City of Daly City and
San Francisco Public Utilities Commission

Feasibility of Expanded Tertiary Recycled Water Facilities

PRELIMINARY DESIGN REPORT

DRAFT • SEPTEMBER 2017
VOLUME ONE

carollo
Engineers...Working Wonders With Water®

CITY OF DALY CITY

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

PRELIMINARY DESIGN REPORT

VOLUME 1 OF 3

TABLE OF CONTENTS

Page No.

CITY OF DALY CITY

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

PRELIMINARY DESIGN REPORT

VOLUME 2 OF 3

TECHNICAL MEMORANDUM NO. 2 - COLMA DELIVERY SYSTEM

LIST OF APPENDICES

TECHNICAL MEMORANDUM NO. 1

TECHNICAL MEMORANDUM NO. 2

TECHNICAL MEMORANDUM NO. 3

LIST OF TABLES

EXECUTIVE SUMMARY

TECHNICAL MEMORANDUM NO. 1

TECHNICAL MEMORANDUM NO. 2

LIST OF FIGURES

EXECUTIVE SUMMARY

TECHNICAL MEMORANDUM NO. 1

TECHNICAL MEMORANDUM NO. 2

TECHNICAL MEMORANDUM NO. 3

CITY OF DALY CITY

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

EXECUTIVE SUMMARY

DRAFT
October 2017

This document is released for the purpose of information exchange review and planning only under the authority of Darren G. Baune, 9/29/2017, California P.E. No. 68899.

CITY OF DALY CITY

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

PRELIMINARY DESIGN REPORT

TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF FIGURES

PRELIMINARY DESIGN REPORT
EXECUTIVE SUMMARY

1.0 PURPOSE

The purpose of this Preliminary Design Report (PDR) is to summarize the field investigations, membrane piloting, preliminary engineering, and project cost estimates performed to develop the Preliminary Design of the Feasibility of Expanded Tertiary Recycled Water Facilities Project (Project). The PDR includes 30 percent design drawings and the following technical memoranda (TM):

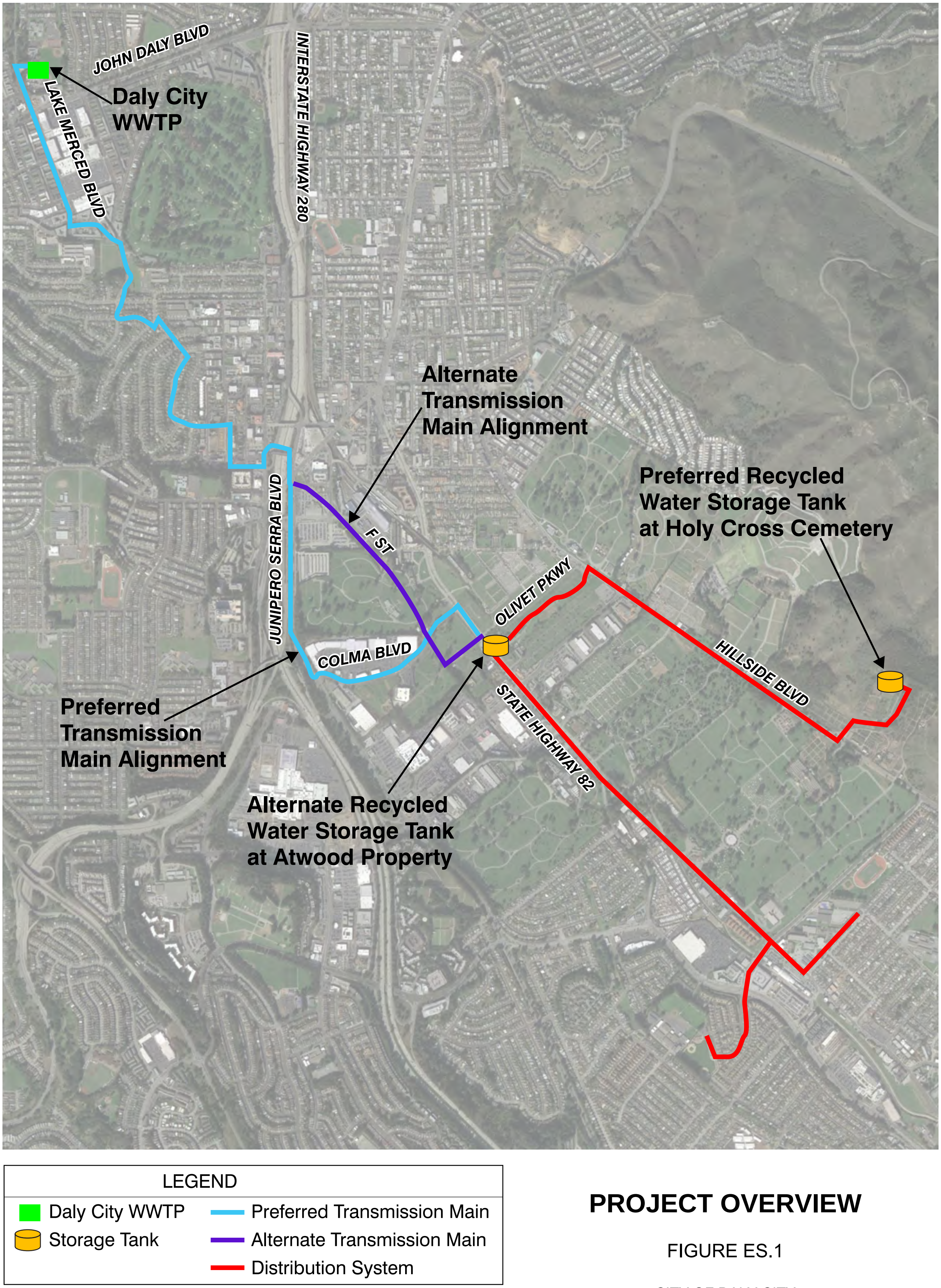
- **TM No. 1 Tertiary Treatment** presents the preliminary design of the new recycled water treatment facility at Daly City's Wastewater Treatment Plant (WWTP). This TM considers the treatment processes to provide recycled water for unrestricted reuse.
- **TM No. 2 Recycled Water Conveyance System** presents the preliminary design of the conveyance system that would deliver recycled water from Daly City's WWTP to customers in Daly City, the Town of Colma, and the City of South San Francisco.
- **TM No. 3 Conceptual Planning for Indirect Potable Reuse** summarizes a conceptual study to add indirect potable reuse treatment at Daly City's WWTP to provide recycled water for groundwater injection.

2.0 PROJECT SUMMARY

The City of Daly City owns and operates a recycled water treatment facility at their WWTP located in Daly City, California. The City is permitted to produce a maximum of 2.77 million gallons per day (mgd) of recycled water for irrigation of nearby golf courses, parks, and medians. Daly City currently serves recycled water to the San Francisco Golf Club, Olympic Club, Lake Merced Golf Club, and Harding Park Golf Club.

The San Francisco Public Utilities Commission (SFPUC) is partnering with Daly City on the Project with a goal of reducing the irrigation demands on the South Westside Groundwater Basin. The Project also provides a local, sustainable, drought-proof irrigation supply for the region. The Project would increase Daly City’s WWTP recycled water treatment capacity by approximately 3 mgd by treating secondary effluent that is currently discharged to the Pacific Ocean.

Figure ES.1 shows an overview of the project. The project includes a new recycled water treatment facility at the Daly City WWTP to supply irrigation to cemeteries, schools, parks, and other facilities in the Town of Colma, South San Francisco, and Daly City.



PROJECT OVERVIEW

FIGURE ES.1

CITY OF DALY CITY
PRELIMINARY DESIGN REPORT

carollo

DC0917-10076f4.ai

The project team identified 22 potential customers with a total average irrigation demand of 2.49 mgd. Approximately 80 percent of the demand is currently supplied by private wells that withdraw from the South Westside Groundwater Basin. The remaining demand is supplied by Cal Water (18 percent) and Daly City Water (2 percent). This project could reduce withdraw from the groundwater basin by 1.99 mgd during the irrigation season by providing an alternative irrigation supply.

2.1 Recycled Water Conveyance System

The recycled water conveyance system includes all facilities required to deliver the recycled water from the WWTP to the customers. Figure ES.1 shows an overview of the project, the potential storage tank sites, and recommended transmission pipeline alignment. The recommended alignment has a primary advantage of not being routed through the SFPUC's easement - adjacent to the Bayden Merced pipeline. The project team considered three potential storage tank sites and all sites were included in the environmental analysis. The Holy Cross and Atwood storage tank sites are the preferred alternatives. We recommend negotiating with landowners and acquiring the storage tank site as a next step. The conveyance system includes the following element:

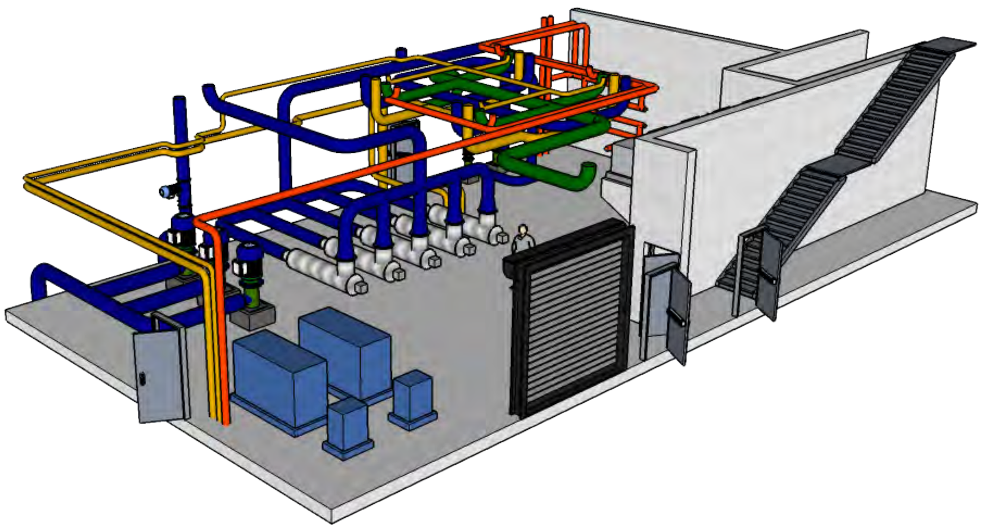
- Recycled water effluent pump station located at the Daly City WWTP.
- Transmission main from WWTP to storage tank site.
- Recycled water storage tank.
- Distribution system from the storage tank to recycled water customers.

2.2 Recycled Water Treatment Facilities

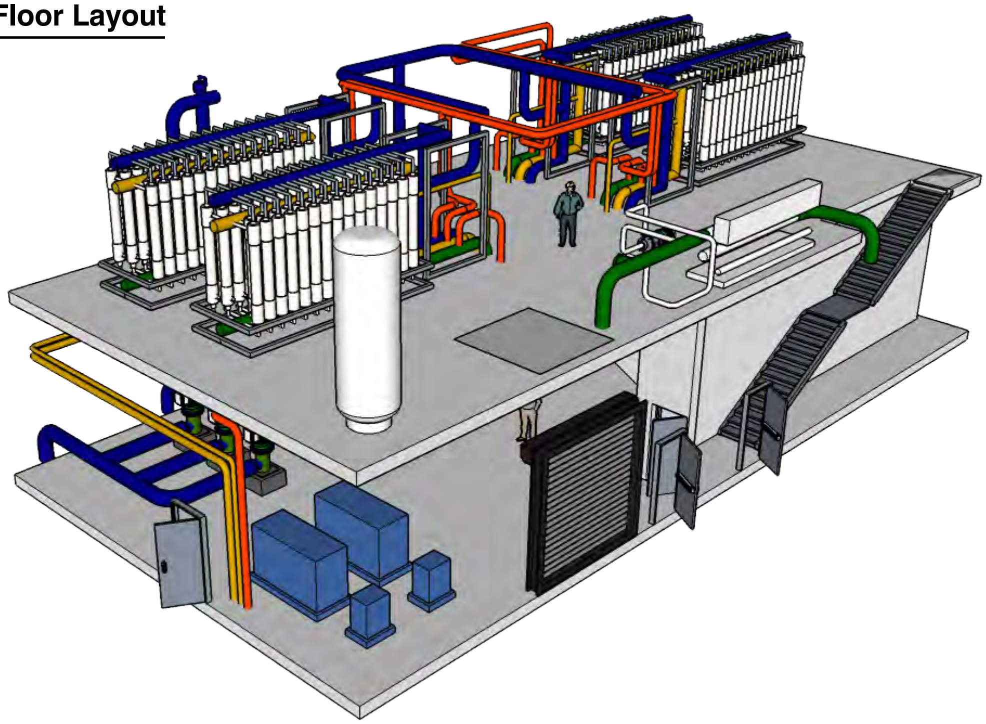
The recommended project treatment improvements would be designed to provide tertiary recycled water that satisfies the regulatory requirements for unrestricted reuse defined by Title 22 of the California Code of Regulations (CCR). This level of treatment allows the water to be used for landscape irrigation, unrestricted recreational impoundment, and spray irrigation of food crops.

The recommended tertiary treatment process includes pretreatment with coagulant and sodium hypochlorite, strainers, membrane filtration, UV disinfection, and post-treatment with gypsum and sodium hypochlorite. The tertiary treatment process would be located within the Tertiary Treatment Building shown in Figure ES.2, and on the site as shown in Figure ES.3.

First Floor Layout



Second Floor Layout



TERTIARY TREATMENT BUILDING LAYOUT

FIGURE ES.2

CITY OF DALY CITY
PRELIMINARY DESIGN REPORT

carollo

DC0917-10076f3.ai

TERTIARY TREATMENT BUILDING

FIGURE ES.3

CITY OF DALY CITY
PRELIMINARY DESIGN REPORT

carollo

DC0917-10076f5.ai

The tertiary treatment system would require the following modifications to the WWTP:

- Modifications to the existing secondary effluent pump station.
- New tertiary treatment building.
- New chemical facilities.
- Relocation of the switchgear building and No. 2 water system.

The project team also considered the feasibility of adding an indirect potable reuse (IPR) facility to provide water for groundwater injection. The conceptual study identified several challenges with this concept including site constraints, additional pilot testing requirements, disposal of reverse osmosis (RO) concentrate, and high costs. The IPR project is not considered feasible at this time.

3.0 PROJECT COST

The estimated project cost ranges between $61,154,000 and $69,711,000 depending on the selected storage tank site and transmission pipeline alignment. Land acquisition for the storage tank site is not included in this cost. The estimate includes a -30/+50 percent accuracy and the cost ranges from $42,808,000 to $104,567,000. Table ES.1 provides a summary of the cost estimate.

Table ES.1 Project Cost Estimate
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Alternative		1	2	3	4
Storage Tank Site		Holy Cross	Holy Cross	Atwood Property	Atwood Property
Transmission Main Alignment		Feasibility Study	Colma Blvd	Feasibility Study	Colma Blvd
Estimated Construction Cost	Tertiary Treatment	$23,752,000	$23,752,000	$23,752,000	$23,752,000
	Conveyance System	$25,171,000	$26,618,000	$31,146,000	$32,017,000
	Total	**$48,923,000**	**$50,370,000**	**$54,898,000**	**$55,769,000**
Estimated Project Cost	Tertiary Treatment	$29,690,000	$29,690,000	$29,690,000	$29,690,000
	Conveyance System	$31,464,000	$33,273,000	$38,932,000	$40,021,000
	Total	**$61,154,000**	**$62,963,000**	**$68,622,000**	**$69,711,000**

Notes:
(1) AACE International Class 4 budgetary estimate (-30% to +50%) - August 2017 ENR.
(2) Land acquisition is not included in costs.

Carollo also estimated the annualized operations and maintenance (O&M) costs for the new facilities, as shown in Table ES.2. The annualized O&M cost ranges from $2,333,000 to $2,812,000 depending on the selected membrane technology and storage tank site.

Table ES.2	**Annualized O&M Cost Estimate(1) Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City**			
	Tertiary Treatment		**Conveyance System**	
Alternatives	**Polymeric Membranes**	**Ceramic Membranes**	**Holy Cross Tank Site**	**Atwood Property Tank Site**
Power	$198,000	$210,000	$244,000	$419,000
Maintenance(2)	$160,000	$160,000	$503,000	$623,000
Chemicals	$256,000	$600,000	$-	$-
Membrane Replacement(3)	$549,000	$287,000	$-	$-
Total	**$1,163,000**	**$1,257,000**	**$747,000**	**$1,042,000**

Notes:

(1) Annualized based on a project life of 50 years and 2.5% annual inflation
(2) Assumed baseline maintenance cost (Year 1) as $100,000 for the tertiary treatment system and 0.5% of the capital cost for the conveyance system. Assumes an annual escalation of O&M cost of 1.8%.
(3) Based on complete membrane replacement every 4 years for the polymeric membranes and 10 years for the ceramic membranes.

Given the project cost and annualized O&M costs, the Carollo estimated the total annualized project cost over the project lifetime of 50 years. Annualized costs are presented in Table ES.3. Based on 2.5 mgd of production during the irrigation season (7 months per year), the estimated project cost is $2,490 to $2,910 per acre-foot. If the recycled water could be utilized for 12 months per year, the estimated project cost would be $1,630 to 2,010 per acre-foot.

Table ES.3	**Project Cost Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City**
Parameter	**Cost**
Annualized Capital Cost(1)	$2,156,000 - $2,458,000
Annualized O&M Cost	$1,910,000 - $2,299,000
Total Annualized Cost	$4,066,000 - $4,757,000
Unit Cost ($/acre-foot) (7 months of operation) (2)	$2,490 - $2,910
Unit Cost ($/acre-foot) (12 months of operation) (3)	$1,630 - $2,010

Notes:

(1) Annualized based on a project life of 50 years, interest rate of 2.5%, and capital cost of $61,154,000 - $69,711,000.
(2) Based on 1,633 acre-feet per year or 2.5 mgd for 7 months each year.
(3) Based on 2,800 acre-feet per year or 2.5 mgd for 12 months each year.

4.0 CALIFORNIA ENVIRONMENTAL QUALITY ACT COMPLIANCE

Daly City prepared an Initial Study/Mitigated Negative Declaration (IS/MND) for the recommended project in accordance with the requirements of the California Environmental Quality Act of 1970, as amended (CEQA), and state and local guidelines implementing CEQA. The purpose of the IS/MND is to assess the potential environmental impacts of the construction and operation of the recommended project.

The IS/MND was made publicly available on July 24, 2017 for the required 30-day public review period under CEQA. The IS/MND concluded that implementation of the project could result in a number of significant effects on the environment and identified mitigation measures that would reduce the significant effects to a less-than-significant level. Daly City prepared a final IS/MND document that responded to all of the comments received during the 30-day public review process and also prepared a Mitigation Monitoring and Reporting Program (MMRP) to ensure compliance with the identified mitigation measures identified and proposed in the IS/MND.

5.0 PROJECT SCHEDULE

It is anticipated that final design would start in 2018 and last for approximately 18 months. This design period includes time for procurement of the membrane system. Construction would then begin in 2019 and last for approximately 24 months. A project schedule is shown in Figure ES.4.

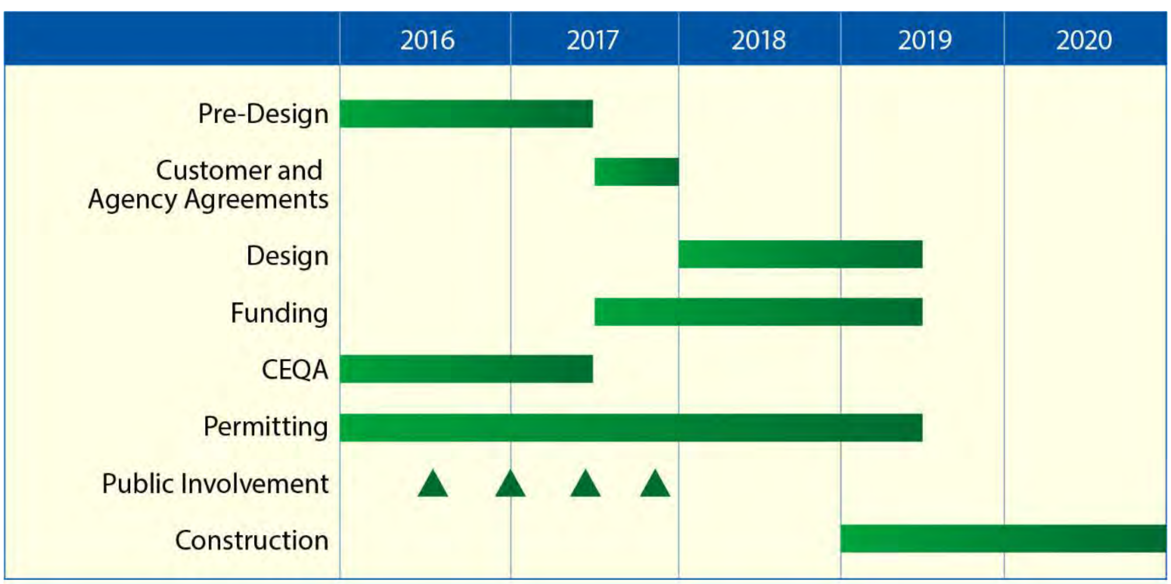


Figure ES.4 Project Schedule

6.0 NEXT STEPS

We recommend the following next steps prior to beginning final design of the Project.

- SFPUC and Daly City negotiate with the cemeteries and other users to develop the necessary agreements and contracts for the SFPUC and Daly City to serve irrigation water.
- SFPUC and Daly City negotiate with the Holy Cross Cemetery and Mr. Tom Atwood to purchase a site for the recycled water storage tank.

This document is released for the purpose of information exchange review and planning only under the authority of Darren G. Baune, 9/29/2017, California P.E. No. 68899.

