and the MPWD as well as defines infrastructure requirements and potential operational and hydraulic constraints.
- **TM #6 - Operational Strategies** summarizes the preliminary operational strategies for both ResWA and Treated Water Augmentation (TWA) to support the development of AWPF design and operational criteria.

These TMs reflect the initial analyses performed to support the PureWater Peninsula Project Basis of Design Report (BODR) and have been included in an appendix to the BODR. Information contained within this TM may be superseded by content in the BODR, reflecting updates to the technical evaluation after the TM was completed.

1. PureWater Peninsula Project Overview

The PureWater Peninsula Project is a potable reuse project that would create a new source of local sustainable water supply using state-of-the-art technology to purify tertiary effluent from SVCW and the San Mateo Wastewater Treatment Plant (WWTP).

The project would be implemented in two phases:

- **Phase 1** – Indirect Potable Reuse (IPR) via ResWA of up to 6 million gallons per day (mgd) of purified water at CSR.
- **Phase 2** – Direct Potable Reuse (DPR) via TWA. Expansion of AWPF to produce an additional 6 mgd of purified water, for a total of up to 12 mgd. Up to 6-8 mgd would be available for ResWA at CSR, and 4-6 mgd would be available for TWA to local drinking water distribution systems.

With the implementation of both PureWater Peninsula Project Phases, the project would provide a maximum of 12 mgd of purified water for local use by 2043.

The PureWater Peninsula Project includes:

- **Source water** derived from up to 8 mgd of tertiary effluent from SVCW and up to 9 mgd of tertiary effluent from the San Mateo WWTP would be combined to produce up to 12 mgd of purified water. Additional source water from SVCW would be available for dilution of RO concentrate.

- Construction of a new **AWPF** to treat source water to meet regulatory requirements for IPR in Phase 1 and DPR for the Phase 2 expansion.
- **Conveyance infrastructure** to deliver tertiary effluent to the new AWPF, purified water to the place of use, and brine for discharge via the existing SVCW outfall.
- A point of connection to SFPUC's **Pulgas DF**, which provides dechlorination of all flows prior to discharge into CSR.
- Multiple points of connection to existing tanks and transmission pipelines to deliver purified water to RWC, Cal Water, and/or the MPWD **drinking water distribution systems (DWDS).**

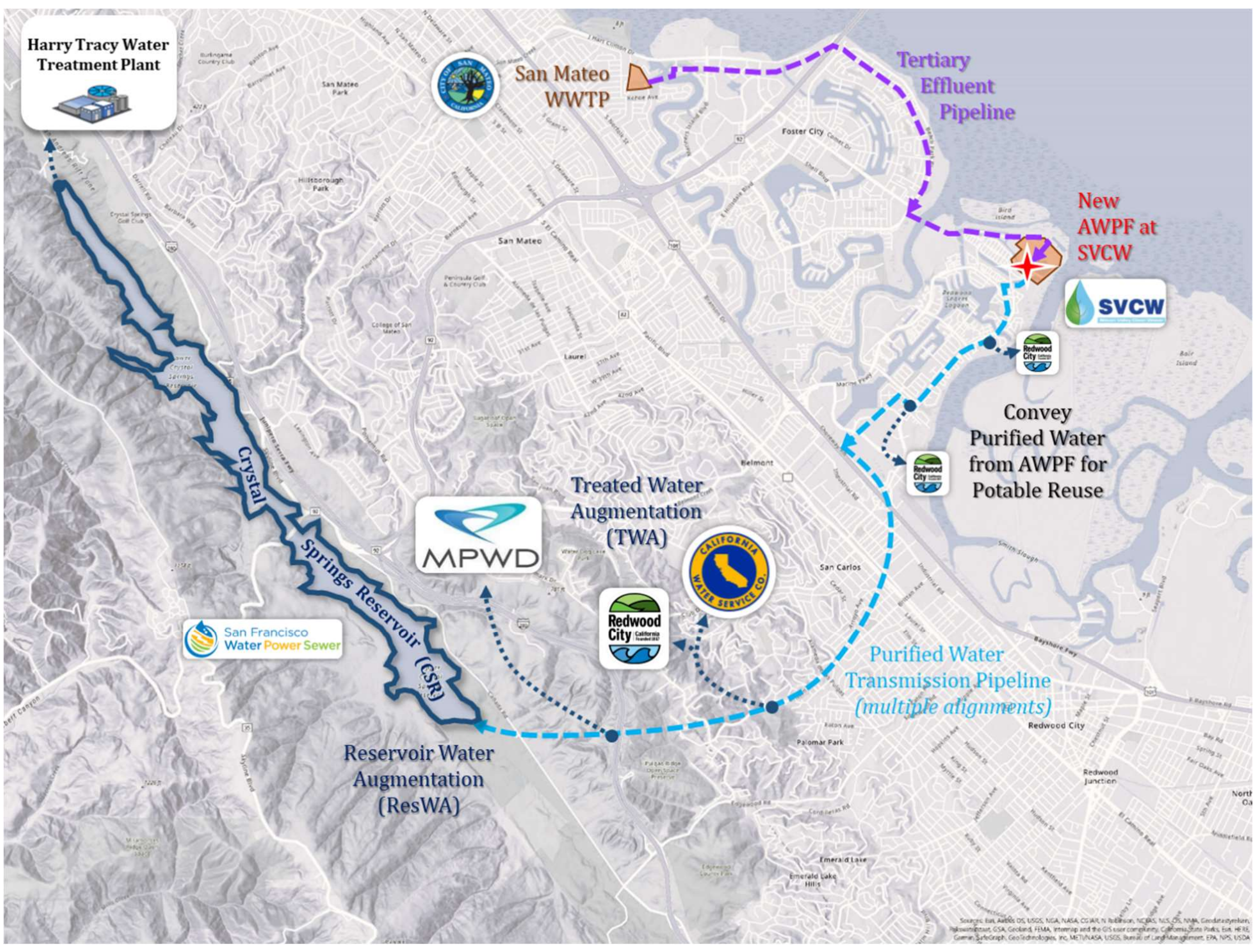
A summary of the PureWater Peninsula Project concept is provided in Table 1-1 and depicted in Figure 1-1.

Table 1-1: PureWater Peninsula Project Facilities

	Phase 1 – IPR (6 mgd)	Phase 2 – IPR and DPR (12 mgd)
Treatment Facilities	• 6 mgd capacity AWPF located near SVCW; water treated to TWA standards. • Associated chemical feed systems, wet wells, inter-process pumps, and other appurtenances.	• Expand unit processes and appurtenances to 12 mgd treatment capacity; water treated to TWA standards. • Breakpoint chlorination facility to provide chemical dosing along the purified transmission pipeline (downstream of final DWDS connection, before Pulgas DF).
Pipelines	• **San Mateo Tertiary Effluent**: ~6 miles of 24"-dia source water pipeline from San Mateo WWTP to AWPF sized for up to 9 mgd source water flow. • **SVCW Tertiary Effluent**: <1 mile of 20"-dia source water pipeline from SVCW to AWPF sized for up to 8 mgd source water flow. • **Purified Water to Crystal Springs Reservoir:** 12-16 miles of 24 -dia purified water transmission pipeline from AWPF to CSR, with provisions for future connections to local drinking water distribution systems. The pipeline would be sized for Phase 2 flows of 12 mgd, with up to 8 mgd of that purified water flow reaching CSR in Phase 2. • **AWPF Brine Disposal:** <1 mile of 12"-dia brine pipeline from AWPF to the existing SVCW outfall.	• **Treated Water Distribution System Connections:** ○ 6"-to 18" dia Distribution pipelines from purified water transmission pipeline to potable water system tie-ins (pipe lengths vary by alternative). ○ Potable water system tie-ins to local drinking water distribution system (RWC, Cal Water and MPWD).
Storage	• **Equalization storage tank (EQ)** for source water, prior to AWPF with potential to convert one of RWC's Recycled Water storage tanks at SVCW for use as equalization. • **Purified water storage tank** for purified water prior to conveyance to CSR.	• Expand source water equalization storage tank capacity for the 12 mgd treatment capacity.

	Phase 1 – IPR (6 mgd)	Phase 2 – IPR and DPR (12 mgd)
Pump Stations	• **San Mateo Tertiary Pump Station:** convey AWPF source water (tertiary effluent) from San Mateo to the AWPF. • **SVCW Tertiary Pump Station:** convey AWPF source water (tertiary effluent) from SVCW to the AWPF • **RO Concentrate Pump Station:** Convey brine from the AWPF to SVCW Outfall connection. • **Purified Water Pump Station at AWPF:** Convey purified water from AWPF to CSR/DWDS connections. • **Purified Water Booster Pump Stations (BPSs):** Several intermediate booster pump stations would be required to convey purified water from the AWPF to CSR/DWDS connections.	• Expand number of pumps at each pump station to meet the 12 mgd treatment capacity.
Pulgas	• Connect to the concrete 11' weir at Pulgas DF prior to augmentation into CSR. • Utilize the existing Pulgas Dechlorination operations and Discharge Channel to augment CSR.	• No additional modifications.

Figure 1-1. PureWater Peninsula Project Concept



2. Source Water Facilities

2.1. AWPF Inflow

The proposed AWPF would receive up to 8.0 mgd of combined tertiary effluent/Title 22 water from the SVCW and City of San Mateo's future Biological Nutrient Removal (BNR) and Membrane Bioreactor (MBR) facility to produce up to 6 mgd of purified water as part of Phase 1. For Phase 2, the proposed AWPF would receive up to 16 mgd from both facilities to produce up to 12 mgd of purified water. It is currently assumed that the source water that reaches the AWPF would be an approximately equal mix of the two source waters for both Phase 1 and 2. The inflows to the AWPF are based on the following and are summarized in Table 2-1:

- SVCW's average monthly dry weather flow from July 2020 to August 2022 provides a conservative estimate of the amount of effluent available for potable reuse. In July 2020, the Sharon Heights Golf Course began using recycled water, resulting in reduced inflows to SVCW. Flow measurements prior to this date are not included. Based on the allotments and demands summarized in Table 2-1, a daily average of approximately 7.5 mgd to 9.7 mgd of SVCW effluent could be available for source water supply.
- San Mateo's average monthly dry weather flow from 2018 to 2022 provides a conservative estimate of the amount of effluent available for potable reuse. Currently, the facility treats an average annual flow of 10.2 mgd with an ADWF of approximately 9.3 mgd based on 2018-2022 flow data. The City of San Mateo does not currently have a recycled water program.

Table 2-1: Estimated Source Water Flows to AWPF (mgd)

Flow	SVCW	San Mateo WWTP
Tertiary Effluent Flows		
Average Dry Weather[1,2]	11.6	9.3
Recycled Water Demands		
Existing Redwood City Demand/Allotment[3]	0.7(average demand) 2.9(average annual allotment)	NA
Future Menlo Country Club Demand[4]	0.2	NA
Future Bayfront Satellite Treatment Plant[4]	1.0	NA
Flows Available for AWPF	**7.5 – 9.7**	**9.3**
Source Water needed for 6.0 mgd AWPF @ 75% Overall Recovery	8.0	8.0
Flows Available for Dilution during Dry Months	**0 – 1.7**	**1.3**

Notes:

1 Note, while a conservative estimate for SVCW ADWF was used based on recent historical flow data, SVCW AWDF could expand to about 16 mgd by 2040 due to projected increase in service area population to about 246,000 people by 2040 and current per capita flow rates (SVCW Capacity Analysis Report, Oct 2013).

2 Sharon Heights Golf and Country Club (SHGCC) pumps and treats raw wastewater from the West Bay Sanitary District (WBSD) collection system for irrigation at the golf course. The Sharon Heights Golf Course recycled water plant completed construction in July 2020. The recycled water plant diverts up to 0.5 mgd of wastewater influent from SVCW which are already accounted for in the SVCW effluent ADWF measurement.

3 Redwood City has a current annual average allocation of 2.9 MGD. However, during summer months, Redwood City's daily recycled water demand can peak to greater than 9 MGD. Given that purified water demand is expected to peak in the summer months, there will be competing demand for SVCW tertiary effluent. From 2013-2021, Redwood City used 0.7 mgd on an average annual basis out of a total allotment of 2.9 mgd of tertiary recycled water. For the purposes of this BODR, available effluent range assumes Redwood City recycled water demands range from 0.7 – 2.9 mgd. However, it is acknowledged that the source flows available for AWPF will depend on influent flows to SVCW and RWC's recycled water demand and agreement, and AWPF flows may need to be turned down to accommodate RWC demands/allotments.

4 Menlo Country Club is in the SVCW wastewater service area and currently receives potable water from the SFPUC. Menlo Country Club has expressed interest in switching to recycled water. It is assumed that Menlo CC's 0.2 mgd of demand would be met by a satellite recycled water facility, hence reducing the amount of source water available from SVCW.

5 WBSD is currently evaluating a new satellite Bayfront Recycled Water Facility. The Bayfront Recycled Water Facility is expected to divert up to 1 mgd of wastewater influent from WBSD (Source: Flow Equalization & Resource Recovery Facility Levee Improvements & Bayfront Recycled Water Facility Project, Draft Environmental Impact Report, December 2020)).

The RO concentrate would typically be blended with excess effluent from SVCW to meet NPDES permit water quality discharge requirements and discharged via the existing SVCW outfall. Depending on the recycled water demands from SVCW's tertiary effluent, up to 1.7 mgd of flow could be available to use to dilute the RO concentrate discharged from the AWPF. However, there may be months when recycled water demands are high and no flow is available from SVCW for dilution.

San Mateo does not currently have recycled water demands and may occasionally have excess discharge to pump to the AWPF site. It is not anticipated that water from San Mateo would be used for dilution since it is of higher water quality than that from SVCW and would be used to feed the AWPF exclusively. RO concentrate dilution and discharge strategies are discussed further in Section 4.3.4.

The AWPF process assumes the following recovery rates:

- Membrane Filtration (MF) Strainer Recovery Rate = 98%
- MF Recovery Rate = 95%
- RO Recovery Rate = 81%
- Overall Recovery Rate = 75%
- RO Concentrate Disposal Rate = 18%

Estimated annual average flows through each AWPF unit process is summarized in Table 2-2.

Table 2-2: AWPF Design Flows

Flow	Phase 1 Average (mgd)	Phase 2 Average (mgd)
AWPF Source Water	8.0	16.0
Ozone/BAC Feed	8.0	16.0
MF Feed	8.0	16.0
MF Effluent/RO Feed	7.8	15.6
RO Feed	7.4	14.9
RO Permeate	6.0	12.0
RO Concentrate	1.4	2.9
UV/AOP Effluent	6.0	12.0
Post-Treatment	6.0	12.0
AWP Purified Water	6.0	12.0

2.2. AWPF Source Water Quality

The source water quality to the AWPF is based on available effluent data from the SVCW and San Mateo WWTP.

- **SVCW effluent** consistently meets the requirements set forth in their discharge permit (Order No. R2-2023-0003; National Pollutant Discharge Elimination System (NPDES) permit No. CA 0038369) from the San Francisco Bay Regional Water Quality Board (RWQCB) (RWQCB 2023).
- The **City of San Mateo's WWTP's effluent** consistently meets the requirements set forth in their discharge permit (Order No. R2-2018-0016; NPDES No. CA 0037541) from the RWQCB (RWQCB 2018). San Mateo is currently upgrading the existing secondary treatment facilities to replace aging infrastructure, meet current and future regulatory requirements, and ensure wet-weather capacity. San Mateo's project is currently in the construction phase, which includes BNR and MBR facilities, and construction is expected to finish in Summer 2024. Thus, there are no measured water quality data for the future facility. However, the anticipated tertiary effluent parameters, provided by the plant design team, are used for this evaluation.

The design water quality assumptions for the AWPF source water are based on a blended 50/50 mix of SVCW/San Mateo tertiary treated water. Table 2-3 lists anticipated source water quality for a select set of constituents used to evaluate potable reuse alternatives.

Table 2-3: Summary of Source Water Quality and Estimated Combined Concentrations

Parameter	Units	SVCW Tertiary Effluent[1]	San Mateo Anticipated Tertiary Effluent	SVCW + San Mateo Combined Tertiary Effluent
TDS[2, 3]	mg/L	1,000	1,900	1,450
TSS[3,4]	mg/L	3.8	0.0	1.9
CBOD[4,5]	mg/L	3.4	1.0	2.2
TOC[6]	mg/L	9.7	2.9	6.3
Turbidity[4]	NTU	3.0	0.25	1.6
Oil and Grease[2]	mg/L	ND	ND	ND
pH[2]	-	7.2	6.9	7.1
Total Ammonia (as N)[4]	mg/L	49	0.03	25
Total Phosphorus[4]	mg/L	4.6	0.03	2.3
Copper[2]	ug/L	5.9	6.0	5.9
Cyanide[2]	ug/L	2.8	ND	1.4
Mercury[2]	ug/L	3.6×10^{-3}	3.8×10^{-3}	3.7×10^{-3}

Notes:

1 SVCW commonly analyzed parameters from 2013-2021 provided to the RWQCB by City to fulfill NPDES general reporting requirements.

2 San Mateo commonly analyzed parameters from 2018-2021 provided to the RWQCB by City to fulfill NPDES general reporting requirements.

3 TDS and TSS for combined tertiary effluent is shown as an average but is likely to vary based on blending timing and water chemistry.

4 SM WWTP TSS, CBOD, Turbidity, Ammonia, and Phosphorus values are based on the projected water quality values summarized in San Mateo's Final Schematic Design Report - Nutrient Removal and Wet Weather Flow Management Upgrade and Expansion Project (Jan 2018, HDR).

5 CBOD = carbonaceous biochemical oxygen demand

6 TOC was calculated using a CBOD/TOC conversion factor of 0.35 (Metcalf & Eddy/AECOM, 2014).

3. Regulatory Requirements

The PureWater Peninsula Project must meet regulatory requirements for potable reuse to protect public health and the environment through:

- **Compliance with applicable potable reuse regulatory requirements** adopted by the State Water Resource Control Board – Division of Drinking Water (DDW). For ResWA, compliance would include minimum retention time, dilution, and advanced treatment requirements. For TWA, the DPR regulations impose similar minimum retention time, dilution, and advanced treatment requirements and are scheduled for adoption on or before December 31, 2023. The DPR regulations include separate TWA treatment processes needed in addition to the advanced treatment requirements for ResWA and the designation of one direct potable reuse responsible agency (DiPRRA) that would be responsible for complying with the DPR regulations.

- **Compliance with Bay discharge NPDES permit requirements.** In particular, the RO concentrate disposal via SVCW's outfall would need to meet existing and future regulations at the SVCW outfall to the San Francisco Bay (SF Bay), which is regulated under three Waste Discharge Requirements (WDRs) / National Pollutant Discharge Elimination System (NPDES) permits: (1) SVCW Individual WDR, (2) SF Bay Watershed WDR for mercury and PCBs and (3) SF Bay Watershed WDR for nutrients.
- **Compliance with SF Bay Basin Plan regulations** and match or be compatible with background water quality concentrations in receiving water reservoirs. For CSR, this includes un-ionized ammonia concentrations controlled by the SF Bay Basin Plan limits and phosphorus concentrations controlled by the background concentrations in Upper CSR. Compliance with California Toxics Rule limits for inland surface waters (e.g., NDMA, trihalomethane) would also be required.

Additional background information on regulatory requirements is provided in **Appendix A: Potable Reuse Regulatory Requirements** of the BODR.

3.1. Purified Water Quality Goals

Water quality goals for the AWPF purified water are summarized in Table 3-1 below and are based on the regulations discussed in the prior section.

Table 3-1: Water Quality Goals for AWPF Purified Water to Crystal Springs Reservoir

Parameter	Units	Purified Water Quality Goal	Basis
Regulated Constituents:			
Primary Drinking Water Standards	--	< MCL	Title 22 CCR
Secondary Drinking Water Standards	--	< sMCL	
NL Contaminants	--	< NL	
Priority Toxic Pollutants (PP)	--	< PP	
Pathogens:			
Virus	Log Reduction	See Table 3-4	DDW ResWA and DPR Regulations
Giardia	Log Reduction		
Cryptosporidium	Log Reduction		
Organics:			
1,4-Dioxane	Log Treatment with UV/AOP	≥ 0.5-log reduction	Title 22 CCR
NDMA	ng/L	≤ 0.69	California Toxics Rule
Bromodichloromethane	µg/L	≤ 0.56	
Dibromochloromethane	µg/L	≤ 0.21	
PFAS	ng/L	See Table 3-10	Proposed EPA MCL
Inorganics:[1]			
Un-ionized Ammonia	mg/L as N	< 0.025 (annual median) <0.4 mg/L (maximum)	SF Bay Basin Plan, CSR Background WQ
Dissolved oxygen	mg/L	<7.0 mg/L	
Total Phosphorus	mg/L	< 0.03	CSR Background WQ
Purified Water Stabilization:[2]			
Temperature	°C	16 to 24	SFPUC Drinking WQ
pH	--	7.9 – 9.7	
Alkalinity	mg/L as $CaCO_3$	4.5 to 79	
Langelier Saturation Index (LSI)	--	0.15 to 0.2	Corrosion Minimization
Calcium Carbonate ($CaCO_3$) Precipitation Potential (CCPP)[3]	mg/L as $CaCO_3$	2 to 6	

Notes:

1. Any augmentation into CSR would not only need to comply with ResWA requirements but would also need to meet local SF Bay Basin Plan requirements and match or be compatible with background water quality concentrations in CSR. See Section 3.3 for more information.
2. Final water stabilization targets based on measured ranges from the 2021 SFPUC Drinking Water Quality Report. Final values should be coordinated with SFPUC, which would draw the purified water through Crystal Springs Reservoir for treatment.
3. CCPP is not a main post-stabilization design goal, but the purified water is expected to have a CCPP in the range shown.

For the Phase 1 of the project, with addition of the purified water to CSR (ResWA), the treatment facility would need to meet the minimum microbial log-removal value (LRV) requirement of 9/8/9 for virus, *Giardia*, and *Cryptosporidium* (V/G/C) pathogen removal outlined in the DDW Final ResWA Regulations (SBDDW-16-02). This criterion is based on a retention time of less than 4 months and dilution ratio of 100:1 per the analysis of the Crystal Springs Reservoir Operations Model described in **Appendix C: Modeling and AWPF Operational Scenarios** of the BODR.

The LRV requirements must be achieved using at least three separate treatment processes and at least two diverse treatment mechanisms, providing multi-barrier protection. A separate treatment process may be credited with no more than 6 log reduction, with at least two processes each being credited with no less than 1.0 log reduction. The types of diverse treatment mechanisms include UV disinfection, physical separation, and chemical disinfection. At a minimum, a typical ResWA treatment train includes MF, RO, and UV-AOP. Additional discussion on ResWA regulatory and treatment requirements are included in **Appendix A: Potable Reuse Regulatory Requirements** of the BODR. Table 3-2 summarizes ResWA treatment requirements.

Table 3-2: Summary of ResWA Criteria and Treatment Requirements

Retention Time (days)[1]	Dilution (Volume:Inflow$_{day}$)[2]	Log Removal at AWPF (V/G/C)-	# of Treatment Processes
$\geq$ 120	100:1	8/7/8	2
	10:1	9/8/9	3
$\geq$ 60	100:1	$\geq$ 9/8/9	2
	10:1	$\geq$ 10/9/10	3

Notes:
1. Retention time is calculated as total volume divided by total outflow
2. Dilution of 100:1 = one percent, by volume, of purified water delivered to the surface water reservoir during any 24-hour period. Dilution of 10:1 = ten percent, by volume, of purified water delivered to the surface water reservoir during any 24-hour period.

For the Phase 2 phase of the project, with purified water addition into the treated water distribution system (TWA), the DDW DPR Regulations (Section § 64669.45. Pathogen Control) requires a minimum microbial LRV requirement of 20/14/15 (V/G/C) which must be achieved using at least four separate treatment processes and at least three diverse treatment mechanisms, providing multi-barrier protection. A separate treatment process may be credited with no more than 6 log reduction, with at least four processes each being credited with no less than 1.0 log reduction. Similar to ResWA, the types of diverse treatment mechanisms include UV disinfection, physical separation, and chemical disinfection. Additional discussion on TWA regulatory and treatment requirements are included in **Appendix A: Potable Reuse Regulatory Requirements** of the BODR. The DPR pathogen control treatment requirements are summarized below in Table 3-3.

Table 3-3: Summary of DPR Pathogen Control Treatment Requirements for TWA

Sum of LRVs for DPR Treatment Train at AWPF (V/G/C)	Minimum # of Treatment Processes	Minimum # of Diverse Treatment Processes	Minimum Typical Treatment Train Requirements
20/14/15	4	3	• Ozone/ BAC • MF/RO • UV-AOP

The proposed pathogen treatment target for each unit treatment process for the PureWater Peninsula Project needed to meet ResWA and DPR regulations is summarized in Table 3-4. The project would be designed to meet DPR log removal requirements starting in Phase 1 to demonstrate full treatment capability before buildout and implementation of Phase 2. The TWA treatment train includes ozone, BAC, MF, RO, UV-AOP, and free chlorine disinfection. Early demonstration of treatment ability and documentation of the water quality and pathogen reduction performance of the AWPF during Phase 1 is anticipated to help streamline the future permitting process even though treated drinking water connections would not be made until Phase 2.

Table 3-4: Summary of Potential LRVs for Unit Treatment Processes

Treatment Processes	Potential/Target Process Log Removal / Inactivation Credits							Potential TWA Total Log Removal/ Inactivation	DDW ResWA Required Log Removal/ Inactivation	DDW TWA Required Log Removal/ Inactivation
	WWTP-Tertiary Filtration [1]	Ozone	BAC[2]	MF	RO	UV/ AOP	Free Chlorine			
Virus	2	2	1	1	2	6	6	***20***	9	20
Giardia	2	1	2	4	2	6	2	***19***	8	14
Cryptospor-idium	2	0	2	4	2	6	0	***16***	9	15
1-4 Dioxane	0	0	0	0	0	0.5	0	***0.5***	0.5	0.5

Notes:

The ultimate inactivation credit achieved for a given process may be based on site-specific performance and/or a negotiated validation approach with DDW on a case-by-case basis (WateReuse 2016).

1 Log removal credits up to 2/2/2 V/G/C through sand filtration (Olivieri et al. (2016)). Note, MBR systems to be installed at the San Mateo WWTP have not been credited for pathogen removal performance in potable reuse in California.

2 Log removal credits based on a conservative estimate of log removal credits typically achieved using direct filtration treatment technologies at surface water treatment plants (SWTR Fact Sheet-EPA Region 8).

3.2. RO Concentrate Discharge

The RO concentrate may need to be blended with SVCW's tertiary effluent to meet existing and future regulations for discharge at the SVCW outfall to the San Francisco Bay (SF Bay). This outfall is regulated under three Waste Discharge Requirements (WDRs) and National Pollutant Discharge Elimination System (NPDES) permits: (1) SVCW Individual WDR, (2) SF Bay Watershed WDR for mercury and PCBs and (3) SF Bay Watershed WDR for nutrients. Table 3-5 and Table 3-6 summarize the Dry Season effluent limitations for SVCW and San Mateo, respectively, and Table 3-7 summarizes SVCW nutrient load targets. The WDR for mercury and PCBs also requires monitoring of discharges for mercury and PCBs to comply with Total Maximum Daily Load (TMDL) limits adopted in 2006 and 2008, respectively.

If dilution water is necessary to meet outfall regulations, SVCW tertiary effluent could be stored in the Redwood City storage tanks on the SVCW site. One of the existing 2 MG tanks has been reserved for AWPF operations and an additional 2 MG tank is planned for construction and can be used to store dilution water as well. RO concentrate disposal considerations are discussed further in **TM #3 – RO Concentrate Disposal**.

Table 3-5: Summary of SVCW Dry Season Effluent Limitations

Parameter	Units	Average Monthly	Average Weekly	Max Daily	Inst. Min	Inst. Max
$CBOD_5$	mg/L	8	12	-	-	-
TSS	mg/L	8	12	-	-	-
Oil and Grease	mg/L	10	-	20	-	-
pH	s.u.[1]	-	-	-	6	9
Turbidity	NTU	10	-	20	-	-
Chlorine, Total Residual	mg/L	-	-	-	-	0
Ammonia, Total	mg/L as N	170	-	250	-	-
Copper, Total Recoverable	µg/L	52	-	84	-	-
Cyanide, Total	µg/L	21	-	36	-	-
Dioxin-TEQ	µg/L	1.4×10^{-8}	-	2.8×10^{-8}	-	-

Notes:
3 s.u. = standard units.
4 Effluent limitations are applicable year-round.

Table 3-6: Summary of San Mateo Dry Season Effluent Limitations

Parameter	Units	Average Monthly	Average Weekly	Max Daily	Inst. Min	Inst. Max
$CBOD_5$	mg/L	15	25	-	-	-
TSS	mg/L	20	30	-	-	-
Oil and Grease[2]	mg/L	10	-	20	-	-
pH[2]	s.u.[1]	-	-	-	6	9
Chlorine, Total Residual[2]	mg/L	-	-	-	-	0
Ammonia, Total[2]	mg/L as N	66	-	120	-	-
Copper, Total[2]	µg/L	51	-	72	-	-
Cyanide, Total[2]	µg/L	20	-	38	-	-
Dioxin-TEQ[2]	µg/L	1.4×10^{-8}	-	2.8×10^{-8}	-	-
Nickel, Total[2]	µg/L	30	-	71	-	-

Notes:
1 s.u. = standard units.
2 Effluent limitations are applicable year-round.

Table 3-7: Summary of SVCW Nutrient Load Targets

Parameter	Inorganic Nitrogen
2014 – 2017 Max Dry Season Average Load	2,500 kg/day
2024 Dry Season Average Load Target[1]	2,900 kg/day

Notes:
1 Dry Season is from May 1 – Sept 30
2 Source: Table F-5 of San Francisco Bay Nutrient Watershed Permit, R2-2019-0017

3.3. CSR ResWA Water Quality and Nutrient Considerations

Water quality considerations for discharges into CSR would be governed by the SF Bay Basin Plan and the background water quality in CSR. Specifically, maximum ammonia concentrations are controlled by the Basin Plan limits and maximum phosphorus concentrations are controlled by the background concentrations in Upper CSR. For constituents that do not have a Basin Plan limit, discharge limits would be governed by drinking water maximum contaminant levels (MCLs), or secondary MCLs. In addition to these quantitative limits, beneficial uses for Upper and Lower CSR also drive water quality objectives which would inform effluent limitations for discharge to CSR. The Basin Plan defines CSR beneficial uses, which include consumptive, recreational, and ecological uses.

Table 3-8 compares the anticipated purified water concentrations of some of the main constituents of interest for CSR ResWA, to corresponding Basin Plan limits, as well as background CSR levels. The concentrations listed here correspond to the concentrations in Lower CSR based on available data.

As shown in Table 3-8, ammonia levels in the purified water would need to be reduced by roughly 3 log from 49 mg/L of ammonia as N to meet the annual median (0.025 mg/L as N) and maximum (0.4 mg/L as N) limits stipulated in the SF Bay Basin Plan, or possibly lower to meet background conditions in Upper CSR. To be conservative, ammonia concentrations from SVCW are evaluated for ammonia removal due to the higher ammonia concentrations from SVCW compared to San Mateo and the planned wastewater treatment improvements at San Mateo to reduce discharge ammonia concentrations. The SF Bay Basin Plan provides ammonia limits as un-ionized ammonia. Ammonia may exist as ionized or un-ionized depending on pH; however, it is conservative to reduce total ammonia concentrations to below the SF Bay Basin Plan limits.

Ammonia can be removed before entering the AWPF at the WWTP or in the purified water stream likely following RO treatment (i.e., RO permeate). Phosphorous is effectively rejected by RO membranes (>99 percent) and is not a major concern for the final recycled water. Nutrient removal in the RO concentrate may not be needed because the discharges to SF Bay nutrient permit are based on a load target/cap and not a concentration limit. RO concentrate considerations are further discussed in **TM #3 – RO Concentrate Disposal**.

Table 3-8: Main Constituents of Interest for ResWA

Constituent	Units	Basin Plan Limit	Background CSR Concentration[1]	Anticipated Influent Water Concentration (SVCW only)	AWPF Removal Rate	Anticipated Purified Water Concentration (SVCW only)
Un-ionized ammonia	mg/L as N	Annual median = 0.025 Maximum = 0.4	0.100	49	95%	2.45
Nitrate [2]	mg/L as N	-	0.000	0.4	99%	0.004
Nitrate + Nitrite	mg/L as N	10	0.000	0.5	99%	0.005
Nitrite	mg/L as N	1	0.000	0.4	99%	0.004
Total P	mg/L	Depends on N : P limits	0.100	5	99%	0.05
PO_4	mg/L	N/A	0.100	25	99%	0.25
Temperature	C	No change; or up to +5 F from background concentrations	21.8	-	-	21.97

Notes:
[1] 2016-2020 Median Values from the SFPUC 2020 Peninsula Watershed Sanitary Survey (Stantec, 2021).
[2] The drinking water MCL for nitrate is 10 mg/L-N.

As shown in Table 3-8, anticipated purified water levels for constituents other than ammonia are well within their respective Basin Plan limits.

However, ambient CSR levels are still not being met, and thus additional treatment would likely be required to reduce nutrient concentrations prior to release into CSR. The AWPF train is assumed to consist of MF or UF, followed by RO and UV-AOP. Phosphorus removal by RO is typically more than 99 percent, while nitrogen removal, particularly ionized ammonia nitrogen, is typically between 95-

97 percent. Nutrients are not well removed by UV-AOP; thus, additional treatment may be needed for purified water to meet standards for discharge into CSR. Closer examination of nutrient concentrations and loading limitations would be needed to determine if further treatment is required, and if so, what level of treatment would be required.

In addition to the nutrients listed above, other constituents of interest evaluated for the ResWA project include compounds that fall under California Toxics Rule (NDMA, Bromodichloromethane and Dibromochloromethane), mercury, chlorinated pesticides as well as some PFAS compounds. However, effluent data from SVCW and San Mateo reported negligible or non-detect quantities of these constituents, and as a result, they do not pose a concern to anticipated quality of the purified water from the AWPF.

Table 3-9 compares nutrient levels present in SVCW effluent and San Mateo WWTP effluent before, and after RO treatment against existing nutrient levels present in CSR. Actual nutrient limits for a CSR ResWA project would depend on site-specific conditions.

Table 3-9: CSR ResWA Water Quality Considerations

Nutrient	Source Water Quality				Potential WQ Limits	
	Source	Purified Flow Rate (mgd)	Dry Season Average (mg/L)	Estimated RO Permeate (mg/L)*	Lower CSR Existing Conditions	Basin Plan Limits
Ammonia as N (mg/L)	SVCW	6	49	2.5	0.0 to 0.3	Annual median = 0.025 mg/L as N Maximum = 0.4 mg/L as N
	SVCW and San Mateo	12	25	1.3		
Total P (mg/L)	SVCW	6	4.6	0.05	0.1 to 0.4	
	SVCW and San Mateo	12	2.3	0.02		

Sources: SVCW effluent water quality (Phase 2/eSMR reports 2019-2021); Crystal Springs data obtained from 2020 Peninsula Watershed Sanitary Survey (provided by SFPUC on June 29, 2021); San Mateo estimated effluent source water Ammonia at 1 mg/L and Total P at 1 mg/L per CH2M (data from Phase 2).
* **RO Product:** Conservatively assumes 95 percent removal of Ammonia and 99 percent removal of Total P. Previous membrane modeling software (Toray DS2) indicated rejection of ammonia by RO for a MF-RO reuse treatment train to be >97 percent.

Based on the data presented in Table 3-9, augmentation of CSR without additional nutrient removal would contribute mass loading to the reservoir. For example, conservatively assuming dry season SVCW effluent as source water with an ammonia concentration of 49 mg/L ammonia as N, the RO permeate ammonia concentration would be 2.5 mg/L ammonia as N conservatively assuming 95 percent rejection by RO. Although the ammonia would largely exist as ionized ammonia, which is not limited by the SF Bay Basin Plan, it is conservative to assume removal of total ammonia (ionized and un-ionized) to meet SF Bay Basin Plan discharge limits. This is one order of magnitude higher than the existing median CSR conditions of 0 to 0.3 mg/L. Assuming 6 mgd of purified water augmentation on average over the year, this could add around 20,000 kg of ammonia (as nitrogen) to CSR annually if additional nutrient removal is not provided.

At this level of design, it would be conservative to assume that the water quality of augmented water would need to match or be compatible with the background levels in CSR. Preliminary observations are:

- Treatment would be required to reduce nitrogen concentrations in purified water to or below reservoir concentrations.
- Blending SVCW source water with San Mateo WWTP's anticipated source water quality would reduce nutrient concentrations and could decrease the amount of nutrient reduction required.
- With RO treatment, total phosphorus loading for either a 6-mgd or 12-mgd AWPF would likely remain below background conditions in CSR.
- Even with RO treatment, ammonia levels in the purified discharge to the reservoir are estimated to be approximately one to two orders of magnitude higher than existing reservoir conditions.
- Modification of the biological treatment process at SVCW to full or partial denitrification would further reduce nitrogen concentrations in the purified water. However, upstream nutrient reduction modifications may still be unable to achieve the low ammonia concentrations required in the final purified water without additional treatment.
- Further treatment of purified water effluent, such as breakpoint chlorination, may be a more cost-effective approach to reduce nutrient concentrations post-RO. This is the approach currently assumed for the AWPF treatment train and is further discussed in Section 4.3.6.

3.4. Nutrient Considerations for Drinking Water Quality

The drinking water MCL for nitrate is 10 mg/L NO_3-N. As shown in Table 3-8, purified water nitrate levels are predicted to be 0.04 mg/L conservatively assuming all AWPF source water comes from dry season SVCW effluent which is well below the nitrate MCL.

However, ammonia also has the potential to convert to nitrate during the BAC process. In the worst case scenario where the BAC process converts all ammonia to nitrate, 3.6 mg/L of nitrate is produced for every 1 mg/L ammonia as part of the nitrification process. Assuming an average of 49 mg/L ammonia as N from the SVCW tertiary effluent coming into the AWPF is all converted to nitrate, there would be about 176 mg/L nitrate as N entering the RO process. After the RO process, about 1.8 mg/L nitrate as N would remain in the purified water assuming a 99% nitrate removal rate. This concentration falls below the 10 mg/L MCL for nitrate and is further decreased when blending with the San Mateo tertiary effluent. However, the PureWater Peninsula Project would need to run pilot testing in future design phases to optimize process parameters and verify TP and TN levels throughout the process.

3.5. Per and Polyfluoroalkyl Substances (PFAS) Considerations

PFAS are a class of more than 5,000 anthropogenic compounds that have been associated with a wide range of harmful human health effects. PFAS are used in a variety of industrial and consumer products and once released into the environment, PFAS do not degrade by natural processes. PFAS have been detected in water resources worldwide including drinking waters and wastewaters. The US Environmental Protection Agency (EPA) recently finalized MCLs six PFAS, and are summarized in Table 3-10.

Table 3-10. PFAS Drinking Water Limits

Compound	Maximum Contaminant Level Goal	Maximum Contaminant Level (enforceable levels)
PFOA[1]	0	4.0 ppt
PFOS[2]	0	4.0 ppt
PFNA[3]	10.0 ppt	10.0 ppt
PFHxS[4]	10.0 ppt	10.0 ppt
HFPO-DA (commonly referred to as GenX Chemicals)[6]	10.0 ppt	10.0 ppt
Mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS[5]	1.0 (unitless) Hazard Index[7]	1.0 (unitless) Hazard Index[7]

1 Perfluorooctanoic Acid
2 Perfluorooctane Sulfonate
3 Perfluorononanoic Acid
4 Perfluorohexane Sulfonate
5 Perfluorobutane Sulfonate
6 Hexafluoropropylene oxide dimer acid (GenX)
7 The the Hazard Index is evaluated when there are two or more PFAS in the mixture of four PFAS (PFHxS, PFNA, HFPO-Da, PFBS), rather than just one PFAS, present in the source water. The Hazard Index is a quotient-based approach to compliance with the following formula:

$$HI\ MCL = \left(\frac{[HFPO\text{-}DA_{water}\,ng/L]}{[10\,ng/L]}\right) + \left(\frac{[PFBS_{water}\,ng/L]}{[2000\,ng/L]}\right) + \left(\frac{[PFNA_{water}\,ng/L]}{[10\,ng/L]}\right) + \left(\frac{[PFHxS_{water}\,ng/L]}{[10\,ng/L]}\right) = 1$$

California has also implemented PFAS notification and response levels for several PFAS as shown in Table 3-11. Notification levels (NLs) are nonregulatory, health-based advisory levels established for contaminants in drinking water for which maximum contaminant levels have not been established. Notification levels are established as precautionary measures for contaminants that may be considered candidates for establishment of maximum contaminant levels but have not yet undergone or completed the regulatory standard setting process prescribed for the development of maximum contaminant levels and are not drinking water standards. They represent the concentration level of a contaminant in drinking water that does not pose a significant health risk but warrants notification. Notification levels are issued by the Division of Drinking Water and developed based on recommendations made by the Office of Environmental Health and Hazard Assessment (OEHHA).

A response level (RL) is set higher than a notification level and represents a recommended chemical concentration level at which water systems consider taking a water source out of service or provide treatment if that option is available to them. Starting in January 2020, California water systems that receive an order and detect levels of PFAS substances that exceed their response level, shall take a water source out of use, treat the water delivered, or provide public notification.

Table 3-11. California PFAS Notification and Response Levels

Compound	Notification Level ng/L (ppt)	Response Level ng/L (ppt)
PFOA	5.1	10
PFOS	6.5	40
PFBS	500	5000
PFHxS	3	20

Following wastewater treatment, PFAS may be detected in the wastewater effluent feed stream to the AWPF. Of the treatment processes employed in the AWPF, RO membranes are expected to reject a wide range of PFAS to >99% including PFOA, PFOS, and other detected PFAS in the source water. PFAS in the purified water are expected to be below the California Drinking Water Notification Levels and proposed EPA PFAS MCLs.

The rejection of PFAS by RO membranes is a separation process and PFAS are not destroyed. As a result, any PFAS present in the wastewater effluent would be concentrated in the RO concentrate stream to be discharged at the SVCW outfall. Because wastewater effluent from both San Mateo and SVCW would be used as source water for the AWPF and the RO concentrate would be discharged at the SVCW outfall, the total mass of PFAS discharged at SVCW would increase relative to the mass of PFAS present in the San Mateo wastewater effluent.

While there are no current limits for PFAS discharge (e.g., National Pollutant Discharge Elimination System, (NPDES)) to ocean outfalls, limits may be implemented in the future. If limits are implemented, dilution of the RO concentrate using excess tertiary effluent source water and/or treatment technologies including adsorbents such as granular activated carbon (GAC) and anion exchange resins (IX) may be used to remove PFAS prior to discharge. Research and testing is also being performed on PFAS destruction technologies in concentrated PFAS waste streams (e.g., RO concentrate). While these are technologies are still in development, pilot testing of PFAS destruction technologies for PFAS in RO concentrate may be performed in the future should PFAS discharge be limited.

4. Conceptual Treatment Process Design Criteria

This section summarizes the conceptual design criteria for the treatment processes, starting with a process flow diagram, describing each treatment process and the overall hydraulic profile for the AWPF. For purposes of the AWPF design criteria TM, it is assumed that all treatment processes are designed to generate 6 mgd of purified water in Phase 1 and 12 mgd of purified water in Phase 2. Design criteria for the treatment facility layout is discussed in the following section.

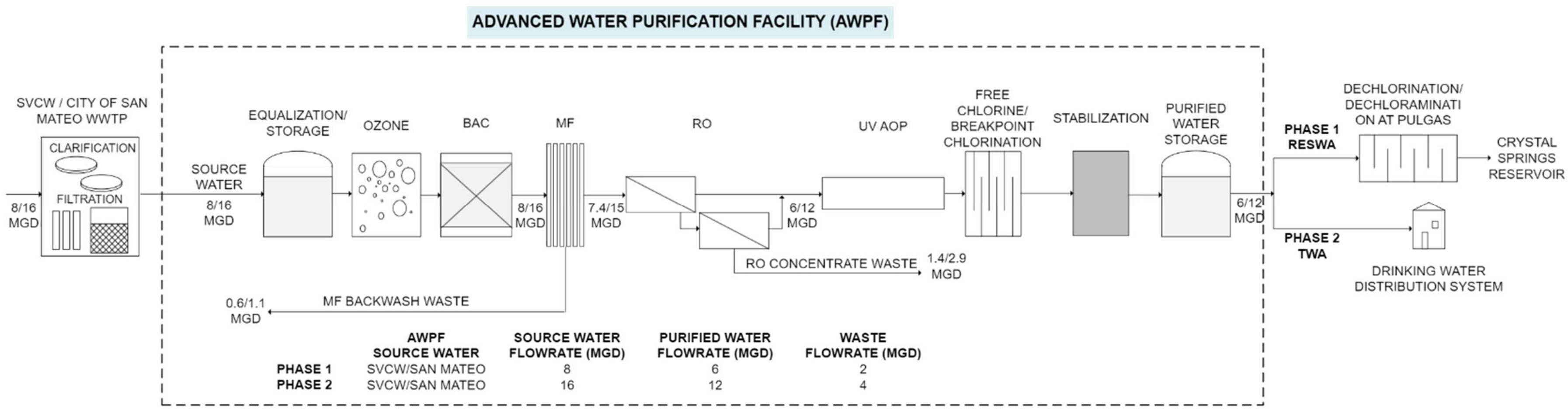
4.1. Process Flow Diagram

This section presents the overall treatment process flow path for the AWPF to meet Phase 1 and Phase 2 purified water requirements. The proposed treatment processes include:

- Ozone and biologically activated carbon (BAC) filtration pretreatment
- Low-pressure membrane microfiltration (MF) or ultrafiltration (UF) pretreatment
- Reverse osmosis (RO) system
- Advanced oxidation process (AOP), which typically combines UV treatment with the addition of an oxidant, such as hydrogen peroxide (H_2O_2) or sodium hypochlorite
- Free chlorine disinfection
- Purified Water Stabilization
- Process equalization and storage tanks

The AWPF process proposed for implementation of Phase 1 (ResWA) and Phase 2 (TWA) is illustrated in Figure 4-1. A detailed Process Flow Diagram (PFD) is included in **Appendix F: Drawings** of the BODR.

Figure 4-1. Proposed AWPF Treatment Process for ResWA or TWA



4.2. Hydraulic Profile

The hydraulic profile for the AWPF is included in the **BODR Appendix F: Drawings (Sheet G-08)** of the BODR. The following pressurized and gravity process stream flows are used to develop the hydraulic profile:

- Source water (tertiary effluent) from San Mateo WWTP and/or SVCW's recycled water storage tanks is pumped to partially buried AWPF influent EQ tank(s). Influent pumps then convey water from the EQ tank(s) through the ozone contactors/BAC and into the partially buried MF Feed Tank. MF Feed Pumps then deliver water though the MF strainers and MF system, to the partially buried RO Feed Tank.

- The MF filtrate from the RO Feed Tank is pumped via the RO Transfer Pump Station through cartridge filters to the RO Feed Pumps. The RO Feed Pumps boost the pressure to convey water through the RO System to the UV/AOP system. A portion of the RO permeate is also conveyed to the RO Flush Tank.

- The treated water flows from the UV Reactors flow through the free chlorine contactors through the post-treatment CO_2 and lime addition points, and finally to the partially buried purified water tank.

- The below-grade Purified Water Pump Station then conveys the AWP Facility purified water through the AWPF pipeline to dechlorination/ dechloramination. In Phase 2, the potable reuse water would be conveyed through existing drinking water connections.

4.3. Process Description and Design Criteria

This section presents a description of process unit sizing and preliminary equipment selection for the major treatment processes and equipment included for the AWPF. The preliminary site layout is detailed in Section 5.

4.3.1. Flow Equalization

The AWPF would provide the highest level of treatment performance and operational reliability when source water is fed at a continuous rate with limited fluctuations. To achieve a steady influent flow rate to the AWPF, an AWPF influent equalization (EQ) tank would be required upstream of the AWPF process train to equalize variations in flow due to diurnal flow patterns. Furthermore, the EQ tanks would provide a place for the source water from SVCW and San Mateo to blend prior to entering the AWPF to provide more consistent influent water quality.

The AWPF influent EQ tanks are sized to provide enough operating volume to store the estimated minimum influent flows (assumed to be 50 percent of average flow i.e., 4 mgd in Phase 1 and 8 mgd in Phase 2) for a total of 8 hours during low diurnal flow periods. The 2 MG AWPF influent equalization tank in Phase 1 would permit maintaining the 8 mgd feed rate to the AWPF during periods when there is only approximately 4 mgd of effluent flows available. The equalization tank would be increased to 4 MG during Phase 2 to provide an operating volume to store 50% of average flow to maintain a 16 mgd feed rate for the future 12 mgd AWPF for 8 hours.

EQ tank sizing should be confirmed from diurnal flow calculations during detailed design. Furthermore, there is a potential opportunity to use a portion of Redwood City's existing 2 MG recycled water tanks and/or future recycled water tank for source water equalization prior to the AWPF depending on the viability of source water blending. These tanks could alternatively provide storage for source water for RO concentrate dilution. The use of these existing assets in combination with or in place of new storage tanks for source water flow equalization and/or RO concentrate dilution should be further evaluated as part of future design phases.

The AWPF influent EQ tank design criteria is summarized in Table 4-1.

Table 4-1: AWPF Influent EQ Tank Design Criteria

Parameter	Unit	Phase 1	Phase 2
Type	Partially buried, pre-stressed concrete tank		
Number of Tanks	qty.	1	2
Design Inlet Flow	mgd	4	8
Design Outlet Flow	mgd	8	16
Differential Flow	mgd	4	8
Target Avg. Operational HDT	hrs	8	8
Target Operational Volume	MG	1.4	2.7
Total Storage Volume, per tank	MG	2.0	2.0
Total Storage Volume, total	MG	2.0	4.0
Tank Diameter	ft	110	110
Total tank height	ft	39	39
Working Depth	ft	22	22

4.3.2. Ozone and BAC

For TWA, the DDW DPR regulations require ozone and biologically activated carbon (BAC) filtration pretreatment prior to the RO/AOP process to help reduce low molecular weight compounds as well as other chemicals of emerging concern (CECs). In particular, the DPR regulations require that an ozone process would provide no less than 1.0 log reduction for each of the following indicators: carbamazepine and sulfamethoxazole; and a BAC process would provide no less than 1.0 log (90 percent) reduction for each of the following indicators: formaldehyde and acetone. Additionally, the ozone system would be designed to achieve 2 logs of pathogen reduction credits for virus and up to 1 log of pathogen reduction credits for Giardia.

The ozone system comprises a liquid oxygen (LOX) and nitrogen boost system which provides feed gas to the ozone generators. At the ozone generators, energy is added to oxygen, splitting the molecules into individual atoms which then collide with oxygen forming ozone. Ozone is then injected into ozone contactors where it oxidizes compounds directly or forms hydrogen peroxyl (HO_2) and hydroxyl (OH) radicals, which oxidize certain contaminants. The ozone contactors will be a closed system with an alarm system for monitoring and notification of potential off gasses. An ozone off-gas destruction step will be installed after the ozone contactors to ensure ozone does not leak into open air. The ozone system design criteria shown in Table 4-2 and equipment sizing is based on Xylem's Wedeco PDOevo Ozone System. At a minimum, 0.3 mg/L-min of contact time (CT) is needed to achieve for 2-log removal virus and 1-log removal Giardia at 15 deg C. Per the DPR regulations, the ozonation process shall be designed to provide a ratio of the applied ozone dose to the design feed water total organic carbon (TOC) concentration greater than 1.0. As a conservative estimate, the maximum ozone dose was assumed to be 1.5 ozone to TOC. Additionally, the ozone contactor is sized such that the flow path length to width ratio is 40 or greater to simulate plug flow conditions and limit short circuiting.

Note, ozone self-decomposes into oxygen over time with a half-life of approximately 20 mins at 15 deg C, and the decomposition could decrease the ozone residual measured at the end of the ozone contactor. This should be verified in later design phases via ozone demand pilot/bench scale testing using blended source water.

Table 4-2: Ozone System Design Criteria

Parameter	Unit	Phase 1	Phase 2
Estimated Ozone Dose			
Ozone Feed Maximum Flow	mgd	8.0	16.0
Target Ozone Residual	mg/L	0.5	0.5
Estimated Influent TOC	mg/L	6.3	6.3
Maximum Design Applied Ozone Dose	mg/L	9	9
Maximum Ozone Usage	ppd	625	1,250
Ozone Generator			
Manufacturer		Xylem	
Model		Wedeco SMOevo/PDOevo	
Number of Generators (Duty + Standby)	no.	1+1	2+1
Design Ozone Concentration (%, by weight)	%	10%	10%
Capacity per Generator at 10% Ozone Conc.	ppd	800	800
Oxygen Feed Rate to produce Ozone capacity	scfm	50	100
Duty Ozone Generation Capacity	ppd	800	1,600
% Duty Rating	%	78	78

Parameter	Unit	Phase 1	Phase 2
Ozone Contactor			
Type		Concrete, 5-pass Serpentine	
Number of Contactors	no.	1	2
Width	ft	60	60
Length	ft	50	50
Operational Water Level	ft	14	14
No. of Baffle Walls	-	4	4
L/W Ratio	-	41	41
Contact Volume	ft^3	42,000	84,000
	gal	314,000	627,000
CT Calculations			
Hydraulic Residence Time (HDT)	min.	60	60
Minimum Baffling Factor, T_{10}/HDT	-	0.5	0.5
T_{10}	min.	28	28
Required CT	mg/L-min	0.3	0.3
Calculated CT	mg/L-min	14	14

The biologically enhanced granular activated carbon (BAC) process removes dissolved organics through adsorption by the activated carbon and biodegradation by bacteria attached on the activated carbon. The BAC process are also expected to achieve 1 logs of pathogen reduction credits for virus and 2 log of pathogen reduction credits for *Giardia* and *Cryptosporidium* based on a conservative estimate of log removal credits typically achieved using conventional/direct filtration treatment technologies at surface water treatment plants. The DPR regulations require an BAC empty bed contact time (EBCT) of 15 minutes. As a conservative estimate, a design EBCT of 20 minutes was chosen. The BAC system design criteria shown in Table 4-3.

Table 4-3: BAC System Design Criteria

Parameter	Unit	Phase 1	Phase 2
BAC Feed Maximum Flow	mgd	8.0	16.0
Minimum Required EBCT	min	15	
Design EBCT	min	20	
Filter Media	-	Granular Activated Carbon	
Filter Type	-	Gravity	
Filter Media Uniformity Coefficient	mm	1.5	
Number of BAC Filters (Duty + Standby/Backwash)		4+1	8+1
Filter Length, each	ft	40	
Filter Width, each	ft	20	
Filter Surface Area, each	ft^2	400	
Water Depth Above Media	ft	2	

Parameter	Unit	Phase 1	Phase 2
GAC Filter Media Depth	ft	9.3	
Sand Filter Media Depth	ft	1	
Filter Media Volume, each	ft^3	3,700	
Filter Media Volume, each	gal	27,700	
Filter Loading Rate, Duty Filters	gpm/ft^2	3.5	

4.3.3. Membrane Filtration

For ResWA and TWA applications, the primary goal of membrane filtration (MF) is to provide pre-treatment for the reverse osmosis (RO) membranes, and to remove suspended particulate matter and larger microorganisms. The MF system also allows the AWPF to achieve at least 4 logs of pathogen reduction credits for both *Giardia* and *Cryptosporidium* and 1 log removal of virus. The pathogen reduction credits are confirmed via daily membrane integrity testing.

The MF system consists of a MF feed tank, MF feed pumps, and automatic strainers mounted off-skid, followed by the MF membrane racks. A partially buried MF Feed tank would provide approximately 10 minutes of hydraulic residence time to store the flow from the BAC filters and would also be sized to hold the BAC backwash water supply. Ancillary systems to support the MF system include MF backwash pumps, air scour blowers, compressed air system, chemically enhanced backwash (CEB), and clean-in-place (CIP) tanks and pumps.

The MF system design criteria shown in Table 4-4 are based on information specific to Toray HFU-2020N membrane modules. Other MF systems that have previously received the required V/G/C log removal credit should also be considered during detailed design. The MF skids comprises individual membrane racks, with each containing membrane modules, piping, valves, instrumentation, an electrical and pneumatic panel, and a coated steel frame. The racks run in parallel to each other and are connected via common influent, filtrate, backwash, and CIP/EFM headers.

Table 4-4: MF System Design Criteria

Parameter	Unit	Phase 1	Phase 2
Membrane Description			
Membrane Type/Material	-	Pressure, PVDF	
Membrane Modules Manufacturer	-	Toray	
Membrane Modules Model	-	HFU-2020N	
Membrane Classification	-	Microfiltration	
MF Skid Capacity/Sizing			
System Target Usable Capacity	mgd	7.8	15.6
Number of MF Skids (Duty)	no.	3	6
Number of MF Skids (Duty + Standby)	no.	3+1	6+1

Parameter	Unit	Phase 1	Phase 2
Number of Modules per Skid	no.	105	105
Number of Blank Modules/Skid	no.	11	11
Active Membrane Area per Module	ft^2	775	775
Flow/Pressure			
Maximum Design Instantaneous Flux	gfd	40	40
Max Instantaneous Module Prod at Rated Flux	gpm	21.5	21.5
Maximum flow per unit	gpm	2,300	2,300
Maximum System Instantaneous Production	mgd	9.8	19.5
Average Design Transmembrane Pressure	psi	10	10
System Production			
Unit Average Filtering Time Percentage	%	85	85
Minimum System Recovery	%	95	95
Max Unit Usable Production	gpm	1,825	1,825
Max Unit Usable Production	mgd	2.6	2.6
Max System Usable Production	mgd	7.8	15.6

4.3.4. Reverse Osmosis

The RO system follows downstream of the MF system. RO separates out dissolved solids, organics, and pathogens remaining in the MF filtrate. The RO system is expected to achieve at least 2 log removal credits for virus, *Giardia*, and *Cryptosporidium*. The RO system consists of a conventional two-stage system designed for 81% recovery and an average flux of 12 gfd to provide a sufficiently conservative design and sufficiently long operational periods between CIPs.

The primary components of the RO system include the RO Feed tank, RO transfer pumps, cartridge filters, RO feed pumps, RO treatment vessels and flush system. As part of the RO process, the MF filtrate is pumped out of the RO Feed tank and pre-treated with cartridge filters to protect the RO membranes against damage by large particles. A partially buried RO Feed tank would provide approximately 20 minutes of hydraulic residence time to store the flow from the MF system, and also store water for MF backwash. The MF filtrate is then conditioned with antiscalant and the pH adjusted as needed with acid to control scaling. Finally, the feed water is pressurized and passed through two stages of RO membrane elements. The RO design criteria is summarized in Table 4-5.

Table 4-5: RO System Design Criteria

Parameter	Unit	Phase 1	Phase 2
Membrane Trains			
Number of Trains			
Small Trains	no.	3	3
Large Trains	no.	0	2

Parameter	Unit	Phase 1	Phase 2
Permeate Capacity per Train			
Small Trains	mgd	2	2
Large Trains	mgd	-	3
Permeate Capacity, Total			
Small Trains	mgd	6	6
Large Trains	mgd	0	6
Recovery	%	81	81
RO Membrane Elements			
Total Number of Elements	no.	TBD	TBD
Element Manufacturer	-	ESPA2-LD; or Equal	
Element Type	-	High Rej. PA Composite	
Membrane Type	-	PA Composite	
Element Length	in.	40	40
Element Diameter	in.	8	8
Minimum Surface Area	ft^2	400	400
Average Rejection	%	99.5	99.5
Average Flux at Rated Capacity	gfd	12	12

4.3.5. UV/Advanced Oxidation

Advanced oxidation of any remaining organic compounds in the combined RO permeate would be accomplished via UV using an oxidant to generate hydroxyl radicals. The RO effluent is injected with select chemical oxidants such as hydrogen peroxide or sodium hypochlorite prior to entering into a UV reactor chamber which contains lamps emitting photons in the UV spectrum. The UV photons convert the oxidants into free radicals which are short-lived but aggressive oxidizers that can reduce pathogens and inorganic contaminants in water. The type of chemical oxidant would be selected at a later design phase.

The designed UV/AOP system is expected to result in at least 6 log removal credits each for virus, *Giardia,* and *Cryptosporidium*. The primary treatment goals include the effluent limit of 0.69 ng/L for NDMA from the CTR and at least 0.5 log removal of 1,4-dioxane to comply with ResWA/TWA potable reuse regulations. Future bench- and pilot-scale testing is needed to determine the appropriate UV and oxidant dose to achieve the UV/AOP treatment goals. The UV/AOP design criteria is summarized in Table 4-6.

Table 4-6: UV-AOP System Design Criteria

Parameter	Unit	Phase 1	Phase 2
Design Capacity	mgd	6	12
Number of UV-AOP Trains (Duty)	no.	4	8
Number of UV-AOP Trains (Duty+Standby)	no.	4+1	8+1
UV Manufacturer	-	Wedeco K series; Trojan UVFlex	

Duty Lamp Banks per Train	no.	2	2
Standby Lamp Banks per Train	no.	2	2
Type/Operating Configuration	-	Lamps perpendicular to the Flow	
Max. Capacity per UV Reactor	mgd	1.5	1.5
Maximum System Capacity with Duty Reactors	mgd	6	12
Lamp Type	-	low pressure high output	
Minimum Virus Inactivation Achieved	log	6	6
Minimum 1,4-Dioxane Reduction Achieved	log	≥ 0.5	≥ 0.5

4.3.6. Free Chlorine Disinfection

Sodium hypochlorite would be added to reduce ammonia levels and provide disinfection log removal credit. Breakpoint chlorination is a treatment technique that can be applied to reduce ammonia by adding sufficient free available chlorine (e.g., in the form of free sodium hypochlorite) to react with the free ammonia and chloramine species present. Breakpoint chlorination is needed to reduce ammonia levels to below CSR background limits and meet drinking water nutrient level limits. The process requires between a 10:1 to 11:1 chlorine to ammonia dosage ratio. In the source water, about 49 mg/L ammonia-N and 1 mg/L ammonia-N is anticipated in the SVCW tertiary effluent and San Mateo WWTP effluent, respectively. Assuming a conservative 95% removal of Nitrogen via RO, all source water from SVCW, and no ammonia is converted to nitrate during the BAC process, 2.5 mg/L ammonia-N is anticipated after the RO process. Therefore, a dose of 25 mg/L of free chlorine is required. In addition, 30 mins of hydraulic residence time is recommended to allow the free chlorine/ chloramine ratio to equilibrate and allows for an accurate reading of the total chlorine levels leaving the plant.

After 30 mins of hydraulic residence time, a chlorine residual of between 1.5-2 mg/L is anticipated. The residual and contact time is expected to provide enough free chlorine contact time to achieve at least 6 logs of virus reduction credit and 2 log of *Giardia* removal credit. 6 mg/L-min of CT is required to achieve 6-log credits for virus and 35 mg/L-min of CT provides 2-log credit for Giardia. Additionally, a flow path length to width ratio of 40 or greater is recommended to simulate plug flow conditions and limit short circuiting.

Sufficient disinfection residual must be maintained for conveyance from the AWPF to CSR (further discussed in Section 4.3.7). Dechlorination or dechloramination of the purified water would occur at or in the pipeline feeding into the SFPUC's Pulgas Pulgas DF prior to discharge to CSR. **TM #4 – Pulgas Disinfectant Residual Alternatives** describes existing treatment processes and identify the infrastructure and/or operational changes needed to accommodate the necessary final steps to dechlorinate or dechloraminate the purified water prior to discharge.

The free chlorine design criteria are summarized in Table 4-7. On site hypochlorite generation could be evaluated as an option to reduce bulk chemical delivery costs of sodium hypochlorite in future design phases.

Table 4-7: Free Chlorine Design Criteria

Parameter	Unit	Phase 1	Phase 2
Estimated Chlorine Dose			
Chlorine Feed Maximum Flow	mgd	6.0	12.0
Target Total Chlorine Residual	mg/L	1.5-2.0	1.5-2.0
Maximum Design Applied Chlorine Dose	mg/L	25	25
Maximum Chlorine Usage	ppd	1,250	2,500
Maximum Chlorine Feed Rate	gph	42	83
Chlorine Chemical Tank			
Number of Tanks	no.	2	4
Type/Material	-	FRP	
Tank Diameter	ft	12	12
Max Chemical Level	ft	20	20
Capacity per Tank	gal	15,000	15,000
Total Capacity	gal	30,000	60,000
Supply at Average Use	days	30	30
Chemical Contact Tanks			
Type		Concrete, 7-pass Serpentine	
Number of Contactors	no.	1	1
Width	ft	45	45
Length	ft	80	80
Operational Water Level	ft	14	14
No. of Baffle Walls	-	6	6
L/W Ratio[1]	-	44	44
Contact Volume	ft^3	46,600	46,600
	gal	350,000	700,000
CT Calculations			
Hydraulic Residence Time (HDT)	min.	84	84
Minimum Baffling Factor, T_{10}/HDT	-	0.5	0.5
T_{10}	min.	42	42
Required CT (V/G/C)	mg/L-min	6/35/NA	6/35/NA
Calculated CT	mg/L-min	63	63

[1] Length of flow path/ width of flow path.

4.3.7. Post-Treatment Stabilization

Following the RO and UV/AOP processes, the purified water stream remains at a low pH and contains low levels of TDS and alkalinity resulting in a high corrosion risk and possible treatability issues at the downstream drinking water treatment facility. To mitigate these risks, post-treatment stabilization is needed to raise pH, alkalinity, and Langelier Saturation Index (LSI) to the purified water goals. Carbon dioxide (CO_2) would be injected upstream of lime to aid in the dissolution of lime, create conditions of favorable carbonate alkalinity, and help with pH control upon lime addition. Lime is added to water to add calcium and magnesium hardness to the water. The specific type of lime stabilization system, chemical storage and chemical dosing pump sizing would be further refined as part of a later design phase.

In Phase 1, free chlorine or chloramines may be used for ResWA into CSR. Using free chlorine in Phase 1 is advantageous since the Pulgas DF can dechlorinate but cannot dechloraminate flows less than 20 mgd. However, in Phase 2, chloramines must be used for TWA to match the disinfectant residual used within the existing drinking water distribution system. When chloramines are required in Phase 2, ammonia would be added at a 5:1 ratio at the end of the treatment plant to form a consistent concentration of chloramines to maintain a disinfection residual in the purified water pipelines for TWA. The purified water would then be dechloraminated for ResWA prior to discharge into CSR. Dechlorination/ dechloramination requirements at or prior to Pulgas DF are discussed in detail as part of **TM #4 – Pulgas Disinfectant Residual Alternatives**.

It is noted that efficacy of chlorination increases with lower pH. As part of the post-stabilization process, lime is added to the purified water which increases pH. Disinfection and lime dosage points would be evaluated as part of a future design phase to determine the optimal water quality and operations to provide the alkalinity and pH required to optimize breakpoint chlorination efficacy and minimize corrosion risk.

Future design efforts would also need to address management of disinfection byproducts (DBPs) in the purified water. Pilot testing could be performed early in the design process to determine if the DBPs would meet the maximum concentration levels (MCL) and notification levels (NL) for the high and low range of UV dose and chloramine concentrations expected for long term operation. It is anticipated that total organic carbon (TOC) concentrations would be low after the UV-AOP process since TOC is removed by ozone/BAC, membrane filtration, and UV-AOP. As a result, there would be a low amount of organic matter available to form DBPs, and DBP levels are expected to fall below MCL and NL limits.

4.3.8. Purified Water Clearwell Tank

The purified water clearwell tank would be sized for 1 hour of residence time at the max 12 mgd flow. The purified water clearwell tank design criteria is summarized in Table 4-8. **Appendix A** of the BODR addresses how storage would meet anticipated DPR requirements. That is, the treatment train, storage, and conveyance must provide continuous longitudinal mixing of the flow, between the terminus of the wastewater collection system and the entry to the drinking water distribution system, sufficient to attenuate a one hour elevated concentration of a contaminant by a factor of ten. Mixing that occurs between the wastewater treatment plant inlet chamber and the DPR project purified water compliance point may be used to meet this requirement.

Table 4-8: Purified Water Clearwell Tank Design Criteria

Parameter	Unit	Phase 1	Phase 2
Type		Partially buried pre-stressed concrete tank	
Number of Tanks	qty.	1	
Target Avg. Operational HDT	hrs	2	1
Target Operational Volume	MG	0.5	
Total Storage Volume	MG	0.5	
Dimensions			
Length	ft	90	
Width	ft	80	
Height	ft	20	
Max Water Depth	ft	12	
Minimum Water Depth	ft	2	

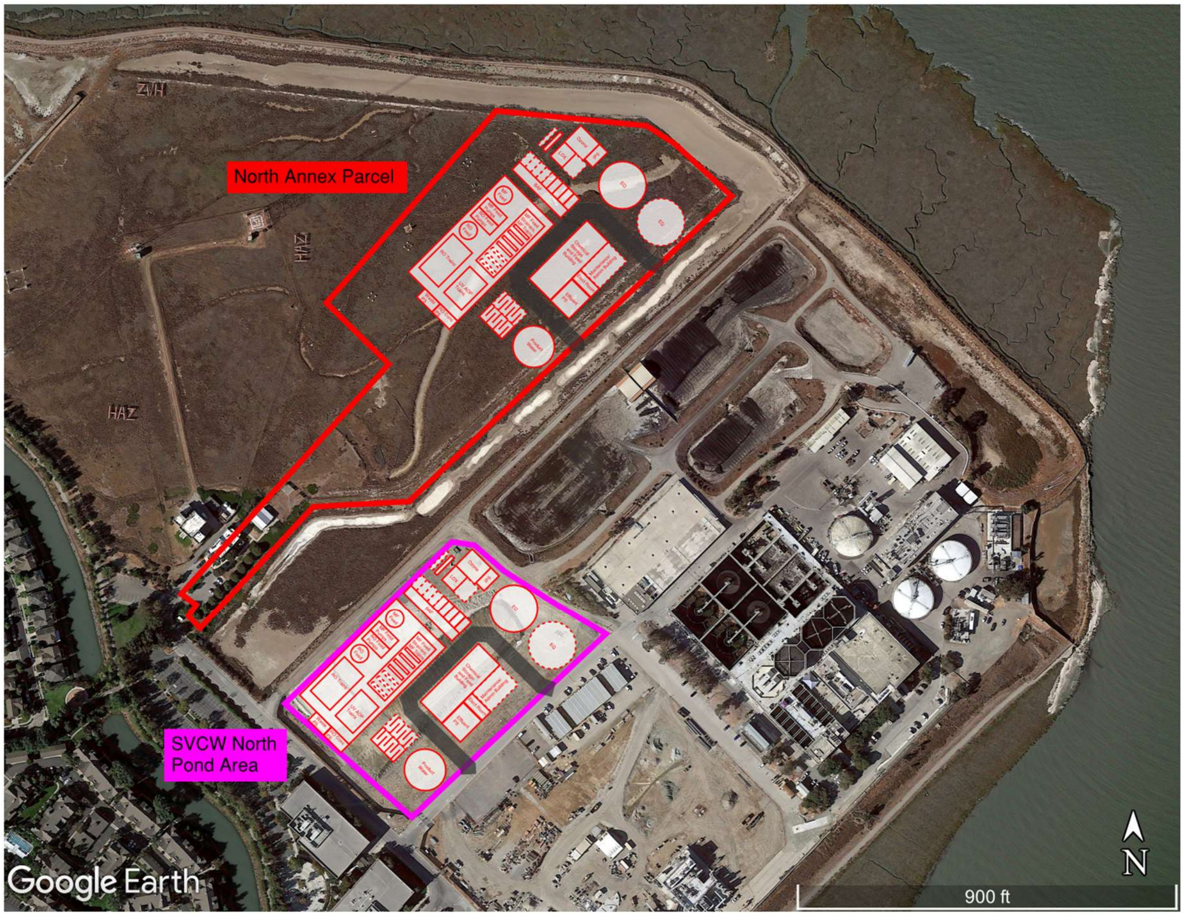
5. Conceptual Facility Design Criteria

This section summarizes the conceptual design criteria for the overall AWPF site.

5.1. Site Layout and Description

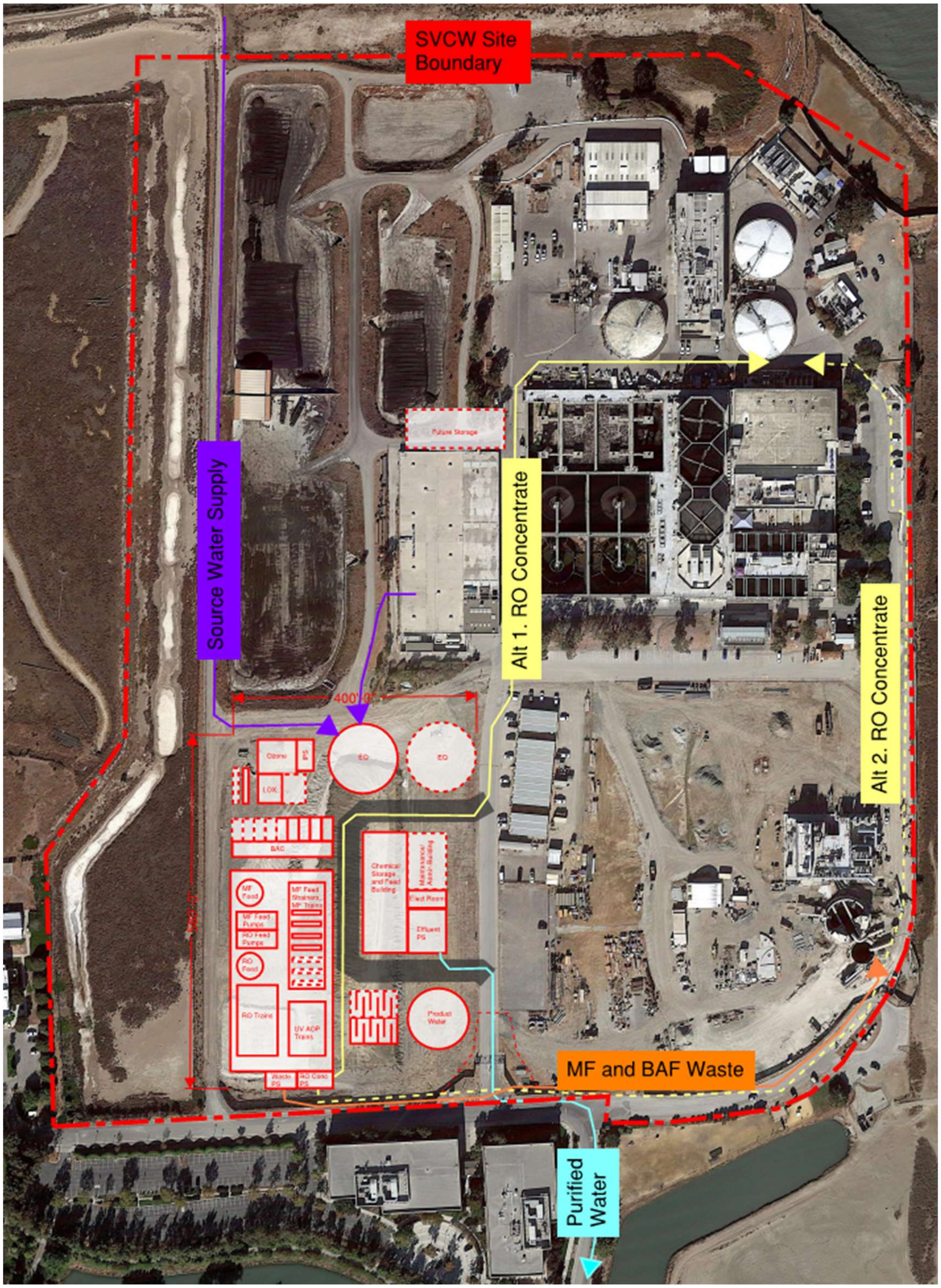
There are two potential locations where the new AWPF could be constructed that are both owned by SVCW, as depicted in Figure 5-1. The preferred site is the 5.5 acre SVCW North Pond area, southwest of the existing sludge drying beds. The alternative site is the North Annex parcel located northwest of the SVCW facility. This land is owned by SVCW but is not preferred for AWPF construction since it is a potentially environmentally sensitive area which may require extended negotiations related to permitting and environmental impacts that could result in significant project schedule delays.

Figure 5-1. AWPF Site Location Options



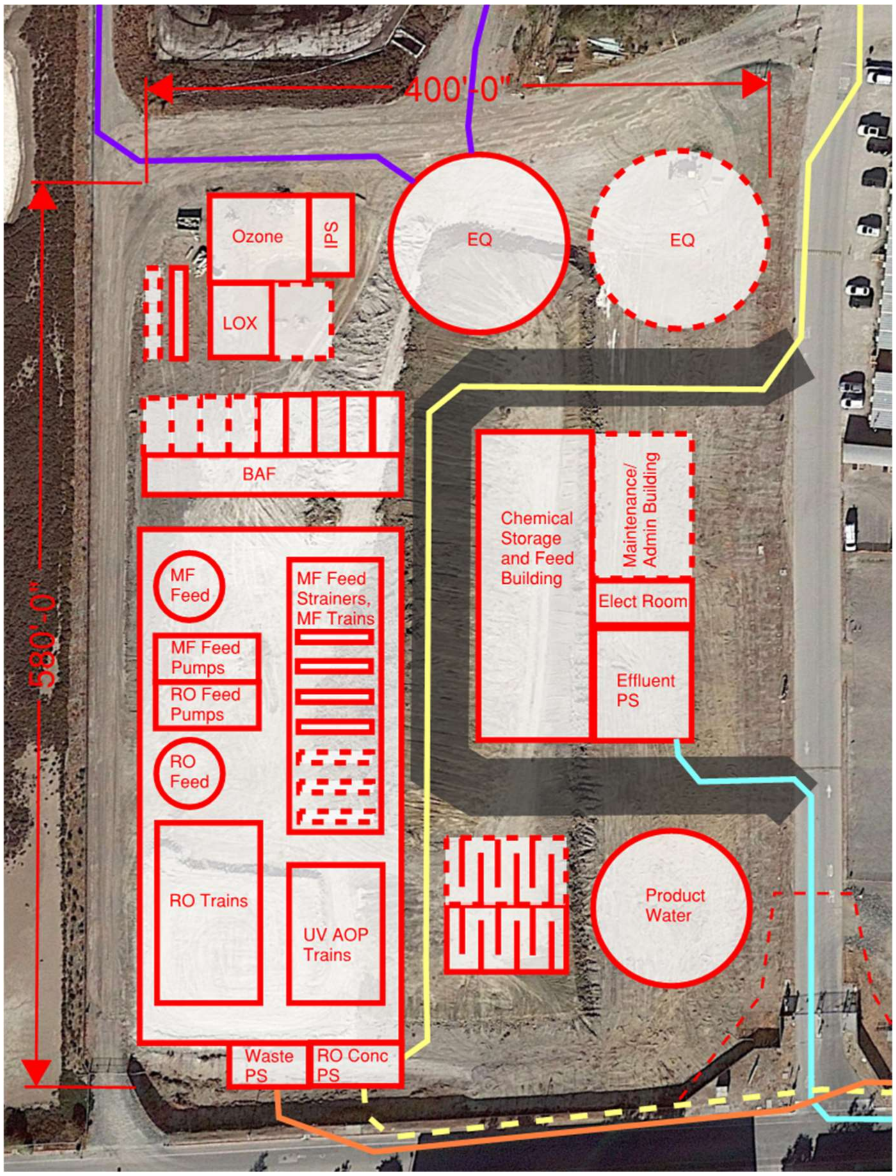
For purposes of this TM, it is assumed that the AWPF would be designed for the SVCW North Pond area. At this site location, it is assumed flow would enter the AWPF at the northwest corner from both SVCW and San Mateo. Purified water would leave the AWPF and feed the distribution system via existing pipelines to the southeast. RO concentrate would be diluted and pumped to the existing SVCW outfall connection point as discussed in **TM #3 – RO Concentrate Disposal**. A conceptual site civil design is shown in Figure 5-2 and has been further refined as part of the BODR.

Figure 5-2. AWPF Layout at SVCW Site



The site layout would be designed to provide appropriate access to the treatment facilities (see Figure 5-3). This would be achieved by the addition of a paved road that divides the site into sections. The road circles the chemical storage and chemical feed building to provide access for chemical delivery trucks. This road would provide access to the MF trains and CIP area for delivery and maintenance activities. Future structures necessary for meeting the 12 mgd Phase 2 design capacity are shown with dashed lines. Placement of these future facilities considers future construction accessibility and reduced disruption of operations.

Figure 5-3. AWPF Site Layout



5.2. Construction Considerations

The project design must abide by the vertical limitations of the site, as dictated by Redwood City zoning codes. Construction design criteria are summarized in Table 5-1.

Table 5-1: Construction Design Criteria

Construction Criteria	Height/Depth Maximum
Building/tank height	25 ft
Building/tank depth	20 ft
Pile depth	110 ft

Redwood City zoning code states that the project site falls within the "Redwood Shores Bay Front" (RSB) zone. The height restriction for buildings constructed within this zone is 30 ft. Due to potential view obstruction concerns from nearby residents, the site layout criteria were developed to limit process equipment and tank structures to a max elevation of 111 feet to meet the max elevation of the nearby RWC recycled water tanks. Above ground buildings would be limited to a max height of 20 feet above grade or about 134 feet elevation, similar to the elevation of nearby SVCW maintenance building adjacent to the existing dual media filters. This self-imposed height restriction is more conservative than what the Redwood City zoning code calls for in the neighboring R-2 zone neighborhood where buildings are permitted to be as tall as 28 ft.

The AWPF would be constructed on young Bay mud which is known to compress significantly when structures are built on top, causing structures to sink over time. Furthermore, if young Bay mud is disturbed excessively during excavation, it can lose its structural integrity, which would prevent completion of deep excavation work without an excavation shoring system designed by a licensed civil engineer. For these reasons, it is assumed that the design structures would be no deeper than about 20 ft.

Due to the consistency of young Bay mud, many structures at SVCW are designed to "float" on top of the mud and shallow ground water with full tanks. To prevent structures from being pushed up out of the mud by buoyant forces, piles are constructed. The depth of the piles depends on the specific area on the site and the type of structure the piles are designed to support. In a recent project, SVCW drove piles on center every 8 ft 2 in. Some of these piles are as much as 110 ft deep. It is anticipated that similar piles would be designed for the AWPF.

Additional construction considerations include environmental and noise impacts to the Redwood Shores community. Methods to limit impact would be evaluated in future design phases and are initially assessed as part of the CEQA checklist documentation in the BODR.

5.3. Electrical

SVCW currently receives its electricity from PG&E. The electrical usage for the AWPF is estimated to be 4,500 KWH/MG purified water for direct potable reuse. Assuming continuous 24-7 operation, this corresponds to an average annual energy requirement of 9,800 MWh/yr and 19,600 MWh/yr for Phase 1 and Phase 2, respectively. It is unlikely that this electrical demand could be met by SVCW's cogeneration operations since the power usage for SVCW's current plant operation exceeds the plant's cogeneration capacity. It is anticipated that the AWPF would require a separate PG&E meter and backup generator since power usage for current SVCW plant operation exceeds the existing cogeneration capacity. Coordination with PG&E should be initiated as soon as possible, as new service with PG&E would require a system impact study (SIS) to determine the capacity of the existing infrastructure, any inefficiencies, and what would be needed to meet new service requirements. Electrical design considerations are documented in the BODR and would be further defined in future design phases.

5.4. Instrumentation, Controls and SCADA

The AWPF would require instrumentation and controls to communicate with the SVCW, San Mateo and SFPUC's Regional Water System (SFRWS) and Pulgas DF. Instrumentation and controls are critical to meeting regulatory requirements and optimizing operations. Examples include:

- The AWPF would need to relay flow information to and from SVCW and San Mateo to provide sufficient effluent to dilute RO concentrate before reaching SVCW's outfall.

- Since the purified water produced would provide a new input to the SFRWS, communication with SFPUC would be especially important during wet periods and wet years. During these times, purified water may displace flows that would otherwise be sent to CSR from the upcountry system; this would require adjustments to SFRWS operations. Control logic to ramp down or stop purified water productions would need to be established as part of future operational strategies, further discussed in Section 6.

- The flow rate of the purified water to the Pulgas DF would need to be communicated to SFPUC as the transition from dechloramination to dechlorination treatment is a function of the minimum influent flow to Pulgas DF. Currently, when the flow is under 20 mgd the plant operates as dechlorination and not dechloramination. Dechloramination mode is preferred since operation in dechlorination impacts the reservoir and how this relates to the Basin Plan discharge limitations of 0.025 mg/L of ammonia.

- Monitoring for reliability and process control is critical to meet and validate regulatory log reduction requirements, monitor and analyze unit process performance, and support reporting. Log reduction credits are validated by evaluating the removal of water quality parameters such as turbidity, UV_{254}, TOC, conductivity, and specific ions (e.g., sulfate, strontium). Additional emerging monitoring technologies such as light scattering technologies or bacteria ATP monitoring to receive additional log reduction credits may be evaluated and tested in the future.

- Instrumentation and controls are also key to optimizing chemical dosing and mixing to manage costs as well as providing automation to manage labor effort.

Instrumentation and Control (I&C) would be achieved through flow and water quality meters, flow control valves, online sensors, SCADA system modifications, and other tools for communication. Preliminary I&C design considerations are presented in the BOD and would be further defined in future design phases.

5.5. Layout Modifications for 8 mgd Treatment Capacity

This TM assumes 6 mgd of purified water flow, but it is possible that 8 mgd would be preferable for Phase 1. If the AWPF treatment capacity increases to 8 mgd, this would increase the sizing and layout of the process equipment needed during Phase 1. However, the overall footprint of the AWPF is not anticipated to change significantly since the total (Phase 1 and Phase 2) AWPF treatment capacity is anticipated to be 12 mgd.

6. Preliminary Operational Strategies

During wet months of wet years there is limited available storage in the SFRWS. Thus, the addition of purified water to CSR or to drinking water systems that would otherwise receive SFRWS flows would result in an upcountry "spill" of water to make room for purified water. To avoid or reduce SFRWS spill, implementation of Phase 1 ResWA would likely include provisions for ramp-down and shutdown operational scenarios. A key AWPF consideration for ramp-down and shutdown is proper maintenance of the MF and RO membranes. Membranes must remain wet and generally should not be removed from operation for greater than 3 to 5 days without membrane preservation practices. Thus, ramp-down and shutdown operations should be thoroughly evaluated to maintain membrane integrity.

The three ResWA operational scenarios that may be implemented to reduce the amount of spill during wet periods and wet years include:

1) **Continuous AWPF Operational Scenario** – the AWPF operates at the design capacity consistently. Upcountry spill of water is likely.
2) **Seasonal Ramp Down Operational Scenario –** the AWPF would operate at full capacity during the summer months (May to October) and ramp down purified water production to half its capacity during the wet year winter months (November to April). This avoids the operational complexity associated with a full shutdown. Under this operational mode, duty membranes and other equipment would be rotated daily to ensure all membranes remain wet and are not out of service for longer than 24 hours. Rotating operational membrane skids is commonly performed and is not expected to be highly labor intensive since this process can be automated. If the treatment plant is shut down for an extended period, RO membrane preservation with sodium bisulfite solution and MF membrane preservation with sodium hypochlorite would be necessary, see Scenario 3.

3) **Seasonal Shut Down Operational Scenario –** the AWPF would operate at full capacity during summer months (May to October) and shut down during wet year winter months. During the shutdown period, the membranes would be fully preserved. Membrane preservation is typically performed using 500-1,000 mg/L of sodium bisulfite to prevent biological growth and performing the preservation can be time consuming and chemical intensive. Sodium bisulfite solution is conservatively assumed to be replaced every two weeks.

Operational scenarios are further explored in the **TM #6 – AWPF Operational Strategies.**

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May 2024

Final Technical Memorandum (TM) #2 – Conveyance Design Criteria

To: PureWater Peninsula Parties

From: Marie Fawcett, PE, Kennedy Jenks

Reviewers: Dawn Taffler, PE, Kennedy Jenks
Mark Minkowski, PE, Kennedy Jenks
Al Shewey, PE, Kennedy Jenks

Subject: Conveyance Design Criteria
PureWater Peninsula Project – Basis of Design Report

The **PureWater Peninsula Project**, previously referred to as the Potable Reuse Exploratory Plan (PREP), is a regional effort to resolve multiple water supply and wastewater issues, while realizing the benefits of shared infrastructure, asset recovery, economies of scale and a more competitive strategy to pursue funding. **Pure Water Peninsula Project Parties** include the Bay Area Water Supply and Conservation Agency, California Water Service (Cal Water), San Francisco Public Utilities Commission (SFPUC), Silicon Valley Clean Water (SVCW), City of San Mateo, Redwood City (RWC), and Mid-Peninsula Water District (MWPD).

This **Technical Memorandum (TM) #2 – Conveyance Facility Design Criteria** establishes the design requirements and preliminary criteria for the project pipelines and pump stations, building on the design concepts identified in the PREP Phase 3 Title XVI Feasibility Study (Kennedy Jenks, 2022).

This TM is organized into the following sections:

1. PureWater Peninsula Project Overview
2. Conveyance Regulatory Requirements
3. Design and Constructability Considerations
4. Conceptual Design Criteria
5. Preliminary Operational Strategies

Additional TMs that support this work include:

- **TM #1 – Advanced Water Purification Facility (AWPF) Design Criteria** focuses on the design parameters for use in developing a conceptual design for the AWPF sizing and expanded unit processes as well as conveyance facilities within the SVCW boundary.
- **TM #3 – Reverse Osmosis (RO) Concentrate Disposal** establishes the design requirements for the AWPF to discharge RO concentrate to the SVCW ocean outfall while meeting current and potential future regulatory requirements.
- **TM #4 – Pulgas Disinfectant Residual Alternatives** describes considerations related to the type of disinfectant residual and removal of disinfectant residual prior to Reservoir Water Augmentation (ResWA) for Crystal Springs Reservoir (CSR) augmentation via the Pulgas Dechloramination Facilities (Pulgas DF).
- **TM #5 – Drinking Water Distribution System Design Criteria** identifies preferred points of connection to introduce purified water into the existing drinking water distribution systems owned and operated by RWC, Cal Water, and the MPWD as well as defines infrastructure requirements and potential operational and hydraulic constraints.
- **TM #6 – AWPF Operational Strategies** summarizes the preliminary operational strategies for both ResWA and Treated Water Augmentation (TWA) to support the development of AWPF design and operational criteria.

These TMs reflect the initial analyses performed to support the PureWater Peninsula Project Basis of Design Report (BODR) and have been included in an appendix to the BODR. Information contained within this TM may be superseded by content in the BODR, reflecting updates to the technical evaluation after the TM was completed.

1. PureWater Peninsula Project Overview

The PureWater Peninsula Project is a potable reuse project that would create a new source of local sustainable water supply using state-of-the-art technology to purify tertiary effluent from SVCW and the San Mateo Wastewater Treatment Plant (WWTP).

The project would be implemented in two phases:

- **Phase 1** – Indirect Potable Reuse (IPR) via ResWA of up to 6 million gallons per day (mgd) of purified water at CSR.
- **Phase 2** – Direct Potable Reuse (DPR) via TWA. Expansion of AWPF to produce an additional 6 mgd of purified water, for a total of up to 12 mgd. Up to 6-8 mgd would be available for ResWA at CSR, and 4-6 mgd would be available for TWA to local drinking water distribution systems.

With the implementation of both PureWater Peninsula Project Phases, the project would provide a maximum of 12 mgd of purified water for local use by 2043.

The PureWater Peninsula Project includes:

- Source water derived from up to 8 mgd of tertiary effluent from SVCW and up to 9 mgd of tertiary effluent from the San Mateo WWTP would be combined to produce up to 12 mgd of purified water. Additional source water from SVCW would be available for dilution of RO concentrate.

- Construction of a new AWPF to treat source water to meet regulatory requirements for IPR in Phase 1 and DPR for the Phase 2 expansion.
- Conveyance infrastructure to deliver tertiary effluent to the new AWPF, purified water to the place of use, and brine for discharge via the existing SVCW outfall.
- A point of connection to SFPUC's Pulgas DF, which provides dechlorination of all flows prior to discharge into CSR.
- Multiple points of connection to existing tanks and transmission pipelines to deliver purified water to RWC, Cal Water and/or the MPWD drinking water distribution systems (DWDS).

A summary of PureWater Peninsula Project concept is provided in Table 1-1 and depicted in Figure 1-1. The overall process flow diagram for the AWPF is shown in Figure 1-2.

Table 1-1: PureWater Peninsula Project Facilities

	Phase 1 – IPR (6 mgd)	Phase 2 – IPR and DPR (12 mgd)
Treatment Facilities	• 6 mgd capacity AWPF located near SVCW; water treated to TWA standards. • Associated chemical feed systems, wet wells, inter-process pumps, and other appurtenances.	• Expand unit processes and appurtenances to 12 mgd treatment capacity; water treated to TWA standards. • Breakpoint chlorination facility to provide chemical dosing along the purified transmission pipeline (downstream of final DWDS connection, before Pulgas DF).
Pipelines	• **San Mateo Tertiary Effluent**: ~6 miles of 24”-dia source water pipeline from San Mateo WWTP to AWPF sized for up to 9 mgd source water flow. • **SVCW Tertiary Effluent**: <1 mile of 20”-dia source water pipeline from SVCW to AWPF sized for up to 8 mgd source water flow. • **Purified Water to Crystal Springs Reservoir:** 12-16 miles of 24 -dia purified water transmission pipeline from AWPF to CSR, with provisions for future connections to local drinking water distribution systems. The pipeline would be sized for Phase 2 flows of 12 mgd, with up to 8 mgd of that purified water flow reaching CSR in Phase 2. • **AWPF Brine Disposal:** <1 mile of 12”-dia brine pipeline from AWPF to the existing SVCW outfall.	• **Treated Water Distribution System Connections:** ○ 6”-to 18” dia Distribution pipelines from purified water transmission pipeline to potable water system tie-ins (pipe lengths vary by alternative). ○ Potable water system tie-ins to local drinking water distribution system (RWC, Cal Water and MPWD).
Storage	• **Equalization storage tank (EQ)** for source water, prior to AWPF with potential to convert one of RWC’s Recycled Water storage tanks at SVCW for use as equalization. • **Purified water storage tank** for purified water prior to conveyance to CSR.	• Expand source water equalization storage tank capacity for the 12 mgd treatment capacity.
Pump Stations	• **San Mateo Tertiary Pump Station:** convey AWPF source water (tertiary effluent) from San Mateo to the AWPF. • **SVCW Tertiary Pump Station:** convey AWPF source water (tertiary effluent) from SVCW to the AWPF. • **RO Concentrate Pump Station:** Convey brine from the AWPF to SVCW Outfall connection. • **Purified Water Pump Station at AWPF:** Convey purified water from AWPF to CSR/DWDS connections. • **Purified Water Booster Pump Stations (BPSs):** Several intermediate booster pump stations would be required to convey purified water from the AWPF to CSR/DWDS connections.	• Expand number of pumps at each pump station to meet the 12 mgd treatment capacity.
Pulgas	• Connect to the concrete 11’ weir at Pulgas DF prior to augmentation into CSR. • Utilize the existing Pulgas Dechlorination operations and Discharge Channel to augment CSR.	• No additional modifications.

Figure 1-1: PureWater Peninsula Project Concept

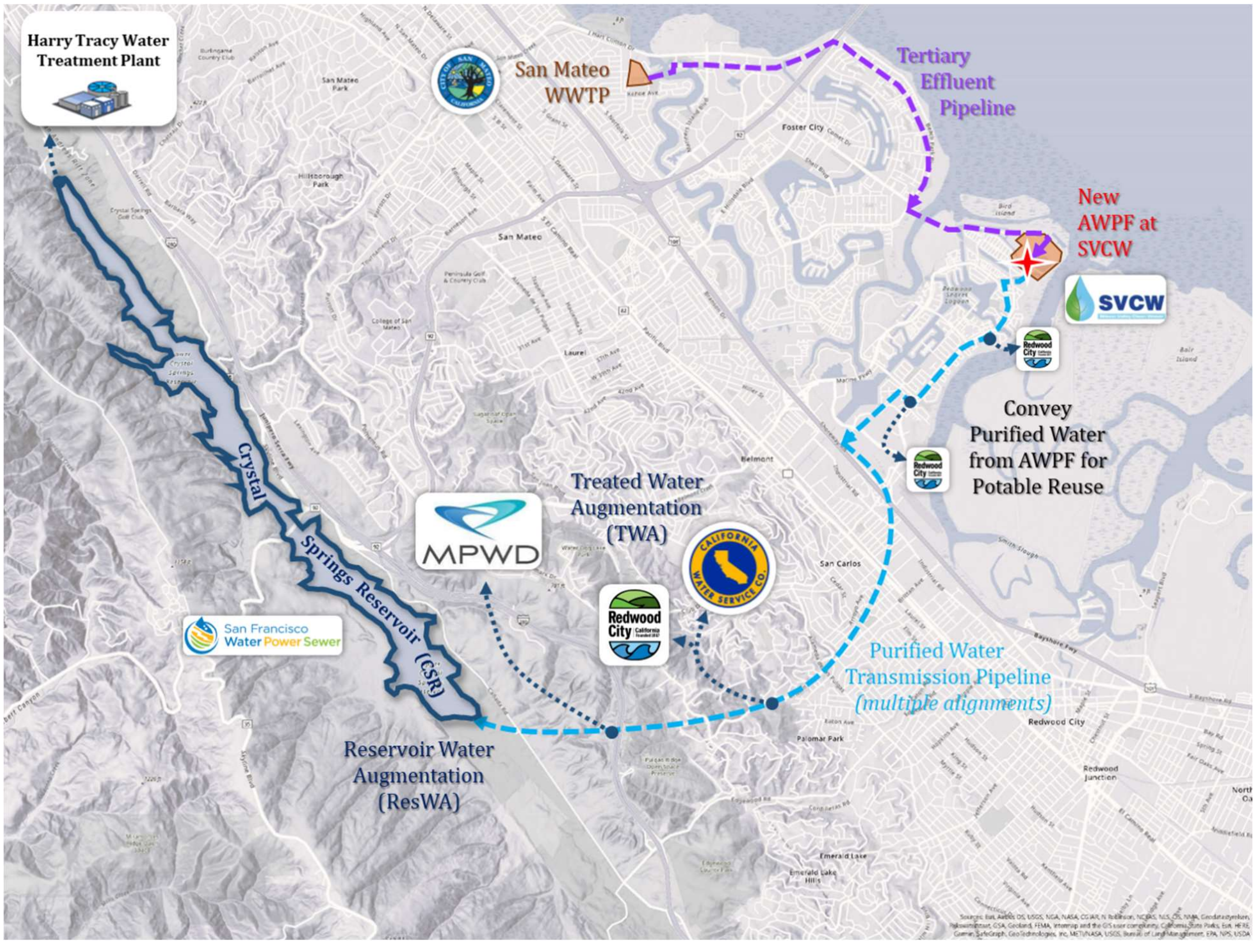
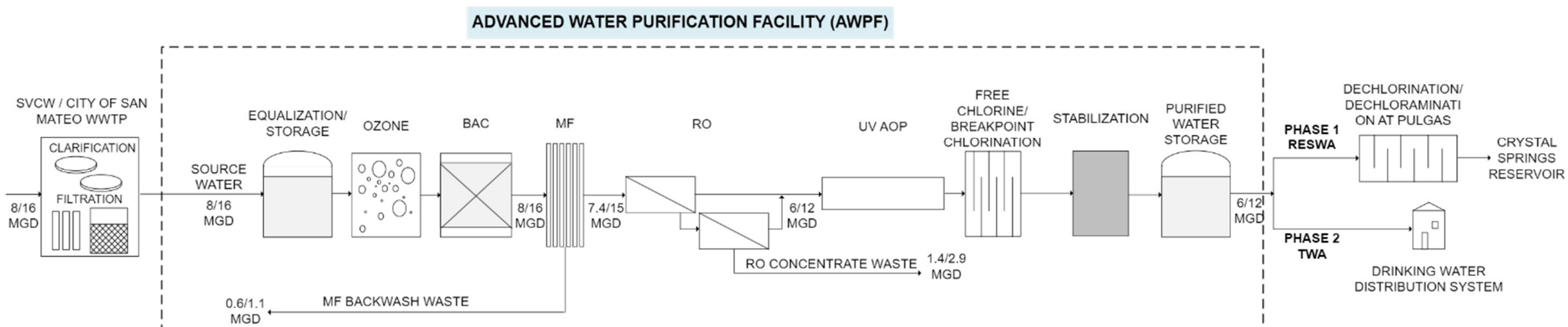


Figure 1-2: PureWater Project Peninsula Overall Process Flow Diagram



	AWPF SOURCE WATER	SOURCE WATER FLOWRATE (MGD)	PURIFIED WATER FLOWRATE (MGD)	WASTE FLOWRATE (MGD)
PHASE 1	SVCW/SAN MATEO	8	6	2
PHASE 2	SVCW/SAN MATEO	16	12	4

Project flows are summarized in Table 1-2. For the purposes of this TM, it is assumed that Phase 1 would include delivery of 6 mgd of purified water to CSR via Pulgas DF. In Phase 2, up to 8 mgd could be delivered to Pulgas DF. The remaining 4 to 6 mgd would be used for TWA through DWDS connections. RO concentrate would be discharged to the existing SVCW outfall. Other AWPF waste flows, including spent washwater, clean-in-place waste streams, drains, would be returned to the SVCW Headworks.

Table 1-2: PureWater Peninsula Project Flows Summary

Flow	Phase 1 Capacity (mgd)	Phase 2 Capacity (mgd)
San Mateo Tertiary Effluent	4.0 - 5.3	9.0[1]
SVCW Tertiary Effluent	4.0 - 5.3	8.0
AWPF Combined Influent	8.0 - 10.6	17.0
RO Concentrate	1.4 - 1.9	2.9
Other AWPF Waste	0.6 - 0.7	1.1
AWPF Purified Water	6.0	12.0
Purified to CSR	6.0	6.0 - 8.0
Purified for TWA	0	4.0 – 6.0

Note:

1 An AWPF combined influent flow of 16.0 mgd is required to produce 12.0 mgd of AWPF purified water, which would be a blend of water from the San Mateo WWTP and SVCW. It is assumed that up to 8.0 mgd would be available from SVCW and up to 9.0 mgd would be available from San Mateo. The AWPF source water ratio could shift to a higher percentage of San Mateo effluent when needed to supplement SVCW flows and/or to maintain some flows to blend with RO concentrate prior to discharge.

2. Conveyance Regulations

The PureWater Peninsula Project must meet regulatory requirements for potable reuse to protect public health and the environment. This section summarizes the conveyance and drinking water distribution system requirements. Additional project requirements related to treatment are presented in **TM #1 - AWPF Design Criteria**.

Currently, there are no federal regulations directly addressing potable water reuse, which is why the State Board has mandated all generally applicable Safe Drinking Water Act (SDWA), Clean Water Act (CWA) and other state regulations specific to water reuse are met. Some of the SDWA aspects that are applicable to the PureWater Peninsula Parties' systems that may apply include, but are not limited to:

- **Lead and Copper Rule** – to demonstrate optimized corrosion control, appropriate water quality parameter monitoring and adherence to action levels.
- **Total Coliform Rule** – to control bacterial growth through monitoring, investigation, and notifications.
- **Surface Water Treatment Rules** – to maintain disinfectant residuals through monitoring, investigation, and notifications.

- **Disinfectants/Disinfection Byproduct (DBP) Rules** – to control DBP formation, identify potential hot spots, implement monitoring plans and treatment techniques for disinfection byproduct precursors control (e.g., TOC reduction requirements).
- **Other regulations governing distribution systems** – including California Waterworks Standards for materials, installation, separation requirements, meters, flushing, isolation/release valves and other requirements and Water System Operations and Maintenance Plan requirements, if directed by DDW.
- **Compliance with Bay discharge NPDES permit requirements.** In particular, the RO concentrate disposal via SVCW's outfall would need to meet existing and future regulations at the SVCW outfall to the San Francisco Bay (SF Bay), which is regulated under three Waste Discharge Requirements (WDRs) / National Pollutant Discharge Elimination System (NPDES) permits: (1) SVCW Individual WDR, (2) SF Bay Watershed WDR for mercury and PCBs and (3) SF Bay Watershed WDR for nutrients.

2.1.1. Pipeline Separation Requirements

Current regulations clearly define separation requirements between potable water pipelines and other pipelines, such as sanitary sewers, raw water, tertiary recycled water, and other non-potable fluids. Specifically, the California Waterworks Standards (California Code of Regulations [CCR] Title 22, Division 4, Chapter 16, Section 64572) establish criteria for the separation of new water mains and new supply lines from non-potable pipelines (excerpt included in Appendix B.1). This section also includes criteria for separation between purified water pipelines and potable water mains.

Separations between recycled water or purified water pipelines and other non-potable pipelines are not specified in regulations and are looked at by SBDDW on a case-by-case basis. Due to the lack of specific regulations or design requirements, the industry design standard for this scenario generally adheres to the separation requirements between potable water mainlines and non-potable water mains.

A 2017 SBDDW memo (included in Appendix B.2) addresses requests for alternatives to the waterworks standards. Specifically, it states that "The SBDDW recognizes that certain conditions may call for the installation of pipelines with less separation distance than what is required by the regulations. In these situations, the water system may propose an alternative pursuant to CCR, Title 22, Section 64551; 100." The request for a waiver must demonstrate the proposed alternative would provide at least the same level of protection to public health, and a written approval from the SBDDW is required prior to implementation.

Utility owners may have additional separation requirements. Purified Water Pipeline Options 1 and 3 follow the SFPUC right-of-way (ROW) in the vicinity of the Bay Division Pipelines (BDPLs). The SFPUC prefers 15-feet of clear separation between pipelines and 5-feet between the pipeline and the property/easement boundary, but may allow exceptions where these requirements are not met for short distances (e.g., utility crossings). The design must comply Title 22 CCR requirements for separation of drinking water pipelines and non-potable water pipelines, or State approved variances.

SFPUC has encountered issues on other projects related to putting recycle water pipe into a drinking water ROW, even in cases where regulatory requirements are met. Preliminary discussions have been held with SFPUC to vet the viability of installing a purified water pipeline (approximately 24 to 28-inch diameter) within the BDPL ROW. Consideration of the use of the SFPUC ROW requires further investigation, but for the purpose of this study, an alignment in the SFPUC ROW would move forward as one of the options.

Any waivers for pipeline separation variances would need to be submitted to and discussed with the Division of Drinking Water, prior to receiving approval.

3. Design and Constructability Considerations

3.1. Easements and Right-of-Way (ROW)

ROW acquisitions and easements are anticipated to be a key project challenge given the number of above and below ground facilities that would be constructed as part of the project. The PureWater Peninsula Parties have dealt with many of these issues through other capital improvement projects and would apply similar methods to address obstacles as they arise. As easement and ROW acquisition challenges have the potential to greatly impact the project schedule, pre-planning of easement acquisition may be required to help ensure timely completion of the project.

At this time, it is assumed most of the pipeline alignments would be constructed in existing streets and ROW. The centerline of the alignment would not be identified in the BODR. Approximate locations for pump stations in this TM are assumed based on hydraulic requirements, desktop analysis of open space from Google Earth, and discussions with the PureWater Peninsula Parties. Pump station siting for the purified alignments would be further developed in the BODR phase with input from the PureWater Peninsula Parties.

3.2. Utilities

Utility considerations are based upon available record drawings and Geographic Information System (GIS) data provided by the PureWater Peninsula Parties. Comprehensive utility locating and identification of conflicts is not included in the BODR. It is assumed that trenchless methods, such as jack and bore, would be used in congested traffic and utility corridors to reduce construction disturbances and utility conflicts unless soil and/or groundwater conditions dictate the use of more intensive methods. Trenchless installation would also be used to cross any waterways and sloughs along the pipe alignments. Proper separation requirements must be maintained unless approved exceptions are granted.

3.3. Geotechnical

This section summarizes the general subsurface conditions that may impact planning and design of the conveyance facilities, based on a desktop study of available information. The general assumptions in this section are used inform the CEQA documentation and conceptual cost estimates that are included in the BODR. Additional geotechnical analysis would be conducted in future design stages.

Young Bay Mud (YBM) is present along the bay front, including along Redwood Shores. YBM is typically soft and highly compressible. The Upper Layer Sediments consist of consolidated bay muds and lie below the weaker YBM layer closest to the surface. These soils are typically more competent and better suited for construction. Considerations for construction include:

- **Piles:** Many of the structures at SVCW and San Mateo WWTP are constructed on deep piles to prevent settlement. In a recent SVCW project, RESCU Front of Plant (FOP) Project, SVCW drove piles on center every 8 ft. Some of these piles were as much as 110 ft deep. It is assumed that new structures in these areas, including pump stations, would be constructed with similar supports systems. Pile depths for structures as the purified water pipelines move away from the AWPF toward Highway 101 may reduce as the YBM and Upper Layer Sediments become thinner. Where possible, it is preferable to construct needed structures on existing piles (e.g., at abandoned tank sites at San Mateo WWTP).
- **Trenchless Pipeline Construction:** Trenchless crossings generally should be constructed at depths to avoid YBM. SVCW has had success mining through the Upper Layer Sediments on the recent RESCU Gravity Pipeline Project. It is assumed that the YBM layer extends to 80 feet below ground surface (bgs) at the Bay edge, then decreases linearly to 0 feet at Highway 101 (i.e., that YBM would not be encountered west of Highway 101). For the purposes of estimating costs and CEQA cyt/fill quantities BODR, a typical microtunneling pit is assumed to be 60 feet deep. Future geotechnical analysis would be required to determine depths for special crossings, which would be constructed beneath the bay mud layer.
- **Open Trench:** Excavation in YBM may require extensive shoring design and construction of shoring system(s) to address YBM weakness, specifically the floors of excavations in YBM.
- **Groundwater Control:** YBM typically has a high-water content and can exhibit the presence of sand lenses with connectivity to more porous formations or the Bay. Groundwater is expected but may be able to be controlled with sumps. At present, it is assumed that watertight shafts would be required for trenchless crossings in these areas.

3.4. Special Construction Methods

This section summarizes special construction methods that would likely be required for pipeline and pump station construction.

3.4.1. Trenchless Construction Methods

Trenchless construction methods may be employed to cross waterways, avoid existing utilities, and reduce community impacts. The Potable Reuse Exploratory Plan Phase 2 and Phase 3 reports identified areas where trenchless methods are anticipated. Key crossings of congested utility areas, busy intersections, highway crossings and sensitive areas for the tertiary effluent and purified alignments are assumed to require trenchless construction methods.

Table 3-1 includes a high-level summary of common trenchless methods that may be employed on the project. Descriptions of common trenchless methods are summarized below.

Table 3-1: Trenchless Construction Methods Summary

Method	Typical Length	Ground Considerations	Recommended Pure Water Peninsula Project Applications
Jack-and-Bore	< 1000 feet	**Suitable:** Stable cohesive soil above or slightly below groundwater **Unsuitable:** Loose or soft soils with groundwater above the tunnel horizon	Key crossings along purified alignments where groundwater is not present, only slightly above the tunnel horizon or is minimal in nature and can be controlled. Recommended as a lower-cost alternative to microtunneling. Access shafts or pits required. Casing pipe is typically steel.
Microtunneling	< 1,500 feet	**Suitable:** Loose to very dense sand, soft to hard clay/silt, rock; typically used where high groundwater exists **Unsuitable:** cobbles and boulders, mixed face conditions	Key crossings along San Mateo Tertiary and purified alignments where high groundwater is present and unable to be controlled. Watertight shafts required.
Horizontal Directional Drilling (HDD)	< 6,000 feet	**Suitable:** Clay, cohesionless sand/silt **Unsuitable:** Soils containing high amounts of open graded gravel (absence of fines), hard rock, cobbles and boulders, or very soft soils (e.g., Young Bay Mud)	Belmont Slough crossing for the San Mateo tertiary alignment, due to length of crossing. The YBM layer should be avoided or transitioned through with a conductor casing because HDD requires a soil matrix with enough strength that once amended with drilling mud would stay open allowing cuttings to be returned to the drill rig. High density polyethylene (HDPE) is commonly used for HDD installations, but other pipe materials may be suitable. Shafts are not required for this method.

Jack-and-Bore

Jack-and-bore (also known as auger boring) is a trenchless construction method in which a casing pipe is jacked through the soil from a drive shaft to a reception shaft. Installation involves a process of jacking the pipe forward into the ground while simultaneously excavating the soil, typically through use of an auger, until the casing reaches the reception shaft. After the casing pipe is installed, the carrier pipeline is pulled through the casing pipe, and the annular space is grouted.

Microtunneling

Microtunneling is a trenchless construction method that utilizes a remotely operated microtunneling boring machine (MTBM) at the face to excavate a tunnel while advancing a steel casing behind it between the jacking and receiving shafts. Watertight launching and receiving shafts are typically required at the entry and exit locations. As the MTBM advances, the excavated soil is transported back to the surface through a slurry system, which utilizes a mix of water and bentonite clay or other additives to transport the cuttings from the face. Once the MTBM reaches the receiving shaft it is removed, and the carrier or product pipeline is installed inside the casing within the tunnel and grouted in place.

Horizontal Directional Drilling (HDD)

Horizontal directional drilling (HDD) is a trenchless method that involves drilling a borehole along a predetermined path and widening it to the desired diameter with reaming tools. Access shafts are not required for this method. A combination of winches and the drilling machine are used to withstand the pulling force of the reaming tools as they are advanced through the length of the HDD alignment. Typically, plastic, steel or ductile iron piping used. Plastic pipe is fusion welded on the surface to create a continuous length of pipe that is pulled through the completed bore hole. Likewise, metallic piping is jointed at the surface and pulled through. Detailed calculations are required to determine the drag forces and necessary equipment size for successful pipe installation. Hydrofracture calculations are also required to establish the bore path depth along the alignment to prevent the surfacing of drilling fluids (typically bentonite clay), which must be carefully controlled to prevent spills, especially near environmentally sensitive areas such as Belmont Slough.

3.4.2. Special Shoring Methods and Ground Improvement

It is anticipated that special shoring methods would be required for construction due to the geotechnical conditions and presence of groundwater at some locations. It is assumed that such methods would be needed in areas with YBM due to its low shear strength. Examples of special shoring methods include jet grouting, micropiles, soil nailing, and soldier piles and lagging.

Tunneling near the Bay would require watertight shafts. This may be accomplished by various methods including slurry walls and secant piles. It is anticipated that ground improvement could be required outside the walls or piles to enhance soil stability.

3.4.3. Pipes Supported on Bridges or Structures

This section includes design considerations for pipes supported on existing bridges or similar structures. It is assumed that the San Mateo tertiary alignment would be supported on an existing water control feature to cross Seal Slough. Considerations for supported pipeline crossings include:

- **Bridge load capacity:** Detailed structural calculations should be performed during design to confirm that the existing structure can accommodate the added weight of the pipeline and any additional loads that may be placed on it.
- **Pipeline design:** The pipeline should be designed to withstand the stresses that may be placed on it due to the movement of the bridge, such as vibrations, and vertical and/or lateral movements. Estimates of the flexure of the bridge due to dynamic loadings should be developed and the pipeline design should accommodate these vertical deflections both at the abutments and along the span. Expansion joints should be installed to allow for movement and prevent stress on the pipeline. The pipeline should be supported on the bridge using suitable brackets and similar structural elements.

- **Access and maintenance:** Adequate access should be provided for maintenance and inspection of the pipeline and support structures. Existing access for vehicles, pedestrians, and other maintenance activities must be maintained.
- **Regulatory requirements:** Design should comply with all relevant regulatory requirements, such as building codes, safety standards, and pipeline separation requirements.

3.4.4. Reuse of Existing Pipelines

SVCW embarked on the Regional Environmental Sewer Conveyance Upgrade (RESCU) Program to replace and rehabilitate SVCW's gravity sewer conveyance system, resulting in some decommissioned pipelines in the project vicinity. In the early phases of the Project, the PureWater Peninsula Parties recognized that this creates an opportunity to repurpose these valuable assets by installing and/or sleeving/sliplining a new pipeline within the decommissioned conveyance pipe. Assets include the existing 54" and 48" diameter pipelines, as illustrated in Figure 3-1, which will be decommissioned as part of the RESCU Program.

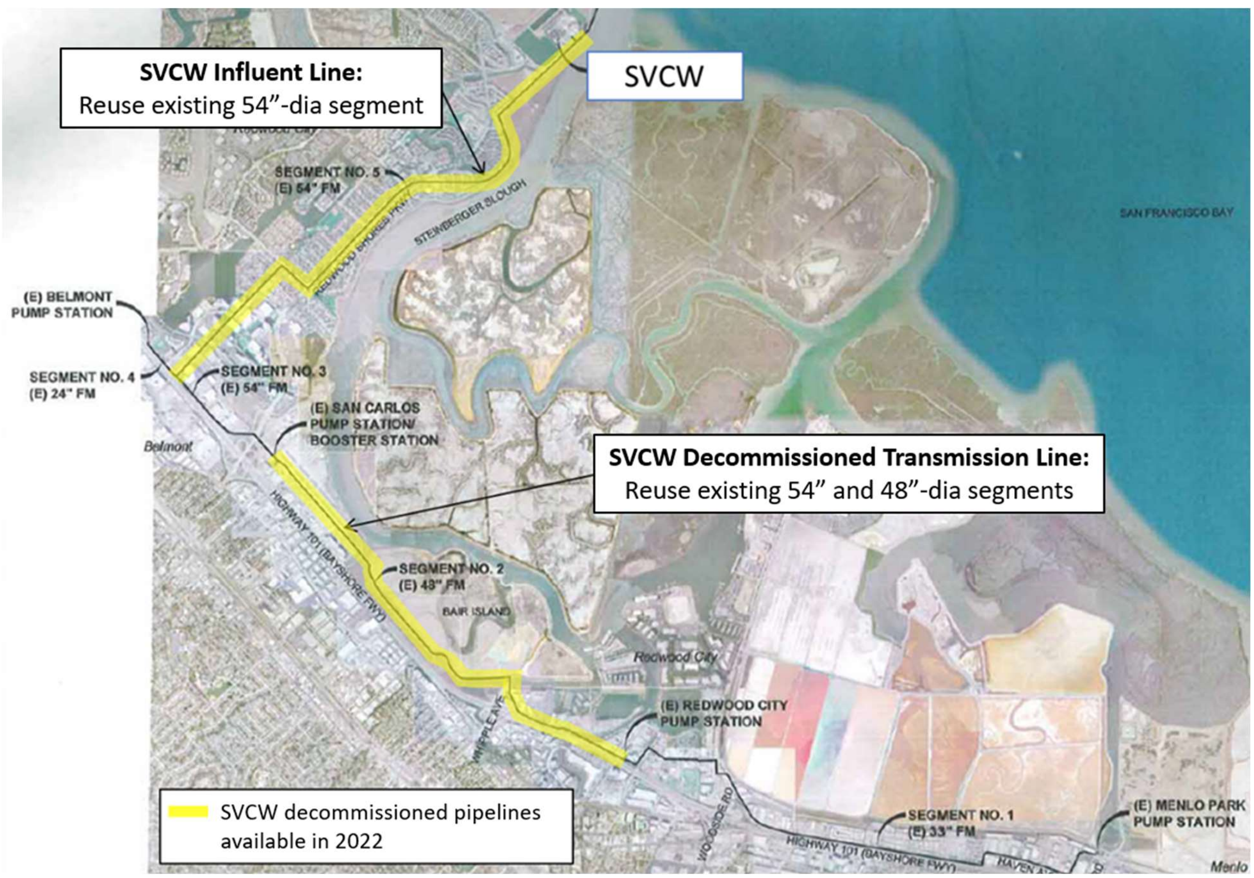
Sliplining is the process of installing a smaller diameter pipe within the existing larger pipe. The new pipe would be fused above ground and pulled through the existing pipes via access pits. It is assumed that the annular space between the new and old pipes would be grouted to provide additional support to the new pipe. Re-lining the pipes has been considered but deemed implausible due to the unknown structural condition of the existing pipes and the oversized diameter for the projected flowrates.

This TM assumes placement of a new pipeline would be installed within the decommissioned pipe, as described below:

- **SVCW's Decommissioned Influent Line** is a 54-inch diameter pipeline that will be decommissioned between mid-2023 and early 2024, as the new SVCW Conveyance system comes online. This segment is approximately three miles in length and traverses through the Redwood Shores area, a community that is particularly sensitive to new construction. The three purified water alignment options from the new AWPF to the connection with CSR are assumed to utilize sliplining in the 54-inch existing pipe to traverse this area. It is assumed that this decommissioned line would be repurposed for purified water Options 1-3. Additionally, the nothern potion of the pipeline within the SVCW fenceline could be used as a carrier pipe for the new RO concentrate pipeline.