CITY OF DALY CITY

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

TECHNICAL MEMORANDUM NO. 1 TERTIARY TREATMENT

DRAFT
October 2017

2700 YGNACIO VALLEY ROAD, SUITE 300 • WALNUT CREEK, CALIFORNIA 94598 • P. 925.932.1710 • F. 925.930.0208

CITY OF DALY CITY

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

**TECHNICAL MEMORANDUM
NO. 1
TERTIARY TREATMENT**

TABLE OF CONTENTS

Page No.

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The City of Daly City (City) is considering adding a new tertiary treatment facility at their wastewater treatment plant (WWTP) to provide recycled water for the irrigation of cemeteries, parks, and school grounds in the Town of Colma and Daly City. The facility would treat secondary effluent to Title 22 recycled water standards for irrigation use. The processes will be designed to achieve a maximum instantaneous capacity of 3.6 million gallons per day (mgd) in order to meet the average recycled water demand of 2.5 mgd.

The key aspects of the project include modifications to the existing secondary effluent pump station, a new tertiary treatment building (Figure ES.1), new chemical facilities, and relocation of the main 12 kV switchgear building. The treatment process, shown in Figure ES.2, consists of pretreatment with coagulant and sodium hypochlorite, self-backwashing strainers, membrane filtration, UV disinfection, and post-treatment with gypsum and sodium hypochlorite. The recycled water will be pumped to a new storage tank in Colma, as shown in Figure ES.3. The estimated construction cost for the tertiary facilities is $23,752,000.

The ultrafiltration membrane system is a significant component of the new treatment process. As such, a one year long pilot study was performed at the Daly City WWTP. Polymeric and ceramic membranes were tested. The results of the study were used to develop full-scale design criteria and evaluate the process performance. The WWTP includes a high-purity oxygen secondary treatment process upstream, which can produce water qualities that have the potential to foul membranes and limit production. Accordingly, the pilot study focused on developing pretreatment and cleaning strategies to minimize fouling.

Successful operation of the full-scale plant will rely on properly managing pretreatment chemicals and membrane chemical cleans. Table ES.1 presents the process risks identified during the pilot study as well as the mitigation measures that are included in the preliminary design.

During the pilot study there were several fouling events that occurred resulting in a rapid decline of membrane permeability. Though this condition was usually reversible with chemical cleaning, the cause of these events is unknown. Operating costs and complexity will decrease if the source of these events can be identified and mitigated.

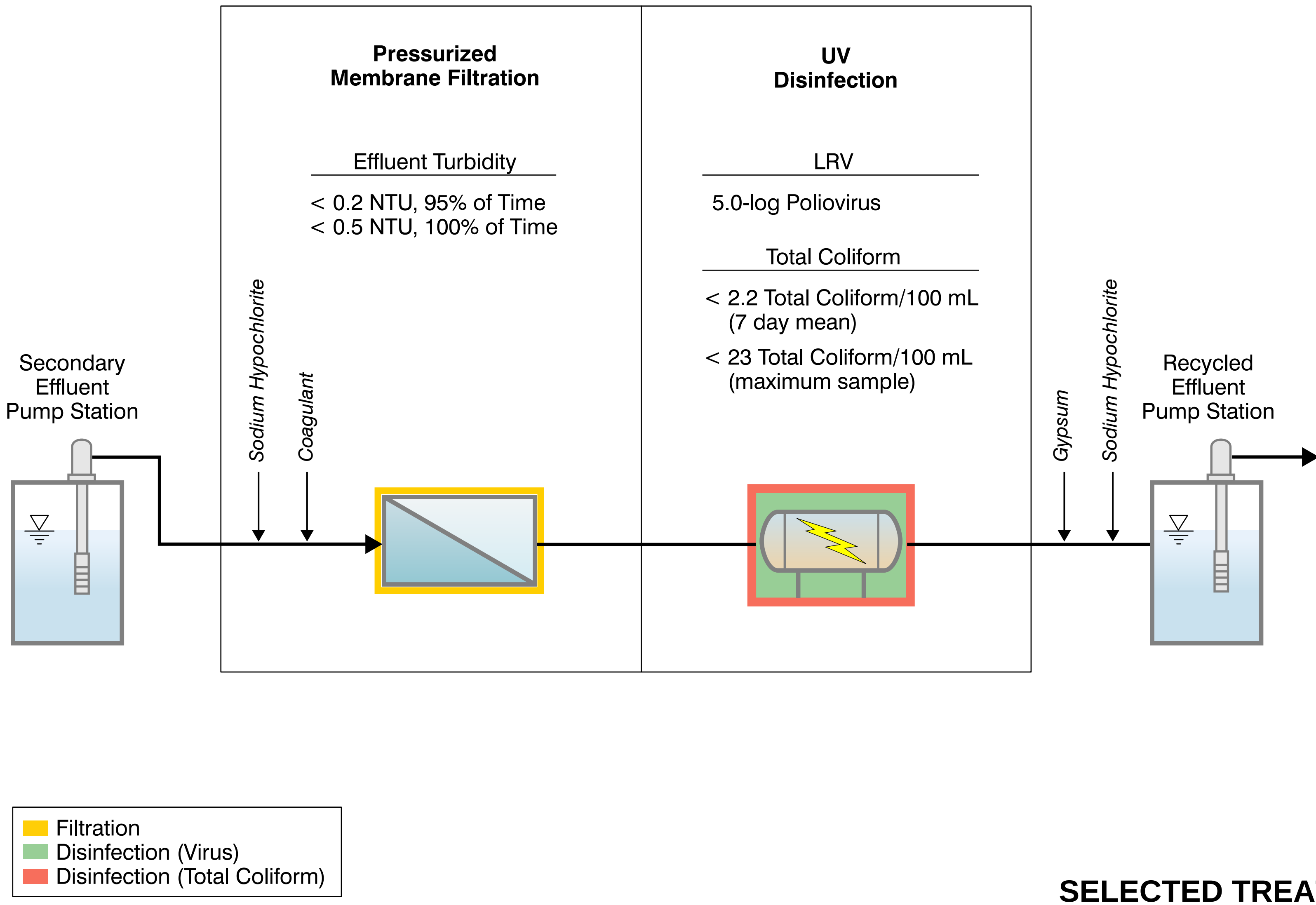
TERTIARY TREATMENT BUILDING

FIGURE ES.1

CITY OF DALY CITY
TM NO. 1 - TERTIARY TREATMENT

carollo

dc0217f5-10076.ai



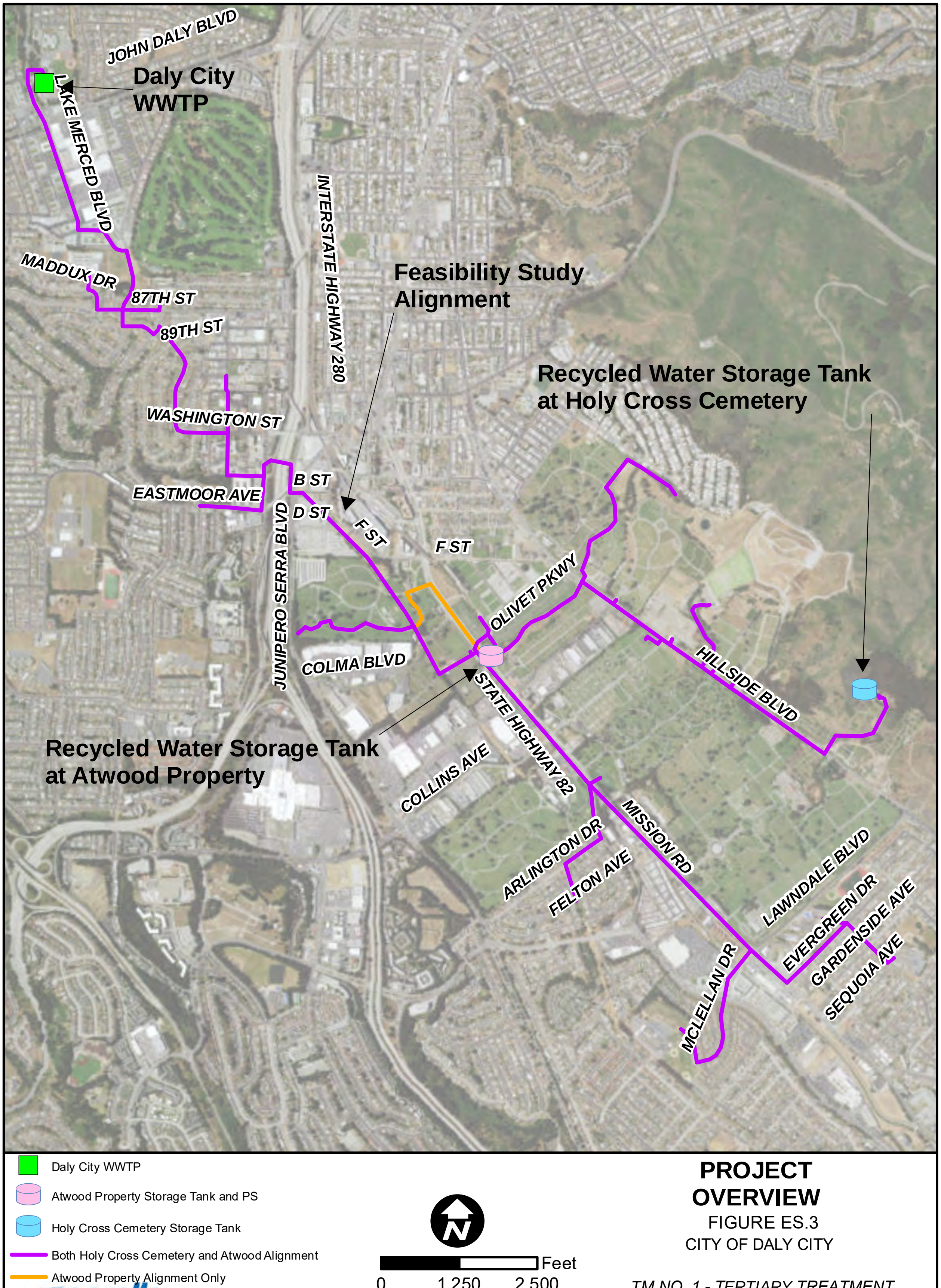
SELECTED TREATMENT PROCESS

FIGURE ES.2

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

carollo®

dc0317rf1-10076.ai



PROJECT OVERVIEW

FIGURE ES.3

CITY OF DALY CITY

TM NO. 1 - TERTIARY TREATMENT

Table ES.1 Mitigation Measures Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City		
	Observed Pilot Risks	**Mitigation Measure**
1	Iron fouling	Coagulant pretreatment and citric acid maintenance cleans
2	Biological growth in pipeline upstream of sodium hypochlorite injection	Sodium hypochlorite injection just downstream of secondary effluent pump station, upstream of 300-foot Membrane Feed Water line
3	Pipeline biological growth sloughing off and clogging pre-filters or fouling membranes	Feed-to-waste feature that directs secondary effluent pump station effluent directly to the headworks, bypassing the membranes
4	Excessive chemical required to achieve cleaning effectiveness	Use of potable water instead of membrane filtrate for cleaning solutions (less ammonia, less alkalinity)
5	Fouling Events	Robust cleaning system sized to accommodate 4 MCs per week per rack and 2 CIPs per month per rack

1.0 INTRODUCTION

1.1 Purpose

The purpose of this technical memorandum (TM) is to present the preliminary design of the new recycled water treatment facilities at the Daly City Wastewater Treatment Plant (WWTP).

1.2 Background

The City of Daly City (City) owns and operates a recycled water treatment facility at their WWTP. The City is permitted to produce up to 2.77 mgd of recycled water at the existing facility. The tertiary process treats secondary effluent to produce recycled water for irrigation of nearby golf courses, city parks, and medians. The unused secondary effluent is disinfected and discharged to the Pacific Ocean through the City's outfall.

The San Francisco Public Utilities Commission (SFPUC) is partnering with Daly City to increase capacity of the recycled water treatment facilities at the Daly City WWTP and supply irrigation water to cemeteries and schools in Colma, South San Francisco, and Daly City. The purpose of the project is to reduce the irrigation demands on the South Westside Groundwater Basin.

2.0 SOURCE WATER QUALITY, REGULATIONS, AND FINISHED WATER QUALITY GOALS

2.1 Intended Use

The objective of the new treatment process is to provide water for irrigation of cemeteries, parks, and school-grounds in the Town of Colma, South San Francisco, and Daly City. The treatment process will be designed to provide tertiary recycled water that satisfies the regulatory requirements for unrestricted reuse defined by Title 22 of the California Code of Regulations (CCR). This level of treatment allows the water to be used for spray irrigation of food crops, landscape irrigation, and unrestricted recreational impoundment. Typical landscape irrigation uses include unrestricted access golf courses, parks, playgrounds, school yards, and other landscaped areas with similar access.

2.2 Source Water Quality

The source water for the tertiary treatment facility will be secondary effluent from Daly City's WWTP. The secondary effluent water quality was sampled from March 2016 to March 2017 as part of the Membrane Pilot Test. Table 1.1 summarizes the key water quality data and Appendix C provides detailed water quality information.

**Table 1.1 Secondary Effluent Water Quality Data
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City**

						Percentiles		
Parameter(1)	**Units**	**Avg.**	**Range**			**5th**	**50th**	**95th**
Temperature	C	22	14.9	--	24.7	18.1	22.3	24.0
pH	-	6.58	6.02	--	8.82	6.25	6.57	6.85
Turbidity	NTU	6.5	0.11	--	53.2	3.4	5.8	10.7
Alkalinity	mg/L	274	220	--	370	238	260	343
Total Organic Carbon	mg/L	21.3	14.3	--	36.2	14.9	22.1	25.2
Total Suspended Solids	mg/L	8.4	4.3	--	14.0	5.1	7.5	12.4
Total Dissolved Solids	mg/L	424	400	--	460	400	420	456
Total Iron	mg/L	0.95	0.15	--	14.00	0.31	0.58	1.30

Notes:
(1) Data from grab samples collected during pilot testing March 1, 2016 through March 17, 2017.

2.3 Finished Water Quality

2.3.1 Regulatory Requirements

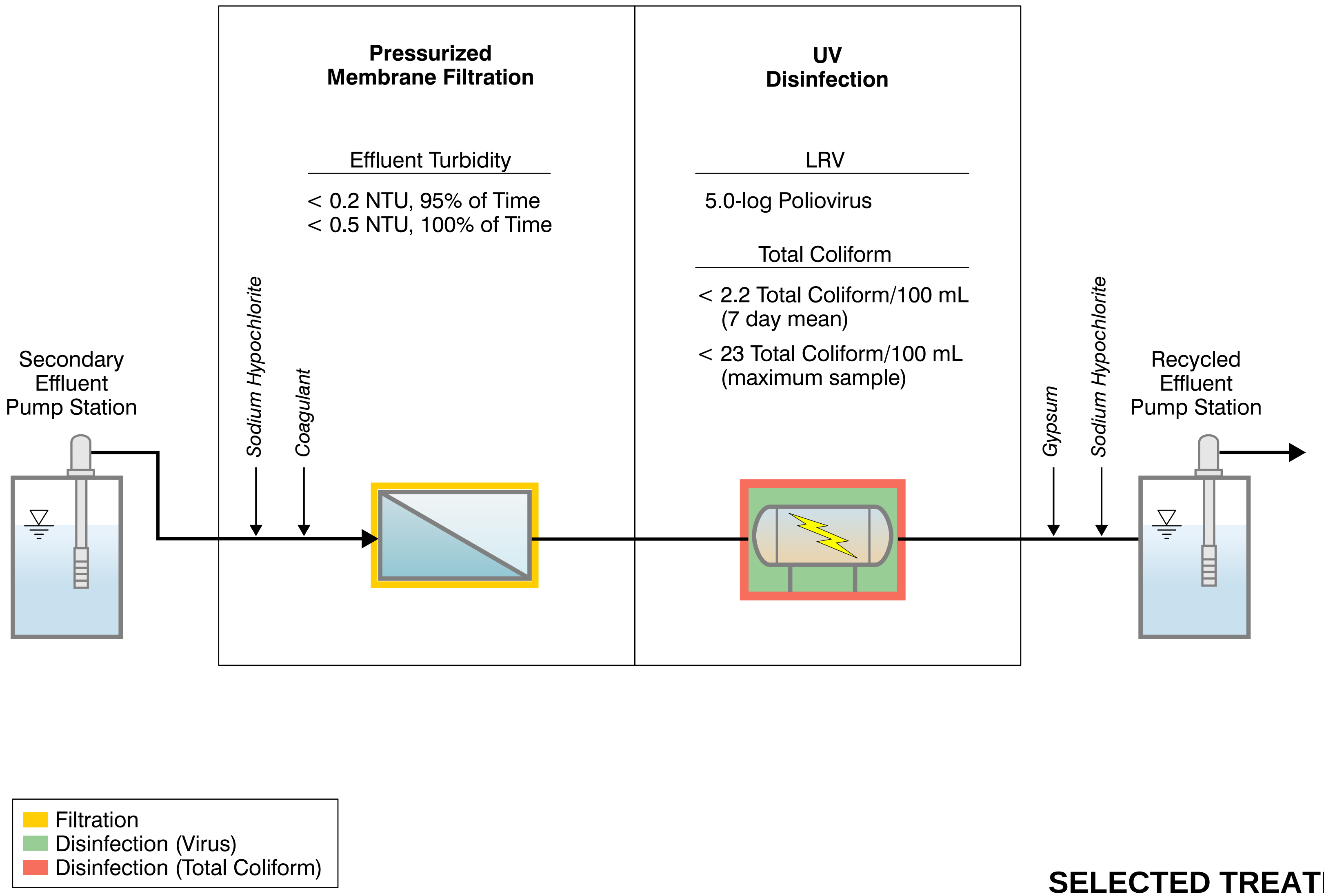
The regulations for recycled water are defined in Title 22 of the CCR. The regulations state that the level of treatment required for irrigation use depends on the end user and the level of treatment must satisfy the most stringent treatment requirements of all potential end users. This project includes the application of recycled water at school yards, which has the most stringent treatment requirements. The treatment standards require the water to be filtered and disinfected. Per Section 60301.230 and 60301.320 of Title 22 (CDPH, 2014), the specific requirements are as follows:

- Membrane Filtrate:
  - Must not exceed 0.2 NTU more than 5 percent of the time within a 24-hour period.
  - Must not exceed 0.5 NTU at any time.
- Total Coliform:
  - Median concentration must not exceed a MPN of 2.2 per 100 milliliters within a 7-day period.
  - Must not exceed a MPN of 23 per 100 milliliters in more than one sample in any 30-day period.
  - Must not exceed a MPN of 240 per 100 milliliters at any time.
- MS2 Inactivation and/or Removal:
  - 5-log inactivation and/or removal between filtration and disinfection combined.

These water quality requirements will be achieved by the treatment processes selected as shown in Figure 1.1.

2.3.2 Aesthetics

An additional treatment objective is to provide recycled water that meets the customer's aesthetic expectations. Based on conversations with potential recycled water customers, the staining of concrete, granite, tile, headstones, and other facilities at the cemeteries is a potential concern. Staining of concrete, granite, tile, and headstones is typically associated with high concentrations of calcium, iron, and manganese content in the water.



SELECTED TREATMENT PROCESS

FIGURE 1.1

CITY OF DALY CITY

TM NO. 1 – TERTIARY TREATMENT

carollo®

dc0317rf1-10076.ai

The project team compared the expected recycled water quality with data from the Westside Groundwater Basin and from Los Angeles County Sanitation District's (LACSD) reclamation facility, as summarized in Table 1.2.

- **The Westside Groundwater Basin** is the existing irrigation supply for some of the potential recycled water customers. As shown in Table 1.2, the concentration of each water quality parameter of interest is expected to be less in Daly City's recycled water than in the Westside Groundwater Basin's water.

- **LACSD** operates ten reclamation plants and serves eight cemeteries. One notable cemetery that uses LACSD's recycled water for irrigation is Rose Hills Memorial Park, which is the largest cemetery in North America. Over the past 25+ years of operation, LACSD has not received any complaints from the cemeteries about staining of headstones from recycled water irrigation. As shown in Table 1.2, Daly City expects similar water quality to that produced by LACSD. Daly City's recycle water may have higher concentrations of iron and manganese, however those concentrations will be lower than the concentrations in the existing groundwater supply.

Based on this information, the water quality parameters associated with staining will be generally low in the recycled water produced by the new tertiary process. However, we recommend performing more detailed analysis (or a pilot test) to determine if staining will be a problem.

Table 1.2 Recycled Water Quality Comparison
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Parameter		Daly City(1)	Westside Groundwater Basin(2)	LACSD(3)
Calcium	(mg/L)	24	52	64.6
Iron	(mg/L)	0.11	0.152	0.035
Manganese	(µg/L)	52.5	129.1	4.56
Copper	(µg/L)	ND(4)	N/A	4.99
Hardness	(mg/L)	116	311	212
Total Dissolved Solids	(mg/L)	403	509	567

Notes:
(1) Average data from grab samples collected during pilot testing March 1, 2016 through March 17, 2017.
(2) Average data from 2015 Annual Groundwater Monitoring Report Westside Basin. Data from wells located near potential recycled water customers (Park Plaza, CUP 10A, CUP 18, CUP 19, CUP 22A, CUP 23).
(3) Average data from San Jose Creek Water Reclamation Plant West's 2014-2015 Annual Report. This facility serves Rose Hills Memorial Park.
(4) ND = Not Detected. Based on two samples collected January 11 and 19, 2017.

2.4 Other Requirements

2.4.1 Sampling and Monitoring

2.4.1.1 Title 22

Per Section 60321 of Title 22 (CDPH, 2014), the sampling requirements are as follows:

- Membrane Filtrate Turbidity:
  - Sample continuously using a continuous turbidity meter and recorder.
  - If continuous sampling fails, may substitute grab samples at least every 1.2 hours, for up to 24 hours.
- Recycled Water Total Coliform Bacteria:
  - Sample at least once daily.

2.4.1.2 Ultraviolet Disinfection Guidelines

Per the Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (National Water Research Institute, 2012) continuous monitoring of UV parameters is critical to ensure sufficient disinfection is provided. The following parameters must be monitored continuously:

- Flow rate.
- UV intensity.
- UV transmittance.
- Turbidity.
- Operational UV dose.

Additionally, the monitoring equipment should be verified and calibrated as follows:

- UV intensity probe:
  - Verify at least monthly.
- UV transmittance:
  - Verify weekly against grab samples measured with laboratory equipment.
  - Calibrate in accordance with manufacturer's recommendation.
- Turbidity:
  - Calibrate in accordance with manufacturer's recommendation.

2.4.2 Operator Certification

The wastewater plant classification and corresponding operator certification requirements are defined in Title 23 of the CCR. Since the expanded tertiary treatment capacity will remain below 10 mgd, the plant's classification and corresponding operator certification requirements should not change.

3.0 TERTIARY SYSTEM CAPACITY

The new tertiary treatment facility will be sized based on the recycled water demands and the availability of supply (secondary effluent), whichever is less. The following project memoranda identified the average daily recycled water demand and supply:

- Project Memorandum (PM) 02 titled, "Recycled Water Customer Outreach" (Carollo, 2016) identified the average daily recycled water demand as 2.49 mgd. This demand is based on 22 potential customers in Colma, Daly City, and South San Francisco.
- PM 07 titled, "Tertiary Expansion Capacity Assessment" (Carollo, 2016) determined that the plant has adequate supply (secondary effluent) to meet the average demand of 2.49 mgd. This analysis was based on 2012 and 2015 flow data and assumed some minor operational changes at the plant.

In order to meet the recycled water demand the membrane facility will need to ramp up to a maximum instantaneous capacity of 3.60 mgd at certain times of the day. Therefore, Carollo recommends sizing the tertiary system to provide a maximum instantaneous capacity of 3.60 mgd.

4.0 FLOW CONTROL STRATEGY

Based on historical plant data and the projected recycled water system demand, the demand will typically be less than the supply (secondary effluent). Therefore, the membrane system will only treat as much water as is required based on the average downstream demand. The remaining water will overflow to the CT basin and then to the ocean outfall.

During normal operation, three trains will be in production and one train will be on standby. When one of the production trains goes into a backwash sequence, the standby train will go into production to maintain a constant feed flow rate.

When one of the trains is offline due to a maintenance clean (MC) or clean-in-place (CIP), the remaining three trains will be in production. The Membrane Feed Water pipeline will have a recirculation line with a control valve that will discharge back into the secondary effluent pump station wet well. When one of the production trains goes into a backwash sequence, the feed pump flow rate will remain constant and the control valve on the recirculation line will modulate open to direct the unused flow back to the pump station. The excess water will then overflow to the CT basin and to the ocean outfall. When the backwash sequence is complete, the control valve on the recirculation line will close to redirect the flow back to the membrane train. This method of operation will eliminate diversions in the feed pump flow rate during backwashes.

The membrane supplier will execute this control strategy, which will be specified in the membrane procurement documents.

5.0 TREATMENT PROCESS

5.1 Overview

The new tertiary treatment process will be fully independent from Daly City's existing tertiary process. The new process requires modifications to the existing secondary effluent pump station, construction of a new tertiary treatment building and ancillary chemical systems, and relocation of the WWTP's main 12 kV switchgear, No. 2 Water System, and storage sheds. Figure 1.2 shows the process flow diagram (PFD) and Figure 1.3 shows the site plan. The key facilities are described below:

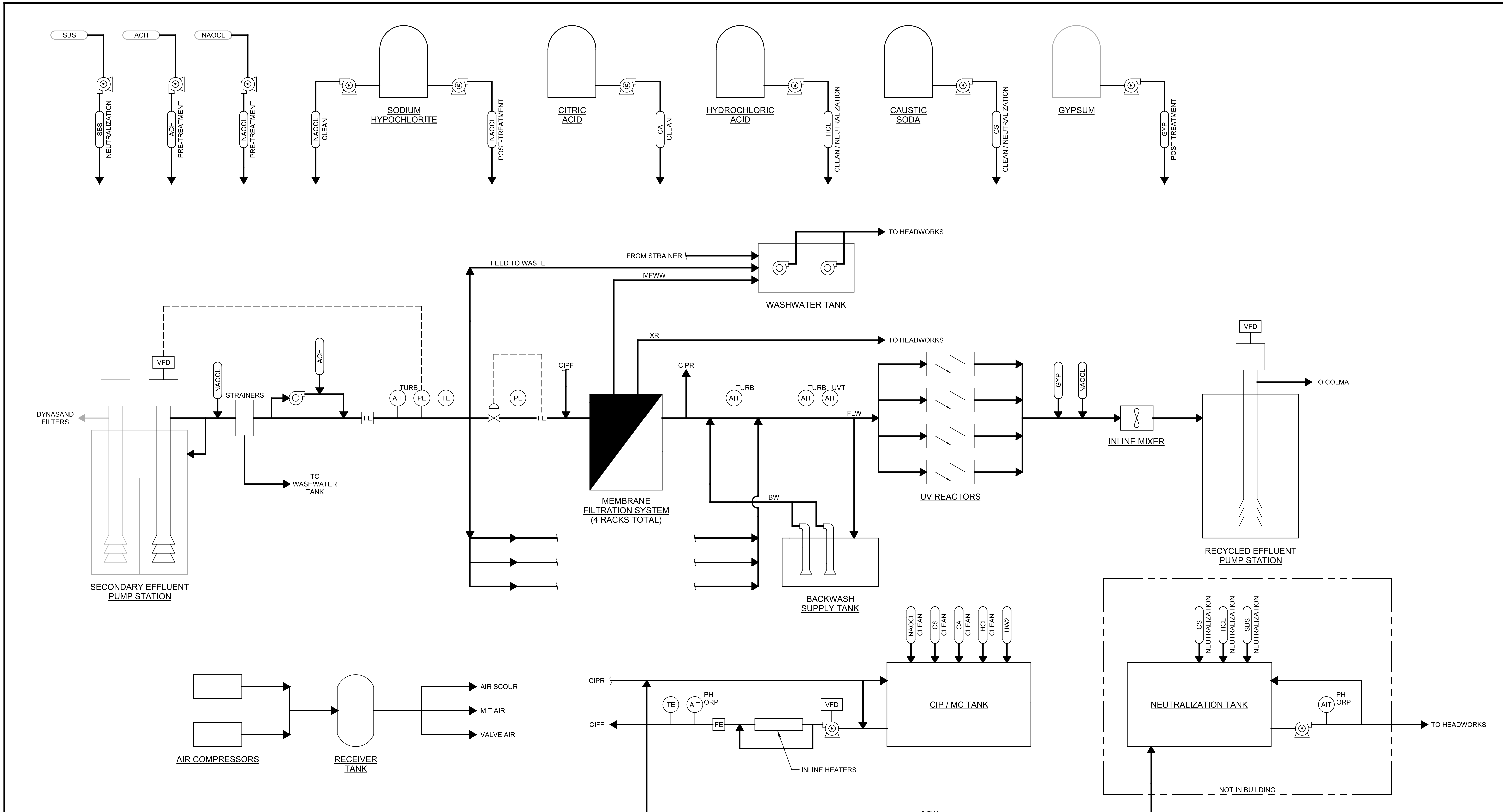
- **Modifications to the Secondary Effluent Pump Station:** The existing Secondary Effluent Pump Station will be modified to add two new pumps. The modifications are required to deliver secondary effluent to the Tertiary Treatment Building.

- **New Tertiary Treatment Building:** The Tertiary Treatment building will be located between the plant entrance gates and will house a majority of the process equipment.

- **New Chemical Facilities:** A chemical storage and cleaning solution neutralization area will be located outside, southwest of the Tertiary Treatment Building.

- **Relocation of Existing Facilities:** The 12 kV switchgear building and storage sheds will be relocated to accommodate the new chemical facilities. The new 12 kV switchgear building will be constructed just north of the Tertiary Treatment building. The No. 2 Water System will be relocated north of the existing Recycled Water Pump Station to accommodate the proposed Tertiary Treatment building.

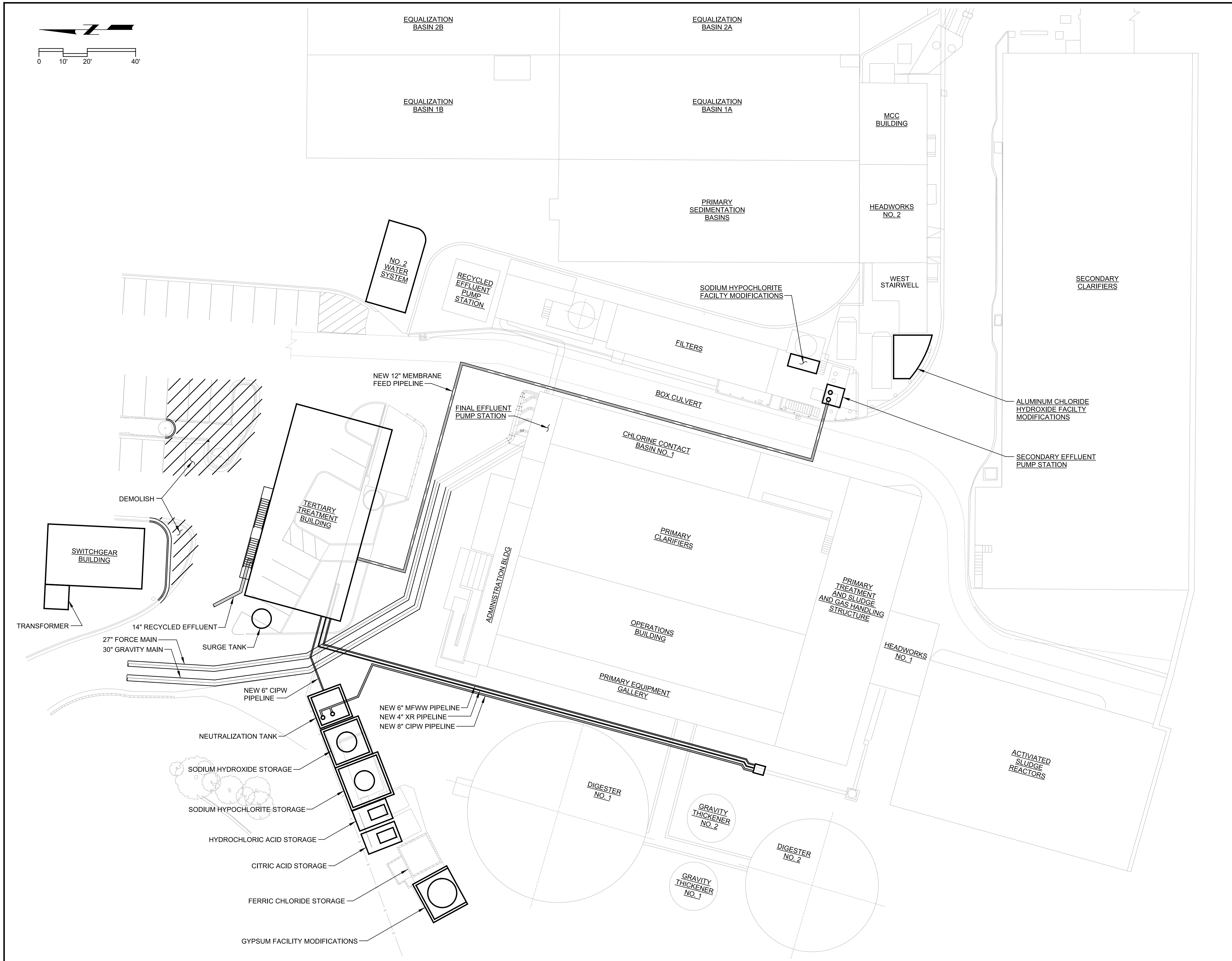
The process elements and their functions are described by the following sections.



PROCESS FLOW DIAGRAM

FIGURE 1.2

CITY OF DALY CITY
TM NO. 1
TERTIARY TREATMENT



SITE PLAN

FIGURE 1.3

CITY OF DALY CITY
TM NO. 1
TERTIARY TREATMENT

5.2 Secondary Effluent Pump Station

The project includes modifications to the secondary effluent pump station to deliver secondary effluent to the new tertiary treatment facility. The modifications include the addition of two new pumps and piping changes. Carollo recommends locating the new pumps (i.e., membrane feed pumps) in the southwest quadrant of the existing secondary effluent splitter box as shown in Figure 1.4 and Figure 1.5.

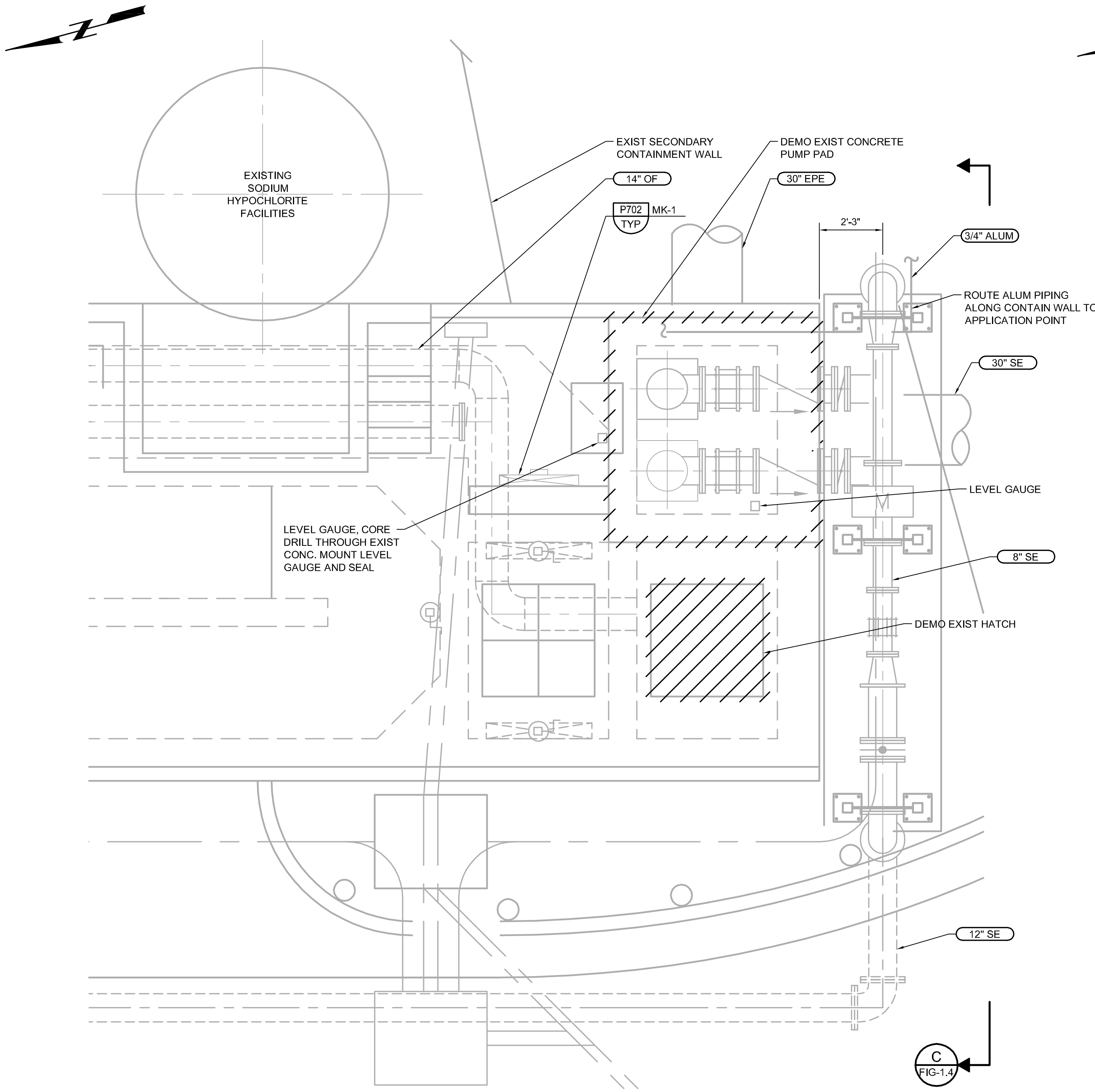
The vertical turbine pumps would be installed in a one duty and one standby configuration and driven by VFDs. This configuration would provide capacity to deliver the design flow (3.6 mgd) plus 10 percent cross-flow for a total of 4.0 mgd. The piping modifications include the addition of isolation valves located on the discharge pipe of the membrane feed pump before the discharge piping tees into the header. A flow meter would be located on the combined discharge header from the membrane feed pumps. The pumps will be controlled by the membrane PLC. Table 1.3 outlines the design criteria for the secondary effluent pump station.

The project team reviewed the constructability of the secondary effluent pump station modifications. The construction sequencing is challenging because the existing secondary effluent splitter box does not include a method to bypass flow. PM 08 titled, "Constructability of the Secondary Effluent Pump Station" (Carollo, 2017) (Appendix D) evaluates two alternatives for construction of the secondary effluent pump station modifications. The preferred alternative will be determined during final design.

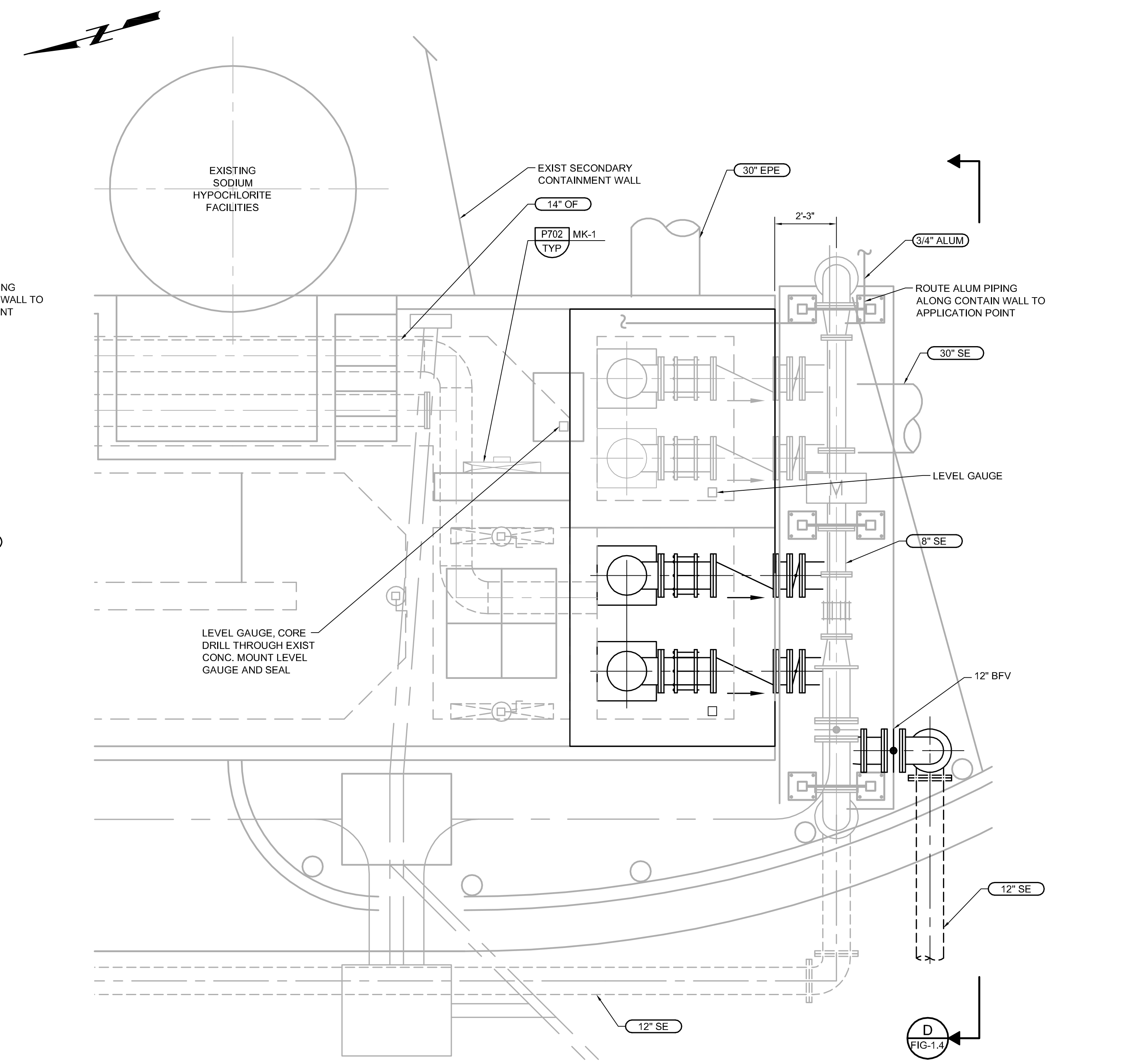
Table 1.3 Secondary Effluent Pump Station and Pipeline
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Parameter	Units	Criteria
Pipeline to Tertiary Treatment		
Diameter	in.	12
Maximum Velocity (@4.0[1] mgd)	fps	7.9
Membrane Feed Pumps		
Type	--	Vertical Turbine
Number of Pumps	No.	2 (1 duty, 1 standby)
TDH	ft	191
Motor Horsepower, each	HP	200
Flow per Pump	mgd (gpm)	4.0 (2,778)[1]

Notes:
(1) Equalized secondary effluent with 10 percent cross-flow.