- **SVCW's Decommissioned Conveyance Line** includes 48-inch to 54-inch pipeline segments that are to be decommissioned in the same timeframe referenced for the SVCW Influent Line. This segment is approximately 2.4 miles in length and passes through an environmentally sensitive area on Inner Bair Island (part of the Don Edwards San Francisco Bay National Wildlife Refuge managed by the US Fish and Wildlife Service), which would be a challenging and expensive stretch in which to lay new pipeline using open cut methods. A segment of the former SVCW 48-inch forcemain on Bair Island, now decommissioned and out of service, is subject to ground movement in poor soils and has exhibited joint leaks while in service and operating under pressure. This area of existing pipeline would require special design focus to be utilized as part of a complete sliplining casing. A significant portion of this 2.4-mile existing alignment of decommissioned pipeline is proposed to be utilized for purified water Options 1 and 3.

Figure 3-1: Potential Pipe Repurposing Segments



Technical considerations for pipeline repurposing are summarized below:

- **<u>Pipeline Material</u>:** Fusible PVC is recommended for pipe repurposing segments due to its pressure capacity, flexibility, durability, resistance to exterior surface abrasion, and jointless construction (see further discussion on pipe materials in Section 3.5.1). Segments of fused PVC pipe would be pulled through the existing decommissioned conveyance pipeline. Although flushing the existing lines would be performed prior to construction, contaminants may remain, and groundwater intrusion is expected. Jointless pipe installed inside the existing pipe would greatly reduce contamination risk. Care must be taken in design to prevent floatation of the polyvinyl chloride (PVC) pipe inside the existing pipeline repurposed to be a casing, since even filled with water, would float. The new PVC pipe would be stabilized inside the existing RCP sewer with grout.

- **Access Pits:** Access pits would be required at angle points in the carrier pipe to pull the new PVC through. It is assumed that access pits would be required every 1,000 linear feet and at angles of approximately 22.5 degrees or greater. The maximum length of a single reach is limited by the size of installation equipment that can be accommodated at the site. A small amount of water run through the existing pipe has also been considered in the past to alleviate scratching of the PVC pipe during sliplining installation and to reduce required pulling forces. The BODR drawings include approximate pit locations for CEQA document development.
- **Pipeline Connections:** At each access pit, PVC segments would be heat-fusion welded together to create a joint-free bond. For drinking water distribution system (DWDS) connections in Phase 2, new PVC could be fused to the purified waterline in a similar method. It is anticipated that this could be done during a shutdown of the AWPF and purified water line. Hot tapping is also possible, but more complex with PVC material, if a shutdown is not allowable.
- **Structural Considerations:** It is anticipated that the useful life of the existing casing pipe would be extended with the purified water pipeline in excess of 40 years. This would be accomplished by grouting the annular space once the purified waterline and other conduits (if any) are installed within the existing casing. It is assumed that the annular space would be grouted as part of the PureWater Peninsula Project. A condition assessment of the existing pipelines and structural analysis should be performed as part of future design phases.
- **Other Potential Uses of the Decommissioned Assets:** This conceptual design utilizes the decommissioned SVCW line(s) as casing pipes for the purified waterline, which would limit other potential uses for the decommissioned lines. Due to constructability constraints and pipeline separation requirements, installing multiple pipelines within these decommissioned lines is likely not feasible, with the exception of smaller-diameter utilities like communications conduits. If it is desired to collocate conduits with the new PVC pipe, it is advisable to install them simultaneously to avoid complications during installation. Attempting to pull additional utilities through the carrier pipe after installing the purified waterline would be challenging due to the twisting that occurs during installation. It is also recommended that the carrier pipe be grouted within the casing after initial install.
- **Operation and Maintenance Considerations:** It is anticipated that SFPUC would operate the purified water pipeline to the CSR. SFPUC currently does not have plastic pipelines in their system, and therefore does not currently have O&M resources available to maintain plastic pipe. Because the PVC pipeline would be grouted within the larger casing pipe, minimal maintenance is expected for the repurposed line segments. If PVC is installed in

other areas, such as the pipe segment between the two repurposed segments, additional O&M supplies and training would be required.

If sections of the existing pipe are identified to be unsuitable for sliplining, separate design and installation methods should be used depending on the conditions of the pipe.

3.5. Pipeline Design Assumptions

3.5.1. Pipeline Materials

There are several pipeline materials that may be suitable for the tertiary, purified, and RO concentrate pipeline applications. The challenge of locating pump stations in densely populated areas along the purified alignments from the AWPF to Crystal Springs Reservoir makes head loss and working pressures key considerations in pipeline material selection. Longevity and cost would also factor into pipeline material selections. It may be desirable to use different materials for different pipelines or pipeline segments, depending on the hydraulics, construction methods, site conditions, and costs.

This section provides a brief summary of the benefits and considerations for several common pipe materials: fusible HDPE, fusible PVC or PVC pipeline, and welded steel pipe (WSP).

HDPE

- Jointless construction reduces the chances of leaks and contamination. This is particularly important for segments in which new pipe would be installed within existing decommissioned pipelines.
- Reduced chance of leaks associated with HDPE pipe may allow for reduced clearances from nearby active pipelines in congested utility corridors.
- Due to its high flexibility and ductility, HDPE can achieve tighter bending radii than other pipe materials, making it suitable for construction methods like sliplining existing pipe and horizontal direction drilling (HDD). Because HDPE can bend and flex without breaking, it may also have reduced risks of catastrophic failure during seismic events.
- HDPE is durable and abrasion resistant. It is also resistant to both internal and external corrosion, eliminating the need for corrosion control for the pipeline. Proper consideration should be given to fitting materials that may be used to connect the pipe to other system components that can corrode.
- HDPE features relatively low internal friction, thereby reducing head loss and improving the system efficiency.
- HDPE is available in various pressure ratings, but it is not currently used as widely as other pipeline materials in the industry for high pressure applications of larger pipe diameters. Typical water transmission applications for 24- to 28-inch pipe go up to 80 psi, although higher pressure ratings available. Achieving higher allowable pressures with HDPE requires thick walls and leads to a significant reduction in cross-sectional area, and an increase in material and construction costs. Fusible HDPE of different pressure ratings may

be fused directly together using heat fusion welding and/or an electrofusion coupling since the pipe exteriors for differing wall thicknesses remains the same.

- Standard individual HDPE pipe lengths are typically 40 linear feet. Additionally, custom fabrications may be required for unusual wall thicknesses in larger diameters, including for pipe repurposing (sliplining) segments and trenchless crossings.
- Standard valves are available in sizes up to 12-inch. Custom valves would be required for larger diameter pipelines.
- SFPUC is expected to own and operate the pipelines to CSR. Currently, SFPUC does not have plastic pipelines in their system. If plastic pipelines are installed, additional O&M resources (materials, equipment, space, operator training, etc.) would be required to maintain the pipelines.

PVC / Fusible PVC

- Fusible PVC features jointless construction, which reduces the chances of leaks and contamination. This is particularly important for segments in which new pipe would be installed within existing decommissioned pipelines.
- Proven in industry for moderately high-pressure applications.
- Relatively low internal friction reduces head loss, improving the system efficiency.
- Stronger with thinner wall thicknesses and stiffer than HDPE, thereby requiring less material to achieve desired strength levels.
- PVC pipes require longer bending radii than HDPE.
- Resistance to both internal and external corrosion, eliminating the need for corrosion control for the pipeline. Proper consideration should be given to fittings that may be used to join the pipe or system components.
- Widely used for direct burial and trenchless installations.
- Fusible PVC allows for easier connections to existing agency pipelines that use PVC.
- SFPUC is expected to own and operate the pipelines to CSR. Currently, SFPUC does not have plastic pipelines in their system. If plastic pipelines are installed, additional O&M resources (materials, equipment, space, operator training, etc.) would be required to maintain the pipelines.

Welded Steel Pipe (WSP)

- Proven material for water transmission mains, including high and very high-pressure applications. Steel has a higher strength-to-weight ratio than non-metallic piping materials and is capable of withstanding higher pressures. Steel pipe is typically specified based on its nominal pipe size and wall thickness, which corresponds to different pressure ratings.

- WSP is the current standard for SFPUC water transmission mains. SFPUC Operations staff have experience in and resources for maintenance of WSP.
- May be used as casing pipe for trenchless crossings, such as microtunneling or jack-and-bore.
- Not feasible as a material for sliplining within existing pipelines.
- Susceptible to corrosion and may require cathodic protection in certain soils, such as YBM.
- Higher coefficient of friction than plastic pipe, resulting in increased friction losses in the system, however this is dependent on the internal lining material.

For the purposes of this conceptual design, it is assumed that the conveyance pipelines would be plastic (PVC and HDPE). Plastic pipe has a relatively low coefficient of friction, which reduces head and pumping energy required, and does not require corrosion control. PVC is recommended for the purified water transmission lines where higher pressures are expected. Fusible PVC is recommended where jointless construction is needed, such as within the pipeline repurposing segments, and could be used for the entire alignment. It is assumed that the San Matero Tertiary pipeline would be HDPE, which is typical for the HDD installations, and adequate for the operating pressures expected (fusible PVC could also be considered). HDPE is preferred for pipelines within the SVCW fenceline.

3.5.2. Depth of Pipe

The pipelines are assumed to be constructed with six feet of cover except where otherwise noted at key crossings. Assumed depths are presented in Table 3-2.

Table 3-2: Assumed Pipe Depths Summary

Construction Method	Location(s)	Pipeline(s)	Assumed Depth of Pipe
Pipe Repurposing (sliplining)	Redwood Shores Parkway, and Inner Bair Island (Purified Options 1 and 3)	Purified	Follows vertical alignments of existing carrier pipe.
Microtunneling	Major intersections where Young Bay Mud is present (assumed to be east of Hwy-101)	San Mateo Tertiary, Purified	Microtunneling in soil modified YBM or when feasible below the YBM layer. The thickness of the YBM layer is conservatively assumed to be 80' deep at the Bay's edge and decreases linearly to zero at Hwy-101.
Jack-and-Bore	Major intersections where groundwater intrusion is not expected	Purified	8 - 20 feet
Horizontal Direction Drilling (HDD)	Belmont Slough	San Mateo Tertiary	As required to cross the slough bottom and avoid Young Bay Mud. Additional studies required.
Pipe Support	Seal Slough crossing	San Mateo Tertiary	Supported on top of the existing water control feature.
Open Trench	All other locations	All	6 feet to top of pipe.

3.5.3. Appurtenances

Locations and design would be determined in future design phases and would follow applicable design standards.

Line Valves

Line valves would be installed to isolate and depressurize pipeline segments for repairs, modifications, inspections, and maintenance. Line valves for transmission pipelines would be placed a maximum of one-half mile apart. Pipelines 16-inches or greater shall utilize butterfly valves. However, plug valves or ball valves may be used in high-pressure locations. Valves rated for higher pressures may be available, but may not be covered by AWWA Standards, in which case valve specifications would be prepared by a licensed engineer.

Blowoffs

Blowoff assemblies would be installed to allow for flushing of accumulated sediments and draining sections of the pipeline for repairs, modifications, maintenance, and inspection. Blowoff assemblies would be installed at low points of the pipeline and at line valve locations. The blowoff assembly discharge would be directed away from the pipeline into a nearby storm drain or other non-erodible surface drainage channel to eliminate the potential for erosion, flooding and ponding. Dechlorination and other requirements may be a condition of release of water from the blow-offs into the environment.

Air and Vacuum Valves

It is assumed that Combination Air and Vacuum Valves (CAVs) would be used on all distribution and transmissions mains to manage air and vacuum pressures. CAVs shall be installed at high points or on the down slope or low side of closed valves when closure of the valve creates a localized high point. CAVs shall also be installed above grade within a secure enclosure outside of the traveled way.

CAVs should be sized as needed to release air during filling of the pipeline, to release small quantities of air during operations, to admit air as the pipeline is being drained, and to admit air in case of a potential line break and to prevent pipeline collapse. Air valves should be sized in accordance with the manufacture's recommendations to admit air into the pipeline at a rate equivalent to the maximum water discharge rates of blowoffs installed down-slope. Calculations to determine the required size should be performed during detailed design.

Flow Meters / Flow Control Valves

It is anticipated that flow meters and modulating flow control valves would be installed along the pipelines at connection points to facilities at the San Mateo WWTP, SVCW site, Pulgas DF, and at intermediate pump stations along the purified alignments. See Section 3.8 for instrumentation and control considerations.

Cathodic Protection

The tertiary, purified, and RO concentrate pipelines would likely be subject to corrosive soils, including YBM. Cathodic protection may be required on the metallic piping (if any) and valves but is not required for plastic pipe such as PVC and HDPE.

Further geotechnical and cathodic protection investigations should be conducted during detailed design to identify what portions of the pipeline require cathodic protection and whether an active and/or passive cathodic protection system is required. Insulating flange kits should be installed between catholically protected and non-protected sections of the pipeline and at all blowoffs and air/vacuum relief valves. SFPUC staff report that they typically install active cathodic protection systems on the welded steel transmission lines in the area.

3.6. Surge Considerations

Surge typically occurs when pumps for pressure pipelines turn on or off, or when valves on pressure pipelines close too quickly. Surge analyses would need to be performed during future design phases to ensure adequate protection of the pipelines and pump stations. In particular, the purified transmission pipeline would feature pump stations in series, and DWDS takeoffs along the length of the pipeline. It was assumed that that there would not be space available to break head, so surge conditions would need to be evaluated.

In general, there are several ways to protect pumps and pipelines in the event of surge, including:

- Install CAVs along the pipeline sized to relieve the pressure or prevent damaging vacuum or compressed air conditions within the pipeline.
- Select pipeline with required thickness designed to withstand the surge pressure. Typically, PVC can withstand surges up to 150 percent of the rated pressure.
- Install slow closing valves to prevent surges.
- Install surge tanks near pump stations – this option is likely not suitable for all booster pump station (BPS) locations due to space constraints (particularly for purified water line booster pump stations). A surge tank could be installed at the AWPF.
- Start pumps at high-head pump stations against a closed valve that slowly opens over time and stop pumps only after these same valves close slowly to a fully closed position. These valves are often termed high-head pump control valves.

The choice of any surge protection device(s) would need to be coordinated with the pump selection and operating strategies during detailed design.

3.7. Electrical

Availability of power would need to be evaluated at the AWPF, SM WWTP, and the potential booster pump station locations. Estimated power requirements for the booster pump stations are summarized in Section 4.

The SVCW site would provide power to the AWPF and the SVCW Tertiary Effluent PS, RO Concentrate PS, and Purified Water PS. SVCW currently receives its electricity from PG&E. It is anticipated that the AWPF and pump stations located at the SVCW site would require a separate PG&E meter and backup generator. Solar panel installation on available rooftops could fulfill some of the power demands needed for the AWPF. Coordination with PG&E should be initiated as soon as possible, as new service with PG&E would require a system impact study (SIS) to determine the capacity of the existing infrastructure, any inefficiencies, and what would be needed to meet new service requirements.

The San Mateo Tertiary PS would receive power from the San Mateo WWTP. It is assumed that the pumping power demands would be relatively small compared to that of the overall plant operations. A separate PG&E meter and backup standby generator may be required.

The purified water alignments would require between one and three intermediate booster pump stations (in addition to the Product Water Pump Station at the AWPF) depending on the preferred alignment. New power connections would be required for the pumps and related equipment (SCADA, power, valves, lighting, etc.). Backup power could also be installed, if desired.

3.8. Instrumentation, Controls and SCADA

The PureWater Peninsula Project t facilities would require instrumentation and controls to communicate with SVCW, San Mateo, SFPUC's Regional Water System (SFRWS), the Pulgas DF, and the drinking water distribution systems of Redwood City, Cal Water, and MPWD. Instrumentation and controls would be critical to meeting regulatory requirements and optimizing operations. Examples include:

- **Communication with SFPUC to manage water balance in the SFRWS.** Purified water produced would provide a new input to SFPUC's SFRWS and would essentially displace flows that would otherwise be sent to CSR or to drinking water systems to meet local demands. The PureWater Peninsula Project would allow the SFRWS to store more water when adequate storage exists. However, during wet periods and wet years, when SFRWS storage is full, the AWPF may ramp down or shut down to avoid "spilling" water from the upcountry system. Thus, incorporating the purified water as an input to SFPUC's Hetch Hetchy Local Simulation Model (HHLSM) and overall SFRWS operation control strategies is critical. Control logic to ramp down or stop purified water production would need to be established as part of future operational strategies and procedures.
- **Integrated controls between the AWPF and the tertiary pump stations at SVCW and San Mateo.** Communication and control of source water to the AWPF would be important to control purified water inflows and provide adequate effluent flows to dilute the RO concentrate prior to discharge via SVCW's outfall. The levels in the AWPF influent tanks could control the tertiary effluent pumps.
- **Communication between the AWPF, SFPUC's Pulgas DF, and local treated drinking water systems**. Communication and control of purified water flows would inform pump station operations and all recipients of purified water. Pulgas DF operations would need to prepare for the impact of consistent, ramp down, or shut down scenarios from AWPF operation. Local drinking water systems (Redwood City, Mid-Peninsula Water District and Cal Water) would need to confirm available storage in tanks, reservoirs, transmission pipelines that receive purified water directly. Information would need to be relayed back to the AWPF if purified water could not be accepted, as this would require ramping down, shutting down, cycling or discharging from the AWPF. Control inputs would likely include tank levels, transmission line flows and other operational logic.

Instrumentation and Control (I&C) would be achieved through flow and water quality meters, flow control valves, pressure regulating valves, online sensors, SCADA system modifications, and other tools for communication. I&C design considerations are documented in the BODR and would be further defined in future design phases.

4. Conceptual Conveyance Design Criteria

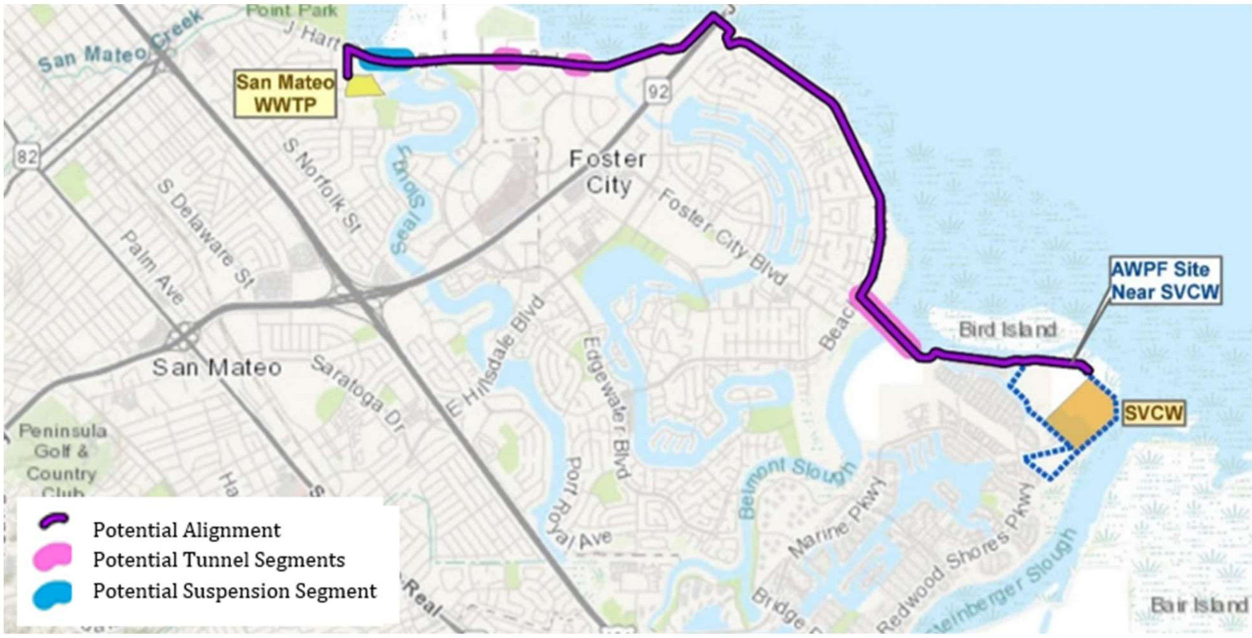
This section includes preliminary design criteria for the conveyance facilities, which are used inform the preliminary CEQA documentation and cost estimating efforts in the BODR. Full design criteria tables are included as Appendix A.

4.1. San Mateo Tertiary Effluent Alignment to AWPF

A new pump station and 24-inch pipeline would convey tertiary effluent from the San Mateo WWTP site to the Influent Tanks at the new AWPF as shown in Figure 4-1. The pipeline alignment would run primarily along the Beach, Park Blvd., parallel to the levee, to the new AWPF influent tanks at the SVCW site. Another short pipeline may be required at the San Mateo WWTP site to convey the tertiary effluent from the existing facilities to the new pump station.

For this TM, it is assumed that up to 9 mgd of San Mateo effluent would be pumped to the AWPF in Phase 2.

Figure 4-1: San Mateo Tertiary Alignment



Siting Considerations

- Improvements to the San Mateo WWTP are currently underway. Several facilities are designated to be abandoned in place in the southeast corner of the site. These locations may be suitable for the new San Mateo tertiary pump station. Siting for the San Mateo Tertiary PS and connection to existing facilities are refined in the BODR.
- San Mateo operates and maintains the Seal Slough Lagoon, adjacent to the WWTP as shown in Figure 4-2, with permits from the Army Corp of Engineers (ACOE), California Department of Fish and Wildlife (CDFW), and the Regional Water Quality Control Board (RWQCB). San Mateo owns a water control feature that spans the slough, known as the North Structure, which also includes a pedestrian walkway and fishing platform. The structure supports several utilities, including a 14" HDPE sewer force main, 3" water line, and telephone and electrical conduits. Foster City has a temporary 6" potable waterline that supplies water to parcels to the east of the new SM WWTP site and the City of San Mateo's storm water pump station. The temporary line currently is buried for the majority of the length, except for the segment that crosses Seal Slough, which has been placed at grade along the existing pedestrian pathway. Foster City and San Mateo are evaluating making this 6" water line a permanent supply line that will potentially get mounted to the side of the control structure.

Separation requirements between a new tertiary effluent line and potable water lines supported on the structure would need to be met. It is assumed that the SM tertiary pipeline can be supported on this structure, shown below.

- The alignment is planned to be within the public ROW, however, a survey of nearby property boundaries should be conducted to verify no private property crossings. The survey should also locate all existing utilities within the ROW to eliminate potential utility conflicts and congestion.

Figure 4-2: Seal Slough Crossing - North Structure

- There are several large utilities that cross under Seal Slough, including a 72" RCP outfall. If supporting the SM tertiary pipeline on the North Structure is not feasible and tunneling is required, separation from these existing lines must be maintained.
- Another key challenge of the alignment is the Belmont Slough crossing, shown in Figure 4-3 which is an environmentally sensitive area near the bay. HDD is recommended for this crossing, but feasibility of this approach would need to be assessed further in a future study. Key areas of future study include identifying adequate construction access for the receiving pit on the south side of Belmont Slough and confirming that the soil in the area could provide sufficient resistance forces for HDD. Foster City Boulevard could serve as a suitable laydown area for the fused pipe prior to pulling it through the borehole. This crossing is expected to require coordination with multiple agencies. PG&E has power lines and access pathways in Belmont Slough in the vicinity of the alignment. The receiving pit would likely be in the vicinity of the levees, and construction would need to be carefully coordinated with the proper agencies to ensure the integrity of the levees is not compromised.

Figure 4-3: Belmont Slough Crossing

Construction Methods

- **Open Trench -** The majority of the pipeline alignments would be constructed in an open trench. Special shoring methods may be required due to groundwater and subsurface conditions in the YBM near the bay front.
- **Seal Slough Crossing** – It is assumed that the tertiary pipeline would be supported on the North Structure. Constructability of this crossing depends on future detailed review of the bridge design, and ability to maintain separation requirements from the existing sewer force main. This crossing is preferable to the East 3rd Ave Bridge, which is owned and operated by Caltrans and would be more complicated and costly. Tunneling could be performed as an alternative construction method if the North Structure crossing is found to be infeasible.
- **Belmont Slough Crossing -** Horizontal direction drilling is recommended for the Belmont Slough crossing, which is approximately 4,000 LF long and in an environmentally sensitive area. The resulting pipe vertical alignment would follow an arced path beneath the slough and act as a siphon, which is operationally feasible since the flow from SM WWTP would be pumped. Management of air in the pipe at the transition points would follow typical design criteria for vacuum valves and blow-offs.
- Tunneling methods to be determined in design are recommended for other key crossings, such as major intersections. The tunneling method would be dependent on soil information, groundwater depth and transmissivity and other factors.

Pipeline Design Criteria

Preliminary San Mateo tertiary pipeline design criteria are presented in Table 4-1.

Table 4-1: Preliminary Design Criteria - San Mateo Tertiary Pipeline

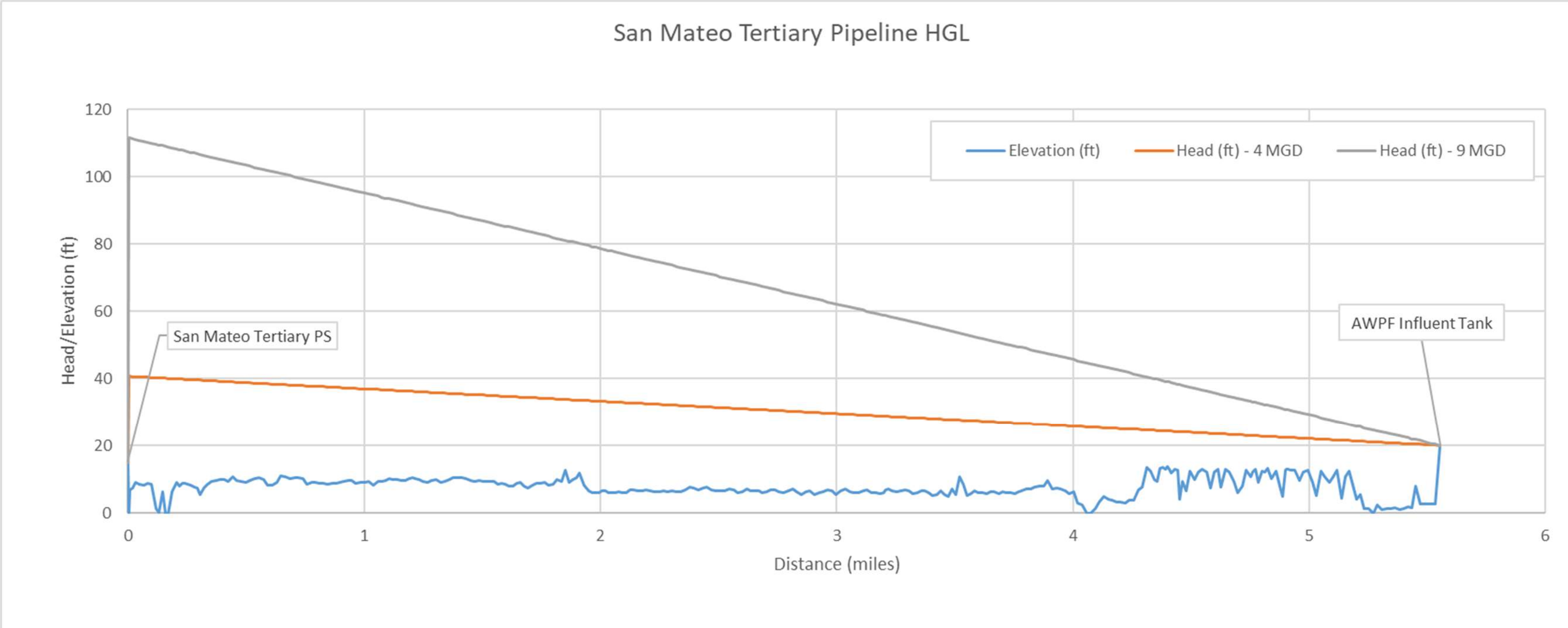
Parameter	Unit	Phase 1	Phase 2
Maximum Design Flow	mgd	4.0	9.0
	gpm	2,778	6,250
Minimum Flow	mgd	2.0	4.0
	gpm	1,386	2,778
Pipe Length	miles	5.51	
	ft	29,750	
Assumed Pipeline Material	-	HDPE	
Pipe Pressure Class	-	DR21	
Pressure Rating	psi	100	
Hazen-Williams Coefficient	-	150	
Nominal Pipe Diameter	in	24	
Inside Pipe Diameter	in	21.58	
Pipe Velocity at Design Max Flow	fps	2.4	5.5
Pipe Velocity at Design Min Flow	fps	1.2	2.4
Static Head	ft	10	10
Design TDH at Max Flow	ft	21	91

Notes:
1. Minor losses assumed to be less than 10% of friction losses.
2. Static head estimated based on approximated tank levels/elevations. Operating conditions within the tanks would need to be further evaluated in detailed design.

Hydraulics & Pump Station

Figure 4-4 shows the ground surface elevation and preliminary hydraulic grade line for the San Mateo tertiary alignment. Except for Seal Slough and Belmont Slough, the topography is relatively flat with elevations ranging from about 6’ to 14’. Because the alignment does not have significant static head, the total dynamic head would be governed primarily by headloss and would vary greatly between Phases 1 and 2. It may therefore be preferable to install smaller pumps in Phase 1 and larger pumps in Phase 2. The smaller pumps could also provide operational flexibility and turndown in Phase 2.

Figure 4-4: San Mateo Tertiary Hydraulic Grade Line



Pump station design criteria are presented in Table 4-2. Because the TDH is relatively low, pump selection should be refined during detailed design to ensure that small changes in head do not cause large fluctuations in flow. Conceptual pump design criteria are included below for the purposes of estimating space and power requirements.

Table 4-2: Preliminary Design Criteria - San Mateo Tertiary PS

Parameter	Unit	Phase 1	Phase 2
Pump Station Design Point at Max Flow	-	2,770 gpm @ 21'	6,250 gpm @ 91'
Small Pumps			
Number of Duty Pumps	-	1	1
Number of Standby Pumps	-	1	1
Design Flow Per Pump (Small)	gpm	2,771	2,771
Design Flow Per Pump (Small)	gpm	26	26
Pump Type	-	horizontal	horizontal
Pump Speed	-	VFD	VFD
Pump Efficiency	%	80%	80%
Drive Efficiency	%	90%	90%
Pump Brake Horsepower	hp	18	18
Calculated Pump Horsepower	hp	20	20
Assumed Motor Horsepower Design	hp	30	30
Large Pumps			
Number of Duty Pumps	-	-	1
Number of Standby Pumps	-	-	1
Design Flow Per Pump (Large)	gpm	-	6,250
Design Head Per Pump (Large)	ft	-	97
Pump Type	-	-	horizontal
Pump Speed	-	-	VFD
Pump Efficiency	%	-	80%
Drive Efficiency	%	-	90%
Pump Brake Horsepower	hp	-	179
Calculated Pump Horsepower	hp	-	199
Assumed Motor Horsepower Design	hp	-	225
Power Required (Pumping Only)	kW	15	149

Notes:

1 Design assumes one smaller pump would be used for lower flow scenarios (including Phase 1) and one larger pump would be used for higher flow scenarios in Phase 2. Hydraulic modeling should be performed during detailed design to consider the full range of flow scenarios. Due to the low static lift, it may be necessary to induce head in the system to operate the pump station.

4.2. SVCW Tertiary Effluent Alignment to AWPF

The SVCW tertiary pump station and pipeline would convey SVCW tertiary effluent to the AWPF Influent EQ Tanks, where it would be blended with San Mateo tertiary effluent. Several tie-in options to the existing facilities may be considered for conveying the SVCW tertiary effluent to the AWPF Influent EQ Tanks. The following three options for tertiary effluent connection points were considered and are further described in this section:

- SVCW Tertiary Option 1 - Connect to SVCW Outfall
- SVCW Tertiary Option 2 - Connect to RWC 42-Inch Filtered Water Line
- SVCW Tertiary Option 3 - Connect to 30-Inch RWC Recycled Water Line

These SVCW tertiary options are summarized in Table 4-3.

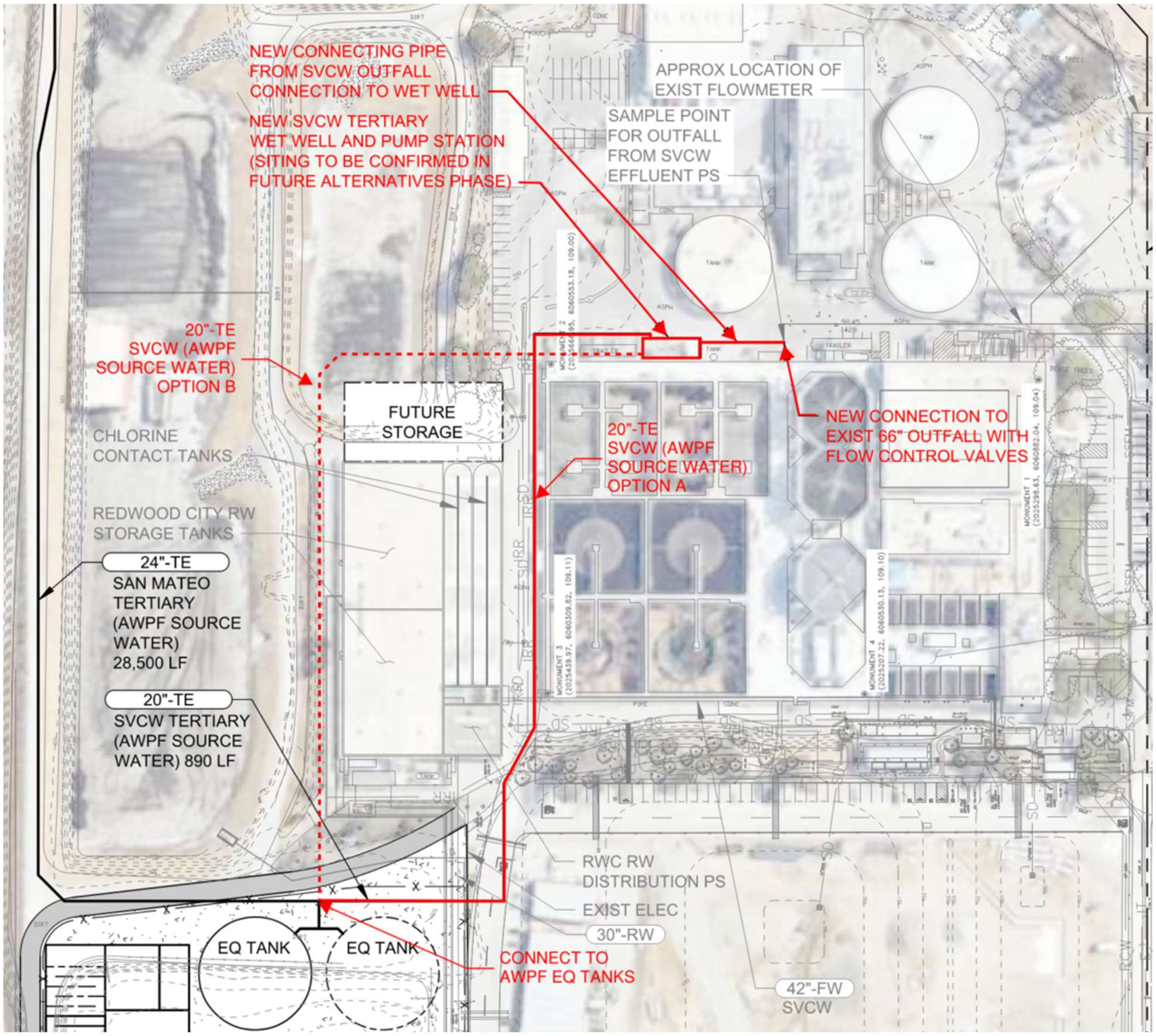
SVCW Tertiary Option 1 - Connect to SVCW Outfall

SVCW is currently upgrading their Final Effluent Pump Station, which conveys tertiary effluent directly to the 66-inch outfall. A new connection could be made to the outfall, downstream of the final effluent pumps (see Figure 4-5). A new SVCW Tertiary Pump Station would be required to overcome the static head (due to depth of the outfall) and to convey the water into the AWPF EQ Tanks. It is assumed that the new pump station would include a wet well to break head from the existing low pressure outfall system. The short pipe segment between the outfall and the wet well could be sized large to ensure that water could be conveyed to the wet well using the existing system head. This BODR assumes vertical turbine pumps could be installed, although horizontal or submersible pumps could also be considered. The new wet well could have a flow control valve. It is assumed that flow control would also be required on the existing 66-inch outfall line, so that adequate flow could be directed to the new wet well and pumps.

A key benefit of this approach is that it would have fewer impacts on the operations of the Final Effluent Pump Stations. Because the Final Effluent Pumps are sized for a maximum capacity of 80 mgd, the pump station has limited turndown. There is limited space in the existing wet pit and Final Effluent Pump Station area to install jockey pumps and piping modifications that would likely be required with the other options.

Challenges associated with this option include locating the new wet well / pump station, and constructability challenges to make the new connection to the outfall and install flow control. It would also require a longer pipeline to the AWPF, through congested areas.

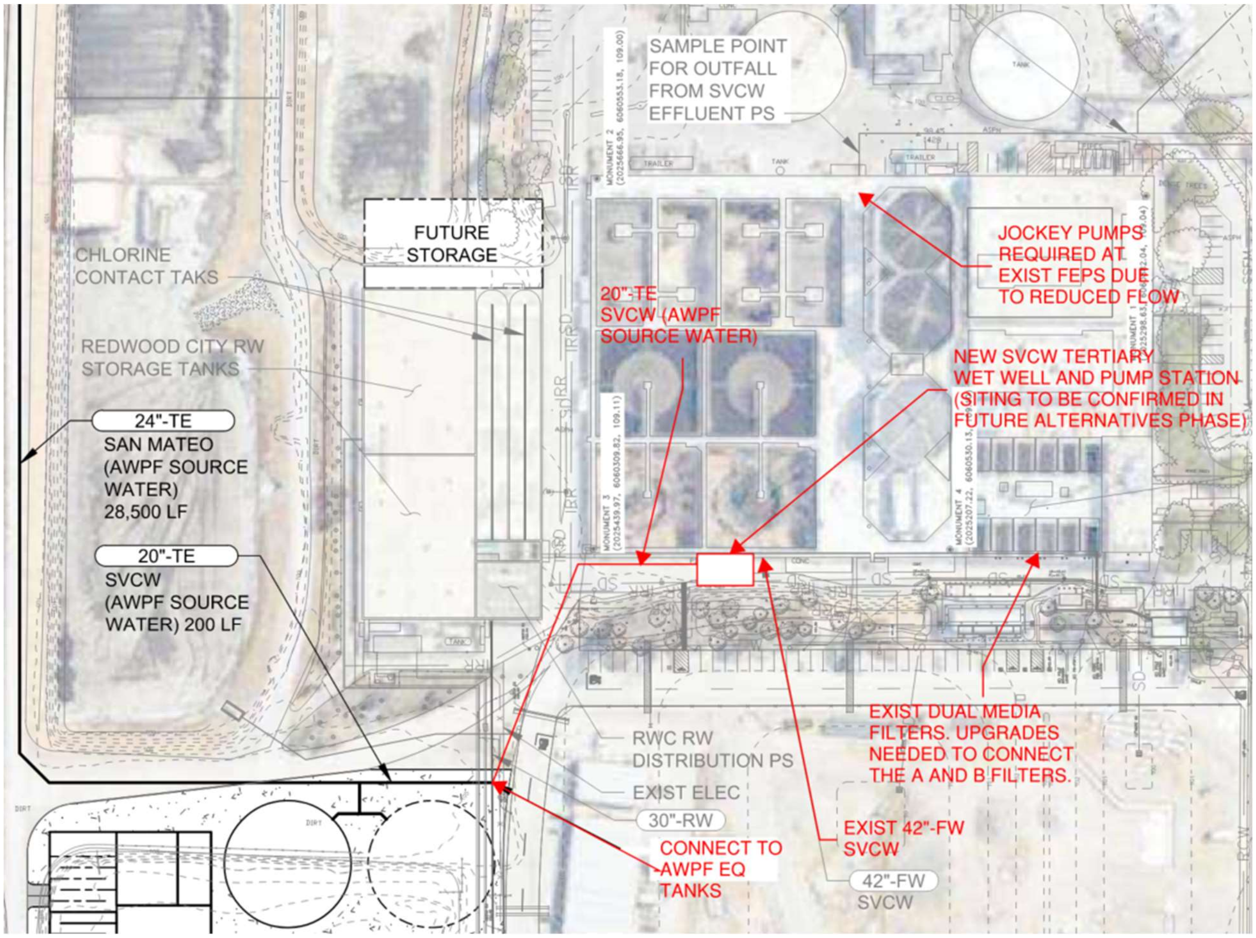
Figure 4-5: SVCW Tertiary Option 1 - Connect to SVCW Outfall



SVCW Tertiary Option 2 - Connect to RWC 42-Inch Filtered Water Line

Connect to existing 42-inch gravity line that conveys water from the dual media filters to the other RWC facilities (see Figure 4-6). This pipeline goes past the AWPF site, which could reduce the pipeline length required. However, a new pump station would be needed to provide head from the gravity line. Given site space constraints, it could be preferable to install a longer length of pipeline. Currently, only half of the dual media filters are operational. The filters would need to be upgrades and a new connection to the existing 42-inch line would be required. Because the existing Final Effluent Pump Station has limited turndown, new jockey pumps would be required in the existing FEPS area to handle the lower range of flows to the SVCW outfall.

Figure 4-6: SVCW Tertiary Option 2: Connect to RWC 42-Inch Filtered Water Line



SVCW Tertiary Option 3 - Connect to RWC 30-Inch Recycled Water Line

Connect to existing 30-inch recycled water pipeline downstream of the RWC treatment facilities (see Figure 4-7), resulting in the shortest new pipeline length. Conveyance of SVCW tertiary effluent would be limited by the upstream processes, including the dual media filters and chlorine contactors. This approach would also require all the tertiary effluent to be treated to recycled water standards, regardless of whether it was going to the AWPF or to RWC's recycled water system. While the AWPF processes could treat this water, it would waste chemicals.

Figure 4-7: SVCW Tertiary Option 3 - Connect to 30-Inch Recycled Water Line

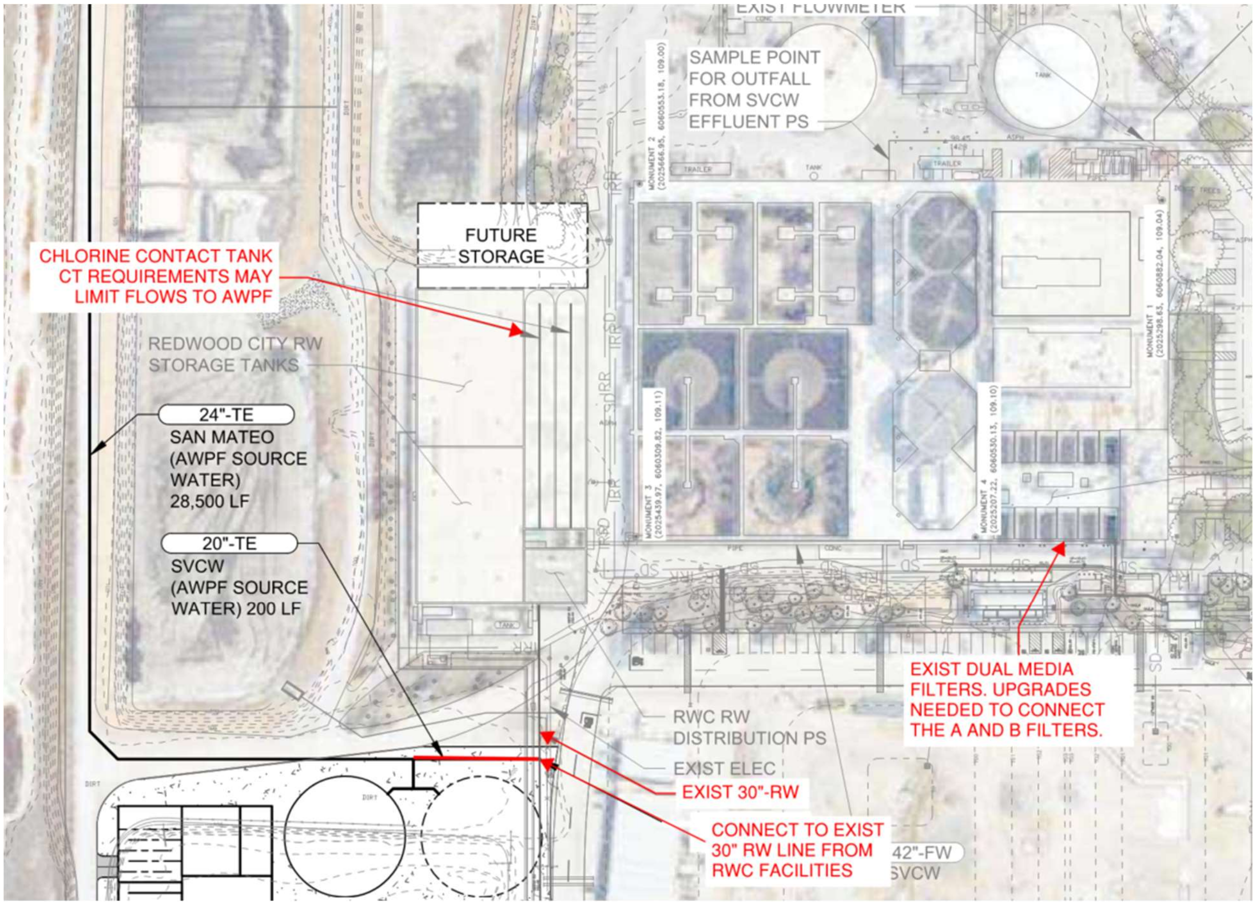


Table 4-3: Comparison of SVCW Tertiary Option Points of Connection

Option	Pros	Cons
Option 1 – Connect to SVCW Outfall	• Fewer impacts to existing SVCW FEPS by connecting to discharge side. • Would operate independently of RWC RW system (with the exception that all the options are indirectly impacted by sharing the same source water as the RWC system).	• Constructability challenges to site a new wet well and pump station. • Constructability challenges to connect to the existing outfall, which is deep, and to install flow control on the existing outfall. • Would likely require installing a new flow control valve on the existing 66-inch outfall line.
Option 2 - Connect to RWC 42-inch Filtered Water Line	• Would not rely on capacity of all RWC RW facilities (compared to Option 2b). • Potential operational benefits of having additional storage in the existing/future recycled water tanks.	• Would require modifications to the SVCW FEPS (jockey pumps to accommodate lower flows). Significant space and constructability challenges. • Would require modifications to dual media filters and connection to existing 42-inch line, which would be challenging from a constructability standpoint. • Capacity would be limited by dual media filters.

Option	Pros	Cons
		• Would require a new pump station since the 42-inch line is gravity-fed. Siting for new pump station could require a longer pipeline. • Would require higher levels of coordination between RWC and SVCW to operate.
Option 3 - Connect to 30-inch Recycled Water Line	• Shortest pipeline alignment. • Could utilize RWC's existing DPS pump station (existing facility includes provisions for future buildout of additional pumps). • Potential operational benefits of having additional storage in the existing/future recycled water tanks.	• Would require modifications to the SVCW FEPS (jockey pumps to accommodate lower flows). Significant space and constructability challenges. • Would require modifications to dual media filters and connection to existing 42-inch line. • Capacity limited by capacity of RWS RW system, including dual media filters and chlorine contact time for RW requirements. • Because 30-inch RW pipeline is shared with RWC recycled water, AWPF Source Water would be treated to recycled water standards (additional chlorine costs). • Would require higher levels of coordination between RWC and SVCW to operate.

For the purpose of this BODR, it is assumed that connecting to the outfall (Option 1) would be the preferred approach. While this option includes constructability and siting challenges for the new facilities, it has fewer impacts to the Final Effluent Pump Station operations. It would avoid the need for modifications to upstream processes at SVCW or the RWC facilities, which would present different space and constructability challenges. The routing options and associated upgrades should be considered in greater detail as part of a future detailed alternatives analysis.

Siting Considerations

- Siting for the SVCW tertiary alignment and pump station would be developed as part of the AWPF siting package and included in the BODR.

Construction Methods

- Open trench. Special shoring methods may be required due to groundwater and subsurface conditions near the bay front.

Pipeline Design Criteria

The preliminary SVCW tertiary pipeline design criteria are presented in Table 4-4.

Table 4-4: Preliminary Design Criteria - SVCW Tertiary Pipeline

Parameter	Unit	Phase 1	Phase 2
Maximum Design Flow	mgd	4.0	8.0
	gpm	2,771	5,542
Minimum Flow	mgd	2.0	4.0
	gpm	1,386	2,771
Pipe Length	miles	0.17	
	ft	890	
Assumed Pipeline Material	-	HDPE	
Pipe Pressure Class	-	DR21	
Pressure Rating	psi	100	
Hazen-Williams Coefficient	-	150	
Nominal Pipe Diameter	in	20	
Inside Pipe Diameter	in	18	
Pipe Velocity at Design Max Flow	fps	3.5	7.0
Pipe Velocity at Design Min Flow	fps	1.8	3.5
Static Head	ft	14	14
Design Total Dynamic Head	ft	17	23

Notes: Minor losses assumed to be less than 10% of friction losses.

Hydraulics

The head required to fill the new AWPF Influent Tanks would be primarily governed by the operational elevations in the AWPF Influent Tanks, and in the existing upstream tertiary storage tanks (e.g., the existing Redwood City Recycled Water Tank). It was assumed that an existing pressurized pipeline such as the 30" Recycled Water line would be tapped to feed the AWPF, eliminating the need to construct an additional pump station at the SVCW site. It is assumed that the connection to the influent tanks would be made near the top of the tank with an air gap.

4.3. RO Concentrate Alignment to SVCW Outfall

The advanced treatment of wastewater for potable reuse using RO membranes produces reject water (herein referred to as the RO concentrate) for disposal. It is assumed that the RO concentrate would be discharged via SVCW's existing outfall pipeline to the SF Bay. For the purposes of this TM, it is assumed that dilution of the RO concentrate would not be required prior to connection to the existing outfall. This assumption is based on current regulations and an AWPF influent water that is 50% from San Mateo and 50% from SVCW. Discharge requirements and operational considerations related to SVCW's outfall, which would inform total blended flows for the pipeline, would be discussed in the future RO Concentrate Disposal TM.

The AWPF includes a new RO concentrate pump station. A short, open trench pipeline would be constructed on the SVCW site to convey RO concentrate to the 60- to 66-inch outfall. Additional details regarding the flows, water quality, blending, regulations, and other considerations are included in **TM #3 – RO Concentrate Disposal.**

Siting Considerations

- The RO concentrate pump station would be located adjacent to the AWPF, near the RO trains.
- Three potential routing options are identified in **TM #3 – RO Concentrate Disposal**
- The preferred tie-in location to the outfall is discussed in the BODR.

Construction Methods

- Open trench. Special shoring methods may be required due to groundwater and subsurface conditions near the bay front.

Pipeline Design Criteria

Preliminary RO concentrate pipeline design criteria are shown in Table 4-5. The design criteria are further developed in **TM #3 – RO Concentrate Disposal** and presented in the BODR.

Table 4-5: Preliminary Design Criteria – RO Concentrate Pipeline

Parameter	Unit	Phase 1	Phase 2
Maximum Design Flow	mgd	1.4 (2.9 with dilution[1])	2.9
	gpm	993	1,986
Minimum Flow	mgd	0.7	1.4
	gpm	1,386	2,771
Pipe Length	miles	0.4	0.4
	ft	2,200	
Assumed Pipeline Material	-	HDPE	
Pipe Pressure Class	-	DR 21	
Pressure Rating	psi	100	
Hazen-Williams Coefficient	-	150	150
Nominal Pipe Diameter	in	12	12
Pipe Velocity at Design Max Flow	fps	2.4	4.5
Pipe Velocity at Design Min Flow	fps	4.3	8.6
Design TDH	ft	20	23

Notes:

1. During Phase 1, up to 1.5 mgd dilution water could be needed to meet NPDES limits for ammonia in the scenario that only AWPF source water from SVCW is available. See TM 3 Section 5.1.2. for additional discussion. During Phase 2, due to limited availability of dilution water at maximum Phase 2 design capacity, it is assumed that the preferred operational strategy to meet NPDES regulations for ammonia and other constituents that approach the NDPES limit would be to shift the AWPF source water ratio to a higher percentage of San Mateo tertiary effluent rather than reducing AWPF production and diverting dilution water to the RO Concentrate PS wet well.

Hydraulics & Pump Station

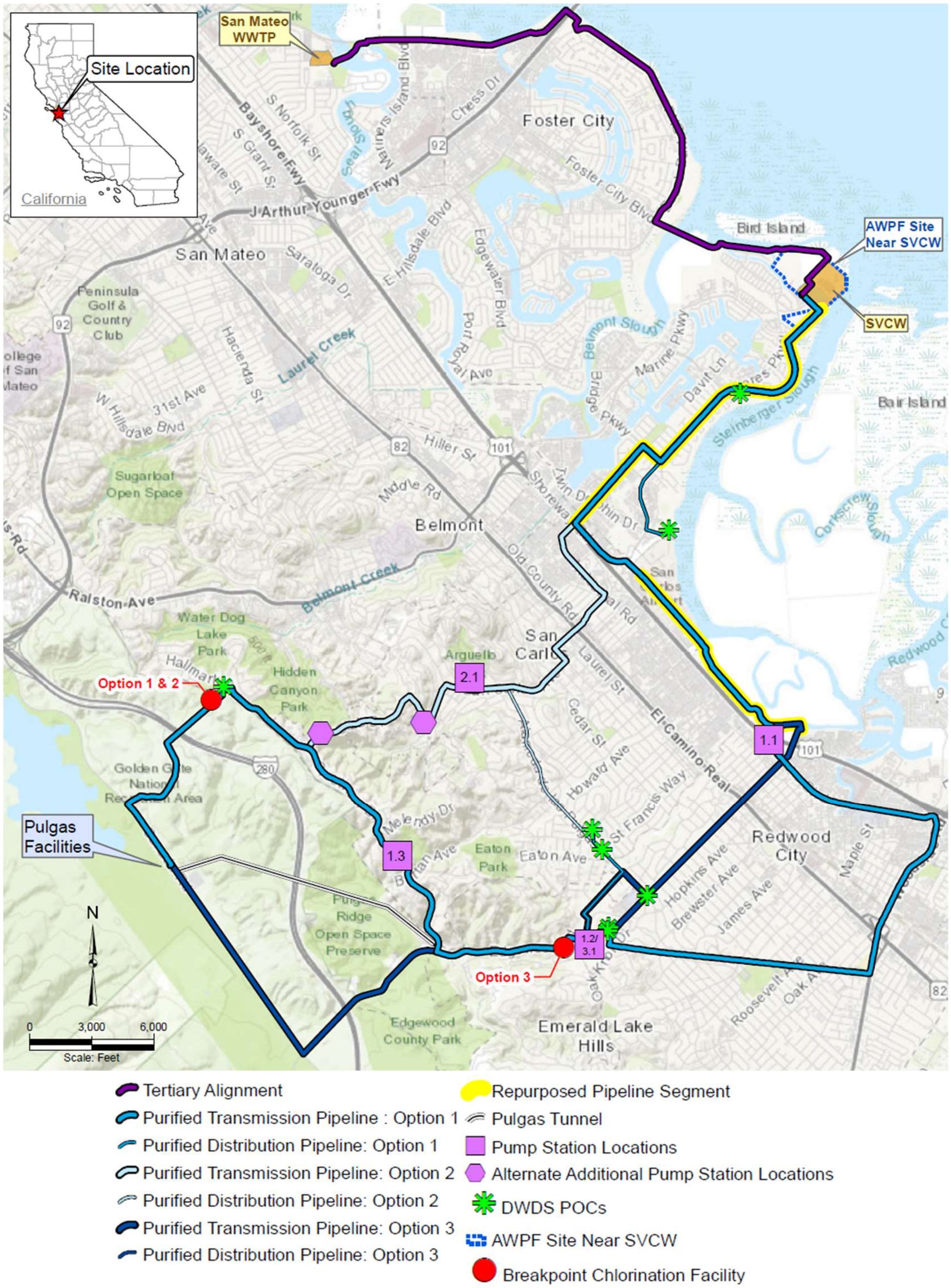
The required pipeline pressure would depend on the tie-in location and the operational characteristics of SVCW's outfall, which is pressurized. Hydraulics should be further evaluated for various operating scenarios of the AWPF and the existing outfall. The alignment is expected to have a small or negative static lift and relatively low headloss due to its short length. Pump selection should be refined during detailed design to ensure that small changes in head do not cause large fluctuations in flow.

4.4. Purified Alignments to Crystal Springs Reservoir

A purified waterline would be constructed to convey water from the new Purified Water Pump Station at the AWPF to SFPUC's Pulgas DF, where it would be introduced into Crystal Springs Reservoir. Several options for connection points at Pulgas DF are being considered and are discussed in **TM #3 – RO Concentrate Disposal.**

Three potential alignment options for the purified line, as outlined in the Phase 2 PREP study and in the following sections. It is anticipated that between one to three intermediate booster pump stations (BPS) would be required along the pipeline, depending on the alignment selected. Siting of aboveground facilities is expected to be a key project challenge. Figure 4-8 shows the three purified water alignment options.

Figure 4-8: Purified Water Alignment Options 1 – 3



In the Phase 2 DPR expansion, intermediate connections would be made to provide purified water to the drinking water systems of Redwood City, Cal Water, and MPWD. Provisions for these connections may be constructed in Phase 1, with the connections and any associated pipelines being completed in Phase 2.

Preliminary purified water pipeline design criteria are shown in Table 4-6. Drinking water distribution system preliminary design criteria are described in **TM #5 – Drinking Water Distribution System Design Criteria**. Cost comparisons for the drinking water distribution system connection alternatives for each purified water alignment option are included in the BODR.

Hydraulic calculation assumptions for the purified water pipeline include:

- Pipelines would be sized for Phase 2 flows.
- Phase 1: 6 mgd purified water production to CSR.
- Phase 2:
  - Up to 6-8 mgd purified water to CSR.
  - Remaining 4-6 mgd used for TWA
  - Flows in purified water pipeline begin at 12 mgd at AWPF PS and decrease based on general assumption of potential take-off locations.
- For the purposes of this TM, the entire length of the purified water pipeline would be 24-inch PVC. WSP may be preferred in some locations on the purified pipelines to accommodate high pressures. Refinements to the material, size, and pressure ratings of the selected pipeline should be confirmed in design.
- Google Earth has been used to identify possible pump station sites, including on PureWater Peninsula Party property/ROW, parking lots, and public parks. Locations are approximate and further evaluation is needed to assess viability.

Table 4-6: Preliminary Design Criteria – Purified Water Alignment Flows

Parameter	Unit	Phase 1	Phase 2
Purified Water Design Flow (Max)	mgd	6	12
	gpm	4,166	8,333
Purified Water Design Flow (Min)	mgd	3	6
	gpm	2,083	4,166
Purified ResWA Delivery to Pulgas DF (Max)	mgd	6	8
	gpm	4,167	5,555
Purified ResWA Delivery to Pulgas DF (Min)		3	3
	gpm	2,083	4,166
Purified TWA Delivery to DWDS POCs (Max)	mgd	-	6
	gpm	-	4,167
Purified TWA Delivery to DWDS POCs (Min)	mgd	-	3
	gpm	-	1,987

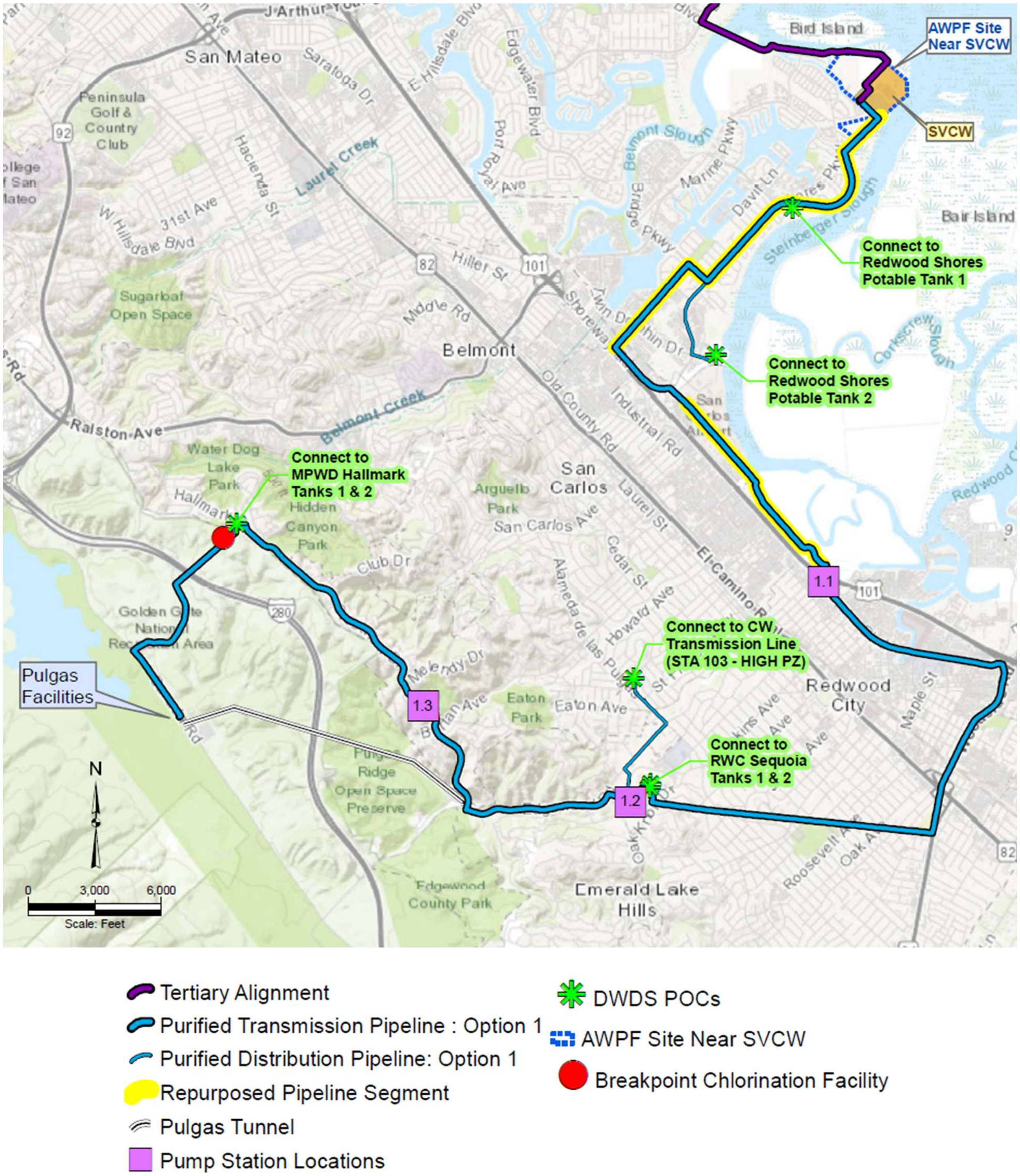
Notes:

1. Pipeline and pump station design parameters are provided for each option in following subsections.
2. Pipeline designed for Phase 2 flows.
3. Conceptual pump station design assumes that each pump station has a capacity of 12 mgd, regardless of whether purified water would be delivered to Pulgas DF or to local DWDSs.

4.4.1. Option 1: Woodside Road – SFPUC ROW

The SFPUC ROW option along Woodside Road (Option 1) represents the alignment that maximizes the use of SFPUC ROW and the reuse of infrastructure along Redwood Shores Pkwy and Bay Shore Road (Figure 4-9). This is the longest alignment with the largest static head among the three options, thereby requiring more pump stations and the expenditure of greater energy.

Figure 4-9: Purified Option 1 Alignment



Siting Considerations

- Option 1 utilizes SVCW's existing decommissioned pipeline infrastructure on Redwood Shores Pkwy and Inner Bair Island, which saves cost and reduces environmental/community impacts in those areas.
- Option 1 primarily follows SFPUC's ROW from the Redwood City area to CSR, which would avoid construction disruption in public ROWs through residential areas. Initial discussions with SFPUC indicate it may be difficult to locate a new pipeline in the ROW, especially in the 80-foot Bay Division Pipeline (BDPL)-1, 2, and 5 ROW south of Edgewood Road. Typical transmission mains in the SFPUC ROW range from 60-inch to 128-inch in diameter. Because the proposed purified waterline is much smaller in diameter, it may be feasible to fit it in the ROW, if exceptions to the typical 15' pipeline separation requirements are relaxed. However, SFPUC is hesitant to allocate its limited ROW space to a smaller pipeline that could instead be installed in the public ROW, where installation of a smaller pipeline in its ROW could impede the installation of a larger SFPUC transmission main in the future.
- It appears to be more feasible to install the purified water pipeline in the SFPUC ROW segment that parallels Edgewood Road, where the five BDPLs converge into a wider right-of-way. This wider segment of ROW is utilized by Purified Water pipeline Options 1 and 3.

Special Construction Methods

- Pipe repurposing in SVCW's existing decommissioned pipelines along Redwood Shores Parkway and Inner Bair Island.
- Trenchless construction for crossing highways, railroads, and complex intersections, such as El Camino Real and Woodside Road. It is assumed that microtunneling would be required where groundwater is present or where the crossing exceeds ~1,000 LF. Jack-and-bore may be a more cost-effective trenchless construction method where groundwater is not anticipated.

Treated Drinking Water Distribution System Connections

Option 1 has many potential DWDS tie-in points for TWA in Phase 2, including several storage tanks. Some potential options include:

- Redwood City: Redwood Shores potable water tanks; Sequoia Tanks
- Cal Water: Transmission mains –Old County Road & Cherry Street; Alameda de Los Pulgas & Edgewood Road, BDPL turnouts, and/or Station 117 PS
- Mid-Peninsula WD: Hallmark Tanks; 20-inch transmission line in Whipple Avenue (near turnout from BDPL)

Pipeline Design Criteria

Preliminary pipeline design criteria are presented in Table 4-7.

Table 4-7: Preliminary Design Criteria – Purified Water Option 1 Pipeline

Parameter	Unit	Phase 1	Phase 2
Pipe Length	miles	15.9	
Pipe Length	ft	83,800	
Pipeline Material	-	PVC	
Nominal Pipeline Diameter	in	24	
Inside Pipeline Diameter	in	24	
Pipeline Velocity at Design Max Flow	fps	3	6
Pipeline Velocity at Design Min Flow	fps	1	3
Total Static Lift	ft	917	917

Notes: Additional minor losses are assumed to be less than 10% of friction losses.

Hydraulics & Pump Stations

A preliminary hydraulic profile of Option 1 is shown in Figure 4-10. The first half of the alignment is relatively flat along the bay front and across the peninsula. The elevation begins rising along Edgewood Road, then sharply increases along Crestview Drive to a high point near Crestview Drive and Los Vientos Way. It is anticipated that Purified Water Option 1 would require four pump stations to deliver purified water to the Pulgas DF, as summarized in Table 4-8:

- Purified Water PS at AWPF site.
- BPS 1.1: Near the end of the pipe repurposing segments.
- BPS 1.2: Near Redwood City's Sequoia Tanks, possibly within existing RWC or SFPUC property/ROW.
- BPS 1.3: Along Crestview Drive, partway up the hill. Assumed to be near Crestview Park.

Figure 4-10: Purified Option 1 Hydraulic Profile and Ground Surface

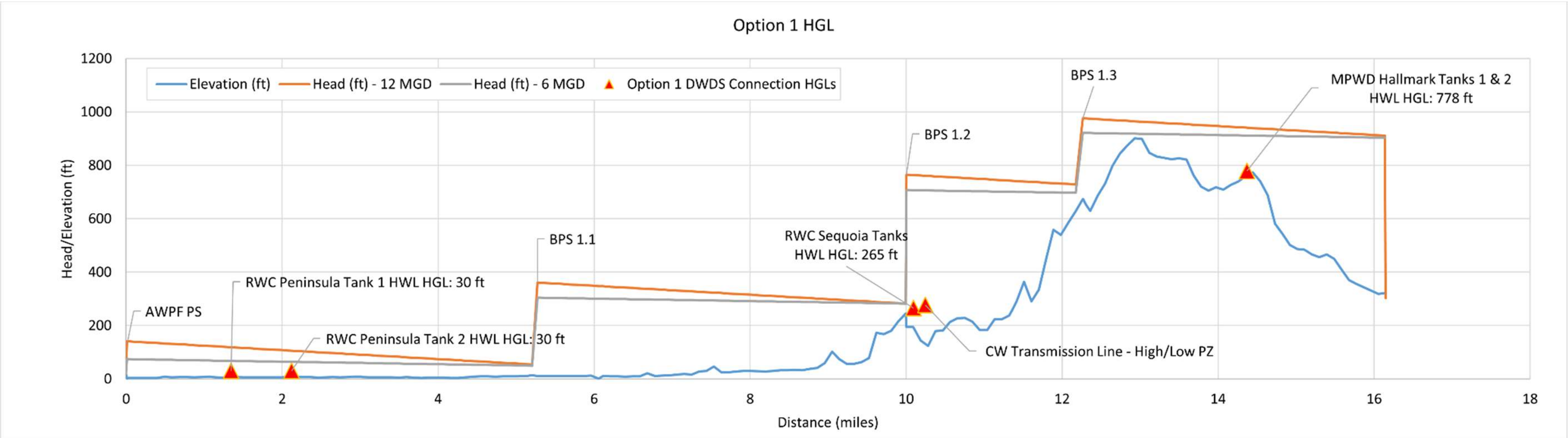


Table 4-8: Option 1 Pump Stations Summary

Pump Station	TDH (ft)	Flow (mgd)	US Pressure (psi)	DS Pressure (psi)	Flow (gpm)	PS Efficiency (%)	Motor Efficiency (%)	Break HP	Calculated HP	Pump Elevation (ft)
					Phase 1					
AWPF PS	65	6	-5	23	4,167	80%	90%	85	95	10
BPS 1.1	255	6	12	122	4,167	80%	90%	335	373	11
BPS 1.2	425	6	34	218	4,167	80%	90%	559	621	194
BPS 1.3	225	6	6	103	4,167	80%	90%	296	329	673
							Total HP:	1,276	1,418	
					Phase 2					
AWPF PS	120	12	-5	47	8,333	80%	90%	316	351	10
BPS 1.1	308	12	9	142	8,333	80%	90%	810	900	11
BPS 1.2	483	12	29	238	8,333	80%	90%	1,270	1,412	194
BPS 1.3	249	12	14	122	8,333	80%	90%	655	728	673
							Total HP:	3,051	3,390	

Notes:

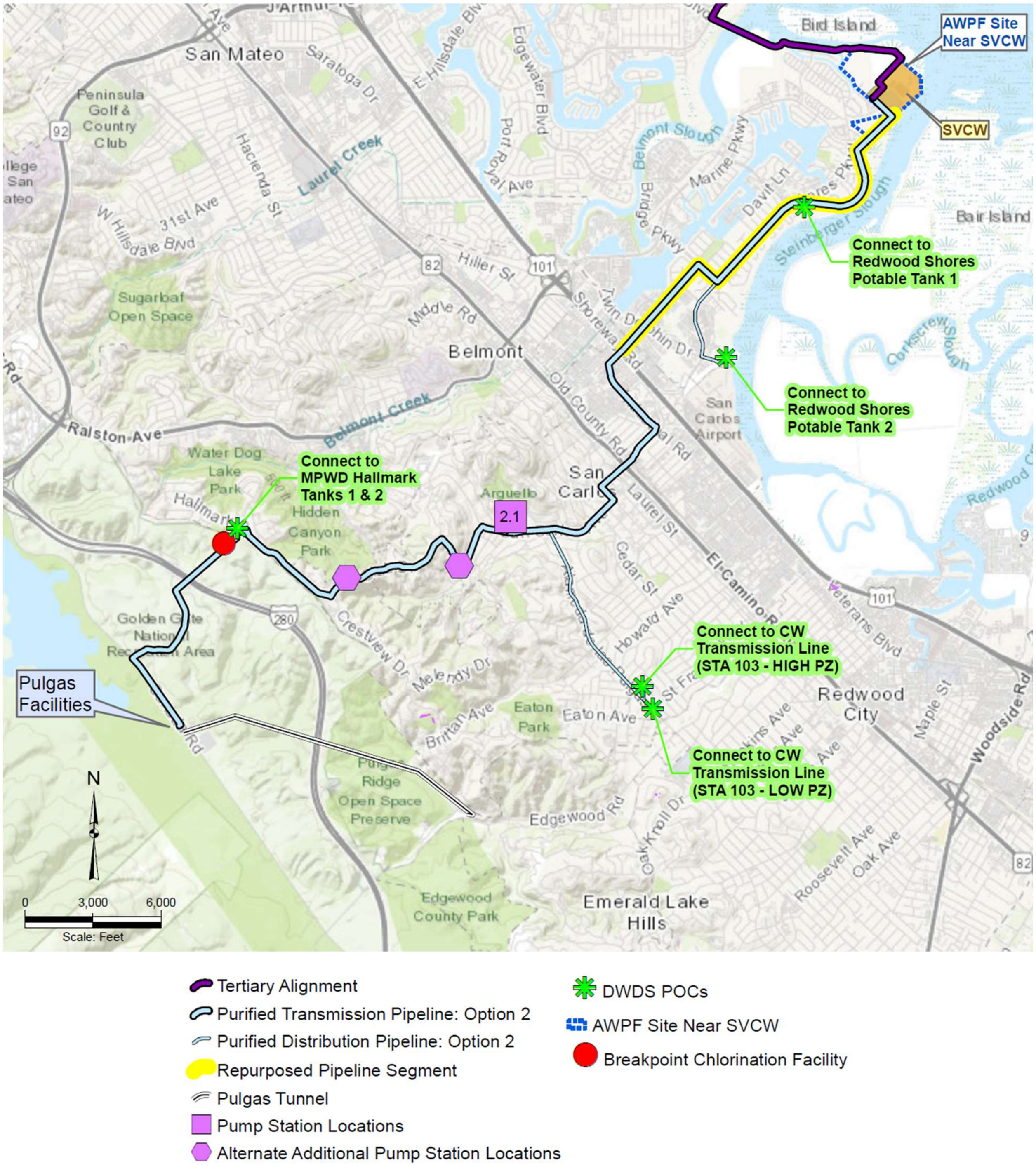
1. US = Upstream; DS = Downstream
2. Conceptual pump station design assumes that each pump station has a capacity of 12 mgd, regardless of whether purified water would be delivered to Pulgas DF or to local DWDSs.
3. It is assumed that BPSs will include 1+1 vertical canned turbine pumps in Phase 1 and 2+1 pumps in Phase 2.

4.4.2. 2: San Carlos – Club Drive

oximately 50% shorter than Option 1 but would result in more disruption in public ROWs through residential and commercial areas of San Carlos and Belmont. This could incur additional costs to account for additional traffic control, public outreach, and pavement repair. Permitting and mitigation requirements would likely impact the construction schedule and cost of this alignment. Fewer pump stations may be required for this alignment, but siting is expected to be a significant challenge.

Another drawback of this alignment is that there are limited options to connect to Redwood City's distribution system. The alignment could serve the Redwood Shores Tanks, but it would only serve customers in the SFRWS service area. This is less desirable from a social equity standpoint and limits the amount of purified water RWC can accept.

Figure 4-11: Purified Option 2 Alignment



Siting Considerations

- Option 2 utilizes one reach of SVCW's existing decommissioned pipeline infrastructure on Redwood Shores Parkway.
- Much of the remaining alignment passes through dense residential neighborhoods, which may present challenges for construction of the pipeline and booster pump station(s).
- Additional potential booster pump stations were identified in earlier iterations of the preliminary design. Based on current assumptions, including availability of land within the boundaries of the hydraulic constraints, only one booster pump station (BPS 2.1) would be required. However, additional/alternate potential BPS sites are noted for further evaluation.

Special Construction Methods

- Pipe repurposing (sliplining) in SVCW's existing decommissioned pipelines along Redwood Shores Parkway.
- Trenchless construction for crossing highways, railroads, and complex intersections, such as El Camino Real and Holly Street. It is assumed that microtunneling would be required where groundwater is present, or where the crossing exceeds ~1,000 LF. Jack-and-bore may be a more cost-effective trenchless construction method where groundwater is not anticipated.

Treated Drinking Water Distribution System Connections

Compared to the other alternative alignments, Option 2 offers limited potential DWDS connection points for TWA. In particular, Redwood City lacks tanks and transmission lines nearby except for the Redwood Shores zone, which is separated from the rest of the RWC system. Some potential options to remedy this short coming include:

- Redwood City: Connect to Redwood Shores potable water tanks; a significant length of pipeline would be required to reach other zones.
- Cal Water: Additional transmission mains – Shoreway Road & Skyway Road; Old County Road & Cherry Street.
- Mid-Peninsula WD: Connect to Hallmark Tanks.

Pipeline Design Criteria

Preliminary pipeline design criteria are presented in Table 4-9.

Table 4-9: Preliminary Design Criteria – Purified Option 2 Pipeline

Parameter	Unit	Phase 1	Phase 2
Pipe Length	miles	9.3	
	ft	49,200	
Pipeline Material	-	PVC	
Nominal Pipeline Diameter	in	24	
Inside Pipeline Diameter	in	24	
Pipeline Velocity at Design Max Flow	fps	3	6
Pipeline Velocity at Design Min Flow	fps	1	3
Total Static Lift	ft	825	825

Notes: Additional minor losses assumed to be less than 10% of friction losses.

Hydraulics & Pump Stations

A preliminary hydraulic profile of Option 2 is shown in Figure 4-12. The initial four (4) miles of the alignment are relatively flat along Redwood Shores to El Camino Real. The pipeline rises to a high point of approximately 825' near Crestview Drive and Club Drive. Figure 4-12 below shows the possible pumping scenario assuming that a pump station with appropriate access could be constructed at this location. The two pump stations for this option are as follows:

- Purified Water PS at AWPF site.
- BPS 2.1: Near Arundel Elementary School.

Based on preliminary calculations and assumptions presented in this TM, it is assumed that a single booster pump station would be sufficient. However, preliminary CEQA investigations in the BODR have been performed on two additional potential pump station locations along the alignment. Siting for the pump station is expected to be difficult for Option 2 as the alignment passes through developed areas with mostly private property.

Figure 4-12: Purified Option 2 Hydraulic Profile and Ground Surface

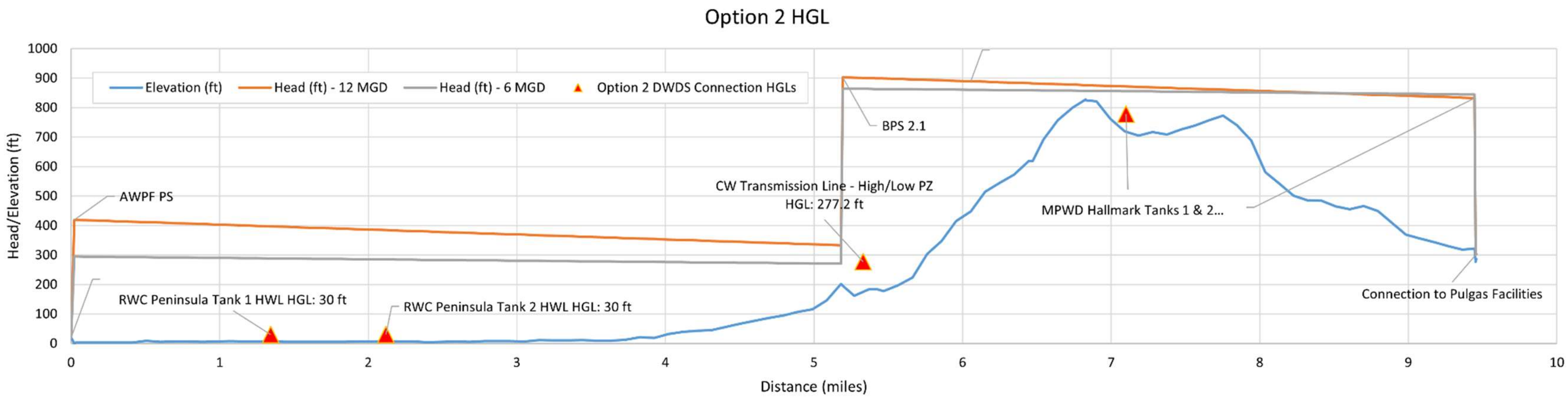


Table 4-10: Option 2 – Pump Stations Summary

Pump Station	TDH (ft)	Flow (mgd)	US Pressure (psi)	DS Pressure (psi)	Flow (gpm)	PS Efficiency (%)	Motor Efficiency (%)	Break HP	Calculated HP	Pump Elevation (ft)
Phase 1										
AWPF PS	287	6	-5	119	4,167	80%	90%	378	419	10
BPS 2.1	590	6	28	284	4,167	80%	90%	776	862	196
							Total HP:	1,154	1,282	
Phase 2										
AWPF PS	400	12	-5	168	8,333	80%	90%	1,052	1,169	10
BPS 2.1	470	12	50	297	8,333	80%	90%	1,499	1,666	196
							Total HP:	2,551	2,835	

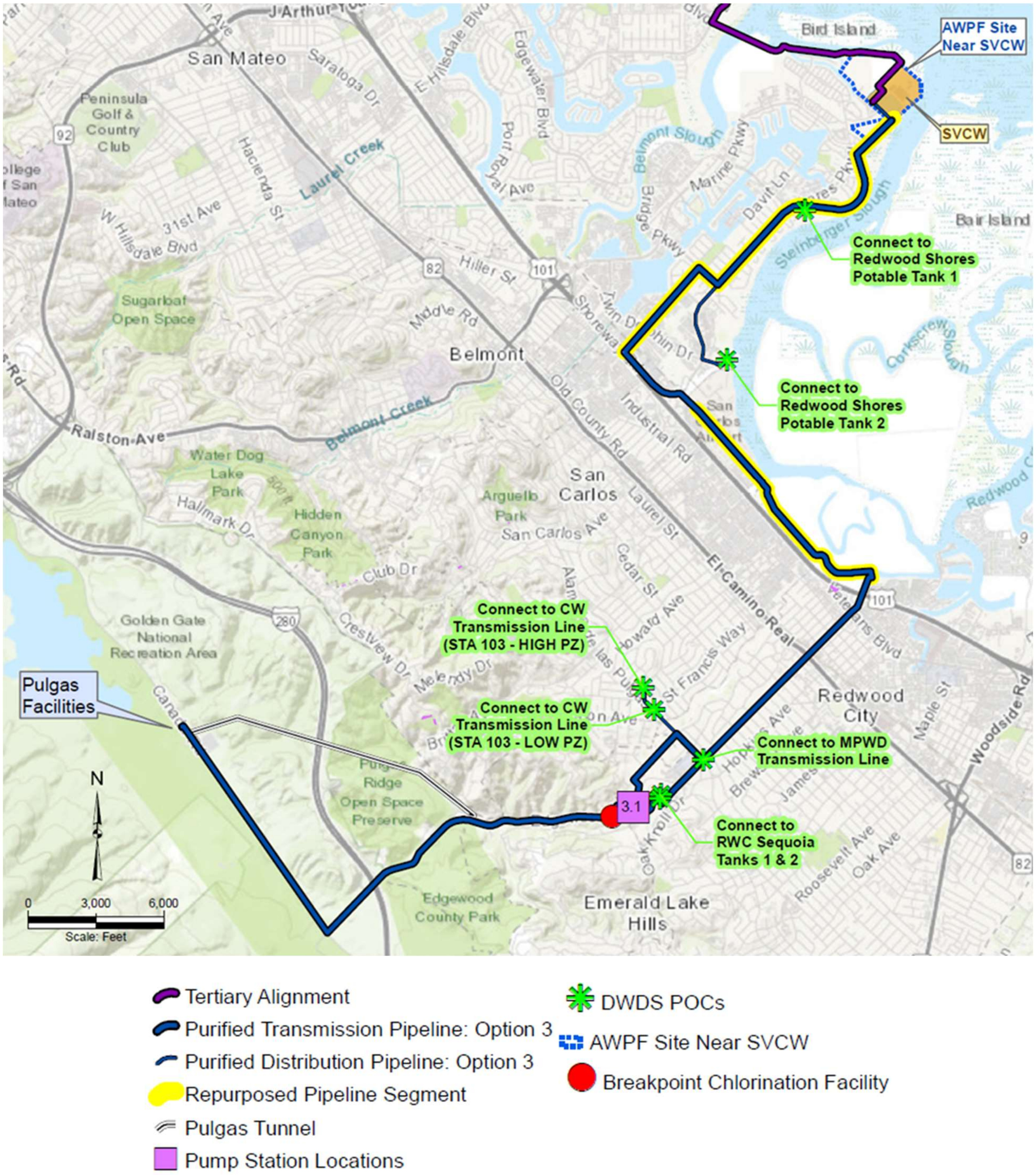
Notes:

1.
2. Conceptual pump station design assumes that each pump station has a capacity of 12 mgd, regardless of whether purified water would be delivered to Pulgas DF or to local DWDSs.
3. 2+1 pumps in Phase 2.

4.4.3. Road

tial to repurpose (slipline) a greater portion of decommissioned pipeline infrastructure along Shoreway Road as shown in Figure 4-13. Microtunneling construction would likely be required when crossing highways, railroads, and complex intersections, except where groundwater is low and jack and bore tunneling is acceptable. Similar to Option 2, higher open trench cost is assumed since the pipeline passes through public ROWs in built-out residential and commercial areas. This alignment also has the lowest amount of lift (i.e., lowest static head), thereby requiring less energy expenditure.

Figure 4-13: Purified Option 3 Alignment



Siting Considerations

- Option 3 utilizes SVCW's existing decommissioned pipeline infrastructure in Redwood Shores Pkwy and on Inner Bair Island, which saves costs and reduces environmental/community impacts in those areas.
- This Option utilizes a short segment of SFPUC's BDPL right-of-way along Edgewood Road. The ROW in this location is wider than in some of the areas utilized by Option 1.
- Due to the lower static lift, pump station siting may be more flexible than in Options 1 and 2.
- The alignment currently runs up Alameda de Las Pulgas, then turns left on Edgewood Road. A short segment of the pipeline could be rerouted to stay on Whipple Ave (similar to Option 1), if desirable for DWDS connections or pump station siting.

Special Construction Methods

- Pipe repurposing (sliplining) is proposed in SVCW's existing decommissioned pipelines along Redwood Shores Parkway and Inner Bair Island.
- Trenchless construction is anticipated for crossing highways, railroads, and complex intersections, such as El Camino Real and Whipple Avenue. It is assumed that microtunneling would be required where groundwater is present or where the crossing exceeds ~1,000 LF. Jack-and-bore may be a more cost-effective trenchless construction method where groundwater is not anticipated.

Treated Drinking Water Distribution System Connections

Option 3 is the only alignment that cannot serve the MPWD Hallmark Tanks. Some potential tie-in options include:

- Redwood City: Redwood Shores potable water tanks; Sequoia Tanks
- Cal Water: Transmission mains – Alameda de Los Pulgas & Edgewood Road; BDPL turnouts, Edgewood & Crestwood
- Mid-Peninsula WD: 20-inch transmission line in Whipple Ave (near the turnout from BDPL)

Pipeline Design Criteria

Preliminary pipeline design criteria are presented in Table 4-11.

Table 4-11: Preliminary Design Criteria – Purified Option 3 Pipeline

Parameter	Unit	Phase 1	Phase 2
Pipe Length	miles	11.9	
Pipe Length	ft	62,800	
Pipeline Material	-	PVC	
Nominal Pipeline Diameter	in	24	
Inside Pipeline Diameter	in	24	
Pipeline Velocity at Design Max Flow	fps	3	6
Pipeline Velocity at Design Min Flow	fps	1	3
Total Static Lift	ft	547	547

Notes: Additional minor losses assumed to be less than 10% of friction losses.

Hydraulics & Pump Stations

A preliminary hydraulic profile of Option 3 is shown in Figure 4-14. Option 3 has significantly lower static lift due to remaining on Edgewood Road rather than extending up Crestview Drive. It is anticipated that purified Option 3 would require only one intermediate booster pump station to deliver purified water to the Pulgas DF. Table 4-12 shows the preliminary pump station design criteria for Option 3. Hydraulically, locating the booster pump station has more flexibility than the other options. It is assumed that the pump station could be located near Redwood City's Sequoia Tanks, or the nearby in the SFPUC ROW.

- Purified Water PS at AWPF site.
- BPS 3.1: Near RWC Sequoia Tanks.

Figure 4-14: Purified Option 3 Hydraulic Profile and Ground Surface

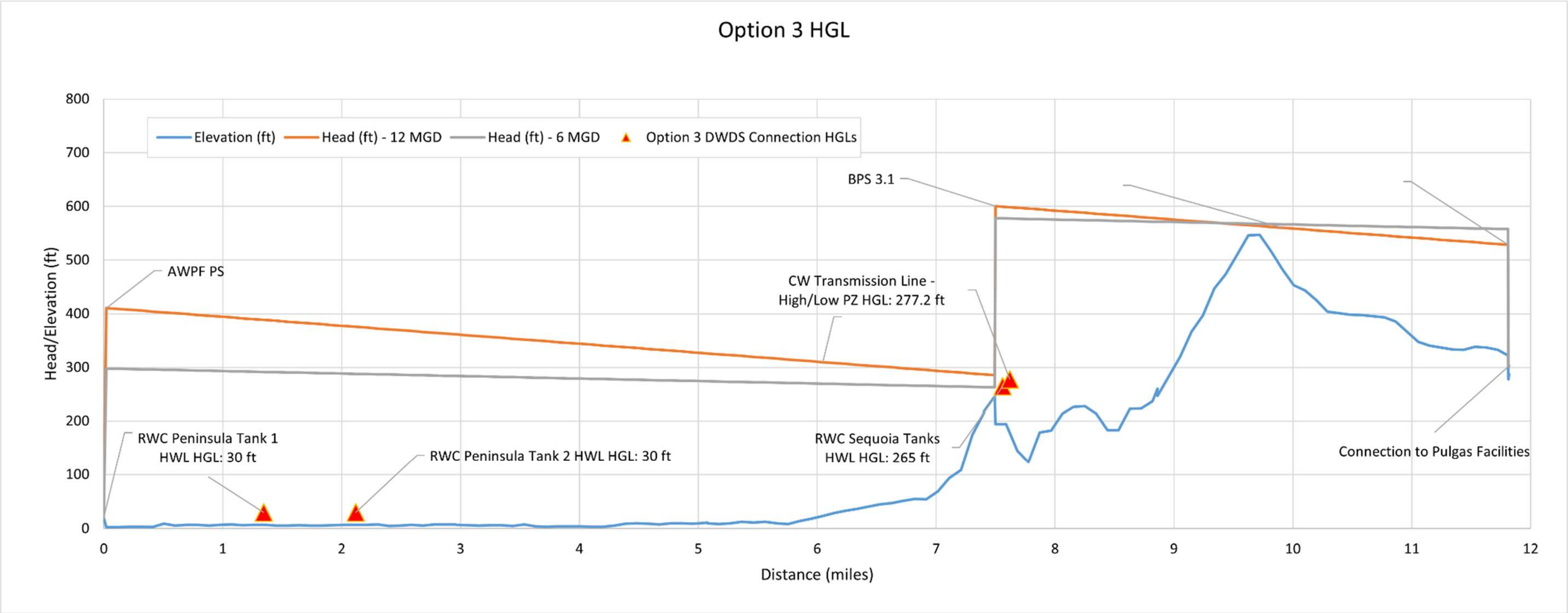


Table 4-12: Option 3 Pump Stations Summary

Pump Station	TDH (ft)	Flow (mgd)	US Pressure (psi)	DS Pressure (psi)	Flow (gpm)	PS Efficiency (%)	Motor Efficiency (%)	Break HP	Calculated HP	Pump Elevation (ft)
Phase 1										
AWPF PS	287	6	-5	119	4,167	80%	90%	378	419	10
BPS 3.1	327	6	4	146	4,167	80%	90%	430	478	194
							Total HP:	808	897	
Phase 2										
AWPF PS	415	12	-5	175	8,333	80%	90%	1,092	1,213	10
BPS 3.1	320	12	21	160	8,333	80%	90%	842	935	194
							Total HP:	1,933	2,148	

Notes:

1. US = Upstream; DS = Downstream
2. Conceptual pump station design assumes that each pump station has a capacity of 12 mgd, regardless of whether purified water would be delivered to Pulgas DF or to local DWDSs.
3. It is assumed that BPSs will include 1+1 vertical canned turbine pumps in Phase 1 and 2+1 pumps in Phase 2.

4.5. Treated Drinking Water System Connections

In Phase 2 of the proposed project, connections would be made from the purified waterline to the drinking water distribution systems of Redwood City, Cal Water, and the Mid-Peninsula Water District. Preliminary meetings were held with each agency to discuss potential tie in locations for the Phase 2 DPR expansion. Potential tie-in locations and associated boundary conditions would be explored further in **TM #5 – Drinking Water Distribution System Design Criteria**. Purified water from the AWPF would be in compliance with current DDW requirements for drinking water augmentation. Additional future studies may be needed to evaluate and model boundary conditions for augmenting each drinking water system and to further define flow restrictions, infrastructure requirements and operational limitations.

Considerations for TWA include:

- Water Quality:
    - Chloraminated vs. Free Chlorine: For the purposes of this TM, it is assumed that the purified water would be chloraminated to match the SFRWS water currently received by the agencies.
    - Blending Ratios: Regulations describing required blending ratios are forthcoming. Preliminary assumptions would be that a maximum of 50% purified water would be blended with other sources.

- System Demands: Consider system demands and ability to accept purified water, including tank sizes and turnover, pipeline capacities, hydraulics, and operational considerations.
- Connection Types:
    - Tank connections are generally preferred because they are simpler in terms of planning, design, and operation. New tank connections would be made with an air gap, and blending of the purified water with the existing sources would occur in the tank. The viability of connecting to an existing tank varies depending on which purified water alignment is selected. Proximity to existing tanks may also be a consideration when evaluating the alternative alignments.
    - Transmission Mains: Connecting to transmission lines may be more complex in terms of hydraulics and blending and could require monitoring and other operational changes. It is anticipated that such connections would require additional modeling and other analysis during design. For the purposes of this TM, it is assumed that connections can be made where the purified waterline pressure is greater than the DWDS pressure. PRV stations could be installed at the connection locations. If the purified waterline pressure is less than the DWDS pressure, a pump station would be required, which would likely present significant challenges given the space constraints in the region.
- Social Equity: Seek equity in distribution of purified water amongst PureWater Peninsula Party customers.

5. Preliminary Operational Strategies

As discussed in the PREP Phase 3 Title XVI Feasibility Study, during wet months of wet years there is limited available storage in the SFRWS. Thus, the addition of purified water to CSR or to drinking water systems that would otherwise receive SFRWS flows would result in an upcountry "spill" of water to make room for purified water. To avoid or reduce SFRWS spill, implementation of Phase 1 ResWA would likely include provisions for ramp-down and shutdown operational scenarios.

The three ResWA operational scenarios that may be implemented to reduce the amount of spillage during wet periods and wet years include:

1) **Continuous AWPF Operational Scenario** – the AWPF operates at the design capacity consistently. Upcountry spilling of water is likely.
2) **Seasonal Ramp Down Operational Scenario –** the AWPF would operate at full capacity during the summer months (May to October) and ramp down purified water production to half its capacity during the wet year winter months (November to April).
3) **Seasonal Shut Down Operational Scenario –** the AWPF would operate at full capacity during summer months (May to October) and shut down during wet year winter months.

Operational scenarios are further explored in **TM #6 – AWPF Operational Strategies**. Impacts of operational scenarios on conveyance project elements include:

- **Pumps:** Pump selection should consider the minimum expected flows. It may be preferable to have multiple pumps or pumps of differing sizes to meet minimum expected flows when the plant is operating at a reduced capacity. Pumps will include VFDs for operational flexibility, which will help facilitate operation at reduced flows.

- **Pipeline velocity:** Pipeline velocity may be lower than the target 2 fps if the AWPF is running at partial capacity. This can be mitigated in part by utilizing system storage, including the AWPF influent tanks, AWPF product water tanks, and potentially other storage at the Pulgas DF. The tertiary effluent and purified water are of high quality absent turbidity, so significant impacts are not expected.

REFERENCES

Kennedy/Jenks Consultants Inc. (Kennedy Jenks) 2022. Draft Final Potable Reuse Exploratory Plan (PREP) Phase 3 Title XVI Feasibility Study. Submitted to the U.S. Bureau of Reclamation on 28 July 2022.

May 2024

Final Technical Memorandum (TM) #3 – Reverse Osmosis (RO) Concentrate Disposal

To:	PureWater Peninsula Parties
From:	Kristine Tolentino, EIT, Kennedy Jenks Rita Newman, PE, Kennedy Jenks
Reviewers:	Dawn Taffler, PE, Kennedy Jenks Todd Reynolds, PE, Kennedy Jenks Sachi Itagaki, PE, Kennedy Jenks Charlie Liu, Ph.D., Kennedy Jenks
Subject:	Reverse Osmosis (RO) Concentrate Disposal PureWater Peninsula Project – Basis of Design Report

The **PureWater Peninsula Project**, previously referred to as the Potable Reuse Exploratory Plan (PREP), is a regional effort to resolve multiple water supply and wastewater issues, while realizing the benefits of shared infrastructure, asset recovery, economies of scale and a more competitive strategy to pursue funding. **PureWater Peninsula Parties** include the Bay Area Water Supply and Conservation Agency (BAWSCA), California Water Service (Cal Water), San Francisco Public Utilities Commission (SFPUC), Silicon Valley Clean Water (SVCW), City of San Mateo, City of Redwood City (RWC), and the Mid-Peninsula Water District (MPWD).

This **Technical Memorandum (TM) #3 – Reverse Osmosis (RO) Concentrate Disposal** establishes the design considerations for the PureWater Peninsula Project Advanced Water Purification Facility (AWPF) to discharge RO concentrate to the SVCW ocean outfall while meeting current and potential future regulatory requirements. RO is a pressure driven membrane treatment process that separates total dissolved solids (TDS), salts, and organic molecules from water to produce the product water called the RO permeate. Separated constituents are concentrated in the waste stream called the RO concentrate. As a result, the elevated concentration of constituents in the RO concentrate may exceed current or potential future regulatory requirements. This TM evaluates the projected RO concentrate water quality and whether dilution of the RO concentrate may be required prior to ocean discharge to meet regulatory requirements. This TM also addresses the potential impact RO concentrate would have to existing pipelines and outfall infrastructure.

This TM is organized into the following sections:

1. PureWater Peninsula Project Overview
2. Regulatory Requirements

3. Source Water and RO Concentrate Flowrates and Water Quality Projections
4. RO Concentrate Water Quality
5. Solutions to Meet Ammonia Requirements
6. Connection to Outfall
7. Conclusions

Additional TMs that support this work include:

- **TM #1 – AWPF Design Criteria** focuses on the design parameters for use in developing a conceptual design for the AWPF sizing and expanded unit processes as well as conveyance facilities within the Silicon Valley Clean Water (SVCW) boundary.
- **TM #2 – Conveyance Facility Design Criteria** establishes the design requirements and preliminary criteria for the project pipelines and pump stations, beyond the AWPF fenceline, building on the design concepts identified in prior planning efforts.
- **TM #4 – Pulgas Disinfectant Residual Alternatives** describes considerations related to the type of disinfectant residual and removal of disinfectant residual prior to Reservoir Water Augmentation (ResWA) for Crystal Springs Reservoir (CSR) augmentation via the Pulgas Dechloramination Facilities (Pulgas DF).
- **TM #5 – Drinking Water Distribution System Design Criteria** identifies preferred points of connection to introduce purified water into the existing drinking water distribution systems owned and operated by RWC, Cal Water, and MPWD and defines infrastructure requirements and potential operational and hydraulic constraints.
- **TM #6 - Operational Strategies** summarizes the preliminary operational strategies for both ResWA and Treated Water Augmentation (TWA) to support the development of AWPF design and operational criteria.

These TMs reflect the initial analyses performed to support the PureWater Peninsula Project Basis of Design Report (BODR) and have been included in an appendix to the BODR. Information contained within this TM may be superseded by content in the BODR, reflecting updates to the technical evaluation after the TM was completed.

1. PureWater Peninsula Project Overview

The PureWater Peninsula Project is a potable reuse project that would create a new source of local sustainable water supply using state-of-the-art technology to purify tertiary effluent from SVCW and the San Mateo Wastewater Treatment Plant (WWTP).

The project would be implemented in two phases:

- **Phase 1** – Indirect Potable Reuse (IPR) via ResWA of up to 6 million gallons per day (mgd) of purified water at CSR.
- **Phase 2** – Direct Potable Reuse (DPR) via TWA. Expansion of AWPF to produce an additional 6 mgd of purified water, for a total of up to 12 mgd. Up to 6-8 mgd would be

available for ResWA at CSR, and 4-6 mgd would be available for TWA to local drinking water distribution systems.

With the implementation of both PureWater Peninsula Project Phases, the project would provide a maximum of 12 mgd of purified water for local use by 2043.

2. Regulatory Requirements

The San Francisco Basin Water Quality Control Plan (Basin Plan) designates beneficial uses to each receiving water body within the State and establishes waste discharge prohibitions to protect these beneficial uses. The beneficial uses for the San Francisco Bay in the San Mateo coastal basin region are listed in Table 2-1 below.

Table 2-1: List of Basin Plan Beneficial Uses for San Francisco Bay

Beneficial Use	Description
Navigation	Use of water for shipping, travel, or other transportation
Industrial service supply	Uses of water for industrial activities such as mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection
Commercial and sport fishing	Uses of water for commercial or recreational collection of fish or other organisms
Marine habitat	Uses of water that support marine ecosystems, including preservation or enhancement of marine habitats and vegetation
Fish migration	Uses of water that support habitats necessary for migration and protection of aquatic organisms that are temporary inhabitants of the water
Fish spawning	Uses of water that support high quality aquatic habitats suitable for reproduction and development of fish.
Shellfish harvesting	Uses of water that support habitats suitable for the collection of shellfish for human consumption, commercial, or sport purposes
Recreation	Use of water for recreational activities which may or may not involve direct contact with water
Wildlife habitat	Uses of waters that support wildlife habitats.
Preservation of rare and endangered species	Uses of waters that support habitats necessary for the survival of plant or animal species established under state and/or federal law as rare, threatened, or endangered.

The State Board ensures that these beneficial uses are protected by implementation of the National Pollution Discharge Elimination System (NPDES) program or Waste Discharge Requirements (WDRs). The PureWater Peninsula Project must meet existing and future regulations to discharge RO concentrate at the SVCW outfall to the San Francisco Bay (SF Bay). The discharge flow is regulated under three WDRs / NPDES permits: (1) SVCW Individual NPDES, (2) SF Bay Watershed WDR for mercury and PCBs and (3) SF Bay Watershed WDR for nutrients as described in the following section.

2.1. NPDES and WDRs

Both SVCW and the City of San Mateo WWTP have existing NPDES permits for discharge of treated effluents into the San Francisco Bay.

- **SVCW effluent** consistently met the requirements set forth in their discharge permit (Order No. R2-2018-0005; NPDES permit No. CA 0038369) from the San Francisco Bay Regional Water Quality Board (SF RWQCB) (SF RWQCB 2018) which expired on March 31, 2023. The updated order, Order No. R2-2023-0003, was adopted on March 8, 2023 and went into effect on May 1, 2023.
- The **City of San Mateo's WWTP's effluent** consistently meets the requirements set forth in their discharge permit (Order No. R2-2018-0006; NPDES No. CA 0037541) from the SF RWQCB (SF RWQCB 2018). San Mateo is currently upgrading their treatment facilities with biological nutrient removal (BNR) and membrane bio-reactor (MBR) facilities. With construction expected to finish in Summer 2024, the anticipated tertiary effluent parameters provided by the plant design team are used for this evaluation.

Water quality goals for the effluent limits, which would also apply to the AWPF RO concentrate discharge, are summarized in Table 2-2 below and are based on current permit conditions. The adopted NPDES permit for SVCW (R2-2023-0003) maintains the same limits shown but reduces the max daily limit for cyanide to 32 µg/L and removes all fecal coliform and oil & grease limits.

Table 2-2: Summary of SVCW NPDES Dry Season Water Quality Effluent Limits

Permit Source	Parameter	Units	Average Monthly	Average Weekly	Max Daily	Inst. Min	Inst. Max
SVCW Individual NPDES	$CBOD_5$	mg/L	8	12	-	-	-
	TSS	mg/L	8	12	-	-	-
	Oil and Grease	mg/L	10	-	20	-	-
	pH	s.u.[1]	-	-	-	6	9
	Turbidity	NTU	10	-	20	-	-
	Chlorine, Total Residual	mg/L	-	-	-	-	0
	Ammonia, Total	mg/L as N	170	-	250	-	-
	Copper, Total Recoverable	µg/L	52	-	84	-	-
	Cyanide, Total	µg/L	21	-	32	-	-
	Dioxin-TEQ	µg/L	1.4×10^{-8}	-	2.8×10^{-8}	-	-
	Enterococcus	CFU/100ml	290 (6-week geometric mean)				
Regional WDR for Mercury and PCBs	Mercury	µg/L	0.066	0.072	-	-	-
	PCB	µg/L	0.012	-	0.017	-	-

Notes:
[1] s.u. = standard units.

In addition to the effluent limits described in Table 2-2, the NPDES permit also imposes qualitative water quality limits on parameters such as temperature, coloration, floating or suspended material, bottom deposits or aquatic growths, and prohibits any discharge to the receiving water (SF Bay) in a way that alters the ambient conditions or impairs beneficial uses. The California State Water Resources Control Board (SWRCB) is currently considering statewide water quality standards for nutrients, other biostimulatory substances, and cyanotoxins under the Biostimulation, Cyanotoxins, and Biological Condition Provisions. However, they are still in the early stages of the development process for setting water quality objectives and a program of implementation, so there are no new requirements yet.

The NPDES discharge permit also enforces discharge limits on the following parameters, which are not to be exceeded:

- **Dissolved oxygen (DO) –** The median DO concentration for any three consecutive months shall not be less than 80% of the DO concentration at saturation.
- **Dissolved sulfide –** The dissolved sulfide concentration cannot exceed ambient background levels.
- **pH –** The pH of the receiving waters cannot drop below 6 or rise above 9. The discharge shall not cause changes greater than 0.5 pH units in the ambient levels.

Discharge of the AWPF RO concentrate via SVCW's existing outfall would require regulatory compliance under a NPDES permit. This may entail a separate NPDES permit by the Owning Entity or a revised NPDES permit by SVCW that allows RO concentrate discharge into the San Francisco Bay waters. As analyzed in Section 4, the RO concentrate, which is expected to be 5.3 times more concentrated than the tertiary effluent, is expected to meet permit limits. However, the more challenging permit conditions to meet are likely to be the toxicity limits (see Section 2.2).

The following studies might need to be conducted by the applicant to support an NPDES permit application to ensure the RO concentrate discharge complies with all State and Regional Water Boards regulations:

- Modeling of the performance of the outfall and diffuser ports to simulate the flow, mixing and dilution of the blended discharge with ambient waters. An example model is EPA's Visual Plume model.
- Evaluation of blended discharge water quality characteristics for conventional and other parameters that may have a reasonable potential to cause excursions of narrative or quantitative water quality objectives (e.g., toxicity to sensitive species) also known as a Reasonable Potential Analysis.
- Preparation of fisheries/biological studies for preservation of rare and endangered species that may be impacted by the construction of facilities and/or the planned discharge.
- Pilot testing to confirm whether effluent has "reasonable potential" to exceed toxicity requirements.

If the project is implemented, the studies described herein would be prepared by the Owning Entity, as part of the new permit application.

2.2. Toxicity Provisions

New limitations for whole effluent acute and chronic toxicity were recently defined in SWRCB's State Policy for Water Quality Control: Toxicity Provisions (Toxicity Provisions), which were adopted by US EPA on May 1, 2023. These newly established toxicity limitations supersede the acute toxicity requirements set forth in the Basin Plan (Section 4.5.5.3.1). Under the new order, it is likely that pilot study results would be required to confirm whether effluent has "reasonable potential" to exceed toxicity requirements before full scale construction would begin. The new requirements include limits on maximum daily effluent limit (MDEL) and median monthly effluent limit (MMEL), and compliance is measured using the instream waste concentration (IWC) of 1.25% effluent at the outfall, the most sensitive species as described in the Monitoring and Reporting Program (Attachment E of the permit), and the Test of Significant Toxicity.

The Toxicity Provisions set the following limitations for whole effluent acute toxicity:

- **MDEL –** No acute aquatic toxicity test result of "fail" for the survival endpoint and no percent effect greater than or equal to 50% for the survival endpoint.
- **MMEL –** No more than one acute aquatic toxicity test result of "fail" in a calendar month for the survival endpoint.

Additionally, the Toxicity Provisions set the following limitations for whole effluent chronic toxicity:

- **MDEL –** No chronic aquatic toxicity test result of "fail" for any sub-lethal endpoint and no percent effect greater than or equal to 50% for the survival endpoint (if the most sensitive species has a survival endpoint) or greater than or equal to 50% for any sub-lethal endpoint (if the most sensitive species has no survival endpoint).
- **MMEL –** No more than one chronic aquatic toxicity result of "fail" in a calendar month for any endpoint.

2.3. Basin Plan Guidelines

As per Basin Plan guidelines, parameters such as DO, temperature, alkalinity, salinity, and toxic materials are parameters of particular significance when wildlife habitat and fish spawning are listed beneficial uses. Salinity is a parameter of particular interest as effluent from the San Mateo WWTP is expected to increase salinity at the outfall. While the Basin Plan does not include any specified salinity limits, the Basin Plan does indicate that the ambient salinity cannot be increased such that beneficial uses are adversely affected. Furthermore, the water quality objectives for toxic pollutants do change based on the salinity levels (greater than 10 ppt vs less than 1 ppt). An analysis of salinity levels at the outfall should be considered to determine the increase in ambient salinity and potential effects to beneficial uses. Hence, an NPDES permit application for the discharge of RO concentrate to the Bay would need prior studies on effluent characterization (including whole effluent toxicity) to evaluate contaminants of key concern in the treated effluent and RO concentrate. These studies would inform the approach (treatment, blending, dilution or other) required for RO concentrate management before final discharge.

Additionally, where preservation of rare and endangered species is applicable, special control requirements may be necessary to assure maintenance of particular water quality criteria, which may vary slightly with the environmental needs of each species. When CEQA is being prepared, the endangered species/plants would be identified and, if necessary, mitigation would be proposed.

2.4. Waste Discharge Requirements for Nutrients

The RO concentrate would also need to adhere to the SF RWQCB sets waste discharge requirements for nutrient removal through the San Francisco Bay Nutrients Watershed Permit (R2-2019-0017). The current 2019 permit will expire on June 30, 2024; there are no published draft limits for the upcoming 2024 revision. The 2019 nutrient watershed permit includes 2024 load targets for inorganic nitrogen for each discharger. Since the growth-limiting nutrient for phytoplankton in the SF bay is nitrogen, only inorganic nitrogen load targets are included; there are no phosphorus load targets. A summary of the limits from the 2019 permit for the dry season between May 1 and September 30 are shown in Table 2-3. These load targets may turn into load caps as part of the next permit for 2025 onwards and may become more stringent in the updated permit.

Table 2-3: Waste Load Discharge Targets for Total Inorganic Nitrogen

Discharger	Maximum Dry Season Average *(May 1, 2014 – September 30, 2017)*	2024 Dry Season Average Load Targets *(15% growth buffer)*
City of San Mateo	1,500 kg/d	1,700 kg/d
Silicon Valley Clean Water	2,500 kg/d	2,900 kg/d

Section 5 includes discussion of strategies to meet the potential future discharge requirements.

2.5. Per and Polyfluoroalkyl Substances (PFAS) Considerations

PFAS are a class of more than 5,000 compounds that have been associated with a wide range of harmful human health effects. Studies have reported detection of PFAS in wastewater effluents worldwide suggesting PFAS may also be detected in the wastewater effluent feed stream to the AWPF. Of the treatment processes employed in the AWPF, RO membranes are expected to reject a wide range of PFAS to >99% including PFOA, PFOS, and other detected PFAS in the source water. PFAS in the purified water are expected to be below the California Drinking Water Notification Levels and proposed EPA PFAS MCLs.

The rejection of PFAS by RO membranes is a separation process and PFAS are not destroyed. As a result, any PFAS present in the wastewater effluent would be concentrated in the RO concentrate stream to be discharged at the SVCW outfall. Because wastewater effluent from both San Mateo and SVCW would be used for the AWPF and the RO concentrate is being discharged at the SVCW outfall, the total mass of PFAS discharged at SVCW would increase relative to the mass of PFAS present in the San Mateo wastewater effluent.

Currently no limits on PFAS discharge in the RO concentrate have been established; however, if limits are established, dilution of the RO concentrate using excess tertiary effluent source water and/or treatment technologies may be used to remove PFAS prior to discharge. The Owning Entity would be responsible for all regulatory compliance and permitting.

3. AWPF Source Water and RO Concentrate Flowrates and Water Quality Projections

Assuming an 81% RO recovery rate, the RO concentrate is expected to have approximately 5.3 times the concentration of the source water constituents. Therefore, to estimate the water quality parameters of the RO concentrate and whether dilution is required prior to ocean discharge, it is important to understand the flowrates and water quality of the AWPF source water entering the RO process.

3.1. Flowrates

The source water that reaches the AWPF is assumed to be approximately an equal mix of the tertiary effluent from SVCW and San Mateo WWTP for both Phase 1 and 2. The inflows to the AWPF are discussed further in **TM #1 – AWPF Design Criteria**, Section 2, and are summarized in Table 3-1.

Table 3-1: Estimated Source Water Flows to AWPF (mgd)

Flow	SVCW	San Mateo WWTP
Tertiary Effluent Flows		
Average Dry Weather[1]	11.6	9.3
Recycled Water Demands		
Existing Redwood City Demand/Allotment[2]	0.7/2.9	NA
Future Menlo Country Club Demand[3]	0.2	NA
Future Bayfront Satellite Treatment Plant[4]	1.0	NA
Flows Available for AWPF	**7.5 – 9.7**	**9.3**
Source Water needed for 6.0 mgd AWPF @ 75% Overall Recovery	8.0	8.0
Flows Available for Dilution during Dry Months	**0 – 1.7**	**1.3**

Notes:

1. While a conservative estimate for SVCW ADWF was used based on recent historical flow data, SVCW AWDF could expand to about 16 mgd by 2040 due to projected increase in service area population to about 246,000 people by 2040 and current per capita flow rates (SVCW Capacity Analysis Report, Oct 2013).
2. Sharon Heights Golf and Country Club (SHGCC) pumps and treats raw wastewater from the West Bay Sanitary District (WBSD) collection system for irrigation at the golf course. The Sharon Heights Golf Course recycled water plant completed construction in July 2020. The recycled water plant diverts up to 0.5 mgd of wastewater influent from SVCW which are already accounted for in the SVCW effluent ADWF measurement. From 2013-2021, Redwood City used 0.7 mgd on an average annual basis out of a total allotment of 2.9 mgd of tertiary recycled water. Redwood City reserves the right to the remaining 2.2 mgd of effluent. Available effluent range assumes Redwood City recycled water demands range from 0.7 – 2.9 mgd.
3. Menlo Country Club is in the SVCW wastewater service area and currently receives potable water from the SFPUC. Menlo Country Club has expressed interest in switching to recycled water. It is assumed that Menlo CC's 0.2 mgd of demand would be met by a satellite recycled water facility, hence reducing the amount of source water available from SVCW.
4. WBSD is currently evaluating a new satellite Bayfront Recycled Water Facility. The Bayfront Recycled Water Facility is expected to divert up to 1 mgd of wastewater influent from WBSD (Source: Flow Equalization & Resource Recovery Facility Levee Improvements & Bayfront Recycled Water Facility Project, Draft Environmental Impact Report, December 2020)).

In Phase 1, 7.6 mgd influent flow to AWPF is needed to produce 6 mgd purified water, and in Phase 2, the influent flow to the AWPF would double to 15.2 mgd of AWPF source water to produce 12 mgd purified water. After the microfiltration (MF) process, the flows entering the RO process would reduce to 7.1 mgd and 14.1 mgd of flow during Phase 1 and 2, respectively. Assuming a RO recovery rate of 81%, approximately 1.4 mgd of RO concentrate in Phase 1, and 2.9 mgd of RO concentrate in Phase 2 would be generated. The RO concentrate blends with what remains of SVCW's tertiary treated effluent flowrate prior to discharging to the Lower San Francisco Bay.

The various operating scenarios and projected flow rates for AWPF source water and RO concentrate are summarized in Table 3-2 for conservative average dry weather flow conditions. The minimum flow through the AWPF RO trains would be 2 mgd, but this flow scenario is not examined further in this TM since less RO concentrate would be generated. In Phase 2, it is assumed that the AWPF source water would be a blended 50/50 mix of SVCW/San Mateo tertiary treated water. However, this is not the confirmed operational condition for Phase 1; the influent flows to the AWPF may consist of only SVCW or only San Mateo tertiary effluent in Phase 1. For example, should a situation occur where flow from either SVCW or San Mateo is unavailable, then a rare scenario may occur where source water to the AWPF is primarily only from one source.

Table 3-2: Estimated AWPF Source Water and Outfall Discharge Flow Rates

	AWPF Source Water		Discharge via the SVCW Outfall		
Operating Scenario	SVCW Effluent (mgd)	San Mateo Effluent (mgd)	Remaining SVCW Effluent to Outfall (mgd)[1]	RO Concentrate Flow Rate (mgd)	Total Flowrate at SVCW Outfall (mgd)
SVCW Effluent Phase 1	8	-	1.7	1.4	2.1
San Mateo Effluent Phase 1	-	8	9.7	1.4	11.1
50/50 Blended Effluent Phase 1	4	4	5.7	1.4	7.1
50/50 Blended Effluent Phase 2	8	8	1.7	2.9	4.6

Note:

1 This is the remaining flow from the 9.7 mgd of available SVCW tertiary treated flow that does not go through AWPF treatment.

3.2. AWPF Source Water Quality

Three possible source water operating conditions are evaluated to estimate the potential Phase 1 source water quality (1) SVCW effluent only, (2) San Mateo effluent only and (3) blended 50/50 mix of SVCW/San Mateo effluent. Table 3-3 provides anticipated source water quality for the permitted constituents of concern. San Mateo's anticipated effluent data includes projections which consider the effects of the future BNR and MBR facilities. The new facilities are anticipated to remove most TSS, CBOD, turbidity, ammonia, and phosphorous. Dioxin-TEQ and PCB do not appear to have sample data available, so their concentrations are considered unknown (unk); future testing for these constituents is needed to estimate RO concentrate concentrations and confirm compliance with permits.

Table 3-3: Summary of AWPF Source Water Quality and Estimated Combined Concentrations

Parameter	Units	SVCW Effluent[1]	San Mateo Anticipated Effluent	50/50 Blended Effluent
TDS[2,3]	mg/L	1,000	1,900	1,450
TSS[3,4]	mg/L	3.8	0.0	1.9
CBOD[4,5]	mg/L	3.4	1.0	2.2
TOC[6]	mg/L	9.7	2.9	6.3
Turbidity[4]	NTU	3.0	0.25	1.6
Oil and Grease[2]	mg/L	ND	ND	ND
pH[2]	Standard units	7.2	6.9	7.1
Chlorine, Total Residual[2]	mg/L	ND	ND	ND
Total Ammonia (as N)[4]	mg/L	49	0.03	25
Total Phosphorus[4]	mg/L	4.6	0.03	2.3
Copper[2]	µg/L	5.9	6.0	5.9
Cyanide, Total[2]	µg/L	3.0	ND	1.4
Dioxin-TEQ[2,7]	µg/L	unk	unk	unk
Enterococcus[2]	MPN/100ml	8.2	8.8	8.5
Mercury[2]	µg/L	3.6×10^{-3}	3.8×10^{-3}	3.7×10^{-3}
PCB[2,7]	µg/L	unk	unk	unk

Notes:

1. SVCW commonly analyzed parameters from 2013-2021 provided to the SF RWQCB by City to fulfill NPDES general reporting requirements.
2. San Mateo commonly analyzed parameters from 2018-2021 provided to the SF RWQCB by City to fulfill NPDES general reporting requirements.
3. TDS and TSS for combined tertiary effluent is shown as an average but is likely to vary based on blending timing and water chemistry.
4. SM WWTP TSS, CBOD, Turbidity, Ammonia, and Phosphorus values are based on the projected water quality values summarized in San Mateo's Final Schematic Design Report - Nutrient Removal and Wet Weather Flow Management Upgrade and Expansion Project (Jan 2018, HDR)
5. CBOD = carbonaceous biochemical oxygen demand
6. TOC is calculated using a CBOD/TOC conversion factor of 0.35 (Metcalf & Eddy/AECOM, 2014).
7. Dioxin-TEQ and PCB are not analyzed as part of the SVCW or SM WWTP annual self-monitoring report.