A PARTIAL DEMOLITION PLAN
SCALE: 3/16" = 1'-0"
FILE: WMDC102rev



B PARTIAL MODIFICATION PLAN
SCALE: 3/16" = 1'-0"
FILE: 00-M-100

PLAN VIEW - SECONDARY EFFLUENT PUMP STATION MODIFICATIONS

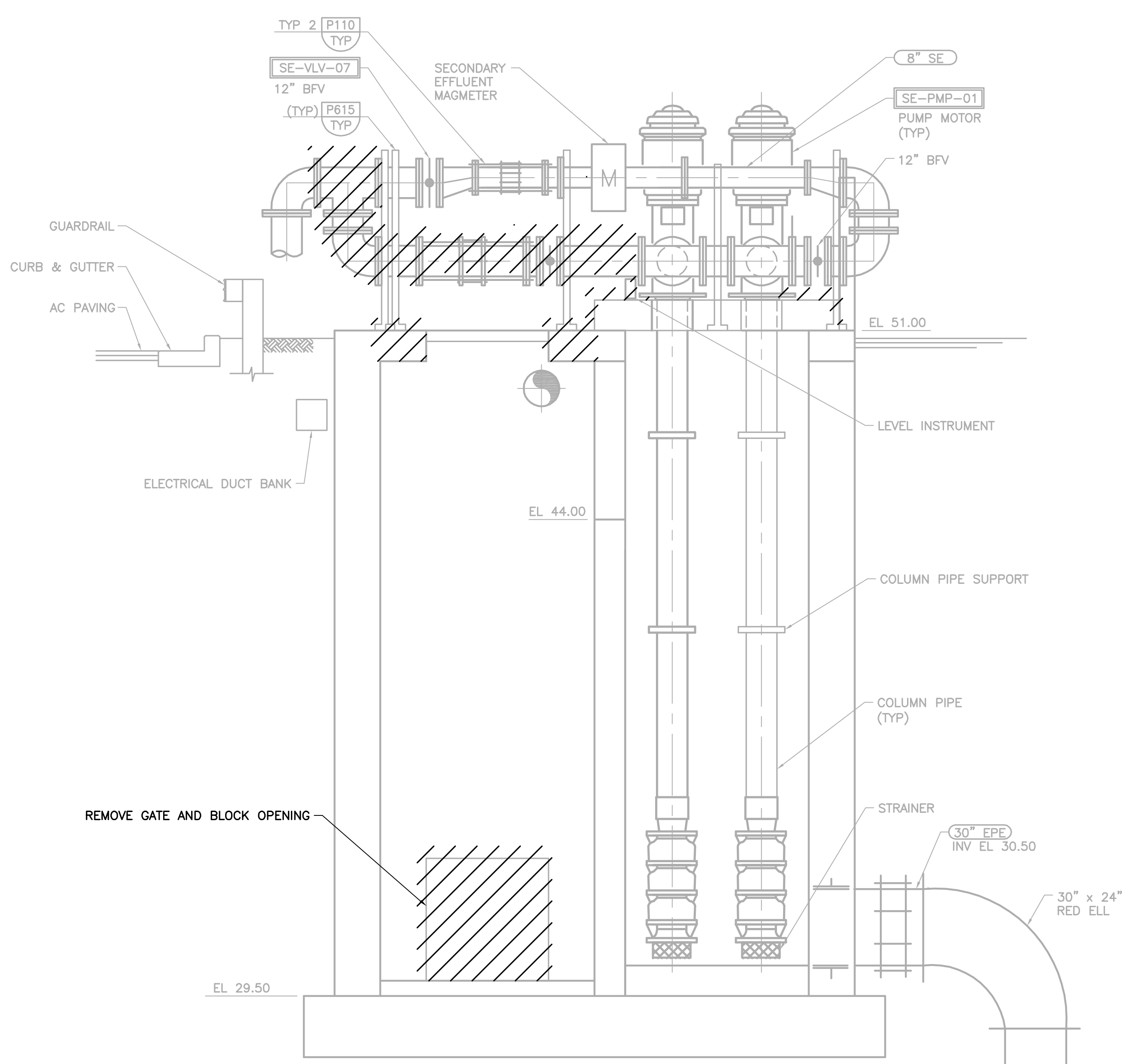
FIGURE 1.4

CITY OF DALY CITY
TM NO. 1
TERTIARY TREATMENT

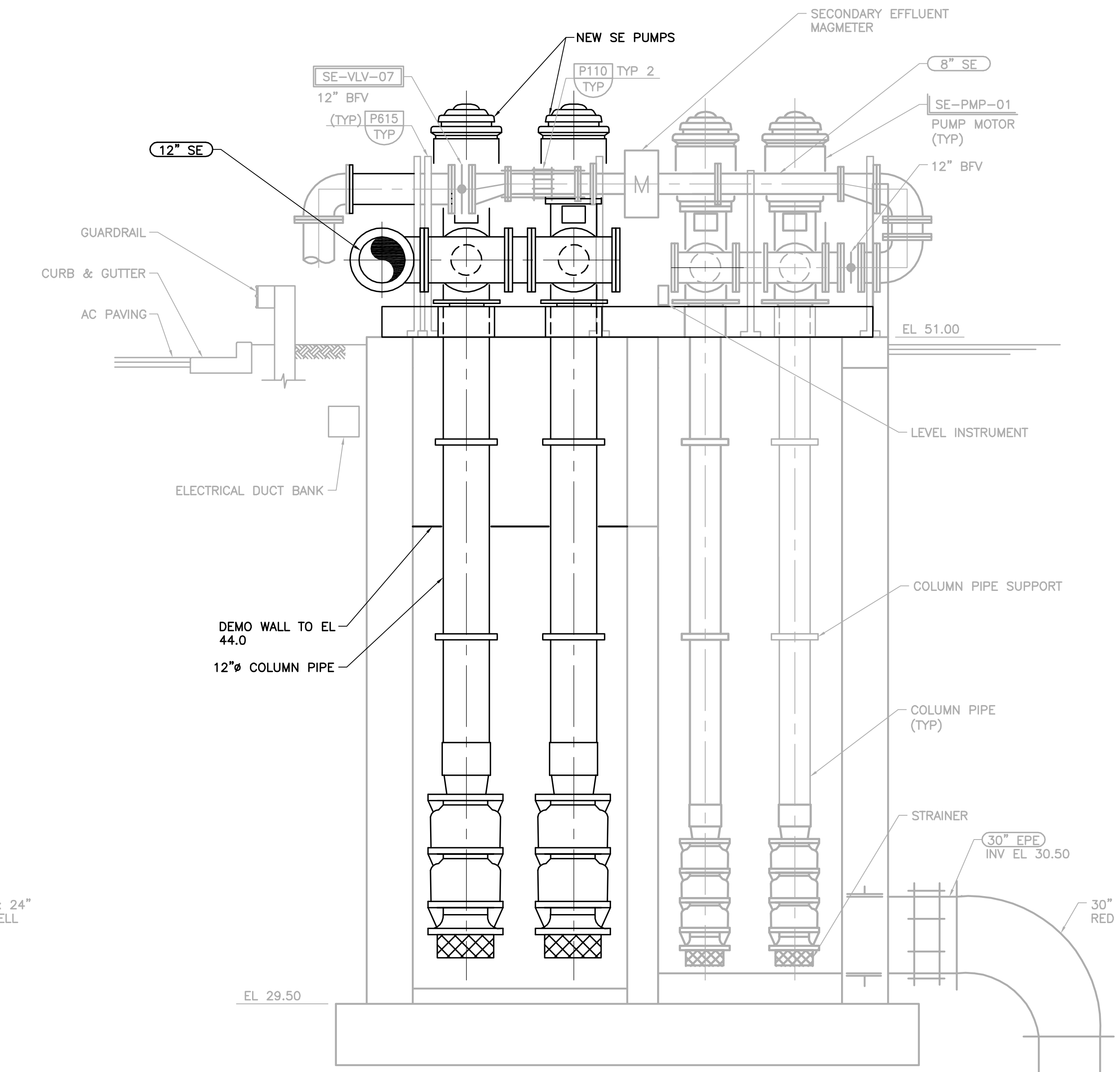
carollo
Engineers...Working Wonders With Water ™

Last Saved By: ALaico 3-01-17 04:14pm

C:\pw_working\projectwise\alaico\d0531425\10076A10FIG1-4 3-01-17 04:36pm ALaico XREFS: WMDC102rev; WMDC203; WSDC100; 00-M-100



C SECTION
FIG-1.3 SCALE: 3/16" = 1'-0"
FILE: FMDC402



D SECTION
FIG-1.3 SCALE: 3/16" = 1'-0"
FILE: 00-M-300

SECTION VIEW - SECONDARY EFFLUENT PUMP STATION MODIFICATIONS

FIGURE 1.5

CITY OF DALY CITY
TM NO. 1
TERTIARY TREATMENT

5.3 Tertiary Treatment

5.3.1 Building Layout

The Tertiary Treatment building will be a two-story structure with an approximate footprint of 82 feet by 41 feet and located between the plant entrance gates as shown in Figure 1.6.

- **First Floor:** The electrical room, control room, UV vessels, and a majority of the mechanical equipment, including recycled water pumps, CIP pumps, backwash pumps, and air compressors are located on the first floor. Locating this equipment on the first floor provides the best access for O&M staff. Figures 1.7 and 1.8 provide images of the first floor design.
- **Below Grade:** The CIP tank, backwash supply tank, and backwash waste tank are all located below grade. Locating these tanks below grade allows adequate space for maintenance of equipment as shown in Figure 1.9.
- **Second Floor:** The membrane racks, pre-filters, pump diffusion flash mixer, and air receiver are located on the second floor of the building. A floor hatch is provided on the south side of the building so that equipment can be transferred to the first floor and out the rollup door. Figure 1.10 show the second floor layout.
- **Roof:** The HVAC equipment is located on the roof of the building, as shown in Figure 1.11. The roof can be accessed by a ladder located in the fire rated stairwell. HVAC equipment can be removed through a roof hatch that is aligned with the floor hatch on the second floor and the rollup door on the first floor.

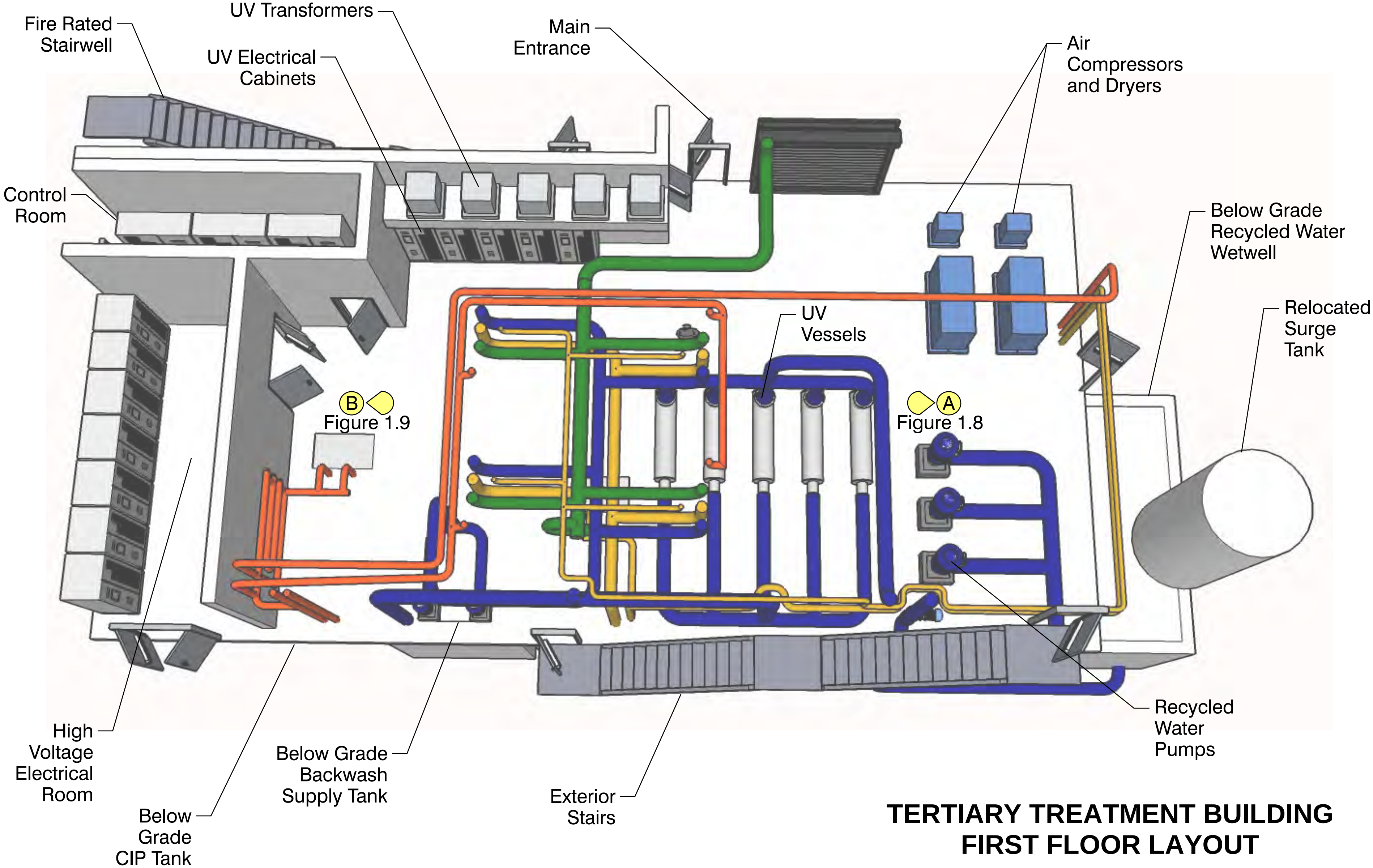
TERTIARY TREATMENT BUILDING

FIGURE 1.6

CITY OF DALY CITY
TM NO. 1 - TERTIARY TREATMENT

carollo

dc0217f5-10076.ai



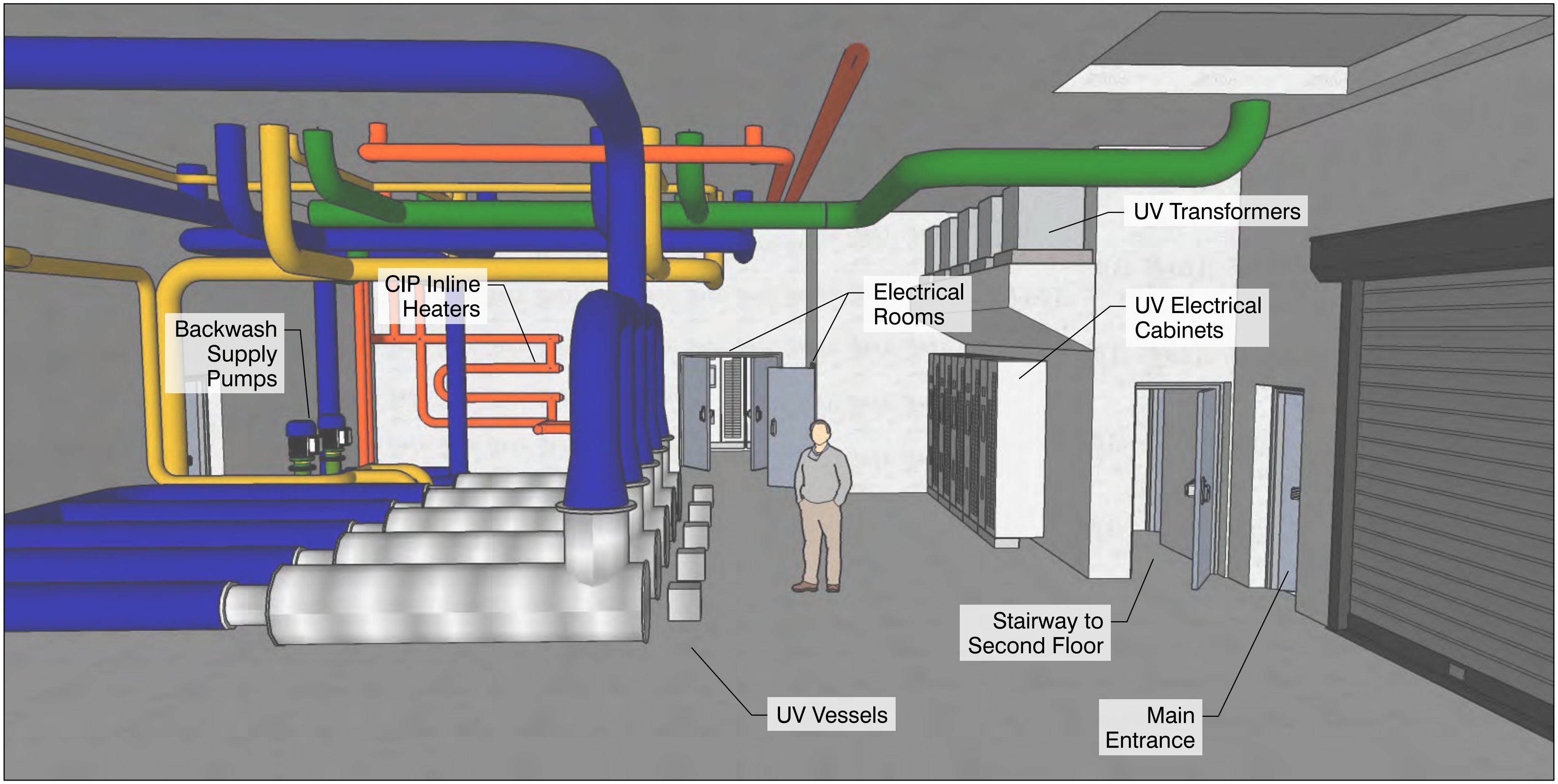
TERTIARY TREATMENT BUILDING FIRST FLOOR LAYOUT

FIGURE 1.7

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

carollo

dc0117-10076rf16.ai



A

See Figure 1.7 for Orientation

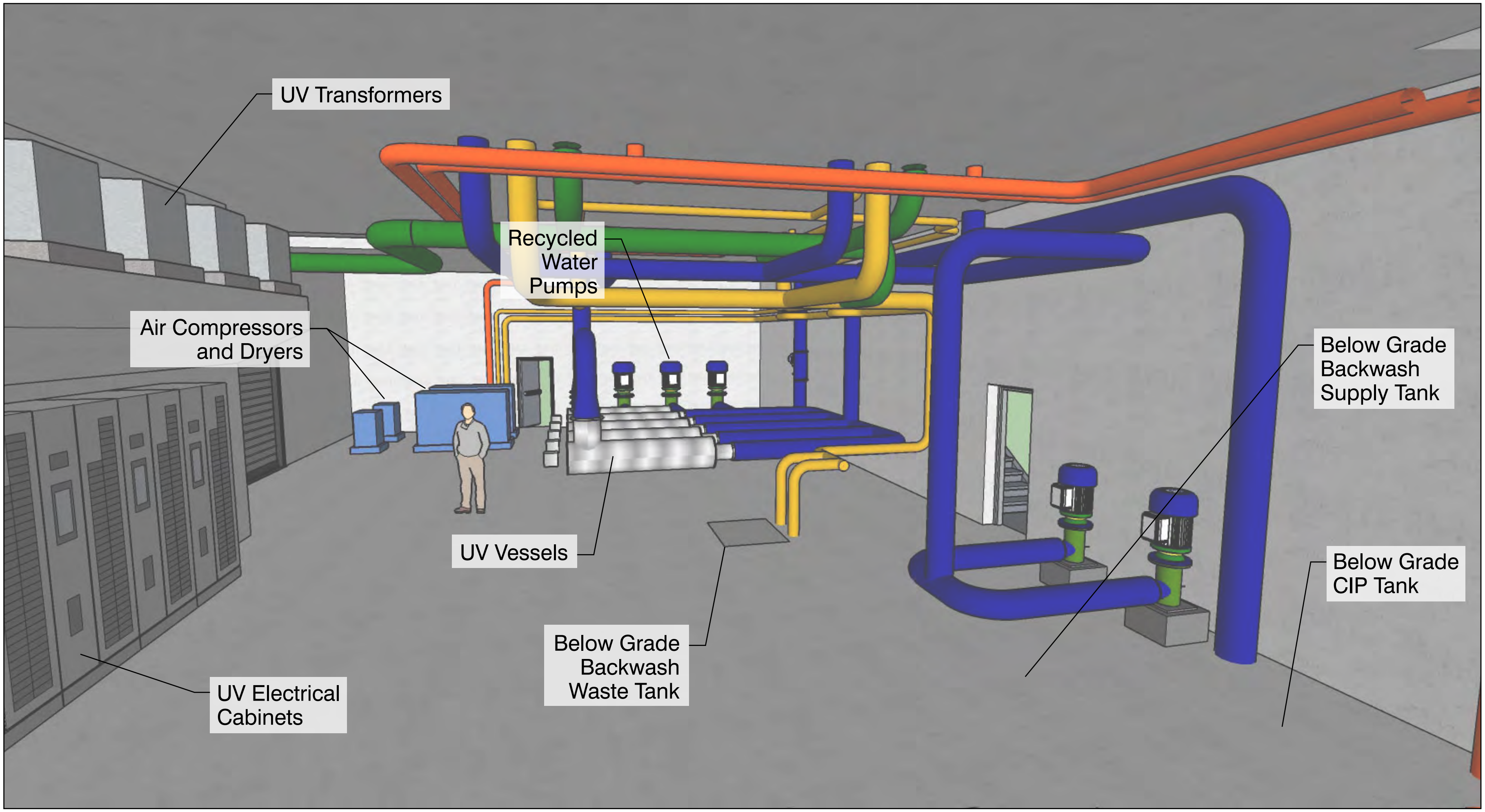
TERTIARY TREATMENT BUILDING FIRST FLOOR ISOMETRIC A