4. RO Concentrate Water Quality

Based on the source water quality, RO concentrate water quality projections are calculated. The following assumptions are used for calculating RO concentrate water quality in each of the two phases:

- **Phase 1**: source water is analyzed for operations with different ratios of SVCW and San Mateo tertiary treated water; assuming 1.4 mgd of RO concentrate would be generated from the RO process.

- **Phase 2:** source water is a 50/50 mix of SVCW/San Mateo tertiary treated water; assuming 2.9 mgd of RO concentrate would be generated from the RO process.
- Based on a RO recovery of 81%, RO concentrate would be 5.3 times more concentrated as the source water that enters the AWPF.
- Of the regulated constituents identified, constituents removed in upstream processes are not evaluated in the RO concentrate calculations. For example, TSS/turbidity removed through the MF process would not reach RO. Instead, removed TSS/turbidity would be backwashed from the filters to a waste equalization tank. This water with higher TSS/turbidity load would be sent to the SVCW headworks for additional treatment.
- pH is also not considered because the acceptable pH range would be achieved as part of the treatment process.

4.1. Phase 1 RO Concentrate Water Quality

Similar to the AWPF source water quality evaluation, three possible source water operating conditions are evaluated to estimate the potential Phase 1 RO concentrate water quality (1) SVCW effluent only, (2) San Mateo effluent only and (3) blended 50/50 mix of SVCW/San Mateo effluent. Table 4-1 identifies RO concentrate water quality projections prior to dilution and parameters that do not need to be evaluated due to upstream treatment processes.

Table 4-1: Projected RO Concentrate Concentrations for Phase 1

Parameter	Units	Most Stringent Limit[2]	Projected RO Concentrate Concentrations for Potential AWPF Source Water Ratios[1]		
			SVCW Tertiary Effluent	Anticipated San Mateo Tertiary Effluent	SVCW + San Mateo Combined Tertiary Effluent
$CBOD_5$	mg/L	8	Removed by ozone treatment		
TSS	mg/L	8	Removed by MF treatment		
pH	s.u.[1]	6	Assumed OK and can be adjusted as part of treatment process		
Turbidity	NTU	10	Removed by MF treatment		
Chlorine, Total Residual	mg/L	0	Non-Detect	Non-Detect	Non-Detect
Ammonia, Total	mg/L as N	170 (daily max of 250)	**326.7**	6.7	166.7
Copper, Total Recoverable	µg/L	52	39.3	40.0	39.7
Cyanide, Total	µg/L	21	20.0	6.0	13.0
Dioxin-TEQ	µg/L	1.4×10^{-8}	Unknown	Unknown	Unknown
Enterococcus	CFU/100ml	290 (geometric mean)	Removed by ozone/MF treatment		
Mercury	µg/L	0.066	0.024	0.025	0.025
PCB	µg/L	0.012	Unknown	Unknown	Unknown

Notes:

1 Concentrations presented before dilution

2 Most stringent limit from SVCW NPDES dry season water quality effluent limits summarized in Table 2-2.

From this evaluation, RO concentrate would exceed the NDPES regulations for total ammonia limit under the operating condition when only SVCW effluent is used for source water. This operating condition would also result in water with total cyanide levels that are near the NPDES limits. These exceedances could be avoided if source water is all San Mateo tertiary effluent or a 50/50 mix of the two sources. However, in the operating condition where source water is a 50/50 mix, total ammonia would still be high and could require dilution of the RO concentrate. Section 5 discusses solutions to meet NPDES regulations, including dilution to meet ammonia limits.

4.2. Phase 2 RO Concentrate Water Quality

For Phase 2, it is assumed that the source water entering the AWPF would be a blended 50/50 mix of SVCW/San Mateo tertiary treated water. The anticipated RO concentrate water quality would be the same in both Phase 1 and Phase 2 and based on the assumptions herein, regulatory exceedances are not anticipated. Refer to Table 3-3 for the projected water quality.

4.3. Nutrient Discharge Load Evaluation

The 2024 dry season total inorganic nitrogen load targets are 2,900 kg/day for SVCW and 1,700 kg/day for San Mateo WWTP per the WDRs for nutrients summarized in Table 2-3. The predicted combined total inorganic nitrogen loading from the RO concentrate discharge and the remaining SVCW tertiary effluent that bypasses AWPF treatment is summarized in Table 4-2. Calculations assume that SVCW's tertiary effluent would continue to have 49 mg/L of total ammonia (see Table 3-3) and RO concentrate would have various levels of total ammonia dependent on the composition of the tertiary effluent entering the AWPF, as shown in Table 4-1.

There are currently no phosphorus loading targets or limits. Although the nitrogen concentrations would be higher in the RO concentrate compared to the current SVCW effluent concentration, the combined total load of nitrogen from SVCW effluent and San Mateo effluent would not increase significantly beyond current conditions. Therefore, the RO concentrate from an AWPF would not negatively impact compliance with the combined effluent nutrient load targets.

However, if future nutrient load caps become more stringent than current inorganic nitrogen load targets, additional treatment may need to be considered. Furthermore, it is possible that the regulatory limit for the San Mateo and SVCW outfalls may be revised when the Regional Water Quality Control Board is made aware of the planned AWPF operations. Since some of San Mateo's ammonia discharge would be sent to SVCW, an argument could be made to increase the nutrient discharge limit at SVCW and lower San Mateo's limit.

Table 4-2: Total Inorganic Nitrogen Discharge Loading

Operating Scenario	Remaining SVCW Effluent to Outfall (mgd)[1]	SVCW Total Inorganic Nitrogen Loading Target (kg/d)	Calculated Total Nitrogen Loading[2] (kg/d)
SVCW Effluent Phase 1	1.7	<2,900	1,600
San Mateo Effluent Phase 1	9.7	<2,900	1,800
50/50 Blended Effluent Phase 1	5.7	<2,900	1,700
50/50 Blended Effluent Phase 2	1.7	<2,900	1,700

Notes:
[1] See Table 3-2 for calculations of SCVW effluent flowrates.
[2] Based on combined nitrogen loading from RO concentrate plus remaining SVCW effluent to outfall

5. Solutions to Meet Ammonia Requirements

As discussed in Section 4.1, RO concentrate is generally expected to meet current SVCW NPDES limits. The only constituent of concern based on the estimated RO concentrate concentrations is ammonia. As shown in Table 4-1, the ammonia concentration in the RO concentrate would exceed the SVCW NDPES limits in Phase 1 if all the AWPF source water comes from SVCW. This could be avoided by blending SVCW effluent with San Mateo effluent, which would be the preferred mode of operation. However, there may be another extreme operating scenario where other RO concentration limits may be exceeded if there are unexpected spikes in a regulated constituent in either SVCW or San Mateo effluent. While the strategies outlined below focus on methods to mitigate ammonia concentration exceedances, Section 5.1 can generally be applied to other constituents that exceed NDPES limits.

5.1. Operational Strategy Shifts

There are several operation strategies that could be applied to avoid non-compliant discharges below the SVCW NPDES limits. The order of precedence of these operational strategies assumes that meeting AWPF production flow rate is the highest priority and assumes that source water from the San Mateo effluent is prioritized when needed, since the average ammonia levels in San Mateo effluent (1 mg/L) are about two percent of SCVW effluent (49 mg/L). Therefore, the order of precedence for these operational solutions is as follows:

1. Shift the AWPF source water ratio to a higher percentage of San Mateo effluent
2. Dilute RO concentrate with ≥1.5 mgd of SVCW effluent
3. Dilute RO concentrate with ≥1.1 mgd of San Mateo effluent
4. Reduce AWPF production to reserve more effluent for dilution

5.1.1. AWPF Source Water Ratio Shift

San Mateo's effluent has a significantly lower ammonia concentration than the SVCW effluent. Therefore, increasing the ratio of San Mateo effluent conveyed to the AWPF would proportionally decrease the ammonia concentration in the RO concentrate. Supplying a 50/50 blend of effluent would generate RO concentrate with a concentration of approximately 167 mg/L Total Ammonia which is lower than the current NPDES limit of 170 mg/L, but not by much. In scenarios where the ammonia level spikes, increasing the ratio of San Mateo to SVCW effluent to 60/40 or more would increase the safety factor between the concentrated ammonia and NPDES limit of 170 mg/L.

5.1.2. Mix RO Concentrate with Dilution Water

If it is not possible to add enough San Mateo effluent to feed the AWPF to decrease ammonia levels to regulatory limits, adding dilution water may be a suitable alternative. AWPF source water would be 5.3 times less concentrated than the RO concentrate; therefore, the SVCW or San Mateo effluent could be used to dilute the RO concentrate. A separate pipeline could be designed to bypass the AWPF equalization tanks to send dilution water directly to the RO concentrate wet well. The diluted RO concentrate would then be pumped to the SVCW outfall. Pumping the dilution water and RO concentrate together would sufficiently mix the two streams without needing to add a stationary mixer or other mixing equipment to the pipelines.

If the AWPF receives only source water from SVCW effluent, up to 1.7 mgd of SVCW effluent could be used for dilution (see Section 3.1). Based on the current water quality analysis, adding 1.5 mgd of SVCW effluent for dilution of the RO concentrate would dilute the total ammonia concentration to 164 mg/L and is expected to prevent ammonia limit exceedances.

However, there may be months when recycled water demands are high and there is no excess flow available from SVCW for dilution. In these situations, up to 1.3 mgd of water from San Mateo could be available for dilution (see Table 3-1). Based on the current water quality analysis, adding 1.1 mgd of San Mateo effluent for dilution of the RO concentrate would dilute the total ammonia concentration to 161 mg/L and is expected to prevent ammonia limit exceedances. Monitoring of AWPF source water ammonia concentrations is a critical part of AWPF operations, for discharge compliance as well as to meet regulatory requirements for indirect and direct potable reuse.

5.1.3. Reduced AWPF Production Operations

If additional dilution water is not available, the AWPF could operate at a reduced production rate to reserve some SVCW effluent to be used for dilution to meet ammonia limits. In this case, ammonia levels would need to be closely monitored to ensure there are no fluctuations that would exceed NPDES limits. This operational strategy would result in producing less purified water than the design goals of 6 mgd or 12 mgd for Phase 1 and Phase 2 respectively. The lack of available dilution water would coincide with the summer months, when SVCW inflows are low and non-potable demands are high. Unfortunately, it is during these same periods when the production of purified water is most desired during dry months, and particularly dry months of dry years. Thus, this would be the least preferred option to implement.

5.2. Options for Additional Treatment Processes

Preventing ammonia level exceedance could be taken a step further by adding an additional treatment process specifically for ammonia removal. Two possible solutions are discussed herein.

5.2.1. Horizontal Levee

One potential solution to address high nutrient loads and ensure compliance could be to route the RO concentrate through a horizontal levee prior to discharge to the Bay. Recent research has supported findings that demonstrate efficient nutrient removal by horizontal levees. Since horizontal levees have a limited capacity, the SF RWQCB recommends that an existing outfall should still be operated to maintain discharge capacity. A horizontal levee could be included as a separate discharge location which would require the Owning Entity to apply for a new separate permit. While large land requirement and limited capacity are potentially significant constraints, this eco-friendly solution could still be a useful in reducing ammonia load.

5.2.2. Biological Treatment of RO Concentrate Stream

Side stream treatment could also be evaluated to remove high strength ammonia from the RO concentrate stream itself. The high concentrations and low flow in the RO concentrate stream could allow for novel treatment processes to be used. For example, Microvi is a technology that can remove up to 99% of ammonia via side stream treatment. The Microvi system has a small footprint, produces nearly no waste, and requires minimal maintenance. As another option, Anammox® is a nitrogen-removal technique that uses anaerobic ammonium oxidation to remove ammonia. Anammox bacteria are autotrophic, meaning they do not need organic carbon to develop. Instead, they get their energy from converting ammonium and nitrite into dinitrogen gas in the absence of oxygen. Exploration of these and other options would involve further study, including exploring different vendors and possibly pilot testing. However, these options can be expensive and may not be preferable compared to the other alternatives considered in this section. Furthermore, the high salinity of the RO concentrate stream may make biological treatment of ammonia more difficult.

5.2.3. Nutrient Removal at the SVCW Facility

Ammonia could be removed at the SVCW facility prior to the AWPF using biological techniques such as Nitrification and Denitrification (NDN) Filters or a Moving Bed Bioreactor (MBBR). Nutrient removal before the AWPF would offer benefits including having one treatment system that could handle both (1) nitrogen removal for the AWPF feed and (2) nitrogen reduction in the RO concentrate (if needed in the future). Ammonia removal at the AWPF would also have the benefit of allowing the biosolids to be disposed at existing sludge handling facilities at SVCW. Physical ammonia removal methods such as ammonia stripping could also be implemented at the WWTP following biological treatment. However, ammonia stripping would require elevated pH's for effective stripping (e.g., pH 11) indicating significant chemical usage to raise and lower the pH before and after treatment, respectively.

SVCW is exploring various nutrient removal options in anticipation of future regulatory requirements. Given that these technologies would be implemented outside of the AWPF fence line and would require additional study to identify SVCW's preferred method, this TM does not identify a recommended process or preference to remove nutrients prior to advance treatment.

6. Connection to Outfall

Per the **TM #1 – AWPF Design Criteria**, it is assumed that the AWPF would be constructed in the SVCW North Pond area. There would be an equalization storage tank for source water, which would store SVCW and San Mateo effluent prior to initiating the advance treatment process. RO concentrate would be conveyed via a 12-inch diameter pipeline to discharge through the existing SVCW ocean outfall. A RO concentrate pump station would likely be needed to meet pressure requirements in the SVCW outfall.

If dilution water is necessary to meet outfall regulations, SVCW effluent could be stored in the Redwood City storage tanks on the SVCW site. One of the existing 2 MG tanks has been reserved for AWPF operations and an additional 2 MG tank is planned for construction and could be used to store dilution water as well. If Redwood City's storage tanks become unavailable, dilution water could also be pulled from the influent EQ tanks.

6.1. Existing Infrastructure

Each of the operating scenarios are evaluated to confirm potential modifications needed for existing infrastructure. The existing SVCW outfall is currently permitted for 29 mgd of discharge, but occasionally operates at as little as 2-4 mgd according to SVCW. Minimum outfall flows will change once the RESCU Gravity Pipeline (Tunnel) project becomes operational. The Tunnel will assist in equalizing flow throughout the day and should minimize low flow conditions due to diurnal fluctuations. Low flow conditions are expected during cleaning cycles for the different components of the Tunnel. The AWPF influent equalization tanks are currently sized assuming 50% of average flow i.e., 4 mgd in Phase 1 and 8 mgd in Phase 2) for a total of 8 hours during low diurnal flow periods (see TM#1 for more discussion). However, future analysis of these flow fluctuations once the Tunnels are operational will be needed in future design phase to refine the sizing for the AWPF influent equalization tanks.

The SVCW outfall flowrates in all operating scenarios would not exceed the permitted 29 mgd, as calculated in Table 3-2. The pipelines that feed the outfall are primarily 66-inch pipe and 60-inch pipe; the anticipated velocities are shown in Table 6-1. Based on this evaluation, the existing pipelines would not need to be modified to accommodate the RO concentrate addition.

Table 6-1: RO Concentrate Flowrates and Velocities

Operating Scenario	Flow Rate @ SVCW Outfall	Velocity through 66" Pipe
SVCW Effluent Phase 1	2.76 mgd	0.2 ft/s
San Mateo Effluent Phase 1	10.76 mgd	0.7 ft/s
50/50 Blended Effluent Phase 1	6.76 mgd	0.4 ft/s
50/50 Blended Effluent Phase 2	3.82 mgd	0.3 ft/s

The existing pipelines are mostly HDPE, with the exception of the pipelines adjacent to the effluent pump station which are made of steel. Since the proposed RO concentrate connection point is downstream of the pump station (see Section 6.2), HDPE is the preferred pipe material that to convey RO concentrate. HDPE is very resistant to corrosion by salts, and the introduction of the RO concentrate is not anticipated to impact the existing pipe material.

6.2. RO Concentrate Connection

The RO concentrate pipeline would be designed to convey up to 1.4 mgd in Phase 1 and 2.9 mgd in Phase 2. A 12-inch diameter HDPE pipe would be suitable to maintain a velocity of 2.8 ft/s to 5.5 ft/s respectively. Since the flowrate of the RO concentrate added to the SVCW ocean outfall would need to be measured as part of the outfall permit, the new connection point could be added upstream of the flow meter that was installed in 2016 as part of the SVCW effluent outfall repair/replacement project and the existing outfall sample point. Locating the connection point downstream of the existing effluent pump station would be recommended to prevent hydraulic impacts to the pump station and upstream chlorine contact tanks. Additionally, the new RO concentrate pipeline would have its own new sampling point so each stream could have different permits.

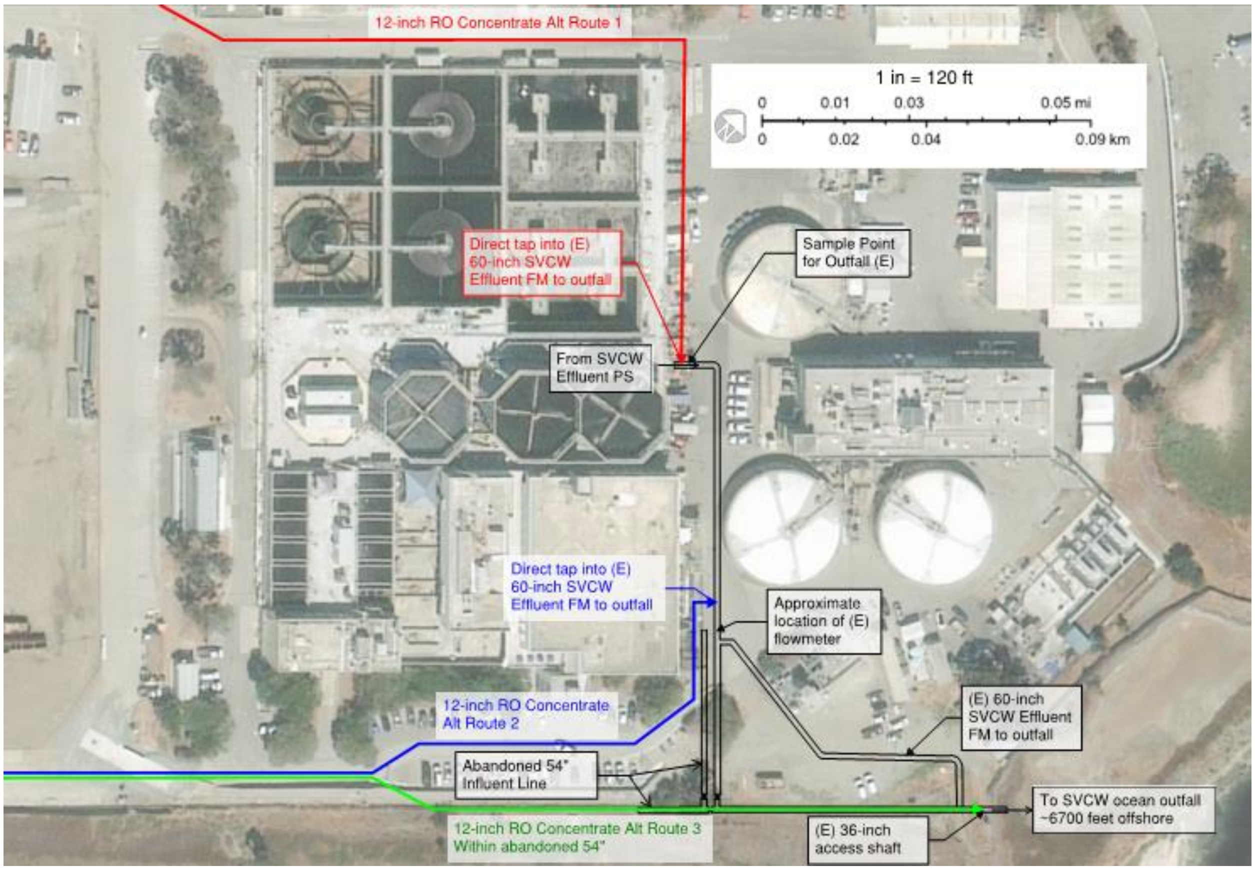
Three alignments have been considered to convey RO concentrate from the RO concentrate Pump Station to the SVCW outfall, as shown in Figure 6-1:

- Red Alt Route 1: Route RO concentrate piping from the proposed AWPF site and past the northern end of the SVCW facility. Tap RO concentrate piping into the existing SVCW outfall pipeline near the SVCW Effluent PS outlet and make the connection upstream of the existing flow meter.
- Blue Alt Route 2: Route RO concentrate piping from the proposed AWPF site and past the southern end of the SVCW facility. Tap RO concentrate piping into the existing SVCW outfall pipeline just upstream of the existing flow meter.
- Green Alt Route 3: Route RO concentrate piping from the proposed AWPF site and past the southern end of the SVCW facility. Install the new RO concentrate piping within the existing

abandoned 54" SCVW influent pipeline and connect to the existing outfall piping downstream of the existing flowmeter via the existing access shaft near the outfall. This option would minimize conflicts with existing utilities.

To make the connection to the pressurized SVCW outfall pipeline in Alternatives 1, 2, and 3, the RO pump station would be designed to achieve a higher pressure in the RO concentrate pipeline at the point of connection than the existing SVCW outfall pipeline. The RO concentrate pump station design criteria are further described in the BODR based on discussions with SVCW that identified an initial preference for the RO concentrate alignment.

Figure 6-1: RO Concentrate Connection Alignment Alternatives



SVCW is initiating an upgrade to the existing effluent pump station which would need to be coordinated with the design of the RO concentrate pump station to ensure there is adequate pumping head to make the connection to the pressurized outfall line.

6.3. Construction Considerations

The AWPF would be constructed on young Bay mud, which is known to compress significantly when structures are built on top, causing structures to sink over time. Furthermore, if Young Bay Mud (YBM) is disturbed excessively during excavation, it can lose its structural integrity, which would prevent completion of deep excavation work without an excavation shoring system designed by a licensed civil engineer. For these reasons, the new RO concentrate conveyance pipeline would need to be designed with deep pipe supports. A preliminary estimate of the depth of the support piles is provided in the BODR and would be further defined in future design phases.

7. Conclusions

Based on the analysis of flow, water quality, treatment processes, current and anticipated regulatory requirements for the discharge of RO concentrate from the proposed AWPF, the following conclusions are presented.

- NPDES regulatory requirements are defined to meet the beneficial uses associated with the Basin Plan. Based on the calculations herein, the RO concentrate should meet existing NPDES/WDR permit requirements under most operating scenarios except when only SVCW effluent is used as AWPF source water. In this operating condition, the RO concentrate should be diluted with remaining SVCW effluent to meet requirements.
- Since NPDES requirements are updated roughly every five years, anticipated future discharge requirements would need to be evaluated to assess if RO concentrate would be able to meet more stringent regulatory limits in the future or if additional dilution or treatment is required to meet future regulatory limits.
- Ammonia is the primary constituent of concern since anticipated RO concentrations would exceed NPDES limits if only SVCW tertiary effluent feeds the AWPF. In the same operating condition, cyanide is a secondary constituent of concern since anticipated RO concentrate concentration would be close to the regulatory limit.
    - Ammonia loads and cyanide concentrations could be reduced through operational strategies such as (1) shifting the AWPF source water ratios (increasing the ratio of San Mateo effluent with lower ammonia concentrations), (2) diluting the RO concentrate with higher flows of SVCW or San Mateo effluent, (3) reducing AWPF production to reserve more effluent for dilution.
    - Additional treatment processes to remove nutrients would be accomplished through horizontal levees, and biological treatment of the RO concentrate stream of nutrient removal prior to advanced treatment. Though effective, these treatment processes would require additional land, infrastructure investments, operations, maintenance, and energy costs.
- The existing outfall and conveyance pipelines have sufficient capacity and are constructed of suitable material to receive RO concentrate without major upgrades or replacement of existing infrastructure.
- RO concentrate could be conveyed via a 12-inch diameter HDPE pressurized pipeline with an RO concentrate pump station that meetings pressure requirements at the point of connection between the SVCW effluent pump station (existing with future upgrades) and outfall sample point.

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May 2024

Final Technical Memorandum (TM) #4 – Pulgas Disinfectant Residual Alternatives

To:	PureWater Peninsula Parties
From:	Charlie Liu, PhD, Kennedy Jenks
Reviewers:	Dawn Taffler, PE, Kennedy Jenks Milt Larson, PE, Kennedy Jenks
Subject:	Pulgas Disinfectant Residual Alternatives PureWater Peninsula Project – Basis of Design Report

The **PureWater Peninsula Project**, previously referred to as the Potable Reuse Exploratory Plan (PREP), is a regional effort to resolve multiple water supply and wastewater issues, while realizing the benefits of shared infrastructure, asset recovery, economies of scale and a more competitive strategy to pursue funding. **PureWater Peninsula Parties** include the Bay Area Water Supply and Conservation Agency (BAWSCA), California Water Service (Cal Water), San Francisco Public Utilities Commission (SFPUC), Silicon Valley Clean Water (SVCW), City of San Mateo, City of Redwood City (RWC), and the Mid-Peninsula Water District (MPWD).

The purified water would meet all regulatory requirements for potable reuse, however, since the purified water coming from the advanced water purification facilities (AWPF) would contain disinfectant residual, this **TM #4 – Pulgas Disinfectant Residual Alternatives** focuses on the considerations related to (i) the type of disinfectant residual and (ii) removal of disinfectant residual prior to Reservoir Water Augmentation (ResWA) for Crystal Springs Reservoir (CSR) augmentation in both project phases.

This TM is organized into the following sections:

1. PureWater Peninsula Project Overview
2. Pulgas Dechloramination Facilities (Pulgas DF) Background and Relationship with PureWater Peninsula Project
3. Purified Water Quality and Disinfectant Residual
4. Pulgas Treatment Alternatives
5. Conclusions and Recommendations

Additional TMs that support this work include:

- **TM #1 – AWPF Design Criteria** focuses on the design parameters for use in developing a conceptual design for the AWPF sizing and expanded unit processes as well as conveyance facilities within the SVCW boundary.
- **TM #2 – Conveyance Facility Design Criteria** establishes the design requirements and preliminary criteria for the project pipelines and pump stations beyond the AWPF fenceline, building on the design concepts identified in prior planning efforts.
- **TM #3 – Reverse Osmosis (RO) Concentrate Disposal** establishes the design requirements for the AWPF to discharge RO concentrate to the SVCW ocean outfall while meeting current and potential future regulatory requirements.
- **TM #5 – Drinking Water Distribution System Design Criteria** identifies preferred points of connection to introduce purified water into the existing drinking water distribution systems owned and operated by the RWC, Cal Water, and the MPWD as well as defines infrastructure requirements and potential operational and hydraulic constraints.
- **TM #6 – AWPF Operational Strategies** summarizes the preliminary operational strategies for both ResWA and Treated Water Augmentation (TWA) to support the development of AWPF design and operational criteria.

These TMs reflect the initial analyses performed to support the PureWater Peninsula Basis of Design Report (BODR) and have been included in an appendix to the BODR. Information contained within this TM may be superseded by content in the BODR, reflecting updates to the technical evaluation after the TM was completed.

1. PureWater Peninsula Project Overview

The PureWater Peninsula Project is a potable reuse project that would create a new source of local sustainable water supply using state-of-the-art technology to purify tertiary effluent from SVCW and the San Mateo Wastewater Treatment Plant (WWTP).

The project would be implemented in two phases:

- **Phase 1** – Indirect Potable Reuse (IPR) via ResWA of up to 6 million gallons per day (mgd) of purified water at CSR.
- **Phase 2** – Direct Potable Reuse (DPR) via TWA. Expansion of AWPF to produce an additional 6 mgd of purified water, for a total of up to 12 mgd. Up to 6-8 mgd would be available for ResWA at CSR, and 4-6 mgd would be available for TWA to local drinking water distribution systems.

With the implementation of both PureWater Peninsula Project Phases, the project would provide a maximum of 12 mgd of purified water for local use by 2043.

The PureWater Peninsula Project includes:

- **Source water** derived from up to 8 mgd of tertiary effluent from SVCW and up to 9 mgd of tertiary effluent from the San Mateo WWTP would be combined to produce up to 12 mgd of purified water. Additional source water from SVCW would be available for dilution of RO concentrate.
- Construction of a new **AWPF** to treat source water to meet regulatory requirements for IPR in Phase 1 and DPR for the Phase 2 expansion.
- **Conveyance infrastructure** to deliver tertiary effluent to the new AWPF, purified water to the place of use, and brine for discharge via the existing SVCW outfall.
- A point of connection to SFPUC's **Pulgas DF**, which provides dechlorination of all flows prior to discharge into CSR.
- Multiple points of connection to existing tanks and transmission pipelines to deliver purified water to RWC, Cal Water and/or the MPWD **drinking water distribution systems (DWDS).**

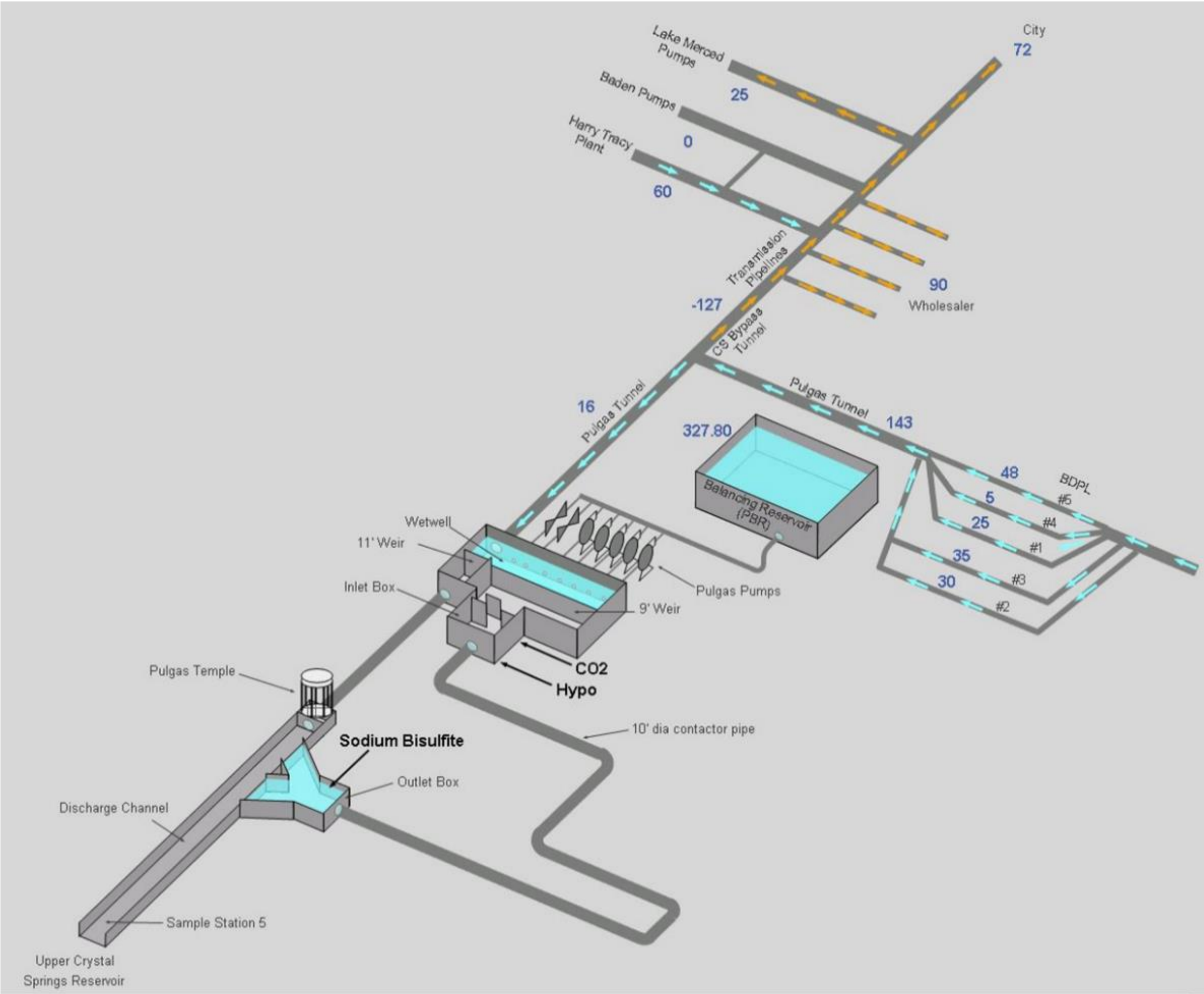
A summary of PureWater Peninsula Project facilities is depicted in Figure 1-1.

Figure 1-1: Potential PureWater Peninsula Project Concept

2. Pulgas DF Background and Relationship with PureWater Peninsula Project

The Pulgas Dechloramination Facility (Pulgas DF) is part of the SFPUC Regional Water System (SFRWS) System. Together with the Pulgas Balancing Reservoir (PBR) and Pulgas Pump Station (PPS), Pulgas DF is used to manage and control water flow to SFPUC customers on the Peninsula. Pulgas DF began operating in February 2004 when SFPUC initiated system-wide conversion from chlorine to chloramine disinfection. Pulgas DF operates to provide chemical treatment for excess flows from the Hetch Hetchy/Sunol Blend delivered to CSR. Figure 2-1 presents the Pulgas DF layout and key features.

Figure 2-1: Pulgas DF Facility Layout



2.1. Pulgas DF Main Treatment Goals

One of the key goals of Pulgas DF is to remove chlorine and ammonia prior to delivery of water to CSR. The two main regulatory requirements Pulgas DF must meet include:

- **Ammonia:** ammonia discharge to CSR is defined by the SF Bay Basin Plan, which limits unionized ammonia discharge to less than 0.025 mg/L as N. Ammonia is removed by dechloramination through breakpoint chlorination, which oxidizes ammonia to nitrogen gas with free chlorine.
- **Chlorine:** chlorine discharge into CSR is regulated by the SWRCB NPDES No. CAG140001 water quality requirements. The total chlorine residual concentration in the discharge is not to exceed 0.019 mg/L. A field monitoring result with a total residual chlorine concentration

greater than or equal to 0.1 mg/L is deemed out of compliance with a chlorine effluent limitation. Chlorine is removed with dechlorination.

2.2. Pulgas DF Operational Modes

To meet these regulatory requirements, two treatment steps must be performed at Pulgas DF:

- **Dechloramination:** chloramines are formed from a combination of chlorine and ammonia. Dechloramination is performed with breakpoint chlorination where high ratios of free chlorine (from sodium hypochlorite) react with free ammonia, often between a 10:1 to 12:1 chlorine-to-ammonia mass ratio, to oxidize ammonia to nitrogen gas. The reaction is pH-dependent and can be reduced using carbon dioxide (CO_2); the reaction requires 15-30 minutes of contact time. The background pH of the Pulgas DF feed water is typically greater than 9, and carbon dioxide at Pulgas DF is used to reduce the pH to ~7 to meet discharge pH limits. The NPDES standard discharge range is between 6.5 and 8.5. Dechloramiation is performed in the 10' diameter pipe contactor between the inlet and outlet boxes at Pulgas DF.
- **Dechlorination:** chlorine is removed through contact with sodium bisulfite at the outlet box. The facility roughly doses 2.25x more sodium bisulfite than chlorine on a mg/L basis indicating that dechlorination mode currently requires 1.37 to 1.54 times the theoretical stoichiometric ratio of sodium bisulfite to chlorine to meet existing discharge permit requirements.

2.3. Pulgas DF Limitations

Pulgas DF operates intermittently, based on SFRWS supply and the system demand flows. Due to intermittent operations, fine-tuning facility operations has been challenging and the facility is unable to perform dechloramination at flows less than 20 mgd. While flows greater than 100 mgd are uncommon, flows less than 20 mgd can occur close to 40% of the time. When low flows occur, Pulgas DF can utilize water from the PBR to supplement flows, if available, to allow dechloramination to occur. However, at flows above 100 mgd, breakpoint chlorination is not completed because the detention time is too low for breakpoint chlorination to be completed and only dechlorination is performed. Similarly, if the PBR cannot be used to supplement flows less than 20 mgd, only dechlorination is performed. Based on Pulgas DF data from 2021 to 2022, the average Pulgas DF flows were 51 mgd and 3% of flows occurring above 100 mgd.

2.4. Potential Impact of PureWater Peninsula Project

The PBR cannot be continuously used to supplement low flows to 20 mgd. For the PureWater Peninsula Project, a continuous flow of 6-8 mgd would be delivered to CSR in both Phases 1 and 2. Without any modifications to the existing operations at Pulgas DF, dechloramination of the purified water could not be performed when the flow is below the 20 mgd threshold. Only dechlorination could be performed at Pulgas DF resulting in elevated ammonia concentrations being discharged to

CSR thereby exceeding SF Bay Basin Plan ammonia limits. Thus, if chloramines are present in the purified water, an alternative to removing chloramines or avoiding sending chloraminated water to CSR would be needed prior to CSR augmentation. Alternatives and dechloramination strategies are evaluated in the following sections. In this study, chloramine removal (i.e., dechloramination) would be completed by breakpoint chlorination and chlorine removal (i.e., dechlorination) would be completed by reaction with sodium bisulfite. Section 4 evaluates these alternatives in detail. For the purposes of this project, dechlorination is expected to be performed at Pulgas DF prior to CSR augmentation in both phases of the project.

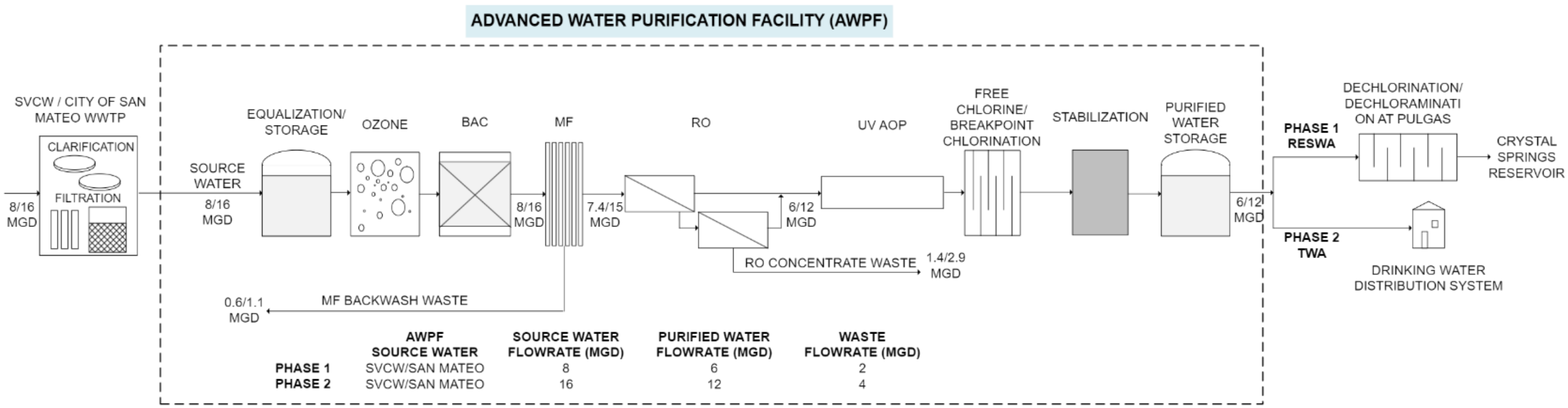
3. Purified Water Quality and Disinfectant Residual

3.1. Purified Water Quality

As discussed in **TM #1 – AWPF Design Criteria,** the proposed treatment processes (Figure 3-1) include:

- Ozone and biologically activated carbon (BAC) filtration
- Low-pressure membrane microfiltration (MF) or ultrafiltration (UF) pretreatment
- Reverse osmosis (RO) system
- Advanced oxidation process (AOP)
- Free chlorine disinfection
- Purified water stabilization
- Process equalization and storage tanks

Figure 3-1: Proposed AWPF Treatment Process for ResWA or TWA



Ammonia/ammonium is expected to be present in the wastewater effluent entering the facility. For simplicity, this TM refers to ammonia and ammonium interchangeably. As discussed in **TM #1 – AWPF Design Criteria**, RO membranes are conservatively expected to reject 95% of the ammonia in the wastewater effluent; however, even with 95% rejection of ammonia, the remaining ammonia present in the purified water is too high to be used for chloramination of the purified water if needed. Breakpoint chlorination is needed to further reduce ammonia concentrations in the purified water. Breakpoint chlorination would be performed during the 'free chlorine disinfection' step of the process at the AWPF, where all ammonia would be removed and oxidized to nitrogen gas. After breakpoint chlorination, only free chlorine would be present in the purified water.

Following breakpoint chlorination at the AWPF, if chloramines are required in the purified water (e.g., to match the SFRWS, which uses chloramines), supplemental ammonia would be dosed at the AWPF to generate chloramines. Thus, the only potential ammonia present in the purified water, following breakpoint chlorination of the ammonia initially present in the wastewater effluent, would be the supplemental ammonia being added back in for chloramination.

3.2. Purified Water Disinfectant Residual

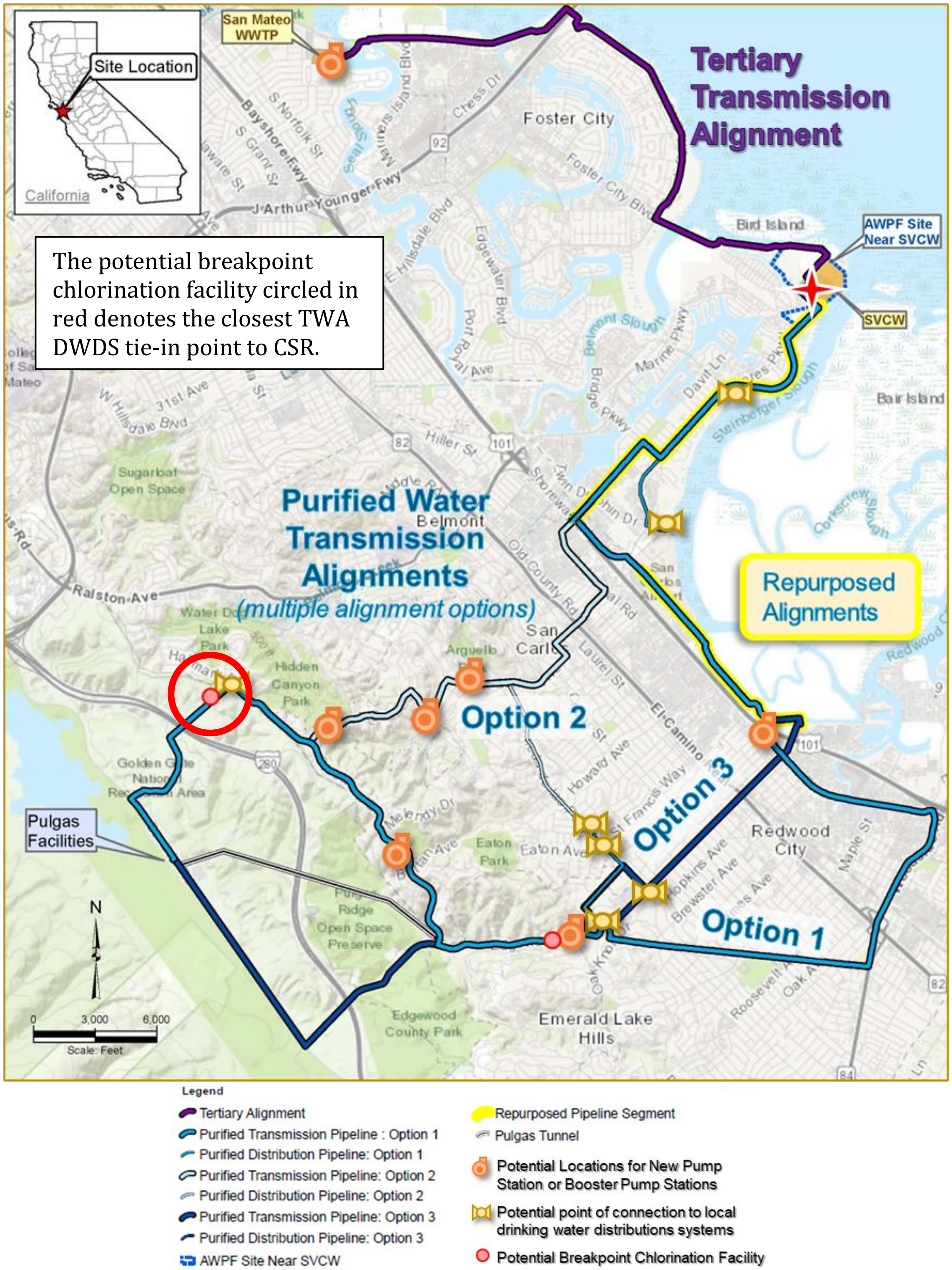
Phase 1 includes IPR via ResWA and Phase 2 includes both IPR via ResWA and DPR via TWA. As shown in Figure 3-2 both Phases would utilize the same conveyance pipeline for IPR and DPR. The drinking water distribution systems (DWDS) tie-in points for TWA are also shown in Figure 3-2. In Phase 1, free chlorine or chloramines may be used for IPR (Table 3-1). However, in Phase 2, chloramines must be used for DPR to match the use of chloramines in the SFRWS. If chloramines are used in either Phase 1 or 2, breakpoint chlorination of the chloraminated purified water must be performed to remove ammonia prior to IPR via ResWA at CSR. As discussed previously, breakpoint chlorination of a continuous stream of purified water cannot be performed at Pulgas DF.

Using only free chlorine in Phase 1 is beneficial as only dechlorination would need to be performed at Pulgas DF without the need of additional chemicals and operations associated with dechloramination with breakpoint chlorination. Dechlorination can be performed at Pulgas DF without significant modification of existing Pulgas DF operations. Discussion of treatment alternatives and disinfectant residual use is provided in Section 4.

Table 3-1: Disinfectant residual options for Phase 1 and Phase 2

Phase	Purified Water Augmentation	Disinfectant Residual	Treatment Needed Prior to ResWA
Phase 1	IPR via ResWA	Free Chlorine	Dechlorination
Phase 1	IPR via ResWA	Chloramine	Dechloramination + Dechlorination
Phase 2	DPR via TWA + IPR via ResWA	Chloramine	Dechloramination + Dechlorination

Figure 3-2: Potential Purified Water Conveyance Pipeline for Phases 1 and 2



4. Pulgas DF Treatment Alternatives

4.1. Phase 1 – IPR

Either free chlorine or chloramines may be used for disinfection as shown in Figure 4-1 and Figure 4-2 in Phase 1. Chloramines are not required in Phase 1 and the removal of chloramines would incur additional chemical cost and operational complexity. The figures in Section 4 have been simplified by utilizing Full Advanced Treatment (FAT) to represent the advanced treatment technologies (Ozone, BAC, MF, RO, UV/AOP) used for the purified water (Figure 3-1).

Figure 4-1: Phase 1 Alternative with Free Chlorine

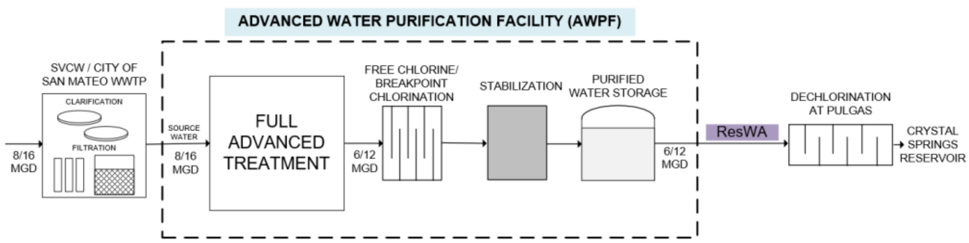
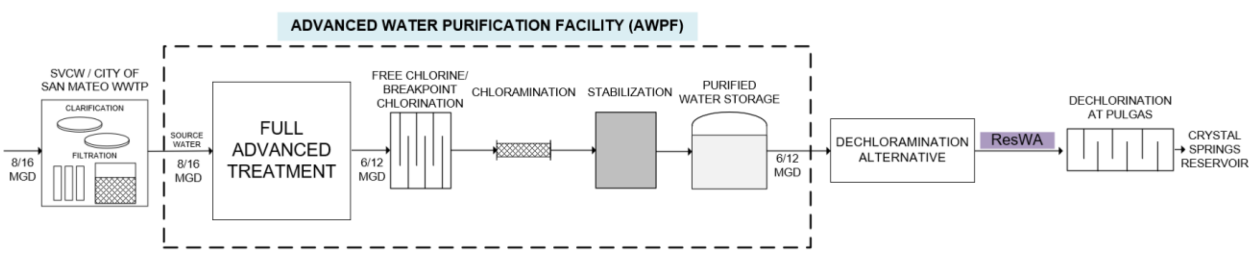


Figure 4-2: Phase 1 Alternative with Chloramines



Potential benefits of using free chlorine instead of chloramines in Phase 1 include:

- Chloramines are not needed in Phase 1 because the purified water does not need to match the disinfectant residual in the SFRWS as required in Phase 2. Utilizing free chlorine is sufficient as the disinfection residual for the purified water.
- If chloramines are used in Phase 1, additional costs and operational complexities would be introduced in Phase 1. These costs and operational complexities may not be necessary in Phase 1 and could be implemented in Phase 2 when chloramines are required in the purified water. Costs and operational complexities include:
    - Chemical dosing of ammonia at the AWPF to generate chloramines for the purified water.
    - Requirement to dechloraminate the purified water prior to Pulgas DF. Dechloramination alternatives are discussed in Section 4.2.

    - Costs for chemicals and operation of the breakpoint chlorination station for the purified water prior to Pulgas DF.
    - Additional operational complexity associated with chloramination and dechloramination.
- Dechloramination of the continuous low flow of purified water cannot be performed at Pulgas DF without major modifications. However, dechlorination can be performed at the Pulgas DF facility without major modifications to existing Pulgas DF operations with potential savings on implementation costs by utilizing existing dechlorination chemical dosing equipment and controls. Following discussions with Pulgas DF staff, potential modifications to Pulgas DF to perform dechlorination of the purified water may include:
    - Purified water pipeline tie-in at the 11' Weir (Figure 2-1). The 11' Weir is located upstream of existing Pulgas DF operations, which is performed at the outlet box and discharge channel. Although rare, flows over 100 mgd entering Pulgas DF spill over the 11' Weir and all flows entering the 11' Weir are dechlorinated.
    - Potential upgrades and updates to sodium bisulfite chemical dosing, chemical storage, chemical analyzers, and SCADA.
    - If adding on or modifying existing dechlorination equipment is not cost effective or significantly impedes existing Pulgas DF operations, new chemical dosing pumps and independent control systems for continuous dechlorination of the purified water may be evaluated as an alternative.
- Utilizing free chlorine in Phase 1 allows for the flexibility of implementing a dechloramination step closer to implementation of Phase 2 and would save on chemical costs for chloramine formation and dechloramination. The anticipated timeline between Phase 1 to 2 is approximately 5 years after Phase 1 is implemented.

Potential drawbacks to utilizing free chlorine instead of chloramines in Phase 1 include:

- Utilizing free chlorine in Phase 1 and switching to chloramines in Phase 2 may disturb the system resulting in adverse water quality impacts such as release of pipe scaling and metals.
- A dechloramination strategy for Phase 2 cannot be tested and validated for an extended period in Phase 1.

However, these drawbacks may be mitigated with testing prior to the beginning of Phase 2. For instance, implementing an appropriate dechloramination strategy and making the switch from free chlorine to chloramines 1-2 years prior to the beginning of Phase 2 may reduce or eliminate potential water quality and operational challenges. The transmission system pipeline is expected to have minimal scale formed because the pipeline would be new and expected to be operated for a few (~5) years prior to the switch from free chlorine to chloramines.

If chloramines are used in Phase 1, dechloramination would need to be performed prior to CSR. Dechloramination options are explored in Alternatives #1a, b, and c in the following section.

4.2. Phase 2 – IPR and DPR

Following Phase 1 of the project, purified water production would increase from 6 mgd to 12 mgd. Up to 6-8 mgd of purified water would be conveyed to CSR for IPR via ResWA, and up to 4-6 mgd of purified water would be used for DPR via TWA. While free chlorine may be used for Phase 1 of the project, chloramines must be used in the DPR portion of Phase 2 to match the existing SFRWS water quality. In Phase 2, new connections would be made to the purified water transmission pipeline constructed in Phase 1 to deliver purified water to the local DWDSs. Chloramines must be removed prior to CSR augmentation to meet regulatory requirements for chlorine and ammonia outlined in the Basin Plan. Alternatives for dechloramination and chloramination for both phases are summarized in Table 4-1.

Table 4-1: Alternatives for Dechloramination and Chloramination for PureWater Peninsula Project Phase 2

Alt #	Alternative	Chloramination Location	Dechloramination Location / Strategy	Dechlorination Location / Strategy
1a	**Centralized** Chloramination at AWPF + Dechloramination in Transmission Pipeline	AWPF	Perform dechloramination in the conveyance pipeline to Pulgas DF	Pulgas DF
1b	**Centralized** Chloramination at AWPF + Dechloramination in New, Dedicated Breakpoint Chlorination Pipeline Contactor at Pulgas DF	AWPF	Install a new, dedicated dechloramination pipeline contactor at Pulgas DF for the low, continuous flow of chloraminated purified water	Pulgas DF
1c	**Centralized** Chloramination at AWPF + Dechloramination at Pulgas DF by Modifying Existing Operations	AWPF	Modify existing Pulgas DF operations to perform dechloramination at low, continuous flows of purified water. Pulgas DF operations staff prefers to not consider this option since the current system is optimized for existing conditions	Pulgas DF
2	**Decentralized** Chloramination at TWA Tie-In Points	TWA Tie-In Points	N/A	Pulgas DF
3	**DPR Only:** Do not perform IPR via ResWA at CSR and only implement DPR via TWA. This alternative is being evaluated as part of a separate study.	AWPF	N/A	N/A

4.2.1. Phase 2 Alternative 1a – Centralized Chloramination at AWPF + Dechloramination in the Conveyance Pipeline

In this alternative, the purified water would be chloraminated at the AWPF to match the SFRWS water quality for DPR via TWA as shown in the process flow schematic in Figure 4-3. Chloramines must then be removed prior to CSR augmentation with IPR via ResWA. Dechloramination would be performed via breakpoint chlorination in the conveyance line to Pulgas DF after the last DWDS tie-in point. Potential breakpoint chlorination chemical dosing facilities would be installed as shown for Figure 3-2.

The reaction time for breakpoint chlorination can be impacted by water quality and can range between 15-30 minutes. Based on the 2015 Operations Plan developed for Pulgas DF, the required contact time for breakpoint chlorination at Pulgas DF was 15 minutes assuming a pH of ~7.5 and chlorine to nitrogen dosing ratio of 10:1 to 12:1. For PureWater Peninsula Project, the target design contact time for breakpoint chlorination is 30 minutes at the AWPF. Conservatively assuming 8 mgd of purified water would be used for CSR augmentation with IPR via ResWA (design considers a range of 6-8 mgd of purified water), a 24-inch diameter pipeline, and a distance of 2.3 miles from the closest potential DWDS tie-in point to Pulgas DF (shown in Figure 3-2), the minimum calculated contact time is 51 minutes. At a maximum, the conveyance pipelines are designed for a 12 mgd maximum flowrate, which provide a 34-minute contact time. These contact times are more than the 15 min currently implemented at Pulgas DF (Pulgas 2015 Operations Plan), and more than the 30 min target design contact time for the AWPF. Hence, there would be sufficient contact time for breakpoint chlorination to be performed in the conveyance pipeline from the last potential DWDS tie-in point to Pulgas DF.

A new chemical dosing station and equipment including pumps and storage for sodium hypochlorite and pH adjustment chemicals would be required near the last DWDS tie-in point. After dechloramination, only dechlorination would need to be performed at Pulgas DF prior to CSR augmentation.

Benefits to this alternative include:

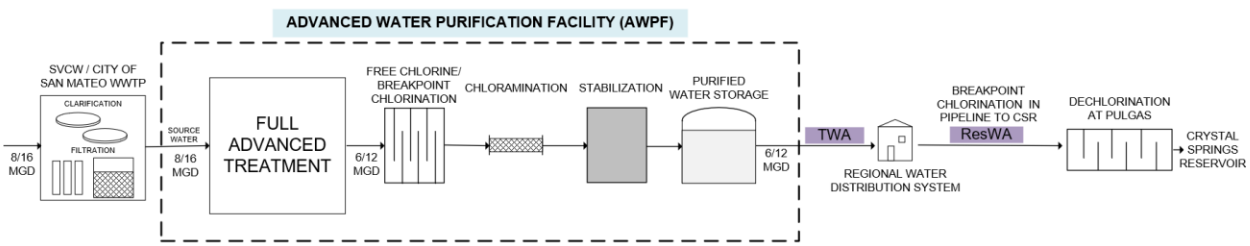
- Beneficial use of existing conveyance pipeline for breakpoint chlorination, eliminating the need to install new breakpoint chlorination pipelines.
- Performing dechlorination at Pulgas DF does not require significant changes to the existing Pulgas DF operations. Improvements at Pulgas DF would include installing a purified water tie-in to the 11’ weir (Figure 2-1), additional chemical dosing and storage, and SCADA and controls updates.
- Beneficial reuse of existing infrastructure and operations implemented in Phase 1 for Phase 2 with minimal changes, reducing the risk of stranded assets. Phase 2 improvements would

include construction of a new chemical dosing station (i.e., Breakpoint Chlorination Facility).

Drawbacks to this alternative include:

- Potential space constraints and disturbances for construction a new chemical dosing station along the Purified Transmission Pipeline.
- Additional O&M, capital costs, and operations staff required for the new dosing station.

Figure 4-3: Phase 2 Alternative 1a – Centralized Chloramination at AWPF + Dechloramination in the Conveyance Pipeline



4.2.2. Phase 2 Alternative 1b – Centralized Chloramination at AWPF + Dechloramination in a New Dedicated Breakpoint Chlorination Pipeline at Pulgas DF

Similar to Alternative 1a, the purified water in Alternative 1b (Figure 4-4) would be chloraminated at the AWPF to match the SFRWS water quality for DPR via TWA. However, rather than performing breakpoint chlorination in the conveyance pipeline, an additional dedicated breakpoint chlorination pipeline would be constructed at Pulgas DF to allow for dechloramination of the low, continuous flow of purified water prior to CSR augmentation. For a conservative detention time of 30 minutes, a 48-inch diameter pipeline length of approximately 1,800 ft would be required. Dechlorination would still be required and performed at Pulgas DF as described in Alternative 1a. A new chemical dosing station would be required and installed near the new dedicated breakpoint chlorination pipeline.

Benefits to this alternative include:

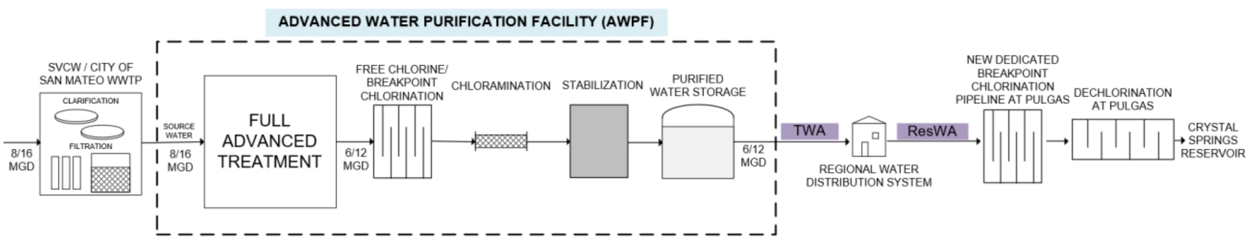
- Dechlorination is still performed at Pulgas DF, and does not require significant operational changes at Pulgas DF.
- More potential flexibility to increase contact time if future purified water flows increase with a dedicated, new pipeline. Based on an initial review of land around Pulgas DF, there is sufficient space to implement an additional dechloramination pipeline.

- Potential easier operation and maintenance with chemical delivery and maintenance of the chemical dosing station and breakpoint chlorination operations due to proximity to Pulgas DF.
- Potential to reduce footprint and co-locate chemical dosing and storage facilities with existing Pulgas DF facilities.

Drawbacks to this alternative include:

- Greater footprint (compared with Alternative 1a) and construction cost to construct a new breakpoint chlorination pipeline.
- Additional O&M, capital costs, and operations staff required for the new dosing station.
- Potential public visibility concerns of implementing a new breakpoint chlorination pipeline when a larger breakpoint chlorination pipeline at Pulgas DF already exists.

Figure 4-4: Phase 2 Alternative 1b – Centralized Chloramination at AWPF + Dechloramination in a New Dedicated Breakpoint Chlorination Pipeline at Pulgas DF



4.2.3. Phase 2 Alternative 1c – Centralized Chloramination at AWPF + Dechloramination at Pulgas DF by Modifying Existing Operations

In Alternative 1c, chloramination would similarly be performed at the AWPF, but dechloramination would be performed using existing Pulgas DF dechloramination operations (Figure 4-5). As discussed previously, Pulgas DF is currently unable to perform dechloramination for low, continuous flows of chloraminated water because the facility was designed to accommodate intermittent fluctuations in the drinking water system. A potential purified water tie-in to existing Pulgas DF operations would be at the 9' weir (Figure 2-1) instead of the 11' weir.

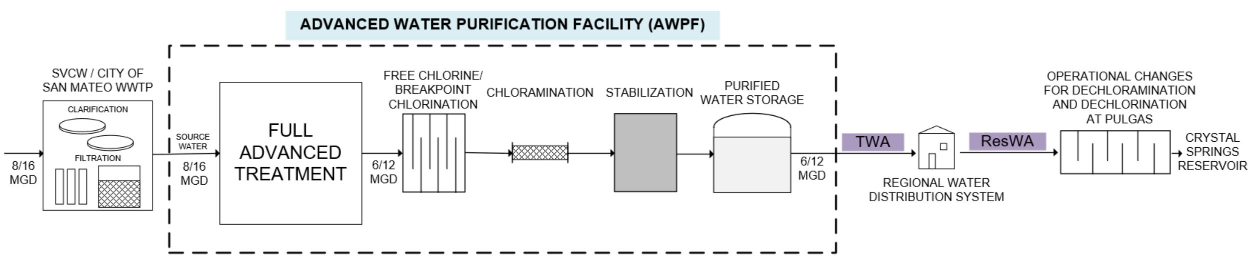
The benefits to this approach include:

- Use of existing Pulgas DF operations for dechloramination may allow for beneficial reuse of existing major infrastructure such as the pipeline contactor.
- Minor, if any, alterations to structures or the environment.

From discussions with Pulgas DF operational staff, there are several challenges to changing existing Pulgas DF operations to perform dechloramination at the Facility for low, continuous flows of chloraminated water including:

- Changing operations to accommodate the low, continuous flow of purified water would impact existing drinking water operations and require readjustment of Pulgas DF operations. Significant effort of ~10 years was needed to fine-tune current Pulgas DF operations.
- Studies to evaluate changes needed for Pulgas DF to perform dechloramination of the continuous low flow of 6-8 mgd of purified water would be required. Potential changes include modification of the existing SCADA system, integration of additional monitoring sensors, and additional storage for increased retention time/contact time for dechloramination. Based on discussions with Pulgas DF staff, increased retention time may be necessary for the existing Pulgas DF system to perform breakpoint chlorination.
- Mixing purified water with Hetch Hetchy water may impact existing dechloramination processes and would require additional treatment fine tuning.
- If dechlorination via the tie-in point at the 11-ft weir and associated chemical dosing equipment implemented in Phase 1, the equipment and tie-ins would likely not be used in Phase 2, resulting in stranded assets.

Figure 4-5: Phase 2 Alternative 1c – Centralized Chloramination at AWPF + Dechloramination at Pulgas DF by Modifying Existing Operations



4.2.4. Phase 2 Alternative 2 – Decentralized Chloramination at DWDS Tie-in Points

Rather than performing chloramination at the AWPF, under this alternative, the purified water leaving the AWPF would contain free chlorine and chloramines would be generated at each individual TWA tie-in point (Figure 4-6) meaning only free chlorine would be delivered to Pulgas DF. This alternative eliminates the need for dechloramination prior to Pulgas DF. Individual chloramination chemical dosing stations would need to be implemented at individual DWDS tie-in locations. There are multiple potential DWDS tie-in locations as shown in Figure 3-2. It is estimated that 4-5 chemical dosing stations would be needed for Purified Option 1, 4 for Option 2, and 3-4 for Purified Option 3.

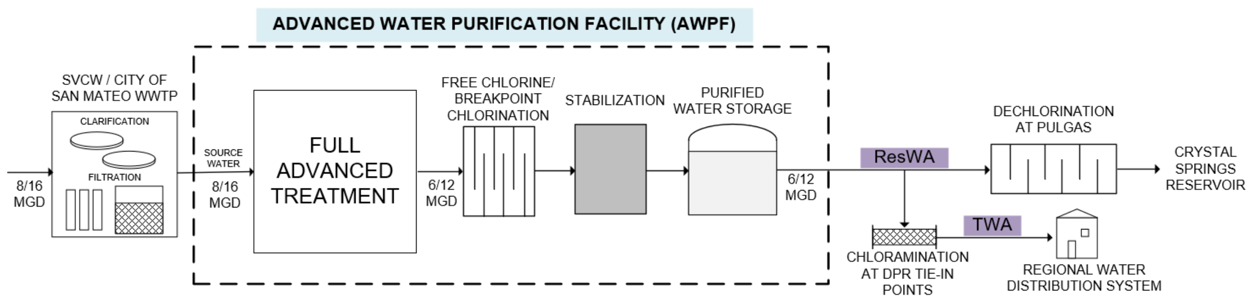
The benefits to this approach include:

- Only dechlorination would need to be performed at Pulgas DF.
- Greater control and flexibility of chloramine disinfectant residual in the system is allowed.

Drawbacks to this approach include:

- High capital costs for implementing multiple chemical dosing systems at DWDS tie-in points and associated high O&M costs for operating and maintaining multiple facilities and chemical deliveries.
- Space to implement dosing systems may be limited and land (if needed) may be challenging to acquire. Potential tie-in points are generally located in urban areas.
- Greater physical disturbances due to multiple dosing stations and chemical deliveries.
- Proper detention time for chloramine formation at each dosing point would be required, which could result in the need to construct additional contact pipelines in congested areas.

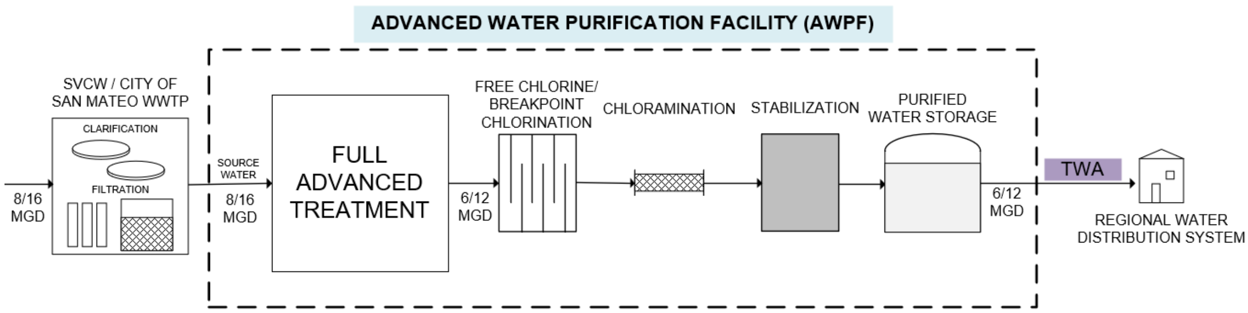
Figure 4-6: Phase 2 Alternative 2 – Decentralized Chloramination at TWA tie-In Points



4.2.5. Phase 2 Alternative 3 – DPR Only

Under this alternative, the purified water would only be used for DPR via TWA only (Figure 4-7) and there would be no initial Phase 1 with IPR via ResWA as well as no IPR performed in Phase 2. A separate study (PRO.188) is evaluating this alternative. Performing DPR only would significantly simplify the selection of disinfectant residual options as chloramines must be used to match the regional distribution system. Additionally, there would be no requirement to evaluate dechloramination alternative and Pulgas DF tie-in challenges as IPR via ResWA at CSR would not occur. However, public acceptance of implementing DPR immediately, without the initial IPR step, may be challenging.

Figure 4-7: Phase 2 Alternative 3 – DPR Only



5. Conclusions and Recommendations

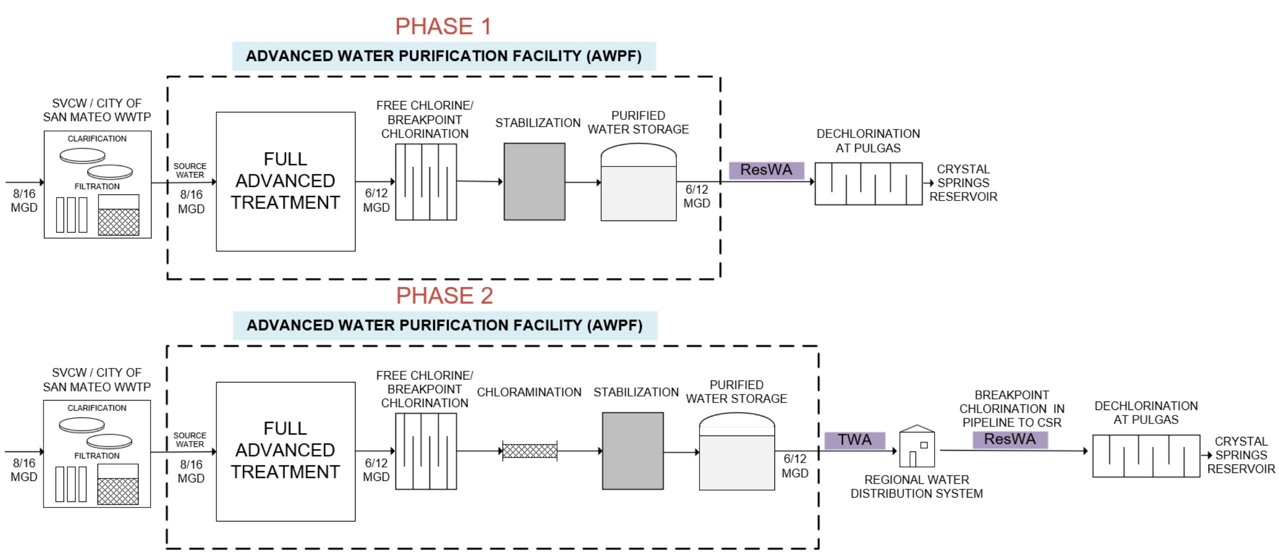
The goal of this TM is to evaluate disinfectant residual for the purified water and strategies to remove the disinfectant residual prior to CSR augmentation with IPR via ResWA. A recap of the key findings is presented below:

- Both free chlorine and ammonia must be removed with dechlorination and dechloramination, respectively, prior to IPR via ResWA.
- While dechlorination can be performed at Pulgas DF with minor modifications, dechloramination currently cannot be performed with the existing Pulgas DF dechloramination contactors without major operational changes. Modification of existing Pulgas DF dechloramination operations to accommodate the continuous low flow of purified water is operationally undesirable.
- Dechloramination alternatives of performing breakpoint chlorination in the conveyance pipeline or in newly constructed breakpoint chlorination pipeline contactors would be needed for dechloramination. Additional chemical costs, costs for constructing chemical dosing systems or pipeline contactors, and operation and maintenance costs would be needed for the dechloramination alternatives.
- Free chlorine and chloramines may be used for disinfectant residual in the transmission pipeline when only IPR occurs in Phase 1. Chloramines must be used in the DPR portion of Phase 2 to match the existing SFRWS water quality.
- An alternative evaluating DPR only would eliminate complexities associated with Pulgas DF as IPR via ResWA would not be performed; however, public acceptance of DPR may be challenging without IPR being performed first.

Several alternatives are evaluated for Phases 1 and 2. **Using free chlorine rather than chloramines in Phase 1 IPR via ResWA may be an ideal alternative because performing dechlorination for the purified water at Pulgas DF requires only minor modifications.** While using chloramines for Phase 1 (not required to match system water quality) provides consistent system water quality between Phases 1 and 2 and confirms the efficacy of the selected dechloramination solution for Phase 2, additional chemical and operational costs for dechloramination would be required in Phase 1 and little flexibility is offered to switch dechloramination solutions in Phase 2 should operations change. Because the timeline for implementing DPR after the initial IPR phase may change, waiting to implement a dechloramination solution provides flexibility. Any potential water quality impacts to the system due to the switch from free chlorine to chloramines may be addressed by performing the switch 1-2 years prior to DPR.

Once Phase 2 begins and both DPR and IPR are implemented, the purified water must have chloramines to match the SFRWS water quality. **Assuming free chlorine is used for Phase 1 and chloramination is implemented at the AWPF in phase 2, the recommended alternative for dechloramination prior to Pulgas DF is to perform breakpoint chlorination in the conveyance pipeline to Pulgas DF after the last DWDS tie-in point (Phase 2, Alternative 1a).** Performing dechloramination in the conveyance pipeline beneficially reuses infrastructure and does not require the construction of a new dechloramination pipeline (i.e., Phase 2, Alternative 1b), does not modify existing Pulgas DF operations (i.e., Phase 2, Alternative 1c), and only requires one chemical dosing station as opposed to several chemical dosing stations (i.e., Phase 2, Alternative 2). Additionally, only minor changes in dechlorination operations at Pulgas DF implemented in Phase 1 would be made in Phase 2 such as an increase in dechlorination chemical due to an increase in free chlorine concentration. Figure 5-1 summarizes the recommended disinfectant residual alternatives in Phase 1 and Phase 2.

Figure 5-1: Recommended Disinfectant Residual Alternatives for Phase 1 and Phase 2



May 2024

Final Technical Memorandum (TM) #5 – Drinking Water Distribution System Design Criteria

To:	PureWater Peninsula Parties
From:	Marie Fawcett, PE, Kennedy Jenks
Reviewers:	Dawn Taffler, PE, Kennedy Jenks Mark Minkowski, PE, Kennedy Jenks Al Shewey, PE, Kennedy Jenks
Subject:	Drinking Water Distribution Systems (DWDS) Design Criteria PureWater Peninsula Project – Basis of Design Report

The **PureWater Peninsula Project**, previously referred to as the Potable Reuse Exploratory Plan (PREP), is a regional effort to resolve multiple water supply and wastewater issues, while realizing the benefits of shared infrastructure, asset recovery, economies of scale and a more competitive strategy to pursue funding. **PureWater Peninsula Parties** include the Bay Area Water Supply and Conservation Agency (BAWSCA), California Water Service (Cal Water), San Francisco Public Utilities Commission (SFPUC), Silicon Valley Clean Water (SVCW), City of San Mateo, City of Redwood City (RWC), and the Mid-Peninsula Water District (MPWD).

This **Technical Memorandum (TM) #5 – Drinking Water Distribution System (DWDS) Connection Design Criteria** identifies preferred points of connection to introduce purified water into the existing DWDSs owned and operated by the Cal Water, RWC, and the MPWD and defines infrastructure requirements and potential operational and hydraulic constraints.

This TM is organized into the following sections:

1. PureWater Peninsula Project Overview
2. Considerations for DWDS Connections
3. Identified DWDS Connections for each Alignment Option
4. Summary of Potential DWDS Connections

Additional TMs that support this work include:

- **TM #1 – Advanced Water Purification Facility (AWPF) Design Criteria** focuses on the design parameters for use in developing a conceptual design for the AWPF sizing and expanded unit processes as well as conveyance facilities within the SVCW boundary.

- **TM #2 – Conveyance Facility Design Criteria** establishes the design requirements and preliminary criteria for the project pipelines and pump stations, beyond the AWPF fenceline, building on the design concepts identified in prior planning efforts.
- **TM #3 – Reverse Osmosis (RO) Concentrate Disposal** establishes the design requirements for the AWPF to discharge RO concentrate to the SVCW ocean outfall while meeting current and potential future regulatory requirements.
- **TM #4 – Pulgas Disinfectant Residual Alternatives** describes considerations related to the type of disinfectant residual and removal of disinfectant residual prior to Reservoir Water Augmentation (ResWA) for Crystal Springs Reservoir (CSR) augmentation via the Pulgas Dechloramination Facilities (Pulgas DF).
- **TM #6 - Operational Strategies** summarizes the preliminary operational strategies for both ResWA and Treated Water Augmentation (TWA) to support the development of AWPF design and operational criteria.

These TMs reflect the initial analyses performed to support the PureWater Peninsula Project Basis of Design Report (BODR) and have been included in an appendix to the BODR. Information contained within this TM may be superseded by content in the BODR, reflecting updates to the technical evaluation after the TM was completed.

1. Pure Water Peninsula Project Overview

The PureWater Peninsula Project is a potable reuse project that would create a new source of local sustainable water supply using state-of-the-art technology to purify tertiary effluent from SVCW and the San Mateo Wastewater Treatment Plant (WWTP).

The project would be implemented in two phases:

- **Phase 1** – Indirect Potable Reuse (IPR) via ResWA of up to 6 million gallons per day (mgd) of purified water at CSR.
- **Phase 2** – Direct Potable Reuse (DPR) via TWA. Expansion of AWPF to produce an additional 6 mgd of purified water, for a total of up to 12 mgd. Up to 6-8 mgd would be available for ResWA at CSR, and 4-6 mgd would be available for TWA to local drinking water distribution systems.

With the implementation of both PureWater Peninsula Project Phases, the project would provide a maximum of 12 mgd of purified water for local use by 2043.

The PureWater Peninsula Project includes:

- **Source water** derived from up to 8 mgd of tertiary effluent from SVCW and up to 9 mgd of tertiary effluent from the San Mateo WWTP would be combined to produce up to 12 mgd of purified water. Additional source water from SVCW would be available for dilution of RO concentrate.
- Construction of a new **AWPF** to treat source water to meet regulatory requirements for IPR in Phase 1 and DPR for the Phase 2 expansion.

- **Conveyance infrastructure** to deliver tertiary effluent to the new AWPF, purified water to the place of use, and brine for discharge via the existing SVCW outfall.
- A point of connection to SFPUC's **Pulgas DF**, which provides dechlorination of all flows prior to discharge into CSR.
- Multiple points of connection to existing tanks and transmission pipelines to deliver purified water to RWC, Cal Water, and/or the MPWD **drinking water distribution systems (DWDS).**

A summary of the PureWater Peninsula Project concept is depicted in Figure 1-1.

Figure 1-1: PureWater Peninsula Project Concept

1.1. PureWater Peninsula Project Facilities

A summary of PureWater Peninsula Project facilities is provided in Table 1-1 and depicted in Figure 1-2

Figure 1-2: Overview of Pipeline Alignments

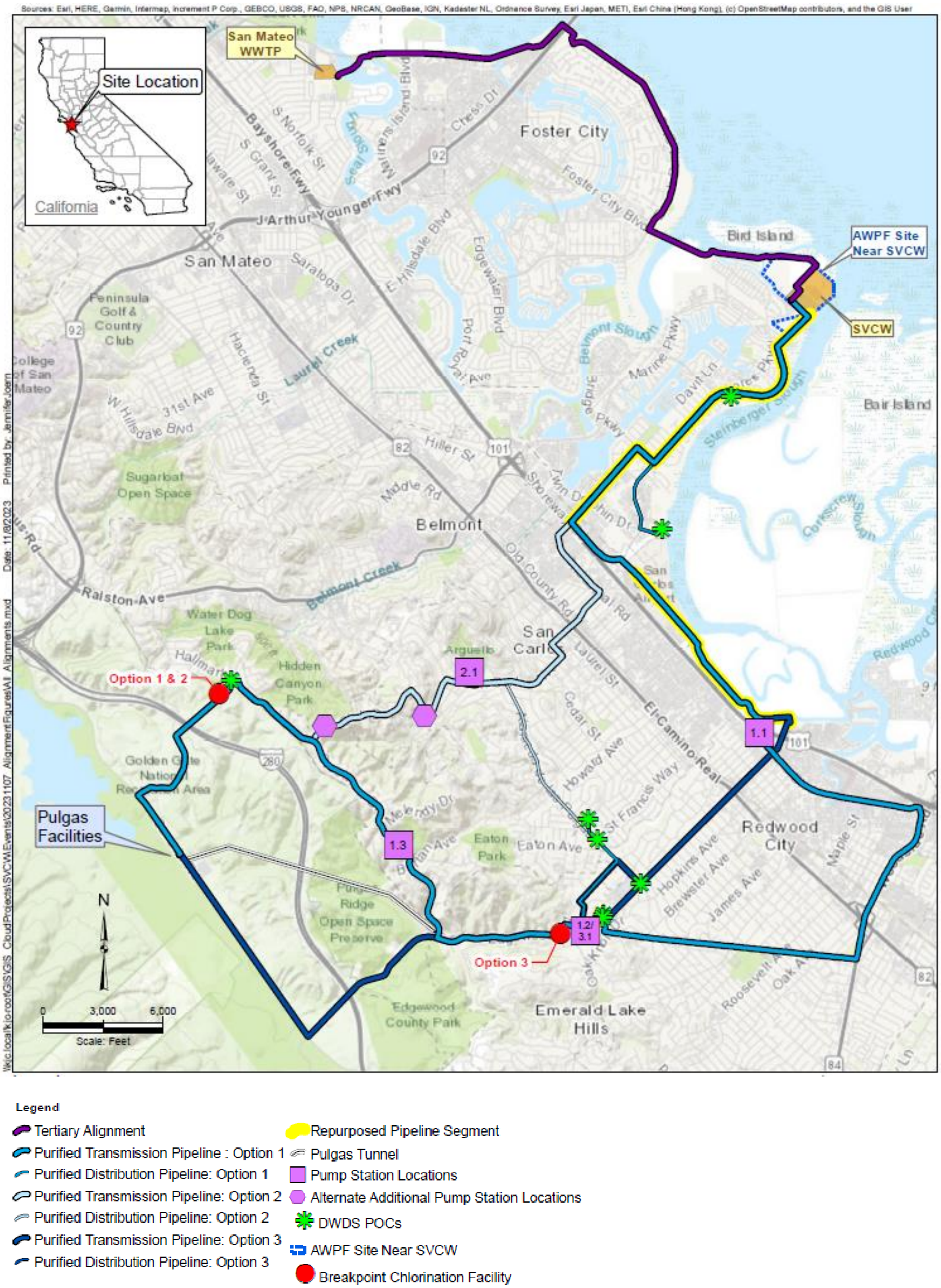
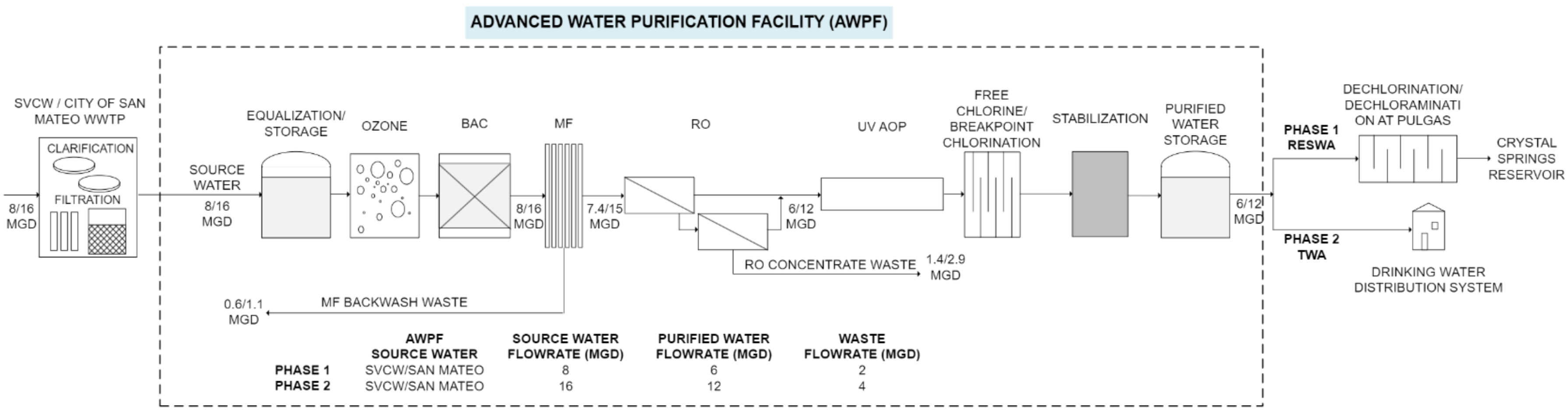


Table 1-1: PureWater Peninsula Project Facilities

	Phase 1 – IPR (6 mgd)	Phase 2 – IPR and DPR (12 mgd)
Treatment Facilities	• 6 mgd capacity AWPF located near SVCW; water treated to TWA standards. • Associated chemical feed systems, wet wells, inter-process pumps, and other appurtenances.	• Expand unit processes and appurtenances to 12 mgd treatment capacity; water treated to TWA standards. • Breakpoint chlorination facility to provide chemical dosing along the purified transmission pipeline (downstream of final DWDS connection, before Pulgas DF).
Pipelines	• **San Mateo Tertiary Effluent**: ~6 miles of 24"-dia source water pipeline from San Mateo WWTP to AWPF sized for up to 9 mgd source water flow. • **SVCW Tertiary Effluent**: <1 mile of 20"-dia source water pipeline from SVCW to AWPF sized for up to 8 mgd source water flow. • **Purified Water to Crystal Springs Reservoir:** 12-16 miles of 24 -dia purified water transmission pipeline from AWPF to CSR, with provisions for future connections to local drinking water distribution systems. The pipeline would be sized for Phase 2 flows of 12 mgd, with up to 8 mgd of that purified water flow reaching CSR in Phase 2. • **AWPF Brine Disposal:** <1 mile of 12"-dia brine pipeline from AWPF to the existing SVCW outfall.	• **Treated Water Distribution System Connections:** ○ 6"-to 18" dia Distribution pipelines from purified water transmission pipeline to potable water system tie-ins (pipe lengths vary by alternative). ○ Potable water system tie-ins to local drinking water distribution system (RWC, Cal Water and MPWD).
Storage	• **Equalization storage tank (EQ)** for source water, prior to AWPF with potential to convert one of RWC's Recycled Water storage tanks at SVCW for use as equalization. • **Purified water storage tank** for purified water prior to conveyance to CSR.	• Expand source water equalization storage tank capacity for the 12 mgd treatment capacity.
Pump Stations	• **San Mateo Tertiary Pump Station:** convey AWPF source water (tertiary effluent) from San Mateo to the AWPF. • **SVCW Tertiary Pump Station:** convey AWPF source water (tertiary effluent) from SVCW to the AWPF • **RO Concentrate Pump Station:** Convey brine from the AWPF to SVCW Outfall connection. • **Purified Water Pump Station at AWPF:** Convey purified water from AWPF to CSR/DWDS connections. • **Purified Water Booster Pump Stations (BPSs):** Several intermediate booster pump stations would be required to convey purified water from the AWPF to CSR/DWDS connections.	• Expand number of pumps at each pump station to meet the 12 mgd treatment capacity.
Pulgas	• Connect to the concrete 11' weir at Pulgas DF prior to augmentation into CSR. • Utilize the existing Pulgas Dechlorination operations and Discharge Channel to augment CSR.	• No additional modifications.

The overall Process Flow Diagram for the AWPF is shown in Figure 1-3. This **TM #5 – Drinking Water Distribution System Design Criteria** identifies preferred points of connection to introduce purified water into the existing DWDSs and defines infrastructure requirements and potential operational and hydraulic constraints.

Figure 1-3: PureWater Peninsula Project Overall Process Flow Diagram



	AWPF SOURCE WATER	SOURCE WATER FLOWRATE (MGD)	PURIFIED WATER FLOWRATE (MGD)	WASTE FLOWRATE (MGD)
PHASE 1	SVCW/SAN MATEO	8	6	2
PHASE 2	SVCW/SAN MATEO	16	12	4

A purified water transmission pipeline would be constructed to convey water from the new Purified Water Pump Station at the AWPF to SFPUC's Pulgas DF, where it would be introduced into Crystal Springs Reservoir. Potential points of connection at the Pulgas DF are further discussed in **TM #3 – RO Concentrate Disposal**.

Three potential alignment options are identified for the purified water transmission pipeline, as shown in Figure 1-2. It is anticipated that between one to three intermediate booster pump stations would be required along the pipeline, depending on the alignment selected. **TM #2 – Conveyance Facility Design Criteria** describes the potential booster pump station locations, which are further refined in the BODR. Purified water distribution pipelines and potential points of connection to the drinking water distribution systems are identified for each purified transmission pipeline alignment.

1.2. PureWater Peninsula Project Flows

PureWater Peninsula Project flows are summarized in Table 1-2. Phase 1 design flows to deliver water for ResWA are defined in the BODR and could range between 6 – 8 mgd for the AWPF purified water. For the purposes of this TM, Phase 1 would produce 6 mgd for ResWA at CSR and the additional 6 mgd produced in Phase 2 would feed the treated drinking water distribution systems. It is assumed that up to 8 mgd could be delivered to CSR. RO concentrate would be discharged to the existing SVCW outfall. Other AWPF waste flows, including backwash water, neutralized chemical waste from membrane chemical cleans, and drains would be returned to the SVCW Headworks.

Table 1-2: PureWater Peninsula Project Flows Summary

Flow	Phase 1 Capacity (mgd)	Phase 2 Capacity (mgd)
San Mateo Tertiary Effluent	4.0 - 5.3	9.0[1]
SVCW Tertiary Effluent	4.0 - 5.3	8.0
AWPF Combined Influent	8.0	16.0
RO Concentrate	1.4	2.9
Other AWPF Waste	0.6	1.1
AWPF Purified Water	6.0	12.0
Purified to CSR	6.0	6.0 - 8.0
Purified for TWA	0	4.0 – 6.0

Note:

[1] An AWPF combined influent flow of 16.0 mgd is required to produce 12.0 mgd of AWPF purified water, which would be a blend of water from the San Mateo WWTP and SVCW. It is assumed that up to 8.0 mgd would be available from SVCW and up to 9.0 mgd would be available from San Mateo. The AWPF source water ratio could shift to a higher percentage of San Mateo effluent when needed to supplement SVCW flows and/or to maintain some flows to blend with RO concentrate prior to discharge.

1.3. DWDS Demands

Water from the San Francisco Regional Water System (SFRWS) comprises a substantial portion of the water supply for BAWSCA's 26 member agencies. Table 1-3 summarizes current and projected water demands for the 26 BAWSCA member agencies based on information provided in BAWSCA FY 2020-21 Annual Survey.

Table 1-3: Current and Projected Water Demands for BAWCA Member Agencies (average, mgd)

Average Demands (mgd)	2020	2025	2030	2035	2040	2045
SFRWS Purchase	139.8	153.9	153.5	157.5	162.0	172.8
Groundwater	17.3	30.6	30.9	32.4	35.4	41.9
Recycled Water	7.7	10.8	12.5	14.0	15.8	17.5
Surface Water	0.8	6.6	6.6	6.6	6.6	6.6
Other Sources	39.8	45.4	43.5	45.1	48.4	44.2
Total BAWSCA Demands	**205.4**	**247.4**	**247.0**	**255.6**	**268.2**	**283.0**

Source: BAWSCA FY 2020-2021 Annual Survey

A summary of system demands for the PureWater Peninsula Project water suppliers, RWC, Cal Water, and MPWD, as reported to BAWSCA for the last four fiscal years is provided in Table 1-4.

Table 1-4: Water Demands and SFRWS Purchases by PureWater Peninsula Project Parties

Average Demands (mgd)	FY 18/19	FY 19/20	FY 20/21	FY 20/22	% Demand Met with SFRWS Supplies
RWC	8.7	9.5	9.2	8.5	92%
Cal Water Bayshore - Mid-Peninsula District [1]	12.3	12.9	13.0	12.4	100%
MPWD	2.5	2.7	2.6	2.4	100%

Source: BAWSCA Member Agencies Profiles https://bawsca.org/members/profiles (BAWSCA, 2023)

[1] Cal Water Bayshore District's Mid-Peninsula serves the communities of San Carlos, San Mateo, parts of unincorporated RWC, and adjacent unincorporated portions of San Mateo County, including The Highlands and Palomar Park.

Two hydrologic flow regimes were established in prior phases of the PREP to reflect conditions during a 6-year drought and 6-year normal/wet period hydrologic flow regime. These hydrologic regimes are used to evaluate available storage in the SFRWS for purified water augmentation and potable water demands during dry and wet periods. Monthly potable demands for the PureWater Peninsula Project water suppliers for the two hydrologic flow regime periods in the winter (October through March) and summer (April through September) months are summarized in Table 1-5. For comparison, annual average demands based on water use presented in each agency's 2020 UWMP are also shown.

Table 1-5: Summary of Potable Demand Analysis for Hydrologic Flow Regimes (mgd)

Water Suppliers	6-year dry period (1987-1992)	6-year wet period (1993 to 1998)	2020 Annual Average[5]
San Francisco Harry Tracy WTP Deliveries[1]			
Winter	23	42	32.2
Summer	21	22	
Annual Average	**21.8**	**32.1**	
Cal Water Bayshore – Mid-Peninsula District – San Carlos Area [2]			
Winter	3.0	3.0	3.2
Summer	4.2	4.6	
Annual Average	**3.6**	**3.8**	
MPWD			
Winter	2.6	2.5	2.7
Summer	3.4	3.7	
Annual Average	**3.0**	**3.1**	
Total RWC[3]			
Winter	7.6	8.7	8.7
Summer	10.5	12.6	
Annual Average	**9.1**	**10.7**	
Redwood Shores[4]			
Winter	1.1	1.2	1.2
Summer	1.5	1.8	
Annual Average	**1.3**	**1.5**	
RWC City Limits Demand			
Winter	6.5	7.5	7.5
Summer	9.0	10.8	
Annual Average	**7.8**	**9.2**	

1. SFPUC Annual Average based on 2020-2021 data provided by SFPUC. Historical dry and wet period data from HHLSM Model representing San Andres Reservoir Releases to HTWP, where the maximum release was 86 mgd.
2. Annual Average demand for San Carlos based on 25% of the 2020 UWMP gross water use for Bayshore Mid-Peninsula District (13.0 mgd).
3. Data for 6-year dry period was not available, values shown represent RWC demand over the prior record provided 1997 to 2020. Redwood Shores recent demand ranges from 1.1 mgd in the winter to 1.5 mgd in the summer based on the period of record from 2013 to 2020. Annual average in 2020 does not include recycled water use.
4. Redwood Shores assumed to use 14% of the Total RWC Demand, based on data from 2013 to 2020. The remainder of the demand is assumed to be distributed within the RWC City limits.
5. Average annual demands as reported in UWMPs.

1.4. DWDS Shortages

BAWSCA's Regional Water Reliability Model is a tool used to develop long-term reliable water supply strategies and support decision-making. This model receives inputs from, but is independent of, the SFPUC's Hetch Hetchy Local Simulation Model (HHLSM), which simulates SFRWS operations using historical hydrology from 1920 to 2017. BAWSCA's Regional Water Reliability Model also receives input through regional cooperation with Valley Water's Water Evaluation and Planning (WEAP) Model, Alameda County Water District's Integrated Resources Planning Model (IRPM) and other local supply information (e.g., Cal Water's Bear Gulch System). The model's study area includes the SFRWS downstream of San Antonio Reservoir through the City of San Francisco. The model provides member agency perspective on frequency, magnitude and timing of shortages based on each agency's demand and regional supplies. Hazen and Sawyer provided the output of modeled shortages from July 1986 to 2011 to simulate shortages by the PureWater Peninsula Project Parties during the defined hydrologic flow regimes. TWA could serve to reduce or even eliminate these shortages, presented in Table 1-6, in dry periods.

Table 1-6: Summary of BAWSCA Regional Water Reliability Model – Shortages Output for PureWater Peninsula Project Water Suppliers

Fiscal Year	MPWD Mid-Peninsula Diversion Shortage		Cal Water Bayshore District Mid-Peninsula Diversion Shortage		RWC Redwood City Diversion Shortage	
(FY)	(AF)	(mgd)	(AF)	(mgd)	(AF)	(mgd)
1988	311	0.3	3,173	2.8	1,539	1.4
1989	353	0.3	3,586	3.2	1,748	1.6
1990	720	0.6	5,453	4.9	2,966	2.6
1991	519	0.5	4,405	3.9	2,292	2.0
1992	649	0.6	5,095	4.5	2,738	2.4
1993	394	0.4	2,766	2.5	1,524	1.4
Average Shortage (1988-1993)	**491**	**0.4**	**4,080**	**3.6**	**2,135**	**1.9**

1.5. Regulatory Requirements

The draft DPR regulations require the designation of one direct potable reuse responsible agency (DiPRRA) that would be responsible for complying with the DPR regulations. The DiPRRA is required to be a public water system that is responsible for using the DPR water. Responsibilities for the DiPRRA include:

- Demonstrating that all treatment processes are designed, installed, and operated in compliance with the DPR regulations and an approved Operations Plan,
- Compliance with the California Waterworks Standards, Title 22, Division 4, Chapter 16,
- Subjecting its facilities and operations to an annual inspection to evaluate its
  - Source(s) and treatment
  - Cross-connection control program

- Enhanced source control program
- Technical, managerial, and financial capacity and that of its partner agencies
- Operations Plan, Monitoring Plan, and Water Safety Plans

The draft DPR criteria are currently being reviewed by the DPR expert panel and the final recommendations are expected to be released in December 2023.

SFPUC is likely to be the identified DiPRRA for the PureWater Peninsula Project. The DiPRRA is required to work collaboratively with the public water system receiving purified water to jointly address potential impacts resulting from the introduction of advanced treated water into a water treatment plant and/or introduction of finished water into a drinking water distribution system and submit necessary plans and reports.

Currently, there are no federal regulations directly addressing potable water reuse, which is why the State Board has mandated all generally applicable Safe Drinking Water Act (SDWA), Clean Water Act (CWA), and other state regulations specific to water reuse are met. Some of the SDWA aspects that are applicable to the PureWater Peninsula Project water distribution agencies that may apply include, but are not limited to:

- **Lead and Copper Rule** – to demonstrate optimized corrosion control, appropriate water quality parameter monitoring, and adherence to action levels.
- **Total Coliform Rule** – to control bacterial growth through monitoring, investigation, and notifications.
- **Surface Water Treatment Rules** – to maintain disinfectant residuals through monitoring, investigation, and notification.
- **Disinfectants/Disinfection Byproduct (DBP) Rules** – to control DBP formation, identify potential hot spots, implement monitoring plans and treatment techniques for disinfection byproduct precursors control (e.g., TOC reduction requirements)
- **Other regulations governing distribution systems** – including California Waterworks Standards for materials, installation, separation requirements, meters, flushing, isolation/release valves, and other requirements and Water System Operations and Maintenance Plan requirements, if directed by DDW.

Regulatory requirement for potable reuse are further described in **Appendix A: Potable Reuse Regulatory Requirements**.

2. Design Considerations for DWDS Connections

Preliminary meetings were held with each water supplier to discuss potential tie-in locations and design considerations to receive purified water in Phase 2 of the PureWater Peninsula Project, through TWA. It is anticipated that future studies would be needed to evaluate and model boundary conditions for augmenting each drinking water system and to further define flow restrictions, infrastructure requirements, and operational limitations.

Design and other considerations that would influence and guide the identification and implementation of connections to a DWDS include:

- **Water Quality:** It is assumed that the purified water would be chloraminated to match the SFRWS water currently received by the agencies. In order to meet water quality requirements at CSR, the water would be dechloraminated downstream of the final DWDS tie-in point. For further discussion, see **TM #3 – RO Concentrate Disposal**.
- **Purified Water Blending Ratios:** Based on the anticipated DPR regulations, recently released in draft form, there are currently no regulatory limitations on the ratio of purified water that can be used to augment a DWDS for TWA. For the purposes of this TM, it is assumed that a maximum of 50% purified water would be blended with other existing water sources for a given service area.
- **System Demands:** System demands are based on available information publicly reported and/or provided by each water supplier. Additional hydraulic analysis and/or modeling may be required to determine demands, hydraulic implications, and operational implications at specific locations in the systems.
- **Operations:**
    - Based on discussions with the PureWater Peninsula Project Parties, it is assumed that SFPUC would own and operate the purified water transmission pipeline. Each of the drinking water distributors (RWC, Cal Water, and MPWD) would be responsible for operating and maintaining the purified water distribution pipelines and connections to their systems. The pipeline material and design for the distribution pipelines could match the standards and preferences of the drinking water distributors.
    - Instrumentation and controls for DWDS connections would be coordinated with the overall PureWater Peninsula Project SCADA system, as well as the drinking water distributors' existing SCADA systems.
    - Controls would include flow-modulating valves to accept purified water at the desired blending ratios for each DWDS connection, based on input from the water distributor's system demands. For tank connections, SCADA would be used to determine which tank(s) would receive purified water and would receive control input on water levels in the receiving tank(s). For connections to existing transmission lines, SCADA would control the flow of purified water based on system demands and flow conditions. PRV stations would be used to adjust the purified water pressure to match existing system pressures.
    - Future analysis would be required to determine the impacts of the purified water deliveries on existing system operations and hydraulics. Specific connections would require detailed design planning and analysis for interface with the purified water system.

- **Point of Connection to Existing DWDS:** The point of connection to each DWDS is identified based on the location and capacity of existing infrastructure. Where possible, one or more points of connection to each DWDS are identified to allow more flexibility to accept purified water given system demands and to promote equity in distribution of purified water to agency customers. Conceptual tie-in locations would vary based on the purified water transmission line alignment.
    - **Existing Tanks:** It is assumed that new tank connections would be made with an air gap. Alternatively, backflow preventers would be installed at the connection points. It is assumed that blending of the purified water with the existing sources would occur within the tank. In general, connections to existing tanks are preferred due to simpler operation and controls, however, the viability of connecting to an existing tank varies depending on which purified transmission pipeline alignment is selected. Proximity to existing tanks may be a consideration when evaluating the alternative alignments.
    - **Existing Transmission Mains:** It is assumed that at a transmission main point of connection, the purified water transmission pressure would be greater than the DWDS pressure. PRV stations would be installed at the connection locations if needed. If the purified water transmission pressure is less than the DWDS pressure, a booster pump station would be required, which could present significant challenges and additional costs given the space constraints in the region. Additional hydraulic analysis would be required to understand mixing conditions at the point of augmentation and could require additional monitoring and other operational changes. It is anticipated that such connections would require additional modeling and other analysis during design.
- **Required Infrastructure:** Key facilities required for the TWA expansion include purified distribution pipelines, connections to existing facilities, power stations for controls, and pressure-reducing stations for connections to distributors' pipelines. Each connection point would have a flow meter and modulating valve to control feed of purified water into the system.
- **Social Equity:** Connections that reach a larger proportion of customers may be preferred to promote equitable distribution of purified water amongst PureWater Peninsula Party customers.

Design criteria for specific DWDS connection points are discussed in the following sections. Siting of connections and associated facilities are further developed in the BODR and **Appendix F: Drawings**.

2.1. Redwood City

The City of Redwood City (RWC) is the third largest city in San Mateo County, with over 82,000 residents. RWC purchases all of its potable water from the SFRWS via 13 active meter connections. Seven of the turnouts are located off Bay Division Pipelines 1 and 2, one turnout is off BDPL 1, 2, and 3, and five turnouts are off BDPL 3 and 4. The distribution system consists of 14 separate pressure zones, 10 pump stations, and approximately 265 miles of water mains. Pumps are located at 7 of the 11 storage sites. RWC has a total of 11 emergency interties with California Water Service of San Carlos, Mid-Peninsula Water District, and the City of Menlo Park (BAWSCA, 2023).

RWC is a member agency of the SVCW JPA and owns and operates two 2-million-gallon storage tanks, a 1-million-gallon chlorine contact tank, a distribution pump station at the SVCW facility, and 17 miles of distribution pipelines to serve tertiary recycled water to non-potable reuse customers in the City's service area.

RWC's service area includes the City limits, as well as the Redwood Shores community. The Redwood Shores area is served potable water by two Redwood Shores Tanks (3 MG and 3.2 MG capacity), which are fed by a dedicated pipeline separate from the rest of the system. The higher elevation pressure zones within the City limits are fed directly from the SFPUC system and are therefore not viable options for DWDS connections.

Connecting to existing tanks would be preferred for ease of operation. The length and routing of the pipeline would vary based on the purified water alignment. The preferred pipeline material would be PVC in accordance with RWC technical design standards. Additional evaluation of tank operations to confirm turnover, level setpoints, and exact points of connection would be performed as part of the next design phase. Connections to the transmission lines are less preferred due to the higher complexity of blending and hydraulics.

Two potential points of connection are identified within the RWC service area:

1. **Redwood Shores Tanks:** RWC has two existing storage tanks (one concrete, one steel) located off Redwood Shores Parkway that serve the Redwood Shores service area. The two tanks have a combined storage capacity of 6.2 MG, and are operated in a three-way rotation along with a flow regulator near Holly Street & Skyway Road. The tanks typically fill every other day. The Redwood Shores Pressure Zone is a viable option for purified delivery due to the proximity of two storage tanks to all three purified alignments, however, its demand is limited by the number of customers in the service area, which is separate from the rest of the RWC system.
2. **Sequoia Tanks**: RWC owns two 4 MG concrete tanks located on Bennet Road, near an SFPUC Bay Division Pipeline (BDPL) turnout and Purified Transmission Pipeline Options 1 and 3. The adjacent SFPUC turnout experiences the highest demand of the RWC turnouts. The Sequoia Tanks serve the Main City Pressure Zone and undergo filling approximately every other day. Connecting to the Sequoia tanks could distribute purified water to approximately one-third of the customers within that pressure zone. The ability to accept purified water may be limited due to the level setpoints in the tanks, which range from 17 feet to 19 feet, and are used to regulate pressure in the distribution system. The tanks are planned for replacement according to the existing Master Plan, so future replacement projects could incorporate DWDS connections.

It is assumed that the Redwood Shores Tanks could be augmented regardless of alignment. Additional connections to the Sequoia Tanks could be made for Purified Transmission Pipeline

Options 1 and 3. There are limited opportunities to connect to the main RWC system from Option 2, as it does not pass by RWC limits.

2.2. Cal Water

Cal Water is a San Jose-based company that serves 484,900 customer connections through 28 Customer and Operations Centers throughout the state. Cal Water's Mid-Peninsula District is located in central San Mateo County and serves the communities of San Carlos, San Mateo, parts of unincorporated RWC, and adjacent unincorporated portions of San Mateo County, including The Highlands and Palomar Park. The Mid-Peninsula District has interties with MPWD, RWC, Belmont, Burlingame, Hillsborough, and Estero Municipal Improvement District.

The Cal Water Mid-Peninsula District purchases all of its potable water from the SFRWS. Water is delivered to the San Carlos area via 3 SFPUC SFRWS turnouts located off BDPL 1 and 2. San Mateo is supplied from 5 turnouts located off the Crystal Springs Pipeline #2 and Sunset Supply Lines. The distribution system includes 22 pressure zones in San Carlos, 18 in San Mateo, 62 booster pumps, 38 storage tanks, and 363 miles of main (BAWSCA, 2023).

While Cal Water has storage tanks in their system, they were not identified as preferred connection points due to their elevations, distance from the purified water transmission pipelines, or other operational factors. Potential points of connection to existing drinking water transmission lines are identified within the Cal Water Bayshore District service area, including:

1. **Station 103 White Oaks Site/BDPL Turnouts SC-02 and SC-03:** Cal Water receives water from the SFRWS via two connections from the BDPL's in Cordilleras Road (SC-02 and SC-03). The water is conveyed to the Cal Water service area via two pipelines: a 21-inch-diameter CCP, which reduces to 16-inch near Station 103, and a 14-inch-diameter AC pipeline, which run along Edgewood Road and Alameda de Las Pulgas. The 14-inch pipeline typically serves the lower-pressure zones directly, while the 21-/16-inch pipeline continues to Station 103. Station 103 is an existing pump station that serves the higher-pressure zones, located at the prior site of the White Oaks Reservoir, which has been demolished. Purified water would be blended into the existing Cal Water transmission line, then the blended water would be pumped using the existing pumps. Together, these two pipelines near Station 103 provide optimal points to augment and distribute purified water to a large portion of Cal Water customers in the San Carlos area. It is anticipated that a single connection to the purified water transmission line could be made with two connections, one to serve the higher-pressure zones and one to serve the lower-pressure zones. It is anticipated that pressure-reducing valve (PRV) stations would be required to match Cal Water system pressures. Cal Water notes that water pumped from Station 103 may feed back down to the lower-pressure zones indirectly from the higher-pressure zones via the existing distribution system.
2. **Large Distribution or Transmission Lines:** Earlier phases of PREP identified the potential to augment various locations within Cal Water's distribution system in southern San Mateo and northern San Carlos. Potential points of connection that were previously identified, but are less preferred, include:

- a 12-inch-diameter service connection at Shoreway Road and Skyway Road, which is close to the previously identified AWPF location near the San Carlos Airport (previously referred to as the Hwy 101 site)
- a 12-inch-diameter transmission line at Old County Road and Cherry Street
- Other existing SFRWS BDPL turnouts, and
- at the Station 117 pump station.

The transmission pipelines near Station 103 were identified as preferred tie-in points due to their ability to provide purified water to much of Cal Water's Mid-Peninsula system via existing pipelines and pump stations. This would promote equity in purified water distribution and streamline operations compared to having many tie-in points elsewhere in the system.

Cal Water's preferred pipeline material is fusible PVC or ductile iron. The length and routing of the pipeline would vary based on the purified water alignment. Constructing the pipeline in Alameda de las Pulgas would be challenging given the amount of existing underground utilities. It may be possible to tie into the 21-inch and 14-inch transmission mains closer to the BDPL turnouts for Purified Transmission Line Alignments Options 1 and 3.

Cal Water also has facilities on Alameda de Las Pulgas, which could be used to convey purified water upon selection of Purified Transmission Pipeline Option 2. Further evaluations could be conducted during design to analyze whether an existing Cal Water pipeline could be used to convey water to Station 103 to reduce cost and construction impacts. For the purposes of this TM, it is assumed that a new purified distribution pipeline would be constructed from the purified transmission pipeline to the vicinity of Station 103.

2.3. Mid-Peninsula Water District

The Mid-Peninsula Water District (MPWD) is a "Special District" and a public agency directly providing water for municipal purposes in east central San Mateo County on the San Francisco Peninsula, about 30 miles south of San Francisco. The MPWD currently supplies water to approximately 27,500 customers in an area slightly larger than the city limits of the City of Belmont. The MPWD is a retail customer of the SFPUC SFRWS, and a BAWSCA member. The District's sole source of potable water is delivered via two SFRWS turnouts, (1) at a low elevation in RWC and (2) a high elevation in the vicinity of the Pulgas Water Temple.

The system contains nine pressure zones. The easternmost zone, east of El Camino Real, is gravity fed from the SFRWS connection. Water is pumped to storage reservoirs at higher elevations to feed the remaining pressure zones. The District operates and maintains a distribution system that includes 20 pumps, 11 water tanks, 13 regulating valves, and 105 miles of water mains. The District also has redundancy built into the distribution system, enabling either of the two SFRWS transmission mains to supply water to all customers of the District. The District has the ability to transfer water between pressure zones in either a pump-up or flow-down mode in emergency conditions. (BAWSCA, 2023)

Two potential points of connection were identified within the MPWD service area:

1. **Hallmark Tanks:** MPWD owns two, 2.5 MG tanks on Hallmark Drive, near the Pulgas Water Temple. The two storage tanks typically provide water to approximately 80% of customers by usage and can be operated to serve the full MPWD service area if needed. The Hallmark Tanks are nearby to Purified Transmission Pipeline Options 1 and 2 but would not be feasible if Option 3 is selected.
2. **Transmission Line in Whipple Avenue/Old County Road:** MPWD owns a 20-inch-diameter transmission line that conveys water from the MPWD BDPL turnout (near the RWC Sequoia Tanks), northeast on Whipple Avenue, then turns and runs northwest along Old County Road to the MPWD distribution system. This transmission line typically provides water to approximately 20 percent of customers by usage. The transmission line is usually operated to optimize power consumption, however, MPWD has the capability to pump from the bottom up if the Hallmark Tanks are offline. A potential point of connection would be at the intersection of Whipple Avenue and Alameda de Las Pulgas. Purified water pipeline pressure would need to exceed the MWPD transmission line pressure (approximately 120 psi) to connect without installing an additional pump station, so it is assumed the connection would be made to the purified water transmission line where adequate head exists.

The tanks are the preferred tie-in location for ease of operation and the ability to provide purified water to a larger proportion of customers. Connecting to the transmission line would have physical constraints at the point of connection (e.g., to install a PRV station) and would serve a smaller proportion of customers. Different tie-in points could be feasible, depending on the purified transmission alignment option. It is assumed that a connection could be feasible for Purified Transmission Alignment Option 3 since the alignment does not pass by the Hallmark Tanks.

3. Identified DWDS Connections for Each Alignment Option

This section illustrates the location of the preferred points of connection for each purified water alignment option. The options are listed in Table 3-7 and described in the following sections.

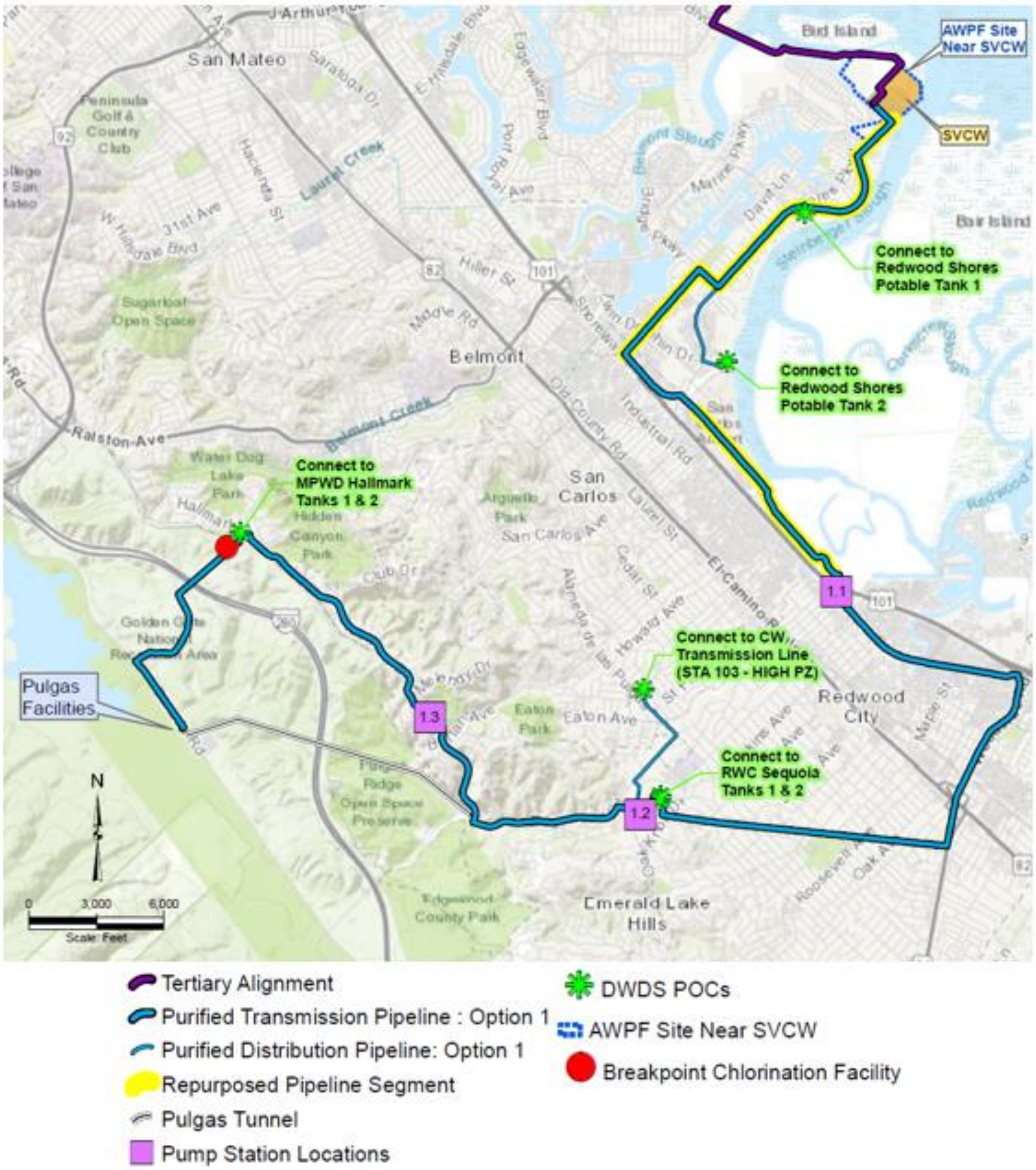
Table 3-7: Identified DWDS Connection for Purified Water Alignment Options 1-3

Purified Water Transmission Alignment Options	DWDS Connection	Description
Option 1 - Woodside Road - SFPUC Right of Water Alignment	Redwood Shores Tanks	Existing Tanks (3MG + 3.2MG)
	RWC Sequoia Tanks	Existing Tank (2.5MG + 2.5MG)
	Cal Water Station 103	Transmission Lines (21”/16” and 14”)
	MPWD Hallmark Tanks	Existing Tanks (2.5MG + 2.5MG)
Option 2 - San Carlos – Club Drive Alignment	Redwood Shores Tanks	Existing Tanks (3MG + 3.2MG)
	Cal Water Station 103	Two Transmission Lines
	MPWD Hallmark Tanks	Existing Tanks (2.5MG + 2.5MG)
Option 3 - Edgewood Road Alignment	Redwood Shores Tanks	Existing Tanks (3MG + 3.2MG)
	RWC Sequoia Tanks	Existing Tank (2.5MG + 2.5MG)
	Cal Water Station 103	Transmission Lines (21”/16” and 14”)
	MPWD Transmission Line	20” Line at Whipple Avenue/Alameda de Las Pulgas

3.1. Option 1: Woodside Road – SFPUC Right of Way Alignment

Option 1 represents the alignment that maximizes the use of SFPUC ROW and the reuse of infrastructure along Redwood Shores Parkway and Bay Shore Road. The concept is to co-locate a potable reuse transmission pipeline in SFPUC's ROW from the RWC area to CSR, which avoids construction disruption in public ROWs through residential areas of the valley. Option 1 is the longest alignment with the largest static head among the three options, thereby requiring more booster pump stations. Option 1 also offers several options for TWA tie-in points, including all of the identified storage tanks, as illustrated in Figure 3-4.

Figure 3-4: Option 1 - Identified DWDS Connections



Close up maps for each DWDS connection, showing the purified water distribution extension from the purified water transmission Option 1 to the Redwood Shores Tanks, RWC Sequoia Tanks and Cal Water Station 103 pipelines, and the MPWD Hallmark Tanks are shown in Figure 3-5, Figure 3-6, and Figure 3-7, respectively. The distribution pipelines to the Redwood Shores Potable Tanks would be the same for all three purified water transmission line alignments. The distribution pipeline to the MPWD Hallmark Tanks would be the same for Alignment Options 1 and 2. Potential purified transmission pipeline booster pump station sites are identified in the BODR. It is anticipated that purified water distribution pipelines to DWDS connections would be made of the discharge end of the booster pump stations to eliminate the need for additional pump stations.