FIGURE 1.8

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

carollo

dc0117-10076rf17.ai



B

See Figure 1.7 for Orientation

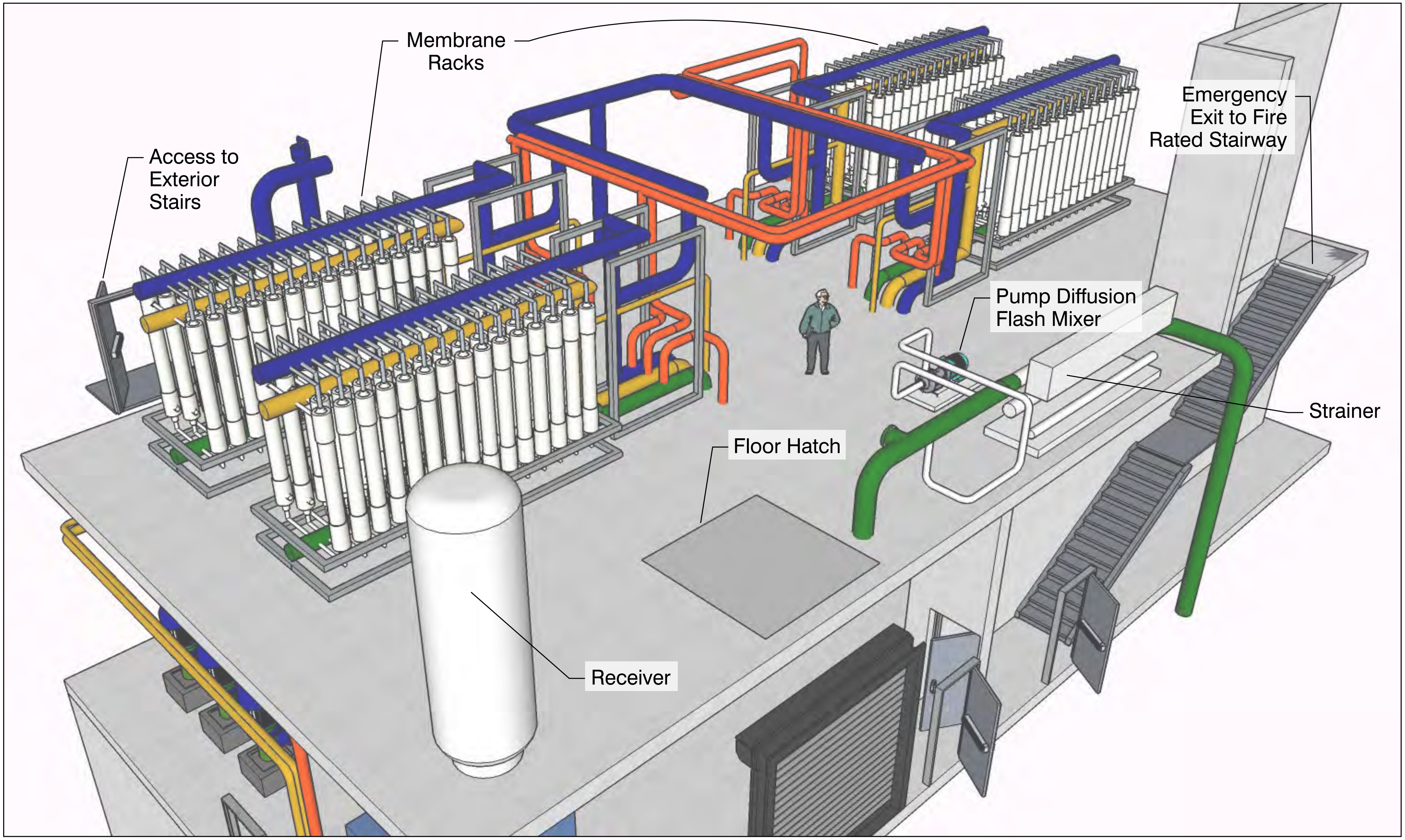
TERTIARY TREATMENT BUILDING FIRST FLOOR ISOMETRIC B

FIGURE 1.9

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

carollo®

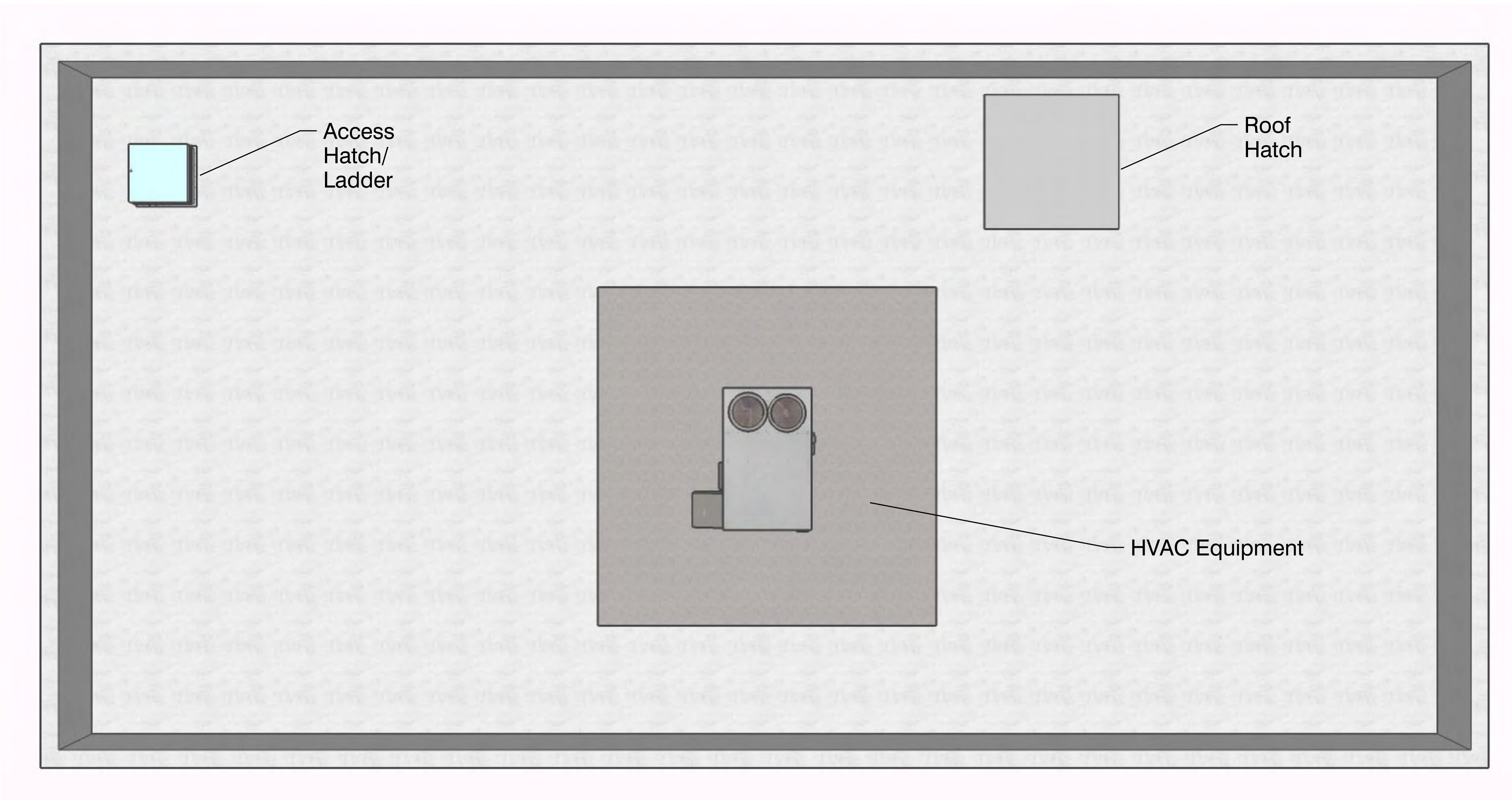
dc0117-10076rf18.ai



TERTIARY TREATMENT BUILDING SECOND FLOOR LAYOUT

FIGURE 1.10

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT



TERTIARY TREATMENT BUILDING ROOF LAYOUT

FIGURE 1.11

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

dc0117-10076rf20.ai

5.3.2 Pretreatment

Sodium hypochlorite will be dosed downstream of the membrane feed pumps as pretreatment to control biological growth on the membranes and piping. Daly City currently doses sodium hypochlorite to disinfect both plant effluent and the recycled water. The sodium hypochlorite chemical storage tank is located east of the secondary effluent pump station. Two new chemical dosing pumps will be added near the existing storage facility and will transfer sodium hypochlorite to a new cross-pipe diffuser or injection wand located in the membrane feed pipeline just downstream of the secondary effluent pump station. The design criteria for the sodium hypochlorite injection system are shown in Table 1.4.

Table 1.4 Sodium Hypochlorite Injection System Design Criteria Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City

Parameter	Units	Criteria
Injection System		
Injection System Type		Cross-pipe Diffuser or Injection Wand
Number of Injectors	No.	2

Aluminum Chloride Hydroxide (ACH) will be dosed upstream of the membranes as pretreatment to enhance membrane performance. Daly City currently utilizes ACH in the existing tertiary treatment facility and the ACH chemical storage tank is located just south of the secondary effluent pump station. Two new chemical dosing pumps will be added near this existing storage facility and will transfer ACH to a new pump diffusion flash mixer on the second floor of the new Tertiary Treatment Building. ACH will be injected via this new pump diffusion flash mixer just downstream of the strainers. Additionally, an ACH diffuser will be installed as backup to the pump diffusion flash mixer. The design criteria for the ACH pump diffusion flash mix system is shown in Table 1.5.

Table 1.5 ACH Pump Diffusion Flash Mix System Design Criteria Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City

Parameter	Units	Criteria
Coagulant Flash Mix		
Flash Mix Type		Pump Diffusion
Pump Type		ANSI End Suction Pump
Number of Pumps	No.	1
Pump Capacity, each	gpm	90
TDH	ft	21
Motor Horsepower, each	HP	1
Mixing Energy	sec^{-1}	1936

5.3.3 Pre-Filter

The purpose of the pre-filter is to provide filtration of abrasive material upstream of the membrane system to prevent membrane damage. It is important to protect the membranes because repair of damaged membrane fibers can result in downtime, a reduction of plant capacity, and increased operations and maintenance costs.

The pre-filter is self-cleaning and consists of filtration discs that are stacked on top of one another and compressed together. The water supply flows from the outside of the discs through the grooves created in between the discs, trapping particles at the surface and along the grooved path to the center. As the particles accumulate, the differential pressure across the filter rises and eventually triggers an automatic backwash. During a backwash, the inlet valve closes, the disc compression is released, and filtered water flows in the reverse direction allowing the discs to separate and spin freely, loosening trapped particles. Refer to http://youtu.be/eYn0PW4MFN0 for an illustration of the pre-filter operation.

Polymeric disc filters are recommended over mesh strainers for this application because they perform well in water with high algae content, and the filter elements can be easily replaced. The pre-filters will be located on the second story of the Tertiary Treatment Building and the design criteria are presented in Table 1.6.

Table 1.6 Pre-Filter System Design Criteria
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Parameter	Units	Criteria
Pre-Filter		
Type: Self-Cleaning Polymeric, Disc Filter		
Filter Degree	Micron	200
Number of Filters	No.	7
Filter Feed Pipe Diameter	in.	10
Pressure Differential Range	psi	1.5 - 7

5.3.4 Membrane Filtration System

5.3.4.1 Pilot Results

The project team performed a membrane filtration pilot study at the Daly City WWTP from March 2016 to March 2017 to develop design criteria for the membrane filtration system. The first phase of the study tested polymeric membranes and the second phase tested a ceramic membrane. The membrane filtration system will treat water from Daly City's high-purity oxygen (HPO) secondary treatment process. HPO facilities operate with short solids retention times, resulting in water qualities that have the potential to rapidly foul membrane filters and limit production. The pilot study focused on developing pretreatment and membrane cleaning strategies that reduce and reverse membrane fouling.

The first phase of the study tested the performance of four polymeric, hollow fiber membrane modules selected for their competitive cost and compatibility with the proposed pretreatment and chemical cleaning strategies. Modules from Toray, Scinor, Dow, and BASF were tested on a membrane pilot skid supplied by Westech Engineering. Based on the design criteria developed from polymeric membrane evaluation, the projected annual operations and maintenance (O&M) cost is $560,000 to $690,000. This annual cost includes energy usage, chemical usage, and membrane replacement. The cost is similar to applications with comparable feed water qualities, however it is 1.9 to 2.4 times higher than applications with lower concentrations of total organic carbon (TOC) in the secondary effluent. For comparison, a lower TOC application is able to operate at a higher loading rate, does not need inline coagulation, and requires less frequent chemical cleans. As a result, the annual O&M costs to treat a lower TOC secondary effluent would be $290,000 for a similarly sized facility.

Since the O&M cost for polymeric membranes is high in this application, the second phase of the study evaluated the potential benefits of a ceramic membrane. Ceramic membranes are developed from robust materials and have the potential to offer a higher loading rate and reduce the O&M cost. Based on the design criteria developed from the ceramic membrane evaluation, the projected annual O&M cost for a ceramic membrane system is $550,000 to $690,000. Although the ceramic membranes have a lower replacement cost due to their long life expectancy, the chemical cost will be greater due to the high coagulant doses required. The projected O&M cost for a ceramic system was only 2 percent lower than the O&M cost for a polymeric system. The capital cost for the two systems were within 5 percent of each other, so the overall lifecycle costs were comparable.

In addition to lifecycle costs, the project team considered other criteria, including installation base, open platform compatibility, membrane life, and solids generation. The overall assessment of both membrane systems was comparable, each with unique strengths and limitations. Therefore, it is recommended that both membrane systems be included in the preliminary design. If the project continues to final design, the project team and City would rank the criteria (life cycle cost, installation base, open platform compatibility, etc.) and screen membrane suppliers for the preselection process. The detailed pilot results are presented in Membrane Pilot Testing Results (Carollo, 2017) provided in Appendix E.

Other findings from the pilot study were as follows:

- Membrane operation at a lower flux (15 gallons per square foot of membrane per day [gfd] for polymeric membranes, 70 gfd for ceramic membrane) resulted in lower rates of fouling, higher permeability, and less frequent CIPs than membrane operation at the design flux (31 gfd for polymeric membranes, 91 gfd for ceramic membrane).

- Iron was identified as a key membrane foulant. ACH pretreatment and/or frequent citric acid maintenance cleans were effective at preventing and recovering from iron fouling.

- Biological fouling was minimized with pre-oxidation.

- Several fouling events occurred that resulted in a rapid decline in membrane permeability. The cause of these events is unknown.

5.3.4.2 Ultrafiltration Membrane System Summary

The purpose of the ultrafiltration (UF) membrane system is to remove suspended solids and meet the turbidity requirements of the Title 22 regulations. The UF membrane system will consist of individual membrane modules assembled onto racks with common piping and ancillary equipment such as a compressed air system, hydraulic backwash system, chemical cleaning system, and neutralization system. The membrane system will utilize polymeric, hollow fiber membranes or ceramic membranes. The basis of the preliminary design is polymeric hollow fiber (PHF) membrane module technology. However, as discussed in the previous section, a ceramic membrane system was evaluated during the pilot study and determined to be comparable to the PHF system. Therefore, design criteria are also included for the ceramic membrane system.

The UF membrane system will be located in the new tertiary treatment building. The membrane racks and the air supply system receiver tank will be located on the second floor and the remaining air equipment will be located on the first floor. The CIP tank, backwash supply tank, and backwash waste tank will all be located below the tertiary treatment building. The only ancillary equipment not located in the new building is the neutralization system, which will be located next to the new chemical systems.

5.3.4.2.1 Modes of Operation

Filtration

During the filtration mode, the membranes will operate in an outside-in flow pattern (i.e., the feed water will be pumped to the outside of the fibers) and filtrate will collect inside the lumen of the fibers. Rejected materials will accumulate on the outside of the membrane fibers.

The system will have the ability to operate in either dead-end filtration mode or cross-flow filtration mode. In dead-end filtration mode, all of the flow is directed through the membrane. In cross-flow filtration mode, while a majority of the flow is directed through the membrane, a percentage of the feed water (up to 10 percent) flows tangentially across the surface of the membrane and is discharged back to Headworks No. 1. Cross-flow filtration mode may become useful when operating at higher flux rates.

Backwash

During filtration, solids will accumulate on the membrane surface and make it necessary to perform a periodic backwash to remove accumulated solids. Backwash procedures vary slightly between the membrane systems, however a backwash generally consists of the following steps:

- **Reverse flow:** The backwash pump is used to pump water into the filtrate port of the module and force water to flow from the inside of the fiber to the outside. In this process, solids are dislodged from the membrane surface and partially flushed out of the module.

- **Air scour:** Air is injected into the feed side of the membrane module either following or simultaneously with reverse flow.
- **Drain:** Solids are evacuated from the module by draining the liquid contents of the rack at a rapid rate.
- **Refill:** Prior to going back into production the membrane air is evacuated from the module and refilled with feed water.

The backwash residuals will be discharged to backwash waste tank located below the new membrane building. The backwash residual water will be pumped from the backwash waste tank to Headworks No. 1.

Maintenance Clean

Backwashing does not remove all materials that accumulate on the membrane surface. Colloidal material, organic material, biological growth, and precipitated or complex inorganic materials (together known as "foulants") can remain on the membrane surface after backwashing. These materials can cause rapid increases in transmembrane pressure, decrease the intervals between clean-in-place (CIP), and ultimately impact system capacity.

Maintenance cleans (MC) are used periodically to remove foulants that were not removed during the hydraulic backwash. MCs are automatically triggered at a user-defined frequency. The MC frequency is selected based on the rate of membrane fouling. A portion of the MC duration is dedicated to recirculating and soaking the membranes in cleaning solution. The remaining time are dedicated to rack preparation, rinsing and flushing steps. All waste solutions, rinse and flush volumes are routed to the neutralization tank, neutralized, and pumped to Headworks No. 1.

Clean-in-Place

Clean-in-Place (CIP) is a rigorous chemical cleaning procedure that is carried out when the membranes become too fouled to operate efficiently. CIP procedures are similar to MC, but generally utilize more concentrated chemical solutions, heated makeup water, and longer soaking/recirculation durations. Cleaning strategies are selected to return the membranes to a clean state as measured by permeability. In practice, CIPs are required when a maximum time has elapsed since the previous CIP, when the membranes are unable to meet the minimum acceptable permeability criteria, or when membranes foul rapidly and reach their maximum transmembrane pressure. A CIP is manually initiated and automatically controlled by the membrane control system.

5.3.4.2.2 Open Platform vs Proprietary

Membrane systems are typically sold as units designed to accommodate a single membrane module. This follows trends established in the 1990s when membranes developed by different manufacturers had little in common, mechanically or operationally, with one another. Single-module system designs leave owners with risks common to any nonstandard product such as noncompetitive module and parts replacement pricing, availability, service, and commercial issues associated with changes in ownership.

The industry is shifting and modern module designs are converging towards common configurations. New membrane products from established membrane manufacturers are similar in size, materials of construction, compatibility, operating pressures, and cleaning strategies. Even ceramic membrane suppliers are adjusting operating strategies to align with open platform systems. As a result, established membrane suppliers are designing open platform membrane systems that have the flexibility to accommodate different modules. The open platform system provides a means for the owner to diversify its source of membrane modules and minimize the risks associated with purchasing a proprietary system. For these reasons, an open platform membrane system is recommended for this project. However, the membranes could be delivered as a proprietary system to save on capital cost and footprint if necessary.

5.3.4.2.3 Waste Washwater Handling

Backwash water from the membranes will flow to a below-grade backwash waste tank, where entrained air will be released. The backwash waste water will then be pumped to the Headworks No. 1.

Chemical cleaning solution waste from the membranes will be pumped to a below-grade neutralization tank. The cleaning solution will be neutralized and pumped to Headworks No. 1.

5.3.4.2.4 Design Criteria

The UF membrane system design criteria are presented in Table 1.7 below.

Table 1.7 UF Membrane System
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Parameter	Units	Polymeric	Ceramic
Membranes			
Number of Racks	No.	4(1)	3(2)
Min. Surface Area Per Rack	sq ft	38,750	17,544
Peak Instantaneous Feed Water Flow with 10% Cross Flow	mgd	4.00	N/A
Peak Instantaneous Feed Water Flow without Cross Flow	mgd	3.60	3.60

Table 1.7	UF Membrane System Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City		
Parameter	**Units**	**Polymeric**	**Ceramic**
Net Production Capacity	mgd	3.00	3.00
Max. Flux (@ 20° C)	gfd	31	70/91
Max. Backwash Interval	min	22	15
Max. Maintenance Clean Frequency	No./Rack/ Week	8	10.5
Max. Clean-in-Place Frequency	No./Rack/ Month	2	1
Air Supply			
Type		Rotary Screw Compressors	N/A
Number of Compressors	No.	2	N/A
Discharge Pressure	psig	150	N/A
Air Dryer			
Number of Air Dryers	No.	2	N/A
Receiver Tank			
Number of Tanks	No.	1	N/A
Capacity	gallons	1060	N/A
Diameter	feet	4	N/A
Backwash			
Source	-	UF Filtrate	
Backwash Supply Tank			
Type	-	Below-grade Tank	
Capacity	gallons	7,540	
Dimensions (L x W)	ft x ft	14 x 9	
Water Depth	ft	8	
Backwash Supply Pumps			
Type	--	Vertical Turbine with VFD	Vertical Turbine with VFD
Number of Pumps	--	2 (1 duty + 1 standby)	2 (1 duty + 1 standby)
Pump Capacity, each	gpm	1,750	3,420
TDH	ft	128	128
Motor Horsepower, each	hp	75	150
Backwash Waste Tank			
Type	--	Below-grade Tank	
Capacity	gallons	7,540	
Dimensions (L x W)	ft x ft	14 x 9	
Water Depth	ft	8	

Table 1.7 UF Membrane System Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City			
Parameter	**Units**	**Polymeric**	**Ceramic**
Backwash Waste Pumps			
Type	--	Submersible Centrifugal	
Number of Pumps	--	2 (1 duty + 1 standby)	
Pump Capacity, each	gpm	420	
TDH	ft	10	
Motor Horsepower, each	hp	1	
CIP System			
CIP Tank			
Type	--	Below-grade Tank	
Capacity	gallons	2,400	
Dimensions (L x W)	ft x ft	8 x 5	
Water Depth	ft	8	
Heat Source	--	Inline Heaters	
Number of Heaters	--	3	
Heat-up Time	hr	3	
Power, total	kW	99	
CIP Recirculation Pumps			
Type	--	Vertical Column Sump	
Number of Pumps	--	2 (1 duty + 1 standby)	
Pump Capacity, each	gpm	650	
TDH	ft	154	
Motor Horsepower, each	hp	40	
Neutralization System			
Neutralization Tank			
Type	-	Below-grade Tank	
Capacity	gallons	12,900	
Dimensions (L x W)	ft x ft	12 x 12	
Water Depth	ft	12	
Neutralization Pumps			
Type	--	Vertical Column Sump	
Number of Pumps	--	2 (1 duty + 1 standby)	
Pump Capacity, each	gpm	1,020	
TDH	ft	18	
Motor Horsepower, each	hp	6	
Additional Design Considerations			
• Minimize flux rate by optimizing the module rack design. • Address iron fouling with ACH pretreatment and/or frequent citric acid maintenance cleans.			