Figure 3-5: Redwood Shores Potable Tanks Approximate Tie-in Location and Distribution Pipeline Extensions for Purified Water Transmission Alignment Option 1

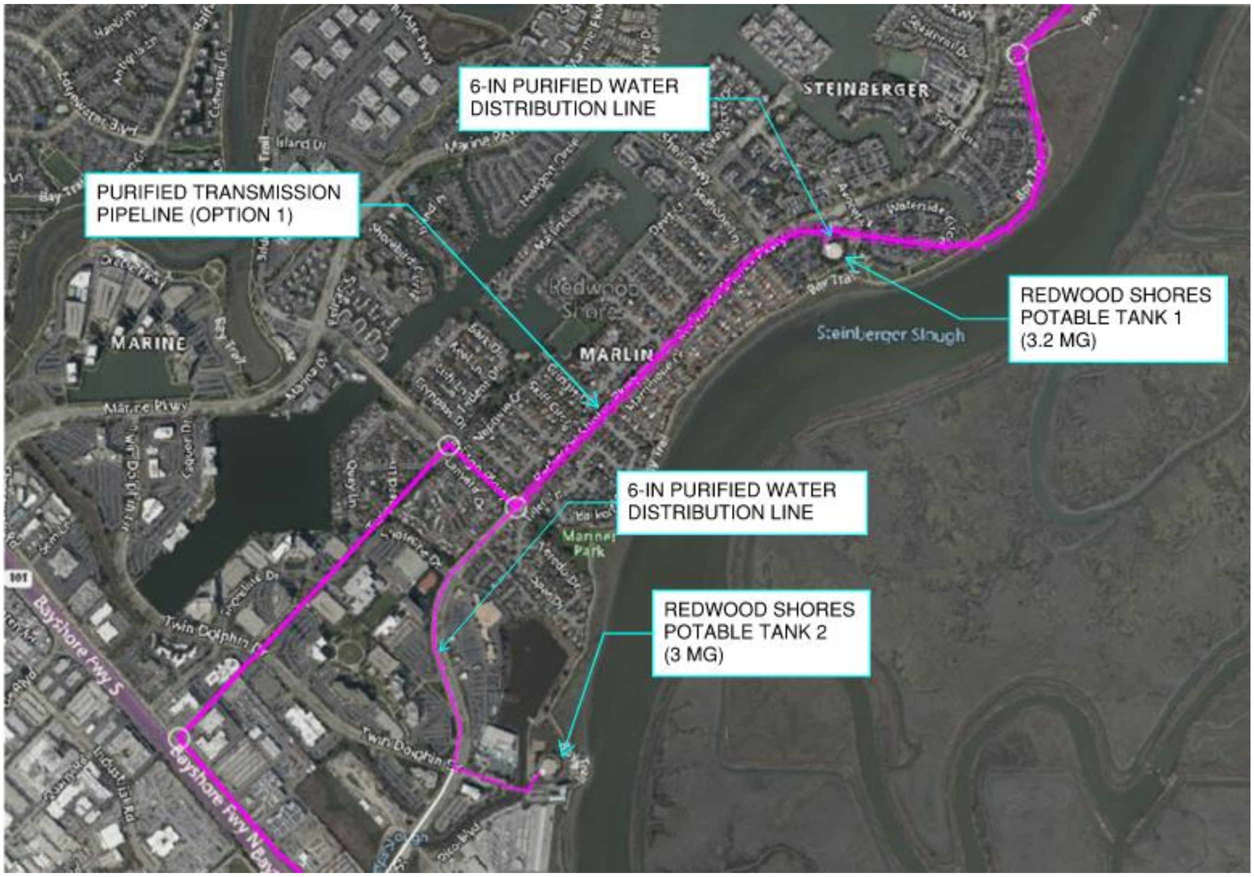


Figure 3-6: RWC Sequoia Tanks and Cal Water Station 103 Connections Approximate Tie-in Locations and Distribution Pipeline Extension for Purified Water Transmission Alignment Option 1

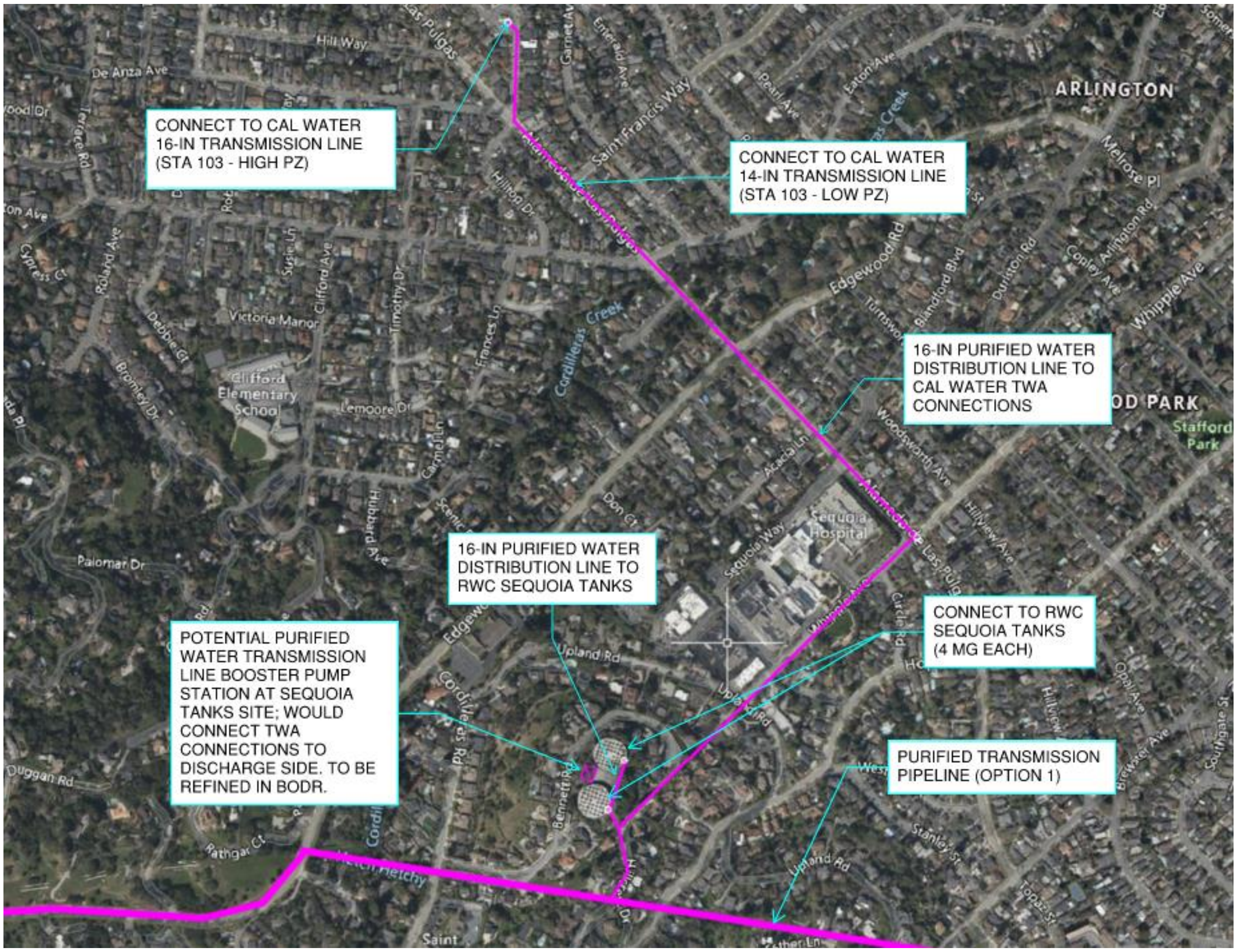
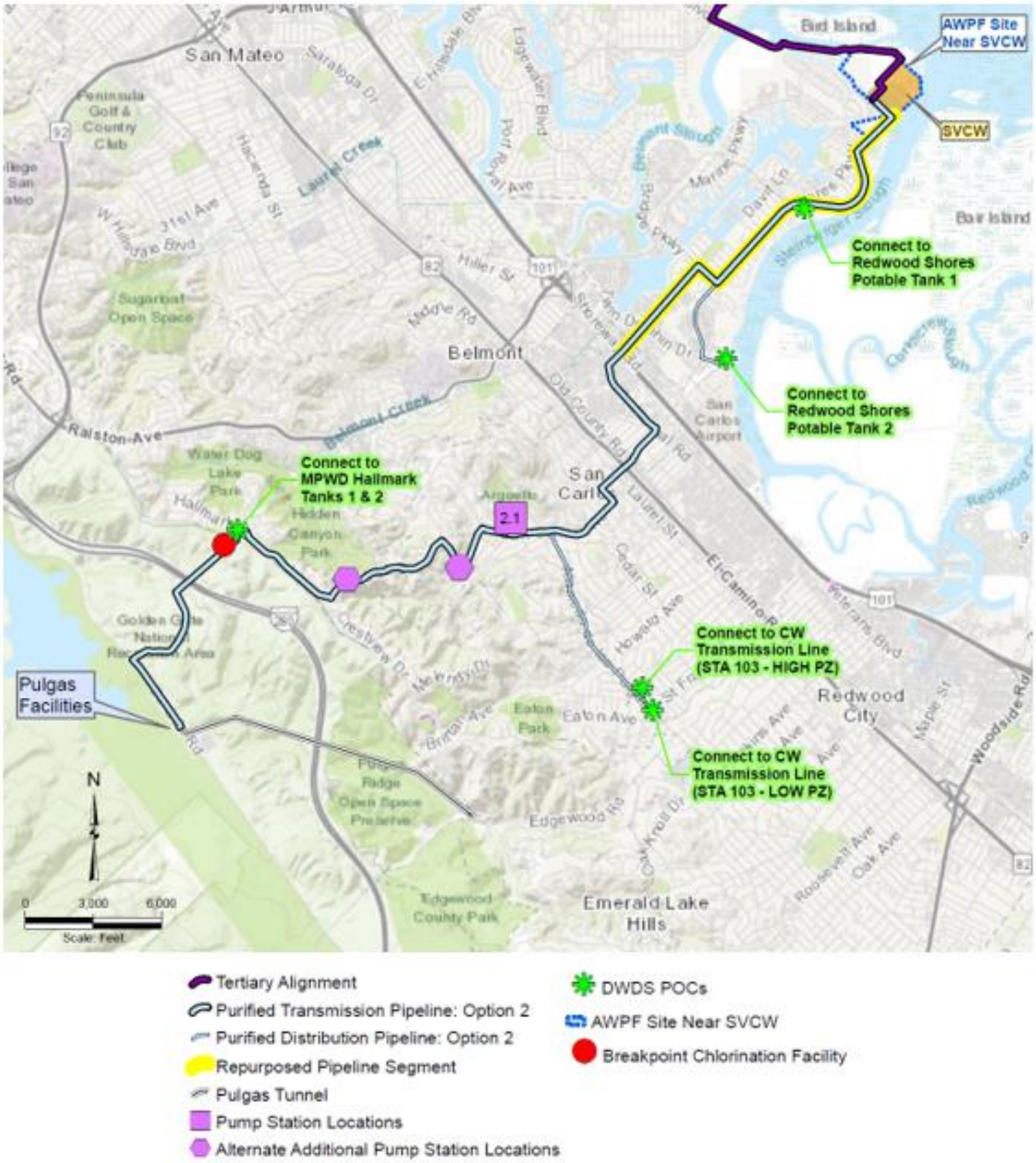


Figure 3-7: MPWD Hallmark Tanks Approximate Tie-in Location and Distribution Pipeline Extension for Purified Water Transmission Alignment Option 1

3.2. Option 2: San Carlos – Club Drive Alignment

Option 2 represents the most direct alignment to CSR and includes the reuse of the decommissioned existing SVCW 54"-dia influent line along Redwood Shores Parkway, while avoiding the Pulgas Tunnel by going under Hwy 280. This alignment is approximately 50% shorter than Option 1 but would result in more disruption in public ROWs through residential and commercial areas of San Carlos and Belmont. Option 2 is the shortest alignment with fewer options for TWA tie-in points, as illustrated in Figure 3-8. The alignment does not pass through RWC and could only serve the Redwood Shores service area of the RWC distribution system. It would also require a longer transmission pipeline to connect to Cal Water's Station 103 connections.

Figure 3-8: Option 2- Identified DWDS Connections



Close up maps for each DWDS connection, showing the purified water distribution extension from the purified water transmission Option 2 alignment to the Redwood Shores Tanks, Cal Water Station 103 and the MPWD Hallmark tanks are shown in Figure 3-9, Figure 3-10and Figure 3-11 respectively.

The distribution pipeline to the Redwood Shores Tanks would be the same for all three purified water transmission line alignments. The distribution pipeline to Cal Water Station 103 is longer than for Options 1 and 3. The length of the purified distribution pipeline to Cal Water would vary depending on where the purified transmission pipeline booster pump stations are located. The distribution pipeline to the MPWD Hallmark Tanks would be the same for Alignment Options 1 and 2.

Figure 3-9: Redwood Shores Potable Tanks Approximate Tie-in Locations and Distribution Pipeline Extension for Purified Water Transmission Alignment Option 2

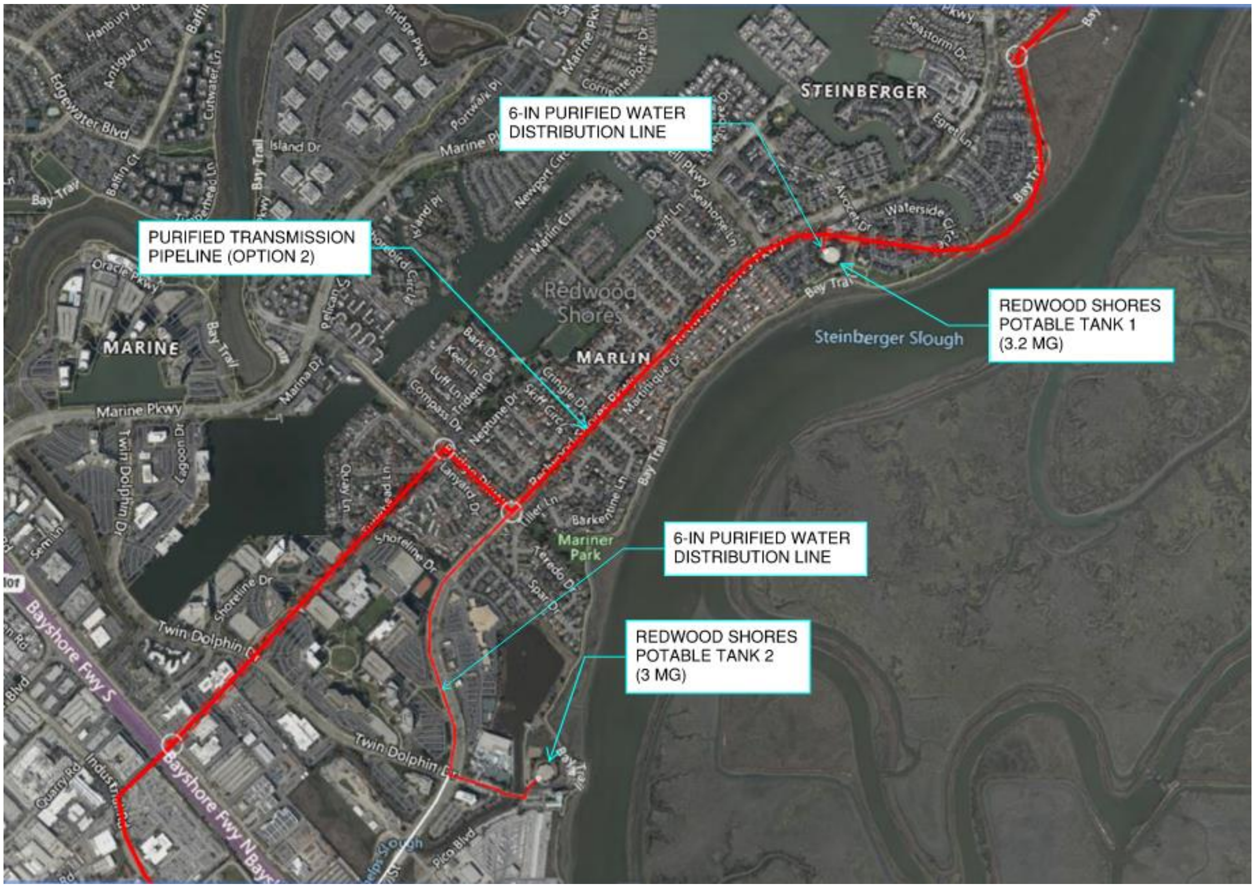


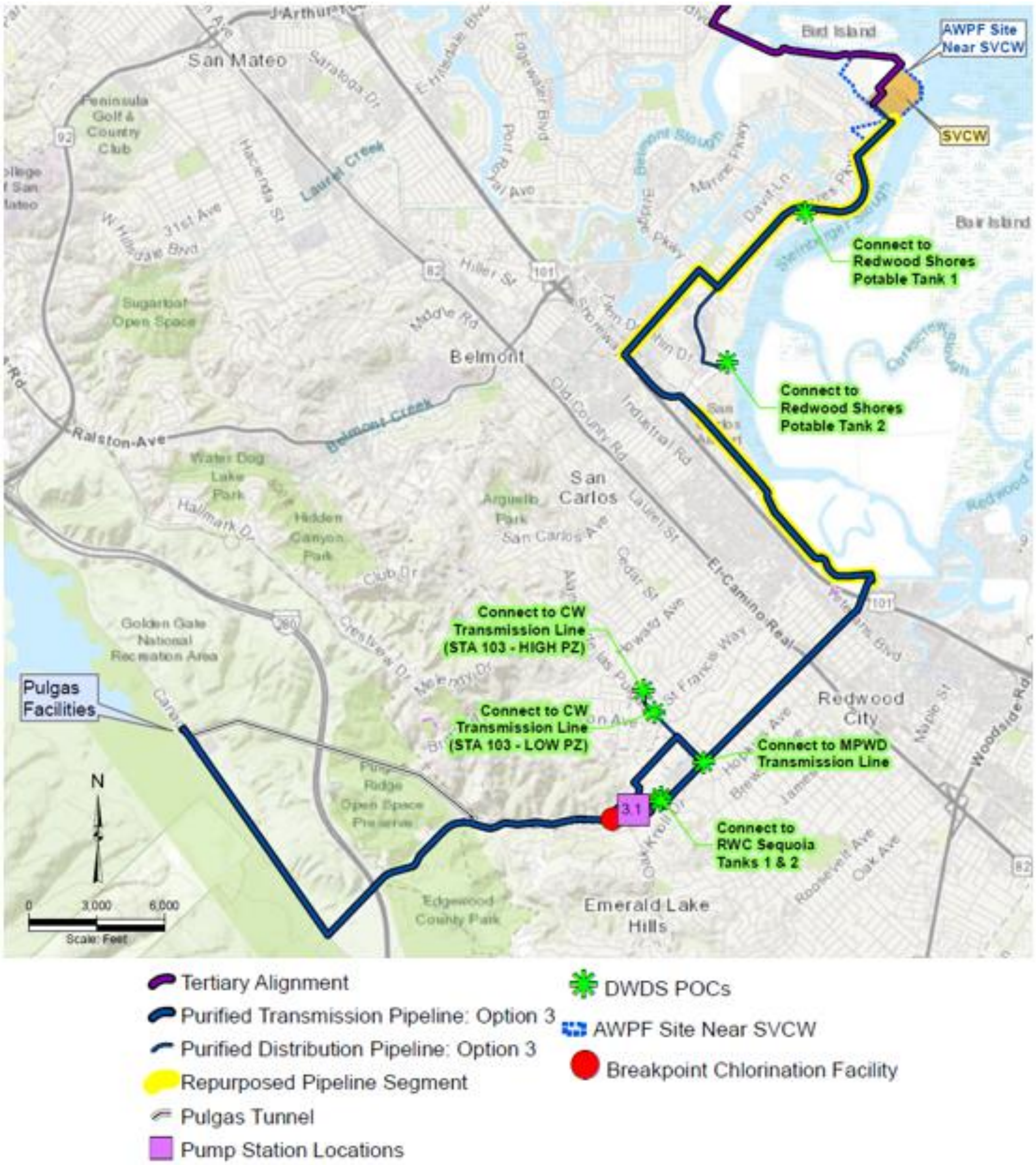
Figure 3-10: Cal Water Station 103 Approximate Tie-in Locations and Distribution Pipeline Extensions for Purified Water Transmission Alignment Option 2

Figure 3-11: MPWD Hallmark Tanks Approximate Tie-in Location and Distribution Pipeline Extension for Purified Water Transmission Alignment Option 2

3.3. Option 3: Edgewood Road Alignment

Option 3 represents an alternative to the SFPUC ROW alignment with the potential to repurpose a greater portion of infrastructure along Shoreway Road. This alignment has the shortest lift (i.e., lowest static head), thereby requiring fewer booster pump stations. Option 3 (Figure 3-12) is the only alignment that cannot serve the MPWD Hallmark Tanks, so it is assumed a connection would be made to MPWD's 20-in Transmission Line.

Figure 3-12: Option 3- Identified DWDS Connections



Close up maps for each DWDS connection, showing the purified water distribution extension from the purified water transmission Option 3 to the Redwood Shores Tanks, MPWD 20-inch Transmission Line, RWC Sequoia Tanks and Cal Water Station 103 are shown in Figure 3-13 and

Figure 3-14, respectively. The distribution pipeline to the Redwood Shores Potable Tanks would be the same for all three purified water transmission line alignments. The distribution pipeline to Cal Water Station 103 is assumed to be the same or similar for Options 1 and 3. While a shorter, more direct route is possible from Option 3, it is assumed that the tie-in point must be located downstream of the purified transmission booster pump station in order to meet Cal Water pressure requirements. Therefore, for Option 2, the line to Station 103 would run parallel to the purified transmission line in Edgewood Road. Purified booster pump station locations and purified distribution connection lengths are refined in the BODR.

Figure 3-13: Redwood Shores Potable Tanks Approximate Tie-in Locations and Distribution Pipeline Extension for Purified Water Transmission Alignment Option 3

Figure 3-14: RWC Sequoia Tanks, Cal Water Station 103, and MPWD Transmission Line Approximate Tie-in Locations and Distribution Pipeline Extensions for Purified Water Transmission Alignment Option 2

4. Summary of DWDS Connections and Design Criteria

Phase 2 of the PureWater Peninsula Project would introduce purified water directly into the drinking water distribution system utilizing existing storage tanks and transmission pipelines. Several potential DWDS points of connection have been identified for each Purified Water Transmission Pipeline alignment to meet the expected available Phase 2 TWA flows. This section summarizes the flow and facility requirements for the potential DWDS connections.

4.1. Anticipated Purified Water Deliveries

Retail water demands and regional water shortages by drinking water suppliers were considered in calculating a potential range of flows to deliver for TWA. Table 4-8 estimates demands and shortages for RWC, Cal Water and MPWD points of connection based on the data presented in Section 1. A range of purified water delivery rates is calculated based on three boundary conditions:

1) **Purified Water Delivery Limited to 50% of Winter Month Demand in Wet Period:** The amount of purified water to augment each system would be limited to 50% of the winter month demand in the 6-year wet period (1993 to 1998), which represents a conservative example of the lowest demand. For this example, Options 2 and 3 would not be able to utilize the 6 mgd of purified water available for TWA, requiring more water to go to ResWA to utilize the full 12 mgd of purified water production.
2) **Assumed Average Purified Water Delivery of up to 6 mgd for TWA:** This caps the total amount of purified water delivery to 6 mgd, which only applies for Option 1.
3) **Purified Water Delivery to Offset Historical BAWSCA Shortages:** Defines the delivery to augment each system to offset 100% of the maximum BAWSCA Regional Water Reliability Model Shortage (1988 to 1993), providing the maximum benefit to the DWDS. Option 1 and 3 would leave only 3.9 mgd and 4.5 mgd of flow available for ResWA.

There are currently no regulatory guidelines regarding the blending of purified water with drinking water for TWA, though the PureWater Peninsula Parties recognize that equitable distribution of purified water within their service area may be desirable.

This analysis made some general assumptions about the demand served by the identified points of connection. Additional analysis would need to be performed to confirm these assumptions. Future studies would further explore and model boundary conditions for augmenting each drinking water system, to further define flow restrictions and operational preferences. The amount of purified water delivered could also vary over time, depending on demands, DWDS preferences, costs and other factors. For the purpose of this analysis, infrastructure is sized to meet the maximum potential delivery to each point of connection.

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Table 4-8: Summary of Purified Water Delivery Assumptions – Phase 2

		DEMANDS		SHORTAGES[2]		RANGE OF PURIFIED WATER DELIVERIES		
Purified Water Transmission Alignment Options	**DWDS Point of Connection Description**	**Winter Months of 6-year wet period[1]** *(1993-1998)*	**2020 UWMP Average Demand**	**BAWSCA Regional Water Reliability Model Shortage** *(1988 to 1993)*		**Limited to 50% of Winter Month Demand in Wet Period**	**Assumed Average Delivery of up to 6 mgd for TWA[3]**	**Delivery to Offset Historical BAWSCA Shortages[4]**
		(mgd)	**(mgd)**	**Ave (mgd)**	**Max (mgd)**	**(mgd)**	**(mgd)**	**(mgd)**
Option 1 - Woodside Road - SFPUC Right of Water Alignment	Redwood Shores Tanks	1.1	1.2	0.4	0.5	0.5	0.5	0.5
	RWC Sequoia Tanks	6.5	7.5	1.5	2.1	3.3	2.7	2.1
	Cal Water Station 103	3.0	3.3	3.6	4.9	1.5	1.5	4.9
	MPWD Hallmark Tanks	2.6	3.3	0.4	0.6	1.3	1.3	0.6
			Total Option 1 Purified Water Delivery Potential =			**6.6**	**6.0**	**8.1**
Option 2 - San Carlos – Club Drive Alignment	Redwood Shores Tanks	1.1	1.2	0.4	0.5	0.5	0.5	0.5
	Cal Water Station 103	3.0	3.3	3.6	4.9	1.5	1.5	4.9
	MPWD Hallmark Tanks	2.6	3.3	0.4	0.6	1.3	1.3	0.6
			Total Option 2 Purified Water Delivery Potential =			**3.3**	**3.3**	**6.0**
Option 3 - Edgewood Road Alignment	Redwood Shores Tanks	1.1	1.2	0.4	0.5	0.5	0.5	0.5
	RWC Sequoia Tanks	6.5	7.5	1.5	2.1	3.3	3.3	2.1
	Cal Water Station 103	3.0	3.3	3.6	4.9	1.5	1.5	4.9
	MPWD 20-in Tranmission Line	2.6	3.3	0.4	0.6	1.3	1.3	0.6
			Total Option 3 Purified Water Delivery Potential =			**6.6**	**6.0**	**8.1**

Notes:

1. Based on October through March demand during wet/normal years, representing the most conservative example of the lowest demand
2. RWC Shores Tanks and Sequoia Tank demands/shortages are assumed to be 20% and 80% of the total RWC service area demands/shortages, respectively. Cal Water and MPWD demands/shortages represent the full-service area demands/shortages.
3. Based on purified water deliveries limited to 50% of the winter month demand in a wet period, and assuming that 6 mgd of PureWater Peninsula Project flows is reserved for ResWA.
4. Based on providing purified water to offset the maximum shortage based on the BAWSCA Water Reliability Model data from 1988 to 1993.

4.2. Facility Requirements

As noted in Section 4.1, for the purpose of this analysis, infrastructure is sized to meet the maximum potential delivery to each point of connection. Table 4-9 summarizes the DWDS connections and design criteria for each Purified Transmission Pipeline Option. It is assumed that tie-ins to the purified water transmission pipeline would be made where adequate head exists to avoid needing additional booster pump stations to serve the DWDS connections. All tank connections would be made with an air gap. All transmission line connections would be made with a PRV vault to match existing DWDS pressures. Siting for PRV vaults and connections are further developed in the BODR.

Table 4-9: Summary of Purified Water Delivery Design Criteria – Phase 2

Purified Transmission Alignment Option	Agency	DWDS Connection Pt.	Storage Capacity	Transmission Pipeline Size	Existing Tank or Pipe Material	Max Assumed Purified Demand		Required Pipe Length	Pipeline Size	Approximate Headloss in Purified Distribution Line	Elevation Change from Point of Connection	DWDS Operating Pressure	Calculated Pressure Req'd at Purified Transmission Connection
			(MG)	(inches)		(mgd)	(gpm)	(ft)	(in)	(ft)	(ft)	(psi)	(psi)
Option 1: Woodside Road – SFPUC ROW	RWC	Redwood Shores Tanks (Tank 1)	3.2	-	concrete	0.5	369	190	6	1	15	-	7
	RWC	Redwood Shores Tanks (Tank 2)	3	-	steel	0.5	347	4,000	6	16	19	-	16
	RWC	Sequoia Tanks	8	-	concrete	3.3	2,292	800	16	3	56	-	26
	Cal Water	Station 103 (Higher & Lower PZs)	-	21 & 14	CCP / AC	4.9	3,403	5,550	16	35	-48	120	114
	MPWD	Hallmark Tanks	5	-	steel	1.3	897	350	10	3	62	-	28
Option 2: San Carlos – Club Drive	RWC	Redwood Shores Tanks (Tank 1)	3.2	-	concrete	0.5	369	190	6	1	15	-	7
	RWC	Redwood Shores Tanks (Tank 2)	3	-	steel	0.5	347	4,000	6	16	19	-	15
	Cal Water	Station 103 (Higher & Lower PZs)	-	21 & 14	CCP / AC	4.9	3,403	8,000	16	16	115	120	177
	MPWD	Hallmark Tanks	5	-	steel	1.3	897	350	10	3	62	-	28
Option 3: Edgewood Road	RWC	Redwood Shores Tanks (Tank 1)	3.2	-	concrete	0.5	369	190	6	1	15	-	7
	RWC	Redwood Shores Tanks (Tank 2)	3	-	steel	0.5	347	4,000	6	16	19	-	15
	MPWD	20-in Transmission Line	-	20	CCP	1.3	897	1,350	10	7	1	120	123
	RWC	Sequoia Tanks	8	-	concrete	3.3	2,292	800	16	3	56	-	26
	Cal Water	Station 103 (Higher & Lower PZs)	-	21 & 14	CCP / AC	4.9	3,403	5,550	16	35	-48	120	114

Notes:

1. PVC assumed for purified distribution connecting pipelines.
2. Purified distribution pipeline sized based on maximum calculated demands at each DWDS connection. Purified deliveries would be limited to 6 – 8 mgd for combined TWA.

5. REFERENCES

Bay Area Water Supply & Conservation Agency (BAWSCA). 2023. Member Agency Profiles. https://bawsca.org/members/profiles

May 2024

Final Technical Memorandum (TM) #6 – Advanced Water Purification Facility (AWPF) Operational Strategies

To:	PureWater Peninsula Parties
From:	Alex Page, PE, Kennedy Jenks Kristine Tolentino, EIT, Kennedy Jenks
Reviewers:	Melanie Tan, PE, Kennedy Jenks Todd Reynolds, PE, Kennedy Jenks
Subject:	Advanced Water Purification Facility (AWPF) Operational Strategies PureWater Peninsula Project – Basis of Design Report

The **PureWater Peninsula Project**, previously referred to as the Potable Reuse Exploratory Plan (PREP), is a regional effort to resolve multiple water supply and wastewater issues, while realizing the benefits of shared infrastructure, asset recovery, economies of scale, and a more competitive strategy to pursue funding. **PureWater Peninsula Parties** include the Bay Area Water Supply and Conservation Agency (BAWSCA), California Water Service (Cal Water), San Francisco Public Utilities Commission (SFPUC), Silicon Valley Clean Water (SVCW), City of San Mateo, City of Redwood City (RWC), and the Mid-Peninsula Water District (MPWD).

This **Technical Memorandum (TM) #6 – Advanced Water Purification Facility (AWPF) Operational Strategies** summarizes the preliminary operational strategies for both Reservoir Water Augmentation (ResWA) and Treated Water Augmentation (TWA) to support the development of AWPF design and operational criteria. The TM summarizes the benefits and limitations of a single- vs dual-treatment train strategy to deliver purified water that meets regulatory requirements for the PureWater Peninsula Project. Additionally, the operational strategies to address the scenarios discussed below (seasonal operations, regulatory requirement alarms, emergency shutdown, source water availability) describe how the future AWPF could be pivoted to optimize production based on system demand and minimize risk when responding to alarms or an emergency scenario.

This TM is organized into the following sections:

1. PureWater Peninsula Project Overview
2. Treatment Train Strategy
3. Seasonal Operational Changes
4. Regulatory Requirement Alarms
5. Emergency Shutdown

6. Source Water Availability
7. Reverse Osmosis (RO) Concentrate Considerations
8. Conclusions

Additional TMs that support this work include:

- **TM #1 – AWPF Design Criteria** focuses on the design parameters for use in developing a conceptual design for the AWPF sizing and expanded unit processes as well as conveyance facilities within the SVCW boundary.
- **TM #2 – Conveyance Facility Design Criteria** establishes the design requirements and preliminary criteria for the project pipelines and pump stations, beyond the AWPF fenceline, building on the design concepts identified in prior planning efforts.
- **TM #3 – RO Concentrate Disposal** establishes the design requirements for the AWPF to discharge RO concentrate to the SVCW ocean outfall while meeting current and potential future regulatory requirements.
- **TM #4 – Pulgas Disinfectant Residual Alternatives** describes considerations related to the type of disinfectant residual and removal of disinfectant residual prior to ResWA for Crystal Springs Reservoir (CSR) augmentation via the Pulgas Dechloramination Facilities (Pulgas DF).

  TM #5 – Drinking Water Distribution System Design Criteria identifies preferred points of connection to introduce purified water into the existing drinking water distribution systems owned and operated by RWC, Cal Water, and the MPWD and defines infrastructure requirements and potential operational and hydraulic constraints.

These TMs reflect the initial analyses performed to support the PureWater Peninsula Project Basis of Design Report (BODR) and have been included in an appendix to the BODR. Information contained within this TM may be superseded by content in the BODR, reflecting updates to the technical evaluation after the TM was completed.

1. PureWater Peninsula Project Overview

The PureWater Peninsula Project is a potable reuse project that would create a new source of local sustainable water supply using state-of-the-art technology to purify tertiary effluent from SVCW and the San Mateo Wastewater Treatment Plant (WWTP).

The project would be implemented in two phases:

- **Phase 1** – Indirect Potable Reuse (IPR) via ResWA of up to 6 million gallons per day (mgd) of purified water at CSR.
- **Phase 2** – Direct Potable Reuse (DPR) via TWA. Expansion of AWPF to produce an additional 6 mgd of purified water, for a total of up to 12 mgd. Up to 6-8 mgd would be available for ResWA at CSR, and 4-6 mgd would be available for TWA to local drinking water distribution systems.

With the implementation of both PureWater Peninsula Project Phases, the project would provide a maximum of 12 mgd of purified water for local use by 2043.

The PureWater Peninsula Project includes:

- **Source water** derived from up to 8 mgd of tertiary effluent from SVCW and up to 9 mgd of tertiary effluent from the San Mateo WWTP would be combined to produce up to 12 mgd of purified water. Additional source water from SVCW would be available for dilution of RO concentrate.
- Construction of a new **AWPF)**to treat source water to meet regulatory requirements for IPR in Phase 1 and DPR for the Phase 2 expansion.
- **Conveyance infrastructure** to deliver tertiary effluent to the new AWPF, purified water to the place of use, and brine for discharge via the existing SVCW outfall.
- A point of connection to SFPUC's **Pulgas DF**, which provides dechlorination of all flows prior to discharge into CSR.
- Multiple points of connection to existing tanks and transmission pipelines to deliver purified water to RWC, Cal Water and/or the MPWD **drinking water distribution systems (DWDS).**

A summary of PureWater Peninsula Project facilities is depicted in Figure 1-1.

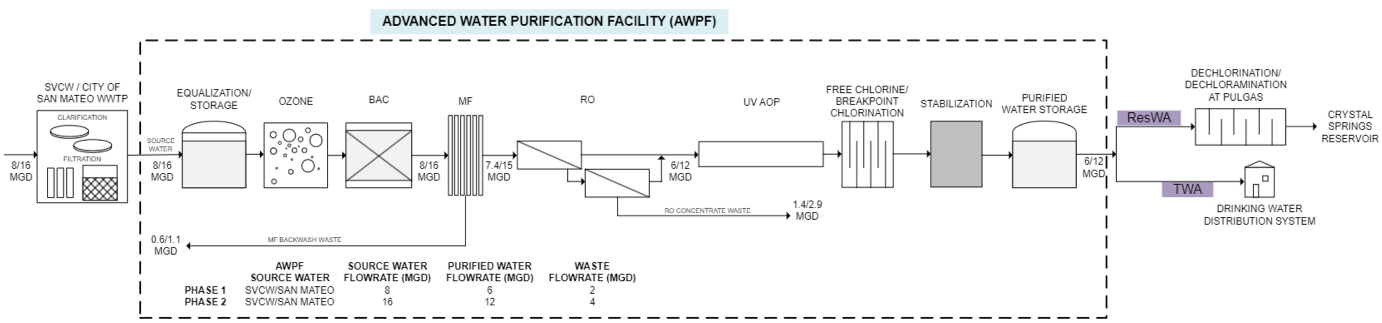
Figure 1-1: PureWater Peninsula Project Concept

2. Treatment Train Strategy

The PureWater Peninsula Project Parties have explored the feasibility and benefits of the two treatment train strategies to implement a hybrid ResWA (IPR) and TWA (DPR) project.

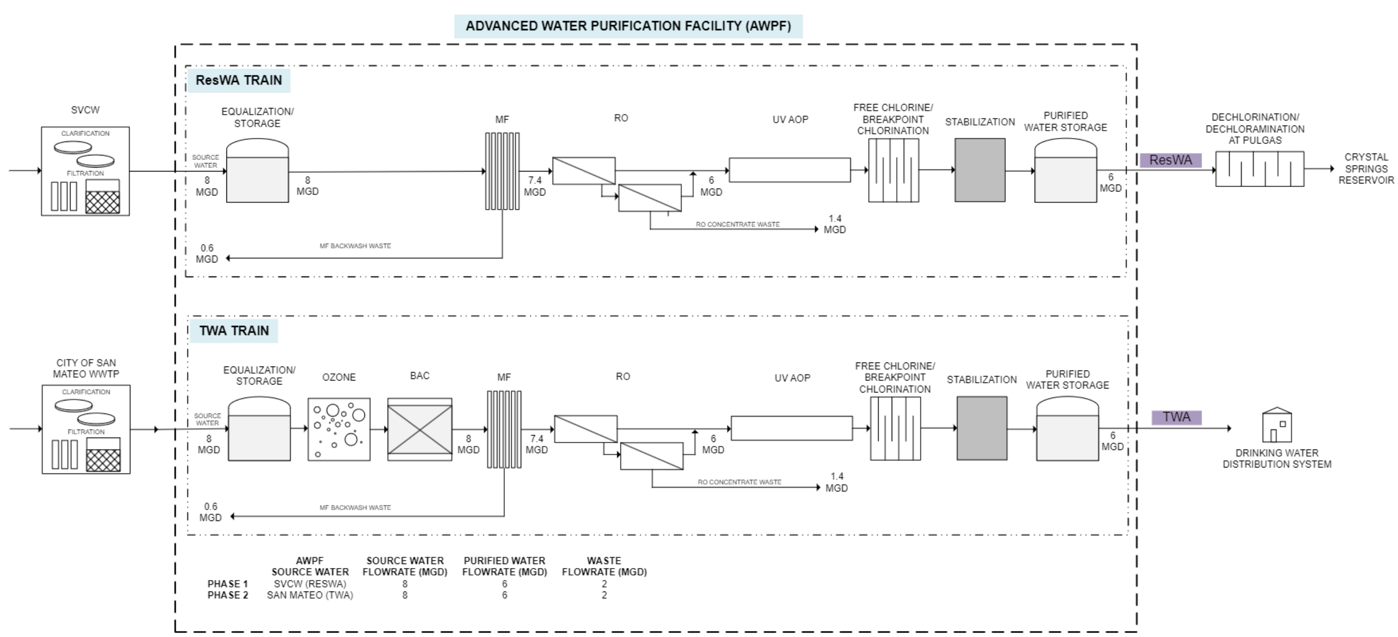
Single Treatment Train Strategy: Construct an AWPF with one treatment train designed to meet TWA standards, as illustrated in Figure 2-1. A 6 mgd AWPF facility meeting California DPR via TWA treatment standards would be constructed during Phase 1. This facility would then be expanded to 12 mgd for Phase 2.

Figure 2-1: Single Treatment Train Process Flow Diagram



Dual Treatment Train Strategy: Construct an AWPF with two independent treatment trains. One treatment train would treat tertiary effluent from SVCW to produce up to 6 mgd for IPR via ResWA at Crystal Springs Reservoir as part of Phase 1, as illustrated in Figure 2-2. The second treatment train would utilize tertiary effluent from San Mateo to produce up to 6 mgd for DPR via TWA as part of Phase 2.

Figure 2-2: Dual Treatment Train Process Flow Diagram



The single treatment train strategy would be the preferred alternative that offers the following benefits:

1. **Early demonstration of TWA feasibility:** One major benefit of constructing Phase 1 with the treatment elements anticipated for TWA, is that the Phase 1 facility would be able to provide real-time data to demonstrate the AWPF's ability to achieve the pathogen reduction levels that are required to meet TWA regulations. The availability of this data during Phase 1 is anticipated to help streamline the future permitting process prior to transitioning to the TWA as part of Phase 2. Designing the facility with a single treatment train strategy would also reduce operational complexities for staff and would allow operators to be trained on a TWA-ready treatment train while producing ResWA water.
2. **Blended AWPF source water advantages:** The single treatment train strategy simplifies the AWPF's source water strategy by blending 50% SVCW and 50% San Mateo tertiary effluent flows. This blending would improve the water quality of the purified water by combining the nitrified San Mateo tertiary effluent with the non-nitrified SVCW tertiary effluent. Delivering these combined AWPF source waters to a single treatment train would reduce the operational complexities of dedicating different AWPF source waters to independent treatment trains and incorporate both source waters into the AWPF design from the beginning of Phase 1.

3. Seasonal Operational Changes

A Crystal Springs Reservoir Operations Model (CSR ROM) was developed in prior planning efforts for the project to assess the impacts of purified water addition to CSR's water quality and to understand under what operational scenarios purified water augmentation would result in Hetch Hetchy water "spilling" in the upcountry system of the Hetch Hetchy Regional Water System (SFRWS). The CSR ROM uses monthly data from SFPUC's Hetch Hetchy Local Simulation Model (HHLSM), which simulates SFRWS operations using historical hydrology from 1920 to 2017. The HHLSM model tracks available storage in the SFRWS, including in the Water Bank. The Water Bank is essentially a storage account on Don Pedro Reservoir, which is located on the Tuolumne River in the upcountry region of the SFRWS system that begins with the Hetch Hetchy Reservoir in Yosemite National Park. The SFRWS is operated such that all reservoirs, including CSR, are filled first and maintained full to the extent possible, and the Water Bank is typically the last to be filled. When the Water Bank is primarily full (e.g., there is no additional storage capacity remaining in the Water Bank), there is no available storage capacity in the SFRWS to absorb water supply from a new source. Hence, "spilling" would occur.

Under Phase 1, purified water produced by the AWPF would be conveyed to CSR for ResWA, under a ResWA permit. The CSR ROM results indicated that there would be limited available storage in the SFRWS during wet months of wet years, typically November through April. To avoid the "spilling" of water into the upcountry system and to allow for more operational flexibility, it is recommended that the AWPF be designed for variable purified water production, including temporary ramp-down or shutdown periods to minimize "spill" when the SFRWS's maximum Water Bank account storage has been reached. As discussed in **Appendix C: Modeling and AWPF Operational Scenarios** of the BODR, further development and analysis of the CSR ROM, in concert with HHLSM model runs, would allow the AWPF to utilize historical forecasting data to gauge AWPF operational demand and to determine which operational strategy would need to be executed for a given year.

Under Phase 2, purified water would continue to be conveyed to CSR and additional flows would be delivered as TWA to drinking water customers. Similar to Phase 1, during wet months of wet years when the SFRWS Water Bank is full, any drop of purified water added to the system would result in "spilling" of water into the upcountry system, independent of whether the water is destined for CSR or for local drinking water systems. Delivery of purified water to drinking water distribution systems would also require coordination with local water purveyors to meet, and not exceed, customer demands and available storage.

Three (3) seasonal operational scenarios for the AWPF are described in this section to guide how the project may be operated during normal, wet, and dry years.

AWPF Seasonal Operational Scenarios:

1. **Seasonal Operational Scenario 1: Continuous AWPF Production** – During dry years the AWPF would continuously operate at the design capacity. Under this operational scenario, "spills" would be infrequent or minimal.
2. **Seasonal Operational Scenario 2: Ramped Down AWPF Production –** During normal to wet years, the AWPF would operate at the design capacity during the summer months (May to October) and ramp down to as low as the minimum design flow during winter months (November to April), depending on available storage in the SFRWS. This would allow for the AWPF to maintain purified water production, and avoids the operational complexity associated with a full plant shutdown. Under this operational scenario, a "spill" in the upcountry system could occur. AWPF operations staff would need to continuously coordinate with SFRWS operations to communicate if a full AWPF shutdown is necessary due to SFRWS Water Bank capacity. The AWPF would coordinate with AWPF source water providers, SVCW and San Mateo, to reduce deliveries as appropriate.
3. **Seasonal Operational Scenario 3: Seasonal AWPF Shut Down –** During wet to extremely wet years, the AWPF would operate at full capacity during summer months (May to October), followed by a full plant shutdown period during the wet winter months (November to April). Full plant shutdown protocols would be developed during the design of the AWPF and would include an implementation schedule for AWPF operations staff to follow.

Table 3-1 summarizes the AWPF system operational strategies, facility response, and impacts to AWPF source water, purified water production, and reverse osmosis concentrate (ROC) disposal during each scenario.

The overall operational scheme for the AWPF would be managed by the DiPRRA in close coordination with the SFRWS operations team, AWPF source water providers (SVCW and San Mateo) as well as local water purveyors. The quantity of purified water produced would be influenced by hydrologic conditions, available storage in the SFRWS Water Bank, and local demands.

Table 3-1: Seasonal Operational Scenarios – Summary of Planned Scenarios (Phase 1 and 2)

Planned Operational Scenario	Operational Scenario Description	Average Purified Water Production	Facility Response	AWPF Source Water Impact	AWPF Purified Water Impact	Reverses Osmosis Concentrate (ROC) Discharge Impact
1	Continuous AWPF Production – Dry years when storage is available in CSR.	Phase 1 = 6 mgd Phase 2 = 12 mgd	During Phase 1, the AWPF would produce 6 mgd of purified water for ResWA at CSR. During Phase 2, the AWPF would produce 12 mgd of purified water for both ResWA at CSR and for TWA (DPR).	During Phase 1, the AWPF would receive about 4 mgd tertiary effluent from SVCW and San Mateo (8 mgd total). During Phase 2, the AWPF would receive about 8 mgd tertiary effluent each from SVCW and San Mateo (16 mgd total).	During Phase 1, 6 mgd of purified water would undergo breakpoint chlorination and then would be conveyed to CSR for ResWA. During Phase 2, 12 mgd of purified water would undergo breakpoint chlorination. 6 mgd would be conveyed to CSR for ResWA. 6 mgd would be chloraminated and sent to drinking water distribution system for TWA.	In Phases 1 and 2, RO concentrate would be generated, blended with SVCW's remaining tertiary effluent, and discharged via the SVCW outfall to the San Francisco (SF) Bay at or below NPDES permit limits.
2	Ramped Down AWPF Production – Forecasted Wet Weather Year	Phase 1 = 2 - 4 mgd Phase 2 = 2 - 8 mgd	In Phase 1, the AWPF production would ramp down to 2-4 mgd for ResWA at CSR. In Phase 2, the AWPF production would ramp down to 2-4 mgd as ResWA at CSR and/or 2-4 mgd of TWA. The anticipated purified water production during ramp-down period would be between 2 and 8 mgd. AWPF production would be guided by the SFRWS capacity to receive purified water.	During Phase 1 and 2, the amount of tertiary effluent would decrease proportionally to the reduced AWPF production, assuming an overall recovery rate of 75%. The remaining tertiary effluent would bypass the AWPF to the respective SVCW or San Mateo outfalls.	During Phase 1, 2-4 mgd of purified water would undergo breakpoint chlorination and then would be conveyed to CSR for ResWA. During Phase 2, 2-8 mgd purified water would undergo breakpoint chlorination. 2-4 mgd would be conveyed to CSR for ResWA and/or 2-4 mgd would be chloraminated and sent to drinking water distribution system for TWA.	Same as Scenario 1, but with reduced production, RO concentrate would decrease proportionally and there would be more available SVCW tertiary effluent to blend with the RO concentrate prior to discharge to the SF Bay.
3	Seasonal AWPF Shut Down – Forecasted Wet Weather Year	Phase 1 = 0 mgd (potentially 1-2 mgd if piloting testing continues) Phase 2 = 0 mgd (potentially 1- 2 mgd if piloting testing continues)	A planned shutdown date would be determined for the AWPF, based on anticipated precipitation and/or available storage in the SFRWS Water Bank. After this date, O&M staff would take process equipment offline for cleaning and maintenance. MF and RO membranes would be preserved. Alternatively, if testing for additional log removal credits or piloting of new technologies are needed, the AWPF could maintain operation at a low capacity (1-2 mgd) during this time. Purified water would be conveyed to the SVCW outfall, headworks, or the non-potable reuse recycled water (preferred) system.	All tertiary effluent from San Mateo and SVCW would be discharged to their respective outfalls. SVCW would continue to serve existing non-potable demands. Alternatively, if pilot testing continues, a reduced amount of tertiary effluent would be required from San Mateo and SVCW.	CSR and local drinking water systems would receive no purified water during this time. If pilot testing continues, purified water could be sent to the SVCW outfall, headworks or a non-potable reuse recycled water (preferred) system temporarily. Yard piping between process equipment and the bypass pumping for the pilot testing operation would be developed as part of a future design phase.	Typically, RO concentrate would not be generated while the AWPF is offline, unless pilot testing is underway. If pilot testing is underway, In Phases 1 and 2, RO concentrate would be generated blended with SVCW's tertiary effluent, and discharged to the SF Bay at or below NPDES permit limits.

Ramping down, shutting down, and restarting up an AWPF takes time and effort to clean and maintain process equipment and preserve RO and MF membranes. Preservation of membranes could also reduce their useful life, requiring more frequent replacement. Planned shutdown and restart procedures are further discussed later in Table 2. During the future phases of the project, it would be worthwhile to further investigate and compare the cost of "spilling" water in the upcountry system versus the cost of ramping or shutting down and restarting up the AWPF to determine when it makes economic sense to allow a "spill".

Under scenario 1, AWPF equipment would operate continuously with normal operations and maintenance (O&M) procedures. Equipment down time would be related to maintenance or routine cleanings, which would not impact purified water production. Under scenarios 2 and 3 operational procedures would need to be defined to protect treatment equipment during periods of low or no flow.

A high-level summary of procedures needed for each treatment train process is summarized in Table 3-2. The shutdown procedures are assumed to apply for seasonal shutdown periods, on the order of months. Short term shutdowns on the order of days to weeks could have different procedures for preserving the process equipment depending on the process. For example, during short term shutdown periods, MF/RO trains could be preserved by via submergence/occasional flushing with filtrate quality water, while during the long term shutdown periods, the MF/RO trains would need to be submerged in a chemical preservation solution. Specific intervals and detailed instructions for short term vs. long term shutdown periods are specific to each manufacturer O&M instructions and would be better defined once preferred manufacturers have been identified. It is recommended that the AWPF O&M Manual contain specific sections for seasonal operational scenarios 2 and 3, and that these sections include the planned shutdown and restart protocols from the equipment manufacturers for all equipment.

Table 3-2: Seasonal Operational Scenarios - Operational Procedures for Treatment Equipment

Treatment Equipment	Seasonal Operational Scenario 2 – Ramped Down AWPF Production	Seasonal Operational Scenario 3 – Seasonal AWPF Shut Down
Ozone	Operate duty ozone generators at lower pounds per day production rate to meet demand at lower AWPF source water flow. Cycle generators into duty mode as needed.	Perform planned ozone system maintenance during seasonal AWPF shutdown period. Pause liquid oxygen deliveries as needed.

Treatment Equipment	Seasonal Operational Scenario 2 – Ramped Down AWPF Production	Seasonal Operational Scenario 3 – Seasonal AWPF Shut Down
Biologically Activated Carbon Filters	Operate filter beds normally but at a reduced flow rate. Adjust backwashing frequency to match reduced flow rates.	Perform planned BAC filter maintenance during seasonal AWPF shutdown period. Test and regenerate media as needed during this time period. Regeneration refers to the method of thermally processing the activated carbon to destroy the adsorbed components contained on its surface which occurs offsite. Backwash would not occur during shutdown when there is no process flows available. Startup after an extended shutdown could last in the order of weeks to disinfect, soak, and backwash the dry media.
Membrane Filtration (MF) Membranes	At lower flows, operate all duty racks when feasible. Duty racks shall not operate below minimum flux rate requirements from membrane supplier. When all racks could not be operated, cycle duty racks to keep membranes wet. Cleaning cycles would be maintained, under lower flow conditions. Cleaning cycles would typically be triggered by predetermined performance parameters like transmembrane pressure.	During long-term shutdown periods, fully preserve MF membranes. During the shutdown period perform routine checks of the preservation solution, based on the manufacturer's recommendations. Replace solution as needed or once per month. Drain water from all ancillary equipment and analyzers to prevent biogrowth while the AWPF is offline. Perform planned MF System maintenance during seasonal AWPF shutdown period.
Reverse Osmosis (RO) Membranes	Under low flow conditions, maintain RO skid operations at equipment supplier's nominally rated flow. Determine the number of duty RO membrane skids based on AWPF production rate. Cycle RO skids in duty mode to keep membranes wet. Cleaning cycles would be maintained under lower flow conditions. Cleaning frequencies would be determined based on fouling and scaling indicated by predetermined performance parameters like differential pressure.	During long-term shutdown periods, fully preserve RO membranes. During the shutdown period perform routine checks of the preservation solution, based on the manufacturer's recommendations. Replace solution as needed or once per month. Drain water from all ancillary equipment and analyzers to prevent biogrowth while the AWPF is offline. Perform planned RO System maintenance during seasonal AWPF shutdown period.

Treatment Equipment	Seasonal Operational Scenario 2 – Ramped Down AWPF Production	Seasonal Operational Scenario 3 – Seasonal AWPF Shut Down
Ultra Violet-Advanced Oxidation Process (UV-AOP)	Under low flow conditions operate the number of reactors (n+1) necessary for the nominal amount of purified water produced. Operate duty reactors to provide design-required regulatory dose at all times.	For seasonal offline periods, completely drain each UV reactor and perform manufacturer-recommended cleaning procedures. Replace lamps if needed. Perform planned UV-AOP System maintenance during seasonal AWPF shutdown period.
Chemical Systems	Chemical feed equipment would be programmed to flow-pace chemical dosing based on online analytical instrumentation readings for each treatment process. Perform routine calibration as AWPF flows decrease and increase. Adjust bulk chemical ordering frequency as needed.	Pause or delay bulk chemical orders to account for seasonal offline periods. Flush chemical feed lines at the start of the AWPF seasonal offline period and perform routine on chemical feed equipment maintenance.
Tanks and PS	Operate purified water tanks and pump stations to maintain appropriate facility and system hydraulics.	Turn down and drain tanks and pump stations for seasonal offline period. Perform routine maintenance, inspections and cleanings of all tanks and pump stations.
RO Concentrate Pipelines	RO Concentrate pipelines would operate normally at a lower flow rate.	Flush RO Concentrate pipeline with RO permeate prior to shutdown to remove salts and discourage biogrowth. Perform planned/routine maintenance and inspections. Plan for pipeline flushing prior to restarting up the AWPF.
Conveyance Pipelines	Conveyance pipelines would operate normally at a lower flow rate.	Perform planned/routine maintenance and inspections. Plan for pipeline disinfection prior to re-starting up the AWPF.

4. Regulatory Requirement Alarms

The AWPF would need to achieve certain log reduction value (LRV) credits and meet the specified process performance criteria across its multibarrier treatment train to control the threat from pathogens, provide adequate public health protection and receive permit approval to produce purified water for ResWA and TWA. The AWPF's SCADA programming would receive inputs from various analytical instruments at critical control points (CCPs) to calculate the real-time LRV credits achieved by the facility and confirm the regulatory requirements are met. The SCADA historian would log the real-time data, and there would be a report programmed to capture the appropriate data from the historian to provide to DDW on a routine basis, as required by the AWPF's permit.

Critical control points are points within a treatment process that are designed to support proper process performance and for which controls exist to reduce, prevent, or eliminate human health hazards of that process (WRF 2016). At each CCP, online analyzers or manual samples are utilized to measure or calculate parameters and evaluate whether the process meets performance criteria with respect to regulations and public health protection. Minimum or maximum limits would be set for each CCP performance parameter, and a regulatory alarm would be triggered to notify operators if the parameter falls outside of the acceptable range. The most common scenario that causes a regulatory alarm at an AWPF, is typically a parameter monitored for a treatment process unit does not meet the target setpoint and causes the AWPF to not achieve permit-required log reductions. Table 4-1 summarizes CCPs and key parameters to monitor for the AWPF.

Table 4-1: AWPF Critical Control Points and Key Parameters

Process	CCP	Parameters	Considerations
Ozone	• BAC feed	• Ozone residual • Temperature • pH • Flow rate • Carbamazepine • Sulfamethoxazole	Virus/Giardia LRV credit would be demonstrated to be 2/1, respectively, by maintaining ozone CT of 0.3 mg/min/L or greater based on EPA CT tables. The draft DPR regulations require that an ozone/BAC process provide no less than 1.0 log reduction each for carbamazepine and sulfamethoxazole.
BAC	• MF Feed	• Turbidity • Formaldehyde • Acetone	Direct filtration systems meeting the combined filter effluent (CFE) turbidity limits listed below, and the operational and design requirements outlined in policy SWTR #2, are granted the 1/2/2 virus/*Giardia/Cryptosporidium* log removal credits: • The turbidity level of representative samples of CFE must be ≤0.3 NTU in at least 95% of the measurements. • The maximum level of turbidity of the CFE must not exceed 1 NTU at any time. The draft DPR regulations require that an ozone/BAC process shall provide no less than 1.0 log (90 percent) reduction each for formaldehyde and acetone.
MF	• MF Filtrate	• Pressure decay testing (membrane integrity testing) • Turbidity	Direct and indirect integrity testing would be required to demonstrate the MF Feed system performance and pathogen removal per the Membrane Filtration Guidance Manual (EPA 2005). Direct membrane integrity testing via pressure decay testing is used to calculate the LRV for Giardia and Cryptosporidium. Indirect membrane integrity monitoring would be achieved with continuous monitoring (every 15 minutes) of turbidity to reach ≤ 0.15 NTU in the MF filtrate from each individual membrane rack.
RO	• RO feed • RO permeate	• Conductivity • TOC	Continuous monitoring (every 15 minutes) of conductivity and continuous monitoring of TOC has been approved by DDW to demonstrate log removal of pathogens by the RO System per the Membrane Filtration Guidance Manual (EPA 2005).
UV-AOP	• UV-AOP feed • UV-AOP product	• UV transmittance • Oxidant residual (chlorine or hydrogen peroxide) • UV dose • Power • Flow rate	UV-AOP feed transmittance would be ≥95% at all times. The design oxidant residual, UV dose, power, and flow rate would be maintained to exceed the UV-AOP system settings required to receive log reduction credit and 1,4 dioxane destruction.
Chlorine Contactors	• Purified water	• Free chlorine residual • Temperature • pH • Flow rate	Virus/Giardia LRV credit would be demonstrated to be 6/2, respectively, by a maintaining free chlorine CT of 35 mg/min/L or greater based on EPA CT tables.

In the event of a regulatory alarm, the AWPF would adjust its operation appropriately to protect end users and to protect the equipment from damage that would occur if a facility is put into a "hard stop". This is typically done with an automated recirculation loop at a reduced purified water production capacity. A recirculation loop is a permanent bypass that is built into a plant and facilitates water moving "in a circle" versus being sent out as treated water. In the case of the AWPF, the recirculation loop would typically bypass water after the UV-AOP process. From there water would circulate through ozone/BAC process, MF/RO membrane processes, and the UV Vessels until the recirculation valve was closed again. This is an important feature to allow AWPF operators to respond to an alarm without having to completely shut down the plant and risk damaging equipment. It is also a useful tool for contractors during start-up and commissioning.

It is recommended that the default automated action when any regulatory alarm is triggered by online analyzers is recirculation mode. This would allow operators time to react to an alarm and adjust flows. Table 4-2 summarizes different operational actions that could be taken when a regulatory alarm is triggered. It is recommended to further define these scenarios and responses with the operations staff during the design of the AWPF.

Table 4-2: Unplanned Regulatory Alarms Response

Event Description	Applicable Regulatory Requirements	Facility Response	AWPF Source Water Impact	AWPF Purified Water Impact	ROC Discharge Impact
Regulatory requirement not met.	ResWA (Phase 1) or TWS (Phase 2)	SCADA alarm would send the AWPF into recirculation mode. Plant O&M staff would respond to alarm. The AWPF would be taken out of recirculation once the alarm is resolved.	AWPF Source water would be received at the source water equalization tanks or pump station until the high level is met. If the AWPF is still in recirculation at this point, tertiary effluent from the San Mateo and SVCW would be temporarily diverted away from the AWPF and to each facility's existing outfall.	Purified water production would stop and the AWPF would go into recirculation mode. Conveyance system would be designed to respond to a sudden loss of water supply. For example, the PWPS would have a surge protection system designed to account for any water hammer coming back towards the AWPF. There could be balancing reservoirs installed either at the AWPF or in the Conveyance system that could store purified water and ramp down the conveyance system when the AWPF shuts off. Siting for potential surge tanks is excepted to be challenging along the purified alignment and would require future study.	ROC would continue to be generated while the plant is in recirculation. ROC would be blended with SVCW's tertiary effluent and discharged to the SF Bay at or below NPDES permit limits.

5. Emergency Shutdown

While unexpected, it is important to plan for emergency shutdowns at any treatment facility. Potential emergency shutdown periods that should be planned for include:

- Power outage
- Pump station failure
- Breakpoint chlorination system failure
- Chloramination system failure
- Other critical asset failure (e.g., pumps, membrane racks, UV reactors)

SVCW currently receives electrical power to their site from Pacific Gas and Electric Company (PG&E) via a 12 kilovolt (kV) service. The service provides power to an existing 12kV switchgear with a 1200A ampacity rating and 500MVA short circuit rating. The future power source for the project has not been determined at this time but could potential utilize and expand on the existing SVCW system or coordinate a new PG&E service to the project site independent of the SVCW service. Additional design information would be need to evaluate power service and backup power options. Emergency shutdown as a result of a power outage would persist until all the processes have been operationally tested and critical failures have been addressed. The exact time period of the shutdown would be dependent on the extent of the failures within the plant.

Other facility failures would cause the AWPF to first go into recirculation mode. Operators would troubleshoot problem areas and attempt to address alarms/failures without fully shutting down the plant. For example, when an emergency shutdown occurs, the AWPF could be programmed or manually put into recirculation mode and on-site equalization could be used to provide temporary retention time. **TM #1 – AWPF Design Criteria** further describes preliminary design criteria for the equalization tanks. Future design efforts would further investigate diurnal flow calculation and could explore different scenarios to provide additional capacity for emergency retention.

During the initial period of any facility failure, AWPF operations staff would assess the situation and DiPRRA would make a decision with input from the AWPF operations staff on whether a full plant shutdown is needed. Table 5-1 provides more details on how AWPF staff could respond to an unplanned emergency shutdown scenario. Similarly, when a regulatory alarm is triggered, the DiPRRA would make a decision with input from the AWPF operations staff on whether a full plant shutdown is needed. These scenarios and actions would be further refined during the design of the AWPF.

Table 5-1: Unplanned Emergency Shutdown Scenarios (Phase 1 or 2)

Unplanned Emergency Shutdown Scenario	Event Description	Average Purified Water Production	Facility Response	Source Water Impact	Purified Water Impact	ROC Discharge Impact
1	Source Water Pump Station failure	0 mgd	Alarm would send the AWPF into recirculation mode. Recirculation mode would be maintained while staff assess the situation and decide if a full plant shutdown is needed.	Source water would be received at the source water equalization tanks or pump station until the high level is met. If the AWPF is still in recirculation at this point, tertiary effluent from San Mateo and SVCW would be temporarily diverted away from the AWPF to their respective outfalls.	Purified water production would be ramped down to protect pumping facilities. The system would be hydraulically balanced before the purified water pump station (PWPS) is turned off.	ROC would continue to be generated while the plant is in recirculation. RO concentrate would be blended with SVCW's tertiary effluent, and discharged to the SF Bay at or below NPDES permit limits.
2	Purified Water Pump Station (PWPS) failure	0 mgd	Alarm would send the AWPF into recirculation mode. Recirculation mode would be maintained while staff assess the situation and decide if a full plant shutdown is needed.	Source water would be received at the source water equalization tanks or pump station until the high level is met. If the AWPF is still in recirculation at this point, tertiary effluent from the San Mateo and SVCW would be temporarily diverted away from the AWPF to their respective outfalls.	Purified water production would be stopped. Conveyance system would be designed to respond to a sudden loss of water supply. For example, the PWPS would have a surge protection system designed to account for any water hammer coming back towards the AWPF. There would be balancing reservoirs installed either at the AWPF or in the Conveyance system that would store purified water and ramp down the conveyance system when the AWPF shuts off.	ROC would continue to be generated while the plant is in recirculation. RO concentrate would be blended with SVCW's tertiary effluent, and discharged to the SF Bay at or below NPDES permit limits.
3	Breakpoint chlorination system failure	0 mgd	Alarm would send the AWPF into recirculation mode. Recirculation mode would be maintained while staff assess the situation and decide if a full plant shutdown is needed.	Source water would be received at the source water equalization tanks or pump station until the high level is met. If the AWPF is still in recirculation at this point, tertiary effluent from the San Mateo and SVCW would be temporarily diverted away from the AWPF to their respective outfalls.	Purified water production would stop.	ROC would continue to be generated while the plant is in recirculation. RO concentrate would be blended with SVCW's tertiary effluent, and discharged to the SF Bay at or below NPDES permit limits.
4	Power Outage	0 mgd	The AWPF would experience a sudden shutdown and all AWPF systems would stop operating. Staff to move to a safe location. After power is restored, operators would assess damage to each process and follow manufacturer's instructions for each process step to restart the system. The individual treatment process units would need to be operationally tested before the overall plant could be tested and restarted. Process for restarting the entire plant would depend on the operational testing requirements for each step, and would be detailed in the O&M and startup manuals. More detailed startup, operational, and control strategies would be developed in future design phases.	Source water flows would stop.	Purified water production would stop.	ROC flows would stop.

6. Source Water Availability

The AWPF would receive source water flows from SVCW and the San Mateo WWTP. San Mateo is currently constructing biological nutrient removal facilities that would result in fully nitrified effluent. SVCW's tertiary wastewater treatment process produces non-nitrified effluent that would contain higher concentrations of ammonia and phosphorus than San Mateo's tertiary effluent. To dilute these constituents and improve performance of each AWPF treatment process, these two source waters would be blended prior to advanced treatment. Under Phase 1 (6 mgd Capacity) the AWPF would receive 4 to 8 mgd, with a 50/50 blend of tertiary effluent from SVCW and San Mateo. Under Phase 2 this range of source water would increase to 8 to 16 mgd, maintaining the 50/50 blend.

The treatment train technologies selected at the AWPF would be designed to meet or exceed the ResWA regulatory requirements, the TWA regulatory requirements, current NPDES discharge permits, and other watershed requirements like matching background concentrations levels in CSR. Operationally, the source waters coming to the AWPF could impact O&M for treatment processes (e.g., cleaning frequency), which ultimately impacts chemical consumption rates and the amount of RO concentrate generated by the AWPF. For example, if source water is unavailable from San Mateo and the AWPF only receives source water from SVCW, then it should be anticipated that cleanings would occur more frequently due to the lower source water quality. It should be noted that the ebb and flow of the quantity of source water received from either San Mateo or SVCW should not impact the AWPF's ability to produce compliant purified water. However, as discussed in **TM #3 – RO Concentrate Disposal**, if the source water is comprised only of SVCW tertiary effluent the RO concentrate ammonia concentrations would exceed the SF Bay requirements, and the AWPF purified water would need to be diluted with the remaining available SVCW tertiary effluent flows to bring ammonia levels below the NPDES limits. Thus, if San Mateo tertiary effluent is not available during operation, this would impact the AWPF's production capabilities.

Availability of SVCW tertiary effluent flows for the AWPF source water may be constrained by competing RWC recycled water demands. RWC has a current annual average allocation of 2.9 mgd of SVCW tertiary effluent. However, during summer months, RWC's daily recycled water demand can peak to greater than 9 mgs. Given that purified water demand is expected to peak in the summer months, it is expected that there will be competing demand for SVCW tertiary effluent. From 2013-2021, RWC used 0.7 mgd on an average annual basis out of a total allotment of 2.9 mgd of tertiary recycled water. For the purposes of this BODR, available effluent range assumes RWC recycled water demands range from 0.7 – 2.9 mgd. However, it is acknowledged that the source flows available for AWPF will depend on influent flows to SVCW and RWC's recycled water demand and agreement, and AWPF flows may need to be turned down to accommodate RWC demands/allotments.

Ideally, source water constraints would be planned accordingly with the DiPRRA and each wastewater facility. Unplanned loss of source water supplies would typically be due to a critical asset failure at either facility. Table 6-1 summarizes potential scenarios and possible AWPF responses. The main operational decision around source availability would occur once Phase 2 is completed. Loss of one source of water from either the City or SVCW in this scenario would require DiPRRA to decide how much purified water gets sent to CSR and/or local drinking water distribution systems.

Table 6-1: Operational Scenarios for Unplanned Source Water Availability

Unplanned Source Water Availability Scenario	Event Description	Average Purified Water Production	Facility Response	Source Water Impact	Purified Water Impact	ROC Discharge Impact
1	No SVCW Flows. AWPF Source Water from San Mateo Tertiary Effluent Only	≤6 mgd	AWPF production would initially ramp down in response to reduced AWPF source water availability. San Mateo flows to the AWPF could ramp up to provide sufficient AWPF source water to meet Phase 1 flows (6 mgd purified water)	San Mateo's tertiary effluent would be fully nitrified and would provide high-quality source water to the AWPF. Chemical systems may be able to be adjusted down when receiving AWPF source water from only San Mateo tertiary effluent.	Production would be reduced to less than or equal to 6 mgd. DiPRRA would have to decide the flow split between CSR and/or local drinking water distribution systems depending on system demands.	ROC would be generated and blended with SVCW's tertiary effluent, and discharged to the SF Bay at or below NPDES permit limits.
2	No San Mateo Flows. AWPF Source Water from SVCW Tertiary Effluent Only	≤6 mgd	AWPF production would initially ramp down in response to reduced AWPF source water availability. SVCW flows to the AWPF could ramp up to provide sufficient AWPF source water to meet Phase 1 flows (6 mgd purified water)	SVCW's tertiary effluent is not fully nitrified, providing a lower-quality source water to the AWPF. Adjustments would need to be made to the chemical systems to accommodate the change in AWPF source water quality.	Production would be reduced to less than or equal to 6 mgd. DiPRRA would have to decide the flow split between CSR and/or local drinking water distribution systems depending on system demands.	ROC is likely to exceed NPDES permit limits for ammonia. See **TM #3 – RO Concentrate Disposal** for additional discussion. RO concentrate would need to be diluted and/or AWPF production would need to be ramped down to provide sufficient RO concentrate dilution from SVCW tertiary effluent to meet NPDES limits.

7. RO Concentrate Considerations

As previously discussed, the RO process generates a concentrate “waste” stream for discharge. Since the AWPF is located near the SVCW ocean outfall connection, tying in the RO concentrate pipeline with the existing outfall to the SF Bay is a cost-effective way to discharge this waste stream.

The PureWater Peninsula Project, and associated facilities, would be required to meet existing and future regulations to discharge RO concentrate via the SVCW outfall to the SF Bay. Currently, SVCW discharges approximately 13.6 mgd of treated wastewater to the Lower SF Bay through a deepwater diffuser that is approximately 6,700 ft offshore. The discharge flow is regulated under three Waste Discharge Requirements (WDRs) / National Pollutant Discharge Elimination System (NPDES) permits: (1) SVCW Individual WDR, (2) SF Bay Watershed WDR for mercury and PCBs, and (3) SF Bay Watershed WDR for nutrients. Once constructed, the RO concentrate generated by the AWPF would be mixed with the remaining tertiary effluent discharge from SVCW. This combined tertiary effluent would be required to continue to meet the permitted discharge requirements.

Under normal operational conditions, the AWPF would receive a 50/50 blend of tertiary effluent from SVCW and San Mateo. During an unplanned event, if the AWPF is receiving only source water from SVCW tertiary effluent, the RO concentrate generated from the AWPF would need additional treatment or dilution to meet current and future discharge regulations. One method to mitigate this risk, would be to install an additional pipeline from MF feed pumps which could be used to dilute the RO concentrate. It is recommended that this dilution line be installed with a backflow preventer and sourced upstream of the UV-AOP process to minimize backflow concerns. Refer to **TM #3 RO Concentrate Disposal** for more details on the considerations for dilution and treatment of the RO concentrate.

8. Conclusions

This TM has identified planned and unplanned operating scenarios that the DiPRRA and future AWPF operators would need to be aware of and respond to.

Under Phase 1, when the AWPF would only be producing water for ResWA, AWPF operators would monitor for ResWA regulatory compliance and coordinate with SFPUC to identify available and/or anticipated storage in the RWA Water Bank, which would guide the decision on the amount of purified water to deliver to CSR. Since Phase 1 of the AWPF would be built with the full advanced treatment process required for a TWA facility, Phase 1 would also be an opportunity for operators to get trained on monitoring and operating the facility to meet TWA requirements. One key difference between Phases 1 and 2 is that the purified water would be chloraminated in Phase 2 only.

In Phase 2, the purified water would be chloraminated and treated to match the SFRWS water quality. After the last DWDS connection, chemicals would be injected from the Breakpoint Chlorination Facility to dechloraminate the water upstream of the Pulgas DF. Since the purified water in Phase 2 would be treated to match the SFRWS water quality, operations at the Pulgas DF would be similar to how they operate currently to meet reservoir augmentation requirements. In addition to coordination with SFPUC and the SFRWS for ResWA, Operators would need to monitor tank levels and demands for TWA with the receiving agencies.The operational tables presented early in the TM define potential planned and unplanned scenarios, and provide guidance and considerations on how the AWPF is expected to operate. It is recommended that these scenarios be discussed in detail with the DiPRRA and AWPF operations staff as the project progresses. Detailed response plans would need to be developed for each scenario to support operators in making efficient and confident decisions.

Items to still be addressed by the PureWater Peninsula Project team include:

1. Understanding the operational costs/trade-offs between "spilling" water in the upcountry system versus the operational costs to shut down, maintain, and restart the AWPF.
2. Developing guidance documents that clearly define under what scenarios to ramp down and shut down the AWPF.
3. Developing guidance documents that clearly define when TWA would be limited due to demands, dilution preferences, facility O&M activities or other conditions identified by each water purveyor specifically for their system.
4. Defining the water quality required now and in the future for the RO concentrate stream, and including dilution capabilities from AWPF flows prior to mixing with SVCWS's tertiary effluent if needed.

Understanding and defining real-time scenarios the AWPF could face facilitates the construction of an AWPF that is operationally flexible and produces safe and reliable water for the SF Peninsula communities.

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Appendix C Modeling and Operational Considerations

Sections C.1 to C.3 describes the existing water supply models used to simulate operations of the Regional Water System (SFRWS) and the development of a Crystal Spring Reservoir Operations Model (CSR ROM) to evaluate the ability to meet reservoir water augmentation (ResWA) regulatory requirements for retention and dilution.

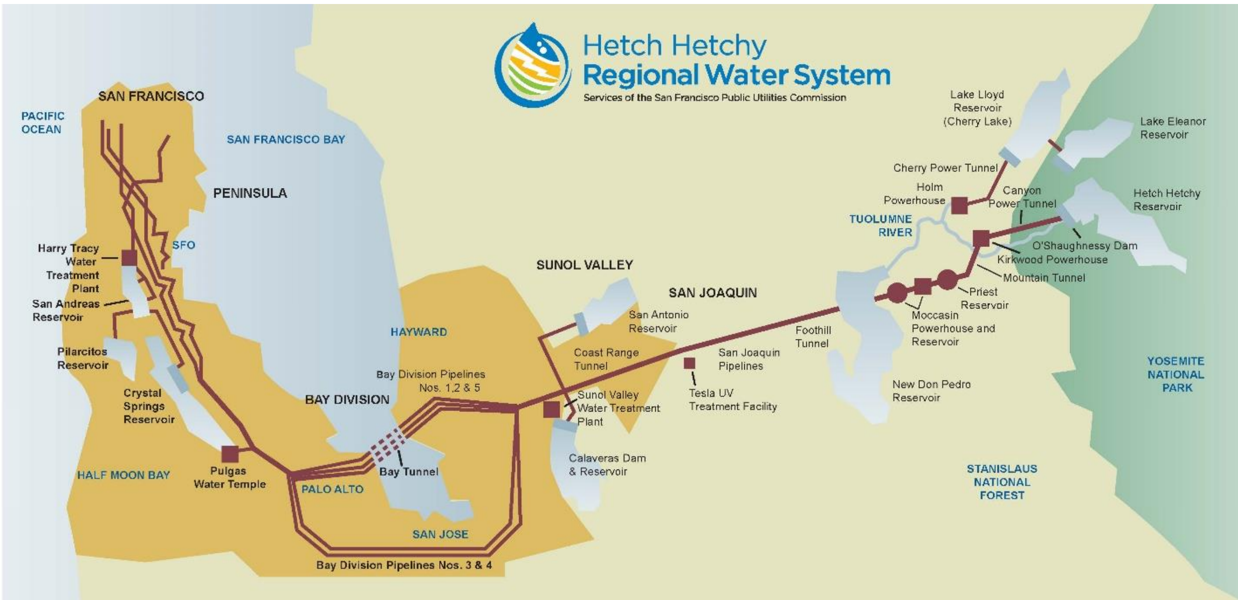
Section C.4 describes an evaluation of the impact of purified water deliveries from the the PureWater Peninsula Project on the SFRWS and describes the quantity of "spill" that could potentially occur under different AWPF operational scenarios.

C.1 Hetch Hetchy Local Simulation Model (HHLSM)

The City and County of San Francisco hold the water rights to store and deliver water from the Tuolumne River watershed stored in the Hetch Hetchy Reservoir and local reservoirs in the Alameda and Peninsula watersheds, which collectively constitute the water supply for the Hetch Hetchy SFRWS. An average of 85 percent of the water supply for the SFRWS is collected from the Tuolumne River, and the remaining 15 percent of the water supply is drawn from local watersheds in Alameda and the Peninsula (SFPUC, 2021).

The Hetch Hetchy SFRWS, illustrated in Figure C-1, consists of a complex series of reservoirs, tunnels, pipelines, pump stations, and treatment plants. The SFRWS delivers water from the Sierra Nevada and SF Bay Area watersheds to four counties in the SF Bay Area. The SFRWS originates in the Hetch Hetchy Valley of Yosemite National Park at the O'Shaughnessy Dam and Hetch Hetchy Reservoir. The O'Shaughnessy Dam impounds water along the main stem of the Tuolumne River, thereby creating Hetch Hetchy Reservoir. The reservoir collects water from the surrounding 459 square miles of watershed for the purpose of providing potable water to 2.7 million residential, commercial, and industrial customers in San Francisco, Santa Clara, Alameda, San Mateo, and Tuolumne Counties.

Figure C-1: Schematic of the Hetch Hetchy Regional Water System



The Hetch Hetchy SFRWS is owned and operated by the SFPUC and serves both Retail and Wholesale Customers in four counties in the SF Bay Area. Together, the BAWSCA agencies account for two-thirds of water consumption from the system and pay for two-thirds of its upkeep. The SFRWS accounts for 97 percent of the SFPUC's retail water supply while the remaining 3 percent are from (a) locally produced groundwater from the Westside Groundwater Basin and Castlewood Well System and (b) recycled water from the Southeast Water Pollution Control Plant, Harding Park Recycled Water Project, and Pacifica Recycled Water Project.

The SFPUC has developed and maintained a monthly timestep water balance model called the **Hetch Hetchy Local Simulation Model (HHLSM),** which simulates SFRWS operations using historical hydrology from 1920 to 2017. HHLSM can be used to simulate the way that different combinations of SFRWS infrastructure and operational requirements would perform through the historical hydrology. For the PureWater Peninsula Project, the HHLSM model was primarily used to understand the amount of available storage space for purified water in the SFRWS in dry years, the associated water supply benefits for the SFRWS, and conversely to evaluate the amount of water that would "spill" from the SFRWS to make room for purified water when the reservoir system is full (e.g., primarily in wet years).

The HHLSM quantifies the amount of available storage in the SFRWS, including in the SFPUC Water Bank Account (Water Bank) in New Don Pedro Reservoir (Don Pedro). The Water Bank is typically the last SFRWS storage to be filled, and it is typically the first SFRWS storage to be emptied during droughts.

Figure C-2 illustrates the amount of available storage in the Water Bank during the 6-year drought and 6-year normal/wet period hydrologic flow regime. When water stored in the Water Bank is less than the maximum allowable account storage, there is room for new supplies to be added to the system, as indicated by the blue area. When the Water Bank is at the maximum account storage, then there is no room to capture or store additional water, and any additional inflow "spills" from the SFRWS system.

Figure C-3 illustrates the amount of upcountry "spill" (green line) that would occur during normal and wet years during current operations when there is insufficient room in the Water Bank to store water. Over the 12-year sequence, approximately 6,350,000 AF (2 trillion gal) would "spill" during normal operations and approximately 1,057,000 AFY (340 billion gal per year) would "spill" on average during 6-year wet period.

During these "spill" periods, any new supplemental supplies (e.g., from a purified water project) would result in additional releases from the system. However, under the proposed instream flow requirements in the Bay-Delta Water Quality Control Plan update, increases to required releases to the Tuolumne River would create more space in the Water Bank for supplemental supplies more frequently than under current conditions.

Figure C-2: Available Water Storage in the Water Bank during Dry and Wet Periods

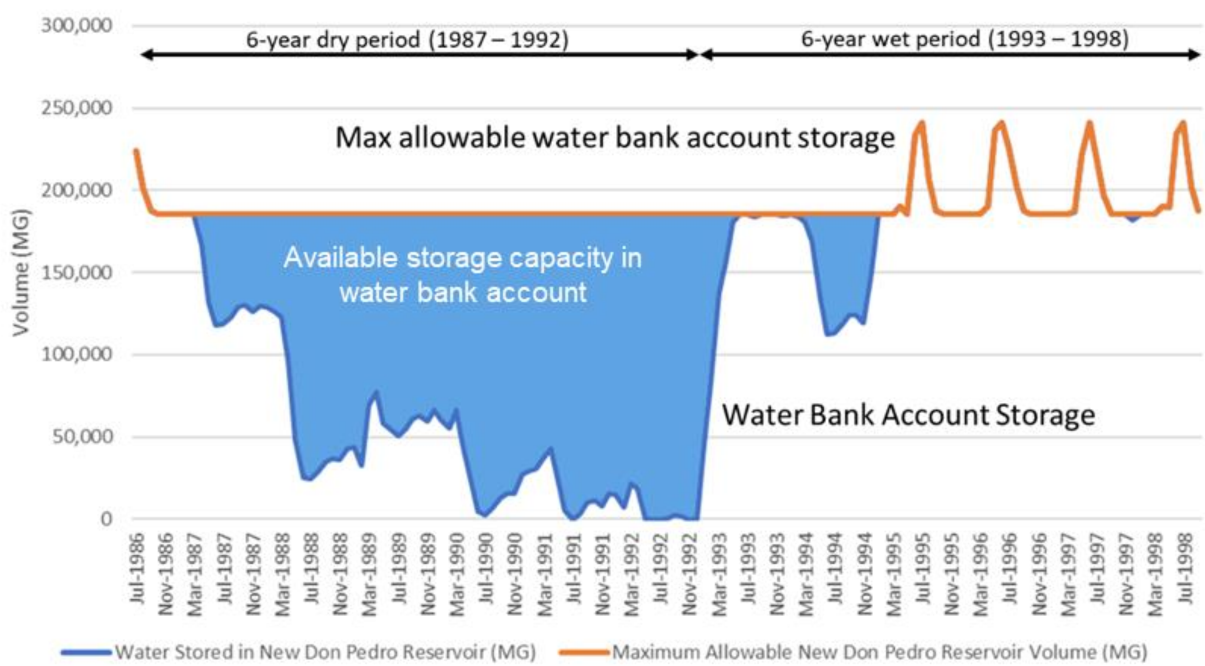
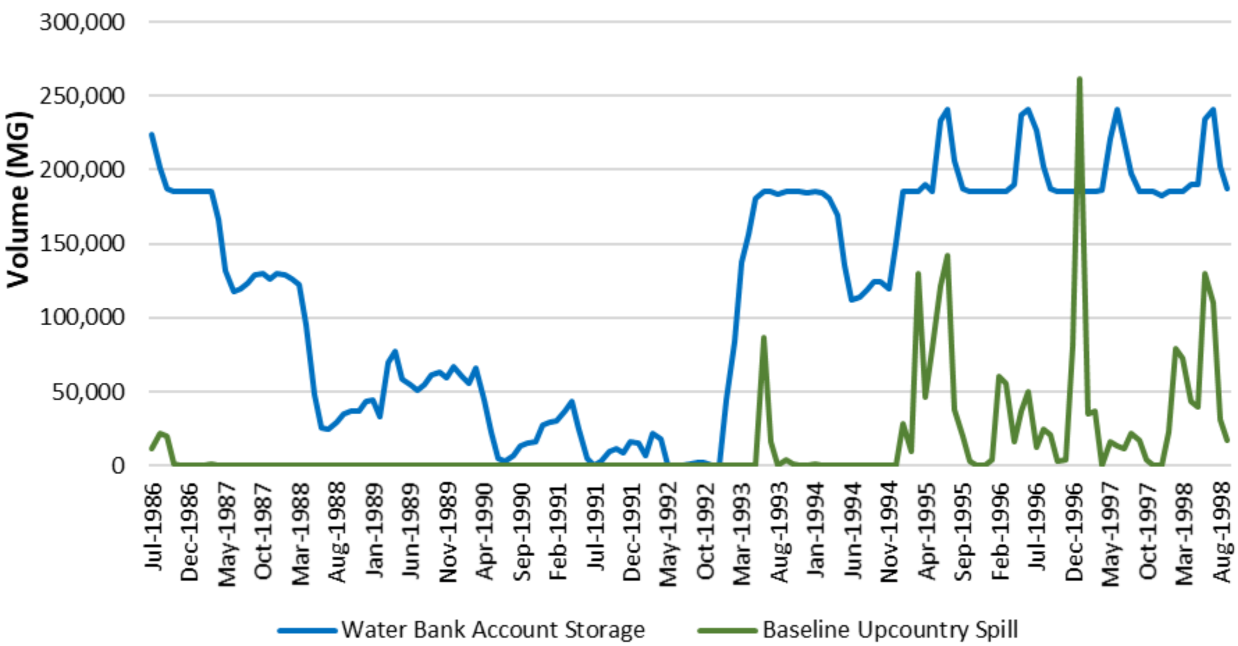


Figure C-3: Water Bank Account Storage and Spills Under Current Operational Scenarios



C.2 BAWSCA Regional Water Reliability Model

The Bay Area Water Supply and Conservation Agency (BAWSCA) has developed a **Regional Water Reliability Model** to develop BAWSCA's long-term reliable water supply strategy and support decision making. This model receives inputs from but is independent from the SFPUC's HHLSM model. BAWSCA's Regional Water Reliability Model also receives input through regional cooperation with Valley Water's Water Evaluation and Planning (WEAP) Model, Alameda County Water District's Integrated Resources Planning Model (IRPM) and other local supply information. The study area includes the SFRWS downstream of San Antonio Reservoir through the City of San Francisco. The model provides member agency perspective on frequency, magnitude and timing of shortages based on each agencies demand and regional supplies. Hazen and Sawyer provided output of modeled shortages from July 1986-2011 to simulate shortages by the PureWater Peninsula Parties during the defined hydrologic flow regimes.

Annual shortages were simulated by BAWSCA's Regional Water Reliability Model during the historical 6-year drought period are presented in Table C-1. The Model outcomes were used to evaluate the amount of purified water that would be needed to offset shortages during dry year conditions. In other words, a potable reuse project could serve to reduce or even eliminate these shortages in dry periods.

Table C-1: Summary of BAWSCA Regional Water Reliability Model – Shortages Output for PureWater Peninsula Project Water Suppliers

	TWA RELEVANCE					
Fiscal Year	MPWD Mid-Peninsula Water District Diversion Shortage		Cal Water Bayshore District Referred to in model as: CWS Mid-Peninsula Diversion Shortage		RWC Redwood City Diversion Shortage	
(FY)	(AF)	(mgd)	(AF)	(AF)	(AF)	(AF)
1988	311	0.3	3,173	2.8	1,539	1.4
1989	353	0.3	3,586	3.2	1,748	1.6
1990	720	0.6	5,453	4.9	2,966	2.6
1991	519	0.5	4,405	3.9	2,292	2.0
1992	649	0.6	5,095	4.5	2,738	2.4
1993	394	0.4	2,766	2.5	1,524	1.4
Average Shortage (1988-1993)	**491**	**0.4**	**4,080**	**3.6**	**2,135**	**1.9**

C.3 CSR Augmentation Simulations

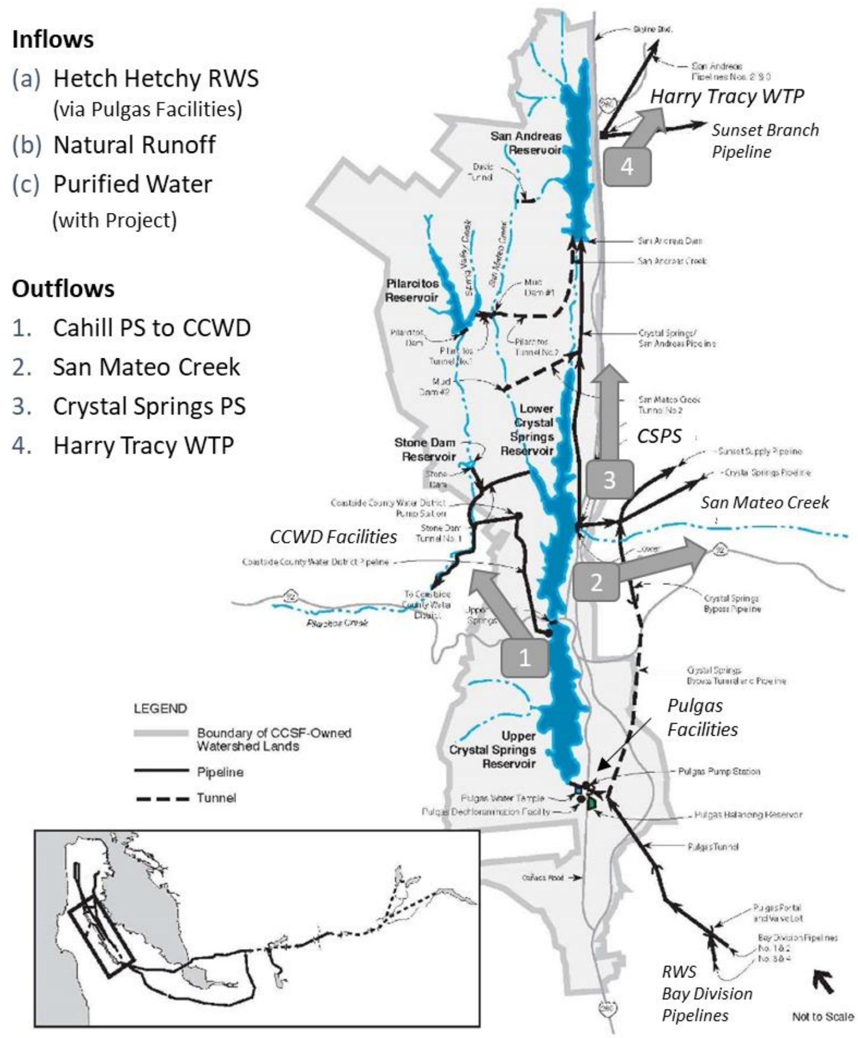
This section provides an overview of the Crystal Springs/San Andres Integrated Reservoir System and describes the CSR Reservoir Operations Model (CSR ROM), which was developed to simulate Reservoir Water Augmentation using a monthly time-step based on outputs from SFPUC's HHLSM model. The CSR ROM is used to estimate the available storage capacity in the SFRWS and the amount of Hetch Hetchy water that would "spill" in the upcountry system as a result of purified water addition to CSR and simulate how a potable reuse project that introduces purified water into CSR would meet ResWA regulatory requirements for retention and dilution.

C.3.1 Overview of the Integrated Reservoir System

The Crystal Springs/San Andres Integrated Reservoir System consists of Upper Crystal Springs Reservoir (CSR), Lower CSR, and San Andreas Reservoir. Upper and Lower CSR are hydraulically connected via two culverts and are operated as a single reservoir. Lower CSR is connected to San Andreas Reservoir in the north via the Crystal Springs Pump Station (CSPS) and Crystal Springs-San Andreas pipeline (see Figure C-4). The two-reservoir system (CSR and San Andreas Reservoir) is owned and operated as part of the SFRWS.

When CSR is refilled with water from the Tuolumne River or the SFRWS East Bay watersheds, treated drinking water in the SFRWS transmission system is dechloraminated and discharged into Upper CSR at the Pulgas DF. Upper and Lower CSRs also capture water from local runoff their respective local watersheds. Water from the Pilarcitos Creek watershed is also periodically transferred to Lower CSR.

Figure C-4: Crystal Springs/San Andres Integrated Reservoir System - Inflows and Outflows



SOURCE: PEIR ON SFPUC WATER SYSTEM IMPROVEMENT PROGRAM / 203287

As illustrated in Figure C-4, there are three main outflows from the three-reservoir system, listed below:

1. Water is pumped out of Upper CSR through the Cahill Ridge Pump Station to **Coastside County Water District (CCWD)** facilities to supplement the other three sources of supply for use in Half Moon Bay. All CCWD water supplies are treated at the Nunes Water Treatment Plant (Nunes WTP), which has a capacity of 4.5 mgd.
2. Stream releases to **San Mateo Creek** occur at the release structures in Lower CSR Reservoir. Water is released from Lower Crystal Springs Dam to San Mateo Creek based on a release schedule defined as part of the Lower Crystal Springs Dam Improvement Project (SFPUC 2010). The minimum release depends on both the type of water year (normal/wet or dry) and time of year. In winter and spring of wetter years, additional releases from CSR to San Mateo Creek are commonly made to keep the reservoir storage at the operational target.

3. Water is pumped through the Crystal Springs Pump Station to San Andreas Reservoir, then to the **Harry Tracy Water Treatment Plant** east of the reservoir, where it is treated before being supplied to SFRWS drinking water customers. San Andreas Reservoir storage is generally maintained at seasonal target storage, so the CSPS rate tends to generally match Harry Tracy WTP production rate. Under typical operation, most of the water treated at Harry Tracy WTP flows to San Francisco, but there are a few wholesale turnouts along the way that include Daily City, City of South San Francisco, City of San Bruno, Westborough, North Coast County Water District, and the Crystal Springs Golf Course. When running at peak capacity, Harry Tracy WTP could be used to feed San Francisco and other SFRWS wholesalers on the peninsula, but that is not typical operation.

Other hydraulic features include open culverts that connect Upper and Lower CSR, which is not considered an outflow but instead a static condition, and the Crystal Springs Pump Station (CSPS), which conveys flows from Lower CSR to San Andres Reservoir. The Sunset Branch pipeline can convey untreated water from Lower CSR to SFRWS wholesalers on the peninsula, but as noted above this is not typical operation and would only be used in an extreme emergency when raw water flows are needed to fight a large fire for example.

CSR's large surface area (approximately 1,300 acres) and significant capacity (approximately 18 billion gallons), along with its existing infrastructure, make this reservoir a suitable reservoir for ResWA. The elongated shape with natural separations between each holding area is beneficial for meeting an extended retention time. The reservoir's overall large capacity provides for generous dilution even at high augmentation rates.

SFPUC's existing water treatment plant (Harry Tracy WTP) and the Pulgas DF at the southern end of CSR, including a dechlorination/dechloramination system and discharge facility, have sufficient capacity to accept purified water from a ResWA project. The following sections provide a high-level evaluation of estimated retention times, dilution, and source water quality to assess the viability of a ResWA project at CSR to meet existing regulations.

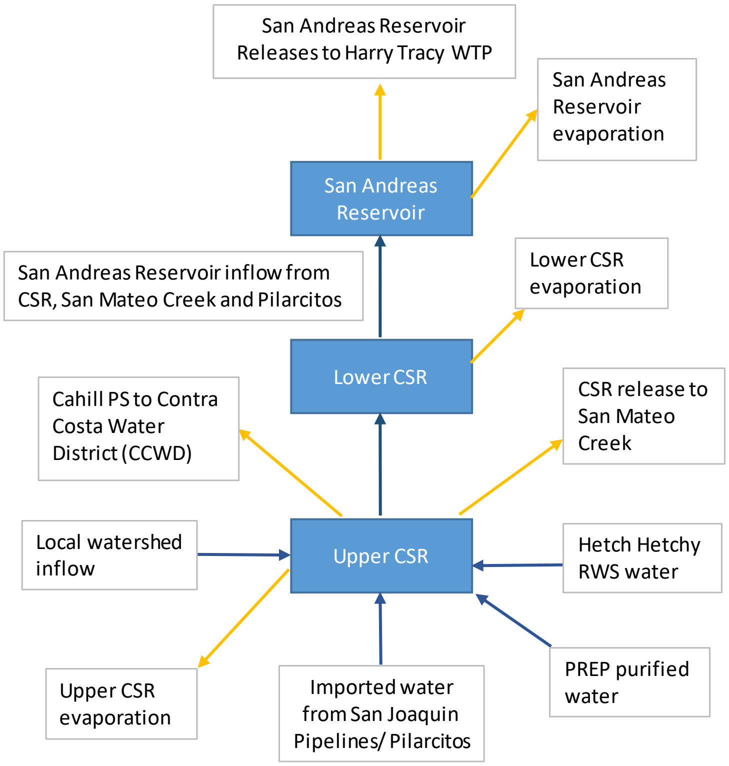
C.3.2 CSR Reservoir Operation Model

As part of the PureWater Peninsula Project, a **CSR Reservoir Operations Model (CSR ROM)** for Reservoir Water Augmentation was developed using a monthly time-step based on outputs from SFPUC's HHLSM model (described in Section C.1). The purpose of the CSR ROM is to:

1. Estimate the available storage in the SFRWS and the amount of Hetch Hetchy water that would "spill" in the upcountry system as a result of purified water addition to CSR, and
2. Simulate how a potable reuse project that introduces purified water into CSR would meet ResWA regulatory requirements for retention and dilution.

The ROM uses HHLSM data from 1987 to 1998 to represent the 12-year flow regime selected for the evaluation to represent both an extended 6-year dry period (1987 – 1992) and extended 6-year wet period (1993 – 1998). Model parameters include inflows, storage volumes, and outflows to Upper CSR, Lower CSR and San Andres reservoir, available storage in the SFRWS and releases to Harry Tracy WTP. A flow diagram for the CSR ROM is illustrated in Figure C-5.

Figure C-5: CSR ROM Flow Diagram



The following sections describes the evaluation of CSR to meet ResWA regulatory requirements for retention and dilution.

C.3.3 CSR ResWA Retention Time Evaluation

Per the Final ResWA Regulations, an initial reservoir retention time of 180 days (6 months) must be demonstrated, with flexibility for an alternative minimum theoretical retention time as low as 60 days (2 months) on a case-by-case basis with State Board approval. ResWA projects with minimum retention times of less than 120 days (4 months) must provide an additional 1-log treatment. A theoretical retention time of no less than 60 days may be considered for approval.

Reservoir retention time is defined as the total volume of the reservoir (V) divided by the total flow out of the reservoir (Q) during a given time period. Retention times are to be calculated at the end of each month based on the reservoir conditions for that month. The CSR ROM was used to calculate retention time on a monthly basis for the 12-year period, reflecting historical dry- and wet- year operations. Inflows into the reservoir (i.e., purified water production rates) are not required or used for this analysis. The ResWA Scenarios were combined with two reservoir system configurations, to anticipate a combination of scenarios that the DDW may be interested in seeing to ensure that the minimum retention criteria could be met.

The two cases are as follows:

1. **Upper CSR** as a standalone reservoir, which includes one outflow from the Cahill Ridge Pump Station that goes directly to a water treatment plant (CCWD's Nunes WTP) as well as reservoir evaporation, and
2. **Integrated Reservoir System,** as a combined system with Upper CSR + Lower CSR + San Andreas, which includes three outflows to CCWD's Nunes WTP, San Mateo Creek discharges and SFPUC's Harry Tracy WTP, as well as reservoir evaporation.

Upper and Lower CSR were not evaluated as a standalone system because there is no new outflow to a water treatment plant. An argument could be made to assume Upper and Lower CSR essentially act as one reservoir because they are hydraulically connected; however, this study considers Upper CSR a standalone reservoir to be conservative. Modeling outflows from the HHLSM on a monthly time-step basis were used as inputs into the CSR ROM for this evaluation.

Table C-2 summarizes the average, maximum and minimum retention time values, in months, for the Upper CSR and Integrated Reservoir System, based on historical reservoir volumes and outflow values.

Table C-2: CSR ResWA Retention Time Evaluation

Retention (months) = Volume $_{reservoir}$ / Outflow $_{total}$					
Upper CSR Retention Time (months)			Integrated Reservoir System Retention Time (months)		
Average	**Max**	**Min**	**Average**	**Max**	**Min**
128	467	36	23	30	3

The retention time evaluation found that:

- Upper CSR always meets the 2-month minimum and 6-month preferred retention requirements, primarily because the maximum outflow to the Cahill Ridge Pump Station is only 6 mgd.
- For the Integrated Reservoir System, the retention is 2 years on average, and stays above the 2-month minimum requirement for the period of simulation.
- There were two months within the entire 12-year period during which the retention time for the Integrated Reservoir System dropped below the 6-month preferred criteria. This occurs during consecutive wet year periods (January 1997 and February 1998). Both timeframes coincide with the high outflows observed in the overall CSR + San Andreas system, when the majority of those outflow conditions were attributed to higher releases in the San Mateo Creek. These higher releases to San Mateo Creek are required to meet WSE in the reservoir for Fountain Thistle.

Implementation of a ResWA project may require modifications to SFRWS operations to maintain a retention time of 6-months, while adhering to other reservoir operation requirements, such as meeting Division of Safety of Dams (DSOD) elevation requirements for San Andreas, meeting summer/winter elevation guide curve criteria, meeting required water surface elevations for the fountain thistle. The ability to modify outflows at times when there are high local inflows from stormwater runoff in the CSR reservoir would be limited. One option may be to utilize predictive analysis tools may be useful to anticipate high local inflow events and preemptively release water from CSR or ramp down production of AWPF purified water to account for high local inflows from the SFRWS. Future studies would include hydrodynamic modeling of the reservoir and an assessment of operational practices to avoid dipping below the 6-month minimum. Based on the worst-case historical scenario, in no case would the retention time go below 2 months.

In comparison to other ongoing ResWA projects, the City of San Diego is pursuing a 30 mgd ResWA project in the 5,800-AF-capacity Miramar Reservoir, which would have an average retention time of just over two months. The City of San Diego was active in the legislative and regulatory efforts to reduce the minimum required retention time to 2 months (60 days) so that ResWA at Miramar would be viable for Phase 1. For the East County Advanced Water Purification Program, Padre Dam Municipal Water District (MWD) is exploring a 15 mgd ResWA project in Lake Jennings (capacity of approximately 9,800 AF), which would have an average retention time of just over 200 days, but a minimum retention time between 1.4 and 2.1 months. Padre Dam MWD is working with the DDW to demonstrate their ability to meet ResWA criteria with specific operational accommodations during emergencies. The Pure Water Project Las Virgenes-Triunfo is moving forward with an 8,840 AF volume reservoir, and their initial simulations of minimum retention time demonstrate the ability to achieve greater than 2 months retention.

A ResWA project may also need to demonstrate that the risk of short-circuiting in the reservoir would be minimal or could be controlled. Given the geometry of CSR, with a long fetch between the inlet and outlet, it appears there would be a significant period for purified flows to travel from the point of augmentation to the San Andreas Reservoir and then to Harry Tracy WTP, minimizing the risk of short circuiting. Future studies would be performed to evaluate dispersion, mixing characteristics, and water quality in the reservoir, using hydrodynamic mixing analyses and/or modeling to refine the ResWA scenarios and confirm the ability to meet regulations.

C.3.4 CSR ResWA Dilution Evaluation

Per the Final ResWA Regulations, pathogen removal requirements are also dependent on a reservoir's ability to dilute discharge flows, if required. As discussed in **Appendix A: Potable Reuse Regulatory Requirements**, standard pathogen removal requirements (i.e., 8/7/8 log removal for V/G/C) are based on achieving a 100:1 (or 1 percent) dilution of a 24-hour discharge of purified water and maintaining greater than 120 days retention time. If a reservoir achieves only 10:1 (10 percent) dilution of a 24-hour discharge of purified water, pathogen removal requirements are increased by a factor of 10 (i.e., 9/8/9 log removal for V/G/C).

The actual capacity of a reservoir to dilute discharge flows is dependent on several factors:

- Discharge facility location and depth,
- Design of the discharge facility,

- Reservoir hydrodynamics (i.e., mixing), and
- Weather (i.e., wind and runoff) conditions.

Reservoir modeling and tracer studies would be required to determine the practical amount of dilution provided by CSR in a 24-hour period. Discharge facility alternative design studies may also be needed if enhanced initial mixing is required.

For the purpose of this analysis, The CSR ROM was used to calculate the monthly theoretical dilution ratios by dividing the monthly reservoir volume by the quantity of purified water delivered during the prior 24-hour period. Table C-3 summarizes the theoretical dilution ratios at purified water flow rates of 6 mgd and 12 mgd considering (1) Upper CSR only and (2) the Integrated Reservoir System for each of the three operational scenarios.

The results show that for both reservoir systems, the 10:1 minimum dilution and 100:1 preferred dilution criteria are always met. Assuming complete mixing (i.e., 100 percent dispersion of purified water throughout the entire reservoir volume), dilution ratios equal to or greater than 400:1 would be possible. In comparison, the City of San Diego's ResWA at Miramar Reservoir and Padre Dam MWD's project at Lake Jennings would have estimated high dilution ratios of about 70:1 and 200:1, respectively. A ResWA at CSR would allow at least 5 times and 2 times more dilution as compared to the San Diego and Padre Dam MWD projects, respectively.

Inversely, the maximum theoretical purified water augmentation rates possible while still achieving dilution ratios of 100:1 and 10:1 could be over 180 mgd for the Full Reservoir System and over 50 mgd for Upper CSR. This is well above the assumed available purified flow of 6 and 12 mgd being considered for PureWater Peninsula Project.

Table C-3: CSR ResWA Minimum Monthly Dilution

Purified Water Deliveries (mgd)	Upper CSR	Integrated Reservoir System
Phase 1: 6 mgd Continuous	860 : 1	3,130 : 1
Phase 1: 6 mgd Seasonal Ramp Down	1,000 : 1	3,520 : 1
Phase 1: 6 mgd Seasonal Shut Down	1,000 : 1	3,520 : 1
Phase 2: 12 mgd continuous	430 : 1	1,560 : 1
Phase 2: 12 mgd Seasonal Ramp Down	500 : 1	1,760 : 1
Phase 2: 12 mgd Seasonal Shut Down	500 : 1	1,760 : 1

In operation, purified water released directly in the southern end of the reservoir during any 24-hour period could mix with a smaller portion of the reservoir volume, so actual dilution of a 24-hour pulse discharge would be less than the theoretical dilutions computed under these assumed complete mixing conditions. Although actual dilution ratios are anticipated to be somewhat lower than the theoretical dilution ratios presented in Table C-3 it should be possible to design a dispersal/release system capable of achieving dilution ratios of at least 100:1 under all operating conditions because proposed purified flows are so small relative to CSR's large reservoir storage volumes.

Based on the conservative retention time and dilution evaluations, it is possible that a ResWA project would need to meet pathogen removal requirements of 9/8/9 (v/c/g), based on a retention time of less than 4 months and dilution ratio of 100:1. However, upon modification to SFRWS operations, SFPUC may be able to adjust CSR operations to avoid the peak outflows that occurred during the consecutive wet years of 1997 and 1998, thus maintaining a retention time of more than 4 months, thereby reducing the pathogen removal requirements to 8/7/8. Hydrodynamic modeling and tracer studies would need to be conducted as part of the next steps to simulate then validate these assumptions.

C.4 AWPF Operational Scenarios

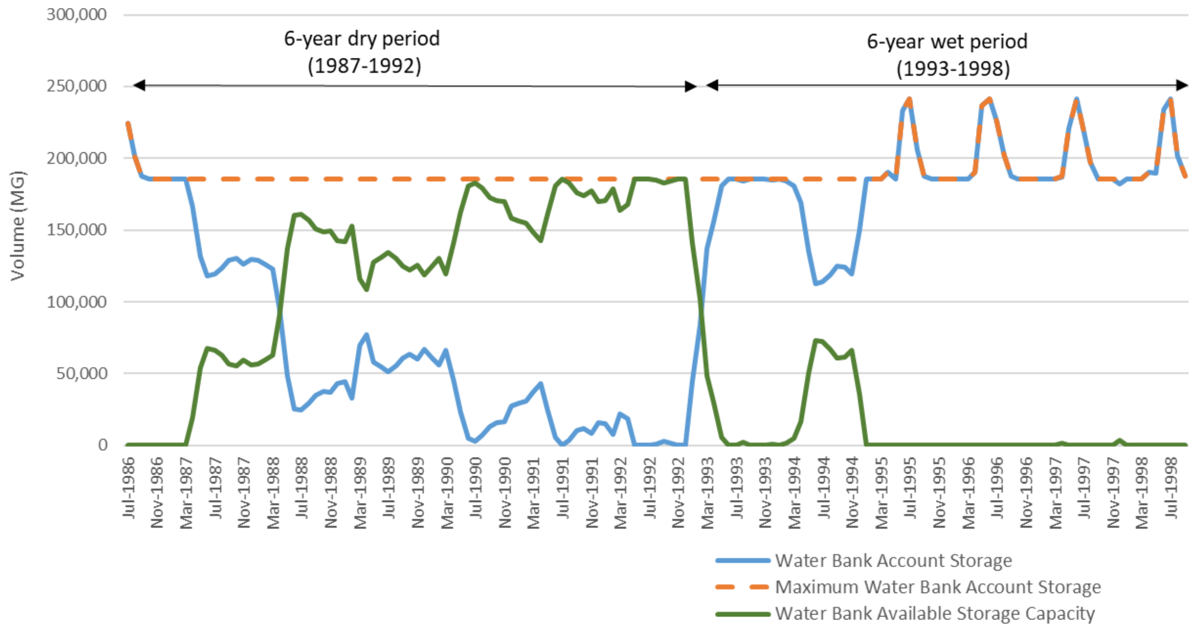
Whether the the PureWater Peninsula Project is delivering water for ResWA or TWA, the addition of a new source of supply to the SFRWS would either supplement or displace water that would otherwise be delivered to the SF Peninsula. This section describes an evaluation of the impact of purified water deliveries from the PureWater Peninsula Project on the SFRWS when the Water Bank is full and describes the quantity of "spill" that could potentially occur under different PureWater Peninsula Project operational scenarios.

C.4.1 RWS "Spill" (Displaced Water) Evaluation

The HHLSM model tracks available storage in the SFRWS, including in the Water Bank. The Water Bank is essentially a storage account on Don Pedro Reservoir, which is located on the Tuolumne River in the upcountry region of the SFRWS system that begins with the Hetch Hetchy Reservoir in Yosemite National Park. The SFRWS is operated such that all reservoirs are filled first and maintained full to the extent possible, and the Water Bank is typically the last to be filled.

The Water Bank storage under historical operations, based on HHLSM outputs, is illustrated in Figure C-6. The orange line represents the maximum volume that the Water Bank can store, and the blue line represents the actual storage in the Water Bank for the 1987-1998 period. During wet years (1993 – 1998) when the Water Bank is primarily full (e.g., there is no additional storage capacity remaining in the Water Bank), there is no available storage capacity in the SFRWS to absorb water supply from a new source. During dry years (1987-1992) the Water Bank has available capacity. The difference between the orange and blue lines in Figure C-6 reflects the remaining available storage capacity in the Water Bank account (green line), which is the storage volume available to accommodate any water displaced from Crystal Springs or San Andreas Reservoir for purified water as part of a ResWA project.

Figure C-6: Overview of Water Bank Storage for Historical Operations



' Note: During some very wet years (e.g., 1995-1998), the recorded Water Bank account storage may exceed the 185,000 MG (570,000 AF) maximum volume typically assumed for the SFRWS. This occurs because SFPUC is able to share some of the volume of Don Pedro Reservoir that is reserved for flood control, between June and September of wet years.

The underlying assumption of the CSR ROM is that CSR is maintained full at seasonal storage targets by SFPUC, and that there is no physical room in the reservoir to accommodate purified water from the AWPF unless there is additional storage available in the greater SFRWS system. If the Water Bank storage is full, an equivalent amount of water would have to be "displaced" from the reservoir system to make room for purified water. This displacement would materialize as an upcountry "spill" from the Water Bank because water from the Upcountry system that would have been sent to Crystal Springs is not needed due to the addition of water from the AWPF. So that water remains Upcountry instead, and spills from a full system.

The HHLSM model could be used to further refine the estimated amount of "spill" with a ResWA project, by performing a more complex simulation of operational adjustments to accommodate purified water. However, based on an initial assessment by SFPUC's modeling group, the refinements would not noticeably change the outcome of this analysis, thus the CSR ROM's estimation of "spill" is used for this analysis.

C.4.2 AWPF Operational Scenarios

Three ResWA operational scenarios were evaluated to assess the impact of continuous versus seasonal augmentation with purified water, to calculate how reduced production of purified water would reduce the amount of spill during wet years. The three AWPF operational scenarios include:

1. **Continuous AWPF Operational Scenario** – the AWPF operates at the design capacity consistently during the 12-year period.

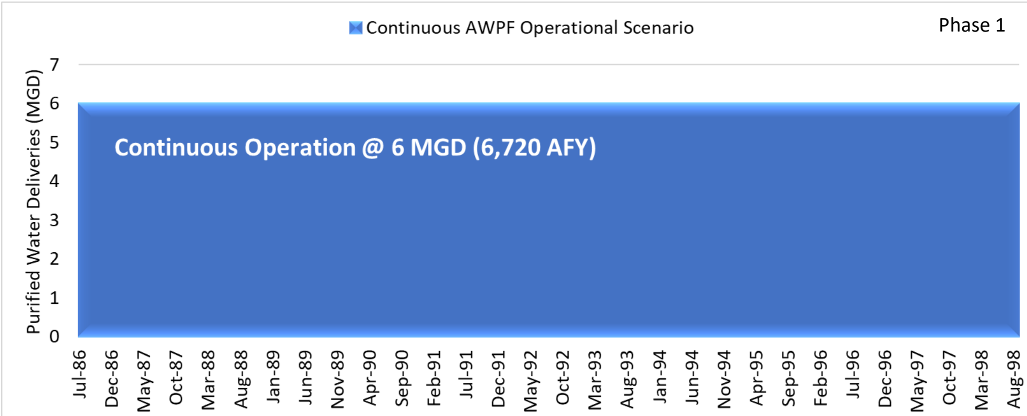
2. Seasonal Ramp Down **Operational Scenario** – the AWPF would operate at full capacity during the summer months (May to October) and ramp down purified water production to half its capacity during the wet year winter months (November to April). Under this operational mode, membranes and other equipment would be rotated to minimize operational complexity associated with a full shutdown.
3. Seasonal Shut Down **Operational Scenario –** the AWPF would operate at full capacity during summer months (May to October) and shut down during wet year winter months. During the shutdown period, the membranes would be fully preserved.

Figure C-7 illustrates the amount of purified water produced under the three operational scenarios for the 6-year dry period (1987-1992) and the 6-year wet period (1993-1998) for Phase 1 (6 mgd production) and Phase 2 (12 mgd production).

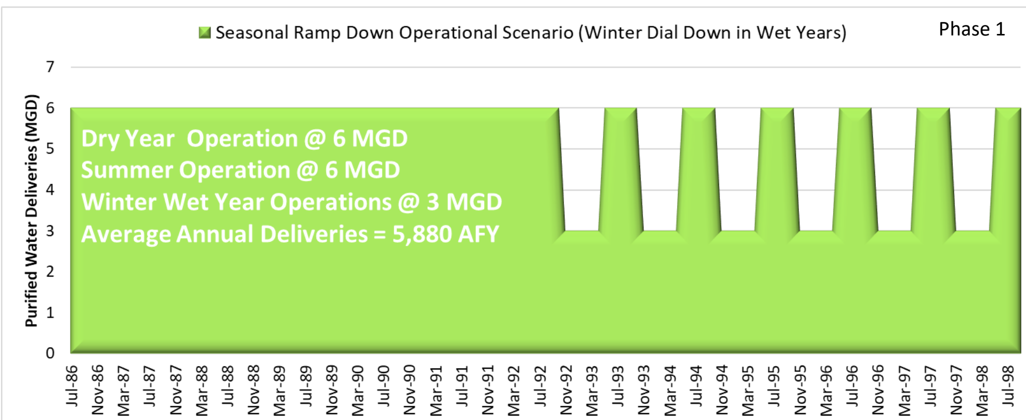
- **Phase 1 (previously Alternative 1a/b):** 6-mgd ResWA with continuous operation of AWPF for all years
- **Phase 1 (previously Alternative 1c):** 6-mgd ResWA with seasonal ramp down to 3 mgd in winter months of wet years and no seasonal ramp down in dry years
- **Phase 1 (previously Alternative 1d):** 6-mgd ResWA with seasonal shutdown to 0 mgd in winter months of wet years
- **Phase 2 (previously Alternative 2a/b):** 12-mgd combined ResWA and TWA with continuous operation of AWPF for all years
- **Phase 2 (previously Alternative 2c):** 12-mgd combined ResWA and TWA with seasonal ramp down to 6 mgd in winter months of wet years and no seasonal ramp down in dry years
- **Phase 2 (previously Alternative 2d):** 12-mgd combined ResWA and TWA with seasonal shutdown to 0 mgd in winter months of wet years

Ramp down operations results in a 12.5 percent reduction in purified water deliveries over the 12-year period and shutdown operation results in 25 percent reduction in purified water deliveries over the 12-year period.

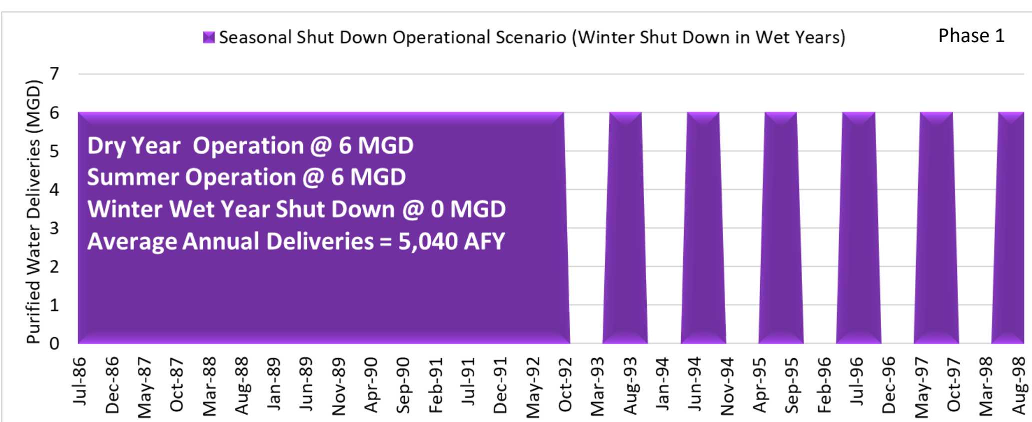
Figure C-7: AWPF Operational Scenarios



Phase 2 would look similar with monthly flows at 12 MGD and average annual purified water delivery of 13,440 AFY.



Phase 2 would look similar with monthly winter flows at 6 MGD, summer flows at 12 MGD and average annual purified water delivery of 11,760 AFY.



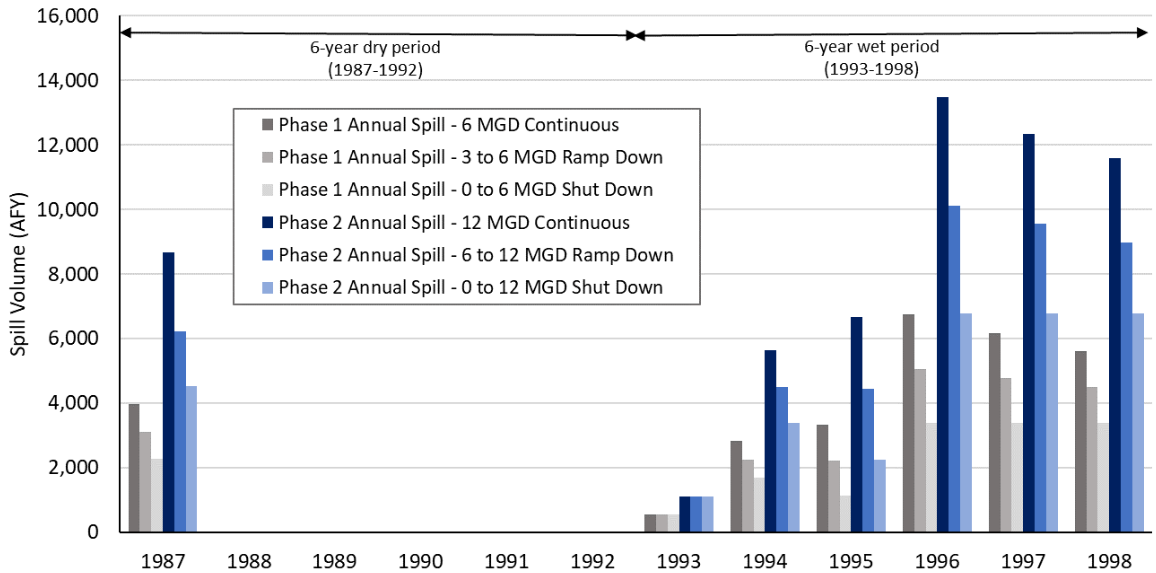
Phase 2 would look similar with monthly summer flows at 12 MGD and average annual purified water delivery of 10,080 AFY.

The CSR ROM has been used to evaluate the impact of Phase 1 (6 mgd) and Phase 2 (12 mgd) operations on upcountry spill under the three operational scenarios. The "spill" analysis found that:

- During most of the dry years, there is generally enough empty storage available for both the 6 mgd and 12 mgd of purified water deliveries without creating additional spill. The only year in the 6-year dry period that resulted in additional spill was 1987, likely due to the prior year being a wet year.
- During wet years, when there is less available storage, the addition of purified water results in increased spill as shown in Figure C-8.
- Historical operations during this same 12-year period, without the introduction of any purified water, resulted in a total volume of uncapturable water of approximately 6,350,000 AF. This could be considered the "baseline spill."
- For Phase 1 (6 mgd), the incremental spill volume (to make room for purified water) over the 12-year period was 15,000 AF to 30,000 AF, which amounts to a slight increase of 0.25 percent to 0.5 percent over the baseline spill.
- For Phase 2 (12 mgd), the incremental spill volume over the 12-year period was 30,000 to 60,000 AF, which amounts to an increase of 0.5 percent to 1 percent over the baseline spill.

Water supply shortages occurred in the SFRWS during the 6-year drought. The water supply from this project could be used to alleviate some of these shortages during similar future dry periods. Additionally, though it is beyond the scope of this analysis, it is noted that the ResWA project alternatives would increase the storage capacity within the SFRWS and would allow for capture of water generated in wet years. This "spill" analysis results are summarized in Figure C-8 and Table C-4.

Figure C-8: Annual "Spill" Evaluation for AWPF Operational Scenarios



Note: In 1993, the spill is the same for the continuous ramp down and shutdown scenarios primarily because during this very wet year, spills occurred during the summer period (June to Sept) when the AWPF is operating at full capacity for all scenarios, hence there is no difference in spill between the scenarios.

Table C-4: Summary of Spill Analysis

Water Year	Flow Regime	Baseline Spill	Annual Increase in "Spill" Over Baseline (AFY)					
			Phase 1 (6 mgd)			Phase 2 (12 mgd)		
			Continuous	Winter Ramp Down	Winter Shut Down	Continuous	Winter Ramp Down	Winter Shut Down
1987	Dry	174,961	3,959	3,112	2,265	8,666	6,224	4,530
1988	Dry	0	0	0	0	0	0	0
1989	Dry	0	0	0	0	0	0	0
1990	Dry	0	0	0	0	0	0	0
1991	Dry	0	0	0	0	0	0	0
1992	Dry	0	0	0	0	0	0	0
1993	Wet	266,704	552	552	552	1,105	1,105	1,105
1994	Dry	72,648	2,817	2,256	1,694	5,635	4,512	3,388
1995	Wet	1,277,553	3,333	2,228	1,123	6,666	4,456	2,247
1996	Wet	1,311,292	6,740	5,064	3,388	13,479	10,128	6,777
1997	Wet	1,562,452	6,169	4,779	3,388	12,338	9,557	6,777
1998	Wet	1,359,765	5,598	4,493	3,388	11,596	8,986	6,777
	Total (AF)	6,025,376	29,169	22,484	15,800	59,484	44,968	31,599
	Increase Over Baseline Spill	n/a	0.5%	0.4%	0.3%	1.0%	0.7%	0.5%
Purified Water Augmented to CSR (AFY)			6,720	5,880	5,040	13,440	11,760	10,080
Annual Average Spill (AFY)			2,431	1,874	1,317	4,958	3,748	2,634
Dry Year Average Spill (AFY)			378	236	95	880	473	190
Wet Year Average Spill (AFY)			4,485	3,512	2,539	9,037	7,024	5,078
Annual Average Water Purified Water Delivery (AFY)			6,720	5,880	5,040	13,440	11,760	10,080
Percent of Purified Water that creates a "spill"			36%	32%	26%	37%	32%	26%

The overall operational scheme for the AWPF would be managed by the DiPRRA in close coordination with the SFPUC SFRWS operations team, AWPF source water providers (SVCW and San Mateo) as well as local water purveyors. The quantify of purified water produced would be influenced by hydrologic conditions, available storage in the SFRWS Water Bank and local demands.

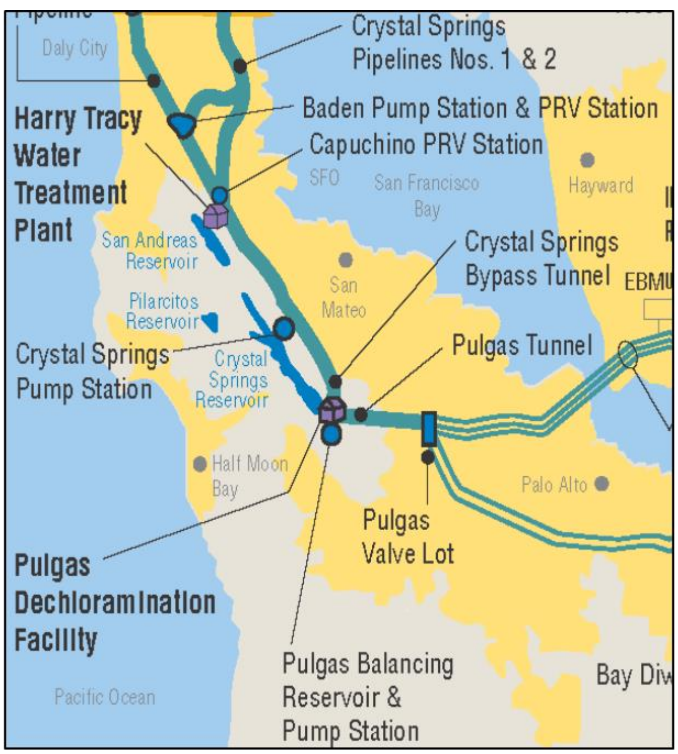
Ramping down, shutting down and restarting up an AWPF takes time and effort to clean and maintain process equipment and preserve RO and MF membranes. Preservation of membranes can also reduce their useful life, requiring more frequent replacement. Planned shutdown and restart procedures are further discussed in **Appendix B: TM #6 – AWPF Operational Strategies**. During the future phases of the project, it would be worthwhile to further investigate and compare the cost of "spilling" water in the upcountry system versus the cost of ramping or shutting down and restarting up the AWPF to determine when it makes economic sense to allow a "spill".

C.5 Pulgas Operations

The Pulgas Dechloramination Facility (Pulgas DF) is part of the SFPUC's Hetch Hetchy SFRWS. Together with the Pulgas Balancing Reservoir (PBR) and Pulgas Pump Station (PPS), Pulgas DF is used to manage and control water flow to SFPUC customers on the Peninsula. Pulgas DF began operating in February 2004 when SFPUC began using chloramines as the distribution system residual disinfectant. Pulgas DF operates to provide chemical treatment for excess flows from the SFRWS delivered to CSR.

Purified water from the AWPF (chloraminated during conveyance) would be blended with water from the SFRWS at the Pulgas DF before entering Upper CSR. The Pulgas Facilities include the Pulgas Tunnel, Pulgas Pump Station, Pulgas Balancing Reservoir, and Pulgas DF, as shown in Figure C-9.

Figure C-9: SFRWS Pulgas DF



Above: Flows from the Pulgas Dechloramination Facility enter the Pulgas Discharge Chanel for release to Upper CSR.

Source: SFPUC SFRWS Training Presentation
http://baywork.org/wp-content/uploads/2017/08/RegWtrSysOvrw_7-2017-sm.pdf

All water supplied from the SFRWS, and the Sunol Valley Water Treatment Plant is transmitted from the mid-Peninsula to the northern portion of the Peninsula and San Francisco via the Pulgas Tunnel. The Pulgas Tunnel conveys water from the Pulgas Valve Lot in Redwood City to either the Crystal Springs Bypass System or to the Pulgas Pump Station. The Crystal Springs Bypass System diverts water directly to the low-pressure zone transmission pipelines on the northern portion of the Peninsula thereby bypassing the Peninsula Reservoirs and Harry Tracy WTP. When the Pulgas Tunnel flowrate exceeds the demand downstream of the Crystal Springs Bypass System, the excess water fills the Pulgas Balancing Reservoir, and eventually is discharged to CSR. The 60-MG Pulgas Balancing Reservoir supplements the system during peak demand periods and is located across from the Pulgas DF. The Pulgas DF removes chlorine and ammonia and balances pH prior to releases to Upper CSR. Among other upgrades to the Pulgas DF implemented by SFPUC over the years, the Pulgas Discharge Channel discharge capacity would be restored to accommodate flows up to 250 mgd in the coming years.

The Pulgas DF are designed for unmanned, automated process control using feedback from sampling stations implemented throughout the facility. CO_2 and sodium hypochlorite are added at the inlet box upstream of the 10-ft-dia contact pipes as shown in Figure C-7. CO_2 is added for pH control (targeting an approximate pH of 7.5) and sodium hypochlorite is added for breakpoint chlorination. Assuming a flow of 100 mgd, the current chlorine contactor after sodium hypochlorite addition achieves a contact time of 15 minutes for breakpoint chlorination. Sodium bisulfite is then dosed at the outlet box to remove any chlorine residual before discharge to CSR.

A connection from the new purified pipeline to the existing Pulgas DF would be constructed. Upon preliminary discussions with SFPUC, a potential tie-in location to the existing facilities would be prior to the 11-ft weir to maintain separation between the existing potable and proposed treated recycled water supply. At this level of study, it would be conservative to assume that the water quality of augmented water would need to match or be compatible with the background levels of water entering the Pulgas DF to aid in the treatment at the Pulgas DF. Additional points of monitoring for flow and water quality, as well as flow control, would be warranted upstream of where the purified water enters the Pulgas DFto provide SFPUC with operational flexibility.

Given the planned increase in capacity of the Pulgas Discharge Channel and current capacity of the Pulgas DF, no major capital infrastructure modifications are assumed to be needed to support the PureWater Peninsula Project.

Appendix B: TM #4 – Pulgas Disinfectant Residual Alternatives discusses considerations related to (i) the type of disinfectant residual and (ii) removal of disinfectant residual prior to ResWA for CSR augmentation in both Phase 1 and 2.

C.6 AWPF Hydraulic Profile Design Criteria

The AWPF hydraulic design assumptions are summarized in Table C-5, which lists assumed elevations, high water lines (HWL) and pressures for each treatment process and facility.

Table C-5: AWPF Hydraulic Profile Design Assumptions

ITEM	FF EL	GRADE EL	HWL (PHASE 1)	HWL (PHASE 2)	STATIC HEAD (PSI)	MAX HEAD LOSS (PSI)	MINIMUM RESIDUAL PRESSURE (PSI)	TDH (PSI)	NOTES
AWPF INFLUENT EQ TANK	75	107.5	96.5	96.5					*Max water surface level estimated to be 21.5 feet above tank FF elev. About 30 ft of the tank will be below ground and about 10 ft of the tank will be above ground.*
INFLUENT PUMP STATION		107.5			12.9				
OZONE	85	107.5	101.92	107.07					*Max water surface level estimated to be 14 feet above tank FF elev.*
BAF	85	105	101.31	104.82		6.0			*Per Calgon Carbon data sheet, assumed clean bed pressure drop through media is ~3 in/ft bed depth. GAC bed depth = 6.5 ft and hydraulic loading rate is 3.6 gpm/ft^2. Assume dirty bed pressure drop is 5 psi over the clean filter pressure.*
MF FEED TANK	75	104	87.1	89.7					*Max water surface level estimated to be 14 feet above tank FF elev in Phase 1 and 16 ft above tank FF elev in Phase 2. About 30 ft of the tank will be below ground and about 10 ft of the tank will be above ground.*
MF FEED PUMPS		104			11.1		20	82.2	*Assume minimum residual pressure of 20 psi. Pump CL elev = 102.00*
STRAINERS						10			*Assume 10 psi differential pressure to trigger strainer replacement (based on Padre hydraulic calculations, provided by Trussell Technologies – Internal Draft Design Criteria, Working Values as of 8/8/16)*
MF FEED MEMBRANE						45			*Average Design Transmembrane Pressure ~10 psi. Assume ~45 psi differential pressure when MF membranes are dirty (based on Padre*

ITEM	FF EL	GRADE EL	HWL (PHASE 1)	HWL (PHASE 2)	STATIC HEAD (PSI)	MAX HEAD LOSS (PSI)	MINIMUM RESIDUAL PRESSURE (PSI)	TDH (PSI)	NOTES
									hydraulic calculations, provided by Trussell Technologies – Internal Draft Design Criteria, Working Values as of 8/8/16)
RO FEED TANK	75	104	89	100					*Max water surface level estimated to be 14 feet above tank FF elev in Phase 1 and 25 ft above tank FF elev in Phase 2. About 30 ft of the tank will be below ground and about 10 ft of the tank will be above ground.*
RO TRANSFER PUMPS		104			26		20	54.0	*Assume minimum residual pressure of 20 psi. Pump CL elev = 102.00*
WAFER STYLE STATIC MIXER						4			*Per Padre hydraulic calcs – Pressure drop of about 4 psi through 30" pipe Wafer Style Static Mixer, Model 2800, BETA 0.8*
CARTRIDGE FILTERS	104.5	104				15			*Assume 15 psi differential pressure to trigger catrtridge filter replacement (based on Padre hydraulic calculations, provided by Trussell Technologies – Internal Draft Design Criteria, Working Values as of 8/8/16)*
RO FEED PUMP/ RO TRAINS	104.5	104				250	10	265.0	*Assume ~250 psi differential pressure when RO membranes are dirty (based on Padre hydraulic calculations, provided by Trussell Technologies – Internal Draft Design Criteria, Working Values as of 8/8/16). Assume 10 psi required for permeate backpressure.*
UV	104.5					5			*Per Padre hydraulic calcs – Assume 5 psi pressure drop through UV-AOP*
CHLORINE CONTACT TANK	95	104	109	109					*Max water surface level estimated to be 14 feet above tank FF elev.*
PRODUCT WATER TANK	95	104	106.2	106.2					*Max water surface level estimated to be 14 feet above tank FF elev in Phase 1 and 25 ft above tank FF elev in Phase 2.*
PRODUCT WATER PUMP STATION	75	104						43.34	*TDH is 100 ft for Purified Option 1 from AWPF to Walnut St (end of repurposed line) per Conveyance Design*

C.7 Conveyance Hydraulic Modeling Results

SFPUC's InfoWater Pro hydraulic model has been used to support the hydraulic calculations for the basis of design of the pipeline and pumps used to convey purified water from the AWPF to CSR. The hydraulic model is a steady state model used to simulate system flows and pressures throughout SFPUC's conveyance and water distribution system. The proposed pipeline alignments and pumping facilities described in Section 4.1 have been georeferenced into the hydraulic model based on the preliminary design drawings included in Appendix F.2 . The hydraulic model has been run using the design flows of 6 and 12 MGD to check the required lift for each proposed pump station and to generate hydraulic profiles that capture the change in pipe elevations along the alignments as well as the upstream and downstream hydraulic boundary conditions at the AWPF and Crystal Springs Balancing Reservoir Tunnel (CSBRT), respectively.

The following assumptions are made for the model analysis:

1. All pipe alignments, diameters, and roughness values in the model are taken from Section 4.1. Pipe elevations are assigned using the latest available USGS Digital Elevation Model (DEM) data.
2. A separate model scenario has been created for each proposed pipeline alignment option and design flow rate. Variable speed pump controls are used to maintain the design flow rate across the multiple pumps in series.
3. All model runs are steady state.

The hydraulic model profiles are shown throughout Section 4.3. The key findings from the hydraulic model include:

1. The high point elevation of the pipeline alignment options ranges from 550 to 900 feet due to the hills just east of CSR. The downstream connection to the CSBRT has a normal operating hydraulic grade line (HGL) of about 300 feet.
2. In order to both maintain positive pipeline pressures at the high point of the pipeline alignment and deliver water to CSBRT at the current operating HGL, a flow control valve would be installed just upstream of the discharge location that would raise the discharge head condition for the upstream pump station and generate enough headloss across the valve to introduce the purified water to CSBRT at the existing operating HGL. The hydraulic model accounts for this flow control valve to help calculate the correct flow and required lift from each of the upstream pump stations in series.
3. With pumps in series and no intermediate storage, the pumps would need variable frequency drives (VFDs) to allow the pumps to modulate their speed (and hence their flow) to respond to upstream or downstream changes in pipeline pressures. Surge protection measures should be evaluated at a later stage of the design.
4. The hydraulic profiles show the operating HGLs for the potential customer tie-in locations for each alignment option (part of Phase 2). Based on the modeled system HGLs, the pump stations provide enough head/pressure to adequately serve each identified customer along the proposed alignments.

Appendix D Cost Analysis

The costs provided herein represent a pre-design level, with 1 to 15 percent project definition and a range of accuracy of +30 percent to -20 percent. These represent the Association for the Advancement of Cost Engineering (AACE) Class 4 level of estimates, which are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval.

This Appendix includes a summary of the cost approach and detailed cost sheets for the AWPF and major conveyance components, but Phase. A summary of costs is presented in Section 5.3.

D.1 Construction Cost Assumptions

The following assumptions are applied to estimate construction costs:

- **Site Preparation and Improvements:** Site preparation costs were estimated for the area that is within the AWPF site boundary; therefore, any costs located outside the boundary were excluded. It was assumed that site preparation and improvements for both phases would be captured and completed during Phase 1 construction.
- **AWPF:** Cost estimates for process system including chemicals, ozone, BAC, MF, RO, UV-AOP were, and are based on unit costs from recent projects, vendor quotes, planning studies, and professional experience. Chemical systems for the process equipment include hydrogen peroxide, ammonia sulfate, etc. Each chemical system includes day tanks, dosing pumps, and other appurtenances. Enclosed buildings, contactors, concrete pads, and pump station costs are based structural footprint and unit cost.
- **Electrical, Instrumentation and Controls (I&C):** Electrical and I&C were assumed to percent of the process equipment, pump station and pipeline costs, ranging from 20% to 25% depending on the facility type. Cost for a new PG&E connection and additional transformers to serve the new energy loads have not been estimated due to the high level of uncertainty and additional coordination needed with PG&C to estimate these costs.
- **Major Storage:** The unit cost for new storage tanks is based on cost curves from RS Means, recently constructed projects in California, and from professional experience.
- **Breakpoint Chlorination:** The breakpoint chlorination costs were estimated from recent projects, vendor quotes, and professional experience. For chemical storage, the cost for a concrete pad, spill sump and sump pump are applied. The cost of the chemical heating system was assumed to be 10 percent of the chemical equipment cost.

- **Tertiary, Transmission, and Distribution Pipelines:** Unit costs used are based on recently bid projects and professional experience for each pipeline construction method including, but not limited to open cut, microtunneling, jack-and-bore, HDD, and supported crossings on bridges and structures.
- **Pump Stations:** The pump station costs consider flow, total dynamic head, and horsepower based on pump station design experience. Due to the uncertainty of preferred BPS sites, site development and improvements, valving and yard piping costs for BPS are estimated as a percent of the estimated pump and building costs. Land acquisition costs for pump stations are based on a percentage applied in project development costs.

The following allowances, contingencies, and non-contract cost percentages are applied to the **subtotal materials, installation, sub-contractor costs** for each phase of all the facilities in each category (e.g., AWPF, storage, pipelines, site preparation and improvements, breakpoint chlorination):

- **Division 1 costs:** 10 percent is applied to the overall subtotal to reflect administration requirements.
- **Taxes:** 8.75 percent is applied to materials.
- **Contractor Markup for Subcontractor:** 15 percent is applied to the overall subtotal.
- **Contractor OH&P:** 15 percent is applied to the overall subtotal.
- **Project development costs:** 15 percent is applied to the overall subtotal and include the following percentages applied to construction costs: land and ROW acquisition (0.5%) and legal support (0.5%), project management (1%), pre-design planning (2%), environmental review and permitting (1%) and engineering design (10%).
- **Estimate Contingency:** 40 percent is applied to the overall subtotal to provide flexibility for contractors' overruns on quantities, changed site conditions, change orders, etc.
- **Escalate to Midpoint:** 4.5 percent is applied to the overall subtotal given the respective phase's midpoint.

The **estimated construction cost** includes all facility costs, allowances, markups, contingencies, and the escalation to the midpoint of construction. Costs are provided in May 2024 dollars using the Engineering News-Record Construction Cost Index (ENRCCI) for San Francisco.

D.2 O&M Cost Assumptions

Operations and maintenance (O&M) costs are estimated to include the following items:

- **Energy Costs:** The cost for power varies diurnally and seasonally, thus energy costs are estimated to be $0.20/kWh for continuous treatment and pumping. A factor of 10 percent is applied to all energy costs. Treatment operation is assumed to be ran 24 hours per day. Pumping operation is assumed to be ran 24 hours per day for the longest pipeline alignment option (Option 1). Breakpoint chlorination treatment operation is assumed to be operated for a 5 hp pump.

- **Labor Costs:** Treatment-related labor is based on a full-time salary with benefits of $175,000 per year. Labor for other work such as work related to pipelines, pump stations, and customer service is based on a full-time salary with benefits of $175,000 per year.
- **AWPF Chemical Costs:** For advanced treatment processes, chemical unit cost is estimated at approximately $230 per acre foot of purified water produced for pre-treatment to minimize fouling and post-treatment to stabilize the RO permeate and meet regulatory requirements. The estimate was based off earlier versions of the Project as well as similar sized projects. Chemicals may include, but are not limited to sodium hypochlorite, sodium bisulfite, citric acid, caustic soda, sulfuric acid, scale inhibitors, lime, carbon dioxide, chlorine, etc.
- **Conveyance Chemical Costs:** Based on the design for each phase, the sodium bisulfite chemical costs are estimated for dechlorination. The pH adjustment was costed for sulfuric acid while sodium hypochlorite chemical costs were estimated for breakpoint chlorination. The chemical costs were based on unit costs provided by SFPUC for November 2023.
- **Maintenance Costs:** A unit cost of $160/AF is included to account for replacement and repair of AWPF facility membranes, UV lights, and other AWPF process equipment. General maintenance costs for other items are estimated at 1.5 percent of capital costs (not including the AWPF)**.**
- **Contingency**: A contingency of 10 percent of the subtotal of O&M costs is also included.

D.3 Ramping Down and Shutting Down AWPF

Ramp down or shutdown scenarios occur during a wet year where the demand for recycled water is low, and the treatment plant is required to reduce treatment capacity. The primary treatment process that requires special consideration during reduced treatment demand are RO membranes. RO membranes generally cannot be out of service for more than 24 hours and if removed from service for more than 24 hours, the membranes should be preserved by a solution of 500-1000 mg/L sodium bisulfite. During a ramp-down scenario, a common practice is to rotate operational RO skids daily to ensure membranes remain wet and in operation and is not expected to be labor intensive. Therefore, no additional O&M costs were assumed in a ramp-down scenario. For a shut-down scenario, membrane preservation is required and assumed to cost approximately $8,333/MG per year ($50,000/year for 6 mgd plant shutdown, $100,000/year for 12 mgd plant shutdown). These costs include chemical costs for sodium bisulfite (1000 mg/L preservation solution) and operator time for preservation assumed to occur every two weeks. A summary of ramp down and shutdown cost assumptions is provided in Table D-1.

Table D-1: Ramp Down and Shutdown Cost Assumptions

Purified Water Delivered and Use:		Phase 1: 6-mgd Capacity ResWA			Phase 1 & 2: 6 mgd Capacity ResWA + 6 mgd Capacity TWA		
Flow Scenarios:	**Unit**	**Continuous**	**Wet Year Ramp Down**	**Wet Year Shut Down**	**Continuous**	**Wet Year Ramp Down**	**Wet Year Shut Down**
Wet Months	(mgd)	6	4.5	3	12	9	6
Dry Months	(mgd)	6	6	6	12	12	12
Average Flow per Year	(mgd)	6	5.25	4.5	12	10.5	9
Average Flow per Year	(AFY)	6,720	5,880	5,040	13,440	11,760	10,080
∆ Water Delivered	%	n/a	-13%	-25%	n/a	-13%	-25%
TOTAL Annual O&M Costs	**($mil/year)**	$19.5	$15.6	$14.4	$33.6	$27.9	$25.2
∆ Annual O&M Costs	(%)	n/a	-20%	-26%	n/a	-17%	-25%
Annual Unit O&M Costs	**($/AFY)**	$2,900	$2,660	$2,860	$2,500	$2,370	$2,500
∆ Annual Unit O&M Costs	(%)	n/a	-8%	-1%	n/a	-5%	0%
Annualized Unit Construction Cost	**($/AFY)**	$4,400	$5,029	$5,867	$2,980	$3,406	$3,973
Life Cycle Unit Cost	**($/AFY)**	$7,300	$7,689	$8,727	$5,480	$5,776	$6,473
∆ Life Cycle Unit Costs	(%)	n/a	5%	20%	n/a	5%	18%

D.4 Engineers Opinion of Probable Costs

This Appendix includes the following cost sheets (CS) to support the summary tables presented in Section 5.2. The treatment cost sheets are listed below and include the Basis of Cost Estimate cover sheet.

Treatment Cost Sheets:

- Cost Sheet #1 – AWPF (Phase 1 and 2)
- Cost Sheet #2 – Pulgas Improvements and Breakpoint Chlorination Facility (Phase 1 and 2)

Conveyance Cost Sheets:

- Cost Sheet #3 –Tertiary Pipeline and Pump Station (Phase 1 and 2)
- Cost Sheet #4A – Option 1 Purified Water Transmission and Distribution (Phase 1 and 2)
- Cost Sheet #4B – Option 2 Purified Water Transmission and Distribution (Phase 1 and 2)
- Cost Sheet #4C – Option 3 Purified Water Transmission and Distribution (Phase 1 and 2)

Operations and Maintenance (O&M) Cost Sheets:

- Cost Sheet #5 – AWPF O&M Costs
- Cost Sheet #6 – Conveyance O&M Costs

Kennedy Jenks

OPINION OF PROBABLE CONSTRUCTION COST

BASIS OF ESTIMATE

PROJECT INFORMATION

Client:	SF-Peninsula Regional PureWater (SPRP) Parties
Project:	SPRP Basis of Design Report (BODR)
KJ Job No.:	2268026*00
Estimate Date:	May 2024
Prepared By:	MSS/MWF
Reviewed By:	JH/DT
Estimate Type:	**Conceptual** (`~10% design level to support CEQA Ready Project)

PROJECT DESCRIPTION:

The SPRP Project is a potable reuse project that would create a new source of local sustainable water supply using state-of-the-art technology to purify tertiary effluent from SVCW and the San Mateo WWTP. The project would be implemented in two phases, Phase 1 - 6 to 8 MGD of Reservoir Water Augmentation (ResWA) at Crystal Springs Reservoir (CSR) and Phase 2 - 4 to 6 MGD of Treated Water Augmentation (TWA) for local use by RWC, Cal Water and/or the MPWD.

The SPRP Project includes:

•Source water derived from up to 8 MGD of tertiary effluent from SVCW and up to 9 MGD of tertiary effluent from the San Mateo WWTP to produce up to 12 MGD of purified water.
•Construction of a new advanced water purification facility (AWPF) to treat source
•Conveyance infrastructure to deliver tertiary effluent to the new AWPF, purified water to the place of use, and brine for discharge via the SVCW outfall.
•A point of connection to SFPUC's Pulgas Facility
•Multiple points of connection to existing tanks and transmission pipelines to deliver purified water to RWC, Cal Water and/or the MPWD drinking water distribution systems (DWDS).

ESTIMATE DOCUMENTS:

DRAWINGS: see Appendix F of the Basis of Design Report
DOCUMENTS: See Basis of Design Report

SOURCE OF COST DATA:

Similar projects, RS Means CostWorks 2023 data for project location. Budget quotes from major process equipment vendors

ESTIMATE ASSUMPTIONS:

The followings assumptions were made in the preparation of this estimate:
- Public bid project with project delivery method to be determined
- Prevailing wage requirements will apply
- Subcontractor cost items reflect construction components that are typically subbed out by contractor
- Project development costs include anticipated costs for land and ROW acquisition and legal support, project management, pre-design planning, environmental review and permitting and engineering design.

SPECIFIC INCLUSIONS:

- Sales Tax on Materials at project location. (In city limits)
- Soft costs are included in project development costs based on estimates provided by SFPUC. These include the following percentages applied to construction costs: land and ROW acquisition (0.5%) and legal support (0.5%), project management(1%), pre-design planning (2%),

SPECIFIC EXCLUSIONS:

The estimate does not include the following:
- PG&E connection and additional transformers to serve the new energy loads (future studies and coordination needed)
- Hazardous or Special Waste removal or disposal (not identified at this time)
- Asbestos / Lead abatement (not identified at this time)
- Soil remediation, testing , removal, or disposal (not identified at this time)
- Independent or Special inspections
- Owners construction management costs
- Archeology or paleo monitoring (not identified at this time)

MAJOR CHANGES FROM PREVIOUS ESTIMATE:

- Quantity takeoff from 10 percent design drawings
- Differentiation of materials, labor and subconsultant costs
- Revised markups and contingencies based on level of design, uncertainties and risks
- Addition of SVCW tertiary PS, wetwell, and connection to 66" SVCW outfall

DESIGN CONTINGENCY:

A estimating contingency of 40% has been included.

Note: This allowance is intended to provide a Estimating Contingency allowance. It is not intended to provide for a Construction Contingency for change orders during construction or to cover unforeseen conditions.

ESCALATION:

An escalation factor has been included to account for a midpoint of construction assuming the time periods below. The owner is cautioned that the project cost should be adjusted for any changes in the project schedule

Current ENR CCI	15418	May 2024
Annual Inflation Escalation Factor:	4.5%	reflects near-term inflation tempered by lower 20 year average
Estimate Phase 1 Construction Start Date	Jan 2030	end date = May 2038
Estimate Phase 2 Construction Start Date	April 2041	end date = Sep 2042
Estimated Phase 1 Construction Duration (Months)	102	*8.5 years*
Estimated Phase 2 Construction Duration (Months)	18	*1.5 years*
Time Until Project Midpoint Phase 1 (Months)	135	*11.3 years*
Time Until Project Midpoint Phase 2 (Months)	234	*19.5 years*

ACCURACY:

The level of accuracy is commensurate with levels developed by the AACE, the Association for the Advancement of Cost Engineering International. At increasing levels of design completion, the narrower the range between upper and lower limits and the greater the accuracy of the estimate.

The costs provided herein represent a pre-design , study, or feasibility level, with 1-15% project definition and a range of accuracy of +50% to +30% percent to -15% to -30% percent. These represent the Association for the Advancement of Cost Engineering (AACE) Class 4 level of estimates, which are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval.

This estimate is based upon competitive bidding, which assumes receipt of multiple bids from three or more General Contractors. Without competitive bidding, pricing can vary significantly from the prices assumed in this estimate.

The enclosed Engineer’s Estimate of Probable Construction Cost is only an opinion of possible items that maybe considered for budgeting purposes. This Project Estimate is limited to the conditions existing at issuance and is not a guaranty of actual construction cost or schedule. Uncertain market conditions such as, but not limited to, local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events and developing bidding conditions, etc. may affect the accuracy of this review. Kennedy Jenks is not responsible for any variance from this Project Estimate or actual prices and conditions obtained.

OPINION OF PROBABLE CONSTRUCTION COST — **KENNEDY/JENKS CONSULTANTS, INC.**

Project: SF-Peninsula Regional PureWater (SPRP) Project Basis of Design Report (BODR)
Cost Sheet: Cost Sheet #1– AWPF (Phase 1 and 2)

Prepared By: MS/MWF
Date Prepared: May 2024
KJ Proj. No. 2268026*00

Estimate Type:
- [ ] Conceptual
- [x] Preliminary (w ~10% plans)
- [ ] Design Development @ ________ % Complete
- [ ] Construction
- [ ] Change Order

Current at ENR 15418
Escalated to ENR
Months to Midpoint of Phase 1 Construction 135
Months to Midpoint of Phase 2 Construction 234

Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	PHASE 1 AWPF									
1.0	**CIVIL SITE WORK , SITE IMPROVEMENTS, AND YARD PIPING**									
1.1	Site Prep	30,340	SY					3	91,020	91,020
1.2	Piling (every 8'2", 110 ft deep) & Pile Driving	2,190	EA					5,500	12,045,000	12,045,000
1.3	Allowance for General Site Grading/Earthwork	1	LS			1,000,000	1,000,000			1,000,000
1.4	Earthwork - Excavation for Below Grade Structures / Foundations	47,210	CY			25	1,180,250			1,180,250
1.5	**Site Improvements**									
1.5.1	Site Improvements: Site Lighting	1	LS					50,000	50,000	50,000
1.5.2	Site Improvements: AC Pavement Roads	2,200	SY					25	55,000	55,000
1.5.3	Site Improvements: Gravel Paving	30,100	SY					12	361,200	361,200
1.5.4	Site Improvements: Misc. (Bollards & Misc.)	1	LS					50,000	50,000	50,000
	AWPF Security Gates	1	LS					55,000	55,000	55,000
	AWPF Site Fencing and Security Gates	2,150	LF					85	182,750	182,750
1.6	**Yard Piping:**									
1.6.1	SVCW Tertiary Effluent Pipeline (20")	975	LF					400	390,000	390,000
1.6.2	MF and BAF Pipeline (12")	1,500	LF					240	360,000	360,000
1.6.3	RO Concentrate Pipeline (12")	1,700	LF					240	408,000	408,000
1.6.4	RO Concentrate Pipeline (12") Sliplining in Existing Pipe	500	LF					240	120,000	120,000
1.6.5	Site Utilities (Potable Water, Non-Potable Water, Fire Hydrants, Sewer)	1	LS					1,000,000	1,000,000	1,000,000
1.6.6	Stormwater Collection & Conveyance	1	LS					100,000	100,000	100,000
1.6.7	Piping Connection: RO Concentrate Pipeline to Existing SVCW Outfall	1	LS					25,000	25,000	25,000
1.6.8	Piping Connection: SVCW Tertiary Wet Well to Existing 66-inch Outfall (Including Valves)	1	LS					250,000	250,000	250,000
2.0	**STRUCTURAL/ ARCHITECTURAL**									
2.1	Membrane-AOP Building	41,700	SF					350	14,595,000	14,595,000
2.2	Building: Chemical Storage and Feed Area	15,000	SF					700	10,500,000	10,500,000
2.3	Building : Maintenance and Admin Area	5,600	SF					800	4,480,000	4,480,000
2.4	Building : Electrical Room	7,500	SF					800	6,000,000	6,000,000
2.5	Process Building : Ozone/LOX/ IPS	17,400	SF					500	8,700,000	8,700,000
2.6	**Ozone Contactors:**									
2.6.1	Ozone Contactors Base Slab	167	CY	300	50,000	300	50,000			100,000
2.6.2	Ozone Contactors Below Grade Walls over 5' Exterior	114	CY	700	79,852	700	79,852			159,704
2.6.3	Ozone Contactors Walls over 5' (interior)	106	CY	700	74,044	800	84,622			158,667
2.7	**BAC Filters:**									
2.7.1	BAC Filters Slab on Grade	289	CY	300	86,667	300.00	86,667			173,333
2.7.2	BAC Filters: Tank Walls - Exterior	161	CY	300	48,333	300.00	48,333			96,667
2.7.3	BAC Filters: Internal Tank Divider Walls	108	CY	300	32,500	300.00	32,500			65,000
2.8	**Chlorine Contactors:**									
2.8.1	Chlorine Contactors Base Slab	200	CY	300	60,000	300	60,000			120,000
2.8.2	Chlorine Contactors Below Grade Walls over 5' Exterior	120	CY	700	84,207	700	84,207			168,415
2.8.3	Chlorine Contactors Walls over 5' (interior)	93	CY	700	65,333	800	74,667			140,000
2.9	**Storage Tanks:**									
2.9.1	AWPF Influent EQ Tank Prestressed Concrete Tank Partially Buried	2,000,000	GAL					3	6,000,000	6,000,000
2.9.2	MF Feed Tank :									
2.9.2.1	Base Slab	157	CY	350	54,950	350	54,950			109,900
2.9.2.2	Below Grade Walls , greater than 5'	239	CY	700	167,048	700	167,048			334,096
2.9.2.3	Elevated Slab	59	CY	800	47,100	800	47,100			94,200
2.9.3	RO Feed Tank :									
2.9.3.1	Base Slab	70	CY	350	24,422	350	24,422			48,844
2.9.3.2	Below Grade Walls , greater than 5'	134	CY	700	93,781	700	93,781			187,563
2.9.3.3	Elevated Slab	105	CY	800	83,733	800	83,733			167,467
2.10	**Concrete Pads/ Canopy Areas :**									
2.10.1	CIP & RO Flush Equipment Slab on Grade	267	CY	350	93,333	350.00	93,333			186,667
2.10.2	CIP & RO Flush Equipment Canopy	7,200	SF	50	360,000	25.00	180,000			540,000
2.10.3	LV & MC XTMR & Switchgear Slab on Grade	74	CY	350	25,926	350.00	25,926			51,852
2.11	**Pump Station Wet Wells:**									
2.11.1	Waste Eq PS Wetwell	1,500	SF	150	225,000	150.00	225,000			450,000
2.11.2	RO Conc PS Wetwell	1,500	SF	150	225,000	150.00	225,000			450,000
2.11.3	MF & RO Feed Pumps/ Cartridge Wet well or Booster Pump Slab w/ Cans	3,900	SF	150	585,000	150.00	585,000			1,170,000
2.11.4	SVCW Tertiary Wet Well	825	SF	150	123,750	150.00	123,750			247,500
3.0	**TREATMENT PROCESS**									
3.1	**Chemical Systems**									
3.1.1	Chemical Systems	10	LS	30,000	300,000	30,000	300,000			600,000
3.2	**Ozone/ BAC**									
3.2.1	Ozone Generator System (1+1 skid)	1	LS	2,970,000	2,970,000	1,485,000	1,485,000			4,455,000
3.2.2	BAC Filters Internals	5	EA	215,000	1,075,000	107,500	537,500			1,612,500
3.2.3	BAC Filters Internals/ Media	3,167	CF	50	158,333	25	79,167			237,500
3.3	**Membrane Filtration (MF)**									
3.3.1	MF System - (4) skids	1	LS	5,000,000	5,000,000	5,000,000	5,000,000			10,000,000
3.4	**RO**									
3.4.1	Small RO Train	3	EA	2,000,000	6,000,000	2,000,000	6,000,000			12,000,000
3.5	**UV-AOP System**									
3.5.1	UV-AOP Train	5	EA	250,000	1,250,000	250,000	1,250,000			2,500,000
3.6	Interconnecting Piping / Fittings/Valves for Tanks	10%		47,103	47,103	47,103	47,103			94,207
3.7	Interconnecting Piping / Fittings/Valves for Process Equipment	10%		1,675,333	1,675,333	1,465,167	1,465,167			3,140,500
4.0	**MAJOR PUMP STATIONS**									
4.1	SVCW Tertiary Pumps (vertical turbine, 30 HP each)	2	EA	40,000	80,000	20,000	40,000			120,000
4.2	SVCW Tertiary Pump Station - Connection to Existing 66" SVCW Outfall and Piping Modifications (58' x20')	1,160	SF					800	928,000	928,000
4.3	AWPF Influent Pumps (vertical turbine, 65 HP each)	3	EA	100,000	300,000	50,000	150,000			450,000
4.4	BAF Backwash Supply Pumps (vertical turbine, 40 HP)	3	EA	85,000	255,000	42,500	127,500			382,500
4.5	MF Feed Pumps (vertical turbine, 200 HP each)	3	EA	120,000	360,000	60,000	180,000			540,000
4.6	MF Backwash Supply Pumps (vertical, 100 HP)	2	EA	100,000	200,000	50,000	100,000			300,000
4.7	Waste EQ Pumps (vertical turbine, 20 HP each)	2	EA	35,000	70,000	17,500	35,000			105,000
4.8	RO Concentrate Pumps (vertical turbine, 25 HP each)	2	EA	40,000	80,000	20,000	40,000			120,000
4.9	Interconnecting Piping / Fittings/Valves for Above	25%		336,250	336,250	168,125	168,125	92,800	23,200	527,575
5.0	**ELECTRICAL**									
5.1	Electrical (including switchgear and standby power)	25%						24,253,651	24,253,651	24,253,651
5.2	New PG&E Meter Connection	*(Not Included at this time, to be explored in future design studies)*								
6.0	**INSTRUMENTATION & CONTROLS**									
6.1	I&C	15%						5,716,917	5,716,917	5,716,917
	SUBTOTAL PHASE 1				**22,847,001**		**21,714,704**		**96,739,739**	**$141,301,444**
	Subtotals				22,847,001		21,714,704		96,739,739	141,301,444
	Division 1 Costs	@	10%		2,284,700		2,171,470		9,673,974	***14,130,144***
	Subtotals				25,131,701		23,886,175		106,413,713	155,431,589
	Taxes - Materials Costs	@	8.75%		2,199,024					***2,199,024***
	Subtotals				27,330,725		23,886,175		106,413,713	157,630,612
	Taxes - Labor Costs	@								-
	Subtotals				27,330,725		23,886,175		106,413,713	157,630,612
	Contractor Markup for Sub	@	15%						15,962,057	***15,962,057***
	Subtotals				27,330,725		23,886,175		122,375,769	173,592,669
	Contractor OH&P	@	15%		4,099,609		3,582,926			***7,682,535***
	Subtotals				31,430,334		27,469,101		122,375,769	181,275,204
	Project Development Costs	@	15%							***27,191,281***
	Subtotals									208,466,485
	Estimate Contingency	@	40%							***83,386,594***
	Subtotals									291,853,079
	Escalate to Midpoint of Construct	@	4.5%	*for 11.25 years is 51%*						***147,750,621***
	Estimated Bid Cost									439,603,700
	TOTAL PHASE 1 (Estimated Construction Cost)								**TOTAL PHASE 1**	**$439,700,000**

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS, INC.**

Project:	**SF-Peninsula Regional PureWater (SPRP) Project Basis of Design Report (BODR)**	**Prepared By:**	MS/MWF
Cost Sheet:	**Cost Sheet #1– AWPF (Phase 1 and 2)**	**Date Prepared:**	May 2024
		KJ Proj. No.	2268026*00

Estimate Type:

- [ ] **Conceptual**
- [x] **Preliminary (w ~10% plans)**
- [ ] **Design Development @** ______ **% Complete**
- [ ] **Construction**
- [ ] **Change Order**

Current at ENR	15418
Escalated to ENR	
Months to Midpoint of Phase 1 Construction	135
Months to Midpoint of Phase 2 Construction	234

Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	PHASE 2 AWPF									
1.0	**CIVIL SITE WORK , SITE IMPROVEMENTS, AND YARD PIPING**									
1.1	Earthwork - Excavation for Below Grade Structures	13,259	CY			25	331,481			331,481
2.0	**STRUCTURAL**									
2.1	**Ozone Contactors:**									
2.1.1	Ozone Contactors Base Slab	167	CY	300	50,000	300	50,000			100,000
2.1.2	Ozone Contactors Below Grade Walls over 5' Exterior	114	CY	700	79,852	700	79,852			159,704
2.1.3	Ozone Contactors Walls over 5' (interior)	106	CY	700	74,044	800	84,622			158,667
2.2	**Chlorine Contactors:**									
2.2.1	Chlorine Contactors Base Slab	191	CY	300	57,200	300	57,200			114,400
2.2.2	Chlorine Contactors Below Grade Walls over 5' Exterior	120	CY	700	84,207	700	84,207			168,415
2.2.3	Chlorine Contactors Walls over 5' (interior)	93	CY	700	65,333	800	74,667			140,000
2.3	**Storage Tanks:**									
2.3.1	AWPF Influent EQ Tank Prestressed Concrete Tank Partially Buried	2,000,000	GAL					3	6,000,000	6,000,000
3.0	**PROCESS EXPANSION**									
3.1	**Chemical Systems**									
3.1.1	Chemical Systems	10	LS	25,000	250,000	6,250	62,500			312,500
3.2	**Ozone/ BAC**									
3.2.1	Ozone Generator System (1 additional skid)	1	LS	891,000	891,000	445,500	445,500			1,336,500
3.2.2	BAC Filters	4	EA	215,000	860,000	64,500	258,000			1,118,000
3.3	**Membrane Filtration (MF)**									
3.3.1	MF System - (3) skids	1	LS	2,400,000	2,400,000	600,000	600,000			3,000,000
3.4	**RO**									
3.4.1	Large RO Train	2	EA	5,500,000	11,000,000	1,375,000	2,750,000			13,750,000
3.5	**UV-AOP System**									
3.5.1	UV-AOP Train	4	EA	312,784	1,251,135	78,196	312,784			1,563,919
3.6	Interconnecting Piping / Fittings/Valves for Above	10%		1,665,214	1,665,214	442,878	442,878			2,108,092
4.0	**PUMP STATION EXPANSION (adding capacity)**									
4.1	SVCW Tertiary Pumps (vertical turbine, 30 HP each)	1	EA	40,000	40,000	20,000	20,000			60,000
4.2	AWPF Influent Pumps (vertical turbine, 65 HP each)	2	EA	100,000	200,000	50,000	100,000			300,000
4.3	MF Feed Pumps (vertical turbine, 200 HP each)	2	EA	120,000	240,000	60,000	120,000			360,000
4.4	Waste EQ Pumps (vertical turbine, 20 HP each)	1	EA	35,000	35,000	17,500	17,500			52,500
4.6	RO Concentrate Pumps (vertical turbine, 25 HP each)	1	EA	40,000	40,000	20,000	20,000			60,000
4.7	Interconnecting Piping / Fittings/Valves for Above	25%		138,750	138,750	69,375	69,375			208,125
5.0	**ELECTRICAL**									
5.1	Electrical (applied to process and pump station expansions)	25%						7,767,705	7,767,705	7,767,705
6.0	**INSTRUMENTATION & CONTROLS**									
6.1	I&C (applied to process and pump station expansions)	15%						3,634,445	3,634,445	3,634,445
	SUBTOTAL PHASE 2				**19,421,736**		**5,980,567**		**17,402,151**	**42,804,453**
	Subtotals				19,421,736		5,980,567		17,402,151	42,804,453
	Division 1 Costs	**@**	**10%**		1,942,174		598,057		1,740,215	***4,280,445***
	Subtotals				21,363,909		6,578,623		19,142,366	47,084,898
	Taxes - Materials Costs	**@**	**8.75%**		1,869,342					***1,869,342***
	Subtotals				23,233,251		6,578,623		19,142,366	48,954,240
	Taxes - Labor Costs	**@**								-
	Subtotals				23,233,251		6,578,623		19,142,366	48,954,240
	Contractor Markup for Sub	**@**	**15%**						2,871,355	***2,871,355***
	Subtotals				23,233,251		6,578,623		22,013,720	51,825,595
	Contractor OH&P	**@**	**15%**		3,484,988		986,794			***4,471,781***
	Subtotals				26,718,239		7,565,417		22,013,720	56,297,376
	Project Development Costs	**@**	**15%**							***8,444,606***
	Subtotals									64,741,983
	Estimate Contingency	**@**	**40%**							***25,896,793***
	Subtotals									90,638,776
	Escalate to Midpoint of Construct	**@**	**4.5%**	*for 19.5 years is 88%*						***79,535,526***
	Estimated Bid Cost									170,174,301
	TOTAL PHASE 2 (Estimated Construction Cost)								**TOTAL PHASE 2**	**$170,200,000**

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS, INC.**

Project:	**SF-Peninsula Regional PureWater (SPRP) Project Basis of Design Report (BODR)**	**Prepared By:**	MS/MWF
		Date Prepared:	May 2024
Cost Sheet:	**Cost Sheet #2 – Pulgas Improvements and Breakpoint Chlorination Facility (Phase 1 and 2)**	**KJ Proj. No.**	2268026*00

Estimate Type:

☐	**Conceptual**	☐	**Construction**	**Current at ENR**	15,418
☒	**Preliminary (w ~10% plans)**	☐	**Change Order**	**Escalated to ENR**	
☐	**Design Development @**	____	**% Complete**	**Months to Midpoint of Phase 1 Construction**	135
				Months to Midpoint of Phase 2 Construction	234

Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	PHASE 1 PULGAS FACILITY UPGRADES									
1.0	**Dechlorination @ Existing Pulgas Facilitities**									
1.1	Upgrades to Existing Sodium Bisulfite System	1	LS					200,000	200,000	200,000
1.2	Connection to Existing Concrete Weir	1	LS	10,000	10,000	10,000	10,000		-	20,000
1.3	Backup Generator Allowance	1	LS		-			30,000	30,000	30,000
2.0	**Electrical**	25%						62,500	62,500	62,500
3.0	**I&C**	15%						37,500	37,500	37,500
	SUBTOTAL PHASE 1				**10,000**		**10,000**		**330,000**	**350,000**
	Subtotals				10,000		10,000		330,000	350,000
	Division 1 Costs	**@**	**10%**		1,000		1,000		33,000	***35,000***
	Subtotals				11,000		11,000		363,000	385,000
	Taxes - Materials Costs	**@**	**8.75%**		963					***963***
	Subtotals				11,963		11,000		363,000	385,963
	Taxes - Labor Costs	**@**								**-**
	Subtotals				11,963		11,000		363,000	385,963
	Contractor Markup for Sub	**@**	**15%**						54,450	***54,450***
	Subtotals				11,963		11,000		417,450	440,413
	Contractor OH&P	**@**	**15%**		1,794		1,650			***3,444***
	Subtotals				13,757		12,650		417,450	443,857
	Project Development Costs	**@**	**15%**							***66,579***
	Subtotals									510,435
	Estimate Contingency	**@**	**40%**							***204,174***
	Subtotals									714,610
	Escalate to Midpoint of Construct	**@**	**4.5%**	*for 11.25 years is 51%*						***361,771***
	Estimated Bid Cost									1,076,381
	TOTAL PHASE 1 (Estimated Construction Cost)							**TOTAL PHASE 1**		**$1,100,000**
	PHASE 2 BREAKPOINT CHLORINATION FACILITY (ALONG PURIFIED TRANSMISSION PIPELINE)									
1.0	**Breakpoint Chlorination Facility Site - Civil Site Work and Building**									
1.1	Site Prep and Earthwork	20%						220,000	220,000	220,000
1.2	Breakpoint Chlorination Building	1,200	SF					700	840,000	840,000
2.0	**BPC Facility - Chemical Feed Systems**									
2.1	Sodium Hypochlorite									
2.1.1	Sodium Hypochlorite Chemical Storage Tank #1	8,000	GAL	6	48,000	1.50	12,000			60,000
2.1.2	Sodium Hypochlorite Chemical Storage Tank #2	8,000	GAL	6	48,000	1.50	12,000			60,000
2.1.3	Sodium Hypochlorite Dosing Pumps	4	EA	10,000	40,000	5,000	20,000			60,000
2.2	Sulfuric Acid									
2.2.1	Sulfuric Acid Chemical Storage Tank	5,000	GAL	6	30,000	1.5	7,500			37,500
2.2.2	Sulfuric Acid Dosing Pumps	2	EA	10,000	20,000	5,000	10,000			30,000
2.3	Concrete Pad, Spill Sump & Sump Pump	3	LS	20,000	60,000	20,000	60,000			120,000
2.0	**Chemical Heating System**	10%						24,750	24,750	24,750
3.0	**Electrical**	25%						356,875	356,875	356,875
4.0	**I&C**	15%						214,125	214,125	214,125
	SUBTOTAL PHASE 2				**246,000.00**		**121,500**		**1,655,750**	**2,023,250**
	Subtotals				246,000		121,500		1,655,750	2,023,250
	Division 1 Costs	**@**	**10%**		24,600		12,150		165,575	***202,325***
	Subtotals				270,600		133,650		1,821,325	2,225,575
	Taxes - Materials Costs	**@**	**8.75%**		23,678					***23,678***
	Subtotals				294,278		133,650		1,821,325	2,249,253
	Taxes - Labor Costs	**@**								**-**
	Subtotals				294,278		133,650		1,821,325	2,249,253
	Contractor Markup for Sub	**@**	**15%**						273,199	***273,199***
	Subtotals				294,278		133,650		2,094,524	2,522,451
	Contractor OH&P	**@**	**15%**		44,142		20,048			***64,189***
	Subtotals				338,419		153,698		2,094,524	2,586,640
	Project Development Costs	**@**	**15%**							***387,996***
	Subtotals									2,974,636
	Estimate Contingency	**@**	**40%**							***1,189,855***
	Subtotals									4,164,491
	Escalate to Midpoint of Construct	**@**	**4.5%**	*for 19.5 years is 88%*						***3,654,341***
	Estimated Bid Cost									7,818,832
	TOTAL PHASE 2 (Estimated Construction Cost)							**TOTAL PHASE 2**		**$7,900,000**

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS, INC.**

Project: SF-Peninsula Regional PureWater (SPRP) Project Basis of Design Report (BODR)
Cost Sheet: Cost Sheet #3 - San Mateo Tertiary Pipeline and Pump Station (Phase 1 and 2)

Prepared By: MS/MWF
Date Prepared: May 2024
KJ Proj. No. 2268026*00
Current at ENR 15,418
Escalated to ENR
Months to Midpoint of Phase 1 Construction 135
Months to Midpoint of Phase 2 Construction 234

Estimate Type:
- [ ] Conceptual
- [x] Preliminary (w ~10% plans)
- [ ] Design Development @
- [ ] Construction
- [ ] Change Order
- ________ % Complete

Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	PHASE 1 TERTIARY PIPELINE AND PUMP STATION									
1.0	**Pipeline from Pump Station @ SM WWTP to storage @AWPF**									
1.1	Open Cut pipeline - Along Bay (24") HDPE / High Groundwater/ In a Roadway or Levee	26,331	LF					1,400	36,863,400	36,863,400
2.0	**Horizontal Directional Drilling (HDD) Under Belmont Slough**									
2.1	HDD Mobilize	1	LS					400,000	400,000	400,000
2.2	HDD Pipeline Crossing (Total Length) (24" pipe - 36" Bore)	2,304	LF					2,000	4,608,000	4,608,000
2.3	HDD Conduit (Total Length) (24" pipe HDPE)	2,304	LF					250	576,000	576,000
2.4	HDD to Open Cut Connections	2	EA	25,000	50,000	25,000	50,000			100,000
3.0	**Supported Crossing on Bridge/Structure**									
3.1	Supported Crossing Length (Total Length) (24")	440	LF	400	176,000	600	264,000			440,000
3.2	Supported Crossing Connections (1 crossings total)	2	EA	25,000	50,000	12,500	25,000			75,000
	AWPF SOURCE - SAN MATEO TERTIARY PUMP STATION									
4.0	**Pump Station and Site Improvements**									
4.1	Pile Driving (100' deep, 8'-2" Spacing)	45	EA					5,500	247,500	247,500
4.2	San Mateo Tertiary Pump Station Building (70 ft x 40 ft)	2,800	SF					800	2,240,000	2,240,000
4.3	Small San Mateo Tertiary Pumps (horizontal; 30 HP)	2	EA	78,300	156,600	19,600	39,200			195,800
4.4	Piping/ Valves/Accessories	2	LS	19,575	39,150	4,900	9,800			48,950
4.5	Yard Piping (24" HDPE Open Cut Pipeline) within plant site	300	LF					400	120,000	120,000
4.6	Connection to San Mateo WWTP Facilities	1	LS					250,000	250,000	250,000
4.7	Backup Generator Allowance	1	LS					100,000	100,000	100,000
4.8	San Mateo Pump Station Electrical	25%						621,000	621,000	621,000
4.9	San Mateo Pump Station Instrumentation and Controls	15%						373,000	373,000	373,000
	SUBTOTAL PHASE 1				**471,750**		**388,000**		**46,398,900**	**47,258,650**
	Subtotals				471,750		388,000		46,398,900	47,258,650
	Division 1 Costs	@	10%		47,175		38,800		4,639,890	***4,725,865***
	Subtotals				518,925		426,800		51,038,790	51,984,515
	Taxes - Materials Costs	@	8.75%		45,406					***45,406***
	Subtotals				564,331		426,800		51,038,790	52,029,921
	Taxes - Labor Costs	@								-
	Subtotals				564,331		426,800		51,038,790	52,029,921
	Contractor Markup for Sub	@	15%						7,655,819	***7,655,819***
	Subtotals				564,331		426,800		58,694,609	59,685,739
	Contractor OH&P	@	15%		84,650		64,020			***148,670***
	Subtotals				648,981		490,820		58,694,609	59,834,409
	Project Development Costs	@	15%							***8,975,161***
	Subtotals									68,809,570
	Estimate Contingency	@	40%							***27,523,828***
	Subtotals									96,333,399
	Escalate to Midpoint of Construct	@	4.5%	*for 11.25 years is 51%*						***48,768,783***
	Estimated Bid Cost									145,102,182
	TOTAL PHASE 1 (Estimated Construction Cost)							**TOTAL PHASE 1**		**$145,200,000**
	PHASE 2 TERTIARY PIPELINE AND PUMP STATION									
1.0	**San Mateo Pump Station**									
1.1	Large San Mateo Tertiary Pumps (horizontal, 225 HP)	2	EA	141,000	282,000	35,250	70,500			352,500
1.2	San Mateo Pump Station Instrumentation and Controls	15%						52,875	52,875	52,875
	SUBTOTAL PHASE 2				**282,000**		**70,500**		**52,875**	**405,375**
	Subtotals				282,000		70,500		52,875	405,375
	Division 1 Costs	@	10%		28,200		7,050		5,288	***33,488***
	Subtotals				310,200		70,500		58,163	438,863
	Taxes - Materials Costs	@	8.75%		27,143					***27,143***
	Subtotals				337,343		70,500		58,163	466,005
	Taxes - Labor Costs	@								-
	Subtotals				337,343		70,500		58,163	466,005
	Contractor Markup for Sub	@	15%						8,724	***8,724***
	Subtotals				337,343		70,500		66,887	474,729
	Contractor OH&P	@	15%		50,601		10,575			***61,176***
	Subtotals				387,944		81,075		66,887	535,906
	Project Development Costs	@	15%							***80,386***
	Subtotals									616,292
	Estimate Contingency	@	40%							***246,517***
	Subtotals									862,808
	Escalate to Midpoint of Construct	@	4.5%	*for 19.5 years is 88%*						***757,114***
	Estimated Bid Cost									1,619,923
	TOTAL PHASE 2 (Estimated Construction Cost)							**TOTAL PHASE 2**		**$1,700,000**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS, INC.**

Project:	**SF-Peninsula Regional PureWater (SPRP) Project Basis of Design Report (BODR)**	**Prepared By:**	MS/MWF
Cost Sheet:	**Cost Sheet #4A - Option 1 Purified Water Transmission and Distribution (Phase 1 and 2)**	**Date Prepared:**	May 2024
		KJ Proj. No.	2268026*00

Estimate Type:

- [ ] **Conceptual**
- [x] **Preliminary (w ~10% plans)**
- [ ] **Design Development @**
- [ ] **Construction**
- [ ] **Change Order**
- ____ **% Complete**

Current at ENR	15,418
Escalated to ENR	
Months to Midpoint of Phase 1 Construction	135
Months to Midpoint of Phase 2 Construction	234

Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	PHASE 1 OPTION 1 PURIFIED WATER TRANSMISSION PIPELINE (24" PVC) AND BOOSTER PUMP STATIONS									
1.0	**Open Cut**									
1.1	Open Cut Pipeline - 24" PVC - SFPUC ROW (unpaved/ low traffic)	16,900	LF					400	6,760,000	6,760,000
1.2	Open Cut pipeline - 24" PVC Along Bay (paved/ low traffic/ high groundwater/ import backfill)	9,100	LF					1,368	12,448,800	12,448,800
1.3	Open Cut pipeline - 24 PVC Other (in streets)	32,300	LF					1,440	46,512,000	46,512,000
2.0	**Jack-and-Bore**									
2.1	Jack-and-Bore Pipeline Crossing with 36" Casing (Total Length)	800	LF					2,000	1,600,000	1,600,000
2.2	Jack and Bore Jacking Pit (30 ft x 12 ft, 12 ft deep)	1	EA					125,000	125,000	125,000
2.3	Jack and Bore Receiving Pit (30 ft x 12 ft, 12 ft deep)	1	EA					75,000	75,000	75,000
3.0	**Microtunneling**									
3.1	Microtunneling Crossing with 36" Casing (Total Length)	1,950	LF					3,200	6,240,000	6,240,000
3.2	Microtunneling Jacking Pit (60 ft deep)	5	EA					150,000	750,000	750,000
3.3	Microtunneling Receiving Pit (60 ft deep)	5	EA					100,000	500,000	500,000
4.0	**Pipeline Repurposing (Sliplining)**									
4.1	Pipeline Repurposing Length - 24" Fusible PVC in 54-inch RCP (Total Length)	14,513	LF	48	696,624	80	1,161,040			1,857,664
4.2	Grout Annular Space - 54" Pipe Repurposing Segment	26,376	CY	200	5,275,244	125	3,297,028			8,572,272
4.3	Pipeline Repurposing Length - 24" Fusible PVC in 48-inch RCP (Total Length)	7,681	LF	49	376,369	80	614,480			990,849
4.4	Grout Annular Space - 48" Pipe Repurposing Segment	10,163	CY	200	2,032,640	125	1,270,400			3,303,040
4.5	Pipeline Repurposing Access Pit (50 ft x 30 ft x 10 ft deep)	26	EA			100,000	2,600,000			2,600,000
5.0	**Supported Crossing on Bridge/Structure**									
5.1	Supported Crossing Length (Total Length)	700	LF	400	280,000	600	420,000			700,000
5.2	Supported Crossing Connections (3 crossings total)	6	EA	25,000	150,000	12,500	75,000			225,000
6.0	**AWPF Product Water Pump Station**									
6.1	Product Water Tank and Clearwell :									
6.1.1	Base Slab	400	CY	350	140,000	350	140,000			280,000
6.1.2	Below Grade Walls , greater than 5'	378	CY	700	264,444	700	264,444			528,889
6.1.3	Elevated Slab	267	CY	800	213,333	800	213,333			426,667
6.2	AWPF Product Pumps (vertical turbine, 250 HP each)	2	EA	125,000	250,000	31,300	62,600		0	312,600
6.3	Product Water Surge Tank System (Allowance)	1	EA	150,000	150,000	75,000	75,000		0	225,000
7.0	**Booster Pump Stations (3 BPS)**									
7.1	Booster Pump Station Building (60 ft x 25 ft x 15 ft building) (3)	4,500	SF					1,000	4,500,000	4,500,000
7.2	Booster Pumps (canned vertical turbine, 500 HP)	2	EA	200,000	400,000	50,000	100,000			500,000
7.3	Booster Pumps (canned vertical turbine, 750 HP)	2	EA	309,800	619,600	77,500	155,000			774,600
7.4	Booster Pumps (canned vertical turbine, 400 HP)	2	EA	197,300	394,600	49,300	98,600			493,200
7.5	Pipe/ Valve/ Fittings	6	LS	49,325	295,950	12,325	73,950			369,900
7.6	Sitework / Site Improvements	15%						995,655	995,655	995,655
7.7	Electrical (applied to above BPS costs)	25%						1,659,425	1,659,425	1,659,425
7.8	Instrumentation and Controls (applied to above BPS costs)	15%						995,655	995,655	995,655
	SUBTOTAL PHASE 1				**11,538,805**		**10,620,876**		**83,161,535**	**105,321,216**
	Subtotals				11,538,805		10,620,876		83,161,535	105,321,216
	Division 1 Costs	**@**	**10%**		1,153,881		1,062,088		8,316,154	***10,532,122***
	Subtotals				12,692,686		11,682,963		91,477,689	115,853,337
	Taxes - Materials Costs	**@**	**8.75%**		1,110,610					***1,110,610***
	Subtotals				13,803,296		11,682,963		91,477,689	116,963,947
	Taxes - Labor Costs	**@**								-
	Subtotals				13,803,296		11,682,963		91,477,689	116,963,947
	Contractor Markup for Sub	**@**	**15%**						13,721,653	***13,721,653***
	Subtotals				13,803,296		11,682,963		105,199,342	130,685,601
	Contractor OH&P	**@**	**15%**		2,070,494		1,752,444			***3,822,939***
	Subtotals				15,873,790		13,435,408		105,199,342	134,508,540
	Project Development Costs	**@**	**15%**							***20,176,281***
	Subtotals									154,684,820
	Estimate Contingency	**@**	**40%**							***61,873,928***
	Subtotals									216,558,749
	Escalate to Midpoint of Construct	**@**	**4.5%**	*for 11.25 years is 51%*						***109,632,866***
	Estimated Bid Cost									326,191,615
	TOTAL PHASE 1 (Estimated Construction Cost)								**TOTAL PHASE 1**	**$326,200,000**
	PHASE 2 OPTION 1 PURIFIED WATER DISTRIBUTION PIPELINES, POINTS OF CONNECTION TO DWDS AND ADDITONAL PUMPS									
1.0	**AWPF Product Water Pump Station - Expand Capacity**									
1.1	AWPF Product Pumps (vertical turbine , 250 HP each)	1	EA	125,000	125,000	31,300	31,300			156,300
2.0	**Booster Pump Station - Expand Capacity**									
2.1	Booster Pumps (canned vertical turbine, 500 HP)	1	EA	200,000	200,000	50,000	50,000			250,000
2.2	Booster Pumps (canned vertical turbine, 750 HP)	1	EA	309,800	309,800	77,500	77,500			387,300
2.3	Booster Pumps (canned vertical turbine, 400 HP)	1	EA	197,300	197,300	49,300	49,300			246,600
2.4	Pipe/ Valve/ Fittings	3	LS	50,000	150,000	12,500	37,500			187,500
3.0	**Purified Distribution Pipelines to TWA Connections**									
3.1	Pipeline to Redwood Shores Tanks - Open Cut Pipeline (6" PVC)	4,190	LF					300	1,257,000	1,257,000
3.2	Pipeline to Redwood City Sequoia Tanks - Open Cut (16" PVC)	800	LF					800	640,000	640,000
3.3	Pipeline to Cal Water Station 103 - Open Cut (16" PVC)	5,000	LF					800	4,000,000	4,000,000
3.4	Pipeline to Cal Water Station 103 - (16" PVC in 30" Casing)	500	LF					3,000	1,500,000	1,500,000
3.5	Microtunneling Jacking Pit (12 ft deep)	1	EA					50,000	50,000	50,000
3.6	Microtunneling Receiving Pit (12 ft deep)	1	EA					30,000	30,000	30,000
3.7	Pipeline to MPWD Hallmark Tanks - Open Cut (10" PVC)	350	LF					500	175,000	175,000
4.0	**DWDS Connections to Existing Facilities**									
4.1	Connections to Existing Tanks (with air gap)	6	EA	50,000	300,000	50,000	300,000			600,000
4.2	Connections to Existing Transmission Pipelines (includes PRV Station)	2	EA	250,000	500,000	250,000	500,000			1,000,000
5.0	**Electrical, Instrumentation, and Controls**									
5.1	Electrical (applied to above Phase 2 costs)	25%						2,619,925	2,619,925	2,619,925
5.2	Instrumentation and Controls (applied to above Phase 2 costs)	15%						1,571,955	1,571,955	1,571,955
	SUBTOTAL PHASE 2				**1,782,100**		**1,045,600**		**11,843,880**	**14,671,580**
	Subtotals				1,782,100		1,045,600		11,843,880	14,671,580
	Division 1 Costs	**@**	**10%**		178,210		104,560		1,184,388	***1,467,158***
	Subtotals				1,960,310		1,150,160		13,028,268	16,138,738
	Taxes - Materials Costs	**@**	**8.75%**		171,527					***171,527***
	Subtotals				2,131,837		1,150,160		13,028,268	16,310,265
	Taxes - Labor Costs	**@**								-
	Subtotals				2,131,837		1,150,160		13,028,268	16,310,265
	Contractor Markup for Sub	**@**	**15%**						1,954,240	***1,954,240***
	Subtotals				2,131,837		1,150,160		14,982,508	18,264,505
	Contractor OH&P	**@**	**15%**		319,776		172,524			***492,300***
	Subtotals				2,451,613		1,322,684		14,982,508	18,756,805
	Project Development Costs	**@**	**15%**							***2,813,521***
	Subtotals									21,570,326
	Estimate Contingency	**@**	**40%**							***8,628,130***
	Subtotals									30,198,456
	Escalate to Midpoint of Construct	**@**	**4.5%**	*for 19.5 years is 88%*						***26,499,145***
	Estimated Bid Cost									56,697,601
	TOTAL PHASE 2 (Estimated Construction Cost)								**TOTAL PHASE 2**	**$56,700,000**

OPINION OF PROBABLE CONSTRUCTION COST | **KENNEDY/JENKS CONSULTANTS, INC.**

Project:	**SF-Peninsula Regional PureWater (SPRP) Project Basis of Design Report (BODR)**	**Prepared By:**	MS/MWF
Cost Sheet:	**Cost Sheet #4B - Option 2 Purified Water Transmission and Distribution Pipeline**	**Date Prepared:**	May 2024
Estimate Type:		**KJ Proj. No.**	2268026*00
		Current at ENR	15,418
		Escalated to ENR	
		Months to Midpoint of Phase 1 Construction	135
		Months to Midpoint of Phase 2 Construction	234

☐ **Conceptual**
☒ **Preliminary (w ~10% plans)**
☐ **Design Development @**

☐ **Construction**
☐ **Change Order**
____ **% Complete**

Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	PHASE 1 OPTION 2 PURIFIED WATER TRANSMISSION PIPELINE AND BOOSTER PUMP STATIONS (24" PVC)									
1.0	**Open Cut**									
1.1	Open Cut pipeline - Along Bay (paved/ low traffic/ high groundwater/ import backfill)	940	LF					1,368	1,285,920	1,285,920
1.2	Open Cut pipeline - Other (in streets)	34,600	LF					1,440	49,824,000	49,824,000
2.0	**Jack-and-Bore**									
2.1	Jack-and-Bore Pipeline Crossing (Total Length)	600	LF					2,000	1,200,000	1,200,000
2.2	Jack and Bore Jacking Pit (30 ft x 12 ft, 12 ft deep)	1	EA					125,000	125,000	125,000
2.3	Jack and Bore Receiving Pit (30 ft x 12 ft, 12 ft deep)	1	EA					75,000	75,000	75,000
3.0	**Microtunneling**									
3.1	Microtunneling Crossing (Total Length) 24" PVC in 36" Stl Casing	840	LF					3,200	2,688,000	2,688,000
3.2	Microtunneling Jacking Pit (60 ft deep)	3	EA					150,000	450,000	450,000
3.3	Microtunneling Receiving Pit (60 ft deep)	3	EA					100,000	300,000	300,000
4.0	**Pipeline Repurposing (Sliplining)**									
4.1	Pipeline Repurposing Length - 24" Fusible PVC in 54-inch RCP (Total Length)	14,513	LF	48	696,624	80	1,161,040			1,857,664
4.2	Grout Annular Space - 54" Pipe Repurposing Segment	26,376	CY	200	5,275,244	125	3,297,028			8,572,272
4.3	Pipeline Repurposing Access Pit (50 ft x 30 ft x 10 ft deep)	17	EA			100,000	1,700,000			1,700,000
5.0	**AWPF Product Water Pump Station**									
5.1	Product Water Tank and Clearwell :									
5.1.1	Base Slab	400	CY	350	140,000	350	140,000			280,000
5.1.2	Below Grade Walls , greater than 5'	378	CY	700	264,444	700	264,444			528,889
5.1.3	Elevated Slab	267	CY	800	213,333	800	213,333			426,667
5.2	AWPF Product Pumps (vertical turbine, 600 HP each)	2	EA	300,000	600,000	75,000	150,000			750,000
5.3	Product Water Surge Tank System (Allowance	1	EA	150,000	150,000	75,000	75,000			225,000
6.0	**Booster Pump Station (1 BPS)**									
6.1	Booster Pump Station Building/Site Improvements (60 ft x 25 ft x 15 ft building)	1,500	SF					1,000	1,500,000	1,500,000
6.2	Booster Pumps (canned vertical turbine, 1000 HP)	2	EA	390,200	780,400	97,600	195,200			975,600
6.3	Pipe/ Valve/ Fittings	2	LS	97,550	195,100	24,400	48,800			243,900
6.4	Sitework / Site Improvements	15%						407,925	407,925	407,925
6.5	Electrical (applied to above BPS costs)	25%						679,875	679,875	679,875
6.6	Instrumentation and Controls (applied to above BPS costs)	15%						407,925	407,925	407,925
	SUBTOTAL PHASE 1				**8,315,146**		**7,244,846**		**58,943,645**	**74,503,637**
	Subtotals				8,315,146		7,244,846		58,943,645	74,503,637
	Division 1 Costs	**@**	**10%**		831,515		724,485		5,894,365	***7,450,364***
	Subtotals			9,146,660.76		7,969,330.06			64,838,010	81,954,000
	Taxes - Materials Costs	**@**	**8.75%**		800,333					***800,333***
	Subtotals				9,946,994		7,969,330		64,838,010	82,754,333
	Taxes - Labor Costs	**@**								-
	Subtotals				9,946,994		7,969,330		64,838,010	82,754,333
	Contractor Markup for Sub	**@**	**15%**						9,725,701	***9,725,701***
	Subtotals				9,946,994		7,969,330		74,563,711	92,480,035
	Contractor OH&P	**@**	**15%**		1,492,049		1,195,400			***2,687,449***
	Subtotals				11,439,043		9,164,730		74,563,711	95,167,483
	Project Development Costs	**@**	**15%**							***14,275,122***
	Subtotals									109,442,606
	Estimate Contingency	**@**	**40%**							***43,777,042***
	Subtotals									153,219,648
	Escalate to Midpoint of Construct	**@**	**4.5%**	*for 11.25 years is 51%*						***77,567,447***
	Estimated Bid Cost									230,787,094
	TOTAL PHASE 1 (Estimated Construction Cost)								**TOTAL PHASE 1**	**$230,800,000**
	PHASE 2 OPTION 2 PURIFIED WATER DISTRIBUTION PIPELINES, POINTS OF CONNECTION TO DWDS AND ADDITONAL PUMPS									
1.0	**AWPF Product Water Pump Station - Expand Capacity**									
1.1	AWPF Product Pumps (vertical turbine, 600 HP each)	1	EA	300,000	300,000	75,000	75,000		0	375,000
2.0	**Booster Pump Station - Expand Capacity**									
2.1	Booster Pumps (canned vertical turbine, 1000 HP)	1	EA	390,200	390,200	97,600	97,600			487,800
2.2	Pipe/ Valve/ Fittings	1	LS	97,550	97,550	24,400	24,400			121,950
2.0	**Purified Distribution Pipelines to TWA Connections**									
2.1	Pipeline to Redwood Shores Tanks - Open Cut Pipeline (6" PVC)	4,190	LF					300	1,257,000	1,257,000
2.2	Pipeline to Cal Water Station 103 - Open Cut (16" PVC)	9,000	LF					800	7,200,000	7,200,000
2.3	Pipeline to Cal Water Station 103 - Carrier Pipe (16" PVC)	500	LF					800	400,000	400,000
2.4	Pipeline to Cal Water Station 103 - (16" PVC in 30" Casing)	500	LF					3,000	1,500,000	1,500,000
2.5	Microtunneling Jacking Pit (12 ft deep)	1	EA					50,000	50,000	50,000
2.6	Microtunneling Receiving Pit (12 ft deep)	1	EA					30,000	30,000	30,000
2.7	Pipeline to MPWD Hallmark Tanks - Open Cut (10" PVC)	350	LF					500	175,000	175,000
3.0	**TWA Connections to Existing Facilities**									
3.1	Connections to Existing Tanks (with air gap)	6	EA	50,000	300,000	50,000	300,000			600,000
3.2	Connections to Existing Transmission Pipelines (includes PRV Station)	5	EA	250,000	1,250,000	250,000	1,250,000			2,500,000
4.0	**Electrical, Instrumentation, and Controls**									
4.1	Electrical (applied to above Phase 2 costs)	25%						3,428,000	3,428,000	3,428,000
4.2	Instrumentation and Controls (applied to above Phase 2 costs)	15%						2,056,800	2,056,800	2,056,800
	SUBTOTAL PHASE 2				**1,550,000**		**1,550,000**		**16,096,800**	**20,181,550**
	Subtotals				1,550,000		1,550,000		16,096,800	19,196,800
	Division 1 Costs	**@**	**10%**		155,000		155,000		1,609,680	***1,919,680***
	Subtotals				1,705,000		1,705,000		17,706,480	21,116,480
	Taxes - Materials Costs	**@**	**8.75%**		149,188					***149,188***
	Subtotals				1,854,188		1,705,000		17,706,480	21,265,668
	Taxes - Labor Costs	**@**								-
	Subtotals				1,854,188		1,705,000		17,706,480	21,265,668
	Contractor Markup for Sub	**@**	**15%**						2,655,972	***2,655,972***
	Subtotals				1,854,188		1,705,000		20,362,452	23,921,640
	Contractor OH&P	**@**	**15%**		278,128		255,750			***533,878***
	Subtotals				2,132,316		1,960,750		20,362,452	24,455,518
	Project Development Costs	**@**	**15%**							***3,668,328***
	Subtotals									28,123,845
	Estimate Contingency	**@**	**40%**							***11,249,538***
	Subtotals									39,373,383
	Escalate to Midpoint of Construct	**@**	**4.5%**	*for 19.5 years is 88%*						***34,550,144***
	Estimated Bid Cost									73,923,527
	TOTAL PHASE 2 (Estimated Construction Cost)								**TOTAL PHASE 2**	**$74,000,000**

OPINION OF PROBABLE CONSTRUCTION COST

KENNEDY/JENKS CONSULTANTS, INC.

Prepared By: MS/MWF

Project: SF-Peninsula Regional PureWater (SPRP) Project Basis of Design Report (BODR)
Cost Sheet: Cost Sheet #4C - Option 3 Purified Water Transmission and Distribution Pipeline
Estimate Type:

- [ ] Conceptual
- [x] Preliminary (w ~10% plans)
- [ ] Design Development @
- [ ] Construction
- [ ] Change Order
- ______ % Complete

Date Prepared: May 2024
KJ Proj. No. 2268026*00
Current at ENR 15,418
Escalated to ENR
Months to Midpoint of Phase 1 Construction 135
Months to Midpoint of Phase 2 Construction 234

Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
	PHASE 1 OPTION 3 PURIFIED WATER TRANSMISSION PIPELINE (24" PVC) AND BOOSTER PUMP STATIONS									
1.0	**Open Cut**									
1.1	Open Cut Pipeline - SFPUC ROW	6,710	LF					400	2,684,000	2,684,000
1.2	Open Cut pipeline - Along Bay (paved/ low traffic/ high groundwater/ import backfill)	1,450	LF					1,368	1,983,600	1,983,600
1.3	Open Cut pipeline - Other (in Streets)	30,394	LF					1,440	43,767,360	43,767,360
2.0	**Jack-and-Bore**									
2.1	Jack-and-Bore Pipeline Crossing (Total Length) 24" in 36" Stl Casing	1,200	LF					2,000	2,400,000	2,400,000
2.2	Jack and Bore Jacking Pit (30 ft x 12 ft, 12 ft deep)	3	EA					125,000	375,000	375,000
2.3	Jack and Bore Receiving Pit (30 ft x 12 ft, 12 ft deep)	3	EA					75,000	225,000	225,000
3.0	**Microtunneling**									
3.1	Microtunneling Crossing (Total Length) - 24" PVC in 36" Stl Casing	920	LF					3,200	2,944,000	2,944,000
3.2	Microtunneling Jacking Pit (60 ft deep)	5	EA					150,000	750,000	750,000
3.3	Microtunneling Receiving Pit (60 ft deep)	5	EA					100,000	500,000	500,000
4.0	**Pipeline Repurposing (Sliplining)**									
4.1	Pipeline Repurposing Length - 24" Fusible PVC or HDPE in 54-inch RCP (Total Length)	14,513	LF	48	698,993	80	1,161,040			1,860,033
4.2	Grout Annular Space - 54" Pipe Repurposing Segment	26,376	CY	200	5,275,244	125	3,297,028			8,572,272
4.3	Pipeline Repurposing Length - 24" Fusible PVC in 48-inch RCP (Total Length)	9,033	LF	48	435,059	80	722,640			1,157,699
4.4	Grout Annular Space - 48" Pipe Repurposing Segment	11,952	CY	200	2,390,423	125	1,494,014			3,884,437
4.5	Pipeline Repurposing Access Pit (50 ft x 30 ft x 10 ft deep)	28	EA			100,000	2,800,000			2,800,000
5.0	**AWPF Product Water Pump Station**									
5.1	Product Water Tank and Clearwell :									
5.1.1	Base Slab	400	CY	350	140,000	350	140,000			280,000
5.1.2	Below Grade Walls , greater than 5'	378	CY	700	264,444	700	264,444			528,889
5.1.3	Elevated Slab	267	CY	800	213,333	800	213,333			426,667
5.2	AWPF Product Pumps (vertical turbine, 750 HP each)	2	EA	309,800	619,600	77,500	155,000		0	774,600
5.3	Product Water Surge Tank System (Allowance	1	EA	150,000	150,000	75,000	75,000		0	225,000
6.0	**Booster Pump Station (1 BPS)**									
6.1	Booster Pump Station Building/Site Improvements (60 ft x 25 ft x 15 ft building)	1,500	SF					1,000	1,500,000	1,500,000
6.2	Booster Pumps (canned vertical turbine, 500 HP each)	2	EA	200,000	400,000	50,000	100,000			500,000
6.3	Pipe/ Valve/ Fittings	2	LS	50,000	100,000	12,500	25,000			125,000
6.4	Sitework/ Site Improvements	15%						318,750	318,750	318,750
6.5	Electrical (applied to above BPS costs)	25%						531,250	531,250	531,250
6.6	Instrumentation and Controls (applied to above BPS costs)	15%						318,750	318,750	318,750
	SUBTOTAL PHASE 1				**10,687,097**		**10,447,500**		**58,297,710**	**79,432,307**
	Subtotals				10,687,097		10,447,500		58,297,710	79,432,307
	Division 1 Costs	@	10%		1,068,710		1,044,750		5,829,771	***7,943,231***
	Subtotals				11,755,807		11,492,250		64,127,481	87,375,538
	Taxes - Materials Costs	@	8.75%		1,028,633					***1,028,633***
	Subtotals				12,784,440		11,492,250		64,127,481	88,404,171
	Taxes - Labor Costs	@								-
	Subtotals				12,784,440		11,492,250		64,127,481	88,404,171
	Contractor Markup for Sub	@	15%						9,619,122	***9,619,122***
	Subtotals				12,784,440		11,492,250		73,746,603	98,023,293
	Contractor OH&P	@	15%		1,917,666		1,723,837			***3,641,503***
	Subtotals				14,702,106		13,216,087		73,746,603	101,664,796
	Project Development Costs	@	15%							***15,249,719***
	Subtotals									116,914,516
	Estimate Contingency	@	40%							***46,765,806***
	Subtotals									163,680,322
	Escalate to Midpoint of Construct	@	4.5%	*for 11.25 years is 51%*						***82,863,163***
	Estimated Bid Cost									246,543,486
	TOTAL PHASE 1 (Estimated Construction Cost)								**TOTAL PHASE 1**	**$246,600,000**
	PHASE 2 OPTION 3 PURIFIED WATER TRANSMISSION PIPELINE (24" PVC) AND BOOSTER PUMP STATIONS									
1.0	**AWPF Product Water Pump Station - Expand Capacity**									
1.1	AWPF Product Pumps (vertical turbine, 750 HP each)	1	EA	309,800	309,800	77,500	77,500		0	387,300
2.0	**Booster Pump Station - Expand Capacity**									
2.1	Booster Pump (canned vertical turbine, 500 HP each)	1	EA	200,000	200,000	50,000	50,000			250,000
2.2	Pipe/ Valve/ Fittings	1	LS	50,000	50,000	12,500	12,500			62,500
2.0	**Purified Distribution Pipelines to TWA Connections**									
2.1	Pipeline to Redwood Shores Tanks - Open Cut Pipeline (6" PVC)	4,190	LF					300	1,257,000	1,257,000
2.2	Pipeline to Redwood City Sequoia Tanks - Open Cut (16" PVC)	800	LF					800	640,000	640,000
2.3	Pipeline Shared with Cal Water/MPWD - Open Cut (18" PVC)	3,350	LF					900	3,015,000	3,015,000
2.4	Pipeline to Cal Water Station 103 - Open Cut (16" PVC)	1,700	LF					800	1,360,000	1,360,000
2.5	Pipeline to Cal Water Station 103 - (16" PVC in 30" Casing)	500	LF					3,000	1,500,000	1,500,000
2.6	Transmission - Open Cut (20" PVC)	1,300	LF					1,000	1,300,000	1,300,000
2.7	Microtunneling Jacking Pit (12 ft deep)	1	EA					50,000	50,000	50,000
2.8	Microtunneling Receiving Pit (12 ft deep)	1	EA					30,000	30,000	30,000
3.0	**TWA Connections to Existing Facilities**									
3.0	Connections to Existing Tanks (with air gap)	6	EA	50,000	300,000	50,000	300,000			600,000
3.1	Connections to Existing Transmission Pipelines (includes PRV Station)	2	EA	250,000	500,000	250,000	500,000			1,000,000
4.0	**Electrical, Instrumentation, and Controls**									
4.1	Electrical (applied to above Phase 2 costs)	25%						2,862,950	2,862,950	2,862,950
4.2	Instrumentation and Controls (applied to above Phase 2 costs)	15%						1,717,770	1,717,770	1,717,770
	SUBTOTAL PHASE 2				**1,359,800**		**940,000**		**13,732,720**	**16,032,520**
	Subtotals				1,359,800		940,000		13,732,720	16,032,520
	Division 1 Costs	@	10%		135,980		94,000		1,373,272	***1,603,252***
	Subtotals				1,495,780		1,034,000		15,105,992	17,635,772
	Taxes - Materials Costs	@	8.75%		130,881					***130,881***
	Subtotals				1,626,661		1,034,000		15,105,992	17,766,653
	Taxes - Labor Costs	@								-
	Subtotals				1,626,661		1,034,000		15,105,992	17,766,653
	Contractor Markup for Sub	@	15%						2,265,899	***2,265,899***
	Subtotals				1,626,661		1,034,000		17,371,891	20,032,552
	Contractor OH&P	@	15%		243,999		155,100			***399,099***
	Subtotals				1,870,660		1,189,100		17,371,891	20,431,651
	Project Development Costs	@	15%							***3,064,748***
	Subtotals									23,496,398
	Estimate Contingency	@	40%							***9,398,559***
	Subtotals									32,894,958
	Escalate to Midpoint of Construct	@	4.5%	*for 19.5 years is 88%*						***28,865,325***
	Estimated Bid Cost									61,760,283
	TOTAL PHASE 2 (Estimated Construction Cost)								**TOTAL PHASE 2**	**$61,800,000**

OPINION OF PROBABLE CONSTRUCTION COST — **KENNEDY/JENKS CONSULTANTS, INC.**

Project:	**SF-Peninsula Regional PureWater (SPRP) Project Basis of Design Report (BODR)**	**Prepared By:**	MS/MWF
Cost Sheet:	**Cost Sheet #5 – AWPF O&M Costs**	**Date Prepared:**	May 2024
Estimate Type:		**KJ Proj. No.**	2268026*00
		Current at ENR	15418
		Escalated to ENR	
		Months to Midpoint of Phase 1 Construction	135
		Months to Midpoint of Phase 2 Construction	234

- [ ] **Conceptual**
- [x] **Preliminary (w ~10% plans)**
- [ ] **Design Development @**
- [ ] **Construction**
- [ ] **Change Order**
- ______ **% Complete**

Annual Operations and Maintenance Costs

Phase 1 AWPF O&M Costs for ResWA (6 mgd)

Item No.	Description	Qty	Units	Total Annual Costs $/Unit	Total	Notes/Sources			
1.0	**Energy**					Treatment Operation =	24	hours per day	
1.1	Energy - Treatment (6 mgd)	9,859,553	KWh	$ 0.20	1,970,000		8760	hours operated per year	
1.2	Energy - Other		KWh	10%	197,000	SVCW total pumping =	10	KW	
							85,583	KWh/yr	
2.0	**Chemicals**					Assumed rate based on production =	9,773,970	KWHh/yr	
2.1	AWPF	6,720	AF	$ 230	1,545,600	Average Annual Production	6720	AF/Y	
3.0	**Labor Costs**								
3.1	Labor - AWPF	13	staff	$ 175,000	2,280,000	Full time staff at	$175,000	average salary + benefits per year	
						Phase 1 = 12 FTE for plant operation, 1 FTE for admin/reg reporting			
4.0	**Maintenance:**								
4.1	AWPF Equipment (Replacement/Repair)	6,720	AF	$ 160	1,080,000	Estimated for MF/RO/UV-AOP equipment and pumps			
4.2	Other (Replacement/Repair)	1.5%			500,000	% of facility direct costs not including process treatment listed above			
5.0	**Contingency**	10.0%			760,000	% of above O&M costs			
		Annual O&M Costs ($/year)			**$8,330,000**				
			Annual Unit O&M Costs ($/AF)		**$1,200**	Phase 1 Purified Water Delivered	6	mgd	*assume continuous operation*
						(for ResWA)	6,720	AFY	

Phase 2 AWPF O&M Costs for TWA (6 mgd)

Item No.	Description	Qty	Units	Total Annual Costs $/Unit	Total	Notes/Sources			
1.0	**Energy**					Treatment Operation =	24	hours per day	
1.1	Energy - Treatment (6 mgd additional flow)	9,977,089	KWh/yr	$ 0.20	2,000,000		8760	hours operated per year	
1.2	Energy - Other		KWh	10%	200,000	SVCW total pumping power =	23	KW	
							203,119	KWh/yr	
2.0	**Chemicals**					Assumed rate based on production =	9,773,970	KWHh/yr	
2.1	AWPF	6,720	AF	$ 230	1,545,600	Average Annual Production	6720	AF/Y	
3.0	**Labor Costs**								
3.1	Labor - AWPF additional for expansion	3.0	staff	$ 175,000	530,000	Full time staff at	$175,000	average salary + benefits per year	
						Phase 2 = 2 additional FTE for expanded plant operation, 1 FTE for added admin/reg reporting for TWA			
4.0	**Maintenance:**								
4.1	AWPF Equipment (Replacement/Repair)	6,720	AF	$ 160	1,075,200	Estimated for MF/RO/UV-AOP equipment and pumps			
4.2	Other (Replacement/Repair)	1.5%			190,000	% of facility direct costs not including process treatment listed above			
5.0	**Contingency**	10.0%			550,000	% of above O&M costs			
		Annual O&M Costs ($/year)			**$6,090,000**				
			Annual Unit O&M Costs ($/AF)		**$900**	Phase 2 Purified Water Delivered	6	mgd	*assume continuous operation*
						(for TWA)	6,720	AFY	

O&M Costs above are by Phase for Treatment - Summary below

Phase	$/yr	$/AF
Phase 1 (6 mgd production for ResWA)	$8,330,000	$1,200
Phase 2 (6 mgd production for TWA)	$6,090,000	$900
Phase 1&2 (12 mgd production for ResWA/TWA)	**$14,420,000**	**$2,100**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS, INC.**

Project:	**SF-Peninsula Regional PureWater (SPRP) Project Basis of Design Report (BODR)**	**Prepared By:**	MS/MWF
Cost Sheet:	**Cost Sheet #6 – Conveyance O&M Costs**	**Date Prepared:**	May 2024
Estimate Type:		**KJ Proj. No.**	2268026*00
	☐ **Conceptual** ☐ **Construction**	**Current at ENR**	15418
	☒ **Preliminary (w/o plans)** ☐ **Change Order**	**Escalated to ENR**	
	☐ **Design Development @** ____ **% Complete**	**Months to Midpoint of Construct (Phase 1)**	135
		Months to Midpoint of Construct (Phase 2)	234

Annual Operations and Maintenance Costs

Phase 1 Conveyance O&M Costs for ResWA

Item No.	Description	Qty	Units	Total Annual Costs $/Unit	Total	Notes/Sources
Purified Pipeline Delivery to CSR						
1.0	**Energy**					Assume all pump stations will have 12 MGD capacity
1.1	Energy- Pumping to CSR	9,260,000	KWh/yr	$ 0.20	1,850,000	Pumping Operation = 24 hours per day
1.2	Energy - Other		KWh	10%	185,000	8,760 hours operated per year
						Max energy of 3 purified water transmission options = 9,260,000 KWH/yr
2.0	**Chemicals**					
2.1	**Dechlorination**					Assume chemical costs similar to current use (unit costs from SFPUC for 11/2023)
2.1.1	Sodium Bisulfite	26,400	GAL	$ 3.60	95,040	Sodium Bisulfite – $3.6/gal dosed at 6 mg/L 2,200 gal/month
3.0	**Labor Costs**					
3.1	Labor	4	staff	$ 175,000	700,000	Full time staff at $175,000 average salary + benefits per year
						4 FTE (or multiple staff for a portion of their time) for MR&R of conveyance facilities
4.0	**Maintenance:** *(as a percent of facility direct costs, not including treatment)*					
4.1	Other (Replacement/Repair)	1.5%			4,909,500	% of facility direct costs not including Treatment
5.0	**Contingency:** *(as a percent of above O&M costs)*	10.0%			770,000	% of above O&M costs
				Annual O&M Costs ($/year)	**$8,509,540**	
				Annual Unit O&M Costs ($/AF)	**$1,300**	Phase 1 Purified Water Delivered 6 mgd (for ResWA) 6,720 AFY *assume continuous operation*
San Mateo Pipeline Delivery to AWPF						
1.0	**Energy**					
1.1	Energy- Pumping to AWPF	130,000	KWh/yr	$ 0.20	30,000	Pumping Operation = 24 hours per day
1.2	Energy - Other		KWh	10%	3,000	8,760 hours operated per year
						15 KW
2.0	**Chemicals** *(not applicable)*					130,000 KWH/yr
3.0	**Labor Costs**					Full time staff at $175,000 average salary + benefits per year
3.1	Labor	1	staff	$ 175,000	180,000	1 FTE for MR&R of San Mateo facilities
4.0	**Maintenance:** *(as a percent of facility direct costs, not including treatment)*					
4.1	Other (Replacement/Repair)	1.5%			2,178,000	% of facility direct costs (including markups)
5.0	**Contingency:** *(as a percent of above O&M costs)*	10.0%			240,000	% of above O&M costs
				Annual O&M Costs ($/year)	**$2,631,000**	
				Annual Unit O&M Costs ($/AF)	**$600**	Phase 1 San Mateo Tertiary Feed Water Delivered 4 mgd (for ResWA) 4,480 AFY *assume continuous operation*

Phase 2 Conveyance O&M Costs for TWA

Item No.	Description	Qty	Units	Total Annual Costs $/Unit	Total	Notes/Sources
Purified Pipeline Delivery to CSR/DWDS						
1.0	**Energy Costs**					Assume all pump stations will have 12 MGD capacity
1.1	Energy- Pumping to CSR	22,150,000	KWh/yr	$ 0.20	4,430,000	Pumping Operation = 24 hours per day
1.2	Energy- Breakpoint Chlorination	32,675	KWh/yr	$ 0.20	10,000	8,760 hours operated per year
1.3	Energy - Other		KWh	10%	444,000	Max energy of 3 purified water transmission options= 22,150,000 KWH/yr
						Breakpoint Treatment = 24 hours per day
						8,760 hours operated per year
						5 hp
2.0	**Chemicals**					
2.1	**Dechlorination**					Assume chemical costs similar to current use (unit costs from SFPUC for 11/2023)
2.1.1	Sodium Bisulfite	26,400	GAL	$ 3.60	95,040	Sodium Bisulfite – $3.6/gal dosed at 6 mg/L 2,200 gal/month
2.2	**Breakpoint Chlorination**					
2.2.1	pH Adjustment (Sulfuric Acid)	5,040	GAL	$ 2.00	10,080	Sulfuric Acid - $2/gal dosed at 4 mg/L 420 gal/month
2.2.2	Sodium Hypochlorite	81,600	lb	$ 2.24	182,784	Sodium Hypochlorite - $2.24/gal dosed at 6 mg/L 6,800 gal/month
3.0	**Labor Costs**					
3.1	Labor	4	staff	$ 175,000	700,000	Full time staff at $175,000 average salary + benefits per year
						4 FTE (or multiple staff for a portion of their time) for MR&R of distribution & DWDS POC facilities.
4.0	**Maintenance:** *(as a percent of facility direct costs, not including treatment)*					
4.1	Other (Replacement/Repair)	1.5%			969,000	% of facility direct costs not including Treatment
5.0	**Contingency:** *(as a percent of above O&M costs)*	10.0%			680,000	% of above O&M costs
				Annual O&M Costs ($/year)	**$7,520,904**	
				Annual Unit O&M Costs ($/AF)	**$900**	Phase 2 Purified Water Delivered 6 mgd (for TWA) 6,720 AFY *assume continuous operation*
San Mateo Pipeline Delivery to AWPF						
1.0	**Energy**					
1.1	Energy- Pumping to AWPF	1,300,000	KWh/yr	$ 0.20	260,000	Pumping Operation = 24 hours per day
1.2	Energy - Other		KWh	10%	26,000	8,760 hours operated per year
						149 KW
2.0	**Chemicals** *(not applicable)*					1,300,000 KWH/yr
3.0	**Labor Costs**					Full time staff at $175,000 average salary + benefits per year
3.1	Labor	1	staff	$ 175,000	180,000	1 FTE for MR&R of San Mateo facilities
4.0	**Maintenance:** *(as a percent of facility direct costs, not including treatment)*					
4.1	Other (Replacement/Repair)	1.5%			25,500	% of facility direct costs (including markups)
5.0	**Contingency:** *(as a percent of above O&M costs)*	10.0%			50,000	% of above O&M costs
				Annual O&M Costs ($/year)	**$541,500**	
				Annual Unit O&M Costs ($/AF)	**$100**	Phase 1 San Mateo Tertiary Feed Water Delivered 5 mgd (for ResWA) 5,600 AFY *continuous operation*

O&M Costs above are by Phase for Conveyance - Summary below

Phase	$/yr	$/AF
Phase 1 Purified Delivery (6 mgd production for ResWA)	$8,509,540	$1,300
Phase 2 Purified Delivery (6 mgd production for TWA)	$7,520,904	$900
Phase 1&2 (12 mgd production for ResWA/TWA)	**$16,030,444**	**$2,200**
Phase 1 San Mateo Tertiary Feed (4 mgd production for AWPF)	$2,631,000	$600
Phase 2 San Mateo Tertiary Feed (5 mgd production for AWPF)	$541,500	$100
Phase 1&2 (9 mgd production for AWPF)	**$3,172,500**	**$700**

Appendix E Preliminary CEQA Checklist

The California Environmental Quality Act (CEQA) Checklist contained within this appendix is intended to provide SFPUC with "CEQA Ready" information at or near the 10-percent level. The CEQA Checklist has been developed as a stand-alone document if supported by the PureWater Peninsula Project drawing set included in Appendix F.

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PureWater Peninsula Project CEQA/NEPA Checklist

May 2024

Prepared for

San Francisco Public Utilities Commission

KJ Project No. 2268026*00

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List of Abbreviations

AAR	Alternatives Analysis Report
ALUC	Airport Land Use Committee
AOP	Advanced Oxidation Process
AWPF	Advanced Water Purification Facility
BAF	biological aerated filter
BDPL	Bay Division Pipeline
EM	SFPUC Environmental Management
BAWSCA	Bay Area Water Supply and Conservation Agency
BMP	best management practice
BODR	Basis of Design Report
BPS	booster pump station
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CER	Conceptual Engineering Report
CESA	California Endangered Species Act
CGS	California Geological Survey
CSR	Crystal Springs Reservoir
CWA	Clean Water Act
DiPRRA	Direct Potable Reuse Responsible Agency
DPR	direct potable reuse
DWDS	Drinking Water Distribution System
EA	environmental assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAA	Federal Aviation Administration
ft or '	foot (feet)
ft^2	square foot (feet)
FTE	full time equivalent
GIR	Geotechnical Interpretive Report
GIS	Geographic Information System
HDD	horizontal directional drilling
IAP	Independent Advisory Panel
in or "	Inch (es)
IpaC	Information for Planning and Consultation
IPR	Indirect Potable Reuse
IPS	influent pump station
LF	Linear Feet

lox	liquid oxygen system
MF	microfiltration
MGD	million gallons per day
MND	Mitigated Negative Declarations
MR&R	maintenance, repair and replacement
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
PREP	Potable Reuse Exploratory Plan
PWS	public water system
RESCU	SVCW Regional Environmental Sewer Conveyance Upgrade Program
ResWA	Reservoir Water Augmentation
RO	reverse osmosis
RSB	Redwood Shores Bay Front
RWQCB	Regional Water Quality Control Board
RWC	Redwood City
RWS	Regional Water System
SBDDW	State Board Division of Drinking Water
SCADA	supervisory control and data acquisition
SFPUC	San Francisco Public Utilities Commission
SHPO	State Historical Preservation Office
SOP	Standard Operating Procedures
SPMP	Site Protection Management Plan
SVCW	Silicon Valley Clean Water
SWRCB	State Water Resources Control Board
TM	technical memorandum
TWA	Treated Water Augmentation
USACE	United State Army Corps of Engineers
USEPA	United Stated Environmental Protection Agency
USFWS	United Stated Federal Wildlife Survey
USGS	United Stated Geological Survey
UST	underground storage tank
UV	ultraviolet
WDR	Waste Discharge Requirement
WWTP	wastewater treatment plant
YBM	Young Bay Mud
yd^3	cubic yard(s)

Section 1: Project Objectives

This report follows the outline for a California Environmental Quality Act (CEQA) Checklist, which is intended to provide San Francisco Public Utilities Commission (SFPUC) with "CEQA Ready" information. "CEQA Ready" to SFPUC means preparation of a conceptual-level design at or near the 10-percent level, and completion of an abbreviated CEQA checklist document, which would allow the project to move forward with CEQA and to be compared with other projects.

This checklist is designed to provide the design team assistance in determining the type of information that must be provided to SFPUC Environmental Management (EM) for environmental review. The use of this form would be iterative as the project is developed, new environmental issues are identified, and additional detail is needed until CEQA certification, and all permits are obtained.

This checklist is intended to be provided at the Draft Conceptual Engineering Report (CER) stage.

The PureWater Peninsula ("Project") is currently at a design level that is representative of approximately 10% level of design. Due to the technical, regulatory, institutional, and jurisdictional complexity of the project, future design may also include an Alternatives Analysis Report (AAR) to determine the preferred pipeline alignments, which is a predecessor report to the CER. Thus, this CEQA Checklist has been performed at a higher-level based on information available at the time of this Basis of Design Report (BODR), using professional experience to provide conservative assumptions. As noted above, this CEQA Checklist will continue to be updated as the Project is developed.

Text in *blue italics*, included at the beginning of each section, describes the direction provided by SFPUC on what information should be focused on for this level of analysis.

Text in grey boxed indicate CEQA Checklist items that were not required to be discussed in this document based on initial discussions with SFPUC EM.

1.1 Project Background

The PureWater Peninsula Project, previously referred to as the Potable Reuse Exploratory Plan (PREP), is a regional effort to resolve multiple water supply and wastewater issues, while realizing the benefits of shared infrastructure, asset recovery, economies of scale and a more competitive strategy to pursue funding. PureWater Peninsula Parties, previously referred to as the PREP Parties, include the Bay Area Water Supply and Conservation Agency (BAWSCA), California Water Service (Cal Water), San Francisco Public Utilities Commission (SFPUC), Silicon Valley Clean Water (SVCW), City of San Mateo, Redwood City (RWC), and Mid-Peninsula Water District (MPWD).

The PureWater Peninsula is a regional effort to study potable reuse opportunities in the San Francisco Mid-Peninsula region.

- PureWater Peninsula (PREP) Phase 1 began in 2016, to explore a wide range of potable reuse concepts in the region, including a preliminary screening of groundwater replenishment and augmentation of local reservoirs.

- PureWater Peninsula (PREP) Phase 2 continued in 2018, the focus of which was to further define the concept of reservoir augmentation at Crystal Springs Reservoir (CSR) and to explore institutional considerations for implementation of a regional potable reuse program.

- PureWater Peninsula (PREP) Phase 3 began in 2020 to further evaluate reservoir augmentation at CSR and explore more direct form of augmentation into the drinking water system.

The outcomes of PureWater Peninsula (PREP) Phase 3 identified a short-list of projects to move forward for further analysis.

The next step is to develop an indirect potable reuse (IPR)/direct potable reuse (DPR) project, referred to as the PureWater Peninsula, resulting from the short list of alternatives identified in PREP Phase 3, to be “CEQA Ready”. The PureWater Peninsula Parties identified the need for a BODR to satisfy these requirements.

1.2 Purpose and Need

Describe the purpose and need for the project. What will this particular project accomplish?

The development of new, local drought-resilient water supplies is needed by the PureWater Peninsula Parties to:

1. Enhance local water supply reliability and resiliency for water providers on the San Francisco Peninsula to prepare for the unpredictability of climate change.

2. Reduce wastewater discharge to the San Francisco Bay, helping communities use locally treated wastewater more efficiently and prevent water from becoming a lost resource.

3. Create a project with multiple economic, environmental, and social benefits that supports and leverages a multi-barrier approach to resource planning.

In addition, the intensified effects of climate change are becoming evident through California as the State has been experiencing consecutive years of drought and consistent higher-than-average temperatures. These dramatic climate shifts are further stressing water reservoirs and changing demands for residential, agricultural, and commercial water use.

The PureWater Peninsula Parties seek to use multi-agency involvement to find broad mutual benefits and identify alternatives that address regional water supply and discharge challenges through maximizing utility of the available recycled water supplies, to provide a local, drought-resistant, sustainable water supply that benefits the environment and communities in the region.

1.3 Project Objectives

List and describe specific project objectives (not Program objectives).

The Project would seek to address three over-arching objectives:

1. Increase local water supply on the San Francisco Peninsula to enhance reliability and resiliency.

2. Reduce discharge to the San Francisco Bay – helping communities use locally treated water more efficiently and prevent water from becoming a lost resource.

3. Create a multi-agency project with multiple economic, environmental, and social benefits.

1.4 Project Description

Specifically, the Project is a phased potable reuse project which is described as follows:

- Phase 1 –IPR via Reservoir Water Augmentation (ResWA) at CSR.

- Phase 2 – DRP via Treated Water Augmentation (TWA) for local use by RWC, Cal Water and/or potentially the MPWD.

- Source water derived from up to 8 mgd of tertiary effluent from SVCW and up to 9 mgd of tertiary effluent from the San Mateo Wastewater Treatment Plant (WWTP) to produce up to 12 mgd of purified water. A maximum of 3 mgd additional source water is available for dilution of reverse osmosis (RO) concentrate, if needed.

- Construction of a new advanced water purification facility (AWPF) to treat source water to meet regulatory requirements for IPR in Phase 1 and DPR for the Phase 2 expansion.

- Conveyance infrastructure to deliver tertiary effluent to the new AWPF, purified water to the place of use, and brine for discharge via the SVCW outfall.

- Construction of a new Breakpoint Chlorination (BPC) Facility, to dechloraminate the purified water prior to connecting to the SFPUC's Pulgas Dechloramination Facility (DF). The BPC Facility will chlorinate the water by injecting chlorine downstream of the last TWA connection that will serve customers directly.

- A point of connection to SFPUC's Pulgas DF, which is used to manage and control water flow to SFPUC customers on the Peninsula and provides dechloramination or dechlorination of all flows prior to CSR augmentation.

- Multiple points of connection to existing tanks and transmission pipelines to deliver purified water to RWC, Cal Water and/or the MPWD drinking water distribution systems (DWDS).

The PureWater Peninsula project vicinity and concept is illustrated in Figure 1-1. The project is located in the Bay Area of Northern California and includes the potential facilities illustrated in Figure 1-2 and listed in Table 1-1.

Figure 1-1: PureWater Peninsula Project Vicinity

Figure 1-2: PureWater Peninsula Project Facilities

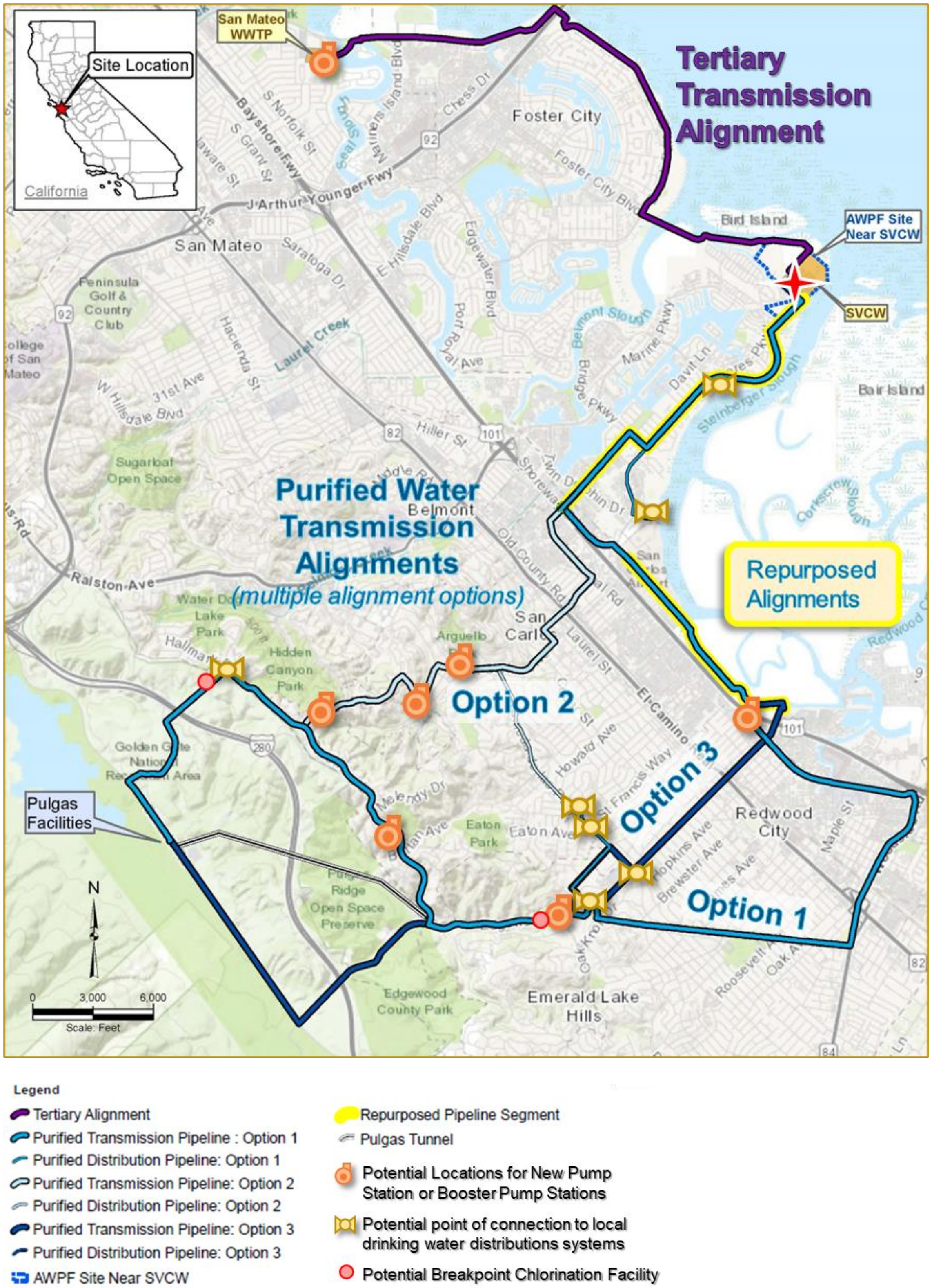


Table 1-1: PureWater Peninsula Project Facilities

	Phase 1 – IPR (6 mgd)	Phase 2 – IPR and DPR (12 mgd)
Treatment Facilities	• 6 mgd capacity AWPF located near SVCW; water treated to TWA standards. • Associated chemical feed systems, wet wells, inter-process pumps, and other appurtenances.	• Expand unit processes and appurtenances to 12 mgd treatment capacity; water treated to TWA standards. • Breakpoint chlorination facility to provide chemical dosing along the purified transmission pipeline (downstream of final DWDS connection, before Pulgas DF).

Pipelines	• **San Mateo Tertiary Effluent**: ~6 miles of 24"-diameter (dia) source water pipeline from San Mateo WWTP to AWPF sized for up to 9 mgd source water flow.
	• **SVCW Tertiary Effluent**: <1 mile of 20"-dia source water pipeline from SVCW to AWPF sized for up to 8 mgd source water flow.
	• **Purified Water to Crystal Springs Reservoir:** 12-16 miles of 24 -dia purified water transmission pipeline from AWPF to CSR, with provisions for future connections to local drinking water.distribution systems. The pipeline would be sized for Phase 2 flows of 12 mgd, with up to 8 mgd of that purified water flow reaching CSR in Phase 2.
	• **AWPF Brine Disposal:** <1 mile of 12"-dia brine pipeline from AWPF to the existing SVCW outfall.
		• **Treated Water Distribution System Connections:**
		  ○ 6"-to 18" dia Distribution pipelines from purified water transmission pipeline to potable water system tie-ins (pipe lengths vary by alternative).
		  ○ Potable water system tie-ins to local drinking water distribution system (RWC, Cal Water, and MPWD).

Storage	• **Equalization storage tank (EQ)** for source water, prior to AWPF with potential to convert one of RWC's Recycled Water storage tanks at SVCW for use as equalization. • **Purified water storage tank** for purified water prior to conveyance to CSR.	• Expand source water equalization storage tank capacity for the 12 mgd treatment capacity.
Pump Stations	• **San Mateo Tertiary Pump Station:** convey AWPF source water (tertiary effluent) from San Mateo to the AWPF. • **SVCW Tertiary Pump Station:** convey AWPF source water (tertiary effluent) from SVCW to the AWPF • **RO Concentrate Pump Station:** Convey brine from the AWPF to SVCW Outfall connection. • **Purified Water Pump Station at AWPF:** Convey purified water from AWPF to CSR/DWDS connections. • **Purified Water Booster Pump Stations (BPSs):** Several intermediate booster pump stations would be required to convey purified water from the AWPF to CSR/DWDS connections.	• Expand number of pumps at each pump station to meet the 12 mgd treatment capacity.
Pulgas	• Connect to the concrete 11' weir at Pulgas DF prior to augmentation into CSR. • Utilize the existing Pulgas Dechlorination operations and Discharge Channel to augment CSR.	No additional modifications.

Section 2: Site Plan

Provide a site plan on a topographic map. Everything should be labeled as either new or existing. Information on the site plan should include the following, including square footage, length, diameter, etc.:

Project site plans for all facilities are provided in the **BODR Appendix F: Drawings**. This section summarizes structural footprints and available information related to utility lines, construction areas and other above ground activities.

2.1 Structural Footprints

Structural footprints (general areas) – existing and created by the project.

The Project would involve construction of new treatment facilities at the AWPF and the new breakpoint chlorination facility, and conveyance facilities on the San Francisco Peninsula. The project includes both above and below ground structures. The estimated footprints are described in the following sections.

2.1.1 AWPF Facilities and Footprints

There are two potential locations for the new AWPF. Both of the potential AWPF sites are owned by SVCW, as depicted in Figure 2-1. The preferred site is the 5.5-acre SVCW North Pond area, southwest of the existing sludge drying beds. The alternative site is the North Annex parcel located northwest of the SVCW facility. This land is owned by SVCW but is not preferred for AWPF construction since it is a potentially environmentally sensitive area which may require extended negotiations related to permitting and environmental impacts that could result in significant project schedule delays.

For purposes of the BODR, it is assumed that the AWPF would be designed for the SVCW North Pond Area. At this site location, it is assumed flow would enter the AWPF at the northwest corner from both SVCW and San Mateo. Purified water would leave the AWPF and feed the distribution system via existing pipelines to the southeast. RO concentrate would be diluted and pumped to the existing SVCW outfall connection point. A conceptual site design of the AWPF at the SVCW North Pond area is shown in Figure 2-2.

The project design must abide by the vertical limitations of the site, as dictated by RWC zoning codes. RWC zoning code states that the project site falls within the Redwood Shores Bay Front (RSB) zone. The height restriction for buildings constructed within this zone is 30 feet (ft). Due to potential view obstruction concerns from nearby residents, the site layout criteria were developed to limit process equipment and tank structures to a max elevation of 111 feet to meet the max elevation of the nearby RWC recycled water tanks. Above ground buildings would be limited to a max height of 20 feet above grade or about 134 feet elevation, similar to the elevation of nearby SVCW maintenance building adjacent to the existing dual media filters. This self-imposed height restriction is more conservative than what the RWC zoning code calls for in the neighboring R-2 zone neighborhood where buildings are permitted to be as tall as 28 ft.

Figure 2-1: AWPF Site Location Options

Figure 2-2: AWPF Site Layout

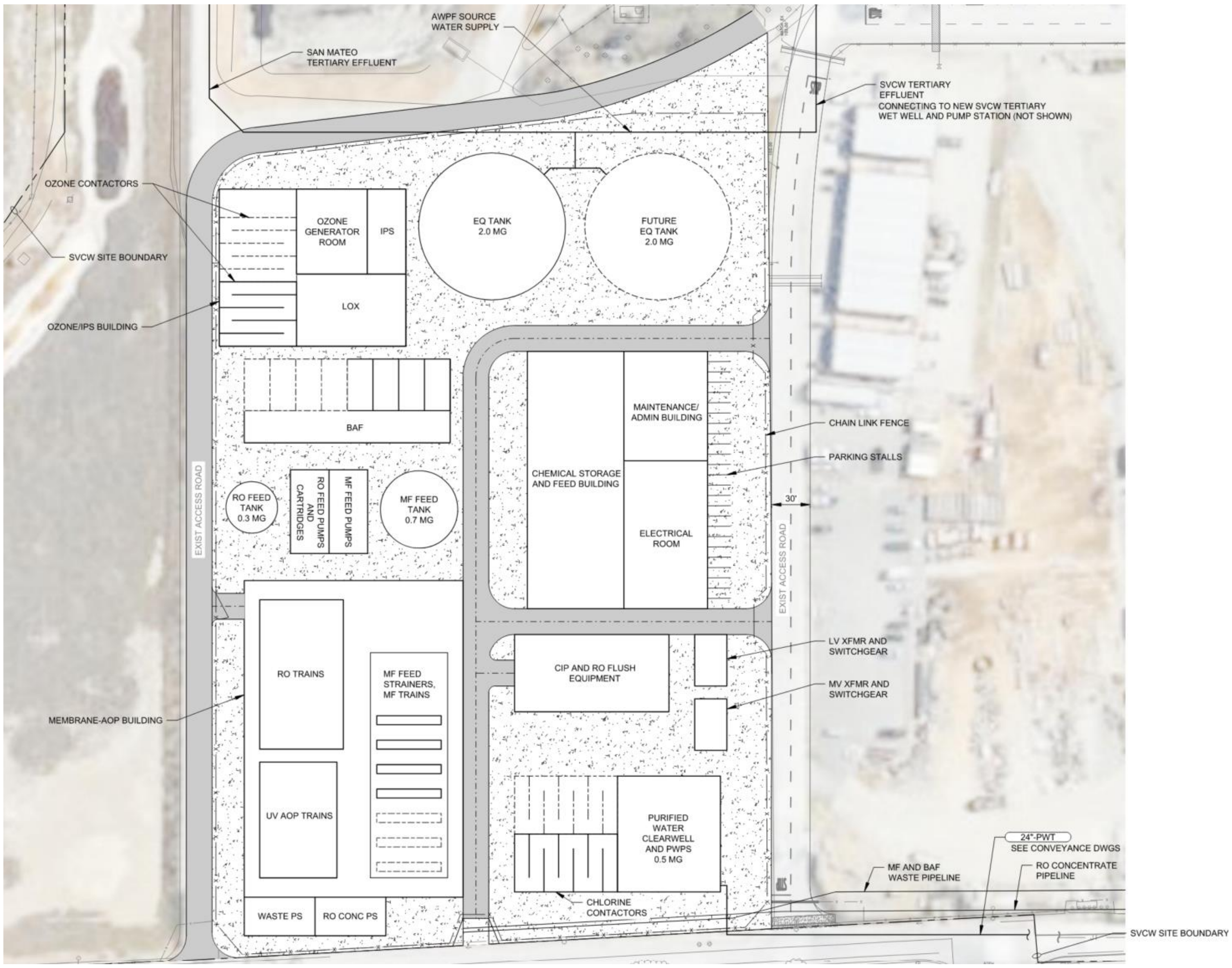


Table 2-1 lists the structural footprint, assumed above grade height and allowable below grade depth of facilities at the AWPF.