Table 1.7 UF Membrane System Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City			
Parameter	Units	Polymeric	Ceramic
• Minimize biological fouling with pre-oxidation. • Utilize utility water to create CIP and maintenance clean cleaning solutions.			
Notes: (1) The polymeric membrane system consists of 4 racks (4 x 33% capacity). 3 racks in productions and 1 on standby or in a CIP/MC. The membrane flux will remain constant. (2) The ceramic membrane system consists of 3 racks (3 x 33% capacity). The flux will vary based on the number of racks online.			

5.3.5 Disinfection

5.3.5.1 Process Selection

The 2009 Feasibility Study (Carollo, 2009) compared ultraviolet light (UV), pasteurization, and ozonation and recommended ozonation as the preferred disinfection process. The recommendation was based primarily on cost and footprint. Since 2009, technology advancements have improved UV efficiency and several new Title 22 ozone systems have been validated. Accordingly, the project team updated the 2009 evaluation to compare UV and ozonation as the final disinfection for this project.

The evaluation for this project compared ozonation and UV based on the criteria summarized in Table 1.8. The evaluation found UV disinfection ranked higher than ozonation in the majority of the criteria. The highlights of the evaluation are summarized below.

- UV systems are utilized at dozens of recycled water facilities in California, while ozone is only utilized at two recycled water facilities.
- UV systems have no moving parts, very few interrelated devices, and require minimal operator attention compared to ozone systems.
- In-vessel UV reactors are able to fit within half the footprint required for ozone systems.
- UV disinfection is more cost effective based on both capital and operations and maintenance costs.
- UV disinfection is advantageous because it can be used for a direct or indirect potable reuse application.

Based on the evaluation results and discussion with the City, UV was selected as the disinfection technology. The complete evaluation is provided in PM 09 titled, "Disinfection Technology Evaluation" (Carollo, 2016) (Appendix F).

Table 1.8 Disinfection Technology Evaluation Results Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City		
Criteria	**Ozone**	**UV**
Prevalence in Recycled Water Industry	Rare	Prevalent
Operator Attention Required	High	Low
Operator Safety Concerns	Low	Low
Footprint	Too large	Acceptable
Cost (Capital and O&M)	High cost	Low cost
Potential for Direct or Indirect Potable Reuse	Moderate	High

5.3.5.2 UV Disinfection

The UV disinfection system design criteria are presented in Table 1.9. The UV system will consist of closed-vessel, low-pressure high-output reactors. The UV dose is 80 millijoules per square centimeter (mJ/cm^2) as recommended in the Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (National Water Research Institute, 2012). The system is designed to achieve the specified dose at the maximum instantaneous flow rate of the membrane filtration system. This design was used as the basis for the equipment layout shown in Figure 1.7.

Table 1.9 UV Disinfection System Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City		
Parameter	**Units**	**Criteria**
UV Disinfection		
Type		Closed-Vessel, Low-Pressure High-Output
Number of Vessels	No.	5 (4 duty+ 1 standby)
Peak Flow Rate	mgd	3.60
Fouling Factor (FF)	--	0.80
End of Lamp Life (EOLL)	--	0.85
UF Filtrate UV Transmittance	%(1)	55
Dose	mJ/cm(2)	80

Notes:
(1) Lower 5th percentile of data collected during Membrane Pilot Test.
(2) Dose per Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (National Water Research Institute, 2012).

5.3.5.2.1 Alternative Design

At least one of the UV disinfection systems considered for the basis of design can be operated at a higher power setting. This mode of operation, would reduce the total number of vessels required, resulting in savings of capital cost and footprint. These revised operating conditions were approved by the State for a drinking water plant in Southern California and would require similar approval for this application. This alternative, presented in Table 1.10, should be considered during final design.

5.3.6 Post Treatment

Gypsum and sodium hypochlorite will be dosed downstream of the membrane filters using an inline mechanical mixer and injection system. This system will be located on the pipeline running from the UV system to the recycled effluent pump station. An inline mechanical mixer will be used to provide adequate mixing. The design criteria for the new chemical mixing system are presented in Table 1.11.

Table 1.10 UV Disinfection System - Alternative Design
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Parameter	Units	Criteria
UV Disinfection		
Type		Closed-Vessel, Low-Pressure High-Output$^{(1)}$
Number of Vessels	No.	4 (3 duty+ 1 standby)
Peak Flow Rate	mgd	3.60
Fouling Factor (FF)	--	0.80
End of Lamp Life (EOLL)	--	0.85
UF Filtrate UV Transmittance	%$^{(2)}$	57
Dose	mJ/cm$^{(3)}$	80

Notes:
(1) Based on higher power setting (360W) of Wedeco LBX1500e system.
(2) Lower 10th percentile of data collected during Membrane Pilot Test. UVT percentile per Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (National Water Research Institute, 2012).
(3) Dose per Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (National Water Research Institute, 2012).

Table 1.11 Post Treatment
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Parameter	Units	Criteria
Inline Mechanical Mixer		
Type		Inline Mechanical Mixer
Number of Chemical Injectors	No.	4
Motor Horsepower, total	HP	3
Mixing Energy	sec^{-1}	10,000

5.4 Recycled Effluent Pump Station

The recycled effluent pump station will pump recycled water to the storage tank located in Colma near the cemeteries. The recycled effluent pumps will be located in the new tertiary treatment building and pump from a below-grade wet well. The pump station includes three vertical turbine pumps (two duty and one standby) on variable frequency drives (VFD) to meet intermediate demands. The pump station will have a total capacity of 3.56 mgd. Each pump will have a capacity of 1.78 mgd.

The pumps will be controlled to maintain a water level setpoint in the new off-site storage tank. A flow meter will be located on the combined discharge header from the recycled effluent pumps. Table 1.12 outlines the design criteria for the recycled effluent pump station. For further discussion on the off-site storage tank and recycled water distribution system, see TM 2 - Colma Delivery System (Carollo, 2017).

Table 1.12 Recycled Effluent Pump Station
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Parameter	Units	Criteria
Distribution System Piping		
Diameter	in.	2 - 20
Maximum Velocity (@3.6 mgd)(1)	fps	6.8
Pumps		
Type	--	Vertical Turbine
Number of Pumps	No.	3 (2 duty, 1 standby)
TDH	ft	540[1]
Motor Horsepower, each	HP	200
Flow, Maximum	mgd (gpm)	3.60 (2,500)
Flow, During Storage Tank Filling	mgd (gpm)	2.73 (1,900)
Flow, Average	mgd (gpm)	2.49 (1,730)
Pump Station Wet Well		
Type	--	Below-grade Tank
Capacity	gallons	37,000
Dimensions (L x W)	ft x ft	25 X 20
Water Depth	ft	13.6

Notes:
(1) Assumes the Holy Cross configuration. The three alternative considered are discussed in PM 05 - Recycled Water Storage Tank Site Evaluation (Carollo, 2017).

6.0 CHEMICAL SYSTEMS

6.1 Overview

The new tertiary process requires chemical addition for pretreatment, post treatment, and chemical cleans of the membrane system. The required chemicals for the new treatment process include sodium hypochlorite, sodium bisulfite (SBS), ACH, gypsum, citric acid, hydrochloric acid, and sodium hydroxide.

The Daly City WWTP currently stores ACH, SBS, gypsum, and sodium hypochlorite onsite. The ACH, SBS, and gypsum storage tanks have sufficient capacity to supply the chemical needs of this project and only new feed systems are required for these chemicals. The sodium hypochlorite tank has sufficient capacity to supply the chemical dose for pretreatment. However sodium hypochlorite is also needed for post treatment and chemical cleans. Thus, a new sodium hypochlorite tank will be provided for these two uses and new feed systems will be provided for all three sodium hypochlorite uses.

The project also requires construction of chemical storage tanks and feed systems for citric acid, hydrochloric acid, and sodium hydroxide. These three new chemical systems, along with the new sodium hypochlorite system, will be located to the west of the new Tertiary Treatment building where the primary switchgear building and two storage sheds are currently located.

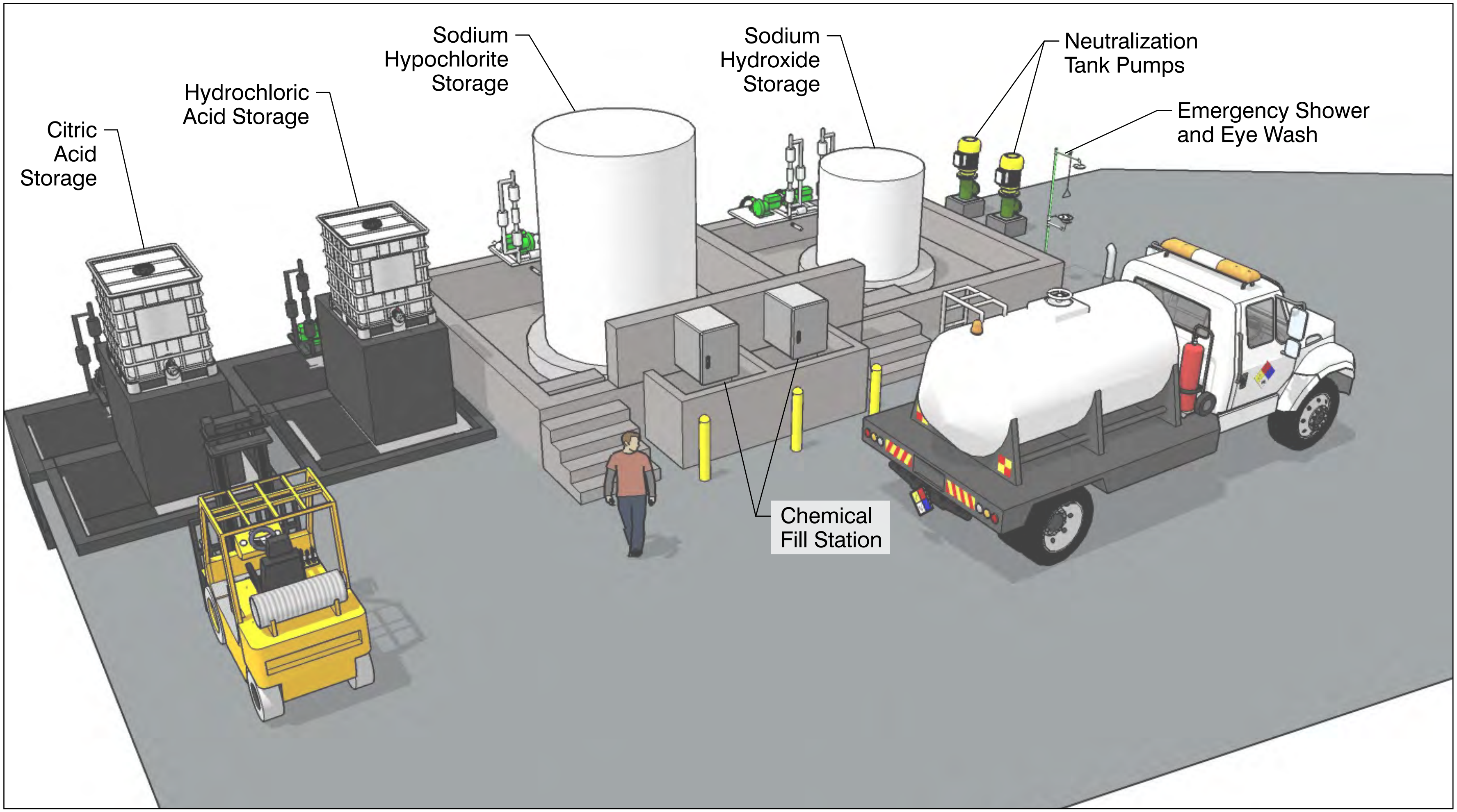
Based on discussions with Daly City staff, the primary switchgear building is outdated and requires replacement. The primary switchgear building will be relocated to the median across the driveway from the current plant entrance in a fenced-in facility. Details of this facility can be found in Section 10.0. The existing storage sheds will also require relocation, the location will be determined during final design.

Figure 1.2 shows the PFD and an overview of the chemical storage and feed system. Each chemical system is summarized below and will be discussed in more detail in subsequent sections. Figure 1.12 shows the proposed layout of the new chemical storage facilities with respect to existing facilities.

6.2 Chemical System Design Criteria

6.2.1 Storage

The chemical facilities will be designed to provide a minimum of 15 days of storage at average flow and maximum chemical dose. This allows for a disruption of chemical delivery to the plant and limits the number of chemical deliveries.



CHEMICAL SYSTEM LAYOUT

FIGURE 1.12

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

dc0117-10076rf21.ai

6.2.2 Containment

The chemical storage tanks and totes will be located within a secondary containment area large enough to store the contents of each storage tank plus the volume of rain from a 24-hour 25-year storm. Each chemical will have separate containment to address incompatible chemicals. A spill is contained within the concrete walls and floor of the containment area. The concrete will be protected with the appropriate chemical resistant coatings, and the floor will be sloped to a sump.

6.2.3 Safety Equipment

Safety equipment includes secondary containment and an emergency shower/eyewash.

6.3 Sodium Hypochlorite

6.3.1 Purpose

Sodium hypochlorite will be used as a pre-oxidant in the membrane feed water to control biological growth on the membranes and the piping as well as for disinfection of the membrane effluent prior to distribution. Sodium hypochlorite will also be used for membrane maintenance and CIP cleans to remove organic foulants from the membrane surface.

6.3.2 Existing System

The existing sodium hypochlorite system is used to provide disinfection for both the existing recycled water effluent and the remaining plant effluent. Sodium hypochlorite is also used to provide a disinfectant residual for distribution in the existing recycled water distribution system. The existing sodium hypochlorite storage tank is located just northeast of the secondary effluent pump station.

6.3.3 Proposed New Facilities

The new tertiary treatment process will dose sodium hypochlorite for pretreatment of the membrane feed water, membrane CIP cleaning, and post filtration disinfection. Sodium hypochlorite for pretreatment will be fed from the existing storage tank because it has sufficient capacity and is located near the application point. Sodium hypochlorite for CIP cleans and post treatment will be fed from a new storage facility located in the new chemical storage area.

Pretreatment of the membrane feed water will be fed via two new diaphragm metering pumps (one duty and one standby) from the existing sodium hypochlorite tank. The injection point is located in the pipeline just downstream of the new membrane feed pumps. A cross-pipe diffuser or injection wand will be added at this location and used to mix the solution across the water column.

The sodium hypochlorite application for membrane cleaning and post treatment will be pumped from a new sodium hypochlorite storage tank located in the new chemical storage area. Adjacent to the new sodium hypochlorite storage tank will be four new diaphragm metering pumps (two duty, two standby). Two of these pumps will batch transfer sodium hypochlorite to the CIP tank for chemical cleans and the other two pumps will transfer sodium hypochlorite continuously to a new inline mechanical mixer located upstream of the recycled effluent pump station.

New flow meters will be used to monitor flow through each of the pumps and totalize volume of chemical used for pretreatment, post treatment, and CIP chemical cleans. Chemical tank level in the new sodium hypochlorite tank will be monitored by an ultrasonic level transmitter.

6.3.4 Safety

A Material Safety Data Sheet (MSDS) for sodium hypochlorite is included in Appendix G. Table 1.13 summarizes the safety issues for handling and storing sodium hypochlorite.

Table 1.13 Sodium Hypochlorite Safety Handling and Storage
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Description	Details
Hazards	
Eyes	Inflammation of eye; redness, watering, itching
Skin	Inflammation; itching, scaling, reddening, blistering
Inhalation	Hazardous, severe irrigation of respiratory tract. May cause chocking or coughing.
Ingestion	Hazardous
NFPA System Rating	
Health Hazard	Rating 3 - Corrosive or toxic
Fire Hazard	Rating 0 - Non combustable
Reactivity Hazard	Rating 0 - Materials that in themselves are normally stable, even under fire exposure conditions, and are not reactive with water

6.3.5 Application Point

Sodium hypochlorite will be applied in three locations:

- CIP Tank.
- Pretreatment in the feed water line.
- Post treatment in the finished water line, upstream of the recycled effluent pump station.

6.3.6 Design Criteria

The design criteria for the new sodium hypochlorite system including a new storage tank and chemical feed pumps for pretreatment, post treatment, and the CIP system are shown in Table 1.14.

Table 1.14 Design Criteria for New Sodium Hypochlorite System
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Description	Units	Existing	New
Characteristics: Liquid, 10.5%, 1.06 lb/gal			
Dose			
Pretreatment (Max)	mg/L		10
Post Treatment (Max)	mg/L		9
CIP Clean (Max)	mg/L		2,400
	gal/CIP		41
Maintenance Clean (Max)	mg/L		900
	gal/MC		16
Bulk Chemical Storage			
Type	--	Bulk Liquid Tank	Bulk Liquid Tank
No. of Bulk Tanks	No.	1	1
Volume, each	gal	8,500	3,900
Feed Pumps: Pretreatment			
Type	--		Diaphragm Metering Pump
No. Pumps	No.		2 (1 duty, 1 standby)
Pump Capacity, each	gpm		0.22
Feed Pumps: Post Treatment			
Type	--		Diaphragm Metering Pump
No. Pumps	No.		2 (1 duty, 1 standby)
Pump Capacity, each	gpm		0.16
Feed Pumps: CIP Clean			
Type	--		Diaphragm Metering Pump
No. Pumps	No.		2 (1 duty, 1 standby)
Pump Capacity, each	gpm		0.03

6.4 Gypsum

6.4.1 Purpose

Gypsum will be added after disinfection to condition the recycled water for turf grass irrigation. Gypsum is used to lower the sodium absorption ratio (SAR) to maintain the recycled water's SAR within the acceptable range to prevent sodium in the water from displacing calcium and magnesium in the soil. This maintains the soil's ability to form stable aggregates and maintains the soil's permeability.

6.4.2 Existing System

Daly City currently contracts with Wastewater Solutions, Inc. to maintain and operate their existing gypsum storage and dosing package system. This system includes a storage silo, batch mixing tank, and diaphragm feeder pump for the existing tertiary treatment system.

6.4.3 Proposed New Facilities

A new diaphragm feeder pump will be added to the gypsum system. Additionally, a new feed line and inline mechanical mixer will be used add gypsum and sodium hypochlorite to the new recycled water effluent prior to distribution.

6.4.4 Safety

A MSDS for gypsum is included in Appendix G. Table 1.15 summarizes the safety issues for handling and storing gypsum.

Table 1.15 Gypsum Safety Handling and Storage
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Description	Details
Hazards	
Eyes	May cause irritation.
Skin	Frequent exposure may have drying effect on skin. Possible itching and irritation may occur.
Inhalation	May cause irritation of the nose, throat, lungs, and upper respiratory tract.
Ingestion	Ingestion of a sufficient quantity could lead to mechanical obstruction of the gut.
NFPA System Rating	
Health Hazard	Rating 0 - Poses no health hazard
Fire Hazard	Rating 0 - Non combustable
Reactivity Hazard	Rating 0 - Materials that in themselves are normally stable, even under fire exposure conditions, and are not reactive with water

6.4.5 Application Point

Gypsum will be applied in one location:

- Post treatment in the finished water line, upstream of the recycled effluent pump station.

6.4.6 Design Criteria

The design criteria for the new gypsum system chemical feed pumps for the post-treatment system are shown in Table 1.16.

Table 1.16 Design Criteria for New Gypsum System
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Description	Units	Existing	New
Characteristics: Liquid, 3.2 meq/L			
Dose			
Post Treatment (Max)	mg/L		250
Bulk Chemical Storage			
Type	--	Silo	
No. of Bulk Tanks	No.	1	
Storage, each	Ton	40	
Feed Pumps			
Type	--	Diaphragm Metering Pump	Diaphragm Metering Pump
No. Pumps	No.	1	1
Pump Capacity, each	gpm	9.5	9.5

6.5 Citric Acid

6.5.1 Purpose

The CIP system will include citric acid for chemically cleaning the UF membranes. Citric acid will be used in combination with hydrochloric acid to remove inorganic foulants from the membrane surface. The acidified cleaning solution will be neutralized with caustic soda prior to disposal to the plant headworks.

6.5.2 Proposed New Facilities

Citric acid storage and feed to the CIP system will be included in the new chemical storage area. Bulk citric acid will be stored in one replaceable 330 gallon chemical tote. This tote will be connected to and stored on top of a permanent storage tank thus enabling the tote to fully drain before being replaced.

New diaphragm metering pumps (one duty, one standby) will be used for batch transfer of citric acid to the CIP system. New flow meters will be used to monitor flow and totalize volume of chemical to the CIP system. Chemical storage tank level will be monitored by an ultrasonic level transmitter.

6.5.3 Safety

A MSDS for citric acid is included in Appendix G. Table 1.17 summarizes the safety issues for handling and storing citric acid.

Table 1.17 Citric Acid Safety Handling and Storage
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Description	Details
Hazards	
Eyes	Causes severe irritation.
Skin	Causes skin irritation.
Inhalation	Causes irritation to the nose and throat. Overexposure could cause coughing, sneezing, and labored breath.
Ingestion	Causes irritation to the gastrointestinal tract. May cause nausea, vomiting, and diarrhea.
NFPA System Rating	
Health Hazard	Rating 2 - May be harmful of inhaled or absorbed
Fire Hazard	Rating 0 - Non combustable
Reactivity Hazard	Rating 0 - Materials that in themselves are normally stable, even under fire exposure conditions, and are not reactive with water

6.5.4 Application Point

Citric acid will be applied in one location:

- CIP Tank.

6.5.5 Design Criteria

The design criteria for the new citric acid system including bulk storage and chemical feed pumps for the CIP system are shown in Table 1.18.

Table 1.18	Design Criteria for New Citric Acid System Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City	
Description	**Units**	**New**
Characteristics: Liquid, 50%, 5.17 lb/gal		
Dose		
CIP Clean (Max)	mg/L	20,000
	gal/CIP	71
Maintenance Clean (Max)	mg/L	1,000
	gal/MC	3.5
Bulk Chemical Storage		
Type	--	Tote
No. of Bulk Totes	No.	1
Volume, each	gal	330
Feed Pumps		
Type	--	Diaphragm Metering Pump
No. Pumps	No.	2 (1 duty, 1 standby)
Pump Capacity, each	gpm	0.05

6.6 Hydrochloric Acid

6.6.1 Purpose

The CIP system will include hydrochloric acid for chemically cleaning the UF membranes. Hydrochloric acid will be used in combination with citric acid to lower the cleaning solution pH for maintenance and CIP cleans. The CIP cleans will remove inorganic foulants from the membrane surface. The acidified cleaning solution will be neutralized with caustic soda prior to disposal to the plant headworks.

6.6.2 Proposed New Facilities

Hydrochloric acid storage and feed to the CIP system will be included in the new chemical storage area. Bulk hydrochloric acid will be stored in one replaceable 330-gallon chemical tote. This tote will be connected to and stored on top of a permanent storage tank thus enabling the tote to fully drain before being replaced.

New diaphragm metering pumps (one duty, one standby) will be used for batch transfer of hydrochloric acid to the CIP system and to the neutralization system. New flow meters will be used to monitor flow and totalize volume of chemical to the CIP and Neutralization systems. Chemical storage tank level will be monitored by an ultrasonic level transmitter.

6.6.3 Safety

A MSDS for hydrochloric acid is included in Appendix G. Table 1.19 summarizes the safety issues for handling and storing hydrochloric Acid.

Table 1.19 Hydrochloric Acid Safety Handling and Storage
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Description	Details
Hazards	
Eyes	Causes severe irritation.
Skin	May produce severe burns, ulceration, and scaring.
Inhalation	Causes irritation, coughing hoarseness, inflammation, and ulceration.
Ingestion	May cause corrosion of the mucous membranes, esophagus, and stomach with nausea, vomiting, and diarrhea.
NFPA System Rating	
Health Hazard	Rating 3 - Corrosive or toxic
Fire Hazard	Rating 0 - Non combustable
Reactivity Hazard	Rating 1 - Normally stable, but can become unstable at elevated temperatures and pressures.

6.6.4 Application Point

Hydrochloric acid will be applied in two locations:

- CIP Tank.
- Neutralization Tank.

6.6.5 Design Criteria

The design criteria for the new hydrochloric acid system including bulk storage and chemical feed pumps for the CIP system are shown in Table 1.20.

Table 1.20	Design Criteria for New Hydrochloric Acid System Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City	
Description	**Units**	**New**
Characteristics: Liquid, 38%, 3.74 lb/gal		
Dose		
CIP Clean (Max)	mg/L	7,400
	gal/CIP	36
Maintenance Clean (Max)	mg/L	550
	gal/MC	2.7
Neutralization CIP Clean (Max)	mg/L	2,300
	gal/CIP	11
Neutralization Maintenance Clean (Max)	mg/L	500
	gal/MC	2.5
Bulk Chemical Storage		
Type	--	Tote
No. of Bulk Totes	No.	1
Volume, each	gal	330
Feed Pumps		
Type	--	Diaphragm Metering Pump
No. Pumps	No.	2 (1 duty, 1 standby)
Pump Capacity, each	gpm	0.025

6.7 Sodium Bisulfite

6.7.1 Purpose

SBS will be used for the neutralization system to dechlorinate waste sodium hypochlorite cleaning solution prior to discharging back to the headworks.

6.7.2 Existing System

Currently SBS is used to dechlorinate the plant effluent before it is sent to the outfall. There is one existing 6,500-gallon storage tank located at the north side of the plant just east of the administration building.

6.7.3 Proposed New Facilities

Two new diaphragm metering pumps (one duty, one standby) will be located adjacent to the existing SBS storage tank. These pumps will batch transfer SBS to the neutralization tank.

6.7.4 Safety

A MSDS for SBS is included in Appendix G. Table 1.21 summarizes the safety issues for handling and storing SBS.

Table 1.21 Sodium Bisulfite Safety Handling and Storage
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Description	Details
Hazards	
Eyes	Causes irritation.
Skin	Causes skin irritation.
Inhalation	Causes irritation to the nose and throat and respiratory system.
Ingestion	Causes irritation to the gastrointestinal tract. May cause nausea, vomiting, and diarrhea. May cause allergic reaction in some asthmatics.
NFPA System Rating	
Health Hazard	Rating 2 - May be harmful if inhaled or absorbed
Fire Hazard	Rating 0 - Non combustable
Reactivity Hazard	Rating 0 - Materials that in themselves are normally stable, even under fire exposure conditions, and are not reactive with water

6.7.5 Application Point

SBS will be applied in one location:

- Neutralization tank.

6.7.6 Design Criteria

The design criteria for the new SBS system chemical feed pumps for the neutralization system are shown in Table 1.22.

Table 1.22 Design Criteria for New Sodium Bisulfite System Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City			
Description	**Units**	**Existing**	**New**
Characteristics: Liquid, 25%, 2.73 lb/gal			
Dose			
Neutralization CIP Clean (Max)	mg/L		3,500
	gal/CIP		24
Neutralization Maintenance Clean (Max)	mg/L		1,300
	gal/MC		9
Bulk Chemical Storage			
Type	--	Bulk Liquid Tank	
No. of Bulk Tanks	No.	1	
Volume, each	gal	6,500	
Feed Pumps			
Type	--		Diaphragm Metering Pump
No. Pumps	No.		2 (1 duty, 1 standby)
Pump Capacity, each	gpm		0.02

6.8 Sodium Hydroxide

6.8.1 Purpose

The CIP system will include sodium hydroxide, also called caustic soda, for chemically cleaning the UF membranes. Sodium hydroxide will be used to increase the cleaning solution pH for maintenance cleans (when needed) and recovery cleans. These cleans remove the inorganic foulants from the membrane surface.

Sodium hydroxide will also be used for the neutralization system to neutralize the pH of the waste citric cleaning solution prior to discharging back to the headworks.

6.8.2 Proposed New Facilities

The proposed sodium hydroxide facilities will include a new storage tank and chemical metering pumps in the new chemical storage area. Two diaphragm metering pumps (one duty, one standby) will be used to transfer sodium hydroxide to both the CIP tank and neutralization tank.

6.8.3 Safety

A MSDS for sodium hydroxide is included in Appendix G. Table 1.23 summarizes the safety issues for handling and storing sodium hydroxide.

Table 1.23 Sodium Hydroxide Safety Handling and Storage
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Description	Details
Hazards	
Eyes	Causes irritation.
Skin	Causes irritation or burning sensation.
Inhalation	Causes damage to respiratory tract and lung tissue that could develop into pneumonia.
Ingestion	Causes severe burning and corrosion of mouth and throat.
NFPA System Rating	
Health Hazard	Rating 3 - Corrosive or toxic
Fire Hazard	Rating 0 - Non combustable
Reactivity Hazard	Rating 2 - Unstable and may react violently if mixed with water

6.8.4 Application Point

Sodium hydroxide will be applied in two locations:

- CIP tank.
- Neutralization tank.

6.8.5 Design Criteria

The design criteria for the new sodium hydroxide system including bulk storage and chemical feed pumps for the CIP and neutralization systems are shown in Table 1.24.

Table 1.24	Design Criteria for New Sodium Hydroxide System Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City	
Description	**Units**	**New**
Characteristics: Liquid, 25%, 2.56 lb/gal		
Dose		
CIP Clean (Max)	mg/L	2,500
	gal/CIP	18
Maintenance Clean (Max)	mg/L	550
	gal/MC	3.9
Neutralization CIP Clean (Max)	mg/L	20,600
	gal/CIP	147
Neutralization Maintenance Clean (Max)	mg/L	1,070
	gal/MC	7.7
Bulk Chemical Storage		
Type	-	Bulk Storage Tank
No. of Bulk Tanks	No.	1
Volume, each	gal	1,100
Feed Pumps		
Type	-	Diaphragm Metering Pumps
No. Pumps	No.	2 (1 duty, 1 standby)
Pump Capacity, each	gpm	0.10

6.9 Aluminum Chloride Hydroxide

6.9.1 Purpose

ACH is used as the primary coagulant.

6.9.2 Existing System

The existing ACH system is used to provide coagulation prior to the existing tertiary treatment system. Currently there is an existing ACH storage tank located just south of the secondary effluent pump station.

6.9.3 Proposed New Facilities

Two new diaphragm metering pumps (one duty, one standby) will be located adjacent to the existing ACH storage tank. These two new pumps will pump ACH to the new tertiary treatment building for injection in the membrane feed water line via a pump diffusion flash mixer.

6.9.4 Safety

A MSDS for ACH is included in Appendix G. Table 1.25 summarizes the safety issues for handling and storing ACH.

**Table 1.25 Aluminum Chloride Hydroxide Safety Handling and Storage
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City**

Description	Details
Hazards	
Eyes	Causes redness and swelling.
Skin	Causes skin irritation.
Inhalation	Causes irritation to the mucous membrane.
Ingestion	Causes irritation to the gastrointestinal tract. May cause nausea, vomiting, and diarrhea.
NFPA System Rating	
Health Hazard	Rating 1 - may be irritation.
Fire Hazard	Rating 0 - Not combustable.
Reactivity Hazard	Rating 0 - Materials that in themselves are normally stable, even under fire exposure conditions, and are not reactive with water.

6.9.5 Application Point

ACH will be applied in one location:

- Pretreatment in the membrane feed water line.

6.9.6 Design Criteria

The design criteria for the new ACH system including bulk storage and chemical feed pumps for the CIP system are shown in Table 1.26.

Table 1.26 Design Criteria for New Aluminum Chloride Hydroxide System Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City			
Description	**Units**	**Existing**	**New**
Characteristics: Liquid, 50%, 5.42 lb/gal			
Dose			
Pretreatment (Max)	mg/L		10
Bulk Chemical Storage			
Type	--	Bulk Storage Tank	
No. of Bulk Tanks	No.	1	
Volume, each	gal	4,600	
Feed Pumps			
Type	--		Diaphragm Metering Pump
No. Pumps	No.		2
Pump Capacity, each	gpm		0.04

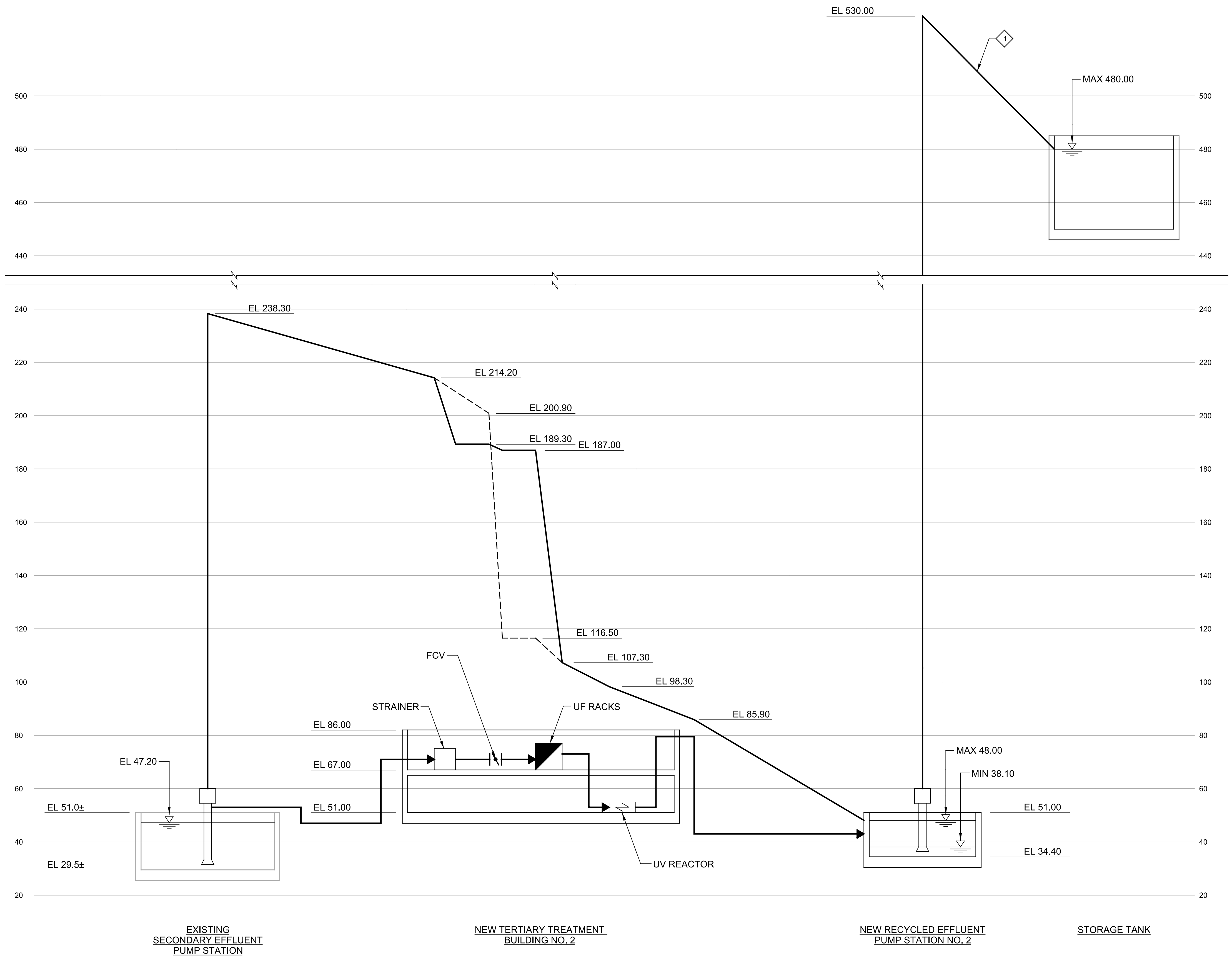
7.0 HYDRAULIC ANALYSIS

7.1 Overview

The hydraulic profile for the new tertiary treatment process is shown in Figure 1.13. As shown, secondary effluent is pumped from the secondary effluent flow splitter box to the membrane filters. The membrane system includes pre-filters and pressure filters which both cause head loss in the system. The membrane system also includes a back loop to make sure the membranes are always submerged. Water then flows by gravity through the UV vessels and inline mechanical mixer to the recycled water effluent pump station where it is pumped to the storage tank in Colma.

7.2 Secondary Effluent Pump Station

The new tertiary system includes modifications to the secondary effluent pump station to deliver flow to the membrane building. The secondary effluent pump station consists of a hydraulic structure with three hydraulically connected chambers. Effluent from the secondary clarifiers flows by gravity to the hydraulic structure. The water level in the chambers is set by the downstream weir at the end of Chlorine Contact Basin No. 1.



GENERAL NOTES:

1. HYDRAULIC PROFILE AT 3.54 MGD. MAXIMUM INSTANTANEOUS FLOW BASED ON 3 MGD OF PRODUCTION.

KEY NOTES:

1. ASSUMES DISTRIBUTION TANK IS LOCATED AT HOLY CROSS AND THE 16" UTILITY BRIDGE ON I-280 IS USED. HYDRAULIC PROFILE WILL BE REVISED IF ALTERNATIVE TANK SITE AND ROUTE ARE CHOSEN.

LEGEND:

FOULED MEMBRANE SYSTEM

CLEAN MEMBRANE SYSTEM

PROCESS FLOW DIAGRAM

FIGURE 1.13

CITY OF DALY CITY

TM NO. 1

TERTIARY TREATMENT

carollo

The existing tertiary system will pump up to 2.77 mgd from the first chamber to the existing tertiary treatment train (DynaSand filters). The remaining flow will flow over the weir wall (the top of wall elevation is 6 feet below the water surface elevation) to a second hydraulic chamber where flow will be pumped to the new tertiary treatment facility. The remaining water will flow through a 30-inch pipe to Chlorine Contact Basin No. 1, and then to the ocean outfall. Figure 1.4 and Figure 1.5 show this configuration.

The membrane feed pumps in the secondary effluent pump station will boost water to a hydraulic grade line (HGL) determined by the membrane system supplier, which is currently estimated at elevation 238 feet.

7.3 Pre-Filter

A pre-filter will be used upstream of the membranes and will generate an additional head loss of 2 pounds per square inch (psi) to 7 psi. Additionally, the self-cleaning filter has a minimum feed water pressure requirement since it will utilize feed water pressure to backwash. This pressure requirement is considered during membrane feed pump selection, however it is not the driving factor.

7.4 Membrane/UV System

The head loss across the membranes will range from 2 to 30 psi depending on the flow and permeability of the membrane. The permeability of each membrane rack depends on the feed water quality and filtration time since the last hydraulic backwash and chemical clean. Each membrane rack has a flow control valve upstream of the membranes to account for variations in membrane permeability.

The membrane filtration and UV disinfection systems must be submerged at all times, therefore a gooseneck will be installed downstream of the treatment systems to make sure the HGL remains above the membrane racks and UV vessels prior to discharge into the recycled water pump station. After the gooseneck the water will flow by gravity into the new recycled effluent pump station.

7.5 Recycled Effluent Pump Station

The recycled effluent pump station includes three vertical turbine pumps (two duty and one standby) to pump recycled water to the new storage tank in Colma. Three possible tank sites were considered and outlined in PM 05 - Recycled Water Storage Tank Site Evaluation (Carollo, 2017). The Holy Cross tank site was selected as the recommended tank site and the hydraulic profile is based on this tank location.

8.0 YARD PIPING

8.1 Overview

The new tertiary process requires modifications to the yard piping at the Daly City WWTP. This section summarizes the relocations of major existing pipes affected by the new tertiary treatment facility as well as routes for required new large-diameter pipes.

Table 1.27 summarizes the large-diameter pipelines required for the new tertiary process. Figure 1.3 also shows the required pipeline modifications.

Table 1.27 Yard Piping Description
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

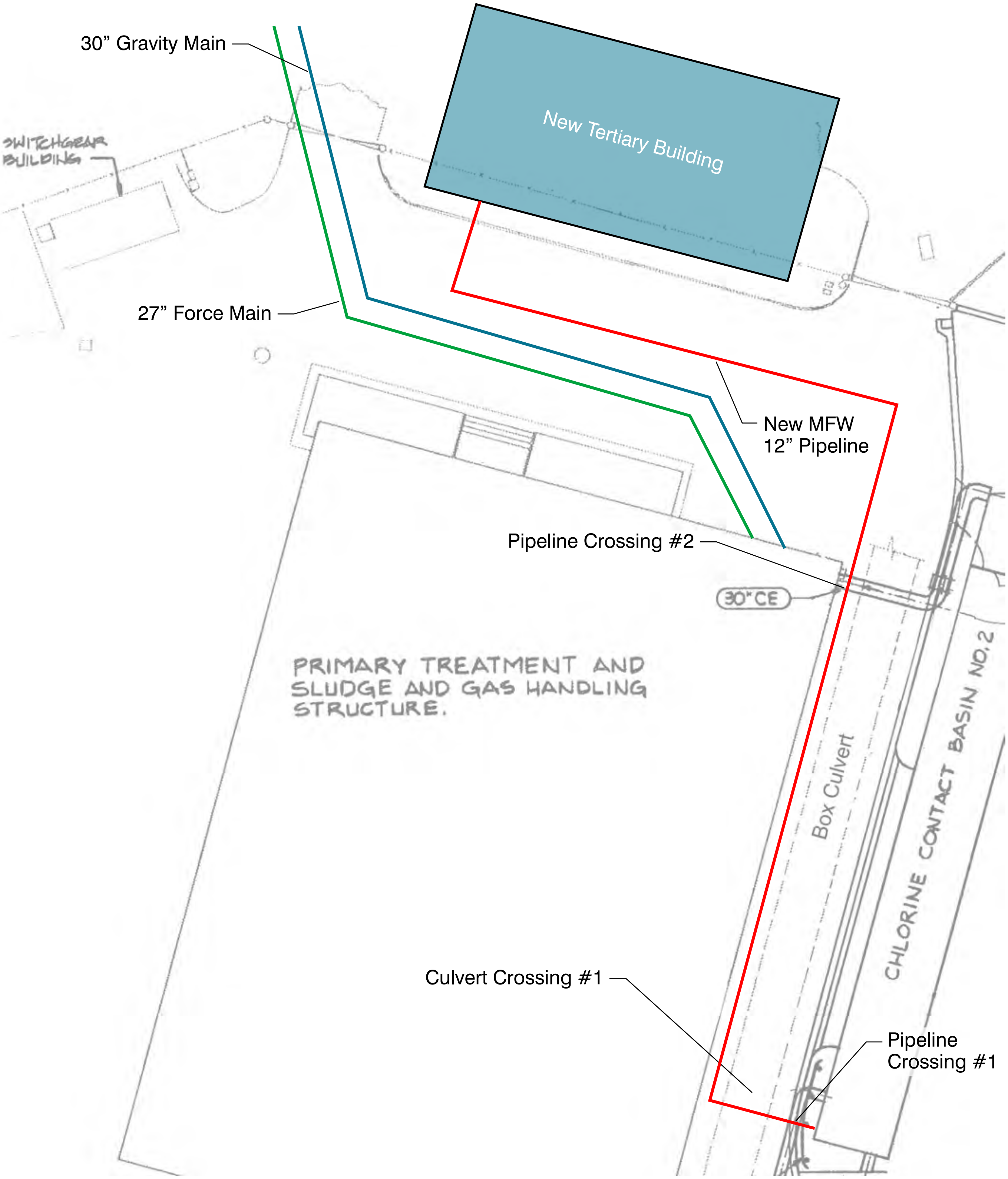
Process	Description	Material	Linear Feet
Membrane Feed Water (MFW)	12-inch from SEPS to Membranes	HDPE	310
Cross Flow (XR)	4-inch from Membranes to Headworks	HDPE	250
Membrane Filtration Wash Water (MFWW)	6-inch from BWW Tank to Headworks	HDPE	250
Clean In Place Waste (CIPW)	8-inch from Membranes to Neutralization Tank	HDPE	50
Clean In Place Waste (CIPW)	8-inch from Neutralization Tank to Headworks	HDPE	250

Notes:
SEPS = Secondary Effluent Pump Station.
BWW = Backwash Waste.