Table 2-1: Structural Footprint of AWPF Treatment Facilities

Structural Footprints for AWPF Treatment Facilities	Approx Area (SF)	Type of Structure (-)	Maximum Height above Grade (ft)	Maximum Depth Below Grade (ft)
SVCW Tertiary PS	1,200	semi buried pump station and wet well	7	< 20
Membrane-AOP Building	41,700	above ground building	20	<10
Maintenance Building	5,600	above ground building	20	<10
Chemical Storage and Feed Building	15,000	above ground building	20	<10
Electrical Room	7,500	above ground building	20	<10
Ozone/IPS Building	17,400	above ground building	20	<10
BAF Contactors	10,400	semi buried process structures	7	<30
MF Feed Pumps	2,000	above ground building	7	<10
RO Feed Pumps and Cartridges	2,000	above ground building	7	<10
Chlorine Contactors	7,200	semi buried process structures	7	<30
Waste PS	1,650	semi buried pump station and wet well	7	< 20
RO Concentrate PS	1,650	semi buried pump station and wet well	7	< 20
AWPF Influent EQ Tank	19,100	semi buried tank	7	<30
CIP and RO Flush Equipment	7,200	above ground building	25	<10
LV XFMR and Switchgear	1,000	above ground building	25	<10
MV XFMR and Switchgear	1,000	above ground building	25	<10
Product Water Tank Clearwell	80	semi buried tank	7	<30
MF Feed Tank	2,900	semi buried tank	7	<30
RO Feed Tank	1,300	semi buried tank	7	<30
Total:	**146,000**			

The AWPF would be constructed on Young Bay Mud (YBM) which is known to compress significantly when structures are built on top, causing structures to sink over time. Due to the consistency of YBM, many structures at SVCW are designed to “float” on top of the mud and shallow ground water with full tanks. To prevent structures from being pushed up out of the mud by buoyant forces, piles are constructed. The depth of the piles depends on the specific area on the site and the type of structure the piles are designed to support. In a recent project, SVCW drove piles on center every 8 ft 2 in underneath structures. Some of these piles were as much as 110 ft deep. It is anticipated that similar piles would be designed for the AWPF. It is assumed that as many as 2,190 piles, at a depth of 110 ft per pile, would be needed to support the new AWPF facilities.

2.1.2 Breakpoint Chlorination Facility Footprint

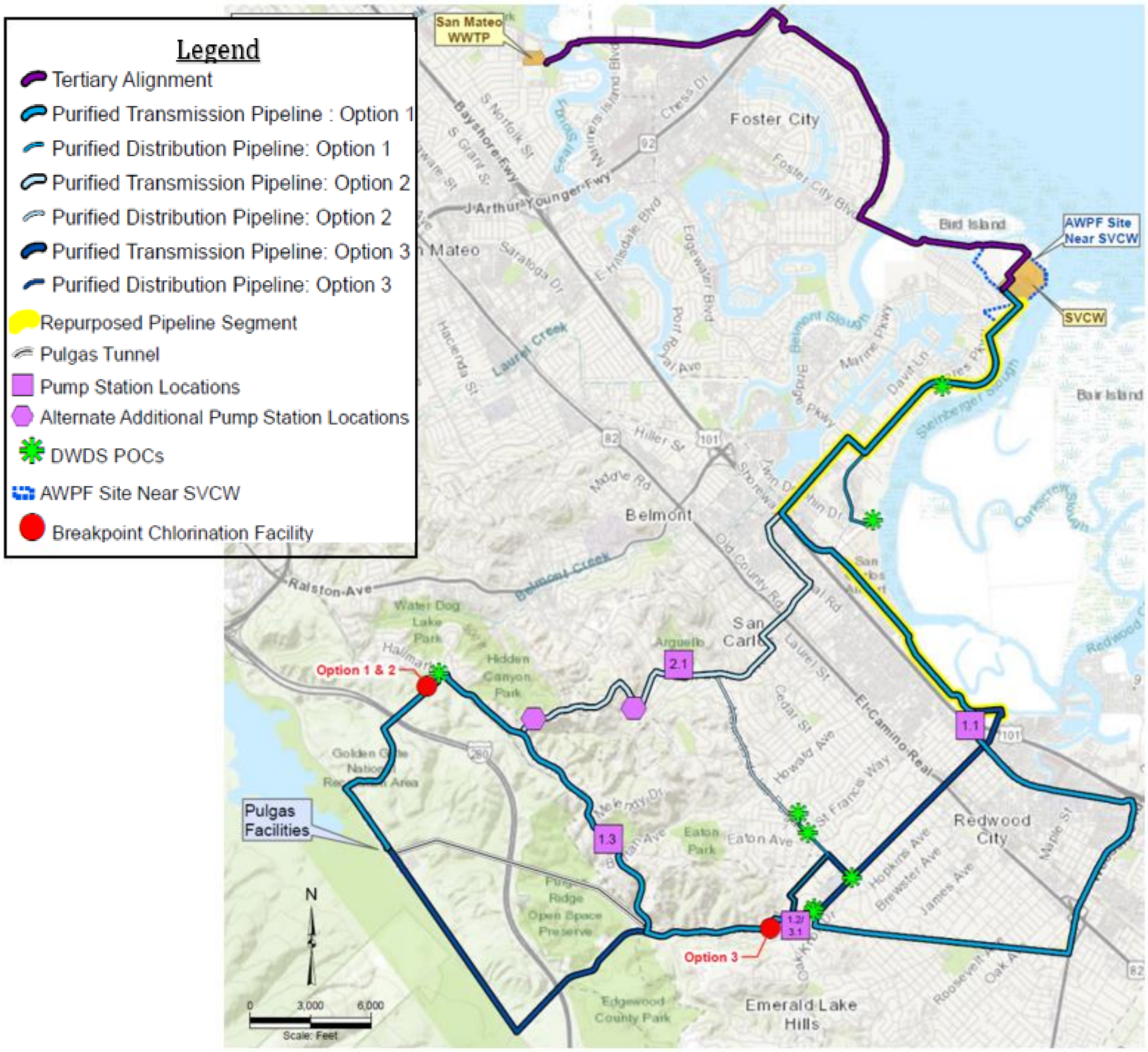
In Phase 2 of the project, a new breakpoint chlorination facility would be constructed along the purified transmission pipeline to feed chemicals and adjust the pH adjustment prior to reservoir augmentation at CSR. The chemical injection point would be located downstream of the last DWDS connection turnout, as shown previously in Figure 1-2. For Purified Transmission Options 1 and 3, the BPC facility would be located downstream of the MPWD Hallmark Tanks. For Purified Transmission Option 2, it would be located near the RWC Sequoia Tanks, downstream of the takeoff to Cal Water Station 103 and the MPWD 20-inch transmission pipeline. The structural footprint of this new Breakpoint Chlorination Facility building would be approximately 1,200 SF. This facility would also require new roadways and paving to provide access for maintenance and chemical deliveries.

2.1.3 Conveyance Facilities and Footprints

Conveyance facilities include pump stations, pipelines, and connections to new and existing facilities. Conveyance facilities (shown in Figure 2-3) described in this section include the San Mateo Tertiary System (includes a new pump station, pipeline, and yard piping/improvements at the San Mateo WWTP site) and the Purified Water System (includes the purified transmission pipeline, purified distribution pipelines, DWDS connections to existing tanks/pipelines, and booster pump stations (BPSs)). There are three alignment options being considered for the purified water transmission pipeline, and each option has different corresponding purified distribution pipelines to serve the DWDS points of connection.

(Note: Conveyance facilities within the AWPF/SVCW fenceline, including the SVCW Tertiary pipeline, upgrades to existing DPS to pump SVCW tertiary effluent, and the RO concentrate pipeline/pump station, and other conveyance at the AWPF/SVCW site, are considered a part of the AWPF facility. Quantities for those facilities are therefore included under the AWPF sections of this CEQA checklist.)

Figure 2-3: PureWater Peninsula Conveyance Facilities



Above-grade facilities associated with the conveyance systems include pump stations, pipeline access points, above ground vaults to house new valves and control equipment, and connections to aboveground facilities (e.g. existing tanks). Above ground pipeline alignments may include pipelines suspended from or supported by an existing bridge. Constructability of these types of crossings would depend on the bridge load capacity, operations and maintenance activities and regulatory requirements. Future detailed review of the bridge design and detailed structural calculations would be needed to confirm the feasibility of an above ground pipeline design. The estimated structural footprints of above-ground conveyance facilities are listed in Table 2-2 and briefly described in this section. Refer to **BODR Appendix F: Drawings** for additional details. Pump station locations are preliminary and would require further study during future design phases. Pipeline vaults/access locations were not identified as part of this project, however, approximate structural footprints were developed based on the lengths of the pipelines and the expected number of pump stations required.

Table 2-2: Structural Footprint of Conveyance Facilities

Structural Footprints for Major Conveyance Facilities	Approx Area (SF)	Type of Structure (-)	Maximum Height above Grade (ft)	Maximum Depth Below Grade (ft)
San Mateo Tertiary Conveyance System	4,000	aboveground pump station with piles, pipeline vaults/appurtenances	25	≤ 20
Purified Option 1				
Purified Transmission Pipeline and Booster Pump Stations (Option 1)	15,500	Three (3) BPSs, above-ground vaults for access/valves/appurtenances	15	≤ 20
Purified Distribution Pipelines and DWDS Connections (Option 1)	2,000	above-ground vaults for access/valves/appurtenances; DWDS connections	10	≤ 20
Purified Option 1 Total:	17,500			
Purified Option 2				
Purified Transmission Pipeline and Booster Pump Station (Option 2)	7,500	One (1) BPS, above-ground vaults for access/valves/appurtenances	15	≤ 20
Purified Distribution Pipelines and DWDS Connections (Option 2)	2,100	above-ground vaults for access/valves/appurtenances; DWDS connections	10	≤ 20
Purified Option 2 Total:	9,600			
Purified Option 3				
Purified Transmission Pipeline and Booster Pump Station (Option 3)	9,500	One (1) BPS, above-ground vaults for access/valves/appurtenances	15	≤ 20
Purified Distribution Pipelines and DWDS Connections (Option 3)	2,000	above-ground vaults for access/valves/appurtenances; DWDS connections	10	≤ 20
Purified Option 3 Total:	11,500			

2.1.3.1 Pipeline Alignments

Pipelines in this section include the San Mateo tertiary alignment and three purified water transmission alignment options, as shown in Figure 2-3. Each purified transmission pipeline alignment has purified distribution pipelines to DWDS connections in Phase 2. At this time, it is assumed most of the pipeline alignments would be constructed in existing streets and PureWater Peninsula Party Agencies' right-of-way (ROW). The centerline of the alignment requires additional study and is not identified in the BODR. Additional evaluation of alignments would be performed in future design phases based on a more comprehensive evaluation of available land for pump stations, geotechnical evaluations for trenchless crossings, structural evaluations for bridge crossings, ability to use the ROW and a more in-depth evaluation of underground utilities.

It is anticipated that several construction methods would be required on the alignments, including open cut construction and trenchless methods. Trenchless methods would be utilized to: (1) cross waterways, highways and railroads, (2) avoid existing utilities in major intersections or congested corridors, (3) mitigate traffic, environmental, and other community impacts. These methods could include Horizontal Directional Drilling (HDD), microtunneling, and jack and bore. A desktop study has been performed to estimate the approximate lengths of various construction methods along each pipeline alignment for cost and CEQA Checklist development.

The Project considers repurposing of two decommissioned pipelines, ranging from 48” to 54” diameter along redwood shores and Bayshore Freeway (as highlighted in Figure 2-3). These pipelines will be replaced as part of the SVCW Regional Environmental Sewer Conveyance Upgrade (RESCU) Program, which will be completed in 2024. This creates an opportunity to repurpose these valuable assets by installing a new pipeline within the decommissioned pipe. Repurposing some or all of these available assets is included in each purified water alignment option, as applicable. Access pits are assumed to be located at angle points or every 1,000 LF, however, further analysis would be needed in detailed design. Repurposing these existing pipelines would reduce community disruption during construction, avoid utility conflicts, and may have lower costs for design and construction. However, reuse of existing pipelines may also be limited by other planned or unknown new projects and the viability and longevity of use would depend on the condition assessment of the asset. There could be potential to reuse/repurpose existing access manholes along the force mains, reducing the amount of above-ground facilities needed.

Open trench construction is generally less costly than trenchless methods and are therefore assumed for the majority of the pipeline alignments, where feasible. It is anticipated that construction closer to the bay would carry a larger cost due to the likelihood of encountering groundwater and less competent soils, including YBM. Therefore, this BODR includes estimates of the lengths of open trench construction along the bay and other open trench construction where significant groundwater/YBM are not expected. Additional studies would be required to confirm the geotechnical conditions and level of the groundwater table. Work within the SFPUC ROW would mostly not be within city streets but would require coordination with other SFPUC operations and future potential pipeline projects, and is also totaled separately.

2.1.3.2 Pump Stations

San Mateo Tertiary Pump Station: A new tertiary pump station is proposed to be located at the San Mateo WWTP site to convey the tertiary effluent from the existing facilities to the new AWPF. Based on discussions with San Mateo staff, it is assumed that the existing Clarifier No. 4, which is slated to be decommissioned as part of ongoing plant upgrades, could be repurposed to serve as tertiary water storage. Pipelines would be constructed within the WWTP site to convey the tertiary water from the plant effluent line (known as the “permeate” line) to the storage reservoir, and from the reservoir to the new pump station. The preferred location for the new pump station is in southwest corner of the site, near the existing Clarifier No. 4. The exact location and layout would be identified in future design phases. Because the site is underlain by YBM, it is assumed that as many as 45 piles, at a depth of 100 ft per pile, would be needed to support the new tertiary pump station.

SVCW Tertiary Pump Station: SVCW is currently upgrading their Final Effluent Pump Station, which conveys tertiary effluent directly to the 66-inch outfall. A new connection could be made to the outfall, downstream of the final effluent pumps. A new SVCW Tertiary Pump Station would be required to overcome the static head (due to depth of the outfall) and to convey the water into the AWPF equalization (EQ) Tanks. It is assumed that the new pump station would include a wet well to break head from the existing low pressure outfall system. The short pipe segment between the outfall and the wet well could be sized large to ensure that water could be conveyed to the wet well using the existing system head. It is assumed that vertical turbine pumps would be installed, although horizontal or submersible pumps could also be considered. The new wet well could have a flow control valve. It is assumed that flow control would also be required on the existing 66-inch outfall line, so that adequate flow could be directed to the new wet well and pumps. The exact location and layout would be identified in future design phases. Because the site is underlain by YBM, it is assumed that as many as 45 piles, at a depth of 100 ft per pile, would be needed to support the new tertiary pump station.

Purified Water Transmission Booster Pump Stations: It is anticipated that between one to three intermediate BPSs would be required along the purified water transmission pipeline, depending on the alignment selected. Option 1, the longest alignment, would require three booster pump stations (BPS 1.1, 1.2 and 1.3). Option 2 would require one booster pump station (BPS 2.1), however, additional alternative site locations are included in this CEQA Checklist, since the alignment is in a particularly built-out area with residential homes. These alternative pump station sites include one alternative site for BPS 2.1, as well as alternatives for a second booster pump station (BPS 2.2-Alt 1 and BPS 2.2-Alt 2). The second booster pump station (BPS 2.2) is not expected to be required, but was included for CEQA consideration given the expected siting challenges and unknown hydraulic conditions. Option 3, which has the lowest static lift of the purified options, assumes one booster pump station (BPS 3.1).

Siting of above ground facilities is expected to be a key project challenge. For the BODR, it is assumed that the BPSs would include canned vertical turbine pumps to reduce footprint and would be housed in above-grade buildings. Below grade pump stations could also be considered in future design phases. New power connections would be required for the pumps and related equipment (supervisory control and data acquisition [SCADA], power, valves, lighting, etc.). Backup power could also be installed, if desired, but additional space for generators would be needed.

The structural footprint for pumps stations would include a building for pumps, power and related equipment. It is assumed that each pump station building would be approximately 60 feet by 24 feet. Additional siting studies would be required to confirm availability of land, power, and access requirements.

2.1.3.3 Purified Transmission Pipeline Connection to Pulgas DF

The purified transmission pipeline would terminate at the SFPUC Pulgas DF. Upon preliminary discussions with SFPUC, a potential tie-in location to the existing facilities would be prior to the 9-ft or 11-ft weir to maintain separation between the existing potable and proposed treated recycled water supply. Additional points of monitoring for flow and water quality, as well as flow control, would be warranted upstream of where the purified water enters the Pulgas DF to provide SFPUC with operational flexibility, and are included in the estimates for each purified option. Given the planned increase in capacity of the Pulgas Discharge Channel and current capacity of the Pulgas DF, no major capital infrastructure modifications are assumed to be needed to support the PureWater Peninsula project. Associated structural footprints are therefore included in the purified pipeline estimates. However, SFPUC may elect to explore additional alternatives analysis of providing an independent dechlorination system upstream of Pulgas DF in future studies. If so, the footprint for this facility would need to be identified in the CEQA checklist.

2.2 Roadways and Parking Areas

Roadways and parking areas – existing & created by the project (both permanent and temporary).

New roadways for the AWPF would leverage existing roads at SVCW for access to a new entrance and the existing roadways around the planned treatment facilities, as shown in Figure 2-2. Parking areas would be located in front of the Maintenance Administration Building and other open areas around the site. Approximately 2,200 square yards of roadways are anticipated in this phase of design. The total footprint of future parking areas would be determined in future design phases.

The new Breakpoint Chlorination Facility would require roadways for access and chemical delivery. Siting for the facility would depend on land availability and the purified option selected. Approximately 10,000 square feet of roadways and paving are anticipated in this phase of design. The total footprint of future parking areas would be determined in future design phases.

New paving and parking areas for conveyance facilities would include access and parking at the BPSs. It is not anticipated that new roadways would be constructed, as land availability is limited. It is assumed that BPSs would be designed with reduced footprints and constructed at existing PureWater Peninsula Party facility sites, or at open land (e.g. parks, empty lots, etc.) Between one and three BPSs would be required depending on the purified option selected. It is assumed that each BPS could include up to 1,000 SF of paving.

Temporary parking requirements during the construction of Phase 1 and Phase 2 for the Project would also be determined in future design phases.

No major roadwork is anticipated. All new facilities are anticipated to be located at or close to existing/paved sites and roadways.

2.3 Utility Lines

Utility lines, including construction utilities such as electrical or dewatering lines. Water crossings should be clearly marked. Estimated pole locations should be marked.

The **BODR Appendix F: Drawings** shows existing water and wastewater lines at SVCW in the vicinity of the preferred AWPF location. Existing utilities at SVCW were considered as part of the layout of the new treatment facilities and associated pipelines at the AWPF. One (E) 30" recycled water line, one (E) 20" recycled water line, two (E) 4" water lines, existing communication and electrical lines run along the southern edge of the AWPF site. One existing 42" filtered water line, a storm drain and irrigation lines run parallel to the western edge of the secondary clarifiers and would cross the proposed 20" SVCW tertiary pipeline. There may also be an abandoned recycled water line that previously fed the wastewater stabilization pond prior to construction of RESCU project within the AWPF site. The alignment of the source water supply line to the equalization tank, the RO concentrate line from the RO concentrate pump stations to the SVCW outfall, the microfiltration (MF) and biological aerated filter (BAF) waste pipeline and the purified water pipeline were aligned to avoid and minimize impact on existing utilities.

For the tertiary, purified transmission and distribution pipelines, utility considerations have been based upon available record drawings and geographic information system (GIS) data provided by the PureWater Peninsula Parties. Comprehensive utility locating and identification of conflicts are not included in the BODR. It is assumed that trenchless methods, such as jack and bore, would be used in congested traffic and utility corridors to reduce construction disturbances and utility conflicts unless soil and/or groundwater conditions dictate the use of more intensive methods. Proper separation requirements would be maintained unless approved exceptions are granted.

A comprehensive utility survey is required to determine if other main utilities need to be relocated or if there is an alternative alignment that would have a reduced impact. Construction power supply and location of power poles have not been identified.

2.4 Standby Generators and SCADA Equipment

Emergency generators, SCADA equipment.

The conceptual design includes a permanent standby power generator located at the new AWPF facility and at the San Mateo tertiary pump station. The generator could be propane or diesel and would likely be located at or the main electrical room (see Figure 2-2). Future design studies at a 30 percent level would confirm power demands for the AWPF, San Mateo tertiary pump station, and the conveyance pumping requirements. Future design studies should also consider options for power redundancy, backup power sources, and other measures to ensure reliability. Given the long lead times for bringing in new power loads, discussions with PG&E should be initiated to understand the capacity for and costs associated with power delivery.

The AWPF would have an independent SCADA system that would collect data and communicate with the San Mateo WWTP, SVCW, SFPUC's Regional Water System (e.g., Pulgas DF) and local DWDS that would receive purified water. The tertiary pump station at the San Mateo WWTP would utilize existing SCADA systems at the San Mateo WWTP.

For BPSs along the purified water transmission pipelines, it is assumed that there would be no permanent standby generators due to space constraints. The Project may choose to have one or more mobile standby power generators to send to BPSs if needed. Since the purified water is a supplemental water source to these systems, if a BPS loses power, purified water delivery would stop. For data collection and communication, each BPS would have panel for SCADA. Communication between the local drinking water agencies' SCADA systems and the PureWater Peninsula Project SCADA system(s) would be integrated to monitor and control TWA and RWA deliveries from the AWPF.

Temporary power would also be necessary for construction activities and at construction trailers. Temporary generators can be used for construction power requirements along the pipeline alignment. Generators for construction use would comply with Bay Area Air Quality Management District requirements with respect to air quality.

2.5 Fencing

Fencing (permanent and construction).

It is assumed that new permanent fencing would not be required for new facilities located within the existing treatment facilities, including San Mateo WWTP and Pulgas DF. Temporary construction fencing would be installed around construction sites since the existing facilities would be continuing typical operation. Lengths of temporary fencing were not determined in this BODR.

The AWPF site is located within the existing SVCW fenceline. For additional security, a new fence would be installed around the AWPF. The AWPF site layout in Appendix F shows the new fence line around the SVCW facility. The construction fence line for the AWPF would include selected staging areas, which could include the area adjacent to the AWPF site that is currently being used as a staging area for other projects at SVCW. The type of construction fence line is to be determined.

Permanent fencing would not be required at the tertiary pump station at the San Mateo WWTP, as it is located within the existing fence line of the WWTP.

Permanent fencing would be required at the BPSs along the purified water transmission pipelines. BPS 1.3/3.1 are assumed to be located at the RWC Sequoia Tanks Site. If future siting studies confirm this approach is feasible, additional fencing would not be required within the existing fenced site. Based on a typical footprint, approximately 250 LF of fencing would be required for each BPS site. Permanent fence details are to be determined based on available space, surrounding land use and local requirements.

Temporary fencing would also be used along the pipeline alignment during construction activities involving regrading, trenching, and for access shafts or pits. Fencing and/or k-rail would be used to close areas to the public.

Temporary fencing would also be required at the staging areas, where construction materials and equipment would be stored when not in use. Potential staging areas are identified in Section 2.8.

2.6 Spoils Areas

Spoils areas.

Soil excavation and disposal, and the amount of suitable soil available for on-site borrow, would be determined once additional soil contamination work has been performed to determine the extent of contamination. At the AWPF, the maximum below grade depth and above grade height for new facilities, -20 ft and +25 ft, respectively) would impact the amount of excavation necessary and on-site borrow soil quantities for construction. This would be similar for pump station construction, where the amount and quality of excess material would depend on site specific conditions at each location. For conveyance trenching and access shafts or pits, it is assumed that the majority of suitable soil would be reused for backfill, with excess material hauled off and imported material used as needed.

Excavated soil that is contaminated and/or unsuitable would be hauled off-site for treatment and disposal. Potential landfills for disposal would depend on soil quality and have not been identified at this time. Suitable, competent soil excavated from the AWPF site would be used as fill for other areas. Temporary stockpiling of supplemental backfill material may be necessary depending on the quantities of contaminated soil being excavated and backfill material needed. The area adjacent to the AWPF site within the SVCW property line may be a suitable area for stockpiling material.

2.7 Grading Areas

All grading areas, such as cutting into a slope.

The SVCW North Pond Area where the proposed AWPF would be constructed is a relatively flat unpaved area. This area has been used for excess soil stockpiles from RESCU construction since 2018. Final disposition of the stockpile volume is unknown at this time. It is anticipated that the site would require significant grading and earthwork to prepare for construction of new AWPF facilities, pipelines and access roads.

The **BODR Appendix F: Drawing** includes a preliminary grading and drainage plan for the AWPF at the North Pond site (Drawing C-04). The limits of the disturbed area is approximately 30,100 square yards, which includes the total AWPF construction area (not including construction staging areas or pipelines to existing SVCW facilities) minus the roadway retained. The site would be graded (cut and fill), with some facilities constructed below grade. Estimating the amount of earthwork and grading required for the construction would require more detailed survey, soil and geotechnical information. Excavation required for structural piles and other below grade facilities would also require additional field investigations. It is anticipated that there would not be a significant net change to the site surface elevation upon construction completion from current conditions and the existing drainage patterns would be maintained.

There would be minor site grading for the tertiary pump station at the San Mateo WWTP, since this site is also located at an established treatment facility that is paved and relatively level. A grading plan has not been developed at this time as the exact location would be determined once the San Mateo WWTP upgrade project is complete and the available space identified in the southwest corner of the site.

Grading for future BPSs along the purified water transmission pipelines would be determined in future design phases based on available space and topography at the identified sites.

Grading for pipeline alignments would generally restore the existing grade after construction. Typical trench depths would typically be between 8 and 10 ft. Trenchless access shafts or pit depths may be deeper to reach competent soil (e.g., below the YBM Layer).

For all construction areas, grading would be performed to provide adequate drainage and meet local requirements for managing stormwater during and after construction.

2.8 Laydown/Staging Areas

Laydown/staging areas.

Onsite staging and stockpiling areas would be designated for the contractor to store construction material, pile excavated spoils, park vehicles, and trailers. Given the level of design provided in the BODR, this information is preliminary in nature and future design efforts would be needed to refine estimates and locations of laydown and staging areas.

Several potential laydown and staging areas were identified with input from the PureWater Peninsula Parties. Future studies would be required to determine availability of using these sites and the total staging areas required for the project. Conceptual laydown/staging areas are shown in the **BODR Appendix F: Drawings.** Potential on- and off-site construction staging areas may include but not be limited to:

- Area adjacent to the AWPF site within the SVCW property line (3 acres)
- Available area within the San Mateo WWTP property line to support construction of the effluent pump station and pipeline, and parking lot on Detroit Drive. (0.2 acre)
- An independent staging area and temporary closure on Foster City Boulevard would be required for staging pipeline for HDD crossing of the tertiary alignment under the Belmont Slough. (3 acres)
- An independent staging area in Shorebird Park for staging related to the HDD crossing of Belmont Slough (2 acres)
- The Highway 101 site, which has previously been used for staging during the SVCW RESCU Project, to support construction of the purified water transmission and distribution pipelines (14 acres). The County may have a planned use for this area in the future, but if available, this may be a suitable site for staging for the Project.
- Lot near Portside Business Park in RWC to support construction of the purified water transmission and distribution pipelines (6 acres)

SFPUC's right-of-way area where the Bay Division Pipelines (BDPL) are buried could potentially be made available for storage of equipment, through no heavy equipment or excessive materials should be placed here in order to prevent damage to the buried pipes. Specific staging areas in the BDPL right-of-way could be determined in future design phases.

The preliminary design does not include significant improvements at the SFPUC Pulgas DF site, however the parking areas may be used to support construction of the pipeline near CSR and construction of the point of the connection to the Pulgas DF. Specific staging areas could be determined in future design phases.

While the exact locations of trenchless crossings have not been identified at this BODR level, work areas would be required around the launching and receiving pits to conduct mining operations.

Temporary onsite storage and staging at or near BPS locations and along the pipeline alignments, likely in the right of way, would be determined in future design phases. In order to address security issues along the pipeline alignment, assume that temporary fencing would be required around staging and work areas as the pipeline is installed.

2.9 Limits on Construction Area

Absolute limits on construction area (provide map, square feet/acreage of the project site). Nothing can occur outside of this area – no parking cars for the workmen, no ground disturbance, nothing. Give yourself enough room to work. However, don't add areas you know you would not need, as it makes the environmental review much more difficult. For example, if you show that an area of trees is within the construction area, EM would assume those trees would be taken down

Conceptual limits on the construction areas are summarized in Table 2-3.

Table 2-3: Estimated Construction Limits

Limits on Construction	Approx Area (acres)	Notes
AWPF Facility and Pipelines Within SVCW Fenceline	7	Includes all facilities, roads, staging area, etc.
Breakpoint Chlorination Facility	5	Includes all facilities, roads, staging area, etc.
Conveyance		
San Mateo Tertiary Pipeline and PS	35	Assumes a 50-ft wide width of way along pipeline alignment, which would include pump stations and access shafts, connection to Pulgas DF, plus additional area for laydown/staging areas.
Purified Option 1	109	
Purified Option 2	73	
Purified Option 3	85	
Total	**156**	**Assumes most conservative purified option.**

For the AWPF, the construction limits extend over most of the southern portion of the SVCW to provide the most flexibility during construction. Since this area has been used as staging for multiple SVCW projects, the site within the construction limits is already a disturbed area.

For the tertiary pump station at the San Mateo WWTP, the limits of construction reflect a defined area in the southwest corner of the site, which has been previously disturbed. This area may reduce in size once a preferred location for the pump station and staging areas are identified during future design stages.

For pipeline alignments, a 50-ft wide buffer along the right-of-way is assumed to set the construction limits for most of the work performed along the alignment, including open trenching and access pits for trenchless construction. For future BPSs along the purified water transmission pipelines, estimated limits of construction reflect a typical pump station of 60x24 ft with additional space for road access around and to the site. The extent of the construction limits would be determined in future design phases based on available space and topography at the identified sites. Additional locations are identified for potential layout/staging areas, including along Foster City Boulevard at the HDD crossing of Belmont Slough. The majority of the pipeline alignments are within roads and other public ROWs. Most heavy construction activities would be confined to the area above the new pipeline. Construction activities, stockpiling of spare pipes and excavated materials may require lay down mats to distribute the loads and provide sufficient cover above existing underground utilities. Public encroachment would occur when the pipe alignment crosses public pathways such as roads, parks and parking lots. There is a possibility that trucks and other construction vehicles would need to park temporarily on residential roads during construction. Locations have not been specified at this time.

2.10 Estimated Cut/Fill Information

Estimated cut/fill information (cubic yards and acreages preferred, but LxWxD is OK). This is necessary for various topical analyses, such as truck haul estimates in the traffic section, land disturbance, etc.

The construction of new treatment facilities at the AWPF, Breakpoint Chlorination Facility, and conveyance facilities would require earthwork for treatment facilities, pump stations and pipelines. The estimated cut and fill quantities are described in the following sections. The net disposal volume is used to estimate truck hauling in the traffic section, land disturbance and other topical areas of the CEQA analysis. Given the level of design provided in the BODR, this information is preliminary in nature and future design efforts would be needed to refine estimates based on selection of a preferred pipeline alignment and identification of preferred locations for pump stations.

2.10.1 AWPF Facilities Cut/Fill Information

This section describes approximate cut/fill quantities based on available topographic data. As noted in previous sections, the SVCW North Pond Area where the proposed AWPF would be area has been used for excess soil stockpiles from RESCU construction since 2018. Final disposition of the stockpile volume is unknown at this time. It is anticipated that the site would require significant grading and earthwork to prepare for construction of new AWPF facilities, pipelines and access roads. This additional earthwork is unknown and therefore not included in the estimates below.

AWPF buildings with basement and/or underground access, EQ tanks and wet wells would require excavations up to a maximum depth of 20-35 ft. The estimated cut, fill and excess volume for major AWPF facilities is presented in Table 2-4. Buildings are assumed to require 5 feet of excavation. Outdoor equipment is assumed to have slab-on-grade construction with minimal cut/fill. Soil excavated to make room for underground facilities would be used as fill for other facilities. The overall site would be backfilled approximately to existing levels using suitable stored material from the site or new imported material. The total estimated volume for disposal is assumed to be 40 percent of the cut volume.

Table 2-4: Estimated Cut and Fill of AWPF Treatment Facilities

Cut/Fill Area for AWPF Treatment Facilities	PHASE 1		PHASE 2	
	CUT	HAUL	CUT	HAUL
	CY	CY	CY	CY
AWPF Facility				
SVCW Tertiary Pump Station	1,505	602		
Membrane-AOP Building	8,500	3,400		
Maintenance Building	1,167	467		
Chemical Storage and Feed Building	3,111	1,244		
Electrical Room	1,556	622		
Ozone/IPS Building	3,731	1,493		
BAF Contactors	7,500	3,000	7,500	3,000
MF Feed Pumps	486	194		
RO Feed Pumps and Cartridges	486	194		
Chlorine Contactors	2,361	944	2,361	944
Waste Pump Station	1,944	778		
RO Concentrate Pump Station	1,944	778		
AWPF Influent EQ Tank	16,755	6,702	16,755	6,702
CIP and RO Flush Equipment	1,685	674		
LV XFMR and Switchgear	324	130		
MV XFMR and Switchgear	324	130		
Product Water Tank Clearwell	4,861	1,944		
MF Feed Tank	4,989	1,995		
RO Feed Tank	2,545	1,018		
Pipelines within SVCW Fenceline	5,000	2,000		
Total Estimated Volume for Disposal:	69,000	28,000	27,000	11,000

2.10.2 Conveyance Facilities Cut/Fill Information

Major earthwork associated with the conveyance facilities would include pipeline trenching, mining for trenchless crossings, construction of access shafts/pits, construction of valve and instrument vaults, and pump station site preparation/foundations. Site specific details about trench dimensions, cover above the crown of the pipeline, shoring, and other construction techniques would be determined in future phases of design. The existing surface would be restored to the prior conditions unless otherwise specified by the designers. It is anticipated that finished elevation would be the similar to pre-construction conditions.

For the purpose of this BODR, the following assumptions are made:

- The majority of suitable excavated soil would be used for fill.

- Open trenches for pipelines 18-inch diameter and less would be 4-ft wide and 8-ft deep to provide approximately 6 feet of cover to top-of-pipe.

- Open trenches for pipelines larger than 18-inch diameter would be 6 feet wide and 9 feet deep to provide approximately 6 feet of cover to top-of-pipe.

- Detailed information on installation pits for trenchless methods (jack and bore, microtunneling, etc.) is not available at this time. Pits could be circular or rectangular in shape and the specific dimensions would vary based on soil and site conditions. Approximate average pit dimensions were assumed for preliminary cut/fill estimations. Mining spoils would be hauled off site.

- Pits for trenchless pipeline installation using jack and bore or similar techniques are assumed to be 30 ft wide x 12 ft long x 20 ft deep.

- Microtunneling launching pits were assumed to be 75 feet long x 30 feet wide x 60 feet deep. Receiving pits were assumed to be 60 feet long x 25 feet wide x 60 feet deep.

- For the HDD crossing, the entry and exit sites would be leveled to facilitate drilling operations. It was assumed that shallow pits would be installed on both ends of the crossing. It is assumed this pit would be 60 feet long x 20 feet wide x 19 feet deep. Further analysis and geotechnical investigations would be required to confirm HDD construction requirements. Mining spoils would be hauled off site.

- Purified booster pump stations would be above-grade buildings.

Most suitable excavated material would be used for backfill or regrading. It was assumed that 40 percent of the excavated material would be off-hauled. The estimated cut and haul quantities for major conveyance facilities is presented in Table 2-5.

Table 2-5: Estimated Cut and Fill of Conveyance Facilities

Cut/Fill Area for Conveyance Facilities	PHASE 1		PHASE 2	
	CUT	HAUL	CUT	HAUL
	CY	CY	CY	CY
San Mateo Tertiary PS and Pipeline	55,000	22,000		
Purified Option 1				
Transmission Pipeline and BPSs (Opt 1)	128,000	51,000		
Distribution Pipelines for TWA (Opt 1)			15,000	6,000
Purified Option 2				
Transmission Pipeline and BPS (Opt 2)	78,000	31,000		
Distribution Pipelines for TWA (Opt 2)			18,000	7,200
Purified Option 3				
Transmission Pipeline and BPS (Opt 3)	85,000	34,000		
Distribution Pipelines for TWA (Opt 3)			5,000	2,000
Total Estimated Volume for Disposal *(assuming the most conservative purified transmission option)*	183,000	73,000	15,000	6,000

2.11 Depth of Excavation

Maximum depth of excavation.

The following assumptions have been made to support the cut and fill estimates presented in Table 2-4 and Table 2-5.

- Maximum depth of excavation for below grade buildings and tanks at the AWPF = 35 ft.
- Maximum pile depth at the SVCW site = 110 ft
- Maximum pile depth at the San Mateo WWTP site = 100 ft
- Maximum depth of a typical open trench pipeline = 9 ft to 12 ft deep
- Maximum depth for access pits or shafts for trenchless pipeline installation = 120 ft

2.12 Planned Changes in Topography

General information about elevation, and planned changes in topography. This includes spoils areas – provide a cross-section of the fill, or at least some type of quantified description.

There would be grading at all construction sites, resulting in minor changes to surface elevations, but there are no planned significant changed in topography due to this Project. The **BODR Appendix F Drawing C-04** shows the grading plan for the AWPF. Refer to Section 2.7.

2.13 Type of Construction to be Used

Specific information about the types of construction equipment to be used. This is to determine noise and air quality impacts.

Major construction activities for the Project include constructing buildings, storage and other treatment facilities at the AWPF site, pile driving at the AWPF site and at the San Mateo WWTP (for the tertiary pump station), open trench and trenchless installation for pipeline alignments (including open trench, jack-and-bore, microtunneling, HDD and/or pipe suspension), constructing new above-ground booster pump stations along the purified transmission pipelines, connecting to new/existing facilities (e.g. weir at Pulgas DF, DWDS connections), and grading and repatching streets.

- General equipment required for these types of construction activities include, but are not limited to excavator, loader, compactor, pneumatic tire roller, sheepsfoot roller, vibratory steel roller, grader, scraper, hydraulic hammer, paver, bulldozer, trencher/saw cutter, trucks (dump truck, water truck, concrete trucks, and contractors' trucks), air compressors, and crane with telescoping boom.
- Additional equipment for installing pipeline along the right of way include jack hammers, electric generators, concrete mixers, welding machines, dewatering pumps, hydraulic pumps, shoring materials, and ventilation fans.
- Trenchless pipeline installation under major roadways or railroad tracks would utilize jack and bore tunneling machines with the general construction equipment listed previously.
- Microtunneling would be accomplished using a Microtunnel Boring Machine (MTBM) and other specialized equipment.
- HDD of the pipeline under the Belmont Slough would utilize specialized HDD equipment.
- Slip lining and anchoring the new pipeline into the decommissioned SVCW pipelines (once the RESCU Program is complete) along Redwood Shores Parkway, and Inner Bair Island, would be accomplished through access pits at angle points in the carrier pipe to pull the new pipeline through using specialized equipment.
- Pile-driving equipment would be identified by the general contractor.

A more detailed construction equipment list would be developed during future design stages to evaluate noise and air quality impacts.

2.14 Structures Affected

Information on all structures affected by the project, including age of existing buildings if known. This is necessary for the historic analysis and needs to be coordinated with the environmental team member early in the process to determine if further studies are needed. This is especially important if demolition or alteration of structures is planned.

Demolition/significant structure modification is not currently anticipated for the Project.

Most above ground structures for the Project would be located at the new AWPF at the North Pond Area of the SVCW site. This is an open, disturbed area that has been used for staging and storing excavated materials during other SVCW projects. There are no existing structures to be impacted at this location.

It is assumed that the new SVCW Tertiary Pump Station would be constructed at SVCW, but not within the AWPF site. The current BODR assumes this would include a wet well and connection/modifications to the existing 66-inch outfall pipeline. It is assumed that a new pump station could be sited such that significant impacts to existing structures, including the SVCW Final Effluent Pump Station and RWC chlorine contactors, are avoided, however, a more detailed analysis is recommended. Other potential alternatives could include wall penetrations or piping upgrades to the existing SVCW main treatment building or the RWC treatment facilities on site.

A new tertiary pump station would be located at the San Mateo WWTP. Currently it is assumed that the pump station would be constructed at an open, disturbed area of the WWTP site. Several facilities are designated to be abandoned in-place in the southwest corner of the site. These locations may be suitable for the new San Mateo tertiary pump station and could potentially be demolished to make room for the new pump station. Demolition of abandoned infrastructure at the disturbed site is not assumed to be an impact attributable to the project. Additionally, this project assumes the existing decommissioned Secondary Clarifier No.4 would be repurposed to provide tertiary storage. There is also potential for other secondary clarifiers to be repurposed for this use. Such work could include modifications to these structures.

Selection of a preferred BPS along the purified water transmission line would be driven by the availability of land for the facility. It is anticipated that preferred sites would not have an existing structure located on them.

Pipeline alignments would generally be in the ROW, avoiding existing structures.

Pipelines supported on bridges would undergo additional analysis to avoid impacting existing structures. Detailed structural calculations would be performed during design to confirm that the existing structure can accommodate the added weight of the pipeline and any additional loads that may be placed on it. The pipeline would also be designed to withstand the stresses that may be placed on it due to the movement of the bridge, such as vibrations, and vertical and/or lateral movements. Estimates of the flexure of the bridge due to dynamic loadings would be developed and the pipeline design would accommodate these vertical deflections both at the abutments and along the span. Expansion joints would be installed to allow for movement and prevent stress on the pipeline. The pipeline would be supported on the bridge using suitable brackets and similar structural elements.

2.15 Off Spoils Areas

Information on offsite spoils areas (and a list of potential landfills if possible). CEQA addresses environmental impacts on offsite spoils areas.

The location of the offsite spoils areas have not been determined at this level of study and would be evaluated as part of future design efforts.

2.16 Addresses of Site

Official address of site (or mailing address if no "official" address), if known. Many PUC facilities do not have addresses.

- The AWPF would be located at the SVCW, located at 1400 Radio Road, Redwood City, California 94065.
- The tertiary pump station would be located at the San Mateo WWTP, located at 2050 Detroit Drive, San Mateo, California 94401.
- The purified water transmission line would connect to the Pulgas Dechloramination Facilities, located at 56 Cañada Road, Redwood City, California 94062
- The DWDS Points of connections do not have an official address. A mailing address for each drinking water agencies is instead provided below:
- Redwood City Public Works Department, - 1017 Middlefield Road, Redwood City, California 94063
- CalWater Bayshore District 341 N Delaware Street, San Mateo, California 94401
- Mid-Peninsula Water District - 3 Dairy Lane, Belmont, California 94002

2.17 Future Operations/Maintenance Activities

Description of future and operations maintenance activities

As presented above, the Project would be implemented in two Phases:

- Phase 1 – Indirect Potable Reuse (IPR) via Reservoir Water Augmentation (ResWA) at CSR. The AWPF would be constructed to produce 6 mgd of purified water and conveyance facilities would be constructed to convey tertiary effluent from San Mateo WWTP to the AWPF and purified water from the AWPF to CSR.
- Phase 2 – Expansion to include Direct Potable Reuse (DRP) via Treated Water Augmentation (TWA) for local use by the RWC, Cal Water and/or potentially the MPWD. The AWPF would be expanded to produce 12 mgd of purified water for ResWA and TWA. Purified water distribution facilities would be constructed to convey water to each DWDS point of connection.

Whether the Project is delivering water for ResWA (Phase 1) or ResWA + TWA (Phase 2), the addition of a new source of supply to the RWS would either supplement or displace water that would otherwise be delivered to the SF Peninsula from the Regional Water System (RWS). Three seasonal operational scenarios have been developed to set some operational guidelines for the AWPF:

- **Seasonal Operational Scenario 1: Continuous AWPF Production** – During dry years the AWPF would continuously operate at the design capacity, 24 hours a day, seven days a week, year-round.

- **Seasonal Operational Scenario 2: Ramped Down AWPF Production –** During normal to wet years, the AWPF would operate at the design capacity during the summer months (May to October) and ramp down to as low as the minimum design flow during winter months (November to April), depending on available storage in the RWS. This would allow for the AWPF to maintain purified water production, and avoids the operational complexity associated with a full plant shutdown. The AWPF would coordinate with AWPF source water providers, SVCW and San Mateo, to reduce deliveries as appropriate. The AWPF would still run 24 hours a day, seven days a week, year-round, but at a reduced capacity.

- **Seasonal Operational Scenario 3: Seasonal AWPF Shut Down** – During wet to extremely wet years, the AWPF would operate at full capacity during summer months (May to October), followed by a full plant shutdown period during the wet winter months (November to April). Full plant shutdown protocols would be developed during the design of the AWPF and would include an implementation schedule for AWPF operations staff to follow. The AWPF would still run 24 hours a day, seven days a week for six months and would shut down for six months, retaining a minimal number of staff to shut down the plant in November, preserve the membranes, maintain equipment during the off period and then prepare equipment to restart in May.

The overall operational scheme for the AWPF would be managed by the direct potable reuse responsible agency (DiPRRA) that would be responsible for complying with the DPR regulations. The DiPRRA would likely be SFPUC, who in turn would work in close coordination with the SFPUC RWS operations team, AWPF source water providers (SVCW and San Mateo) as well as local water purveyors. The quantify of purified water produced would be influenced by hydrologic conditions, available storage in the RWS Water Bank and local demands. The conveyance facilities would subsequently follow these same operational scenarios.

Responsibilities for maintenance, repair and replacement (MR&R) activities has not yet been fully defined due to the number of PureWater Peninsula Parties and need for an institutional framework to clearly define roles and responsibilities. For the purpose of this document, the following assumptions are made regarding:

- MR&R for the AWPF would be the responsibility of the DiPRRA, which is assumed to be SFPUC.

- MR&R for components that connect to the SVCW facility would be the responsibility of SVCW, in close coordination with SFPUC.

- MR&R for the purified water transmission pipeline, BPSs and connection to the Pulgas DF is assumed to be SFPUC.

- MR&R for the tertiary effluent pump station at the San Mateo WWTP would be the responsibility of the City of San Mateo.

- MR&R for the for the tertiary pipeline could be the responsibility of SFPUC, the City of San Mateo or a combination of the two.
- MR&R for the purified water distribution pipelines and points of connection to local DWDS would be the responsibility of the drinking water distributor, with or in close coordination with SFPUC.

Refer to Section 9.2 for estimated staffing levels.

2.18 Parking/Loading Spaces

Information on parking/loading spaces (numbers of each, including handicapped spaces).

New parking spots and loading spaces would be integrated into the site layout at the AWPF near the administrative building and in front of treatment processes that would require deliveries and MR&R activities. Please refer to the **BODR Appendix F: AWPF Drawings C-03** for the AWPF site layout.

New parking spots and loading spaces would not be required at the tertiary pump station at the San Mateo WWTP, as existing areas at the WWTP could be utilized.

At least one area to park and load would be accommodated for at each BPS location along the purified water transmission pipelines for maintenance only.

Points of connection to existing DWDS would utilize existing parking and loading spaces.

The point of connection to the Pulgas DF would utilize existing parking and loading spaces.

The new Breakpoint Chlorination Facility would require at least one area to park, as well as access for chemical deliveries.

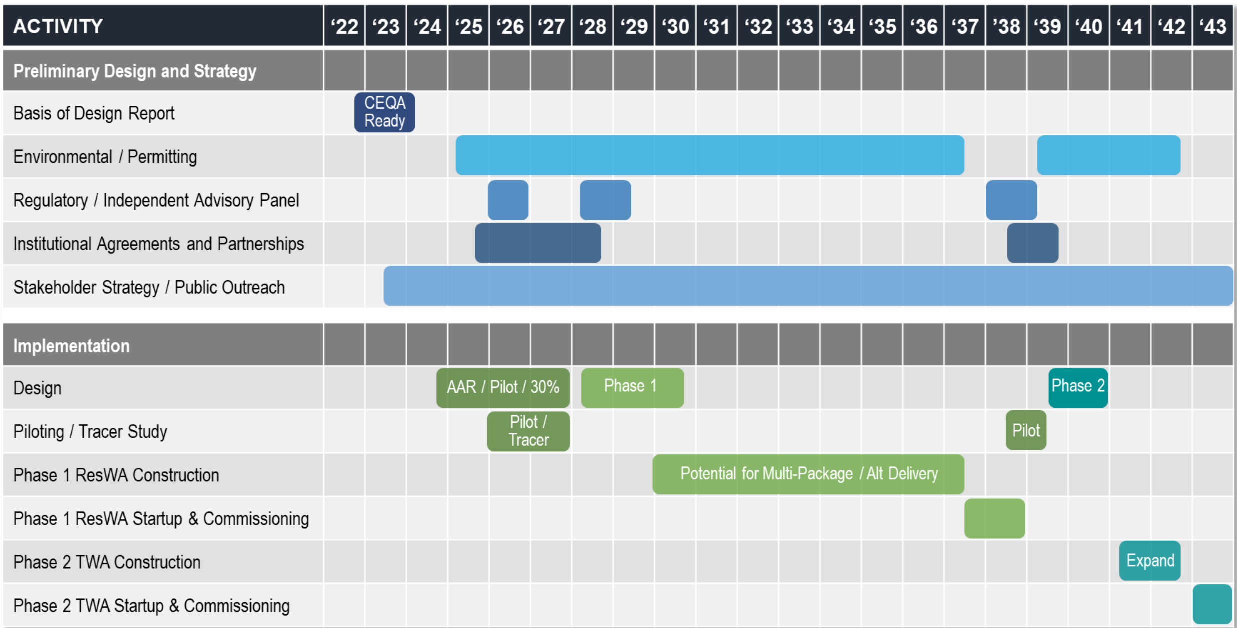
2.19 Preliminary Project Schedule

Preliminary project schedule.

A high-level potential timeline for implementation of the PureWater Peninsula Project is shown in Figure 2-4. The intent of this timeline is to provide a general and conservative estimate of when major activities would occur over a 20-year period. The majority of facilities would be designed and constructed in Phase 1. Phase 2 activities would focus on the drinking water system points of connection and expansion of the AWPF.

The schedule could be reduced by overlapping activities and reducing time between activities, depending on project drivers. In particular, the design and construction period could be streamlined depending on selection of a preferred delivery method (e.g., traditional design bid build vs alternative delivery) and the staging of design and construction packages. The earliest anticipated service date for ResWA is 2039.

Figure 2-4: Potential Timeline for Major Activities to Implement PureWater Peninsula Project



Of particular relevance for project schedule:

Environmental (CEQA / National Environmental Policy Act [NEPA]) /Permitting: Includes development and implementation of strategies for environmental documentation (e.g., National Pollutant Discharge Elimination System [NPDES] requirement for discharge to CSR and the San Francisco Bay, CEQA/NEPA checklist, potential mitigation requirements, other documentation) and permitting. Includes:

- Development environmental documentation to complete CEQA, likely a programmatic Environmental Impact Report, and an Environmental Impact Statement for NEPA compliance, to cover: a pilot project (if developed), Phase 1 ResWA and Phase 2 TWA.

- Securing land, right-of-water and construction permits and other approvals necessary to finalize design and move to construction for a pilot project (if developed), Phase 1 ResWA and Phase 2 TWA.

Regulatory / Independent Advisory Panel (IAP): Includes development and implementation of strategies for regulatory compliance to meet ResWA and TWA requirements. Includes:

- Engagement of the State Board Division of Drinking Water (SBDDW) / State Water Resources Control Board (SWRCB) early in the process related to strategies to demonstrate the ability to meet, or validation needed, to meet regulatory requirements for ResWA and TWA.

- Creation of an IAP, consisting of external experts to support initial coordination with regulatory agencies.

  - The IAP could guide the development of demonstration testing and reservoir tracer study concepts, as part of the piloting process

  - Presentation of project updates to IAP external experts on demonstration testing, reservoir tracer study, and Title 22 Report outcomes to secure preliminary approvals from SBDDW and the RWQCB.

  - The IAP would coordinate with regulatory agencies, in effect providing third party review and validation of project findings.

  - The IAP could ramp up as-needed to support the distinct phases of the project.

- Activities to meet regulatory requirements, such as completing a Title 22 report (for ResWA and TWA) and any updated studies required for SBDDW drinking water permits and complete Regional Water Quality Control Board (RWQCB) NPDES and Bay discharge permits, including applicable state and federal water quality standards, policies, provisions, and prohibitions.

Institutional Agreements and Partnerships: Includes development and implementation of strategies for institutional agreements and partnerships, including financial and funding options. Specific activities may include:

- Defining institutional operations and ownership models and roles for partners.

- Development of institutional agreements and terms, which would include a partnership framework to guide contracts, cost sharing, commitments between parties, and other contracts as-defined by the framework.

- Finalizing contracts, purchase agreements, and other binding documents, as needed through piloting, Phase 1 and 2 design and construction.

- Identification of state and federal funding programs that are available to assist agencies with planning, piloting, design, and construction of regional reuse projects.

- Perform rate and workforce impact studies

- Consideration of alternate delivery and financing approaches (e.g., design-build, design-bid-build, design-build-operate, etc.).

- Applying apply for design and construction dollars and administer grant/loan if successful.

- Securing financing and/or alternative delivery approach.

Stakeholder Strategy / Public Outreach: Includes development and implementation of strategies for stakeholder and public outreach, continued stakeholder and public engagement activities, which would continue through the different phases to gain support for the project, and address concerns regarding construction and operational activities.

Design: Initial activities include further evaluation of pipeline alignments and the potential to develop a pilot plan to test membrane performance for the blended source waters. The design of Phase 1 ResWA facilities would be informed by initial design efforts, piloting and other strategies (e.g., regulatory, permitting, institutional, outreach).

Piloting and Tracer Studies: Includes reservoir modeling and development of a treatment demonstration project, including data gathering, water quality sampling and validation of outcomes to demonstrate that regulatory requirements would be met.

Phase 1 Construction: Includes preparation of information and materials for bid and award and executing construction activities.

Phase 1 Startup and Commissioning: Includes development of Standard Operating Procedures (SOPs) and conducting training for ResWA.

Phase 2 Design: Includes activities to initiate design of the Phase 2 TWA facilities, based on input from initial design efforts, piloting and other strategies (e.g., regulatory, permitting, institutional, outreach).

Phase 2 Construction: Includes preparation of information and materials for bid and award and executing construction activities.

Phase 2 Startup and Commissioning: Includes development of SOPs and conducting training for TWA.

2.20 Construction Duration by Type of Activity

Construction durations by type of activity. While optional during preparation of this checklist, it would be eventually required for the environmental review.

The construction duration by type of activity would be influenced by future design stages, selection of construction methods, market conditions and the preferred delivery method. Based on professional experience, similar ResWA projects in progress by East County Advanced Water Purification Program and Pure Water Project Las Virgenes-Triunfo, and similarly sized projects led by SFPUC, it is assumed that Phase 1 would be constructed over an 8 to 9 year period and the Phase 2 expansion could be accomplished in a 2 year period. Duration of individual construction activities would be discussed in future design phases.

2.21 Blowoff Locations and Discharge Locations

Blowoff locations, and information on where discharges would drain. Also, shutdown information when it concerns discharges. This should be shown on a map.

AWPF discharges for MF and BAF waste would be routed to the headworks of the SVCW facility and RO concentrate discharge would be conveyed to the SVCW outfall, as illustrated in Figure 2-2.

Blowoffs for the conveyance system would be located at high and low points along each pipeline and at either of the HDD crossing.

Potential emergency shutdown periods at the AWPF that may result in an unplanned discharge include: power outage, pump station failure, breakpoint chlorination system failure, chloramination system failure, and other critical asset failure (e.g. pumps, membrane racks, ultraviolet [UV] reactors). With the exception of a power outage, when an emergency shutdown occurs, the AWPF can be programmed or manually put into recirculation mode and on-site equalization can be used to provide temporary retention time.

Future design efforts will provide additional information on planned and unplanned discharges.

2.22 Landscaping Plans

Landscaping plans. While optional during preparation of this checklist, it will be eventually required for the environmental review. (This is not a requirement for a plan but rather a general description of type of land cover.)

A landscaping plan is not available at this level of design for this document.

Section 3: Land Use

Land use and zoning restrictions are expected to affect and guide design requirements for the proposed AWPF and conveyance facilities. Land use and zoning requirements should be reviewed with local planning agencies during future project phases.

Future design efforts would support responding to the following CEQA checklist requirements.

3.1 Project Area Maps

Aerials of the project area (including staging areas, spoils areas, etc.) are provided in the **BODR Appendix F: AWPF Drawings C-02 to C-04.**

A Redwood Shores land use map and San Mateo County assessor parcel map for SVCW are shown in Figure 3-1 and Figure 3-2, respectively. The existing SVCW facility is indicated by #6, the proposed AWPF location is located in the adjacent temporary sewage disposal easement (referred to as the SVCW North Pond Area in Figure 2-1) and the alternate AWPF location in the North Annex Parcel is indicated by #7.

Figure 3-1: Redwood Shores Zoning Map

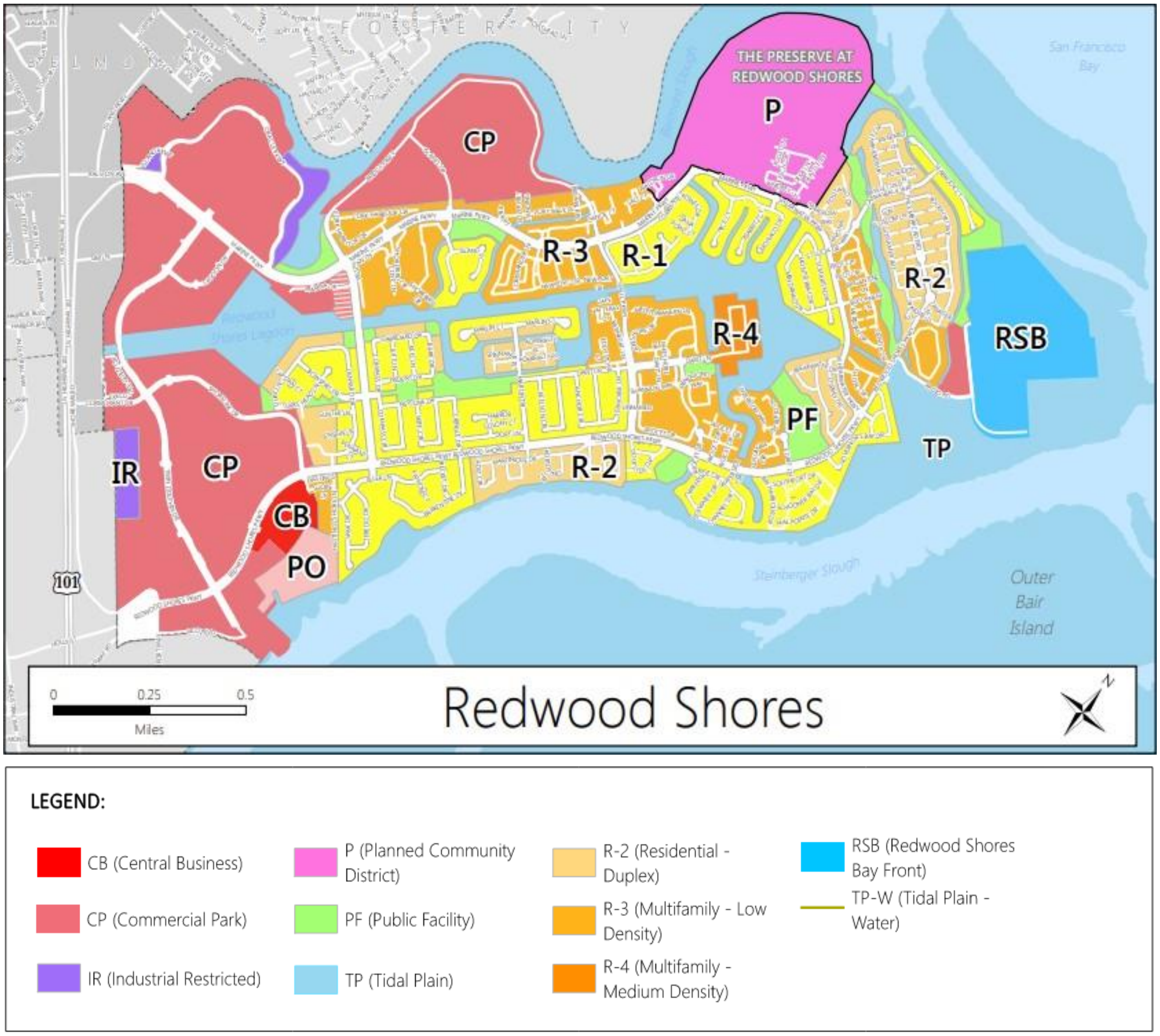


Figure 3-2: San Mateo County Assessor Parcel Map

Parcel maps of the conveyance facilities have not been collected at this level of design.

A copy of USGS 7.5-minute quad maps have not been collected for the project area at this level of design.

3.2 Ownership and Encroachment Issues

Information on encroachment issues have not been collected at this level of design. The AWPF and tertiary effluent pump station should not incur issues due to their location within existing facilities and the partnership with the owners of those facilities. Most pipelines would be within the public right-of-way, and encroachment issues would be determined once a boundary survey has been completed.

Future design efforts would identify structures or trees that would need to be removed from a planned pump station site, alignment or point of connection to a DWDS facility and a list of all property owners within 300 ft of the property line of the site, if appropriate. A tree survey would be conducted by the CEQA consultant and a list of property owners would be collected with the support of the CEQA consultant and/or a real estate consultant.

3.3 Land Use

Present and past use of the site, especially permitted uses, if available.

The past and present use of the SVCW site is a WWTP that includes office, parking, and industrial facilities. The preferred AWPF location in the SVCW North Pond Area in Figure 2-1 is indicated to be a temporary sewage disposal easement on the San Mateo County assessor parcel map shown in Figure 3-1 and Figure 3-2. This area has historically been and is currently used by SVCW as a staging and spoils storage area to support other projects at the facility. The past and present use of the potential tertiary pump station is the San Mateo WWTP includes existing filters and clarifiers that are planned to be demolished or repurposed as part of the current WWTP upgrade project.

Information on the past and present use of proposed location for BPSs is not available at this time. Additional information on past and present uses for the conveyance pipelines and points of connection would be developed in future phases of design.

3.4 Other Land Use Considerations

Information on growth-inducing issues has not been collected at this level of design and would be coordinated with the environmental manager.

San Francisco Master Plan designation and zoning of the project parcels. Sites outside City of San Francisco limits require local designation/zoning information. This information has not been collected at this level of design.

Information on any historic preservation requirements has not been collected at this level of design.

3.5 Watershed and Basin Plan Requirements

3.5.1 Bay Discharge Requirements

Discharge of treated wastewater from SVCW's outfall is regulated under three (3) Waste Discharge Requirements (WDRs) / NPDES permits, as summarized in Table 3-1.

These permits establish requirements for the overall water quality-based effluent limitations, mercury and polychlorinated biphenyls limitations, and nutrients monitoring requirements, respectively. With an AWPF, the combined effluent discharged from SVCW's outfall would consist of the RO concentrate from the AWPF blended with the remaining effluent. This combined effluent would need to meet the requirements described in the WDR/NPDES permits, which is described in greater detail in Appendix A.

Table 3-1: Summary of Existing and Future Regulations at SVCW Outfall to SF Bay

Permit	Permit Type	Key Relevant Items
SVCW WDR **ORDER No. R2-2018-0005** **NPDES No. CA0038369**	**Individual**	**Dry Season (May 1 to Sept 30) Effluent Limits**
WDR for Mercury and PCBs **ORDER No. R2-2017-0041** **NPDES No. CA0038849**	**SF Bay Watershed**	**Year-Round Effluent Limits** Average annual – by mass Monthly and weekly – by concentration
WDR for Nutrients **ORDER No. R2-2014-0014** **NPDES No. CA0038873**	**SF Bay Watershed**	**Focus on Nutrients** 2014 – 2018: Concentration and load monitoring 2019 – 2024: Load targets 2025 onwards: Potential load caps

3.5.2 SF Bay Basin Plan Requirements

Any augmentation of CSR would need to meet local San Francisco Bay Basin Plan requirements and consider the background water quality concentrations of the receiving water. The San Francisco Bay Basin Plan includes specific quantitative and general qualitative limits related to the discharge of water into CSR; these limits would be implemented through the permit process. CSR is part of the South Bay Basin. Relevant quantitative limits include limits on un-ionized ammonia (Annual median= 0.025 mg/L as N; Maximum = 0.4 mg/L as N) and dissolved oxygen (7.0 mg/L for cold water habitats); there are no quantitative limits for phosphorus. Qualitative limits include limits on bioaccumulation, biostimulatory substances, population, and community ecology, etc. Purified water that is added to CSR would have to meet these regulatory limits.

The San Francisco Bay Basin Plan regulations have more stringent ammonia water quality limits as compared to the background concentrations in CSR. Phosphorus limits are controlled by background CSR concentrations since there are no Basin Plan limits, but anti-degradation provisions apply. The Project, at this level of design, assumes that the water quality of augmented water would need to match or be compatible with the background levels.

Information on watershed requirements, including applicable policies of the Watershed Management Plans, if applicable, has not been collected at this level of design.

3.6 Permitting Requirements

Information on known permits other than CEQA, NEPA, & resource agencies for project approval required for Project construction and operation are listed in Table 3-2. The permits and approvals needed for the project would be confirmed during CEQA document preparation.

Table 3-2: Overview of Potential Regulatory Permitting Requirements

Agency	Regulation	Trigger	Permit
United State Army Corps of Engineers (USACE)	Section 404 of the Clean Water Act (CWA)	Impacts to Waters of the United States.	404 Authorization (Nationwide or Individual) Permit)
United States Fish and Wildlife Service (USFWS)	Section 7 of the Federal Endangered Species Act (ESA)	Impacts to federally listed species and/or critical habitat where a federal agency has discretionary action	Biological Opinion; jeopardy decision; incidental take permit
California Department of Fish and Wildlife (CDFW)	Section 1602 of the Fish and Game Code	Impacts to Waters of the State	Streambed Alteration Agreement (1602 Permit)
CDFW	Section 2080.1 of the California Endangered Species Act (CESA)	Impacts to State-listed species that are included in a Federal ESA permit	Consistency Determination
CDFW	Section 2081 of the CESA	Impacts to State-listed species	Incidental Take Permit
RWQCB	Section 401 of the CWA	Impacts to Waters of the United States.	401 Water Quality Certification
RWQCB	Section 402 of the CWA	Construction; dewatering	NPDES Permit (General Construction Permit)
RWQCB	Section 13260(a) of the California Water Code	Changes to regulated discharges to waters of the United States.	SVCW WDR ORDER No. R2-2018-0005 NPDES No. CA0038369
RWQCB	Section 13260(a) of the California Water Code	Changes to regulated discharges to waters of the United States.	WDR for Mercury and PCBs ORDER No. R2-2017-0041 NPDES No. CA0038849
RWQCB	Section 13260(a) of the California Water Code	Changes to regulated discharges to waters of the United States.	WDR for Nutrients ORDER No. R2-2014-0014 NPDES No. CA0038873
RWQCB	Porter-Cologne Act	Impacts to Waters of the State	Waste Discharge Requirement
SBDDW	Title 22, California Code of Regulations (CCR) Division 4, Chapter 3 – Articles 1, 5, 7 Chapter 17 – Article 9	A project involving the planned placement of purified recycled water into a surface water reservoir that is used as a source of domestic drinking water supply, for the purpose of supplementing the source of domestic drinking water supply.	ResWA Project permit (for the water recycling agency) and a ResWA public water system (PWS) domestic water supply permit

Agency	Regulation	Trigger	Permit
SBDDW	Title 22, CCR Division 4, Chapter 3 – Articles 1, 5, 7 Chapter 17 – Article 9	A project involving the planned placement of purified recycled water into a treated drinking water system.	TWA requirements have yet to be finalized but would require permits to be secured by the direct potable reuse responsible agency (DiPRRA)
State Historic. Preservation Office (SHPO)	Section 106 of the National Historic Preservation Act (NHPA)	Section 404 Permit	106 Compliance

Based on initial discussions with SFPUC EM, the following CEQA Checklist items were not required to be discussed in this document:

1. Aerials of the project area (including staging areas, spoils areas, etc.).
2. Information on encroachment issues – will anything (structures, trees) need to be removed from our ROW?
3. Parcel maps of the area, showing adjacent properties.
4. Copy of United Stated Geological Survey (USGS) 7.5-minute quad maps for the project area.
5. A list of all property owners within 300 feet of the property line of the site if a GRE, NegDec or EIR is expected. Two sets of address labels are required.
6. San Francisco Master Plan designation and zoning of the project parcels. Sites outside City limits require local designation/zoning information.
8. Information on growth-inducing issues. *This should be coordinated with the environmental manager*.
9. Information on any historic preservation requirements.
10. Information on watershed requirements, including applicable policies of the Watershed Management Plans, if applicable.
11. Information on all other permits other than CEQA, NEPA, & resource agencies for project approval (e.g., NPDES, SPMP, etc.) required for the project.

Section 4: Water, Operations, and Maintenance

The potential issues listed below are anticipated during construction, operation, and maintenance of the new facilities. Other issues may exist, but are unanticipated at this time.

4.1 Dewatering Information

Dewatering information (estimated location of Baker tanks, location of discharge, estimated quantity if known, etc.)

It is assumed that dewatering pumping would be required for construction activities in the YBM materials at SVCW and the San Mateo WWTP to keep the foundation area dry from ground water during excavation and before foundation concrete can be laid. For construction at SVCW and the San Mateo WWTP, if Baker tanks are needed, they would be located near the point of excavation to handle construction dewatering pumping requirements. Construction dewatering pumped could potentially be sent back to the headworks of the plant if the pretreatment rule allows it.

There may similarly be a need for dewatering pumping during construction activities associated with pipeline alignments in the YBM materials and in areas of high groundwater. Dewatering pumping would be needed for open trench construction, in access shafts or pits used for trenchless construction activities and during the area where the pipeline would be slip lined through repurposed pipelines. If possible, construction dewatering water could be discharge into a local sewer. If Baker tanks are needed, they would be located near the point of excavation and could be used to hold water prior to discharge to a local sewer or provide pretreatment of groundwater prior to discharge.

The exact locations and the duration of dewatering would be determined as part of future design efforts.

Future design efforts could explore options to minimize dewatering requirements by using hydraulic cutoff walls, such as sheet piles, secant piles, or soil-mix type walls installed on top of the bay mud (almost impermeable layer). This could groundwater infiltration during excavation and construction.

4.2 Groundwater Level Information

Information on groundwater levels, if known.

Groundwater in the vicinity of the SVCW facility is generally characterized as shallow tide influenced groundwater within artificial fill that overlies estuarine deposits. Groundwater levels are generally less than 10 ft below the ground surface and experience varying degrees of fluctuation coinciding with the tidal stage of adjacent sloughs, creeks and the San Francisco Bay. The local shallow groundwater regime is tidally influenced and hydraulically connected to the nearby sloughs. (SVCW, 2017).

Groundwater in the vicinity of the San Mateo WWTP is part of the San Mateo Plain groundwater subarea, which is in the larger South Bay Groundwater Basin. Groundwater throughout the area is ample, with local variations in groundwater flow due to topography, geology, and the geometry of local aquifers. Groundwater studies were completed for the Bay Meadows Project, which is located approximately in the center of the San Mateo Clean Water Program Area. Groundwater beneath the Bay Meadows area, located south of the WWTP, has been encountered at depths of approximately 10 to 13.5 ft. Groundwater levels rose to depths of only 3 to 5 ft below grade within 7 hours after drilling during groundwater studies. In later studies, groundwater was encountered at depths of 7 to 10 ft. During subsequent geotechnical investigations of the Bay Meadows area, groundwater was encountered at depths from 4 to 19 ft below the existing grade (CH2MHill, 2016).

Groundwater studies in the Silicon Valley along pipeline alignments and pump stations locations would be collected and reviewed as part of future studies. Site investigations to measure groundwater levels would be conducted as part of future design efforts.

Based on initial discussions with SFPUC EM, the following CEQA Checklist items were not required to be discussed in this document:

1. Flood zone maps, if available. Information on ordinary high water mark for waterways, if applicable.
2. Salt water intrusion information, if necessary. *Often occurs as a result of dewatering drawdown*.
3. Information on operation water quality/quantity issues (such as any planned discharges, diversion rates, planned releases, etc.).

Section 5: Hazardous Waste

5.1 Chemical and Fuel Storage

Information on chemicals and fuels storage during construction and operation.

The AWPF facility would include storage and use of chemicals, including but not limited to:

- Chemical oxidants such as hydrogen peroxide or sodium hypochlorite: The type of chemical oxidant would be selected at a later design phase.
- Free chlorine: to achieve breakpoint chlorination and provide sufficient disinfection residual for conveyance
- Lime stabilization: The specific type of lime stabilization system, chemical storage and chemical dosing pump sizing would be further refined as part of a later design phase.
- Sodium bisulfite: for preservation of membranes during ramp down or shutdown periods, to prevent biological growth
- Other chemicals associated with feed systems for wet wells, inter-process pumps and other appurtenances, such as anti-scalants, to be further defined during pump selection in future design phases.
- On-site emergency generator fuel, if-needed (diesel or propane)

The tertiary effluent pump station at the San Mateo WWTP could include a disinfection feed system to provide sufficient disinfection residual for conveyance to the AWPF. The type of chemical disinfectant would be selected at a later design phase and would likely depend on available chemicals onsite at the WWTP.

BPSs would likely not include storage and use of chemicals for cleaning and maintenance.

The Breakpoint Chlorination Facility would house chemicals to achieve breakpoint chlorination and pH adjustment, such as sodium hypochlorite and sulfuric acid.

During construction, the contractor would be required to meet county and state fuel storage requirements. Chemicals used on-site for construction would likely include generator fuel (diesel or propane) and bentonite (used to keep pile holes open).

Other chemicals that could be used during construction include oils, lubricants, lime, paints, primers, acetylene tanks and cleaning solvents. Storage of these chemicals on-site may not be needed or desired.

5.2 Existing Phase I, Phase II or Geotechnical Studies

Existing Phase I, Phase II, or geotechnical studies are required if you already have them. However, it is not required for you to perform these studies. Not needed for pipeline alignments.

No Phase I or II reports, nor geotechnical studies have been done for the Project.

Geotechnical reports at the SVCW have been performed as part of the SVCW RESCU Program and other projects at the SVCW. A Geotechnical Data Report was prepared for the SVCW Front of Plant Project in 2018, by Kleinfelder, for the area adjacent to the proposed AWPF site at the SVCW North Pond area. The report summarizes available geotechnical data from current and previous investigations within the project area and includes boring logs, cone penetration test profiles and laboratory testing results. This report and others would be reviewed as part of future design and a site specific geotechnical investigation would be conducted at the preferred AWPF location.

Geotechnical reports at the San Mateo WWTP have been performed as part of the City of San Mateo Clean Water Program and would be reviewed as part of future design efforts once a preferred location for the tertiary effluent pump stations has been selected.

Based on initial discussions with SFPUC EM, the following CEQA Checklist items were not required to be discussed in this document:

1. Underground storage tanks (UST) information. *Coordination with the environmental team member is necessary if USTs exist. A Phase I or II site assessment might be required*.
2. Site status on the State's "Cortese List" (list of sites with known hazardous contamination).

Section 6: Noise

6.1 Pile Driving Information

Information on pile driving, if needed. Indicate the locations and estimated duration of pile/sheet driving.

Pile driving activities and other noisy construction activities shall be completed as quickly as possible to limit noise exposure. Where conditions allow, vibratory pile drivers shall be used to drive sheet piles. Pile holes shall be pre-drilled to minimize the number of blows required to seat the pile. Implementation of mitigations measure to reduce the effects of offsite vibration would be employed, recognizing that depending on type, location, and duration of the construction activity, vibration impacts may still exceed applicable criteria; impacts from construction may be significant and unavoidable.

Prior projects at SVCW have established that pile driving activities would exceed thresholds, but that the period of exceedance would be limited to 30 days or less at any one time. A recent SVCW EIR (SVCW, 2017) indicated that due to this limited exceedance, pile driving would be exempt from certain thresholds.

Based on initial estimates, approximately 2,190 piles would be required for construction of the AWPF driven every 8 ft 2 in on center underneath structures. The piles would be approximately 14” x 14” square and 110 feet deep. Additional information is provided in the **BODR Appendix F: Drawings.**

Pile driving would likely be needed for the construction of a new tertiary effluent pump station at the San Mateo WWTP. A recent San Mateo EIR (City of San Mateo, 2019) indicated the need for pile foundations for structures with moderate to heavy loads, with measures to reduce the potential for damage to nearby structures as a result of vibrations or ground displacement during pile driving operations.

Based on initial estimates, approximately 45 piles would be required for construction of the tertiary effluent pump station at the San Mateo WWTP. The piles would be approximately 14” x 14” square and 100 ft deep. Additional information is provided in the **BODR Appendix F: Drawings.**

Based on initial discussions with SFPUC EM, the following CEQA Checklist items were not required to be discussed in this document:

1. Spec. sheets on any noise-generating operational equipment (such as pumps, compressors, or generators – we also need to know the types of actuators being used on valves). *This is used with zoning information to determine if operational noise is within an acceptable range. If not, design changes may be required. This should be coordinated with the environmental team member. These spec. sheets do not need to be of the exact equipment that will be used (as that is probably not known). Spec. sheets of representative equipment can be used*.

Section 7: Aesthetics

7.1 Estimated Size/Height and Detail of Proposed Structures

Information on estimated size/height and detail of existing or proposed structures. This includes vaults and proposed access to vaults.

The approximate footprint (area), type of structures and maximum height above grade for the AWPF treatment facilities and conveyance facilities are presented earlier in Table 2-1 and Table 2-2, respectively. Information on the planned architecture of above-ground structures is not known at this time but is anticipated to be similar to current structures at nearby facilities. Most of the larger above ground structures would be located at SVCW and would be designed to match the aesthetics of existing plant facilities and adhere to local requirements. Similarly, the tertiary pump station located at the San Mateo WWTP would match the aesthetics of existing pump stations at the WWTP. Above ground vaults along the pipeline alignment and BPSs would adhere to local zoning, general and specific plan requirements. Facilities located near residents may require additional considerations to reduce visual impacts through fencing, plantings or other means to screen the facility from view.

7.2 Information on Site Lighting

Site lighting for above ground structures would follow existing guidelines and would be similar to existing lighting. Lights would shine downward and not spill into residential areas. Except for safety lighting on the exterior of the facilities, the existing general nighttime character of the sites would be dark with little or no artificial lighting.

Lighting during construction would be temporary and depend on the construction hours and activities. Lighting near the San Carlos Airport and major roadways may be limited during certain periods to avoid adverse impacts to airport operations and distraction of pilots and motorists. Project contractors would need to coordinate closely with airport staff and obtain all the necessary Airport Land Use Committee (ALUC) and/or Federal Aviation Administration (FAA) approvals to minimize lighting impacts during construction.

Based on initial discussions with SFPUC EM, the following CEQA Checklist items were not required to be discussed in this document:

1. Spec. sheets on proposed lighting elements. *These spec. sheets do not need to be of the exact equipment that will be used (as that is probably not known). Spec. sheets of representative equipment can be used. While optional during preparation of this checklist, it will be eventually required for the environmental review*.
2. Planned color of structures, if known

Section 8: Geology and Soils

8.1 Geotechnical Studies

Geotechnical studies, if available (See hazardous waste above). Required by the Planning Dept Required if you already have them. However, it is not required for you to perform these studies.

As discussed in Section 5.2, a number of geotechnical reports at the SVCW have been reviewed and performed as part of the SVCW RESCU Program and other projects at the SVCW to identify associated geotechnical conditions and potential impacts. A list of some relevant studies includes:

- South Bayside System Authority Pre-design of Planned Pump Stations, Redwood City, San Carlos and Menlo Park, California, Geotechnical Data Report, prepared by Jacobs Associates, dated October 22, 2013.
- Draft Predesign Geotechnical Interpretive Report (GIR), South Bayside System Authority Pump Station Predesign, CIP #7010, Task Order No. 2012-01, prepared by DCM Consulting, Inc., dated November 25, 2013.
- Technical Memorandum, Freyer & Laureta, Inc., Soil Corrosivity Evaluation, Silicon Valley Clean Water (SVCW)," prepared by V&A Consulting Engineers, dated December 2015.
- Preliminary Characterization of Subsurface Conditions, SVCW Clean Water Tunnel – Alignment 4BE, Redwood City, California, prepared by Geotechnical Consultants, Inc. (GCI), dated December 9, 2015.
- Preliminary Pile Foundation Design Criteria, Peak Flow Diversion Structure, Silicon Valley Clean Water, Redwood City, California, prepared by DCM Consulting, Inc., dated January 11, 2016.
- Geotechnical Data Report Silicon Valley Clean Water Front of Plant Project – 1400 Radio Road, Redwood City California. Prepared by Kleinfelder, dated May 14, 2018.

Geotechnical reports at the San Mateo WWTP have been performed as part of the City of San Mateo Clean Water Program and would be reviewed as part of future design efforts once a preferred location for the tertiary effluent pump stations has been selected. A list of some relevant studies includes:

- Engeo, Inc. 2009. Supplemental Geotechnical Exploration. City of San Mateo Bayfront Levee Improvements – Seal Slough Site and East Levee Site. San Mateo, CA. September 4. 143 pp.
- Ninyo and Moore. 2013. Preliminary Geotechnical Evaluation, San Mateo Corporation Yard, Detroit Drive and J. Hart Clinton Drive, San Mateo California. Prepared for Dreyfuss and Blackford Architects. August 30.

The Project is located in the San Francisco Bay Area, which is seismically active and characterized by complex folding and faulting. The project facilities in this area will likely experience minor earthquakes and possibly a major earthquake from one or more of the nearby active faults. The California Geological Survey (CGS) Seismic

Hazards Zone map associated with soil liquefaction and earthquake-induced landslides prepared by the CGS for the Redwood Point Quadrangle indicates that the project site is situated within a seismic hazard zone associated with liquefaction (Kleinfelder, 2018).

Soils along the bay, including the AWPF site and SM WWTP generally included dense clayey sand fill and 18 inches of lime-treated Bay Mud underlain by YBM, which consists of very soft and compressible fat clay. The YBM is underlain by stiff to very stiff lean clay to sandy lean clay, sands (clayey, silty, and/or poorly graded), and Older Bay Deposits, which consists of hard to very stiff lean clay (Kleinfelder, 2018). Pile foundations would be required for construction of facilities over YBM, as previously discussed in Section 6.

It is anticipated that YBM would also be encountered along portions the pipeline alignments near the bay. For trenchless crossings in these areas, watertight shafts would be required and depths the pits and crossings would vary depending on the specific soils encountered at those locations.

Based on initial discussions with SFPUC EM, the following CEQA Checklist items were not required to be discussed in this document:

1. Information on faults. This includes if the project is located on an Alquist-Priolo Earthquake Fault zone, if known (See http://www.consrv.ca.gov/CGS/rghm/ap/ for more information on these fault zones).
2. Information on expansive soil (as per Building code), if known.
3. Information on geologic work near/adjacent to structures (estimates of vibration effects).

Section 9: Traffic

9.1 Traffic Information

Traffic information, such as proposed haul routes.

Traffic impacts would include road closures along the pipeline alignments and additional traffic related to construction activities. The extent of traffic impacts and total number of truck trips is not known at this time. Truck trips would include (but is not limited to) transport of equipment, pipelines, tanks, steel, concrete, piles, building materials, mining equipment and materials, and soil hauling.

Based on initial cut and fill estimates for the project, approximately 84,000 to 105,200 cubic yards (yd^3) of soil would need to be removed from the different Project areas. Excess material would be repurposed or hauled for disposal. The ultimate hauling location would depend on the quality of the material. The number of truckloads would depend on the actual size of the trucks used by the contractor. Table 9-1 shows estimated truck trips for soil hauling assuming an average truck capacity of 8 yd^3. Hauling routes are not specified at this level of design. Routes to landfills would depend on which landfills are used.

Table 9-1: Estimated Truck Trips for Soil Hauling

Facility	Estimated Truck Trips for Hauling	
	Phase 1	Phase 2
AWPF and Pipelines within SVCW Fenceline	2,625	625
San Mateo Tertiary PL and PS	2,750	0
Purified Option 1	6,400	750
Purified Option 2	3,900	900
Purified Option 3	4,250	250
Total Estimated Truck Trips (assuming most conservative purified option):	**11,800**	**1,400**

Additional trucks would be needed to bring in construction materials such as pipelines, piles, concrete, and steel. Truck trips needed for pipeline installation would depend on the purified alignment selected. Based on initial pile driving estimates, approximately 2,180 and 45 piles would be required for construction of the AWPF and the San Mateo tertiary pump station, respectively. Two piles would be delivered on each truck requiring approximately 1,090 and 23 trucks to deliver the piles to SVCW and the San Mateo WWTP, respectively.

Traffic control for construction activities at PureWater Peninsula Party sites would coordinated be between the project contractor and owners to avoid impacts to operations at treatment plants and other facilities. A new roadway would likely be constructed to direct heavy construction vehicles to the AWPF and staging areas. There would be designated areas for parking spaces for workers, operations trailers and hauling trucks.

During the construction period, on-site and off-site truck traffic, road closures would be needed along the selected pipeline alignments and at pump station locations. Construction traffic would be well spread over the construction duration for each item of work. Construction traffic and deliveries would be limited to certain access points to minimize impacts to the residential neighbors and other adjacent uses. Specific constraints would be determined during predesign and design. A more detailed traffic control plan would be prepared as part of future design efforts. The EIR team would conduct a project-wide traffic impact study.

There would be some long-term traffic impacts associated with operation of the treatment and conveyance facilities, such as operational/maintenance activities at the various project sites and chemical deliveries to the AWPF and Breakpoint Chlorination Facility. New vehicle traffic routes for AWPF operations would be established to minimize impacts to residences as much as possible. The new facilities would include a new truck entrance/exit at the AWPF and a new entrance/exit for operations and maintenance at the AWPF. The existing SVCW plant entrance/exit would continue to be used for operations.

9.2 Estimated Staffing Levels of Proposed Facility

Estimated staffing levels of existing or proposed facility. Used to determine parking/traffic issues.

The project would include new O&M staff for each responsible agency to support new facilities and provide administrative and regulatory support for the program. For the purposes of this BODR, and to estimate annual operating costs, the following additional full time staff area assumed:

AWPF Facility:

- Phase 1 = 12 FTE for plant operation, 1 FTE for administration/regulatory reporting for RWA, 4 FTE (or multiple staff for a portion of their time) for MR&R of conveyance facilities.

- Phase 2 = 6 additional FTE for expanded plant operation, 1 FTE for added administration/regulatory reporting for TWA, 2 FTE (or multiple staff for a portion of their time) for MR&R of distribution facilities.

Conveyance Facilities:

- Phase 1 = 4 FTE for conveyance operations and administration activities for TWA.

- Phase 2 = 4 additional FTE for conveyance operations and administration activities for TWA.

Section 10: Biological Resources

If any trees greater than 4 inches in trunk diameter or taller than 20 feet will be removed, a plot plan is required showing the location, size, and common or botanic name(s) of each.

Trees are not likely to be encountered at the SVCW and San Mateo WWTP Sites. The need for tree removal along pipeline alignment and at BPSs would be further explored once a preferred alignment and BPS sites are identified. An EIR consultant would then be retained to conduct bio surveys and tree surveys as-needed.

A high-level environmental screening was completed for potential treatment and conveyance facilities using the United States Fish and Wildlife Service's (USFWS) Information for Planning and Consultation (IpaC) system and GIS. Shapefiles were uploaded to the IpaC system database to evaluate potential environmental considerations in each area, including endangered species, critical habitats, migratory birds, and wetlands (USFWS, 2019). IpaC natural resource lists and detailed maps are included in **Attachment C.**

The number of endangered species, critical habitats and migratory bird counts are summarized in Tables 10-1 to 10-3 for potential treatment facilities, pump stations and pipeline alignments, respectively, based on the IpaC database outcomes. The presence of wetlands and the approximate area disturbed considerations is also summarized in the tables.

Table 10-1: Environmental Screening Summary of Potential Treatment Facility Locations

Potential AWPF Locations	# of Endangered Species Potentially Affected by Activities	# of Critical Habitats Potentially Affected by Activities	# of Migratory Bird Species of Potential Concern	Wetlands Present	Extent of Area Evaluated for IpaC Database (acres)
AWPF North Pond Area Layout	13	0	22	YES	5.91
AWPF North Annex Parcel Layout	13	0	22	YES	6.74

Source: (USFWS IPAC Database 2023)

Table 10-2: Environmental Screening Summary of Pump Stations

Potential Pump Station Locations	# of Endangered Species Potentially Affected by Activities	# of Critical Habitats Potentially Affected by Activities	# of Migratory Bird Species of Potential Concern	Wetlands Present	Extent of Area Evaluated for IpaC Database (acres))
New Tertiary PS at San Mateo WWTP	15	0	22	NO	11.54
BPSs Associated with Purified Water Transmission Pipeline Options 1, 2 and 3					
Option 1 - BPS-1.1	16	0	22	NO	1.14
Option 1 - BPS-1.2	14	0	20	NO	0.24
Option 1 - BPS-1.3	15	0	20	NO	1.78
Option 2 - BPS-2.1	15	0	22	NO	0.20
Option 2 - BPS-2.1 Alternative	15	0	22	NO	0.45
Option 2 - BPS-2.2 Alt1	15	0	22	NO	0.30
Option 2 - BPS-2.2 Alt2	15	0	22	NO	0.17
Option 3 - BPS-3.1	14	0	20	NO	0.24
Pulgas DF Point of Connection	15	1	20	NO	0.07

Source: (USFWS IPAC Database 2023)
Note: Option 1 BPS 2 is the same as Option 3 BPs

Table 10-3: Environmental Screening Summary of Pipeline Alignments

Potential Pipeline Alignments	# of Endangered Species Potentially Affected by Activities	# of Critical Habitats Potentially Affected by Activities	# of Migratory Bird Species of Potential Concern	Wetlands Present	Extent of Area Evaluated for IpaC Database (acres))
San Mateo Tertiary Alignment (to SVCW Site)	18	0	34	YES	13.55
Purified Water Alignment Option 1 - SFPUC ROW	24	1	23	YES	43.91
Purified Water Alignment Option 2 - San Carlos Road	21	1	23	YES	29.43
Purified Water Alignment Option 3 - Edgewood Road	24	1	23	YES	34.23

Source: (USFWS IPAC Database 2023)

Section 11: Air Quality

Information on any generators (including map and spec. sheets) for air requirements. Contact the EPM for the latest requirements and refer to Sample CEQA Air Quality Information (eDOCS DM #762889).

Short-term construction activities associated with implementation of the Project may cause short-term air emissions, increased noise levels, increased traffic, and similar impacts. These impacts are expected to be mitigated by implementation of best management practices (BMP) to comply with local and state standards and would be similar for all potential pipeline alignments, pump stations, and AWPF sites.

Construction equipment type may include but not be limited to crane, excavator, loader, backhoe, paver, paving equipment, rollers, saw cutting, pile driving, tunneling, hauling trucks, employee vehicles and other special equipment.

The total number of units, fuel type, horsepower, hours of operation and other details are not available at this time. Additional information would be further explored in future studies and detailed design. At which time the Sample CEQA Air Quality Information (eDOCS DM #762889) spreadsheet would be populated.

Section 12: NEPA Compliance

Note on NEPA: If your project has federal funding attached, requires certain federal permits (primarily an "Individual" Corps wetland permit), or is located on federal land, NEPA analysis might be required (NEPA is the federal equivalent of CEQA). NEPA will require that you analyze a range of alternatives in equal level of detail, and also have other informational requirements that will need to be addressed in the CER. Your EPM will have more information on NEPA compliance.

Due to the potential for federal funding for construction of the PureWater Peninsula Project, NEPA compliance would be required. The project sponsor would serve as the lead agency for NEPA as well as CEQA compliance. To meet NEPA and CEQA compliance requirements, a joint CEQA and Environmental Assessment (EA) or an Environmental Impact Statement (EIS) would be prepared, depending on the level of significant impacts findings. The EA/EIS would evaluate biological resources, cultural resources, water quality, hydrology, land use, seismic, traffic, and other issues of environmental concern to assess potential impacts of the PureWater Peninsula Project.

Compliance with the NEPA would be required before any ground-disturbing activity would begin. This would include submitting a Finding of No Significant Impact, or a Record of Decision completed by the federal NEPA lead agency.

To comply with federal environmental laws and regulations, the PureWater Peninsula Project should also evaluate the following federal laws in its NEPA document if required:

Federal ESA, Section 7: The USFWS and the United States Department of Commerce National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) must be consulted for any project that would have the potential to adversely impact a federal special-status species.

National Historic Preservation Act (NHPA), Section 106: The NHPA focuses on federal compliance. Section 106 requires Federal agencies to take into account the effects of their undertakings on historic properties. The Section 106 process seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties.

Floodplain Management – Executive Order 11988: Each agency shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities. Before taking an action, each agency shall determine whether the proposed action would occur in a designated floodplain. The generally established standard for risk is the flooding level that is expected to occur every 100 years. If an agency determines or proposes to, conduct, support, or allow an action to be located in a floodplain, the agency shall consider alternatives to avoid adverse effects and incompatible development in the floodplains.

Protection of Wetlands – Executive Order 11990: Projects, regardless of funding, must get approval for any temporary or permanent disturbance to federal and state waters, wetlands, and vernal pools. Applicants must consult with the US Army Corps of Engineers early in the planning process if any portion of the project site contains wetlands, or other federal waters.

Wild and Scenic Rivers Act: Projects must address whether there are construction restrictions or prohibitions for projects near or in a designated “wild and scenic river.” A listing of designated “wild and scenic rivers” can be obtained at http://www.rivers.gov/rivers/california.php.

Safe Drinking Water Act, Source Water Protection: Projects must comply with the Safe Drinking Water Act and document whether or not a project has the potential to contaminate a sole source aquifer. For projects impacting a listed sole source aquifer, the applicant must identify an alternative project location, or develop adequate mitigating measures in consultation with the United Stated Environmental Protection Agency (USEPA).

Environmental Justice – Executive Order No. 12898: Projects must Identify and address any disproportionately high and adverse human health or environmental effects of the project’s activities on minority and low-income populations.

References

Ch2MHill, 2016. Final Programmatic Environment Impact Report – City of San Mateo Clean Water Program. SCH#2015032006. Prepared for the City of San Mateo. April 2016.

City of San Mateo, 2019. Public Draft Report – Underground Flow Equalization System Project. Environmental Impact Report. SCH#2018092013. Prepared for the City of San Mateo. March 2019

Kleinfelder. 2018. Geotechnical Data Report Silicon Valley Clean Water Front of Plant Project – 1400 Radio Road, Redwood City California. Prepared for SVCW, dated May 14, 2018.

Silicon Valley Clean Water (SVCW), 2017. Integrated Final Environmental Impact Report Silicon Valley Clean Water Wastewater Conveyance System and Treatment Plant Reliability Improvement Project CIP No. 6006 State Clearinghouse Number # SCH 2016022055. Prepared by SVCW in consultation with David J Powers & Associates, Inc. August 2017.

Attachment A: Signatures

This CEQA/NEPA Checklist has been completed by:

Completed by:

Signature

Tile

Date

Signed by:

Signature

Tile

Date

Attachment B: IpaC Database

This attachment includes reports from the United States Fish and Wildlife Service's (USFWS) Information for Planning and Consultation (IpaC) system and Geographic Information System (GIS). Shapefiles for major facilities and pipeline alignments were uploaded to the IpaC system database to evaluate potential environmental considerations in each area, including endangered species, critical habitats, migratory birds, and wetlands (USFWS, 2019). The IpaC natural resource lists and maps are listed below and included in this attachment.

IPaC Resources Reports and Maps: Facility Sites

01_Potential AWPF Location – SVCW North Pond Area

02_Potential AWPF Location – North Annex Parcel

03_Potential Tertiary PS Location – San Mateo WWTP

04_Potential BPS 1.1 - Purified Transmission Alignment Option 1

05_Potential BPS 1.2 - Purified Transmission Alignment Option 1

06_Potential BPS 1.3 - Purified Transmission Alignment Option 1

07_Potential BPS 2.1 - Purified Transmission Alignment Option 2

08_Potential BPS 2.1alt - Purified Transmission Alignment Option 2

09_Potential BPS 2.2alt1 - Purified Transmission Alignment Option 2

10_Potential BPS 2.2alt2 - Purified Transmission Alignment Option 2

11_Potential BPS 3.1 - Purified Transmission Alignment Option 3

12_Pulgas Point of Connection

IPaC Resources Reports and Maps: Pipeline alignments

13_Tertiary Alignment – San Mateo WWTP to AWPF

14_Purified Transmission Alignment Option 1

15_Purified Transmission Alignment Option 2

16_Purified Transmission Alignment Option 3

IPaC **U.S. Fish & Wildlife Service**

01_Potential AWPF Location - SVCW North Pond Area

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse Reithrodontomys raviventris Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/613	Endangered

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Western Snowy Plover Charadrius nivosus nivosus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/8035	Threatened

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) Masticophis lateralis euryxanthus Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5524	Threatened
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened
San Francisco Garter Snake Thamnophis sirtalis tetrataenia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp Branchinecta lynchi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/498	Threatened

Flowering Plants

NAME	STATUS
California Seablite Suaeda californica No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6310	Endangered
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

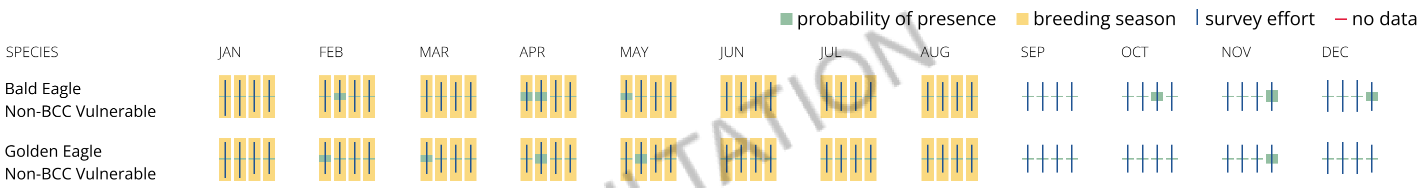
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the

Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher Haematopus bachmani This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black Turnstone Arenaria melanocephala This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Long-eared Owl asio otus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

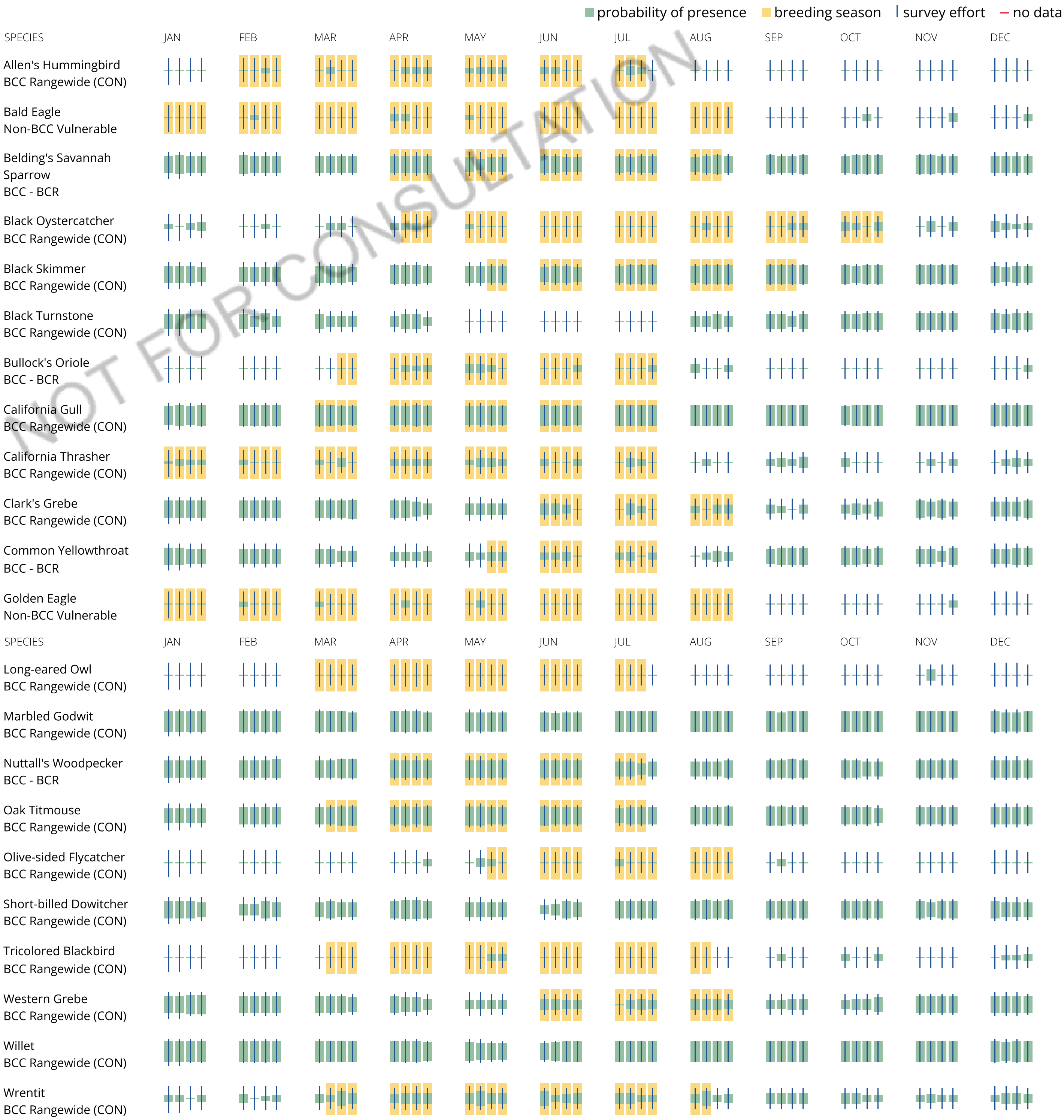
Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER POND
- PUBKx

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

02_Potential AWPF Location - North Annex Parcel

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local offices

San Francisco Bay-Delta Fish And Wildlife

(916) 930-5603
(916) 930-5654

650 Capitol Mall
Suite 8-300
Sacramento, CA 95814

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse Reithrodontomys raviventris Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/613	Endangered

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Western Snowy Plover Charadrius nivosus nivosus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/8035	Threatened

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) Masticophis lateralis euryxanthus Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5524	Threatened
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened
San Francisco Garter Snake Thamnophis sirtalis tetrataenia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp Branchinecta lynchi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/498	Threatened

Flowering Plants

NAME	STATUS
California Seablite Suaeda californica No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6310	Endangered
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

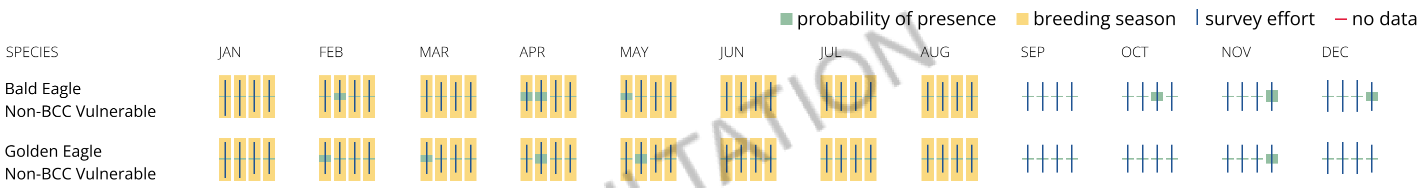
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the

Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher Haematopus bachmani This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black Turnstone Arenaria melanocephala This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Long-eared Owl asio otus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15

Marbled Godwit Limosa fedoa — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

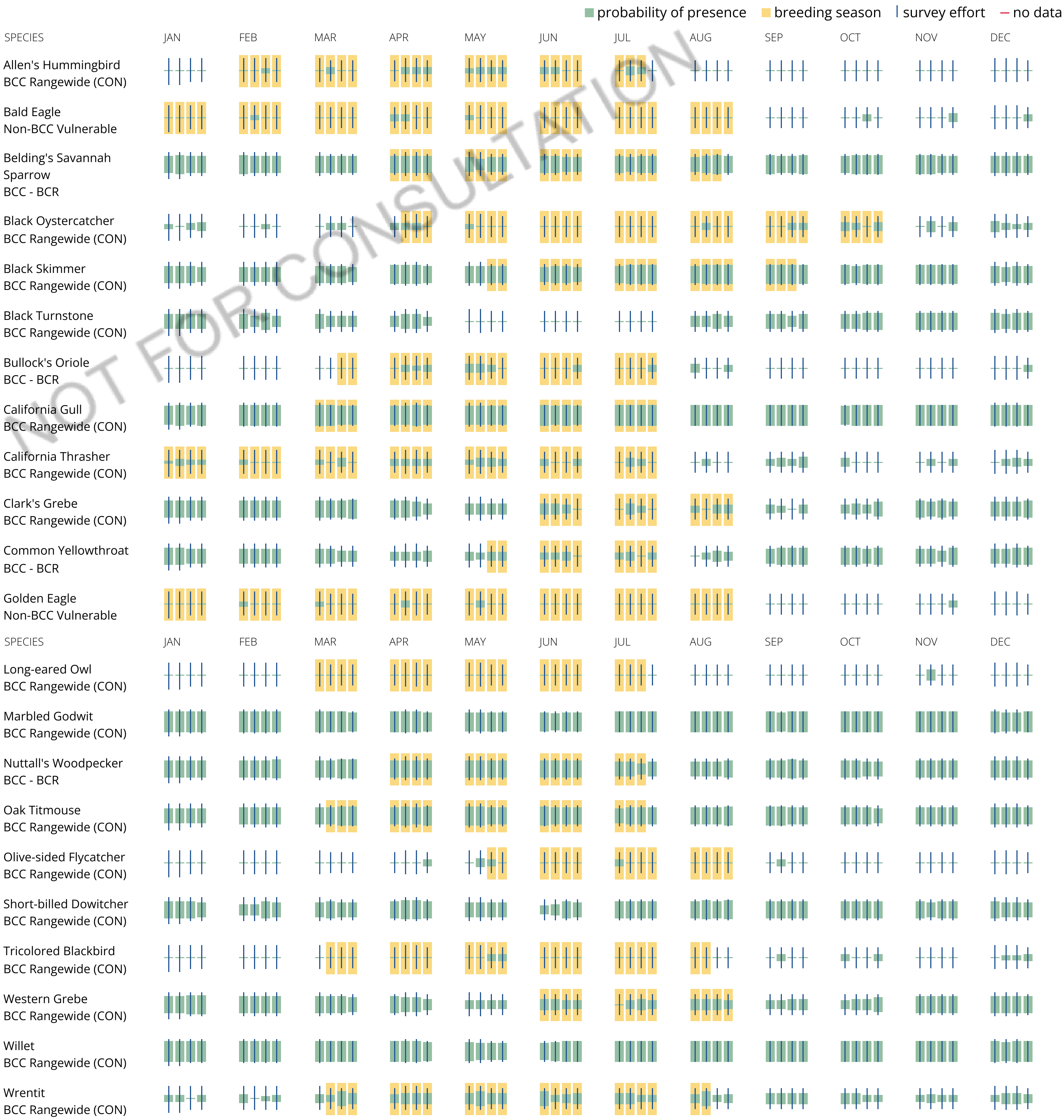
Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND
- PEM1Ah

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

03_Potential Tertiary PS Location - San Mateo WWTP

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse *Reithrodontomys raviventris* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/613	Endangered

Birds

NAME	STATUS
California Clapper Rail *Rallus longirostris obsoletus* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern *Sterna antillarum browni* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet *Brachyramphus marmoratus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

NAME	STATUS
Western Snowy Plover Charadrius nivosus nivosus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/8035	Threatened

Reptiles

NAME	STATUS
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened
San Francisco Garter Snake Thamnophis sirtalis tetrataenia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
California Seablite Suaeda californica No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6310	Endangered
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered
San Mateo Woolly Sunflower Eriophyllum latilobum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7791	Endangered
White-rayed Pentachaeta Pentachaeta bellidiflora Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7782	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

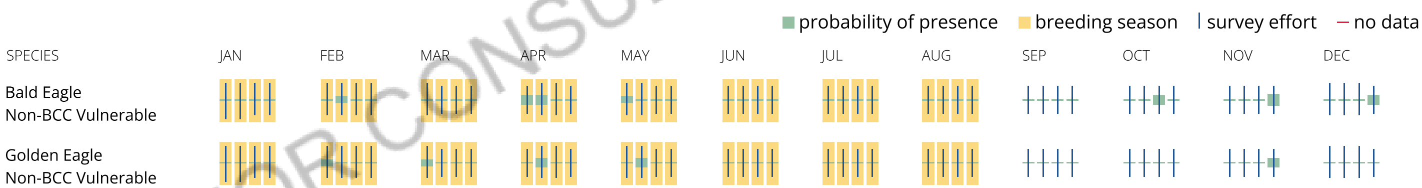
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf

- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher Haematopus bachmani This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black Turnstone Arenaria melanocephala This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Long-eared Owl asio otus
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3631
Breeds Mar 1 to Jul 15

Marbled Godwit Limosa fedoa
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481
Breeds elsewhere

Nuttall's Woodpecker Picoides nuttallii
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410
Breeds Apr 1 to Jul 20

Oak Titmouse Baeolophus inornatus
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656
Breeds Mar 15 to Jul 15

Olive-sided Flycatcher Contopus cooperi
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914
Breeds May 20 to Aug 31

Short-billed Dowitcher Limnodromus griseus
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480
Breeds elsewhere

Tricolored Blackbird Agelaius tricolor
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910
Breeds Mar 15 to Aug 10

Western Grebe aechmophorus occidentalis
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743
Breeds Jun 1 to Aug 31

Willet Tringa semipalmata
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
Breeds elsewhere

Wrentit Chamaea fasciata
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
Breeds Mar 15 to Aug 10

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

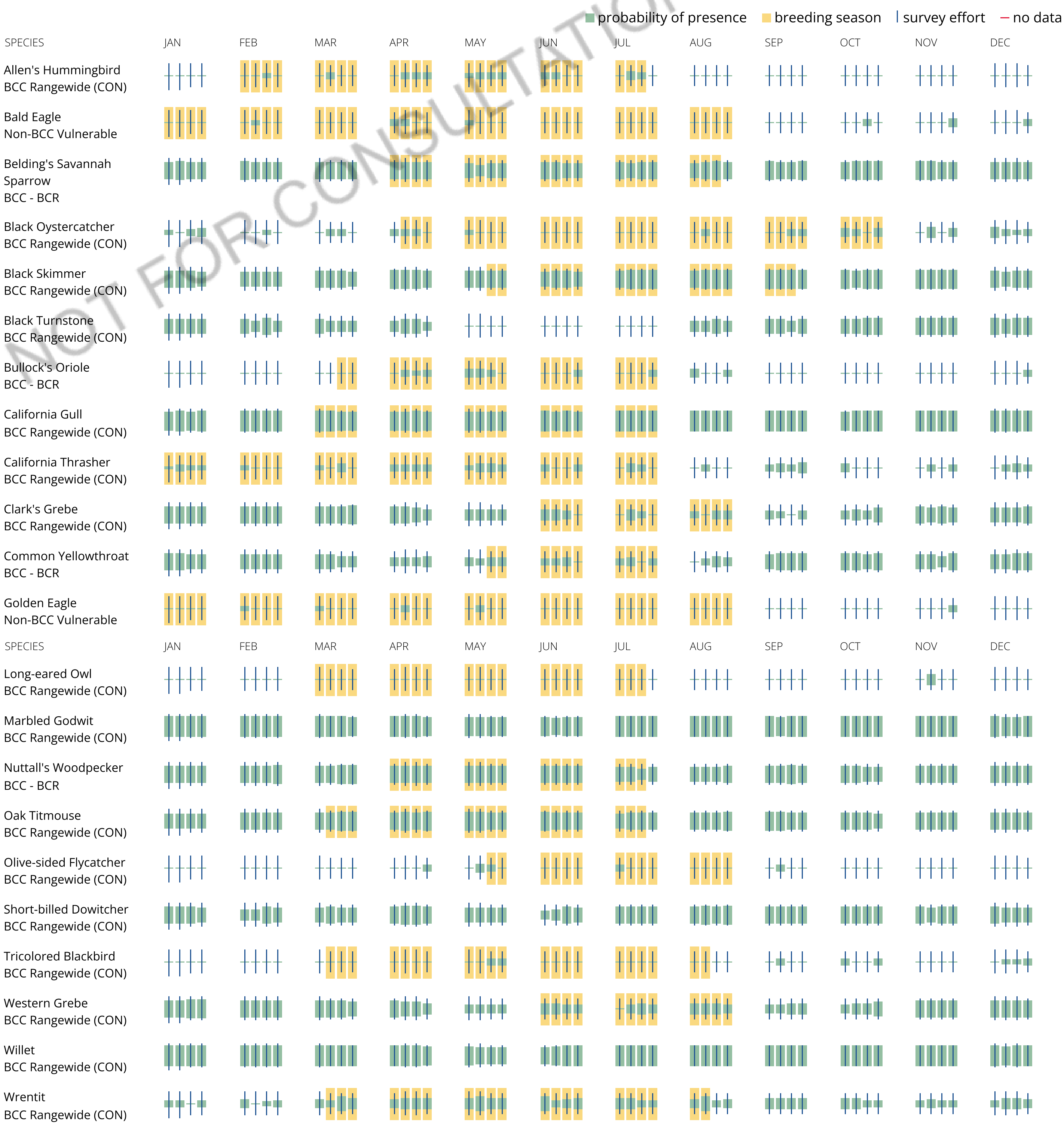
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

04_Potential BPS 1 - Purified Transmission Alignment Option 1

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse Reithrodontomys raviventris Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/613	Endangered

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Western Snowy Plover Charadrius nivosus nivosus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/8035	Threatened
Yellow-billed Cuckoo Coccyzus americanus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/3911	Threatened

Reptiles

NAME	STATUS
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened
San Francisco Garter Snake Thamnophis sirtalis tetrataenia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
California Seablite Suaeda californica No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6310	Endangered
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered

Showy Indian Clover Trifolium amoenum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6459	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

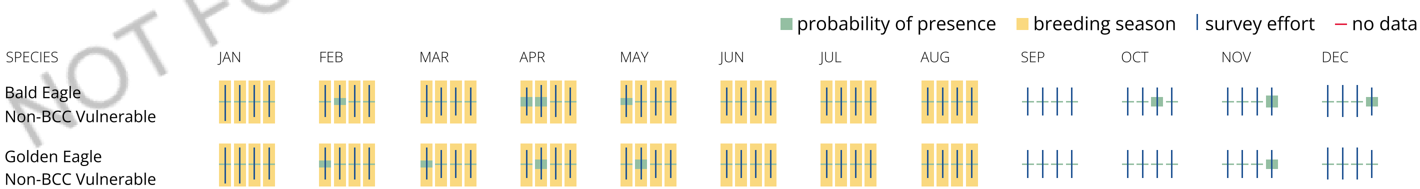
Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird *Selasphorus sasin* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow *Passerculus sandwichensis beldingi* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher *Haematopus bachmani* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Skimmer *Rynchops niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black Turnstone *Arenaria melanocephala* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bullock's Oriole *Icterus bullockii* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull *Larus californicus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher *Toxostoma redivivum* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe *Aechmophorus clarkii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31

Common Yellowthroat Geothlypis trichas sinuosa — Breeds May 20 to Jul 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/2084

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Long-eared Owl asio otus — Breeds Mar 1 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3631

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season ( )

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

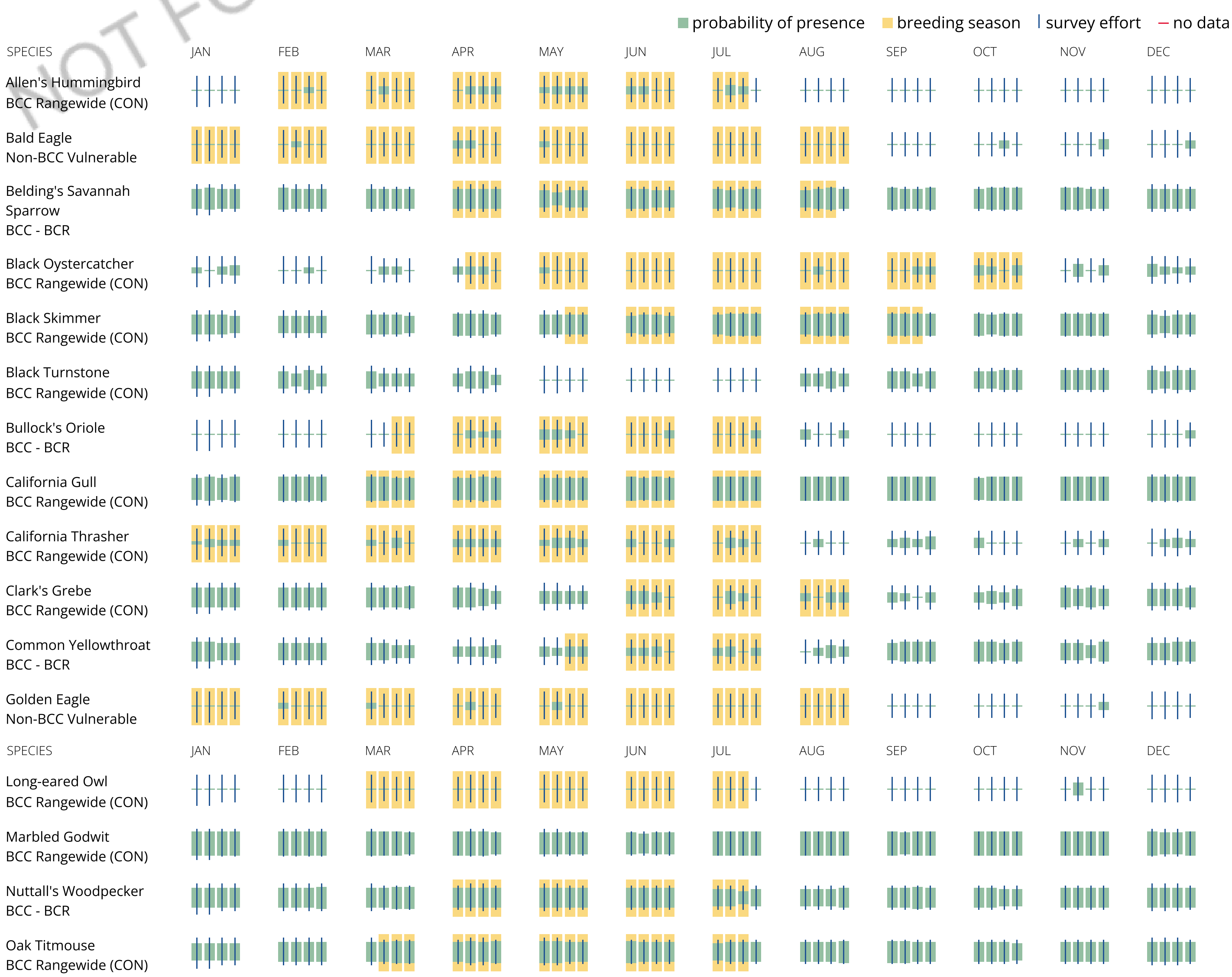
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

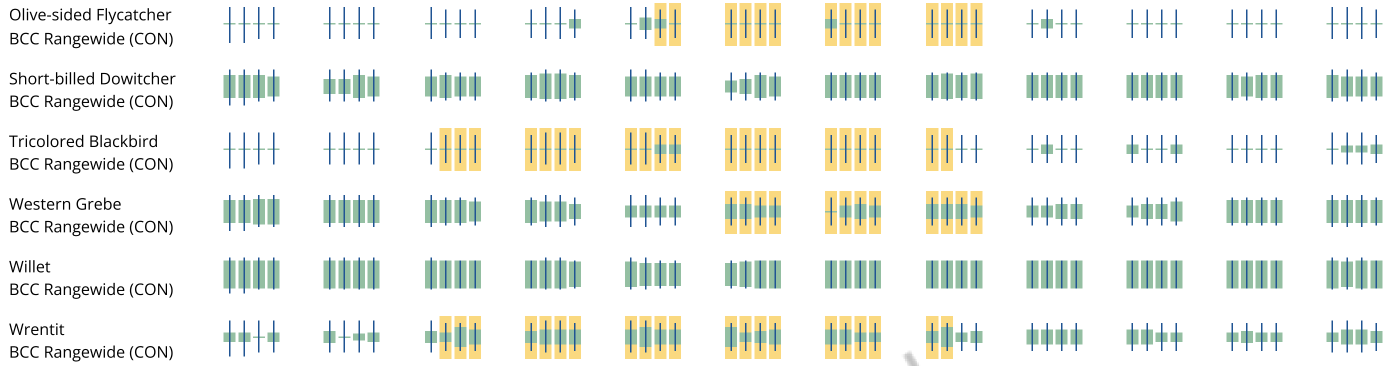
No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

05_Potential BPS 2 - Purified Transmission Alignment Option 1

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
California Clapper Rail *Rallus longirostris obsoletus* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern *Sterna antillarum browni* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet *Brachyramphus marmoratus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Reptiles

NAME	STATUS
Green Sea Turtle *Chelonia mydas* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened

San Francisco Garter Snake Thamnophis sirtalis tetrataenia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened
Foothill Yellow-legged Frog Rana boylii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5133	Proposed Threatened

Fishes

NAME	STATUS
Tidewater Goby Eucyclogobius newberryi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered
White-rayed Pentachaeta Pentachaeta bellidiflora Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7782	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

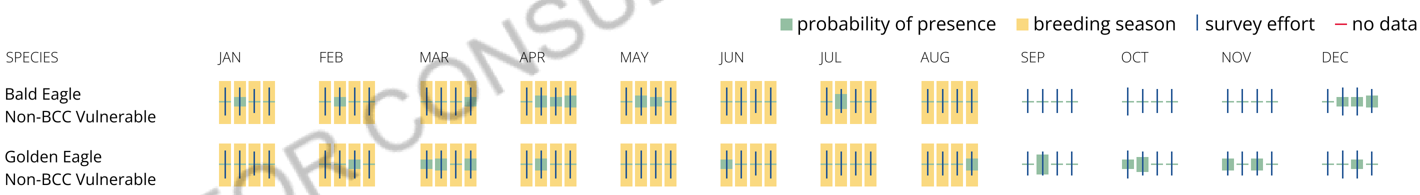
Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf

- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Lawrence's Goldfinch Carduelis lawrencei This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9464	Breeds Mar 20 to Sep 20

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

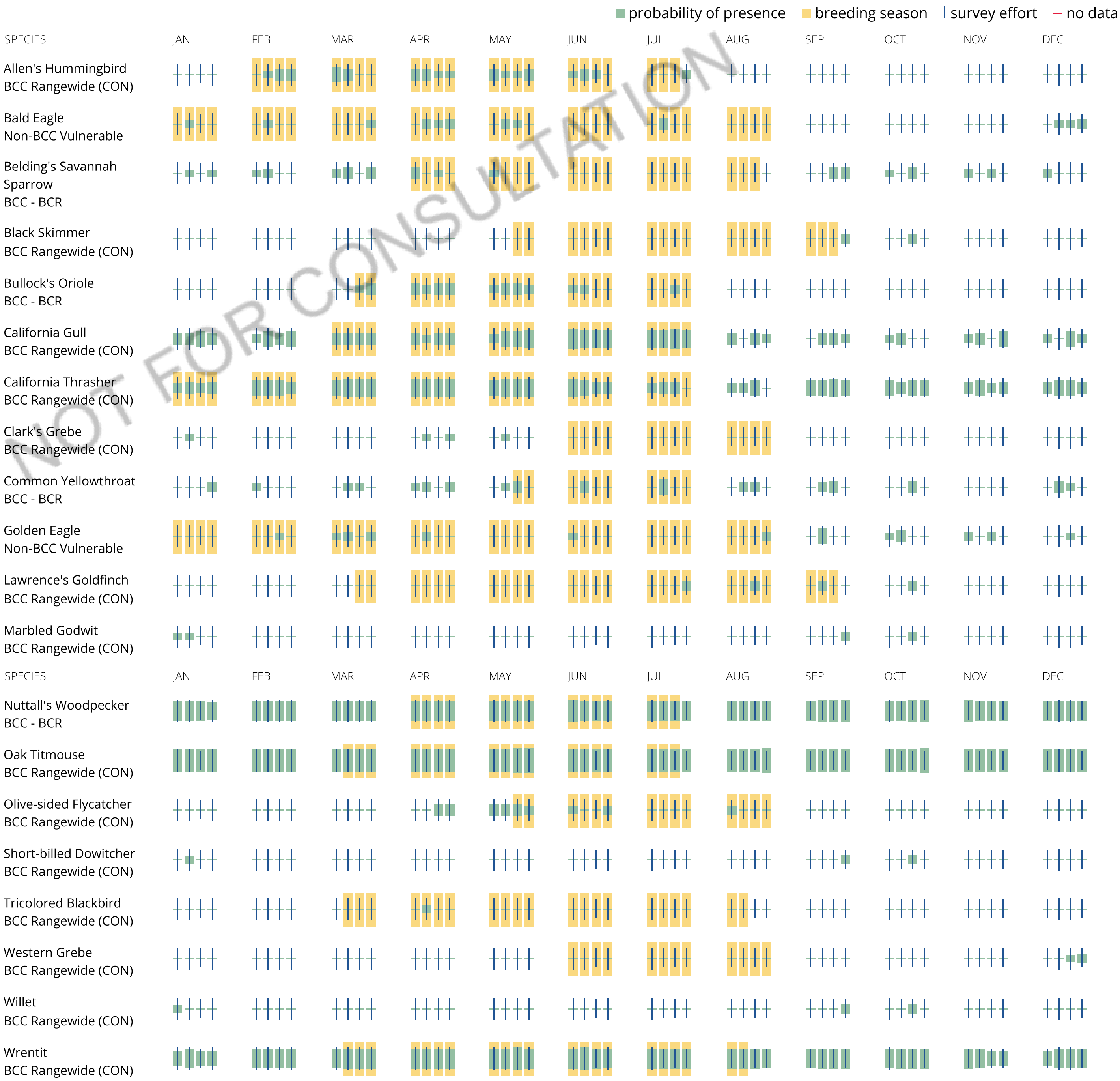
Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

06_Potential BPS 3 - Purified Transmission Alignment Option 1

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Reptiles

NAME	STATUS
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened

San Francisco Garter Snake Thamnophis sirtalis tetrataenia — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5956

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened
Foothill Yellow-legged Frog Rana boylii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5133	Proposed Threatened

Fishes

NAME	STATUS
Tidewater Goby Eucyclogobius newberryi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
Mission Blue Butterfly Icaricia icarioides missionensis Wherever found There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/6928	Endangered
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered

White-rayed Pentachaeta Pentachaeta bellidiflora — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7782

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

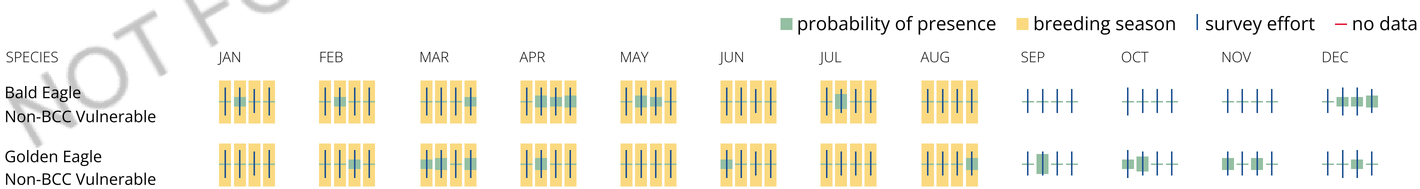
Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Lawrence's Goldfinch Carduelis lawrencei — Breeds Mar 20 to Sep 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9464

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

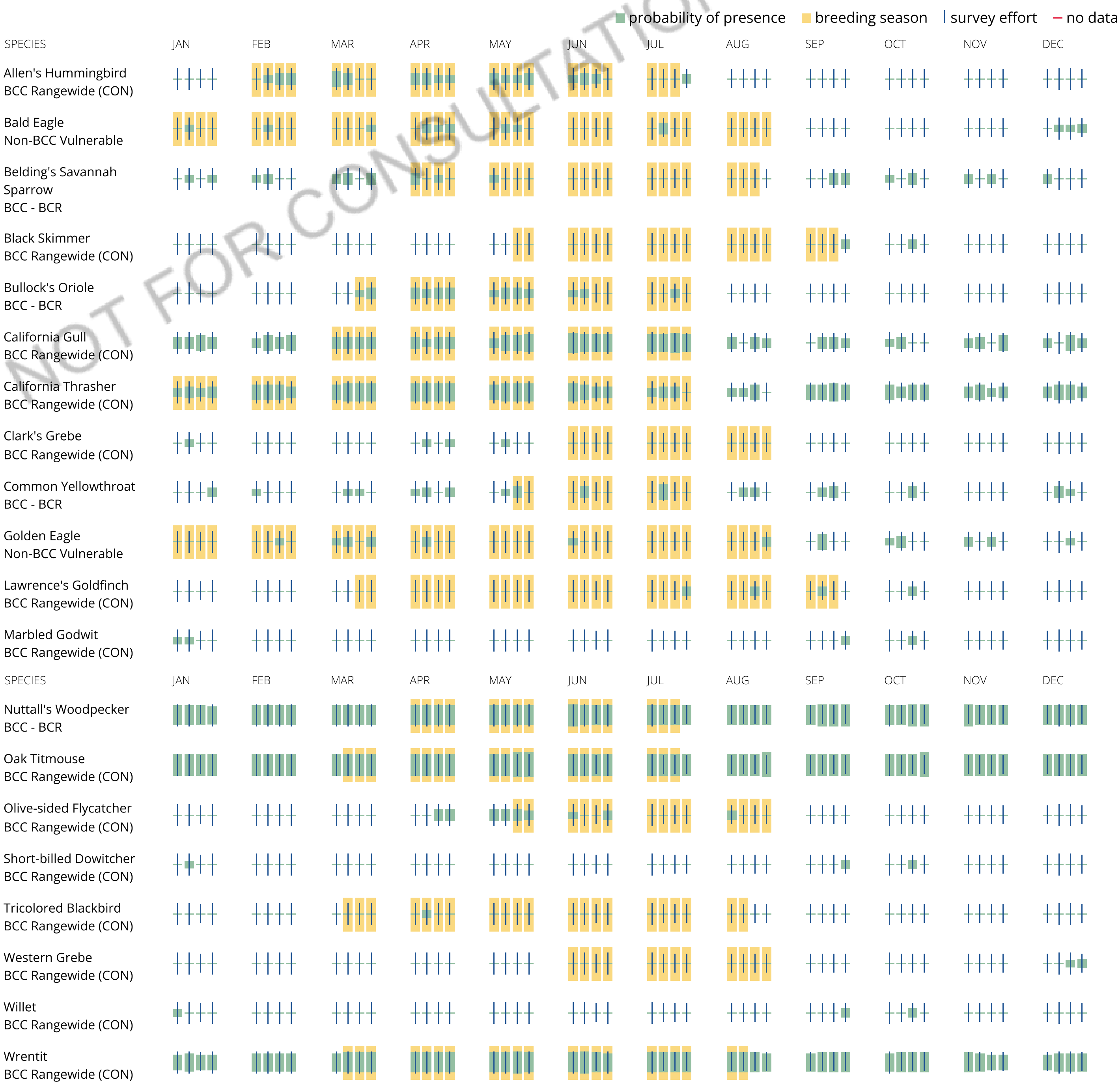
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

07_Potential BPS 1 - Purified Transmission Alignment Option 2

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse Reithrodontomys raviventris Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/613	Endangered

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Western Snowy Plover Charadrius nivosus nivosus — Threatened
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
https://ecos.fws.gov/ecp/species/8035

Reptiles

NAME	STATUS
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened
San Francisco Garter Snake Thamnophis sirtalis tetrataenia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
Foothill Yellow-legged Frog Rana boylii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5133	Proposed Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered
San Mateo Woolly Sunflower Eriophyllum latilobum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7791	Endangered
White-rayed Pentachaeta Pentachaeta bellidiflora Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7782	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

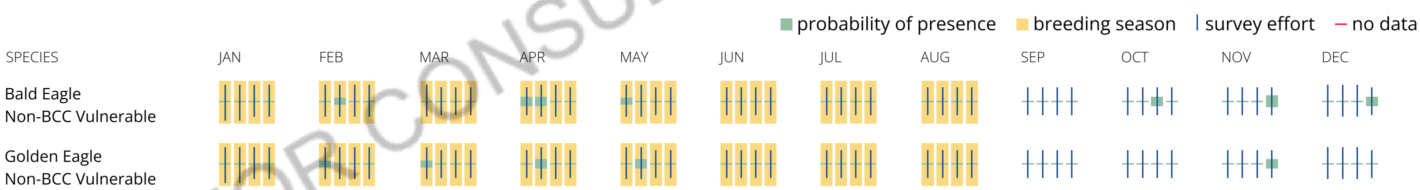
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the [Avian Knowledge Network (AKN)](). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets]() and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act]() requirements may apply). To see a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator (RAIL) Tool]().

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern (BCC)]() and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network (AKN)](). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets]() and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act]() requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator (RAIL) Tool]().

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the [Eagle Act]() should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf

- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher Haematopus bachmani This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black Turnstone Arenaria melanocephala This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Long-eared Owl asio otus — Breeds Mar 1 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3631

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

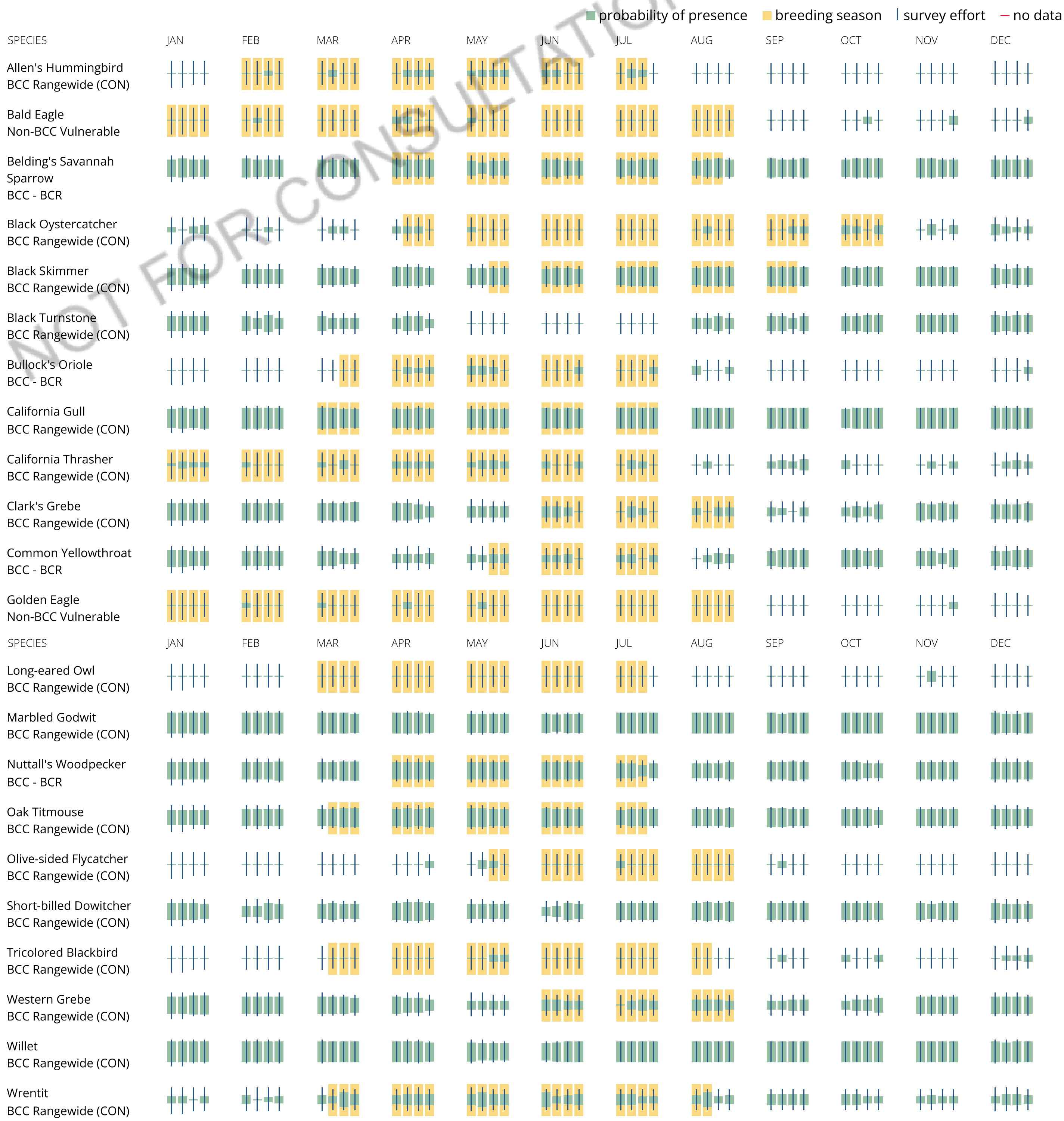
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

08_Potential BPS 1 Alternative - Purified Transmission Alignment Option 2

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Reptiles

NAME	STATUS
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened

NAME	STATUS
San Francisco Garter Snake Thamnophis sirtalis tetrataenia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened
Foothill Yellow-legged Frog Rana boylii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5133	Proposed Threatened

Fishes

NAME	STATUS
Tidewater Goby Eucyclogobius newberryi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
Mission Blue Butterfly Icaricia icarioides missionensis Wherever found There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/6928	Endangered
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered

White-rayed Pentachaeta Pentachaeta bellidiflora | Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7782

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season ()

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

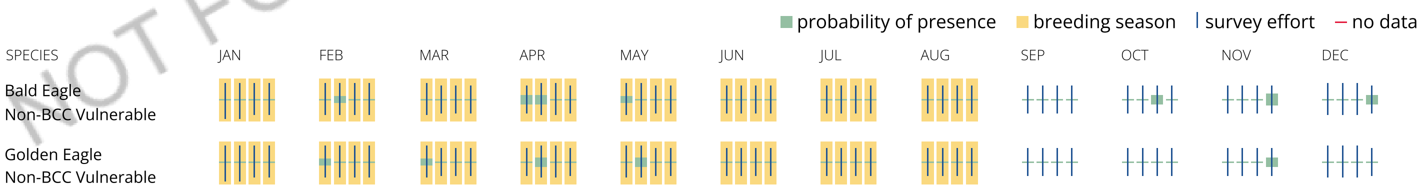
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the [Avian Knowledge Network (AKN)](). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets]() and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act]() requirements may apply). To see a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator (RAIL) Tool]().

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern (BCC)]() and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network (AKN)](). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets]() and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act]() requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator (RAIL) Tool]().

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the [Eagle Act]() should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The [Migratory Birds Treaty Act]() of 1918.
2. The [Bald and Golden Eagle Protection Act]() of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher Haematopus bachmani This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black Turnstone Arenaria melanocephala This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31

Common Yellowthroat Geothlypis trichas sinuosa — Breeds May 20 to Jul 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/2084

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Long-eared Owl asio otus — Breeds Mar 1 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3631

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

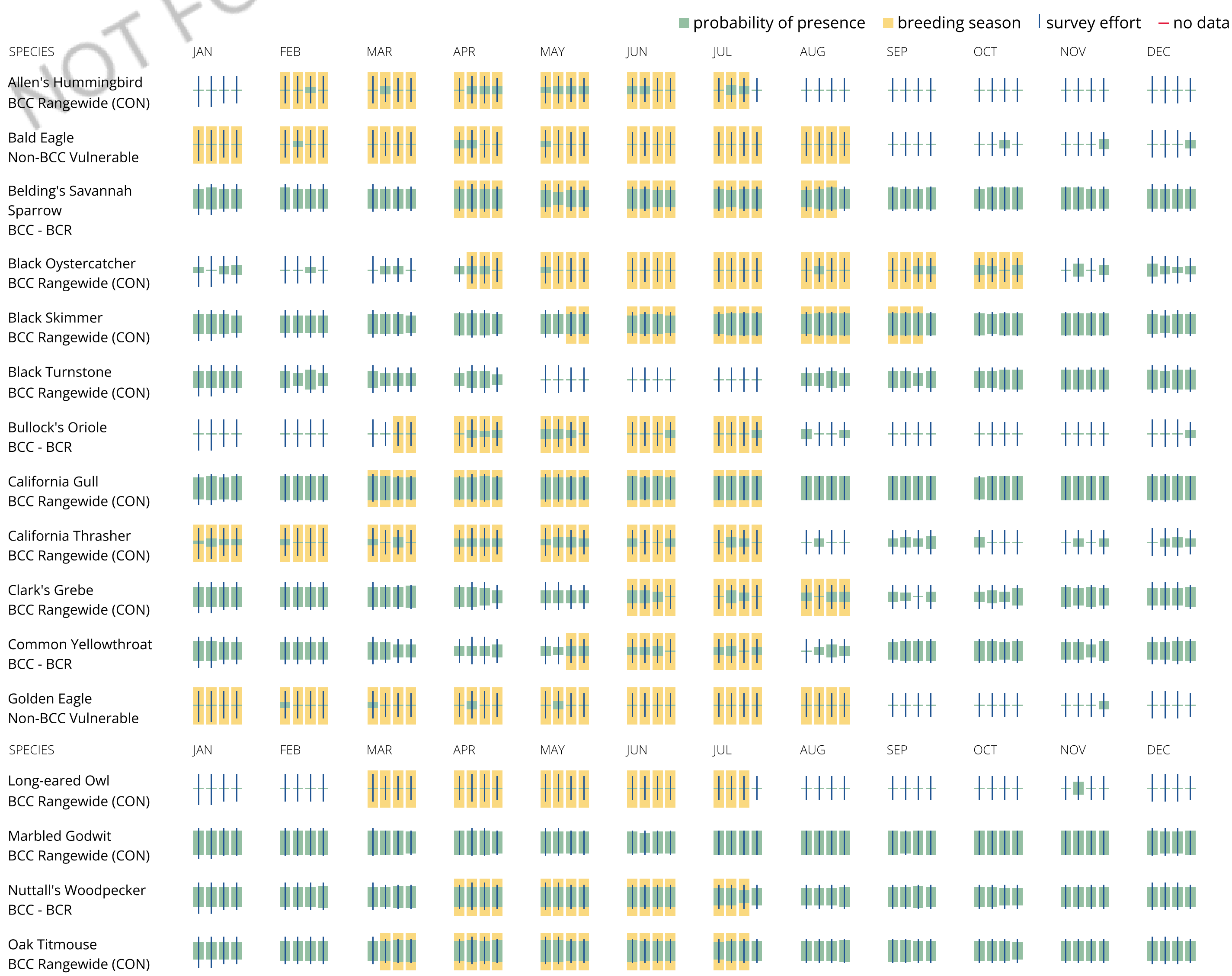
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

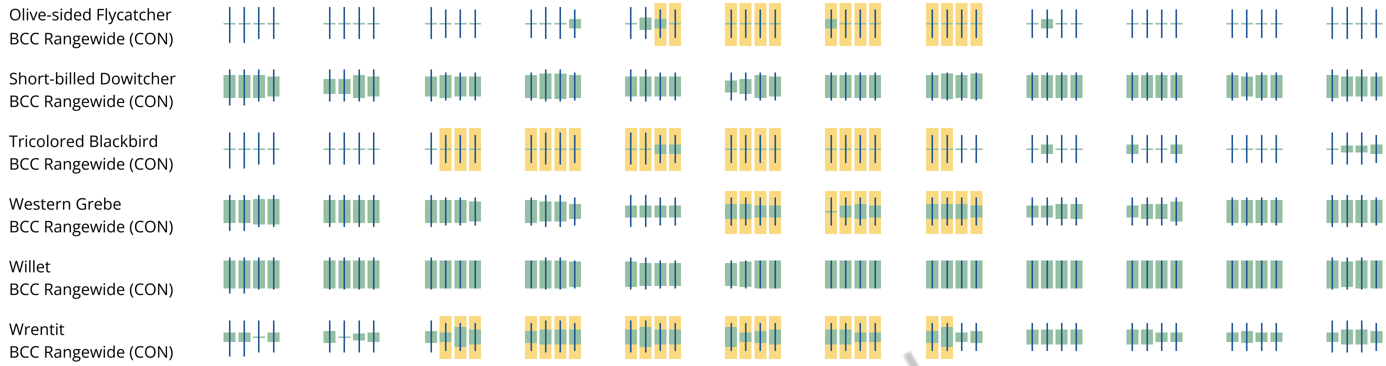
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

09_Potential BPS 2 - Purified Transmission Alignment Option 2

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
California Clapper Rail *Rallus longirostris obsoletus* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern *Sterna antillarum browni* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet *Brachyramphus marmoratus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Reptiles

NAME	STATUS
Green Sea Turtle *Chelonia mydas* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened

San Francisco Garter Snake Thamnophis sirtalis tetrataenia — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5956

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened
Foothill Yellow-legged Frog Rana boylii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5133	Proposed Threatened

Fishes

NAME	STATUS
Tidewater Goby Eucyclogobius newberryi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
Mission Blue Butterfly Icaricia icarioides missionensis Wherever found There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/6928	Endangered
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered

White-rayed Pentachaeta Pentachaeta bellidiflora Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7782	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

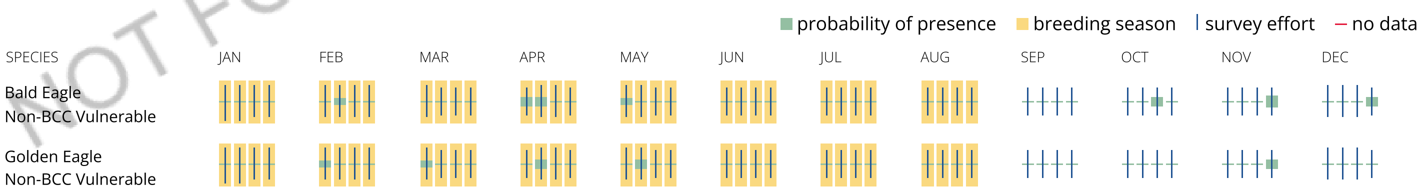
Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher Haematopus bachmani This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black Turnstone Arenaria melanocephala This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31

Common Yellowthroat Geothlypis trichas sinuosa — Breeds May 20 to Jul 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/2084

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Long-eared Owl asio otus — Breeds Mar 1 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3631

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

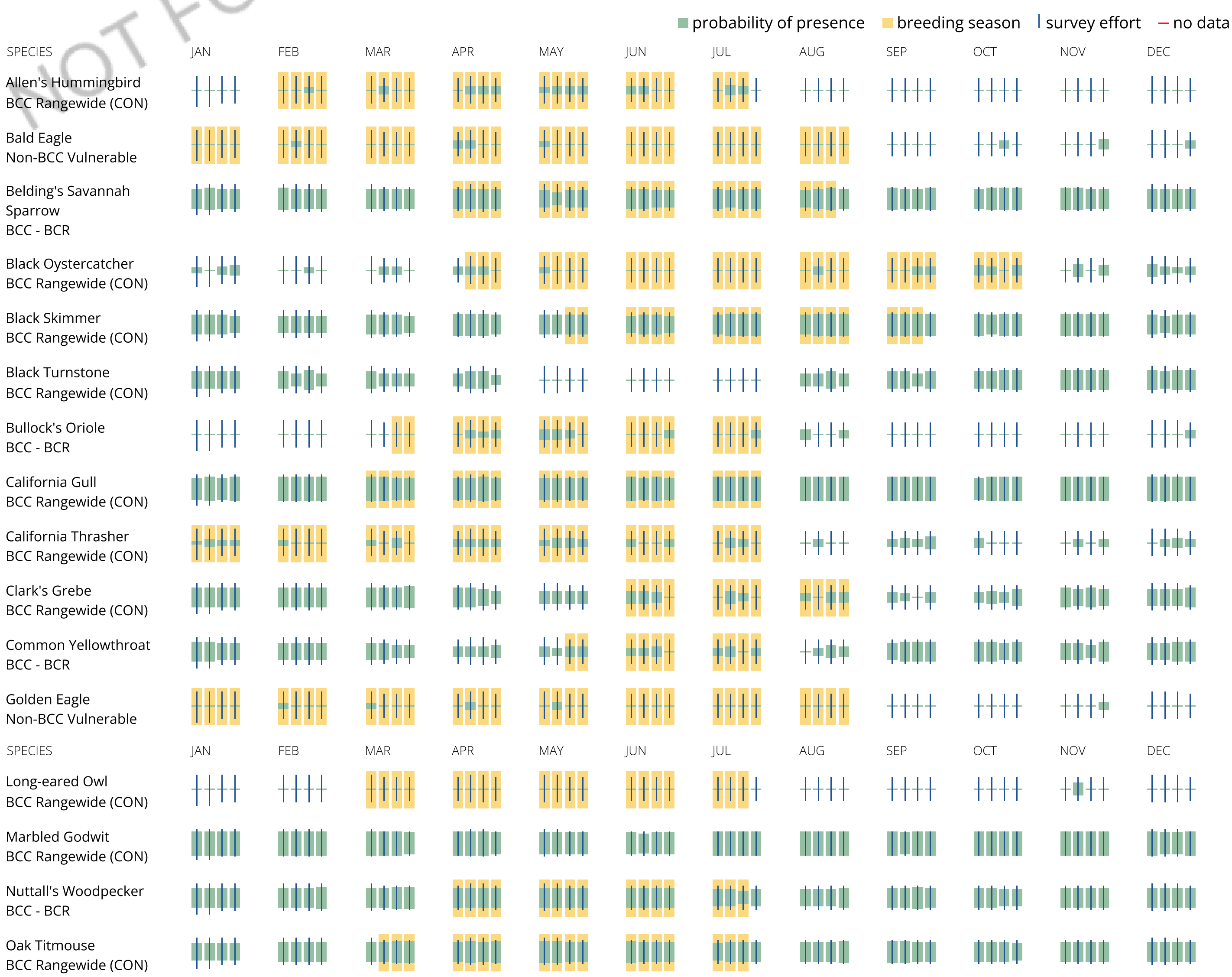
Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

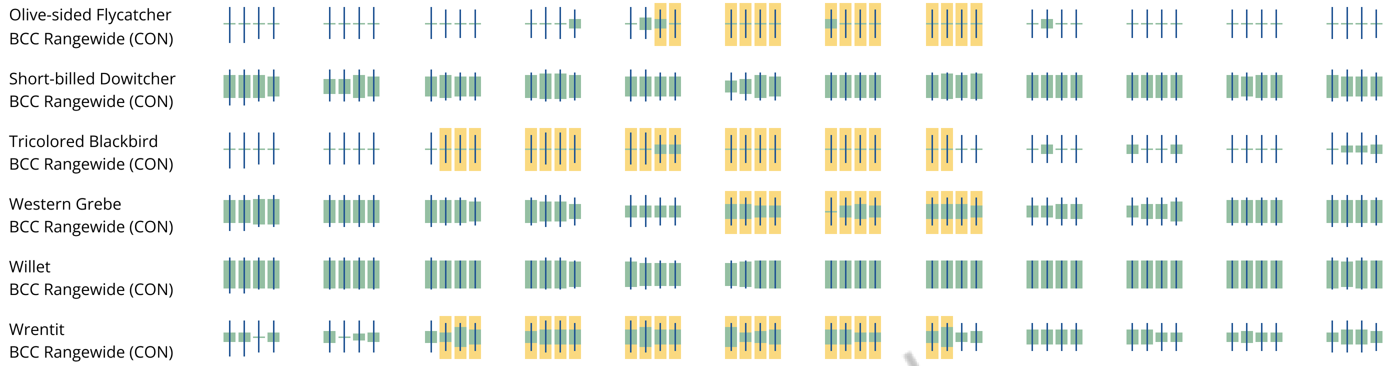
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

10_Potential BPS 2 Alternative - Purified Transmission Alignment Option 2

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Reptiles

NAME	STATUS
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened

San Francisco Garter Snake Thamnophis sirtalis tetrataenia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened
Foothill Yellow-legged Frog Rana boylii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5133	Proposed Threatened

Fishes

NAME	STATUS
Tidewater Goby Eucyclogobius newberryi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
Mission Blue Butterfly Icaricia icarioides missionensis Wherever found There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/6928	Endangered
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered

White-rayed Pentachaeta Pentachaeta bellidiflora | Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/7782

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

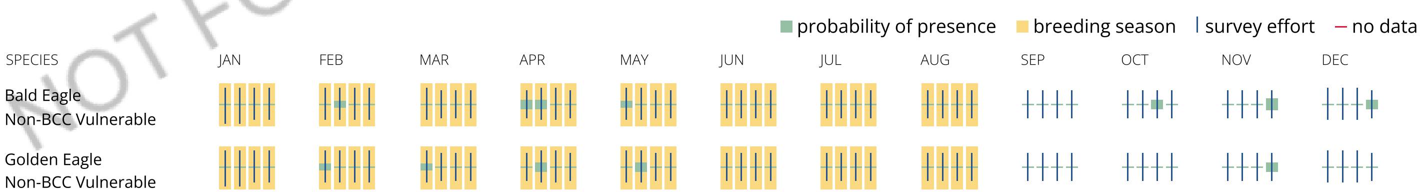
Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher Haematopus bachmani This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black Turnstone Arenaria melanocephala This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31

Common Yellowthroat Geothlypis trichas sinuosa — Breeds May 20 to Jul 31

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/2084

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Long-eared Owl asio otus — Breeds Mar 1 to Jul 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3631

Marbled Godwit Limosa fedoa — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

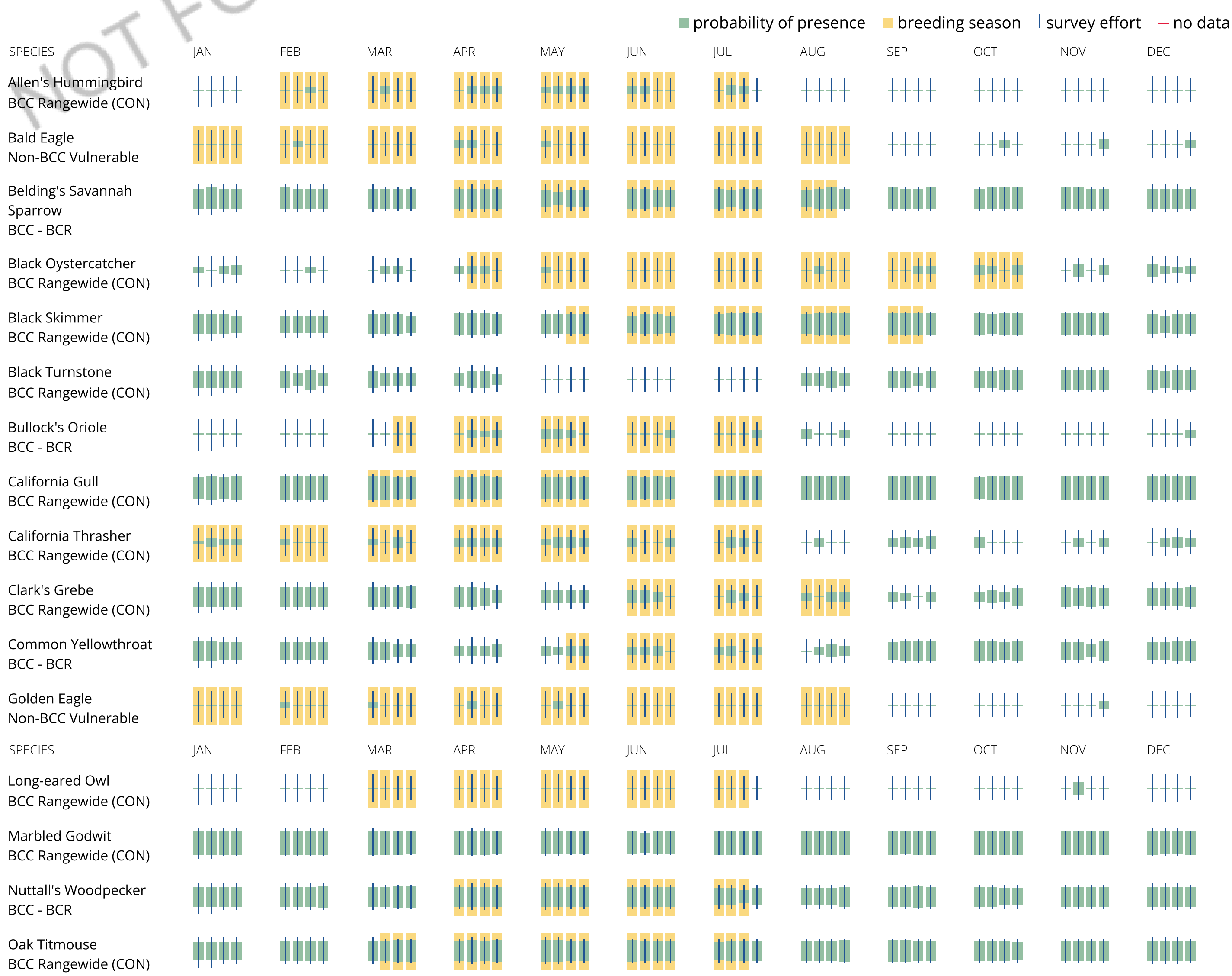
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

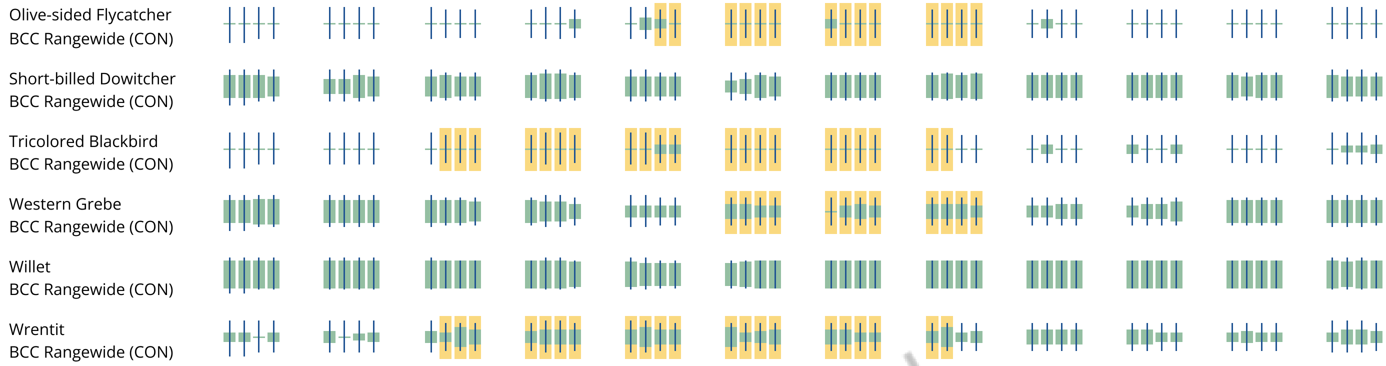
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

10_Potential BPS 1 - Purified Transmission Alignment Option 3

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
California Clapper Rail *Rallus longirostris obsoletus* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern *Sterna antillarum browni* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet *Brachyramphus marmoratus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Reptiles

NAME	STATUS
Green Sea Turtle *Chelonia mydas* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened

San Francisco Garter Snake Thamnophis sirtalis tetrataenia — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5956

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened
Foothill Yellow-legged Frog Rana boylii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5133	Proposed Threatened

Fishes

NAME	STATUS
Tidewater Goby Eucyclogobius newberryi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered
White-rayed Pentachaeta Pentachaeta bellidiflora Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7782	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

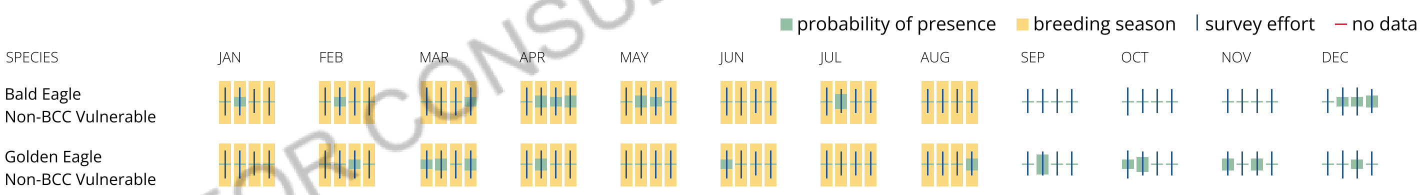
Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf

- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Lawrence's Goldfinch Carduelis lawrencei This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9464	Breeds Mar 20 to Sep 20

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

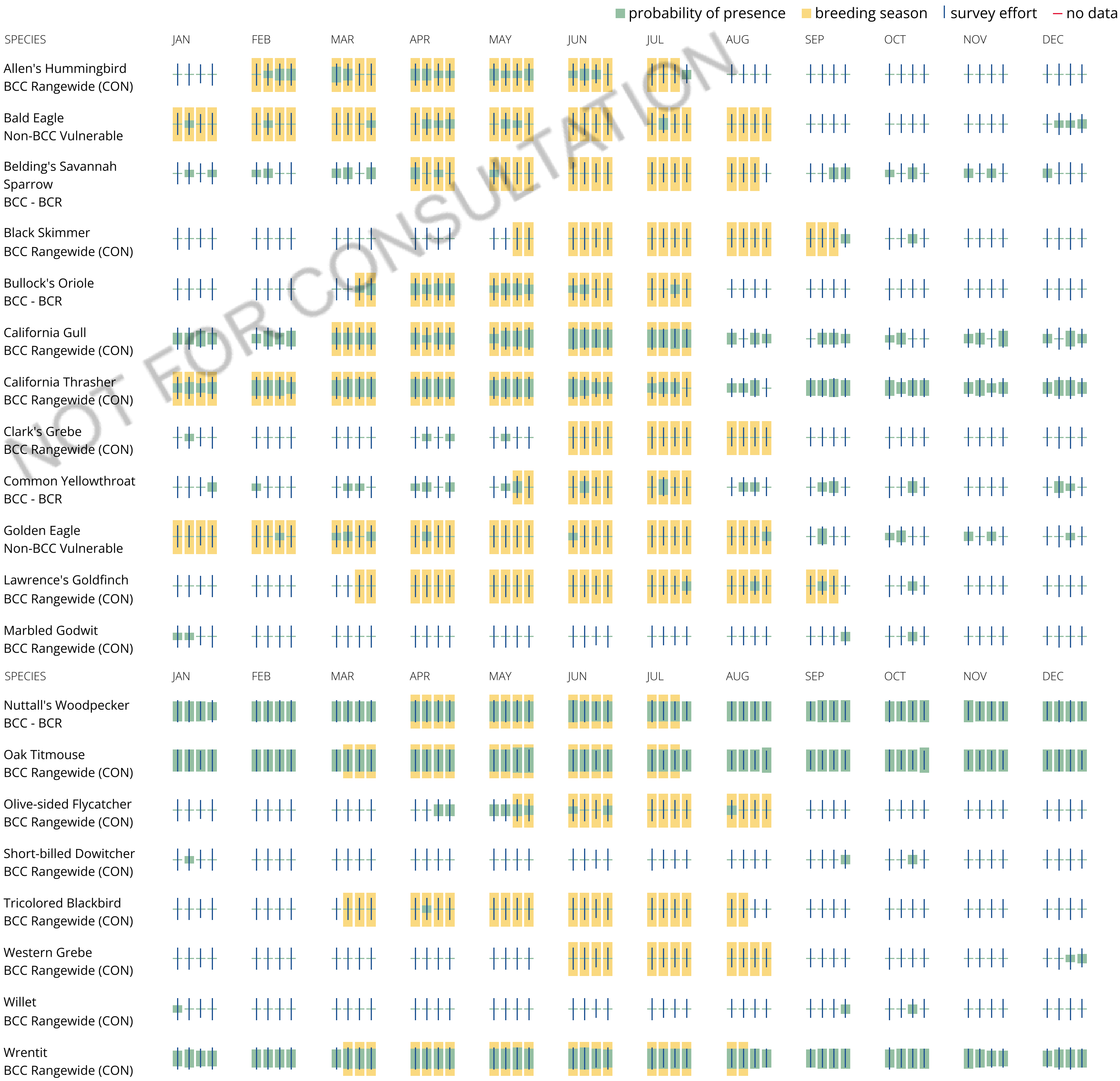
Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

12_Pulgas Point of Connect

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Reptiles

NAME	STATUS
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened

San Francisco Garter Snake Thamnophis sirtalis tetrataenia — Endangered
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5956

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened
Foothill Yellow-legged Frog Rana boylii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5133	Proposed Threatened

Fishes

NAME	STATUS
Tidewater Goby Eucyclogobius newberryi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
Mission Blue Butterfly Icaricia icarioides missionensis Wherever found There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/6928	Endangered
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered

White-rayed Pentachaeta Pentachaeta bellidiflora Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7782	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
California Red-legged Frog Rana draytonii https://ecos.fws.gov/ecp/species/2891#crithab	Final

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

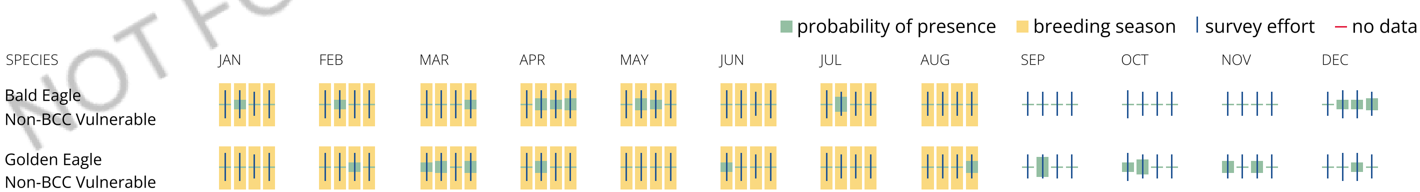
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Lawrence's Goldfinch Carduelis lawrencei — Breeds Mar 20 to Sep 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9464

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

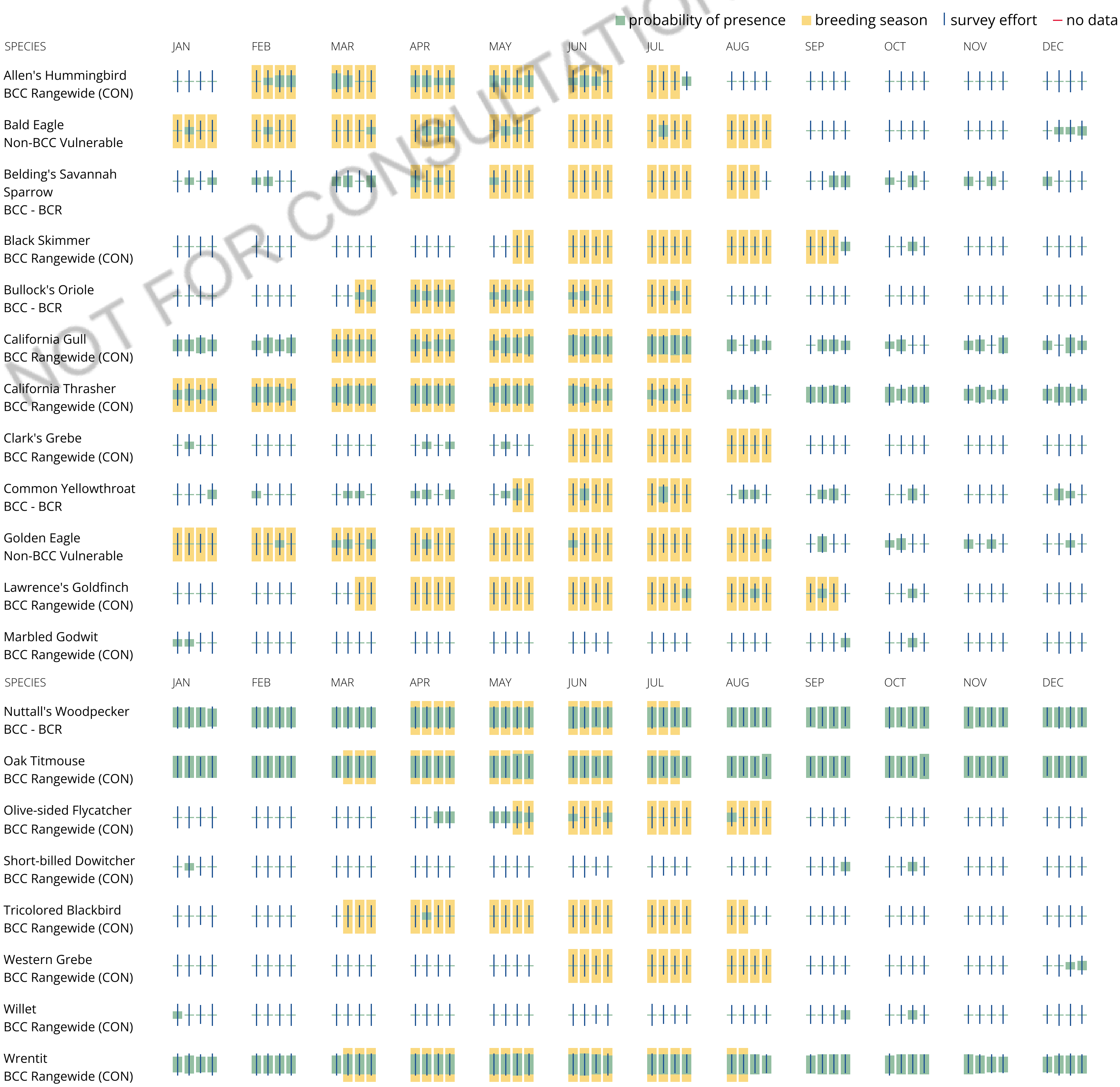
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures] describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

13_Tertiary Alignment - San Mateo WWTP to AWPF

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local offices

San Francisco Bay-Delta Fish And Wildlife

(916) 930-5603
(916) 930-5654

650 Capitol Mall
Suite 8-300
Sacramento, CA 95814

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse Reithrodontomys raviventris Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/613	Endangered

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Western Snowy Plover Charadrius nivosus nivosus — Threatened
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
https://ecos.fws.gov/ecp/species/8035

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) Masticophis lateralis euryxanthus Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5524	Threatened
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened
San Francisco Garter Snake Thamnophis sirtalis tetrataenia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp Branchinecta lynchi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/498	Threatened

Flowering Plants

NAME	STATUS
California Seablite Suaeda californica No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6310	Endangered
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered

Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered
San Mateo Woolly Sunflower Eriophyllum latilobum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7791	Endangered
White-rayed Pentachaeta Pentachaeta bellidiflora Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7782	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

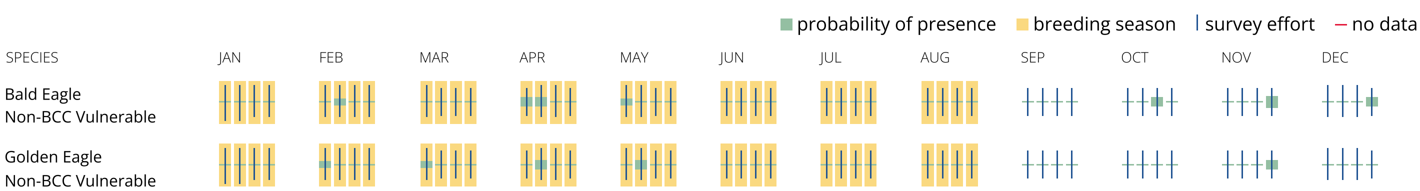
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the [Avian Knowledge Network (AKN)]. The AKN data is based on a growing collection of [survey, banding, and citizen science datasets] and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act] requirements may apply). To see a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator (RAIL) Tool].

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern (BCC)] and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network (AKN)]. The AKN data is based on a growing collection of [survey, banding, and citizen science datasets] and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act] requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator (RAIL) Tool].

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher Haematopus bachmani This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Scoter Melanitta nigra This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15

Black Turnstone Arenaria melanocephala This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Brown Pelican Pelecanus occidentalis This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 15 to Sep 30
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Loon gavia immer This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/4464	Breeds Apr 15 to Oct 31
Common Murre Uria aalge This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Apr 15 to Aug 15
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Long-eared Owl asio otus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15
Long-tailed Duck Clangula hyemalis This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/7238	Breeds elsewhere
Marbled Godwit Limosa fedoa This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9481	Breeds elsewhere
Nuttall's Woodpecker Picoides nuttallii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9410	Breeds Apr 1 to Jul 20

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Red Phalarope Phalaropus fulicarius — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-breasted Merganser Mergus serrator — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-necked Phalarope Phalaropus lobatus — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-throated Loon Gavia stellata — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Ring-billed Gull Larus delawarensis — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Surf Scoter Melanitta perspicillata — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

White-winged Scoter Melanitta fusca — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

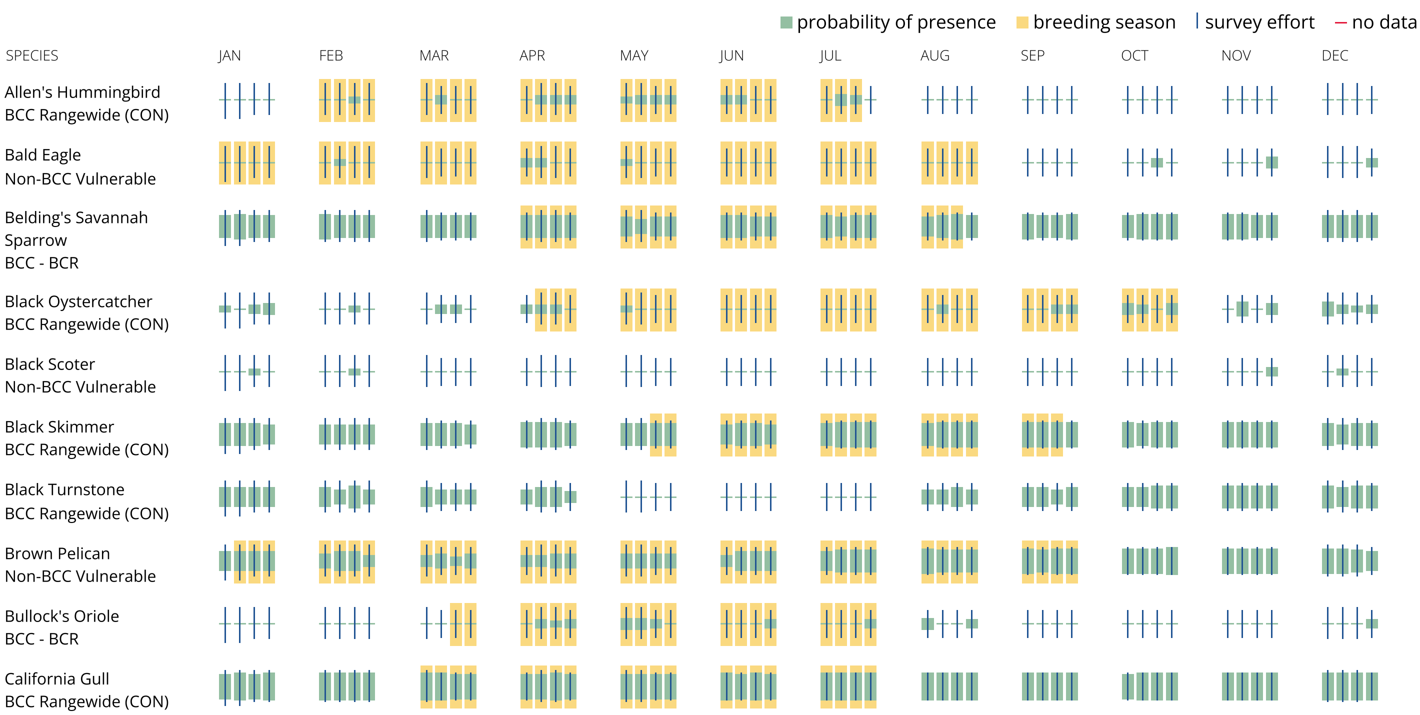
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

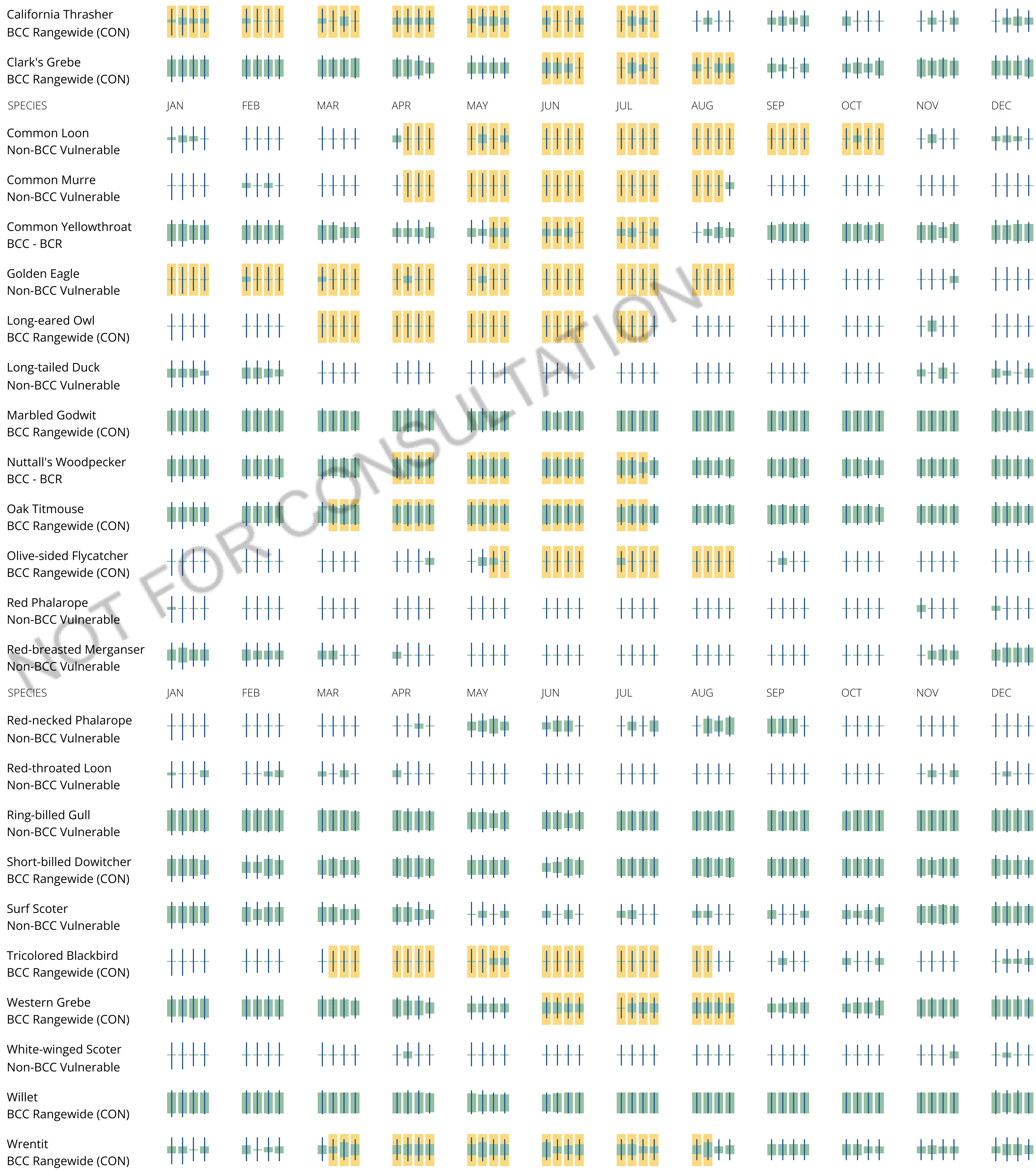
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern (BCC)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

This location overlaps the following National Wildlife Refuge lands:

LAND	ACRES
DON EDWARDS SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE	24,970.16 acres

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

ESTUARINE AND MARINE DEEPWATER
- E1UBL

ESTUARINE AND MARINE WETLAND
- E2USN
- E2USMh
- E2EM1N
- E2SBN

FRESHWATER EMERGENT WETLAND
- PEM1Ch

FRESHWATER POND
- PUSCh
- PUBKx

LAKE
- L2UBHh3

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

14_Purified Transmission Alignment Option 1

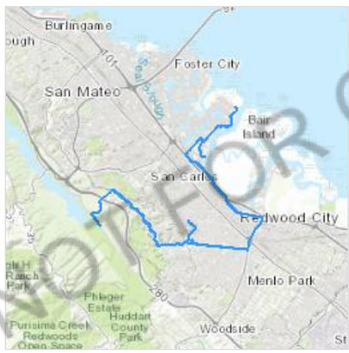
IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California



Local offices

San Francisco Bay-Delta Fish And Wildlife

📞 (916) 930-5603
📠 (916) 930-5654

650 Capitol Mall
Suite 8-300
Sacramento, CA 95814

Sacramento Fish And Wildlife Office

📞 (916) 414-6600
📠 (916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse Reithrodontomys raviventris Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/613	Endangered

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Western Snowy Plover Charadrius nivosus nivosus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/8035	Threatened
Yellow-billed Cuckoo Coccyzus americanus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/3911	Threatened

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) Masticophis lateralis euryxanthus Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5524	Threatened
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened
San Francisco Garter Snake Thamnophis sirtalis tetrataenia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened
Foothill Yellow-legged Frog Rana boylii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5133	Proposed Threatened

Fishes

NAME	STATUS
Tidewater Goby Eucyclogobius newberryi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
Bay Checkerspot Butterfly Euphydryas editha bayensis Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2320	Threatened
Mission Blue Butterfly Icaricia icarioides missionensis Wherever found There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/6928	Endangered

Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp Branchinecta lynchi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/498	Threatened

Flowering Plants

NAME	STATUS
California Seablite Suaeda californica No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6310	Endangered
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered
San Mateo Woolly Sunflower Eriophyllum latilobum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7791	Endangered
Showy Indian Clover Trifolium amoenum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6459	Endangered
White-rayed Pentachaeta Pentachaeta bellidiflora Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7782	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
California Red-legged Frog Rana draytonii https://ecos.fws.gov/ecp/species/2891#crithab	Final

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

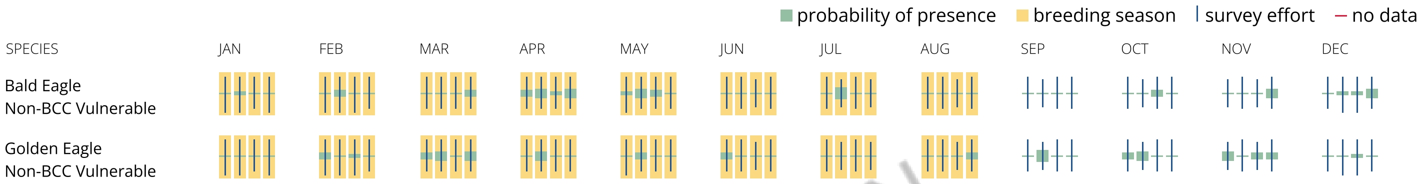
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher Haematopus bachmani This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black Turnstone Arenaria melanocephala This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Lawrence's Goldfinch Carduelis lawrencei This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9464	Breeds Mar 20 to Sep 20
Long-eared Owl asio otus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

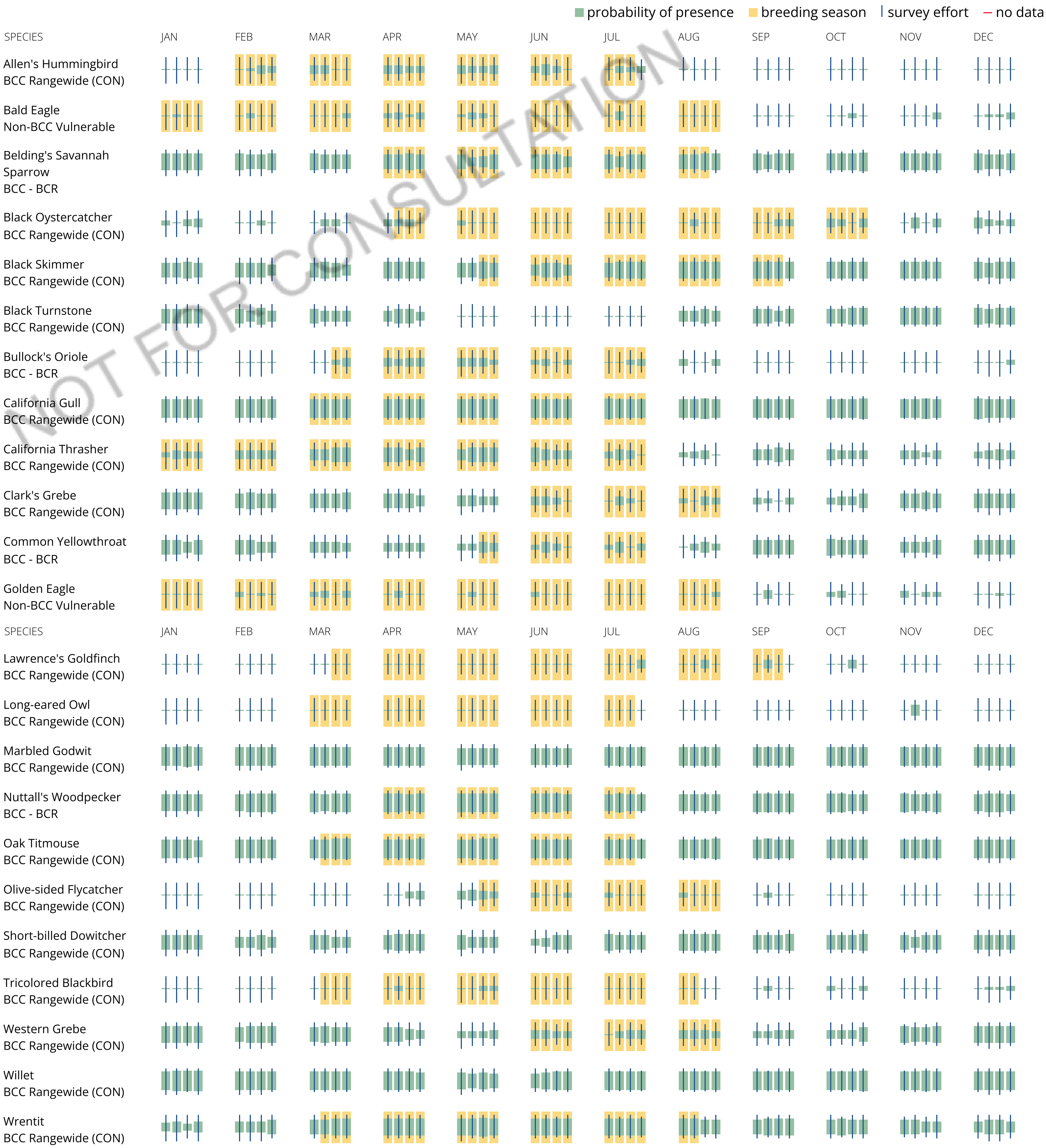
Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

This location overlaps the following National Wildlife Refuge lands:

LAND	ACRES
DON EDWARDS SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE	24,970.16 acres

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

ESTUARINE AND MARINE DEEPWATER
- E1UBL

ESTUARINE AND MARINE WETLAND
- E2EM1N
- E2SBNx
- E2EM1Nh
- E2USN

FRESHWATER EMERGENT WETLAND
- PEM1Ch

FRESHWATER FORESTED/SHRUB WETLAND
- PFOA

FRESHWATER POND
- PUBKx
- PUSCh

RIVERINE
- R4SBC
- R4SBCx
- R4SBAx

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

15_Purified Transmission Alignment Option 2

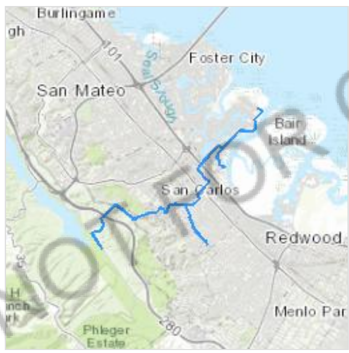
IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California



Local offices

San Francisco Bay-Delta Fish And Wildlife

(916) 930-5603
(916) 930-5654

650 Capitol Mall
Suite 8-300
Sacramento, CA 95814

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse Reithrodontomys raviventris Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/613	Endangered

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Western Snowy Plover *Charadrius nivosus nivosus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/8035	Threatened

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) *Masticophis lateralis euryxanthus* Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5524	Threatened
Green Sea Turtle *Chelonia mydas* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened
San Francisco Garter Snake *Thamnophis sirtalis tetrataenia* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* Wherever found There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander *Ambystoma californiense* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened
Foothill Yellow-legged Frog *Rana boylii* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5133	Proposed Threatened

Fishes

NAME	STATUS
Tidewater Goby *Eucyclogobius newberryi* Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
Mission Blue Butterfly *Icaricia icarioides missionensis* Wherever found There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/6928	Endangered
Monarch Butterfly *Danaus plexippus* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Crustaceans

NAME	STATUS

Vernal Pool Fairy Shrimp Branchinecta lynchi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/498	Threatened

Flowering Plants

NAME	STATUS
California Seablite Suaeda californica No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6310	Endangered
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered
San Mateo Woolly Sunflower Eriophyllum latilobum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7791	Endangered
White-rayed Pentachaeta Pentachaeta bellidiflora Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7782	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
California Red-legged Frog Rana draytonii https://ecos.fws.gov/ecp/species/2891#crithab	Final

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

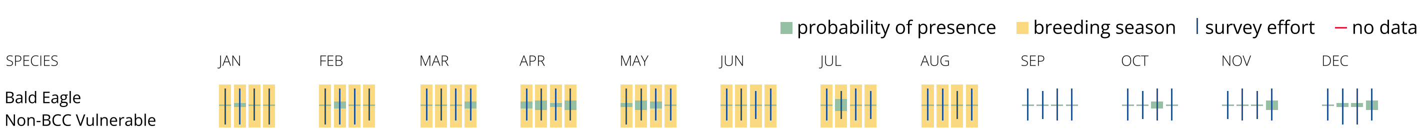
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Golden Eagle
Non-BCC Vulnerable

What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15

Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher Haematopus bachmani This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black Turnstone Arenaria melanocephala This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Lawrence's Goldfinch Carduelis lawrencei This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9464	Breeds Mar 20 to Sep 20
Long-eared Owl asio otus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15
Marbled Godwit Limosa fedoa This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9481	Breeds elsewhere
Nuttall's Woodpecker Picoides nuttallii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9410	Breeds Apr 1 to Jul 20

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

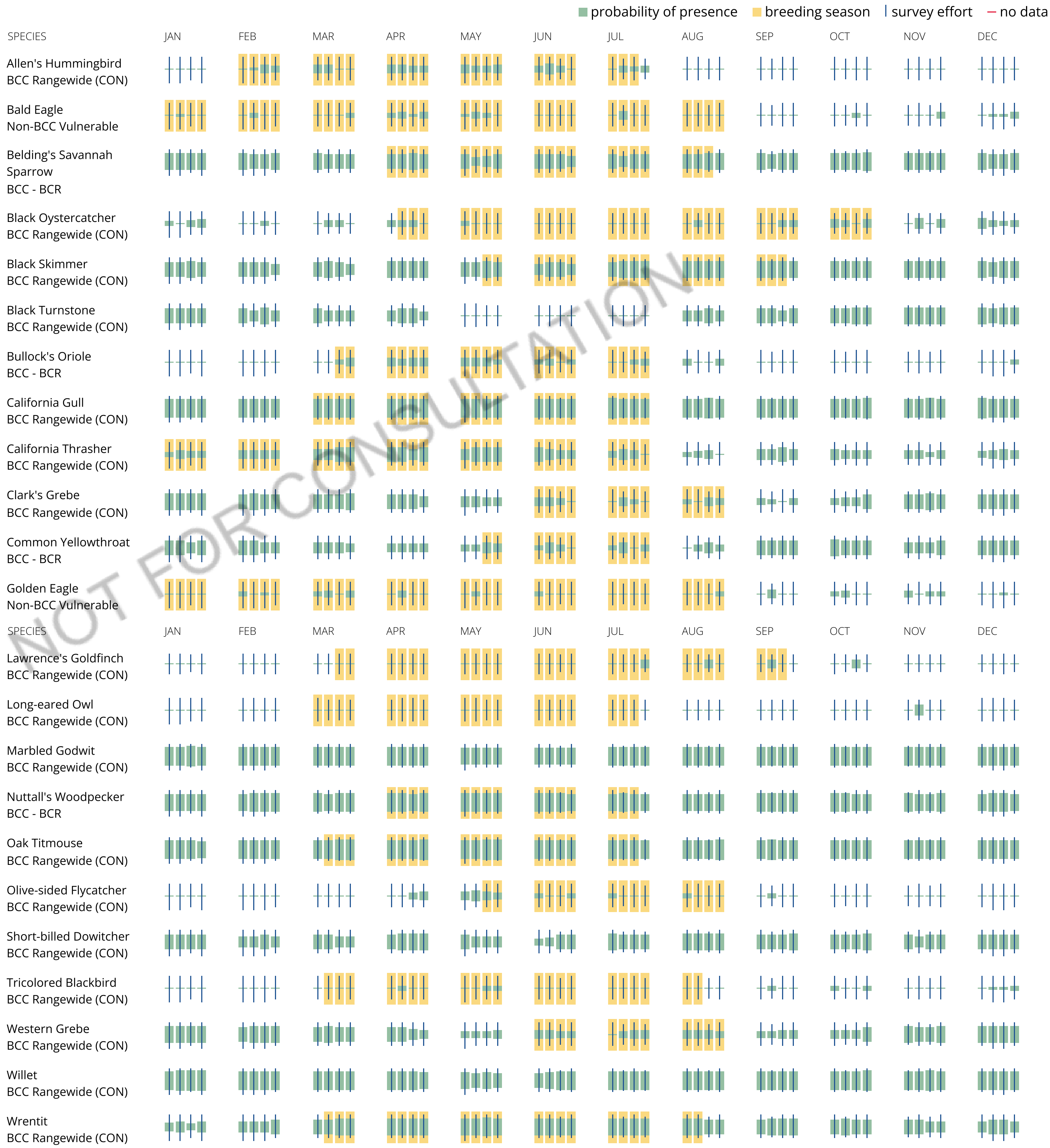
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

ESTUARINE AND MARINE WETLAND
- E2EM1N

FRESHWATER FORESTED/SHRUB WETLAND
- PFOA

FRESHWATER POND
- PUBKx
- PUSCh

RIVERINE
- R4SBC
- R4SBCx
- R4SBAx

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

IPaC **U.S. Fish & Wildlife Service**

16_Purified Transmission Alignment Option 3

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

San Mateo County, California

Local offices

San Francisco Bay-Delta Fish And Wildlife

(916) 930-5603
(916) 930-5654

650 Capitol Mall
Suite 8-300
Sacramento, CA 95814

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse Reithrodontomys raviventris Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/613	Endangered

Birds

NAME	STATUS
California Clapper Rail Rallus longirostris obsoletus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern Sterna antillarum browni Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8104	Endangered
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened

Western Snowy Plover Charadrius nivosus nivosus — Threatened
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
https://ecos.fws.gov/ecp/species/8035

Yellow-billed Cuckoo Coccyzus americanus — Threatened
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
https://ecos.fws.gov/ecp/species/3911

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) Masticophis lateralis euryxanthus Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5524	Threatened
Green Sea Turtle Chelonia mydas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6199	Threatened
San Francisco Garter Snake Thamnophis sirtalis tetrataenia Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5956	Endangered

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii Wherever found There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened
Foothill Yellow-legged Frog Rana boylii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5133	Proposed Threatened

Fishes

NAME	STATUS
Tidewater Goby Eucyclogobius newberryi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/57	Endangered

Insects

NAME	STATUS
Bay Checkerspot Butterfly Euphydryas editha bayensis Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/2320	Threatened
Mission Blue Butterfly Icaricia icarioides missionensis Wherever found There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/6928	Endangered

Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp Branchinecta lynchi Wherever found There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/498	Threatened

Flowering Plants

NAME	STATUS
California Seablite Suaeda californica No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6310	Endangered
Fountain Thistle Cirsium fontinale var. fontinale Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7939	Endangered
Marin Dwarf-flax Hesperolinon congestum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5363	Threatened
San Mateo Thornmint Acanthomintha obovata ssp. duttonii Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2038	Endangered
San Mateo Woolly Sunflower Eriophyllum latilobum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7791	Endangered
Showy Indian Clover Trifolium amoenum Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6459	Endangered
White-rayed Pentachaeta Pentachaeta bellidiflora Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7782	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
California Red-legged Frog Rana draytonii https://ecos.fws.gov/ecp/species/2891#crithab	Final

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

Additional information can be found using the following links:

- Eagle Managment https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

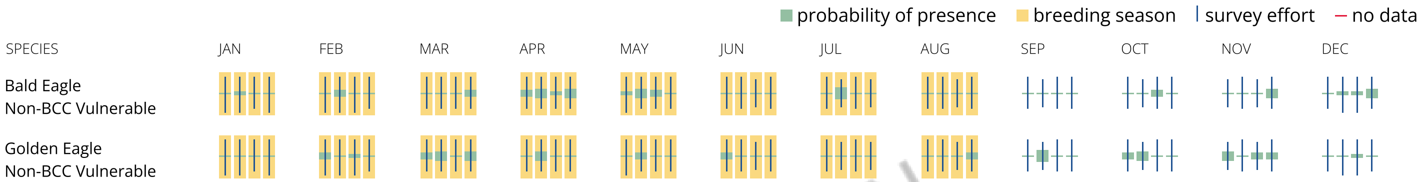
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the [Avian Knowledge Network (AKN)](). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets]() and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act]() requirements may apply). To see a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator (RAIL) Tool]().

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern (BCC)]() and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network (AKN)](). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets]() and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act]() requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator (RAIL) Tool]().

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the [Eagle Act]() should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/ documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Aug 31
Belding's Savannah Sparrow Passerculus sandwichensis beldingi This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Black Oystercatcher Haematopus bachmani This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9591	Breeds Apr 15 to Oct 31
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black Turnstone Arenaria melanocephala This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bullock's Oriole Icterus bullockii This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull Larus californicus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Clark's Grebe Aechmophorus clarkii This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Golden Eagle Aquila chrysaetos This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Lawrence's Goldfinch Carduelis lawrencei This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9464	Breeds Mar 20 to Sep 20
Long-eared Owl asio otus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15

Marbled Godwit Limosa fedoa — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

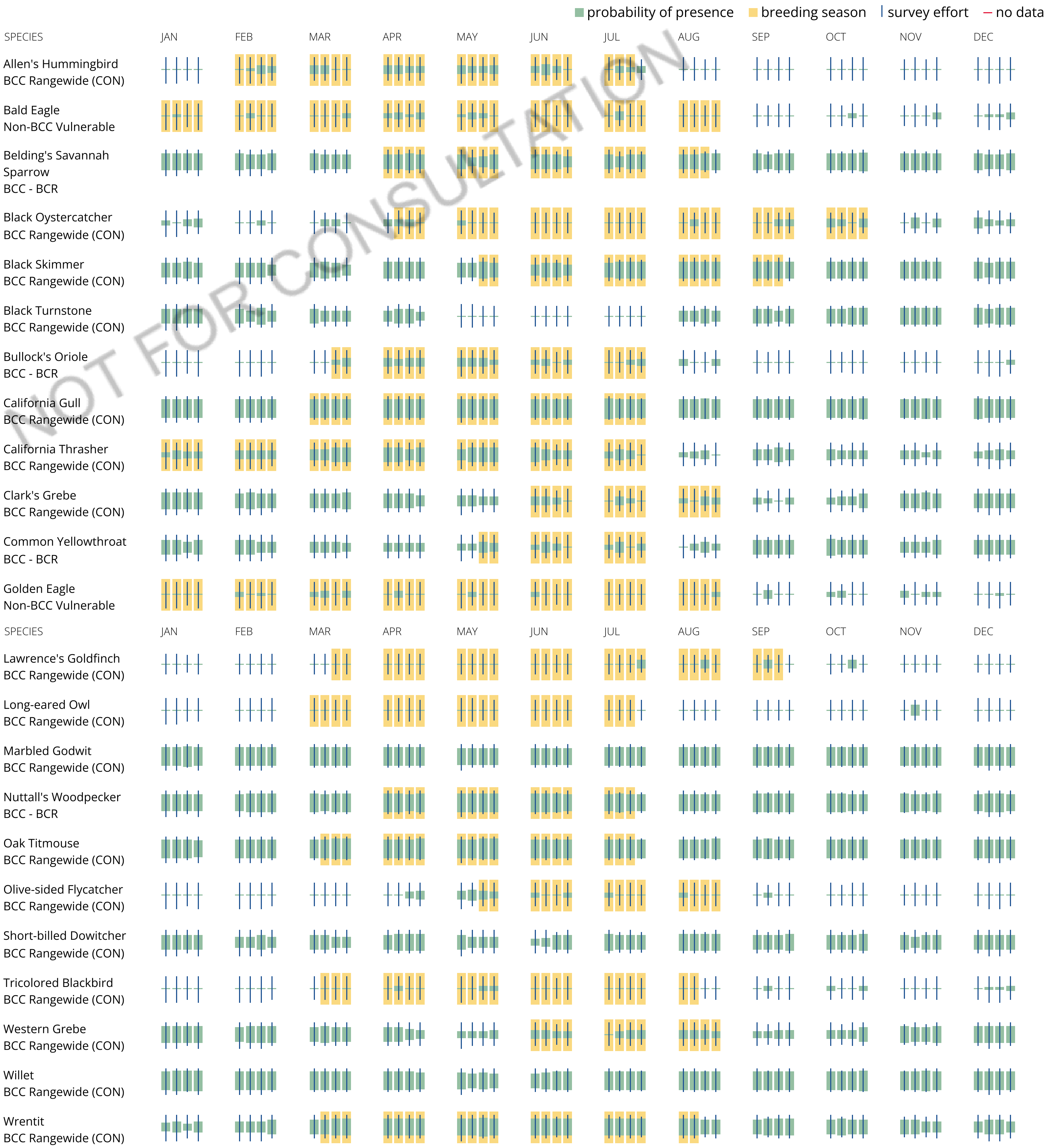
Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

This location overlaps the following National Wildlife Refuge lands:

LAND	ACRES
DON EDWARDS SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE	24,970.16 acres

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

ESTUARINE AND MARINE WETLAND
- E2EM1N
- E2SBNx
- E2EM1Nh
- E2USN

FRESHWATER EMERGENT WETLAND
- PEM1Ch

FRESHWATER FORESTED/SHRUB WETLAND
- PFOA
- PSSA

FRESHWATER POND
- PUBKx
- PUSCh

RIVERINE
- R4SBC
- R4SBAx

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Appendix F Drawings

F.1 AWPF Drawings

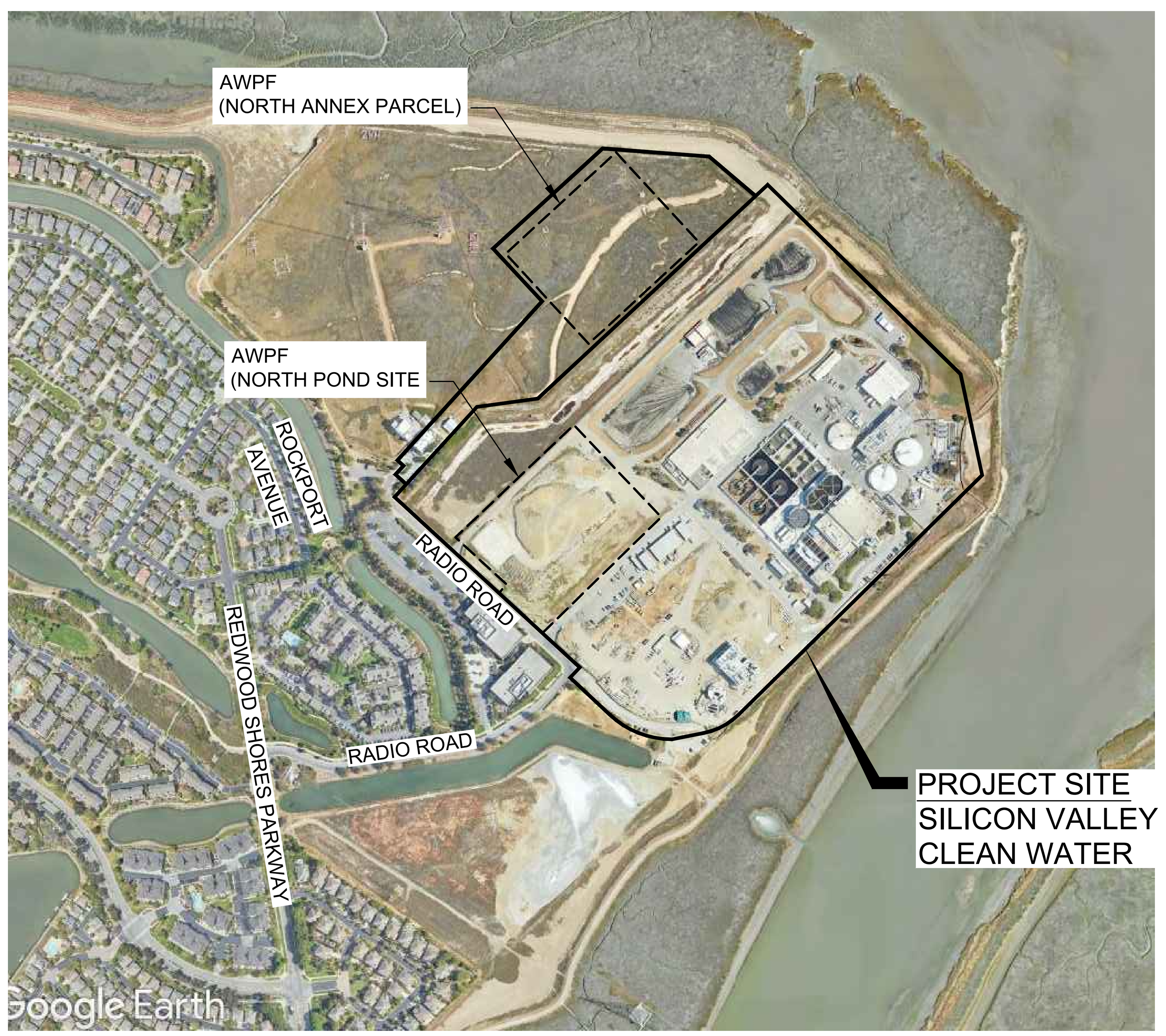
AWPF Conceptual-Level Design Package:

- G-01: Cover, Location & Vicinity Maps, And Drawing Index
- G-02: General Abbreviations
- G-03: General Notes, Legend And Process Symbols
- G-04: Project Flow Diagram, Design Criteria And Pipe Schedule
- G-05: General Process Symbols
- G-06: AWPF Process Flow Diagram - I
- G-07: AWPF Process Flow Diagram - II
- G-08: Hydraulic Profile - AWPF
- C-01: Civil Legend
- C-02: AWPF Site Topography And Yard Piping Plan
- C-03: AWPF Site Plan
- C-04: AWPF Grading Plan

PUREWATER PENINSULA
SAN MATEO COUNTY, CALIFORNIA

BASIS OF DESIGN REPORT
ADVANCED WATER PURIFICATION FACILITY

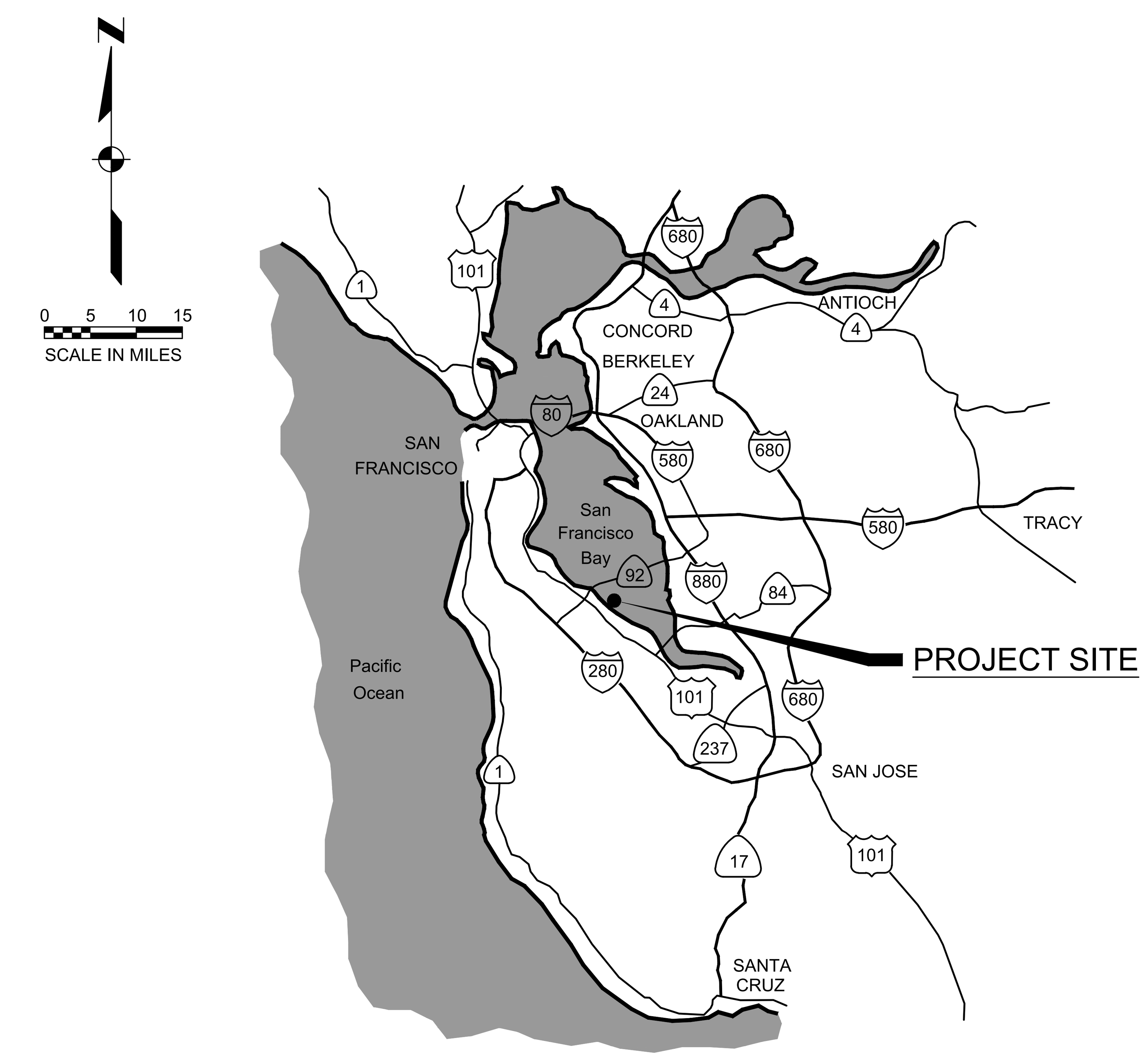
Pure Water PENINSULA
Our Water | Our Future



LOCATION MAP
SCALE: NTS

DRAWING INDEX

SHEET	DRAWING	TITLE
GENERAL		
1	G-01	COVER, LOCATION & VICINITY MAPS, AND DRAWING INDEX
2	G-02	GENERAL ABBREVIATIONS
3	G-03	GENERAL NOTES, LEGEND AND PROCESS SYMBOLS
4	G-04	PROJECT FLOW DIAGRAM, DESIGN CRITERIA AND PIPE SCHEDULE
5	G-05	GENERAL PROCESS SYMBOLS
6	G-06	AWPF PROCESS FLOW DIAGRAM - I
7	G-07	AWPF PROCESS FLOW DIAGRAM - II
8	G-08	HYDRAULIC PROFILE - AWPF
CIVIL		
9	C-01	CIVIL LEGEND
10	C-02	AWPF SITE TOPOGRAPHY AND YARD PIPING PLAN
11	C-03	AWPF SITE PLAN
12	C-04	AWPF GRADING PLAN



VICINITY MAP
SCALE: NTS

Kennedy Jenks

10% SUBMITTAL	NO	REVISION	DATE	BY
PRELIMINARY DESIGN PHASE NOT FOR CONSTRUCTION THIS DOCUMENT IS AN INTERIM DOCUMENT AND NOT SUITABLE FOR CONSTRUCTION. AS AN INTERIM DOCUMENT, IT MAY CONTAIN DATA THAT IS POTENTIALLY INACCURATE OR INCOMPLETE AND IS NOT TO BE RELIED UPON WITHOUT THE EXPRESS WRITTEN CONSENT OF THE PREPARER.				

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0 — 1"
0 — 25mm
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DRAWN CBD
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PUREWATER PENINSULA
SAN MATEO COUNTY, CALIFORNIA
BASIS OF DESIGN REPORT
ADVANCED WATER PURIFICATION FACILITY
Kennedy Jenks

COVER, LOCATION & VICINITY MAPS, AND DRAWING INDEX

SCALE NTS
JOB NO 2268026.00
DATE MAY 2024
SHEET 1 OF 12
G-01

ABBREVIATIONS

'	FOOT, FEET
"	INCH, INCHES
#	POUND, NUMBER
%	PERCENT
&	AND
@	AT
℄	CENTERLINE
ℙ	PLATE
±	APPROXIMATELY
<	LESS THAN
=	EQUALS
>	GREATER THAN
Δ	DEFLECTION
∠	ANGLE
°	DEGREE(-S) (ANGULAR)
A	AMPERE(-S)
A/C	AIR CONDITIONING
A/D	ANALOG TO DIGITAL
A/M	AUTO/MANUAL
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS
AB	AGGREGATE BASE, ANCHOR BOLT(-S)
ABAN(-D)	ABANDON(-ED)
ABS	ABSOLUTE, ACRYLONITRILE-BUTADIENE-STYRENE
AC	ASPHALTIC CONCRETE, ALTERNATING CURRENT
ACH	AIR CHANGES PER HOUR
ACI	AMERICAN CONCRETE INSTITUTE
ACK	ACKNOWLEDGE
ACOUS	ACOUSTIC(-AL)
ACP	ASBESTOS CEMENT PIPE
ADA	AMERICANS WITH DISABILITIES ACT
ADDIT	ADDITIONAL
ADJ	ADJUST(-ED,-MENT,-ABLE)
ADJT	ADJACENT
ADWF	AVERAGE DRY WEATHER FLOW
AF	ACRE-FEET, AMPERE FRAME
AFCI	ARC-FAULT CIRCUIT INTERRUPTER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AGG	AGGREGATE
AI	ANALOG INPUT
AIC	AMPERES INTERRUPTING CAPACITY
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AISI	AMERICAN IRON AND STEEL INSTITUTE
AITC	AMERICAN INSTITUTE OF TIMBER CONSTRUCTION
ALT	ALTERNAT(-E, -OR)
ALTD	ALTITUDE
ALUM	ALUMINUM
AMB	AMBIENT
ANC	ANCHOR
ANN	ANNUNCIATOR
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ANT	ANTENNA
AO	ANALOG OUTPUT
APA	AMERICAN PLYWOOD ASSOCIATION
APPROX	APPROXIMATE(-LY)
ARCH	ARCHITECT(-URAL)
AS	AMMETER SWITCH
ASB	ASBESTOS
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASD	ADJUSTABLE SPEED DRIVE (DC)
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASPH	ASPHALT
ASSY	ASSEMBLY
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AT	AMPERE TRIP
ATM	ATMOSPHERE (14.7 LB/IN2)
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AUX	AUXILIARY
AVE	AVENUE
AVG	AVERAGE
AWG	AMERICAN WIRE GAGE
AWS	AMERICAN WELDING SOCIETY
AWT	ADVANCED WATER TREATMENT
AWWA	AMERICAN WATER WORKS ASSOCIATION
B/W	BOTTOM OF WALL
BARM	BARMINUTOR
BATT	BATTERY
BB(S)	BEARING BAR(-S)
BC	BEGINNING OF HORIZONTAL CURVE, BARE COPPER
BCR	BEGIN CURB RETURN
BD	BOARD, BELT DRIVE
BDD	BACKDRAFT DAMPER
BF	BLIND FLANGE
BFP	BELT FILTER PRESS, BACKFLOW PREVENTER
BHP	BRAKE HORSEPOWER
BITUM	BITUMINOUS
BKR	BREAKER
BL	BUILDING LINE
BLDG	BUILDING
BLK	BLOCK(-S)
BLKG	BLOCKING
BM	BEAM, BENCH MARK
BM-1	BEAM MEMBER 1
BN	BOUNDARY NAILING
BO	BLOWOFF
BOC	BACK OF CURB
BOD 5	BIOCHEMICAL OXYGEN DEMAND (5 DAY)
BOT	BOTTOM
BP	BASE PLATE
BRG	BEARING
BS	BLACK STEEL, BOTH SIDES
BSMT	BASEMENT
BTU	BRITISH THERMAL UNIT

BTWN	BETWEEN
BVC	BEGINNING OF VERTICAL CURVE
C	CURVE, CONDUCTOR, CONTACT
C/C	CENTER-TO-CENTER
C/S	CONSTANT SPEED
CAB	CABINET
CALC(S)	CALCULATION(S)
CAT	CATEGORY
CATV	CABLE TV
CB	CATCH BASIN, CIRCUIT BREAKER
CC	CUBIC CENTIMETER(-S)
CCT	CHLORINE CONTACT TANK
CCTV	CLOSED-CIRCUIT TELEVISION
CD	CONTROL DAMPER
CEM	CEMENT
CEN	CENTRAL
CENT	CENTRIFUGAL
CER	CEILING EXHAUST RETURN
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CH	CHAMBER
CHAN	CHANNEL
CHEM	CHEMI(-CAL, -STRY)
CHK	CHECK
CHKD	CHECKERED
CI	CAST IRON
CID1	CLASSIFICATION I, DIVISION 1
CID2	CLASSIFICATION I, DIVISION 2
CIP	CAST IRON PIPE, CAST IN PLACE, CLEAN IN PLACE
CIRC	CIRCULA(-R, -TION)
CIRCUM	CIRCUMFERENCE
CISP	CAST IRON SOIL PIPE
CJ	CONSTRUCTION JOINT
CJP	COMPLETE JOINT PENETRATION
CKT	CIRCUIT
CL2	CHLORINE
CLASS	CLASSIFICATION
CLG	CEILING
CLOS	CLOSET
CLR	CLEAR(-ANCE)
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CM	CENTIMETERS
CMC	CEMENT MORTAR COATED
CML	CEMENT MORTAR LINED
CML&C	CEMENT MORTAR LINED AND COATED
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CNJ	CONTROL JOINT
CNTR	CENTER
CNTRSK	COUNTERSUNK
CO	CLEANOUT, CONDUIT ONLY
CO2	CARBON DIOXIDE
COAX	COAXIAL
COD	CHEMICAL OXYGEN DEMAND
COL	COLUMN
COM	COMMON
COMM	COMMUNICATION
COMP	COMPRESSOR
CONC	CONCRETE
COND	CONDENSATE, CONDUIT
CONN	CONNECT (-ED, -S, -ION)
CONST	CONSTRUCTION
CONT	CONTINU(-ED, -OUS, -ATION)
COORD	COORDINATE
COP	COEFFICIENT OF PERFORMANCE
COR	CORNER
CORP	CORPORATION
CORR	CORRUGATED
COTG	CLEANOUT TO GRADE
CP	CONTROL POINT, CATHODIC PROTECTION
CPLG	COUPLING
CPT	CONTROL POWER TRANSFORMER
CPVC	CHLORINATED POLYVINYL CHLORIDE
CR	CONTROL RELAY, CRUSHED ROCK
CSD	CEILING SUPPLY DIFFUSER
CT	COURT, CURRENT TRANSFORMER, COOLING TOWER
CTRL	CONTROL
CTS	CATHODIC TEST STATION
CU FT	CUBIC FOOT, CUBIC FEET
CU IN	CUBIC INCH(-ES)
CU M	CUBIC METER(-S)
CU YD	CUBIC YARD(-S)
CUR	CURRENT
CV	VALVE FLOW COEFFICIENT
CWT	ONE HUNDRED POUNDS
DB	DRY BULB
DBL	DOUBLE
DC	DIRECT CURRENT
DCA	DOUBLE CHECK ASSEMBLY (TWIN ELEMENT CHECK VALVE)
DCS	DISTRIBUTED CONTROL SYSTEM
DEFL	DEFLECTION
DEG	DEGREE(-S)
DEG C	DEGREES CELSIUS
DEG F	DEGREES FARENHEIT
DEMO	DEMOLISH
DEPT	DEPARTMENT
DH	HEAD LOSS (IN FEET), DOWNHOLE
DI	DUCTILE IRON, DROP INLET, DISCRETE INPUT
DIA	DIAMETER
DIAG	DIAGONAL, DIAGRAM
DIAPH	DIAPHRAGM
DIM(-S)	DIMENSION(-S)
DIP	DUCTILE IRON PIPE
DIR	DIRECTION
DISC	DISCONNECT
DISCH	DISCHARGE
DISTR	DISTRIBUTION
DL	DEAD LOAD
DN	DOWN
DO	DISSOLVED OXYGEN, DISCRETE OUTPUT

DPDT	DOUBLE POLE, DOUBLE THROW
DPST	DOUBLE POLE, SINGLE THROW
DR	DOOR, DRAIN, DRYER
DRG	DOUBLE RUBBER GASKET JOINT
DS	DOWN SPOUT
DTL(-S)	DETAIL(-S)
DUP	DUPLEX
DWG(-S)	DRAWING(-S)
E	EAST
EA	EACH, EXHAUST AIR
EC	END OF HORIZONTAL CURVE
ECC	ECCENTRIC
ECD	EPOXY COATED
ECR	END CURB RETURN
EER	ENERGY EFFICIENCY RATIO
EF	EACH FACE
EFFIC	EFFICIENCY
EFFL	EFFLUENT
EG	EXISTING GRADE
EGL	ENERGY GRADE LINE
EL	ELEVATION, EPOXY LINED
EL&C	EPOXY LINED AND COATED
ELEC	ELECTRIC(-AL)
ELEM	ELEMENTARY
ELL	ELBOW
EMBED	EMBEDMENT
EMERG	EMERGENCY
EN	EDGE NAILING
ENCL	ENCLOSURE
ENET	ETHERNET
ENGR	ENGINEER
ENTR	ENTRANCE
EP	EDGE OF PAVEMENT
EPA	ENVIRONMENTAL PROTECTION AGENCY
EQ	EQUAL (-LY, -IZATION)
EQPM	EQUIPMENT
ES	EACH SIDE
ES/EW	EMERGENCY SHOWER/EYE WASH
ESP	EXTERNAL STATIC PRESSURE
EST	ESTIMATE(-D)
E-STOP	EMERGENCY STOP
ETC	ET CETERA
ETM	ELAPSED TIME METER
ETS	ELECTROLYSIS TEST STATION
EUSERC	ELECTRIC UTILITY SERVICE EQUIPMENT REQUIREMENTS COMMITTEE
EVC	END OF VERTICAL CURVE
EW	EACH WAY
EWT	ENTERING WATER TEMPERATURE
EXC	EXCAVATE
EXH	EXHAUST
EXIST	EXISTING
EXP	EXPANSION
EXT	EXTERNAL, EXTERIOR
FA	FIRE ALARM
FAB	FABRICATE(-D)
FAC	FACTORY
FACIL	FACILIT(-Y, -IES)
FAI	FRESH AIR INTAKE
FB	FLAT BAR
FC	FLEXIBLE COUPLING
FCA	FLANGE COUPLING ADAPTER
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN, FIRE DAMPER
FDC	FIRE DEPARTMENT CONNECTION
FDR	FEEDER
FE	FIRE EXTINGUISHER
FF	FAR FACE, FINISHED FLOOR
FFE	FINISHED FLOOR ELEVATION
FG	FINISHED GRADE
FH	FIRE HYDRANT
FIG	FIGURE
FIN	FINISH(-ED)
FL	FLOW LINE
FLA	FIRE/SMOKE DAMPER
FLASH	FLASHING
FLEX	FLEXIBLE
FLG	FLANGE(-D)
FLOC	FLOCCULATION
FLR	FLOOR
FM	FLOW METER
FN	FIELD NAILING
FNDN	FOUNDATION
FO	FIBER OPTIC
FOS	FACE OF STUD
FPS	FEET PER SECOND
FREQ	FREQUENCY
FRP	FIBERGLASS REINFORCED PLASTIC
FRT	FIRE-RETARDANT FLOOR
FS	FINISHED SURFACE, FAR SIDE
FSD	FIRE/SMOKE DAMPER
FT	FOOT, FEET
FTG	FOOTING
FU	FUSE
FURN	FURNITURE, FURNISHINGS
FURR	FURRING
FUT	FUTURE
FVNR	FULL VOLTAGE, NON REVERSING
FVR	FULL VOLTAGE, REVERSING
FWD	FORWARD
G	GRAMS, GROUND (ELECTRICAL)
GA	GAUGE
GAC	GRANULAR ACTIVATED CARBON
GAL	GALLON(-S)
GALV	GALVANIZED
GAS	GASOLINE
GB	GRADE BREAK
GC	GROOVED COUPLING
GDL	GROUND LEVEL
GFCI	GROUND-FAULT CIRCUIT INTERRUPTER
GI	GALVANIZED IRON
GL	GLASS
GLAZ	GLAZING
GLB	GLULAM BEAM
GLL	GLASS LINED

GND	GROUND
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GPR	GROUND PENETRATING RADAR
GR	GRATE
GRL	GUARDRAIL
GRS	GALVANIZED RIGID STEEL
GS	GALVANIZED STEEL
GYP (BD)	GYPSUM (BOARD)
H	HIGH, HEIGHT
H2O2	HYDROGEN PEROXIDE
H2S	HYDROGEN SULFIDE
H2SO4	SULFURIC ACID
HB	HOSE BIBB
HD	HEAVY DUTY, HEAT DETECTOR
HDG	HOT DIP GALVANIZE(-D)
HDPE	HIGH DENSITY POLYETHYLENE
HDWD	HARDWOOD
HGL	HYDRAULIC GRADE LINE
HGR	HANGER
HH	HANDHOLE
HI	HYDRAULIC INSTITUTE
HM	HOLLOW METAL
HMI	HUMAN MACHINE INTERFACE
HOA	HAND-OFF-AUTOMATIC
HOR	HAND-OFF-REMOTE
HORZ	HORIZONTAL
HP	HORSEPOWER
H-P	HINGE POINT
HPT	HIGH POINT
HR(S)	HOUR(-S)
HRL	HANDRAIL
HSPF	HEATING SEASONAL PROFICIENCY FACTOR
HSS	HOLLOW STRUCTURAL SECTION
HST	HOIST
HT	HEIGHT
HTG	HEATING
HTR	HEATER
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING
HVY	HEAVY
HWL	HIGH WATER LEVEL
HWY	HIGHWAY
HYD	HYDRAULIC
HZ	HERTZ (CYCLES PER SECOND)
I&C	INSTRUMENTATION AND CONTROL
I/O	INPUT/OUTPUT
IBC	INTERNATIONAL BUILDING CODE
ICC	INTERNATIONAL CODE COUNCIL
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
IEER	INTEGRATED ENERGY EFFICIENCY RATIO
IF	INSIDE FACE
IL	INDICATING LIGHT
IN	INCH(-ES)
INFL	INFLUENT
INST	INSTANTANEOUS
INSTR	INSTRUMENT(-ATION)
INSUL	INSULATION
INT	INTERIOR, INTERNAL
INV	INVERT
IP	INTERNET PROTOCOL
IPS	INTERNATIONAL PIPE STANDARD, INCHES PER SECOND, IRON PIPE SIZE
IR	INFRARED
IRRG	IRRIGATION
IS	INTRINSICALLY SAFE
ISA	INTERNATIONAL SOCIETY OF AUTOMATION
ISO	ISOLAT(-E, -ION), ISOMETRIC
ISR	INTRINSICALLY SAFE RELAY
IW	INDUSTRIAL WASTE
IX	ION EXCHANGE
JB	JUNCTION BOX
JST	JOIST
JT	JOINT
KA	KILOAMPERE(-S)
KCMIL	THOUSANDS OF CIRCULAR MILS
KG	KNIFE GATE, KILOGRAM(-S)
KHZ	KILOHERTZ
KIP	ONE THOUSAND POUNDS
KM	KILOMETER(-S)
KSI	KIPS PER SQUARE INCH
KV	KILOVOLT(-S)
KVA	KILOVOLT-AMPERE(-S)
KVAR	KILOVOLT-AMPERE(-S) REACTIVE
KVARH	KILOVOLT-AMPERE REACTIVE HOUR(-S)
KW	KILOWATT(-S)
KWH	KILOWATT HOUR(-S)
L	LITER(-S), LENGTH, LINE
L/D	LITERS PER DAY
LA	LIGHTNING ARRESTER
LAB	LABORATORY
LAM	LAMINATE
LAN	LOCAL AREA NETWORK
LAT	LATERAL
LAV	LAVATORY
LB(-S)	POUND(-S)
LB(-S)/SF	POUND(-S) PER SQUARE FOOT
LCP	LOCAL CONTROL PANEL
LCS	LOCAL CONTROL STATION
LD	DEVELOPMENT LENGTH
LDG	LANDING
LE	LIFTING EYE
LEED	LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN
LEL	LOWER EXPLOSIVE LIMIT
LF	LINEAR FEET
LG	LONG
LH	LEFT HAND
LIP	LIP OF GUTTER
LIQ	LIQUID

LL	LIVE LOAD
LLBB	LONG LEG BACK-TO-BACK
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LO	LOW
LOC	LOCATION
LONGIT	LONGITUDINAL
LOR	LOCAL-OFF-REMOTE
LOTO	LOCK-OUT, TAG-OUT
LP	LOW POINT, LIGHTING PANELBOARD
LPG	LIQUIFIED PETROLEUM GAS (PROPANE OR BUTANE AS NOTED)
LR	LONG RADIUS
L-R	LOCAL-REMOTE
LS	LIMIT SWITCH
LT	LEFT, LIGHT, LEFT TURN
LTG	LIGHTING
LV	LOW VOLTAGE
LW	LIGHT WEIGHT
LWL	LOW WATER LEVEL
LWT	LEAVING WATER TEMPERATURE
M	METER(-S)
mA	MILLIAMPERE(-S)
MACH	MACHINE
MATL	MATERIAL
MAX	MAXIMUM
MB	MACHINE BOLT
MBH	BTU PER HOUR (THOUSANDS)
MBR	MEMBRANE BIOREACTOR
MC	MOISTURE CONTENT, MISCELLANEOUS CHANNEL
MCA	MINIMUM CIRCUIT AMPACITY
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MECH	MECHANICAL
MF	MICROFILTRATION
MFR	MANUFACTURER
MFRD	MANUFACTURED
MG	MILLIGRAM(-S), MILLION GALLON(-S)
MG/L	MILLIGRAMS PER LITER
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MHZ	MEGAHERTZ
MIL(-S)	ONE-THOUSANDTH OF AN INCH
MIN	MINIMUM, MINUTE(-S)
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
ML	MILLILITER(-S)
MLO	MAIN LUGS ONLY
MM	MILLIMETER(-S), MULTIMODE (FIBER)
MMBH	BTU PER HOUR (MILLIONS)
MOCP	MAXIMUM OVERCURRENT PROTECTION
MOD(-S)	MODIF(-Y, -ICATIONS)
MON	MONUMENT
MOV	MOTOR OPERATED VALVE
MPH	MILES PER HOUR
MR	MOISTURE-RESISTANT
MSE	MECHANICALLY STABILIZED EARTH
MT(-D, -G)	MOUNT(-ED, -ING)
MTL	METAL
MTR	MOTOR
MTS	MANUAL TRANSFER SWITCH
MUL	MULLION
MV	MEDIUM VOLTAGE
N	NORTH, NEUTRAL (ELECTRICAL)
N/A	NOT APPLICABLE
NAD	NORTH AMERICAN DATUM
NAOCL	SODIUM HYPOCHLORITE
NAOH	SODIUM HYDROXIDE
NAVD	NORTH AMERICAN VERTICAL DATUM
NC	NORMALLY CLOSED
NDT	NON-DESTRUCTIVE TEST(ING)
NE	NORTHEAST
NEC	NATIONAL ELECTRICAL CODE (NFPA 70)
NECA	NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION
NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION
NETA	INTERNATIONAL ELECTRICAL TESTING ASSOCIATION
NF	NEAR FACE, NANOFILTRATION
NFC	NOT FOR CONSTRUCTION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NG	NATURAL GAS
NH3	AMMONIA
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN, NUMBER
NOM	NOMINAL
NORM	NORMAL
NPT	NATIONAL PIPE THREAD
NRS	NON-RISING STEM GATE VALVE
NS	NEAR SIDE
NSG	NON-SHRINK GROUT
NT	NORMALLY THROTTLED
NTS	NOT TO SCALE
NW	NORTHWEST
NWL	NORMAL WATER LEVEL
O/C	OPEN/CLOSE
O3	OZONE
OA	OVERALL
OBD	OPPOSED BLADE DAMPER
OC	ON CENTER
OD	OUTSIDE DIAMETER
ODP	OPEN DRIP PROOF
OF	OVERFLOW, OUTSIDE FACE
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OFS	OUTSIDE FACE OF STUD
OG	ORIGINAL GROUND
OH	OPPOSITE HAND, OVERHEAD
OIT	OPERATOR INTERFACE TERMINAL
OL	THERMAL OVERLOAD RELAY
OPNG(-S)	OPENING(-S)
OPP	OPPOSITE

ORIG	ORIGINAL
OS&Y	OUTSIDE SCREW AND YOKE (RISING STEM GATE VALVE)
OSA	OUTSIDE AIR
OSC	OPEN/STOP/CLOSE
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OT	OVER TEMPERATURE
OZ	OUNCE(-S)
P	PNEUMATIC, PIPE, POLE
P/L	PROPERTY LINE
PA	PUBLIC ADDRESS
PACP	PERFORATED ASBESTOS CEMENT PIPE
PAF	POWDER/POWER ACTUATED FASTENER
PB	PULLBOX, PUSHBUTTON
PC(-S)	PIECE(-S), PHOTOCELL, POINT OF CURVE (BEGIN CURVE), PROGRESSIVE CAVITY
PCC	POINT OF COMPOUND CURVE, POINT OF COMMON COUPLING
PCCP	PRESTRESSED CONCRETE CYLINDER PIPE
PCF	POUNDS PER CUBIC FOOT
PCO	PRESSURE CLEANOUT
PCOTG	PRESSURIZED CLEANOUT TO GRADE
PD	PRESSURE DROP, POSITIVE DISPLACEMENT
PE	PHOTOELECTRIC, PLAIN END, POLYETHYLENE
PEMB	PRE-ENGINEERED METAL BUILDING
PEN	PENETRAT(-E, -ION)
PER	PERIODIC
PERC	PERCOLAT(-E, -ION)
PERF	PERFORAT(-E, -ED, -ES, -ATION)
PF	POWER FACTOR, PROFILE
PFAS	PER- AND POLYFLUOROALKYL SUBSTANCES
PFOA	PERFLUOROOCTANOIC ACID
PFOS	PERFLUOROOCTANESULFONATE
PFR	POWER FACTOR RELAY
PH	PIPE HANGER, PHASE
pH	MEASURE OF ACIDITY OR ALKALINITY
PHMS	PAN HEAD MACHINE SCREW
PHSMS	PAN HEAD SHEET METAL SCREW
PI	POINT OF INTERSECTION
PID	PROPORTIONAL-INTEGRAL-DERIVATIVE
PIV	POST INDICATOR VALVE
PLAS	PLASTER
PLC	PROGRAMMABLE LOGIC CONTROLLER
PLF	POUND PER LINEAL FOOT
PM	PROJECT MANAGER, POWER MONITOR
PNL	PANEL
PNLBD	PANELBOARD
POE	POWER OVER ETHERNET
POT	POTABLE
PP	PARTIAL PENETRATION, POWER POLE, PAGES
PPB	PARTS PER BILLION
PPE	PERSONAL PROTECTIVE EQUIPMENT
PPM	PARTS PER MILLION
PR	PAIR
PRE-ENG	PRE-ENGINEERED
PRESS	PRESSURE
PRI	PRIMARY
PROJ	PROJECT(-ION)
PROP	PROPERTY, PROPOSED, PROPELLER
PROT	PROTECT(-OR)
PRS	PRESSURE SNUBBER
PRV	PRESSURE RELIEF VALVE, PRESSURE REDUCING VALVE
PS	PIPE SUPPORT, POWER SUPPLY
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE (PRESSURE ABOVE VACUUM)
PSIG	POUNDS PER SQUARE INCH GAUGE (PRESSURE ABOVE ATMOSPHERE)
PSL	PIPE SLEEVE
PSTA	PUMP STATION
PSV	PRESSURE SUSTAINING VALVE
PT(-S)	POINT OF TANGENT (END CURVE), PRESSURE-TREATED, POTENTIAL TRANSFORMER, POINT(-S)
PU	POLYURETHANE
PVC	POLYVINYL CHLORIDE, POINT OF VERTICAL CURVE
PVI	POINT OF VERTICAL INTERSECTION
PVMT	PAVEMENT
PVT	POINT OF VERTICAL TANGENCY
PW	POTABLE WATER
PWR	POWER
PWWF	PEAK WET WEATHER FLOW
Q	FLOW OR DISCHARGE
R, RAD	RADIUS
R/W	RIGHT OF WAY
RA	RETURN AIR
RAS	RETURN ACTIVATED SLUDGE
RC	REINFORCED CONCRETE
RCCP	REINFORCED CONCRETE CYLINDER PIPE
RCP	REINFORCED CONCRETE PIPE
RCPT	RECEPTACLE
RCT	REPEAT CYCLE TIMER
RD	ROAD
REC	RECEIVING
RECIRC	RECIRCULAT(-E, -ION)
RECT	RECTANG(-LE, -ULAR)
RED	REDUCE(-R)
REF	REFERENCE
REFR	REFRIGERATOR
REG	REGULAT(-E, -OR, -ION, -ING)
REINF	REINFORC(-E, -ED, -ING, -EMENT)
REL	RELATIVE
REQD	REQUIRED
REQT	REQUIREMENT
RESIL	RESILIENT
RESV	RESERVOIR
REV	REVISION
RH	RIGHT HAND
RIO	REMOTE INPUT/OUTPUT
RM	ROOM

RMT	REMOTE
RND	ROUND
RO	REVERSE OSMOSIS
RPM	REVOLUTIONS PER MINUTE
RPP	REDUCED PRESSURE PRINCIPLE
RPS	REVOLUTIONS PER SECOND
RR	RAILROAD
RST	RESET
RT	RIGHT TURN, RESET TIMER
RTE	ROUTE
RTN	RETURN
RTU	ROOF TOP UNIT, REMOTE TELEMETRY UNIT
RVSS	REDUCED VOLTAGE, SOLID STATE
S	SEWER, SOUTH
S/S	START/STOP
S/W	SIDEWALK
SA	SUPPLY AIR
SAN	SANITARY
SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
SCFM	STANDARD CUBIC FEET PER MINUTE
SCH	SCHEDULE
SCR	SILICON CONTROLLED RECTIFIER
SD	STORM DRAIN, SMOKE DETECTOR
SDMH	STORM DRAIN MANHOLE
SE	SOUTHEAST
SEC	SECONDARY, SECOND(-S)
SECT	SECTION
SED	SEDIMENTATION
SEER	SEASONAL ENERGY EFFICIENCY RATIO
SER	SERVICE ENTRANCE RATED
SGNL	SIGNAL
SH	SHOWER
(SH)	SHIELDED
SHT	SHEET
SI	SIDE INLET
SIM	SIMILAR
SK	SINK
SL	SLUDGE
SLBB	SHORT LEGS BACK-TO-BACK
SLH	SHORT LEG HORIZONTAL
SLV	SHORT LEG VERTICAL
SM	SINGLEMODE (FIBER)
SMACNA	SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
SMS	SHEET METAL SCREW
SO2	SULFUR DIOXIDE
SP	STATIC PRESSURE, SET POINT
SP GR	SPECIFIC GRAVITY
SPC(-S, -D)	SPACE(-S, -D)
SPD	SURGE PROTECTIVE DEVICE
SPDT	SINGLE POLE, DOUBLE THROW
SPEC(-S)	SPECIFICATION(-S)
SQ	SQUARE
SQ CM	SQUARE CENTIMETERS
SQ FT	SQUARE FEET
SQ IN	SQUARE INCHES
SQ M	SQUARE METER(-S)
SQ MI	SQUARE MILES
SQ YD	SQUARE YARD(-S)
SRG	SINGLE RUBBER GASKET JOINT
SS	STAINLESS STEEL, SANITARY SEWER, SOLID STATE
SSD	SATURATED SURFACE DRY
ST	STREET
STA	STATION
STAG	STAGGER
STB	SHORTING TERMINAL BLOCK
STD(-S)	STANDARD(-S)
STIFF	STIFFEN(-ER)
STL	STEEL
STM	STEAM
STOR	STORAGE
STP	SHIELDED TWISTED PAIR
STRC	STRUCTUR(-E, -AL)
SUB	SUBNATANT
SUBM	SUBMISSION, SUBMIT
SUP	SUPERNATANT
SUPP	SUPPORT(-S)
SURF	SURFACE
SUSP	SUSPEND(-ED)
SW	SOUTHWEST, SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYM	SYMMETRICAL
SYNC	SYNCHRONIZING
SYS	SYSTEM
T	TIME(-R)
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
T/C	TOP OF CONCRETE
T/P	TOP OF PAVEMENT
T/S	TOP OF STEEL
T/W	TOP OF WALL
T-_-P	TYPE ______ PIPE
T-_-S	TYPE ______ SUPPORT
TA	TRANSFER AIR
TAN	TANGENT(-IAL)
TB	THRUST BLOCK, TERMINAL BLOCK
TBM	TEMPORARY BENCHMARK, TUNNEL BORING MACHINE
TC	TRAY CABLE
TCP	TRANSMISSION CONTROL PROTOCOL
TDH	TOTAL DYNAMIC HEAD
TDS	TOTAL DISSOLVED SOLIDS
TEFC	TOTALLY ENCLOSED FAN COOLED
TEL	TELEPHONE
TEMP	TEMPERATURE, TEMPORARY
TMPTNK	TEMPERING TANK
TENV	TOTALLY ENCLOSED NON-VENTILATED
THK	THICK(-ENED, -ENER, -NESS)
THRU	THROUGH

TMV	THERMOSTATIC MIXING VALVE
TNK	TANK
TOD	TOTAL OXYGEN DEMAND
TOPO	TOPOGRAPHY
TOT	TOTAL, TOTALIZE(R)
TP	TEST PIT
TR	TREAD(-S)
T-R	THROUGH ROOF
TRTMT	TREATMENT
TS	STRUCTURAL TUBING
TSS	TOTAL SUSPENDED SOLIDS
TSTAT	THERMOSTAT
TURB	TURBIDITY
TYP	TYPICAL
U	URINAL
UBC	UNIFORM BUILDING CODE
UD	UNDERDRAIN
UF	ULTRAFILTRATION
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORIES
UNKN	UNKNOWN
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
USGBC	UNITED STATES GREEN BUILDING COUNCIL
UT	ULTRASONIC TESTING
UTP	UNSHIELDED TWISTED PAIR
UV	ULTRAVIOLET
V	VOLTS
V/S	VARIABLE SPEED
VA	VOLT-AMPERES
VAC	VACUUM
VAR	VARIES, VARIABLE, VOLT-AMPERES REACTIVE
VAT	VINYL ASBESTOS TILE
VC	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE, VENDOR CONTROL PANEL
VD	VOLUME DAMPER
VEL	VELOCITY
VERT	VERTICAL
VERTS	VERTICAL BARS
VFD	VARIABLE FREQUENCY DRIVE (AC)
VFI	VACUUM FAULT INTERRUPTER
VIF	VERIFY IN FIELD
VOL	VOLUME
VPI	VERTICAL POINT OF INTERSECTION
VS	VOLTMETER SWITCH
VT	VENT
VTP	VERTICAL TURBINE PUMP
VTR	VENT TO ROOF
VVT	VARIABLE VOLUME/TEMPERATURE
W	WIDE, WIDTH, WIRE, WATTS, WELDED, WEST
W/	WITH
W/O	WITHOUT
WAN	WIDE AREA NETWORK
WAS	WASTE ACTIVATED SLUDGE
WB	WATER BAR, WET BULB
WC	WATER CLOSET, WATER COLUMN
WCLIB	WEST COAST LUMBER INSPECTION BUREAU
WCO	WALL CLEANOUT
WD	WOOD
WEF	WATER ENVIRONMENT FEDERATION
WER	WALL EXHAUST OR RETURN
WF	WIDE FLANGE
WG	WATER GAUGE
WH	WATER HEATER
WHDM	WATT-HOUR DEMAND METER
WHM	WATT-HOUR METER
WM	WATER METER
WMH	WATER MANHOLE
WNDW	WINDOW
WP	WEATHERPROOF, WATERPROOF, WORK POINT, WEATHER PROTECTED
WR	WEATHER RESISTANT
WS	WELDED STEEL, WATER SURFACE
WSD	WALL SUPPLY DIFFUSER
WSP	WELDED STEEL PIPE
WSTP	WATERSTOP
WT	WEIGHT, WALL THICKNESS
WTP	WATER TREATMENT PLANT
WTR	WATER
WV	WATER VALVE
WW	WASTEWATER
WWF	WELDED WIRE FABRIC
WWM	WELDED WIRE MESH
WWTP	WASTEWATER TREATMENT PLANT
XFMR	TRANSFORMER
XP	EXPLOSION PROOF
YD	YARD
YR	YEAR

SEE DRAWING G-05 FOR A LIST OF EQUIPMENT DESIGNATIONS AND PROCESS IDENTIFICATION CODES.

PROJECT-SPECIFIC

ADMIN	ADMINISTRATIVE
AWPF	ADVANCED WATER PURIFICATION FACILITY
BAC	BIOLOGICALLY ACTIVATED CARBON
BAF	BIOLOGICALLY ACTIVE FILTRATION
EFM	ENHANCED FLUX MAINTENANCE
FW	FILTERED WATER
IPS	INFLUENT PUMP STATION
LOX	LIQUID OXYGEN SYSTEMS
PS	PUMP STATION
PWPS	PURIFIED WATER PUMP STATION
RW	RECYCLED WATER
RWC	REDWOOD CITY
SM	SAN MATEO
SPRP	SF-PENINSULA REGIONAL PUREWATER
SVCW	SILICON VALLEY CLEAN WATER
UV AOP	ULTRAVIOLET ADVANCED OXIDATION PROCESS

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NOTES

1. SYMBOLS ARE FOR REFERENCE ONLY, NOT ALL SYMBOLS ARE USED IN THESE CONTRACT DRAWINGS.
2. THE NOTE IN THE TITLE BLOCK OF THIS DRAWING WHICH SHOWS A SCALE OF 1" APPEARS ON DRAWINGS FOR IDENTIFICATION OF SCALE DISTORTIONS ON HALF SIZE DRAWINGS AND DRAWING REPRODUCTIONS. IT SHALL MEAN THAT THE DRAWING IS FULL SIZE AND THE DRAWING SCALES ACCURATE WHEN THE LENGTH OF THIS LINE IS ONE INCH. IF THE LENGTH IS OTHER THAN ONE INCH, DRAWING SCALES MUST BE ADJUSTED ACCORDINGLY.
3. EXISTING PIPING IS DESIGNATED BY SERVICE RATHER THAN MATERIAL TYPE. MATERIAL TYPES, IF KNOWN, APPEAR OUTSIDE THE PIPING CALL OUT BUBBLE, AND MAY NOT BE THE SAME MATERIAL TYPES SPECIFIED FOR NEW PIPING.
4. ABBREVIATIONS USED IN THIS CONTRACT DOCUMENT CONFORM TO ANSI Y1.1, UNLESS NOTED OTHERWISE ON DRAWINGS.
5. ALL STANDARD DETAILS APPLY TO ALL THE CONTRACTOR'S WORK WHETHER SPECIFICALLY REFERENCED OR NOT.
6. SEE FRONT END SHEETS FOR EACH DISCIPLINE'S STANDARD SYMBOLS, ETC.
7. SEE ADDITIONAL GENERAL NOTES THROUGHOUT DRAWING SET.

CALLOUTS AND SHORTHAND SYMBOLS

►	DIRECTION OF FLOW
A	SHEET KEYNOTE
℄	CENTERLINE
⅊	PLATE
Ø	DIAMETER
±	APPROXIMATELY
∠	ANGLE
▼	WATER/FLUID SURFACE
1	BUILDING GRID LABEL OR ACCESSORY NUMBER
##-##	DOOR
XXX	ROOM
##	WALL
##-##	WINDOW

SYMBOLOGY

NORTH ARROW

NEW

LABEL — EXISTING; SCREENED TEXT LABELS FOR SCREENED ELEMENTS IMPLY THE ELEMENT IS EXISTING

FUTURE

EXISTING LINEAR ELEMENTS TO BE REMOVED OR DEMOLISHED

EXISTING NON-LINEAR ELEMENTS TO BE REMOVED OR DEMOLISHED

CENTERLINE

MATCHLINE CONTINUED ON SHEET — MATCHLINE

BREAK LINE

SAND OR GROUT (IN PLAN AND SECTION)

CONCRETE (IN PLAN AND SECTION)

UTILITY CROSSING UNDERNEATH / UTILITY CROSSING OVER — CROSSING UTILITIES

PIPING DESIGNATIONS

NEW PIPING

CENTERLINE ELEVATION (UNLESS OTHERWISE NOTED)

XXX.X

6"-RW

XXX.X

6"-RW

PROCESS CODE, SEE PIPE SCHEDULE

NOMINAL PIPE DIAMETER

EXISTING PIPING

6"-RW

6"-RW

FUTURE PIPING

6"-RW

6"-RW

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PRELIMINARY DESIGN PHASE

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NO	REVISION	DATE	BY

SCALES

0 — 1"

0 — 25mm

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MONTH YEAR

DESIGNED KT

DRAWN CBD

CHECKED MWF

PUREWATER PENINSULA

SAN MATEO COUNTY, CALIFORNIA

BASIS OF DESIGN REPORT

ADVANCED WATER PURIFICATION FACILITY

Kennedy Jenks

GENERAL NOTES, LEGEND AND PROCESS SYMBOLS

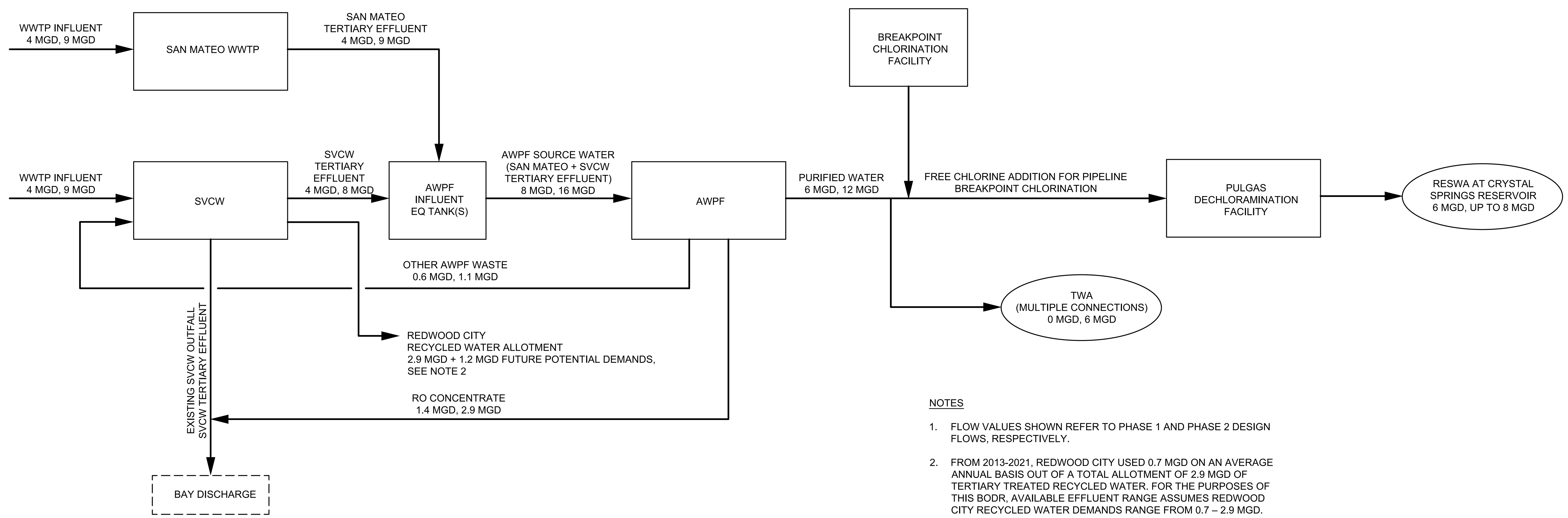
SCALE NTS

JOB NO 2268026.00

DATE MAY 2024

SHEET 3 OF 12

G-03



NOTES

1. FLOW VALUES SHOWN REFER TO PHASE 1 AND PHASE 2 DESIGN FLOWS, RESPECTIVELY.
2. FROM 2013-2021, REDWOOD CITY USED 0.7 MGD ON AN AVERAGE ANNUAL BASIS OUT OF A TOTAL ALLOTMENT OF 2.9 MGD OF TERTIARY TREATED RECYCLED WATER. FOR THE PURPOSES OF THIS BODR, AVAILABLE EFFLUENT RANGE ASSUMES REDWOOD CITY RECYCLED WATER DEMANDS RANGE FROM 0.7 – 2.9 MGD. HOWEVER, DURING SUMMER MONTHS, REDWOOD CITY'S DAILY RECYCLED WATER DEMAND CAN PEAK TO GREATER THAN 9 MGD. THE SOURCE FLOWS AVAILABLE FOR THE AWPF WOULD DEPEND ON INFLUENT FLOWS TO SVCW AND RWC'S RECYCLED WATER DEMAND AND AGREEMENT, AND AWPF FLOWS MAY NEED TO BE TURNED DOWN TO ACCOMMODATE RWC DEMANDS/ALLOTMENTS.

OVERALL PROJECT FLOW DIAGRAM

SCALE: NTS

DESIGN CRITERIA

AWPF PROCESS STREAM FLOW SUMMARY

DESCRIPTION	PHASE 1 AVERAGE FLOW	PHASE 2 AVERAGE FLOW
AWPF SOURCE WATER	8	16
OZONE/BAC FEED	8	16
MF FEED	8	16
MF EFFLUENT/RO FEED	7.8	15.6
RO FEED	7.4	14.9
RO PERMEATE	6	12
RO CONCENTRATE	1.4	2.9
UV/AOP EFFLUENT	6	12
CHLORINE CONTACT TANK EFFLUENT	6	12
AWPF PURIFIED WATER	6	12

OVERALL PROJECT FLOWS SUMMARY

FLOW	PHASE 1 CAPACITY (MGD)	PHASE 2 CAPACITY (MGD)
SAN MATEO TERTIARY EFFLUENT	4.0	9.0
SVCW TERTIARY EFFLUENT	4.0	8.0
FLOW AVAILABLE FOR DILUTION OF RO CONCENTRATE	0.0	1.0
AWPF COMBINED INFLUENT	8.0	16.0
RO CONCENTRATE	1.4	2.9
OTHER AWPF WASTE	0.6	1.1
AWPF PURIFIED WATER	6.0	12.0
PURIFIED TO CSR	6.0	6.0 - 8.0
PURIFIED FOR TWA	0	4.0 - 6.0

PIPE SCHEDULE

ID	DESCRIPTION	SERVICE	MATERIAL	FIELD JOINTS	FITTINGS	NOTES
TE	SVCW/SAN MATEO TERTIARY EFFLUENT (AWPF SOURCE WATER)	B/E	HDPE	HEAT WELD	PE	ASTM D3350/AWWA 906
PWT	PURIFIED WATER TRANSMISSION	B/E	HDPE	HEAT WELD	PE	ASTM D3350/AWWA 906
RO	RO CONCENTRATE	B/E	PVC	BELL AND SPIGOT	DI	ASTM D1784/AWWA C900, SCH 80

SERVICE LEGEND
B = BURIED
E = EXPOSED

MATERIAL
DI = DUCTILE IRON
HDPE = HIGH DENSITY POLYETHYLENE
PE = POLYETHYLENE
PVC = POLYVINYL CHLORIDE

NOTE

MAJOR PIPELINES TO AND FROM THE AWPF SITE ARE SHOWN. PROCESS AND YARD PIPING DESIGN WITHIN THE AWPF WILL BE IDENTIFIED AS PART OF A FUTURE DETAILED DESIGN PHASE.

PIPING - SINGLE LINE

- NEW WORK (NOT SCREENED)
- EXISTING (SCREENED)
- FUTURE (LONG DASH, SHORT DASH)
- PROCESS - PRIMARY
- PROCESS - SECONDARY
- PROCESS - DRAIN
- PROCESS - HEAT TRACED
- OR CONNECTED
- NOT CONNECTED

TANKS AND VESSELS

- TANK WITH CONICAL ROOF
- TANK WITH DOMED ROOF
- TANK WITH FLAT ROOF
- OPEN TOP TANK
- TANK WITH FLOATING COVER
- PRESSURE VESSEL - VERTICAL
- PRESSURE VESSEL - HORIZONTAL
- HOPPER, VESSEL, OR BIN
- FILTER VESSEL
- STORAGE DRUM

MISCELLANEOUS

- PIPE MATERIAL CHANGE
- A B ROTAMETER
- A B ROTAMETER WITH INTEGRAL VALVE
- VENT
- FLAME ARRESTOR
- SILENCER SILENCER
- SNUBBER
- WEIGH SCALE
- CHEMICAL DIFFUSER
- INJECTION MIXER
- STATIC MIXER
- WAFER MIXER

EQUIPMENT

MISCELLANEOUS

- DU DRIVE UNIT
- M MOTOR

CENTRIFUGAL PUMPS

- M HORIZONTAL
- M SUBMERSIBLE
- M VERTICAL TURBINE PUMP HEAD
- M VERTICAL TURBINE PUMP T-HEAD
- VERTICAL TURBINE PUMP CAN
- VERTICAL TURBINE PUMP INTAKE

PIPING ACCESSORIES AND FITTINGS

- FLANGE
- UNION
- TEE
- Y STRAINER
- FLOW STRAIGHTENING VANE
- SCREWED CAP
- WELDED CAP
- BLIND FLANGE
- QUICK DISCONNECT
- REDUCER (CONCENTRIC)
- REDUCER (ECCENTRIC)

NOTES

1. SEE THE PRECEDING DRAWING FOR EQUIPMENT DESIGNATIONS AND PROCESS IDENTIFICATION CODES.
2. THIS IS A GENERALIZED LEGEND SHEET. SEE ALSO ISA S5.1, S5.3 AND S7.3.

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PRELIMINARY DESIGN PHASE
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NO	REVISION	DATE	BY

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PUREWATER PENINSULA
SAN MATEO COUNTY, CALIFORNIA
BASIS OF DESIGN REPORT
ADVANCED WATER PURIFICATION FACILITY

Kennedy Jenks

GENERAL PROCESS SYMBOLS

SCALE NTS
JOB NO 2268026.00
DATE MAY 2024
SHEET 5 OF 12
G-05

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PUREWATER PENINSULA
SAN MATEO COUNTY, CALIFORNIA
BASIS OF DESIGN REPORT
ADVANCED WATER PURIFICATION FACILITY

Kennedy Jenks

AWPF PROCESS FLOW DIAGRAM - II

SCALE NTS
JOB NO 2268026.00
DATE MAY 2024
SHEET 7 OF 12
G-07

GENERAL SHEET NOTES

1. HYDRAULIC GRADE LINE SHOWN AT MAXIMUM PHASE 2 PRODUCT WATER FLOW OF 12 MGD.

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SAN MATEO COUNTY, CALIFORNIA

BASIS OF DESIGN REPORT

ADVANCED WATER PURIFICATION FACILITY

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HYDRAULIC PROFILE

SCALE NTS

JOB NO 2268026.00

DATE MAY 2024

SHEET 8 OF 12

G-08

TOPOGRAPHY AND MAPPING SYMBOLS

125	MAJOR CONTOURS
124	MINOR CONTOURS
	TOP OF SLOPE
	TOE OF SLOPE
	PROPERTY LINE
R/W R/W	RIGHT-OF-WAY LINE
	GRADE BREAK
R	RIDGE LINE
ESMT	EASEMENT LINE
ESMT TEMPORARY	TEMPORARY EASEMENT LINE
	TRAIL OR DIRT ROAD
	FLOW LINE
	FLOOD HAZARD AREA
	EDGE OF WETLANDS
	RAILROAD
	SITE OR RETAINING WALL
	GUARDRAIL (PERMANENT)
	LIMITS OF GRADING
	LIMITS OF EXCAVATION

EXISTING UTILITIES

G	NATURAL GAS
HPG	HIGH PRESSURE GAS
LPG	LIQUID PETROLEUM
W	WATER LINE
PW	POTABLE WATER
FIRE	FIRE SUPPLY WATER
REW	RECLAIMED WATER
UW	UTILITY/NON-POTABLE WATER
IRR	IRRIGATION WATER
SDR	STORM DRAIN
SS	SANITARY SEWER
STM	STEAM
TEL	TELEPHONE
COMM	COMMUNICATIONS LINE
FOC	FIBER OPTIC CABLE
CATV	CABLE TV
E	POWER
UNK	UNIDENTIFIED
ABND	ABANDONED UTILITY

ROADWORK AND PAVING

NOTES:
1. PAVING PATTERNS MAY ONLY APPEAR IN PORTIONS OF PAVED AREAS TO DEFINE LIMITS OF PAVING.
2. SEE ALSO GENERAL LEGEND FOR ADDITIONAL PAVING PATTERNS.

	ASPHALT (IN PLAN AND SECTION)
	CONCRETE CURB
	CONCRETE CURB AND GUTTER
	DRIVEWAY/ACCESS RAMP
	WELDED WIRE FABRIC (IN SECTION)

CONTROL SYMBOLS

BM-XX	BENCH MARK
#	SITE COORDINATES (SEE TABLE ON DRAWINGS)
DESCRIPTION N XXXXXXX.XX E XXXXXXX.XX	SITE COORDINATES
	CONTROL POINT
	MONUMENT
FG XXX.XX	FINISHED ELEVATION/GRADE
EG XXX.X ±	EXISTING ELEVATION/GRADE
X	CURVE DATA (SEE TABLE ON DRAWINGS)

STRUCTURES

x x x	FENCE (CHAIN LINK)
	FENCE (WOOD)
	FENCE (SWING GATE)
	PROTECTIVE BARRIER
	PROTECTIVE BARRIER (REMOVABLE)
	STRUCTURE
	STRUCTURE (BELOW GRADE)

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SAN MATEO COUNTY, CALIFORNIA
BASIS OF DESIGN REPORT
ADVANCED WATER PURIFICATION FACILITY

Kennedy Jenks

CIVIL LEGEND

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DATE MAY 2024
SHEET 10 OF 12
C-01

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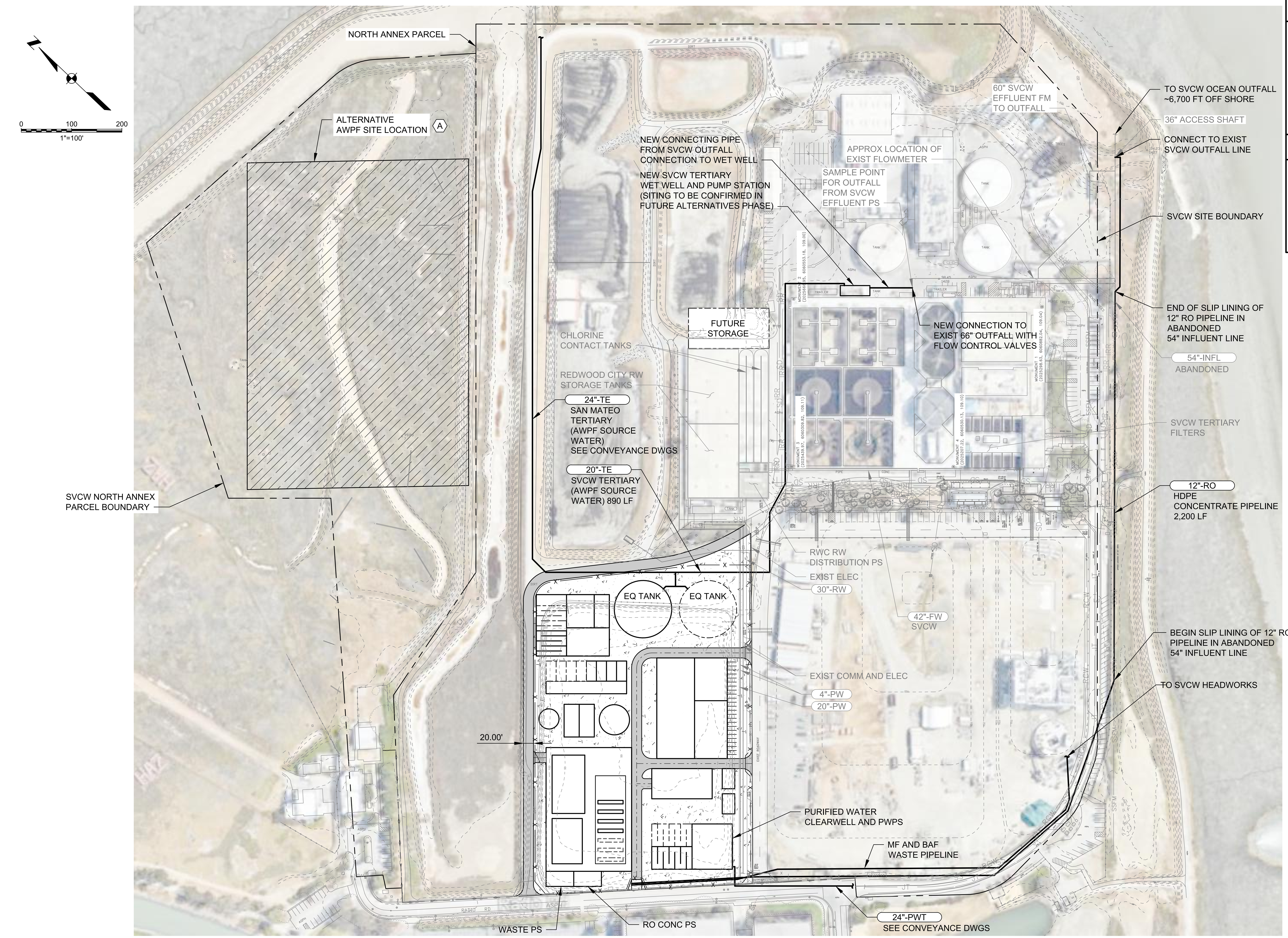

GENERAL SHEET NOTES

1. ASSUME STRUCTURAL PILES WOULD BE SPACED EVERY 8'-2" OC BELOW STRUCTURES AT A DEPTH OF 110 FT PER PILE, EST QTY = 4,300.
2. SAN MATEO TERTIARY EFFLUENT AND SVCW TERTIARY EFFLUENT WILL BE CONVEYED TO THE NEW EQ TANKS AT THE AWPF, WHERE THEY WILL BE BLENDED TO PRODUCE THE AWPF SOURCE WATER. SEPERATE CONNECTIONS TO THE EQ TANKS WOULD BE MADE FOR EACH PIPELINE WITH AIR GAPS.

SHEET KEYNOTES

A. ALTERNATIVE AWPF SITE LOCATION IS SHOWN WITHIN THE SVCW NORTH ANNEX PARCEL BOUNDARY. THIS LAND IS OWNED BY SVCW BUT IS NOT PREFERRED FOR AWPF CONSTRUCTION SINCE IT IS A POTENTIALLY ENVIRONMENTALLY SENSITIVE AREA WHICH MAY REQUIRE EXTENDED NEGOTIATIONS RELATED TO PERMITTING AND ENVIRONMENTAL NEGOTIATIONS THAT COULD RESULT IN SIGNIFICANT PROJECT SCHEDULE DELAYS.

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PUREWATER PENINSULA

SAN MATEO COUNTY, CALIFORNIA

BASIS OF DESIGN REPORT

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AWPF SITE TOPOGRAPHY AND YARD PIPING PLAN

SCALE 1" = 100'

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C-02

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SAN MATEO COUNTY, CALIFORNIA
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AWPF SITE PLAN

SCALE 1" = 40'
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AWPF GRADING PLAN

SCALE 1" = 40'
JOB NO 2268026.00
DATE MAY 2024
SHEET C-04 OF 12

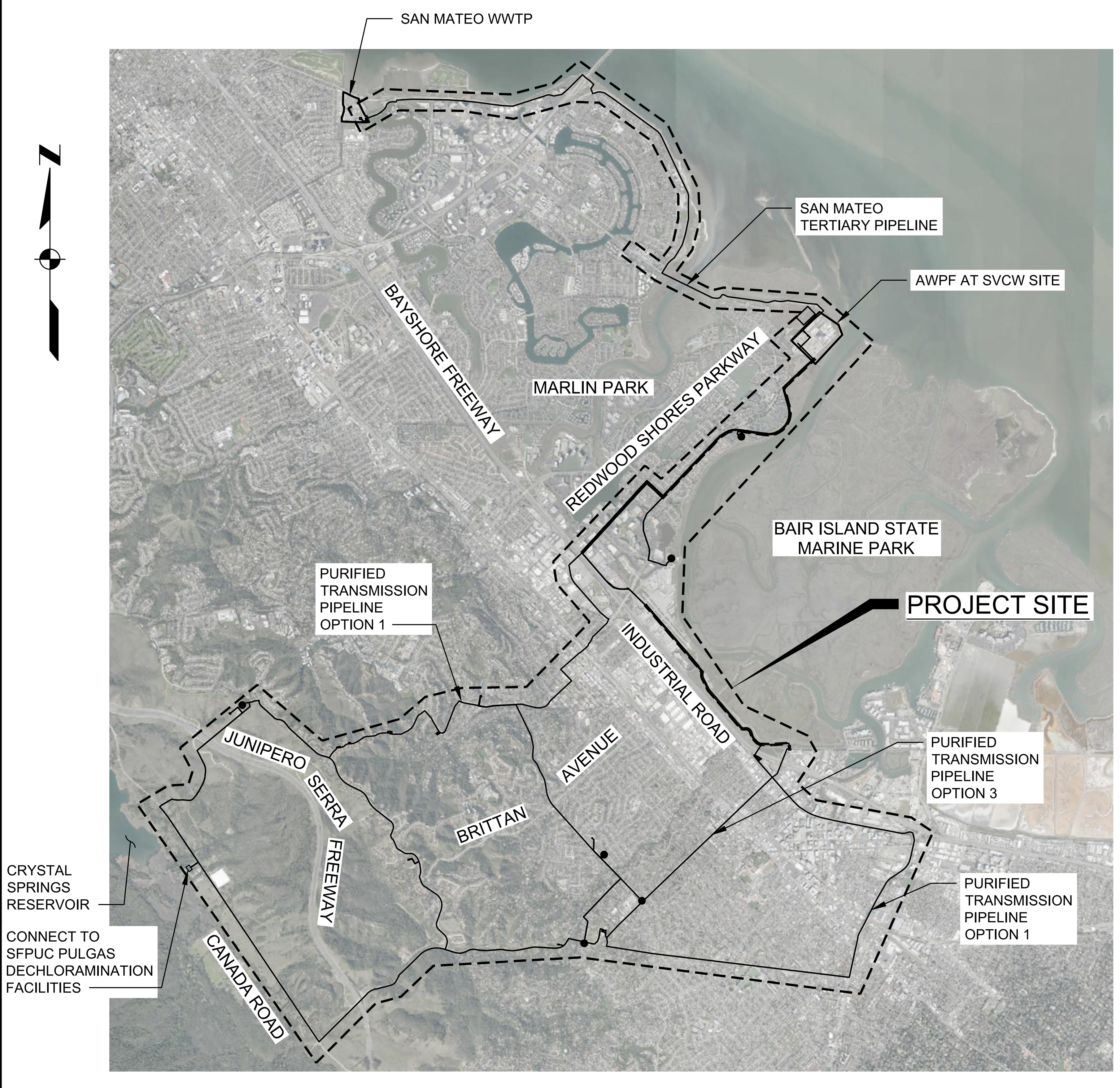
F.2 Conveyance Drawings

Conveyance Conceptual-Level Design Package:

- G-01: Cover, Location and Vicinity Maps, and Drawing Index
- G-02: General Notes, Abbreviations, and Legend
- G-03: Hydraulic Profile - San Mateo Tertiary and SVCW Tertiary Pipelines
- G-04: Hydraulic Profile - Purified Transmission Pipeline Option 1
- G-05: Hydraulic Profile - Purified Transmission Pipeline Option 2
- G-06: Hydraulic Profile - Purified Transmission Pipeline Option 3
- C-01: San Mateo Tertiary Pump Station Site Plan
- C-02: San Mateo Tertiary Pipeline Plan - Sta 1+00 To AWPF
- C-03: Purified Water Pipeline Option 1 Plan - Sta 1+00 to Sta 360+00
- C-04: Purified Water Pipeline Option 1 Plan - Sta 360+00 to Pulgas
- C-05: Purified Water Pipeline Option 2 Plan - Sta 1+00 to Pulgas
- C-06: Purified Water Pipeline Option 3 Plan - Sta 1+00 to Sta 290+00
- C-07: Purified Water Pipeline Option 3 Plan - Sta 290+00 to Pulgas
- C-08: Purified Water Option 1/2/3 – Enlarged Plans
- C-09: Purified Water Option 1 – Enlarged Plans
- C-10: Purified Water Option 2 – Enlarged Plans
- C-11: Purified Water Option 3 – Enlarged Plans
- M-01: Typical Purified Booster Pump Station Plan

PUREWATER PENINSULA
SAN MATEO COUNTY, CALIFORNIA

BASIS OF DESIGN REPORT
CONVEYANCE UPGRADES

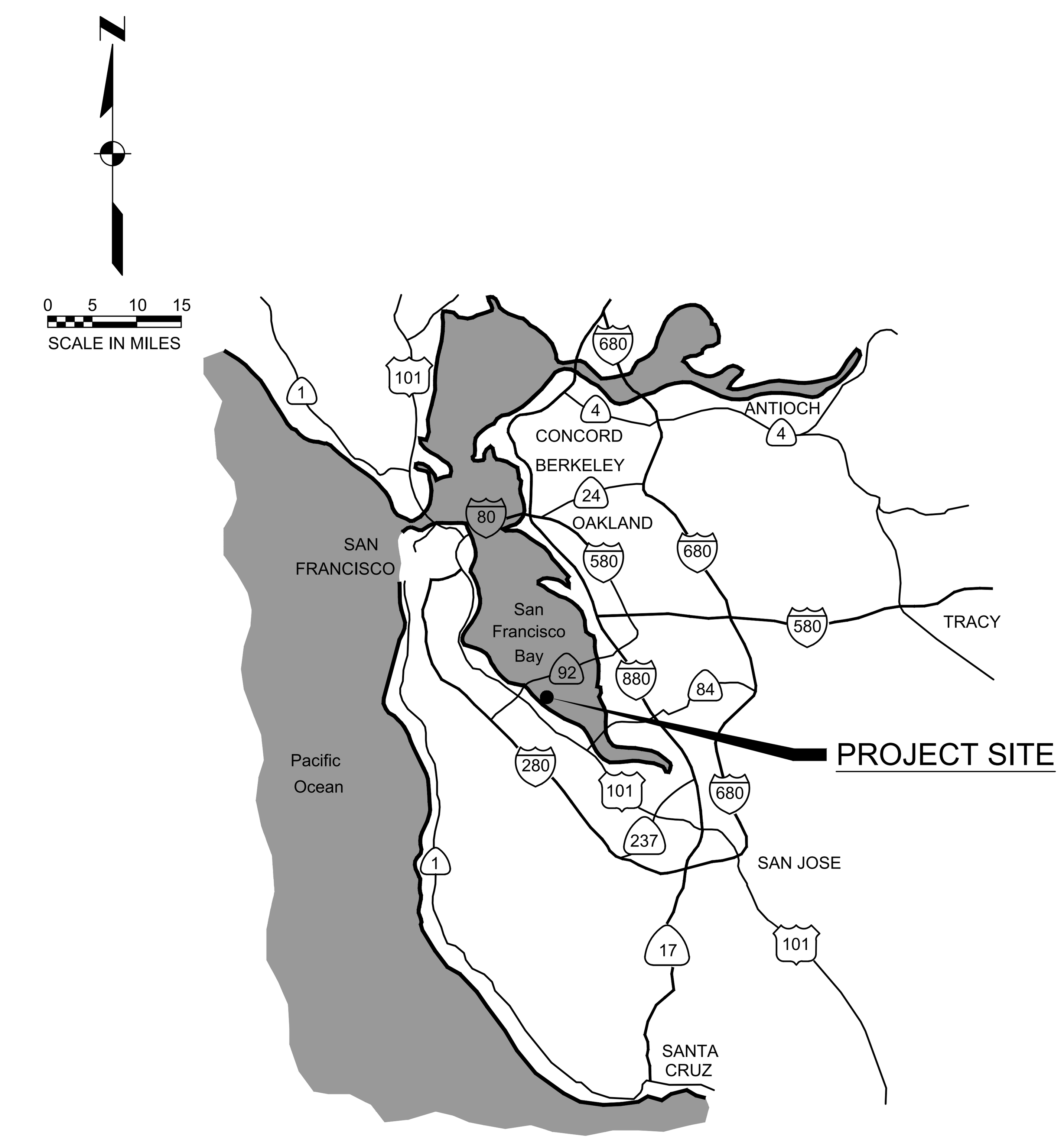


LOCATION MAP
SCALE: NTS

Pure Water PENINSULA
Our Water | Our Future

DRAWING INDEX

SHEET	DRAWING	TITLE
GENERAL		
1	G-01	COVER, LOCATION AND VICINITY MAPS, AND DRAWING INDEX
2	G-02	GENERAL NOTES, ABBREVIATIONS AND LEGEND
3	G-03	HYDRAULIC PROFILES - SAN MATEO TERTIARY AND SVCW TERTIARY PIPELINES
4	G-04	HYDRAULIC PROFILE - PURIFIED WATER PIPELINE - OPTION 1
5	G-05	HYDRAULIC PROFILE - PURIFIED WATER PIPELINE - OPTION 2
6	G-06	HYDRAULIC PROFILE - PURIFIED WATER PIPELINE - OPTION 3
CIVIL		
7	C-01	SAN MATEO TERTIARY PUMP STATION SITE PLAN
8	C-02	SAN MATEO TERTIARY PIPELINE PLAN - STA 1+00 TO AWPF
9	C-03	PURIFIED WATER PIPELINE OPTION 1 PLAN - STA 1+00 TO STA 360+00
10	C-04	PURIFIED WATER PIPELINE OPTION 1 PLAN - STA 360+00 TO PULGAS
11	C-05	PURIFIED WATER PIPELINE OPTION 2 PLAN - STA 1+00 TO PULGAS
12	C-06	PURIFIED WATER PIPELINE OPTION 3 PLAN - STA 1+00 TO STA 290+00
13	C-07	PURIFIED WATER PIPELINE OPTION 3 PLAN - STA 290+00 TO PULGAS
14	C-08	PURIFIED WATER OPTION 1/2/3 - ENLARGED PLANS
15	C-09	PURIFIED WATER OPTION 1 - ENLARGED PLANS
16	C-10	PURIFIED WATER OPTION 2 - ENLARGED PLANS
17	C-11	PURIFIED WATER OPTION 3 - ENLARGED PLANS
MECHANICAL		
18	M-01	TYPICAL PURIFIED BOOSTER PUMP STATION PLAN



VICINITY MAP
SCALE: NTS

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NOTES

GENERAL

1. THIS PROJECT IS WITHIN REDWOOD CITY, FOSTER CITY AND CITY OF SAN CARLOS RIGHT OF WAY. CONTRACTOR SHALL CONFORM TO THE CITIES ENCROACHMENT PERMIT AND REQUIREMENTS.
2. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE AWWA STANDARDS.
3. THIS CONCEPTUAL-LEVEL DESIGN IS FOR THE PLANNING PURPOSES ONLY. DESIGN ELEMENTS, INCLUDING BUT NOT LIMITED TO: PIPELINE ALIGNMENTS, MATERIALS, AND SIZES; PUMP STATION LOCATIONS; HYDRAULICS; SURGE ANALYSIS; DWDS CONNECTION LOCATIONS; POWER AND OTHER SITING CONSIDERATIONS AND GRADING; SHALL BE FURTHER EVALUATED IN FUTURE DETAILED DESIGN PHASES.

UTILITIES

1. DETAILED UTILITY INFORMATION IS NOT SHOWN ON THESE CONCEPTUAL DRAWINGS AND WOULD BE DEVELOPED DURING FUTURE DESIGN PHASES.
2. CENTERLINE OF NEW PIPELINES NOT IDENTIFIED IN THIS CONCEPTUAL-LEVEL DESIGN.

ABBREVIATIONS

AC	ASBESTOS CEMENT
ALT	ALTERNATIVE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AWPF	ADVANCED WATER PURIFICATION FACILITY
AWWA	AMERICAN WATER WORKS ASSOCIATION
BAC	BIOLOGICALLY ACTIVATED CARBON
BAF	BIOLOGICALLY ACTIVE FILTRATION
BPS	BOOSTER PUMP STATION
CCP	CONCRETE CYLINDER PIPE
CHEM	CHEMICAL
CIP	CLEAN IN PLACE
CSR	CRYSTAL SPRINGS RESERVOIR
DPR	INDIRECT POTABLE REUSE
DWDS	DRINKING WATER DISTRIBUTION SYSTEM
EFM	ENHANCED FLUX MAINTENANCE
EG	EXISTING GRADE
EL	ELEVATION
EP	EDGE OF PAVEMENT
EQ	EQUALIZATION
FF	FAR FACE,FINISHED FLOOR
FG	FINISHED GRADE
H2O2	HYDROGEN PEROXIDE
HGL	HYDRAULIC GRADE LINE
HW	HIGH WATER
IPS	INFLUENT PUMP STATION
LOX	LIQUID OXYGEN SYSTEMS
LV	LOW VOLTAGE
MF	MICROFILTRATION
MV	MEDIUM VOLTAGE
NTS	NOT TO SCALE
PS	PUMP STATION
RESWA, RWA	RESERVOIR WATER AUGEMENTATION
RO	REVERSE OSMOISIS
SFPUC	SAN FRANCISCO PUBLIC UTILITIES COMMISSION
SVCW	SILICON VALLEY CLEAN WATER
TWA	TREATED WATER AUGMENTATION
UV	ULTRAVIOLET
UV/AOP	ULTRAVIOLET ADVANCED OXIDATION PROCESS
WWTP	WASTEWATER TREATMENT PLANT
XFMR	TRANSFORMER

SYMBOLOGY

NORTH ARROW

\# SITE COORDINATES (SEE TABLE ON DRAWINGS)

NEW PIPING

REPURPOSED PIPING

MATCHLINE STA ______ SEE _____ MATCHLINE

BREAK LINE

1+00 10+00 20+00 STATIONING

FACILITY BOUNDARY

STAGING/CONSTRUCTION AREA

SFPUC RIGHT-OF-WAY

PIPING DESIGNATIONS

NEW PIPING

6"-RW

PROCESS CODE, SEE PIPE SCHEDULE

NOMINAL PIPE DIAMETER

PIPE SCHEDULE

ID	DESCRIPTION	MATERIAL	DIAMETER
PWD	PURIFIED WATER DISTRIBUTION	PVC	6-18"
PWT	PURIFIED WATER TRANSMISSION	PVC	24"
TE	TERTIARY EFFLUENT	HDPE	24"

MATERIAL
HDPE = HIGH DENSITY POLYETHYLENE
PVC = POLYVINYL CHLORIDE

DESIGN FLOWS

	CAPACITY (MGD)	
	PHASE 1 (IPR ONLY)	PHASE 2 (IPR+DPR)
SAN MATEO TERTIARY EFFLUENT TO AWPF	4	9
SVCW TERTIARY EFFLUENT TO AWPF	4	8
COMBINED TERTIARY EFFLUENT (SM + SVCW)	8	17
AWPF SOURCE WATER	8	16
PURIFIED WATER PRODUCED	6	12
PURIFIED WATER TO CSR (IPR)	6	0
PURIFIED WATER TO DWDS CONNECTIONS (DPR)	6 - 8	4 - 6
RO CONCENTRATE	1.4	2.9

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BASIS OF DESIGN REPORT
CONVEYANCE UPGRADES

Kennedy Jenks

GENERAL NOTES, ABBREVIATIONS AND LEGEND

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G-02

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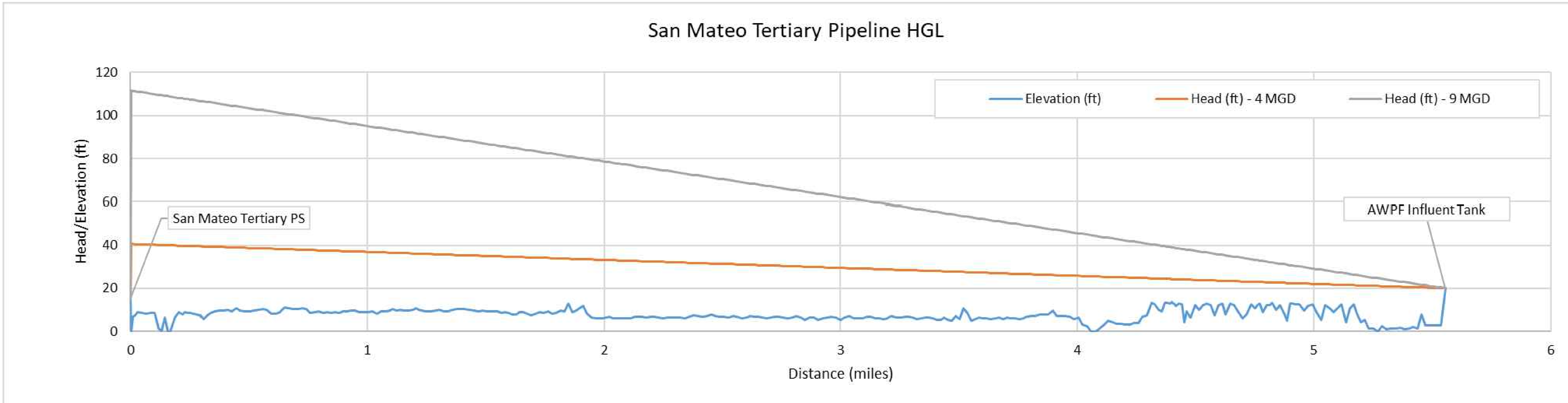

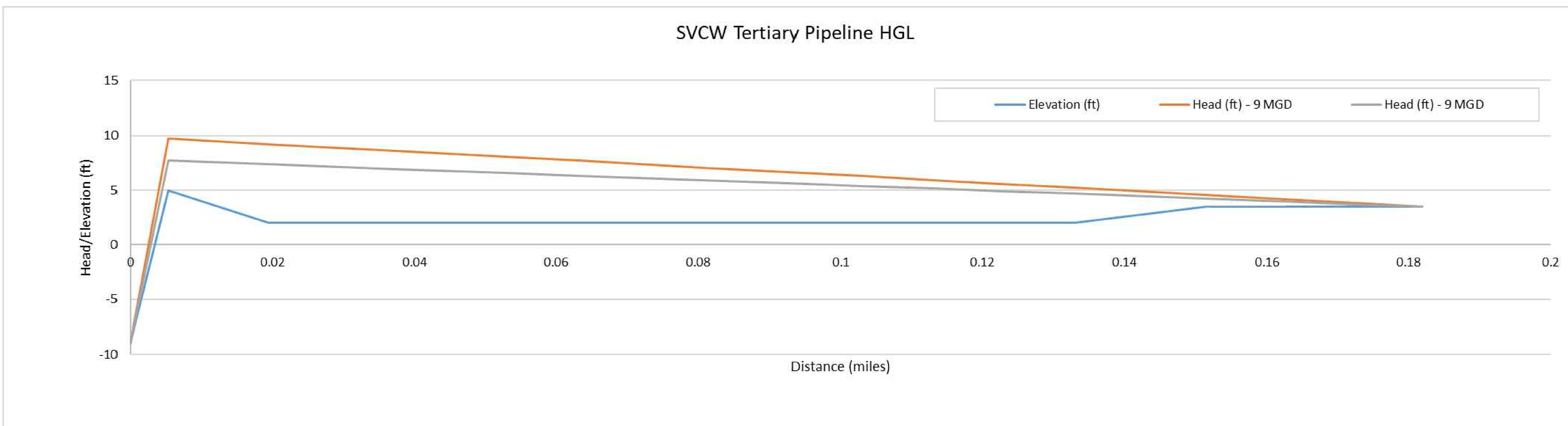

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HYDRAULIC PROFILES
SAN MATEO TERTIARY AND
SVCW TERTIARY PIPELINES

SCALE NTS
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SHEET 3 OF 18
G-03

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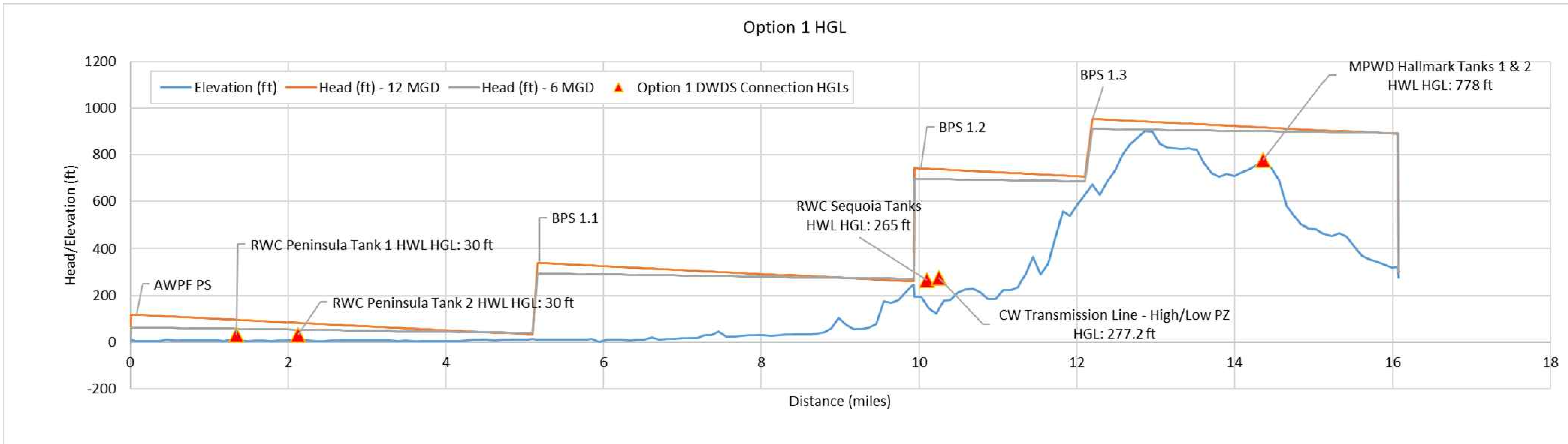

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HYDRAULIC PROFILE
PURIFIED WATER PIPELINE - OPTION 1

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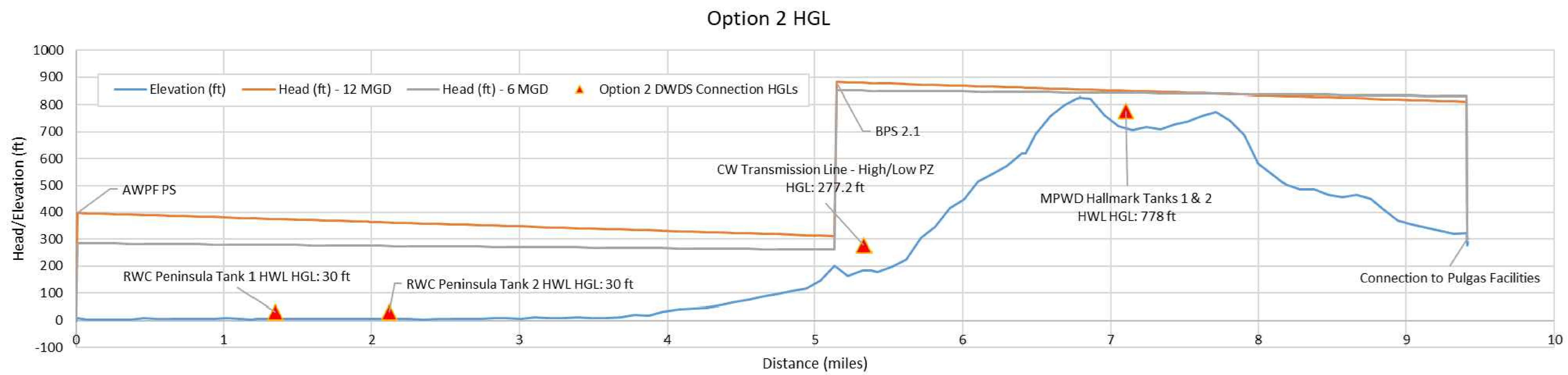

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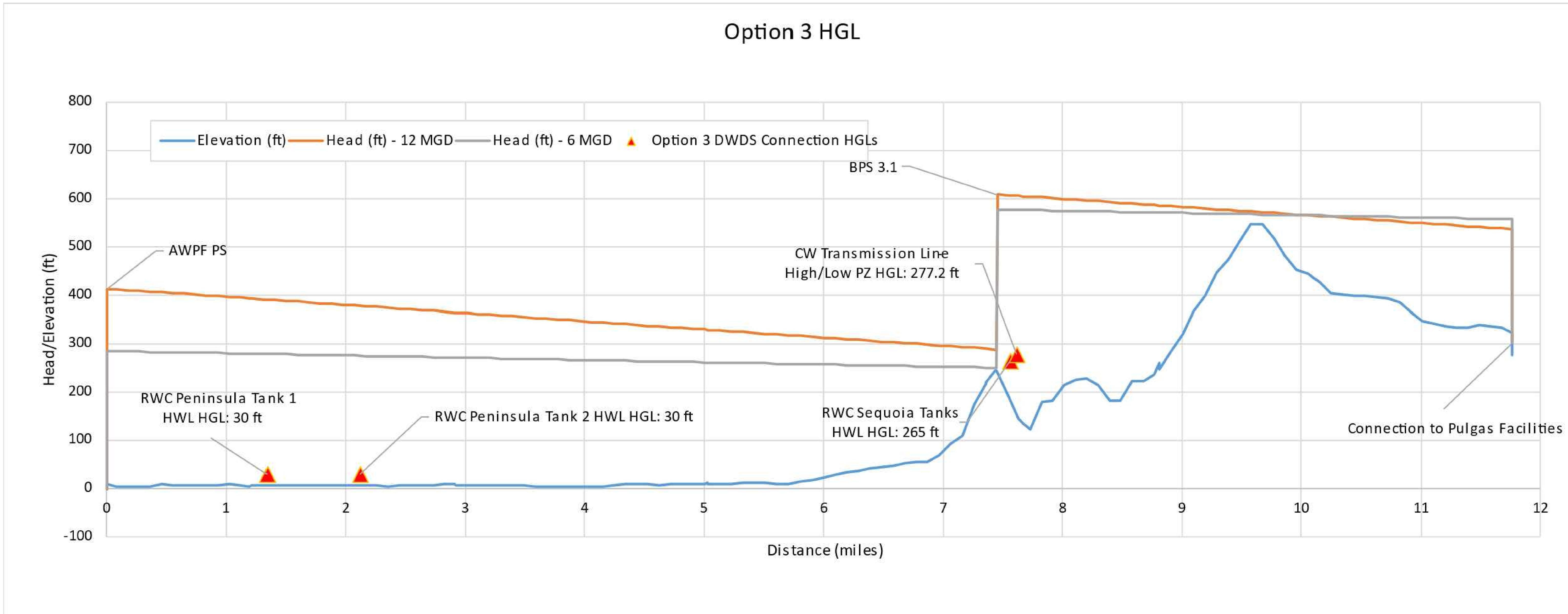
Kennedy Jenks

HYDRAULIC PROFILE
PURIFIED WATER PIPELINE - OPTION 2

SCALE	NTS
JOB NO	2268026.00
DATE	MAY 2024
SHEET	5 OF 18

G-05



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PUREWATER PENINSULA
SAN MATEO COUNTY, CALIFORNIA
BASIS OF DESIGN REPORT
CONVEYANCE UPGRADES

Kennedy Jenks

HYDRAULIC PROFILE
PURIFIED WATER PIPELINE - OPTION 3

SCALE: NTS
JOB NO: 2268026.00
DATE: MAY 2024
SHEET 6 OF 18
G-06

Plot Date: 5/2/2024 3:19 PM
User: CLARISSA DEOCARES
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\Silicon Valley Clean Water\Projects\SF-Peninsula Regional Purewater (SPRP) Project_2268026.00\10-Design\10.06-Drawings\Civil\2 - Conveyance\2268026_00-C-001.dwg

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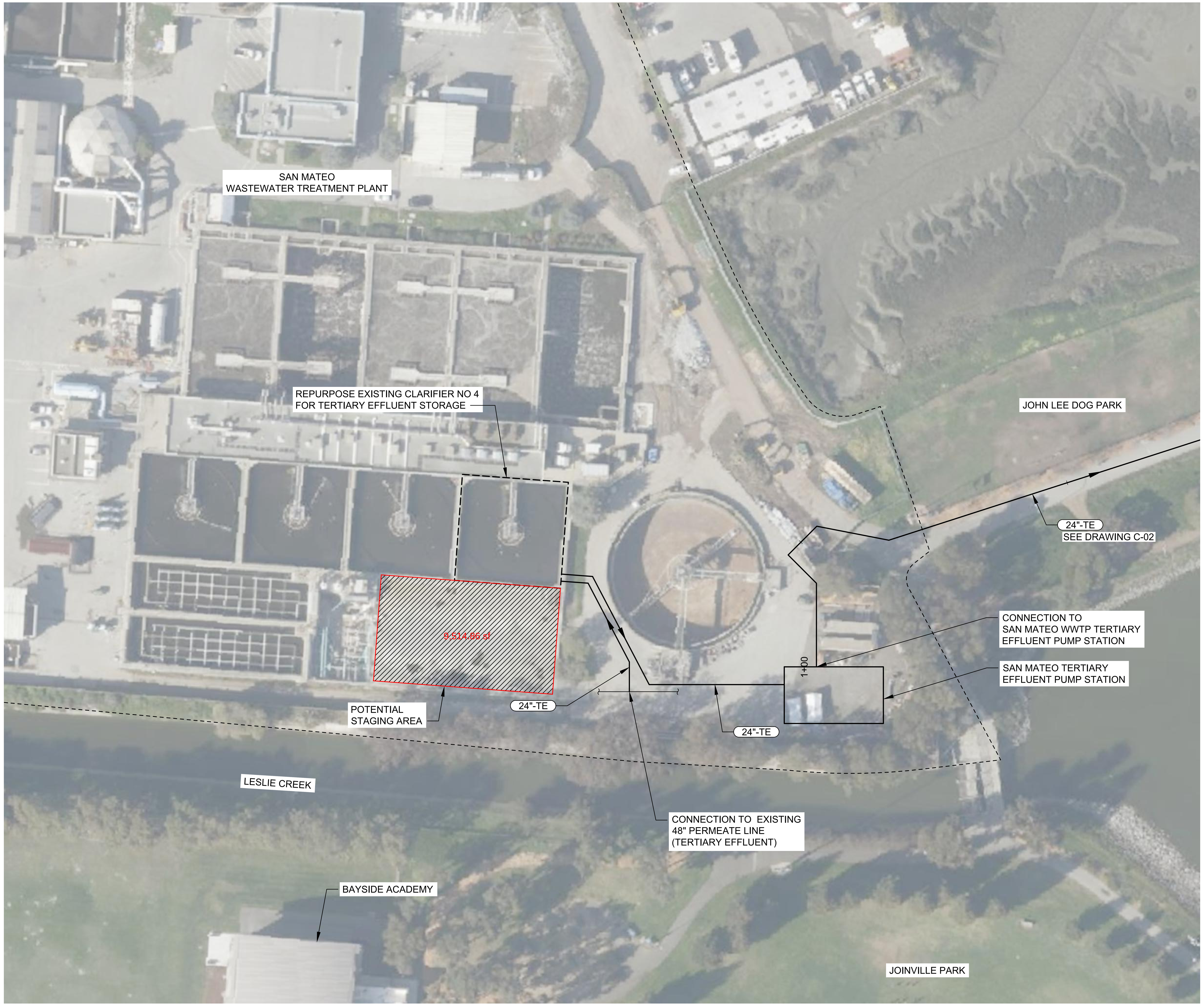

GENERAL SHEET NOTES

1. CONSTRUCTION ON UPGRADES TO THE SAN MATEO WWTP ARE CURRENTLY UNDERWAY. SEVERAL FACILITIES ARE SLATED TO BE REPURPOSED OR DECOMISSIONED. ADDITIONAL ALTERNATIVES EVALUATIONS MAY BE PERFORMED IN FUTURE DESIGN PHASES TO COMFIRM SITING OF NEW PUMP STATION. A LOCATION ADJACENT TO THE SAN MATEO WWTP MAY BE CONSIDERED.
2. MINOR SITE GRADING WOULD BE REQUIRED FOR CONSTRUCTION OF THE NEW AWPF SOURCE WATER PUMP STATION TO PROVIDE ADEQUATE DRAINAGE.
3. FOR THE PURPOSES OF THIS BODR, IT IS ASSUMED THAT UP TO 45 PILES WOULD BE REQUIRED TO SUPPORT THE NEW SM TERTIARY EFFLUENT PUMP STATION WITH SPACING OF 8'-2" AND A DEPTH OF 100 FEET.

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SAN MATEO COUNTY, CALIFORNIA
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Kennedy Jenks

SAN MATEO TERTIARY PUMP STATION
SITE PLAN

SCALE 1"=40'
JOB NO 2268026.00
DATE MAY 2024
SHEET 7 OF 18
C-01

Plot Date: 5/1/2024 10:46 AM
User: CLARISSA DEOCARES
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A B C D E F G H

N
0 1000 2000
1"=1000'

PLAN

N
0 1000 2000
1"=1000'

PLAN

POINT TABLE

POINT	STATION	DESCRIPTION
1	1+00.00	CONNECT TO AWPF SOURCE WATER (SAN MATEO) PS
2	6+53.72	BEGIN BRIDGE CROSSING OVER SEAL SLOUGH
3	10+94.41	END BRIDGE CROSSING OVER SEAL SLOUGH
4	205+69.23	BEGIN HDD CROSSING UNDER BELMONT SLOUGH
5	228+73.13	END HDD CROSSING UNDER BELMONT SLOUGH
6	291+74.99	CONNECT TO NEW EQ TANKS AT AWPF

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PUREWATER PENINSULA
SAN MATEO COUNTY, CALIFORNIA
BASIS OF DESIGN REPORT
CONVEYANCE UPGRADES

Kennedy Jenks

SAN MATEO TERTIARY PIPELINE PLAN
STA 1+00 TO AWPF

SCALE 1"=1000'
JOB NO 2268026.00
DATE MAY 2024
SHEET 8 OF 18
C-02

Plot Date: 5/2/2024 3:21 PM

User: CLARISSA DEOCARES

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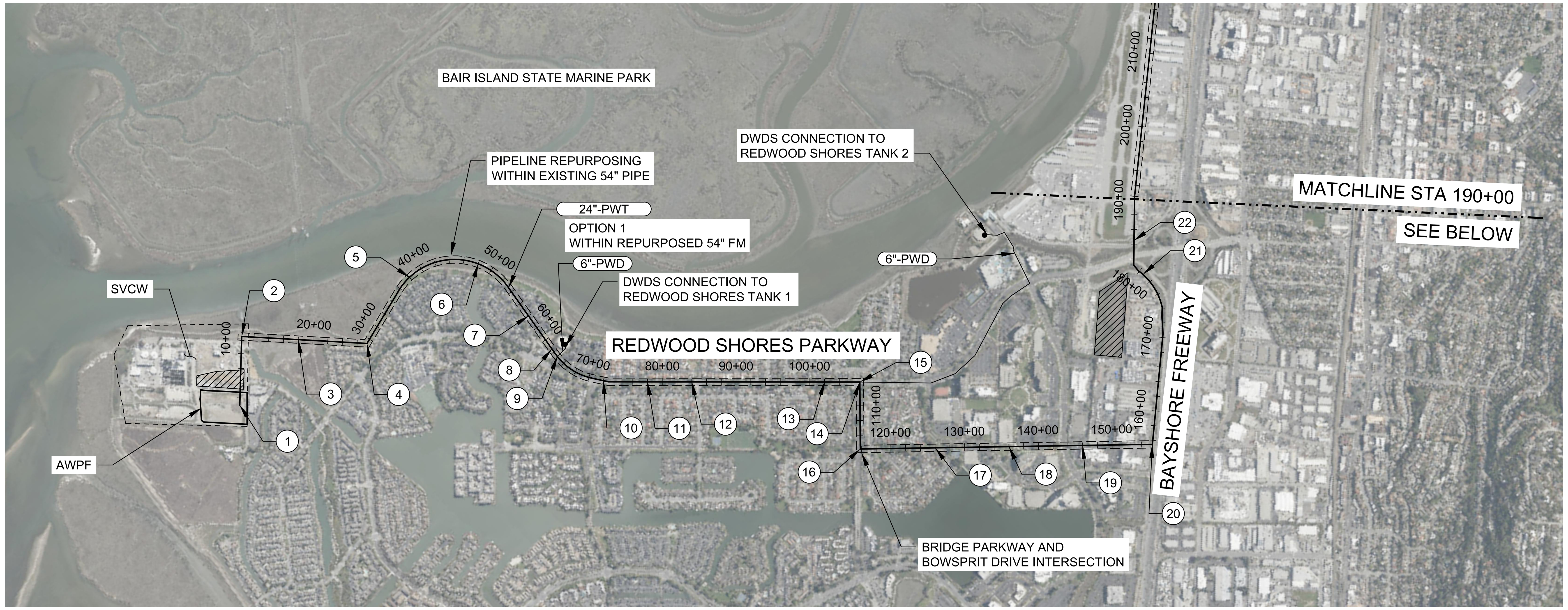

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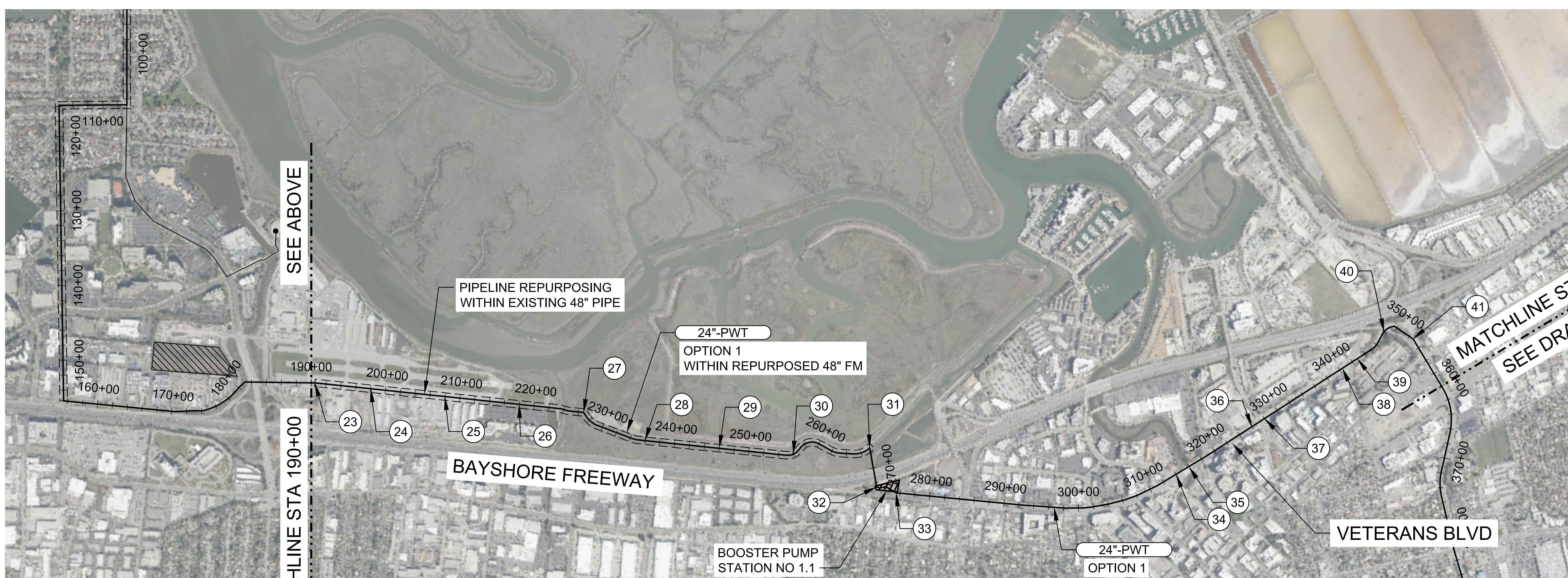

PLAN

POINT TABLE

POINT	STATION	DESCRIPTION
1	1+00.00	CONNECT TO NEW AWPF PRODUCT WATER PUMP STATION
2	10+32.71	BEGIN PIPELINE REPURPOSING (ACCESS PIT)
3	18+00.00	PIPELINE REPURPOSING ACCESS PIT
4	27+32.90	PIPELINE REPURPOSING ACCESS PIT
5	38+00.00	PIPELINE REPURPOSING ACCESS PIT
6	48+00.00	PIPELINE REPURPOSING ACCESS PIT
7	58+00.00	PIPELINE REPURPOSING ACCESS PIT
8	63+51.00	PIPELINE REPURPOSING ACCESS PIT
9	64+74.78	DWDS CONNECTION TO RWS TANK 1
10	72+00.00	PIPELINE REPURPOSING ACCESS PIT
11	78+00.00	PIPELINE REPURPOSING ACCESS PIT
12	84+00.00	PIPELINE REPURPOSING ACCESS PIT
13	102+00.00	PIPELINE REPURPOSING ACCESS PIT
14	106+78.12	PIPELINE REPURPOSING ACCESS PIT
15	106+78.12	DWDS CONNECTION TO RWS TANK 2
16	115+86.12	PIPELINE REPURPOSING ACCESS PIT
17	126+00.00	PIPELINE REPURPOSING ACCESS PIT
18	136+00.00	PIPELINE REPURPOSING ACCESS PIT
19	146+00.00	PIPELINE REPURPOSING ACCESS PIT
20	155+45.20	PIPELINE REPURPOSING ACCESS PIT / END PIPELINE REPURPOSING
21	179+37.00	MICROTUNNEL JACKING PIT
22	184+50.00	MICROTUNNELING RECEIVING PIT
23	190+49.66	BEGIN PIPELINE REPURPOSING (ACCESS PIT)
24	198+00.00	PIPELINE REPURPOSING ACCESS PIT
25	208+00.00	PIPELINE REPURPOSING ACCESS PIT
26	218+00.00	PIPELINE REPURPOSING ACCESS PIT
27	226+70.60	PIPELINE REPURPOSIG ACCESS PIT
28	236+00.00	PIPELINE REPURPOSING ACCESS PIT
29	246+00.00	PIPELINE REPURPOSING ACCESS PIT
30	256+00.00	PIPELINE REPURPOSING ACCESS PIT
31	267+31.28	END PIPELINE REPURPOSING (ACCESS PIT)/MICROTUNNELING JACKING PIT
32	272+60.36	MICROTUNNELING RECEIVING PIT
33	275+51.12	PURIFIED BOOSTER PS NO 1.1
34	314+00.00	START BRIDGE CROSSING
35	316+00.00	END BRIDGE CROSSING
36	326+00.00	MICROTUNNELING JACKING PIT
37	328+00.00	MICROTUNNELING RECEIVING PIT
38	340+40.61	MICROTUNNELING JACKING PIT
39	342+80.88	MICROTUNNELING RECEIVING PIT
40	348+00.00	MICROTUNNELING JACKING PIT
41	352+60.83	MICROTUNNELING RECEIVING PIT

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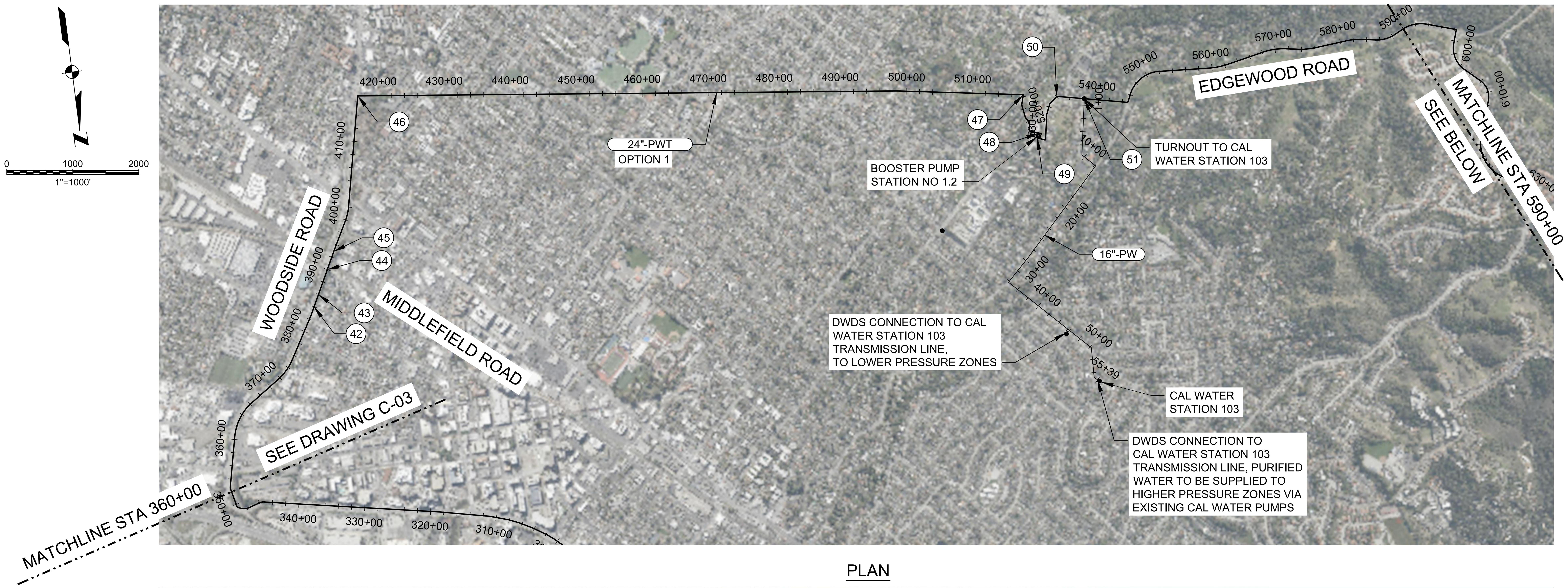
PUREWATER PENINSULA
SAN MATEO COUNTY, CALIFORNIA
BASIS OF DESIGN REPORT
CONVEYANCE UPGRADES

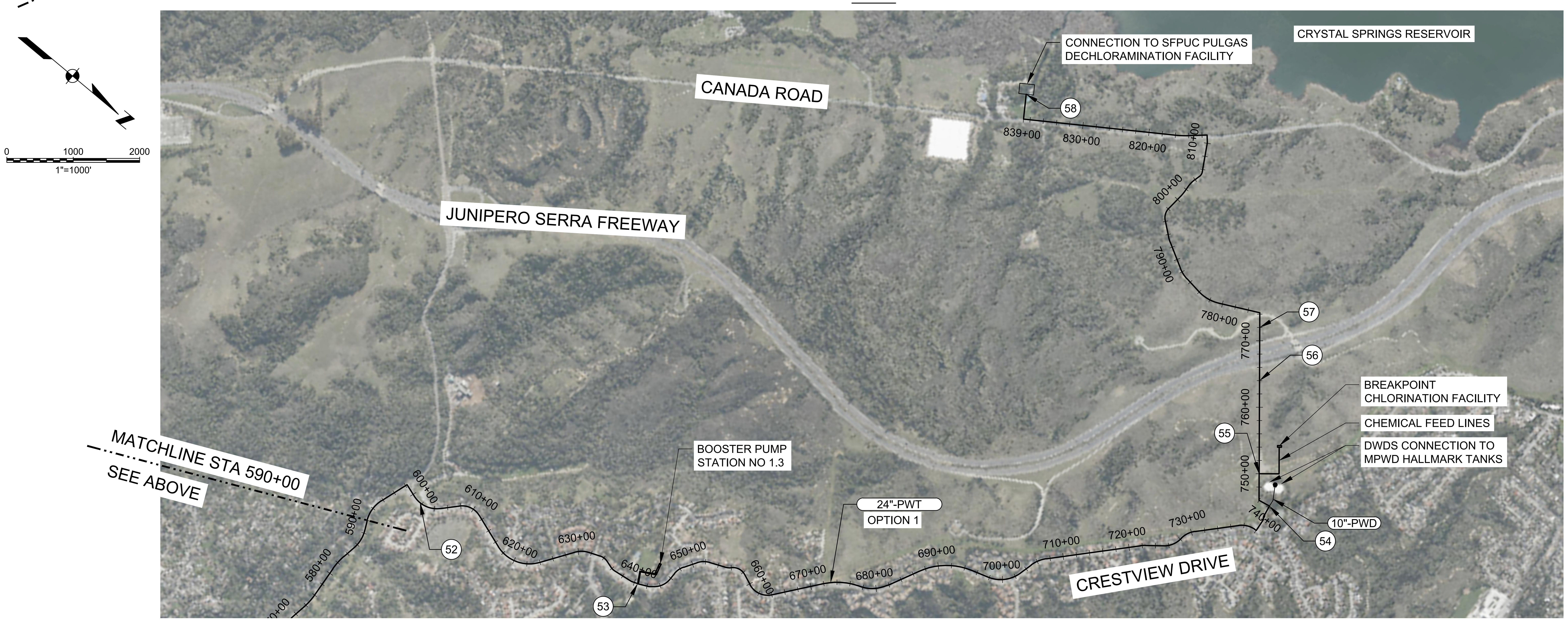
Kennedy Jenks

PURIFIED WATER PIPELINE OPTION 1 PLAN
STA 1+00 TO STA 360+00

SCALE 1"=1000'
JOB NO 2268026.00
DATE MAY 2024
SHEET 9 OF 18
C-03



PLAN



PLAN

POINT TABLE

POINT	STATION	DESCRIPTION
42	384+00.00	START BRIDGE CROSSING (WOODSIDE RD/PENNSYLVANIA AVE)
43	386+00.00	END BRIDGE CROSSING (WOODSIDE RD/PENNSYLVANIA AVE)
44	390+00.00	START BRIDGE CROSSING (WOODSITE RD/EL CAMINO REAL)
45	392+90.63	END BRIDGE CROSSING (WOODSIDE RD/EL CAMINO REAL)
46	416+91.19	ENTER SFPUC ROW
47	517+74.45	EXIT SFPUC ROW
48	524+98.28	PURIFIED BOOSTER PS NO 1.2
49	525+67.90	DWDS CONNECTION TO RWC SEQUOIA TANKS
50	534+02.48	ENTER SFPUC ROW
51	538+21.10	DWDS CONNECTION TO CAL WATER STATION 103
52	601+64.45	EXIT SFPUC ROW
53	640+53.44	TO PURIFIED BOOSTER PS NO 1.3
54	744+22.47	DWDS CONNECTION TO MPWD HALLMARK TANKS
55	750+00.00	INJECTION POINT FOR DECHLORAMINATION
56	764+00.00	MICROTUNNELING JACKING PIT
57	772+00.00	MICROTUNNELING RECEIVING PIT
58	839+00.00	CONNECT TO SFPUC PULGAS FACILITIES

Plot Date: 5/1/2024 11:12 AM

User: CLARISSA DEOCARES

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PUREWATER PENINSULA

SAN MATEO COUNTY, CALIFORNIA

BASIS OF DESIGN REPORT

CONVEYANCE UPGRADES

Kennedy Jenks

PURIFIED WATER PIPELINE OPTION 1 PLAN

STA 360+00 TO PULGAS

SCALE 1"=1000'

JOB NO 2268026.00

DATE MAY 2024

SHEET 10 OF 18

C-04

Plot Date: 5/1/2024 11:00 AM
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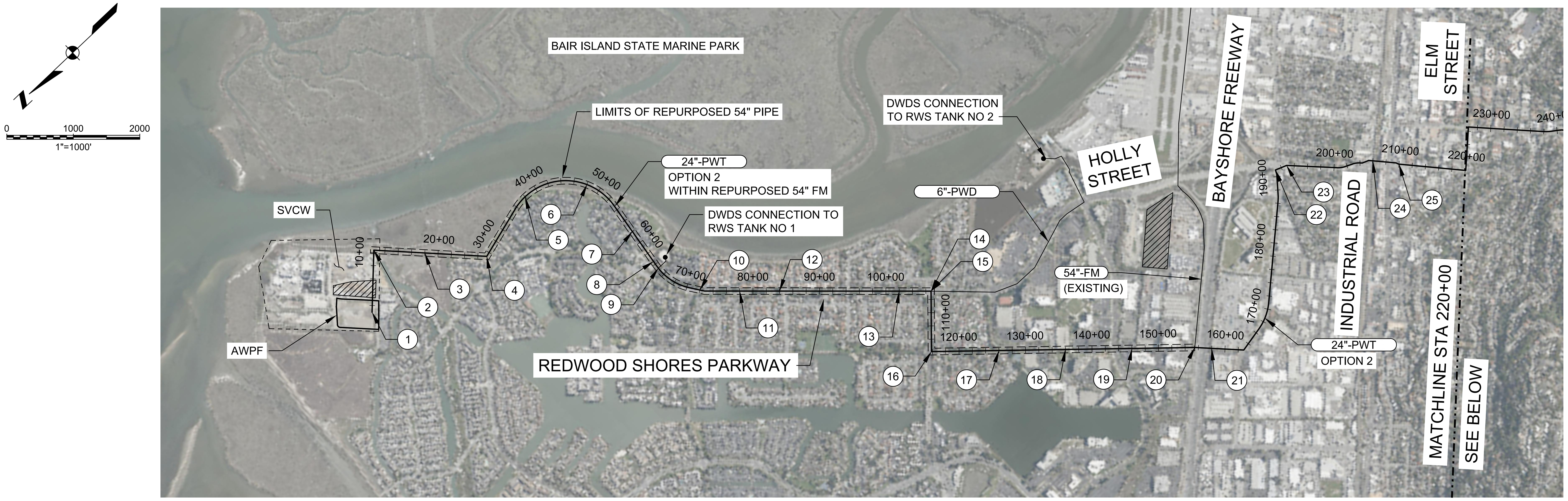

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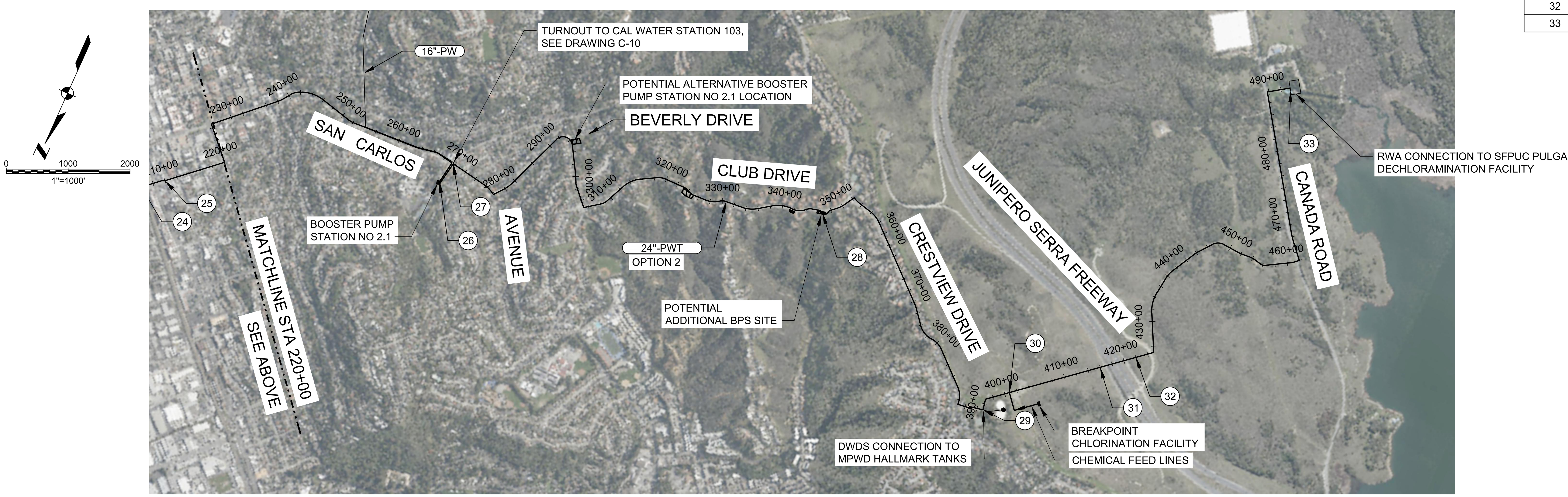

PLAN

POINT TABLE

POINT	STATION	DESCRIPTION
1	1+00.00	CONNECT TO AWPF PRODUCT WATER PUMP STATION
2	10+32.71	BEGIN PIPELINE REPURPOSING (ACCESS PIT)
3	18+00.00	PIPELINE REPURPOSING ACCESS PIT
4	27+32.90	PIPELINE REPURPOSING ACCESS PIT
5	38+00.00	PIPELINE REPURPOSING ACCESS PIT
6	48+00.00	PIPELINE REPURPOSING ACCESS PIT
7	58+00.00	PIPELINE REPURPOSING ACCESS PIT
8	63+51.00	PIPELINE REPURPOSING ACCESS PIT
9	64+74.78	DWDS CONNECTION TO RWS TANK 1
10	72+00.00	PIPELINE REPURPOSING ACCESS PIT
11	78+00.00	PIPELINE REPURPOSING ACCESS PIT
12	84+00.00	PIPELINE REPURPOSING ACCESS PIT
13	102+00.00	PIPELINE REPURPOSING ACCESS PIT
14	106+78.12	PIPELINE REPURPOSING ACCESS PIT
15	106+78.12	DWDS CONNECTION TO RWS TANK 2
16	115+86.12	PIPELINE REPURPOSING ACCESS PIT
17	126+00.00	PIPELINE REPURPOSING ACCESS PIT
18	136+00.00	PIPELINE REPURPOSING ACCESS PIT
19	146+00.00	PIPELINE REPURPOSING ACCESS PIT
20	155+45.20	END PIPELINE REPURPOSING (ACCESS PIT)/MICROTUNNELING JACKING PIT
21	158+00.00	MICROTUNNELING RECEIVING PIT
22	191+04.56	MICROTUNNELING JACKING PIT
23	192+85.01	MICROTUNNELING RECEIVING PIT
24	206+00.00	MICROTUNNELING JACKING PIT
25	210+00.00	MICROTUNNELING RECEIVING PIT
26	269+44.85	BOOSTER PUMP STATION 2.1
27	269+64.99	DWDS CONNECTION TO CAL WATER STATION 103
28	346+64.99	POTENTIAL ADDITIONAL BPS SITE
29	394+98.74	DWDS CONNECTION TO MPWD HALLMARK TANKS
30	400+76.27	INJECTION POINT FOR DECHLORAMINATION
31	416+00.00	JACK AND BORE JACKING PIT
32	422+00.00	JACK AND BORE RECEIVING PIT
33	493+51.10	CONNECT TO SFPUC PULGAS FACILITIES

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SAN MATEO COUNTY, CALIFORNIA
BASIS OF DESIGN REPORT
CONVEYANCE UPGRADES

Kennedy Jenks

PURIFIED WATER PIPELINE OPTION 2 PLAN
STA 1+00 TO PULGAS

SCALE 1"=1000'
JOB NO 2268026.00
DATE MAY 2024
SHEET 11 OF 18
C-05

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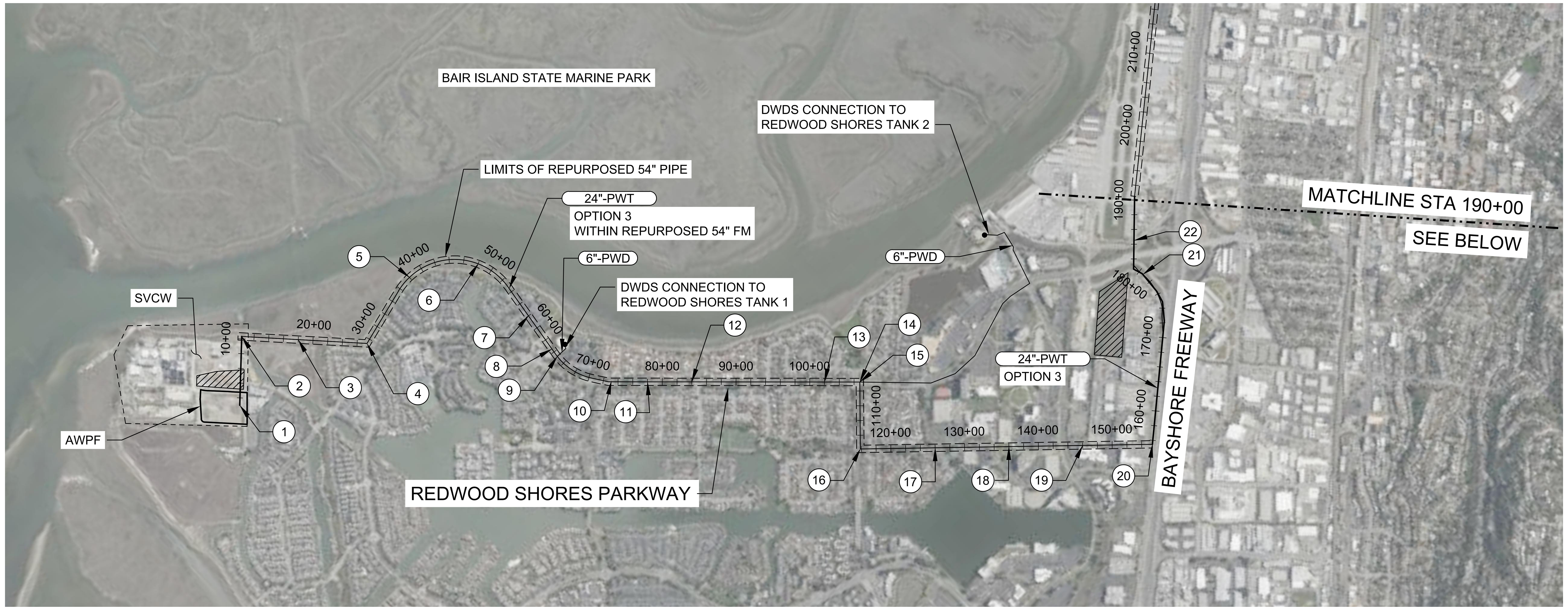

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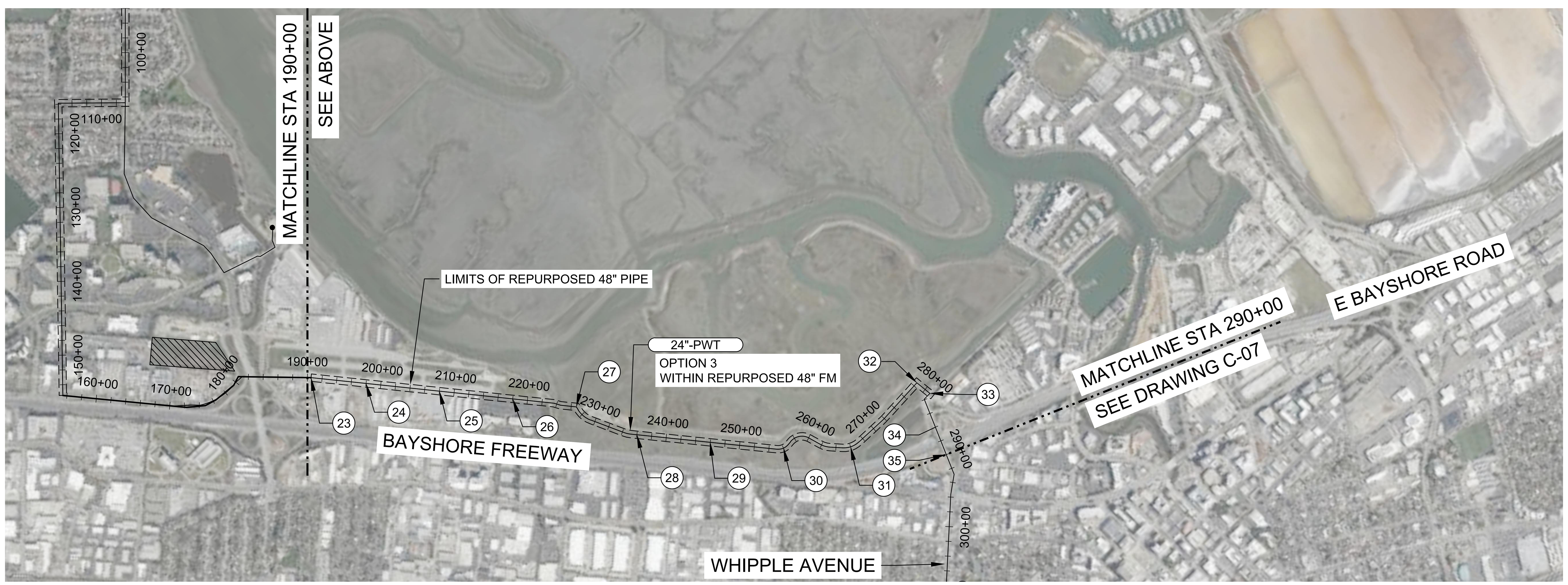

PLAN

POINT TABLE

POINT	STATION	DESCRIPTION
1	1+00.00	CONNECT TO NEW AWPF PRODUCT WATER PUMP STATION
2	10+32.71	BEGIN PIPELINE REPURPOSING (ACCESS PIT)
3	18+00.00	PIPELINE REPURPOSING ACCESS PIT
4	27+32.90	PIPELINE REPURPOSING ACCESS PIT
5	38+00.00	PIPELINE REPURPOSING ACCESS PIT
6	48+00.00	PIPELINE REPURPOSING ACCESS PIT
7	58+00.00	PIPELINE REPURPOSING ACCESS PIT
8	63+51.00	PIPELINE REPURPOSING ACCESS PIT
9	64+74.78	DWDS CONNECTION TO RWS TANK 1
10	73+10.50	PIPELINE REPURPOSING ACCESS PIT
11	78+00.00	PIPELINE REPURPOSING ACCESS PIT
12	84+00.00	PIPELINE REPURPOSING ACCESS PIT
13	102+00.00	PIPELINE REPURPOSING ACCESS PIT
14	106+78.12	PIPELINE REPURPOSING ACCESS PIT
15	106+78.12	DWDS CONNECTION TO RWS TANK 2
16	115+86.12	PIPELINE REPURPOSING ACCESS PIT
17	126+00.00	PIPELINE REPURPOSING ACCESS PIT
18	136+00.00	PIPELINE REPURPOSING ACCESS PIT
19	146+00.00	PIPELINE REPURPOSING ACCESS PIT
20	155+45.20	PIPELINE REPURPOSING ACCESS PIT / END PIPELINE REPURPOSING
21	179+37.00	MICROTUNNEL JACKING PIT
22	184+50.00	MICROTUNNELING RECEIVING PIT
23	190+49.66	BEGIN PIPELINE REPURPOSING (ACCESS PIT)
24	198+00.00	PIPELINE REPURPOSING ACCESS PIT
25	208+00.00	PIPELINE REPURPOSING ACCESS PIT
26	218+00.00	PIPELINE REPURPOSING ACCESS PIT
27	226+70.60	PIPELINE REPURPOSIG ACCESS PIT
28	236+00.00	PIPELINE REPURPOSING ACCESS PIT
29	246+00.00	PIPELINE REPURPOSING ACCESS PIT
30	256+00.00	PIPELINE REPURPOSING ACCESS PIT
31	266+00.00	PIPELINE REPURPOSING ACCESS PIT
32	278+55.27	PIPELINE REPURPOSING ACCESS PIT
33	280+82.67	END PIPELINE REPURPOSING (ACCESS PIT)
34	286+00.00	MICROTUNNELING JACKING PIT
35	290+00.00	MICROTUNNELING RECEIVING PIT

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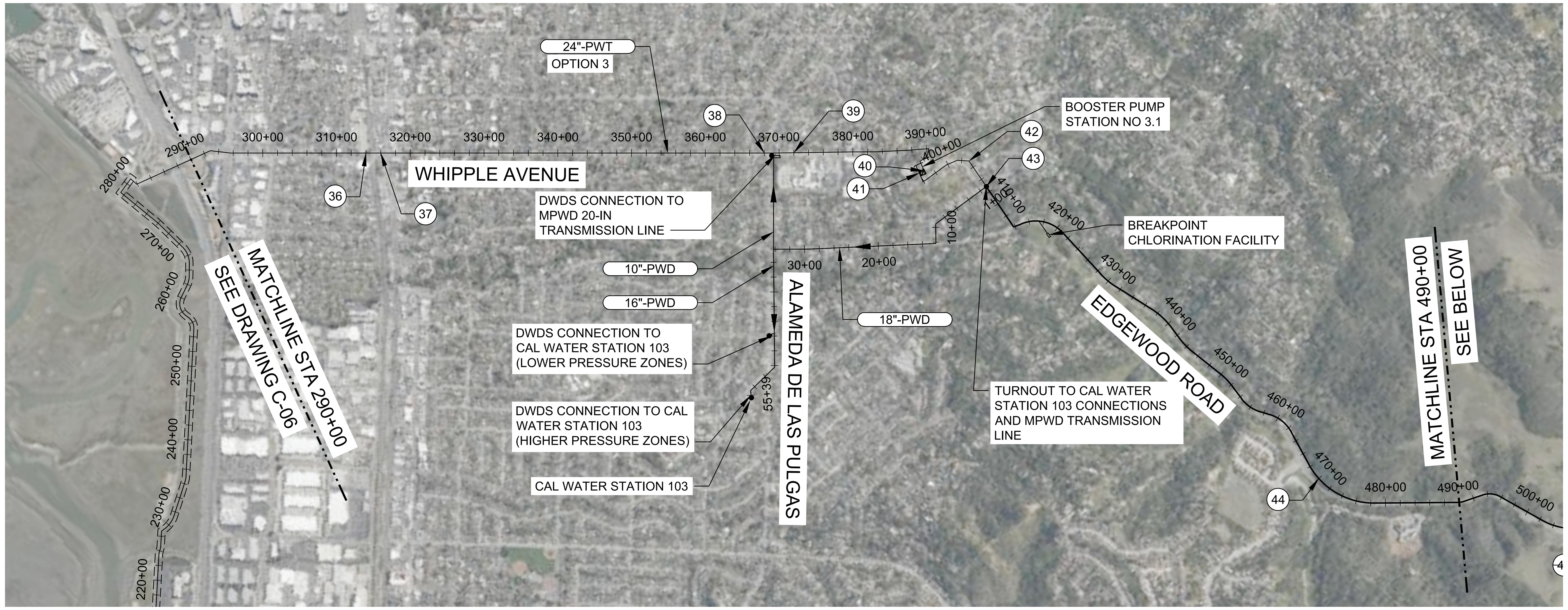
SAN MATEO COUNTY, CALIFORNIA
BASIS OF DESIGN REPORT
CONVEYANCE UPGRADES
Kennedy Jenks

PURIFIED WATER PIPELINE OPTION 3 PLAN
STA 1+00 TO STA 290+00

SCALE 1"=1000'
JOB NO 2268026.00
DATE MAY 2024
SHEET 12 OF 18
C-06

0 1000 2000
1"=1000'



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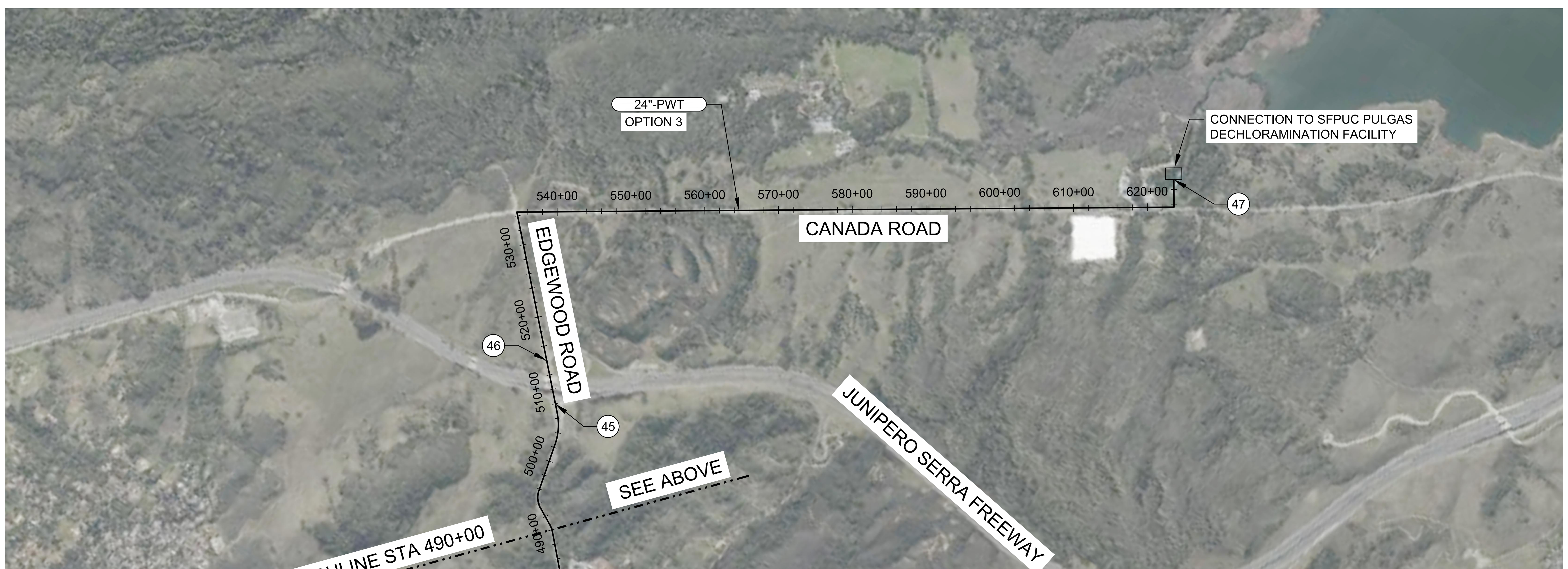

PLAN

POINT TABLE

POINT	STATION	DESCRIPTION
36	314+00.00	JACK AND BORE JACKING PIT
37	316+00.00	JACK AND BORE RECEIVING PIT
38	368+00.00	JACK AND BORE JACKING PIT
39	372+00.00	JACK AND BORE RECEIVING PIT
40	393+94.97	PURIFIED BOOSTER PS NO 1 (OPTION 3)
41	394+64.77	DWDS TURNOUT TO RWC SEQUOIA TANKS
42	402+99.35	ENTER SFPUC ROW
43	407+17.97	DWDS TURNOUT TO CAL WATER STATION 103 AND MPWD
44	470+00.00	EXIT SFPUC ROW
45	508+00.00	JACK AND BORE JACKING PIT
46	514+00.00	JACK AND BORE RECEIVING PIT
47	627+35.13	CONNECT TO SFPUC PULGAS FACILITIES

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Kennedy Jenks

PURIFIED WATER PIPELINE OPTION 3 PLAN
STA 290+00 TO PULGAS

SCALE 1"=1000'
JOB NO 2268026.00
DATE MAY 2024
SHEET 13 OF 18
C-07

PURIFIED WATER DISTRIBUTION EXTENSION TO REDWOOD SHORES TANK NO 1 - PLAN

PURIFIED WATER DISTRIBUTION EXTENSION TO REDWOOD SHORES TANK NO 2 - PLAN

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PURIFIED WATER OPTION 1/2/3
ENLARGED PLANS

SCALE 1"=1000'
JOB NO 2268026.00
DATE MAY 2024
SHEET 14 OF 18
C-08

Plot Date: 5/1/2024 11:19 AM
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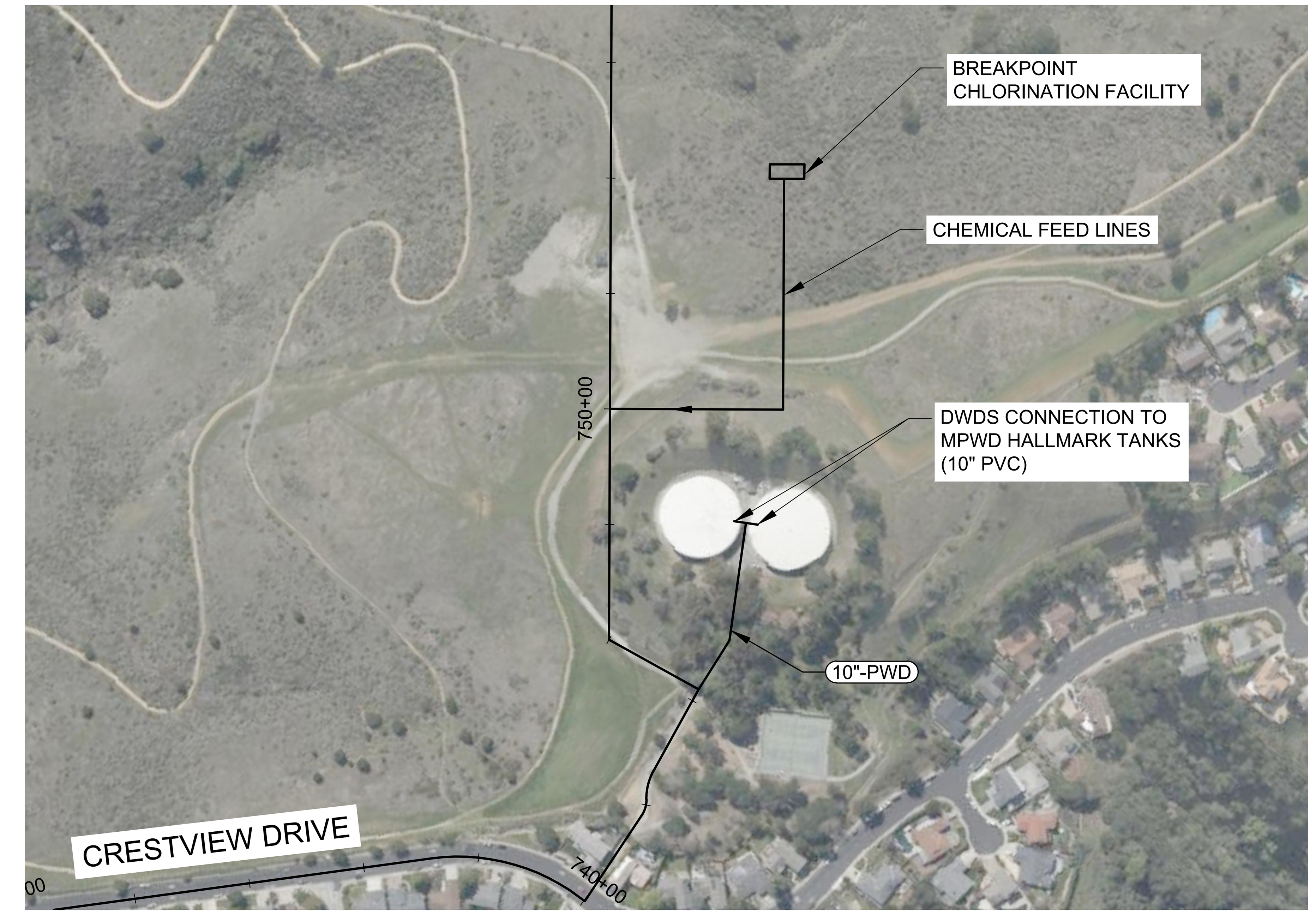
0 100 200
1"=100'

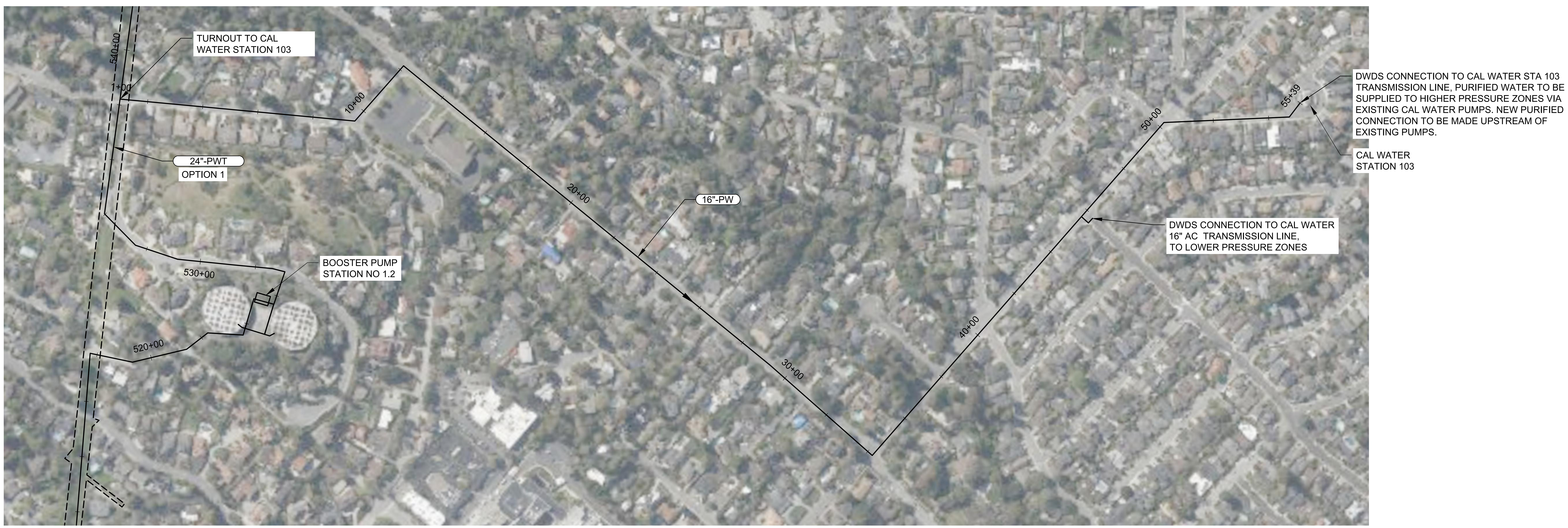
PURIFIED WATER DISTRIBUTION EXTENSION TO REDWOOD CITY SEQUOIA TANKS - PLAN

0 200 400
1"=200'



PURIFIED WATER DISTRIBUTION EXTENSION TO MPWD HALLMARK TANKS - PLAN

0 200 400
1"=200'



PURIFIED WATER DISTRIBUTION EXTENSION TO CAL WATER STATION 103 - PLAN

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SCALES
0 1"
0 25mm
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SAN MATEO COUNTY, CALIFORNIA
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PURIFIED WATER OPTION 1
ENLARGED PLANS

SCALE 1"=200'
JOB NO 2268026.00
DATE MAY 2024
SHEET 15 OF 18
C-09

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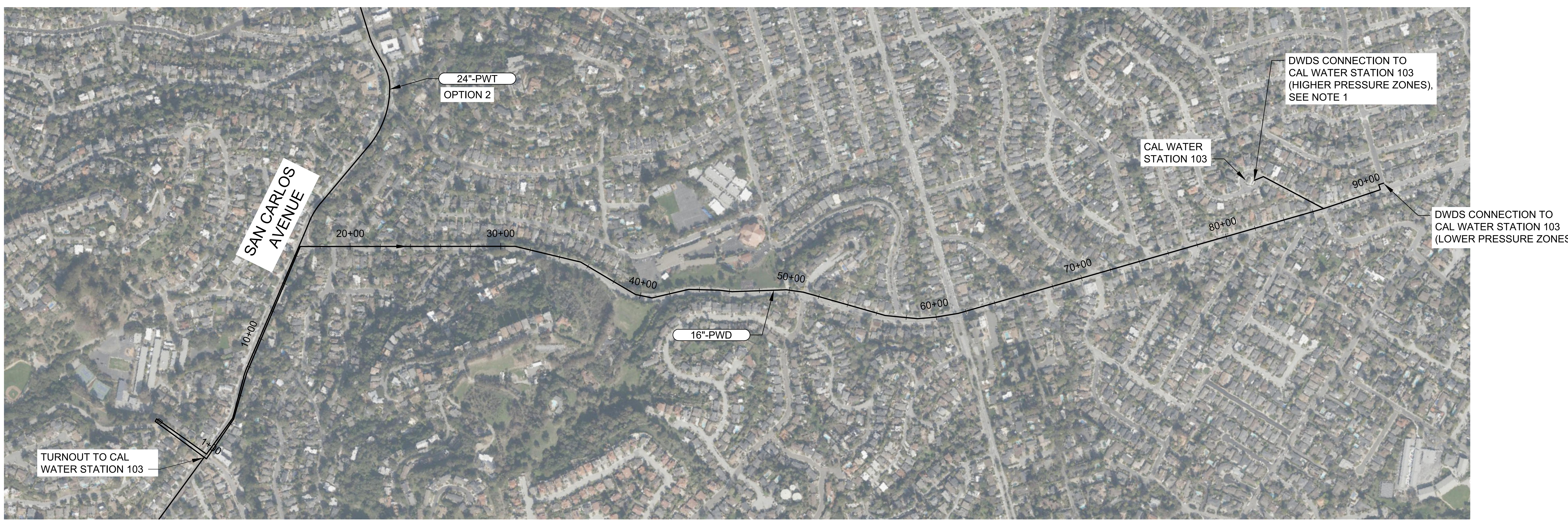
GENERAL SHEET NOTES

1. CONNECT TO CAL WATER'S EXISTING TRANSMISSION PIPELINE UPSTREAM OF THE EXISTING STATION 103 PUMP STATION.
2. FOR PURIFIED WATER OPTIONS 1 THROUGH 3, IT IS ASSUMED THAT THERE WOULD BE TWO NEW PURIFIED CONNECTIONS TO CAL WATER'S EXISTING TRANSMISSION PIPELINES. ONE CONNECTION WOULD SERVE THE LOWER PRESSURE ZONES VIA A NEW CONNECTION TO THE 16" AC. THE OTHER PURIFIED CONNECTION WOULD CONNECT UPSTREAM OF THE STATION 103 PUMP STATION. THE STATION 103 PUMP STATION SERVES THE HIGHER PRESSURE ZONES. CAL WATER'S EXISTING PUMPS WOULD BE USED TO CONVEY THE BLEND OF PURIFIED WATER AND SF REGIONAL WATER SYSTEM WATER SUPPLIES.

0 200 400
1"=200'

PURIFIED WATER DISTRIBUTION EXTENSION TO MPWD HALLMARK TANKS - PLAN

0 400 800
1"=400'



PURIFIED WATER DISTRIBUTION EXTENSION TO CAL WATER STATION 103 PLAN

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SCALES
0 1"
0 25mm
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PURIFIED WATER OPTION 2
ENLARGED PLANS

SCALE AS SHOWN
JOB NO 2268026.00
DATE MAY 2024
SHEET 16 OF 18
C-10

0 200 400
1"=200'

GENERAL SHEET NOTES

1. CAL WATER'S EXISTING TRANSMISSION LINE, UPSTREAM OF EXISTING STATION 103 PUMP STATION.
2. FOR PURIFIED WATER OPTIONS 1 THROUGH 3, IT IS ASSUMED THAT THERE WOULD BE TWO NEW PURIFIED CONNECTIONS TO CAL WATER'S EXISTING TRANSMISSION PIPELINES. ONE CONNECTION WOULD SERVE THE LOWER PRESSURE ZONES VIA A NEW CONNECTION TO THE 16" AC. THE OTHER PURIFIED CONNECTION WOULD CONNECT UPSTREAM OF THE STATION 103 PUMP STATION. THE STATION 103 PUMP STATION SERVES THE HIGHER PRESSURE ZONES. CAL WATER'S EXISTING PUMPS WOULD BE USED TO CONVEY THE BLEND OF PURIFIED WATER AND SF REGIONAL WATER SYSTEM WATER SUPPLIES.
3. EXISTING UTILITIES ARE NOT SHOWN. CAL WATER OWNS AND OPERATES SEVERAL PIPELINES IN THIS AREA, INCLUDING A 21"-CCP AND A 14"-AC TRANSMISSION PIPELINE THAT DELIVER SF REGIONAL WATER SYSTEM WATER FROM FROM SFPUC'S BAY DIVISION PIPELINES (BDPLs) TO CAL WATER'S SYSTEM . THESE EXITING PIPELINES RUN ALONG EDGEWOOD BLVD, THEN TURN UP ALAMEDA DE LAS PULGAS TOWARDS CAL WATER STATION 103. FOR PLANNING PURPOSES, NEW PURIFIED WATER PIPELINE IS SHOWN PARALLEL TO THESE ALIGNMENTS, HOWEVER, IT MAY BE FEASIBLE TO CONNECT THE NEW PURIFIED DWDS CONNECTIONS CLOSER TO THE BDPL TIE IN POINTS TO REDUCE TO TOTAL LENGTH OF PIPING NEEDED. FUTURE ANALYSIS IS REQUIRED TO IDENTIFY PREFERRED PIPELINE ROUTING AND BLENDING.

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SCALES
0 — 1"
0 — 25mm
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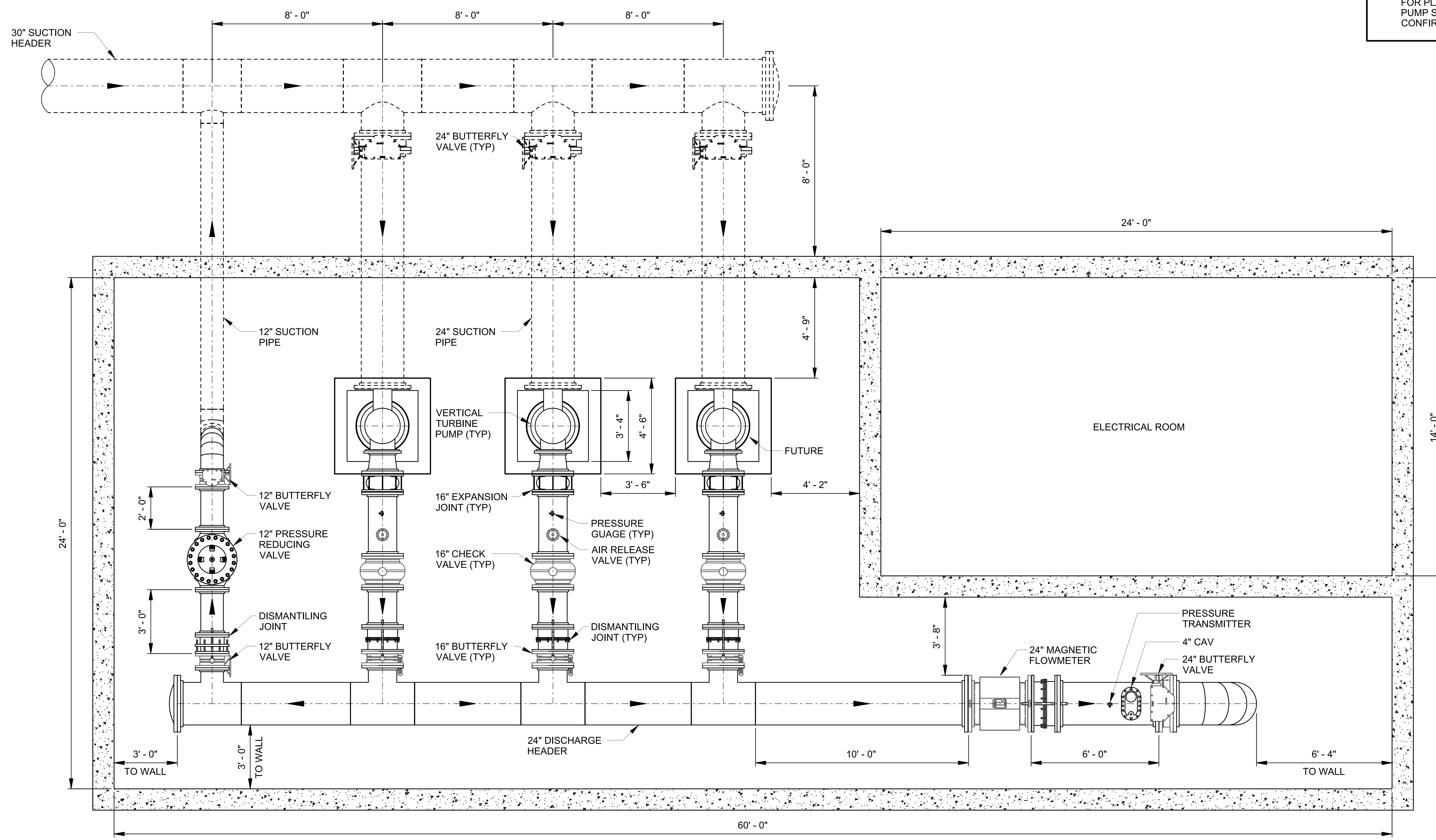
PURIFIED WATER OPTION 3
ENLARGED PLANS

SCALE 1"=200'
JOB NO 2268026.00
DATE MAY 2024
SHEET 17 OF 18
C-11

GENERAL SHEET NOTES

1. THIS CONCEPTUAL BOOSTER PUMP STATION LAYOUT IS PROVIDED FOR PLANNING PURPOSES ONLY. HYDRAULICS, PUMP SELECTION, PUMP STATION LAYOUT, AND SITE-SPECIFIC REQUIREMENTS TO BE CONFIRMED DURING FUTURE DETAILED DESIGN PHASES.



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SCALES

0 ——— 1"

0 ——— 25mm

IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

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PUREWATER PENINSULA
SAN MATEO COUNTY, CALIFORNIA

BASIS OF DESIGN REPORT
CONVEYANCE UPGRADES

Kennedy Jenks

TYPICAL PURIFIED BOOSTER PUMP STATION PLAN

SCALE 3/8"=1'-0"

JOB NO 2268026.00

DATE MAY 2024

SHEET 18 OF 18

M-01

Contact Information

275 Battery Street, Suite 550
San Francisco, California 94111

415-243-2150

Kennedy Jenks