8.2 Membrane Feed Water Pipeline

Secondary effluent will be routed in a 12-inch pipeline from the secondary effluent pump station to the new Tertiary Treatment building. Figure 1.14 shows the proposed pipeline route.

With this pipe route, the proposed secondary effluent pipeline will have to cross over an existing 30 inch chlorinated effluent line after exiting the secondary effluent pump station (Pipe Crossing #1) and under an existing box culvert (Culvert Crossing #1). At its shallowest, the existing chlorinated effluent line is approximately 15 feet below grade. At its deepest, the base of the existing box culvert is approximately 9.5 feet below grade. Thus, the new 12-inch line will pass over the existing chlorinated effluent pipe and under the existing box culvert at approximately 10.5 feet below grade (top of pipe).



MEMBRANE FEED WATER PIPELINE ALIGNMENT

FIGURE 1.14

The new secondary effluent pipe will then run beneath an existing 12-inch recycled effluent line and alongside the existing box culvert. As shown in Figure 1.15, there will be 2 feet of clearance between the existing recycled effluent pipe and the new secondary effluent pipe. There will also be 3 feet of clearance between the existing box culvert and the new secondary effluent pipe.

The new secondary effluent pipe will also have to cross over an existing 30-inch chlorinated effluent line located at the north side of the chlorine contact basin No. 2 (Pipe Crossing #2). At its shallowest, this existing chlorinated effluent pipe is buried approximately 13 feet below grade. The new 12-inch line will pass over the existing pipe at approximately 5.5 feet below grade (top of pipe).

The new secondary effluent pipe will then make a 90 degree turn towards the west and an additional 90 degree turn to the north to reach the new Tertiary Treatment building.

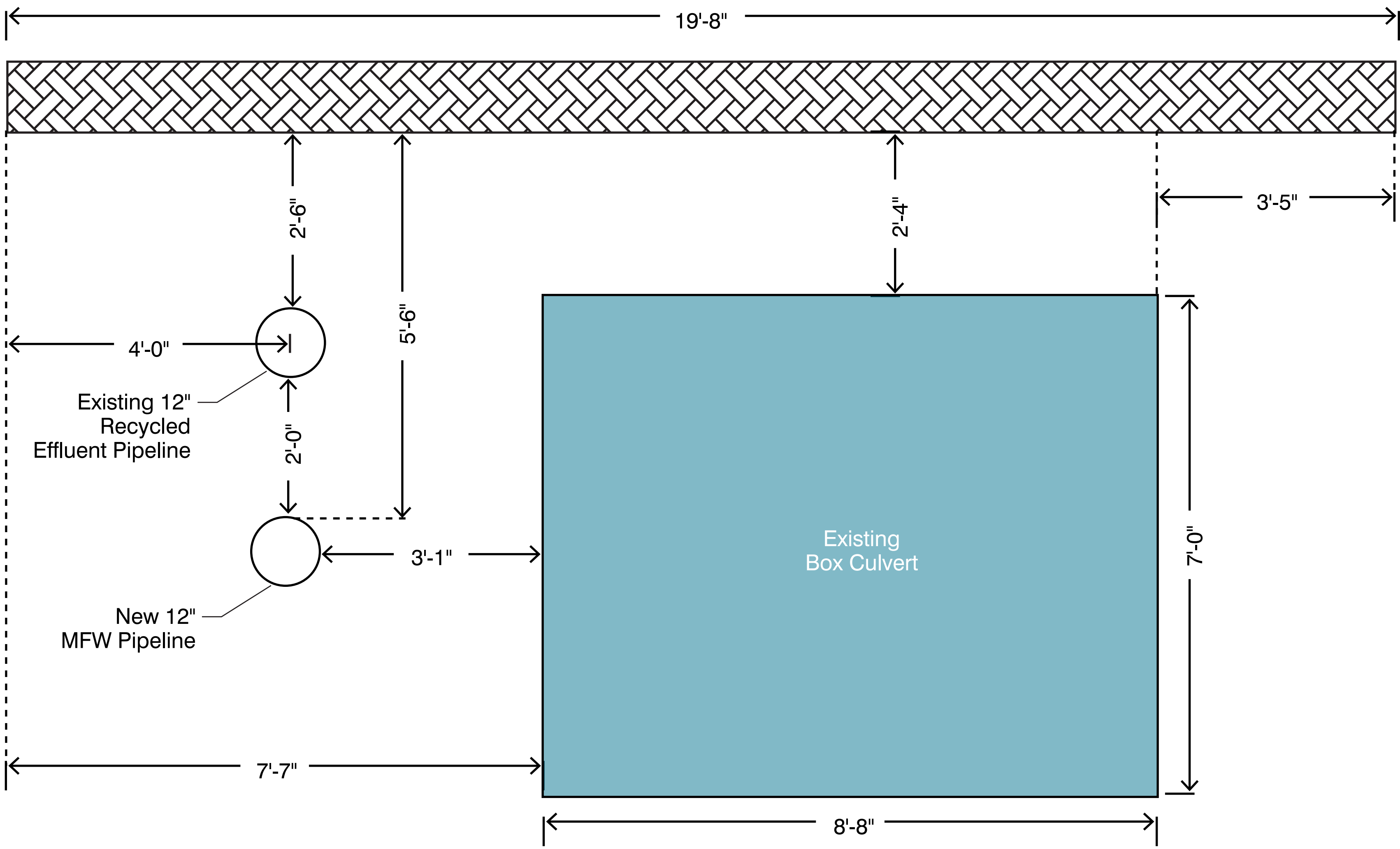
8.3 Cross Flow and Membrane Filtration Wash Water Pipeline

The Cross Flow (XR) and Membrane Filtration Wash Water (MFWW) pipelines transport wastewater from the membrane treatment process to Headworks No. 1 to be recycled through the WWTP process. The XR pipeline is 4 inches in diameter and the MFWW pipeline is 6 inches in diameter. Figure 1.16 shows the proposed routing for these two pipelines.

There is an existing pipe chase that runs from the sludge thickeners to the Primary Equipment gallery, just under the ground surface. Its depth varies, but averages about 9 feet deep. To avoid this pipe chase, the XR and MFWW pipelines will be routed underneath this pipe chase.

Both pipelines are routed to an existing sewer manhole which discharges into Headworks No.1. This manhole will need to be replaced. Additionally, the existing sewer line from the manhole to the headworks is 12 inches in diameter and will likely have to be upsized, as shown in Figure 1.16.

Additionally, there is a proposed project to locate Air Flotation Thickening electrical equipment along the primary equipment gallery, just south of the pipe chase ("Air Flotation Thickener Building Electrical Upgrades" [Carollo, 2016]). The proposed building would be approximately 30 feet long by 6 feet wide and would interfere with the proposed XR and MFWW pipe routing. If this project moves forward, the XR and MFWW pipes would be routed around this building to the west.



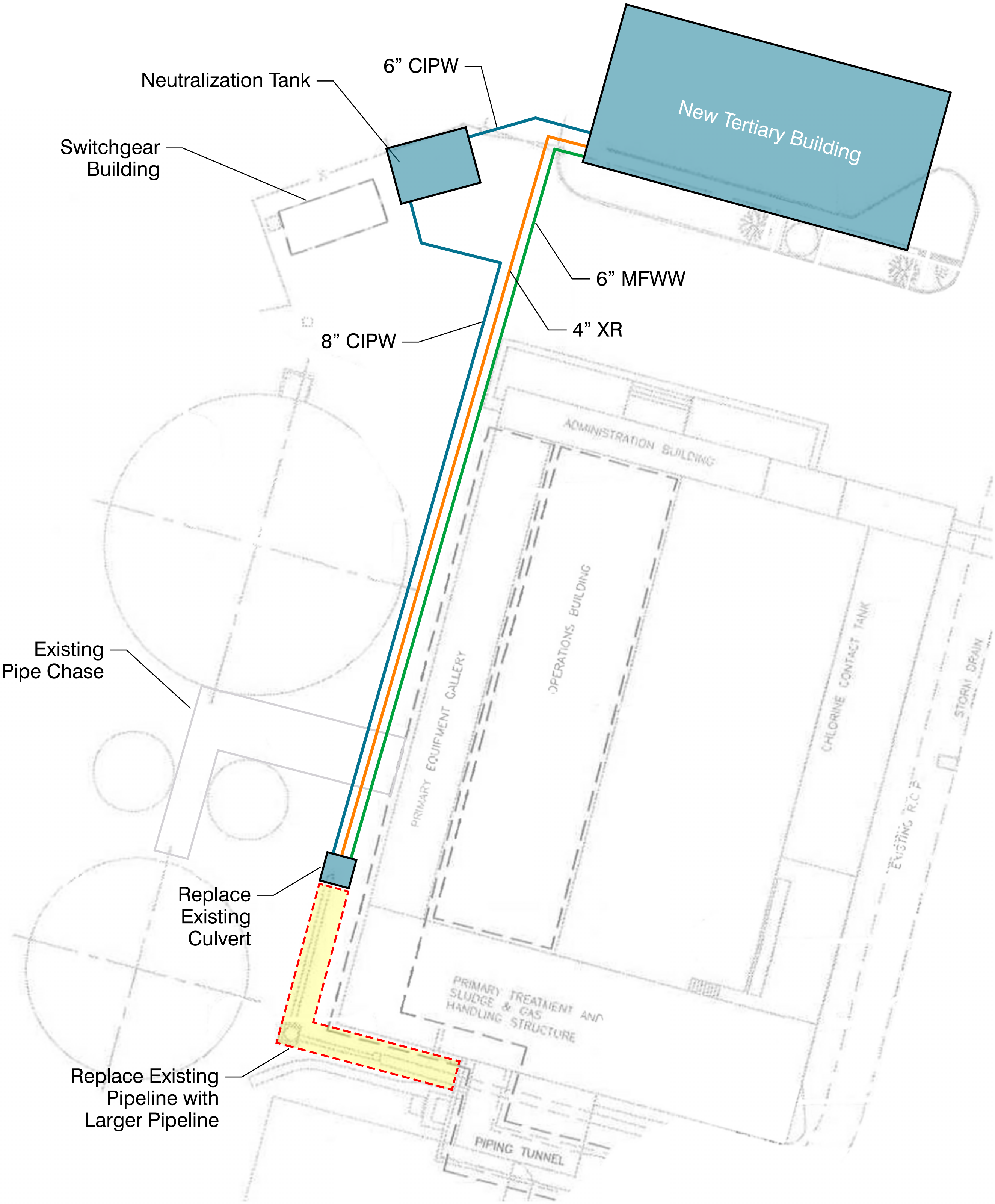
TYPICAL MEMBRANE FEED WATER PIPELINE ALIGNMENT

FIGURE 1.15

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

carollo

dc0117-10076rf2.ai



PROPOSED XR, MFWW, CIPW, AND FLW YARD PIPELINE ROUTING

FIGURE 1.16

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

carollo

dc0117-10076rf3.ai

8.4 Clean-In-Place Waste Pipeline

The first portion of the Clean-in-Place Waste (CIPW) pipeline conveys clean-in-place waste from the membrane building and transports it in an 8 inch pipeline to the neutralization tank. The pipeline is routed from the west side of the new tertiary building to the underground neutralization tank at a depth of approximately 3 feet, as shown in Figure 1.16. This pipeline will pass over the re-routed final effluent force main and gravity main. To provide at least 1 foot of clearance below the new pipelines, the new final effluent force main will need to be located at least 4.5 feet below grade. This is deeper than the existing line.

The second portion of the CIPW pipeline will transport neutralized, clean-in-place waste from the neutralization tank back to the headworks of the WWTP. The size of this pipeline is 8 inches. The 8-inch pipeline will follow a similar path as the XR and MFWW pipelines described in Section 8.3 above. This pathway is shown in Figure 1.16. A typical pipe alignment for the CIPW, XR, and MFWW pipelines is shown in Figure 1.17.

8.5 Final Effluent Pipelines

The proposed Tertiary Building will be located directly on top of the two existing plant effluent pipelines, and thus these pipes along with the connected surge tank will need to be relocated with this project.

8.5.1 Existing Location

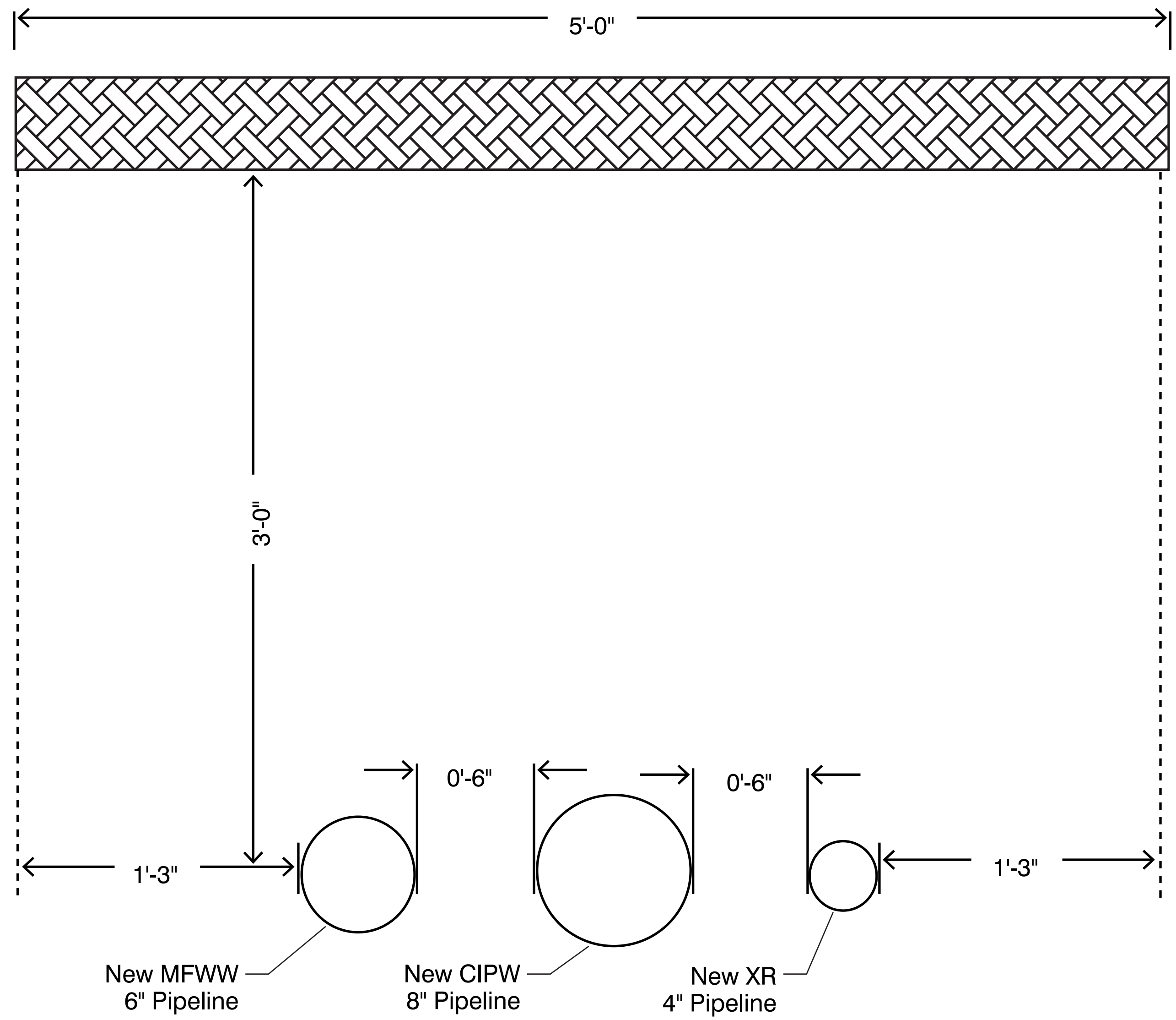
As shown in Figure 1.18, one of these pipes is a 30 inch gravity main while the other is a 27-inch force main. Figure 1.18 also shows the location of the existing surge tank for the effluent force main.

The existing 30 inch gravity main is currently buried under 2.5 feet to 3 feet of cover and the existing 27-inch force main is currently buried under 7 feet to 8 feet of cover at the location of the proposed Tertiary Building. The existing gravity main slope is 0.16 percent. Figure 1.18 shows the existing pipe profiles.

8.5.2 Proposed Route

To minimize the amount of earthwork required with this project, moving the two effluent pipes to the west of the proposed Tertiary Building is preferred, as excavation of that area will be required for other yard piping with the project. Figure 1.19 shows the proposed effluent pipe re-routing location.

This re-routing will add approximately 32 feet of piping to both the gravity and force main lines. While this additional piping is not expected to impact the force main, this additional piping will decrease the gravity main slope to 0.15 percent. This slope decrease will decrease the gravity line pipe capacity from approximately 10.6 mgd to 10.2 mgd, based on preliminary hydraulics calculations.



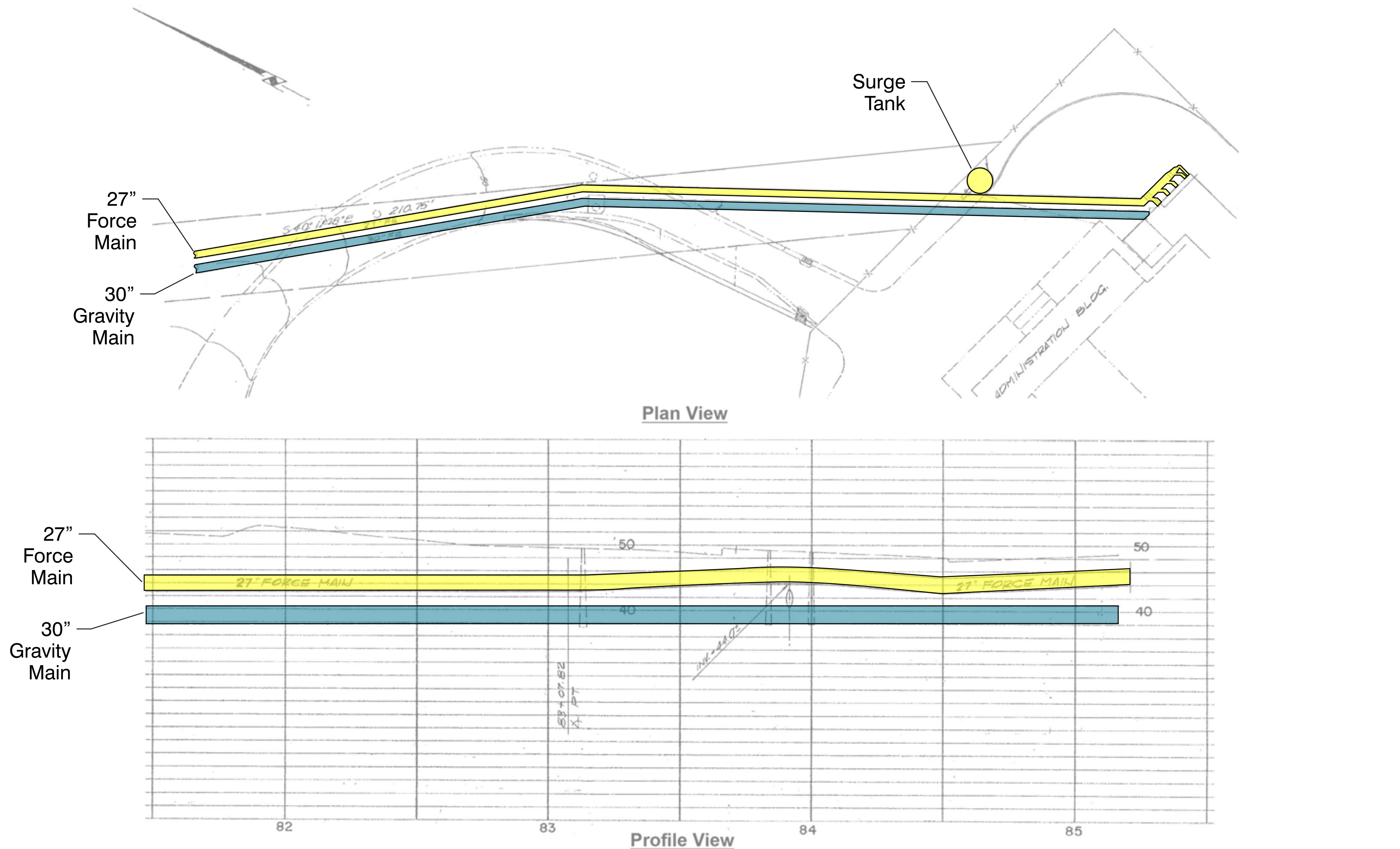
TYPICAL MFWW, CIPW, AND XR PIPELINE ALIGNMENT

FIGURE 1.17

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

carollo

dc0117-10076rf4.ai

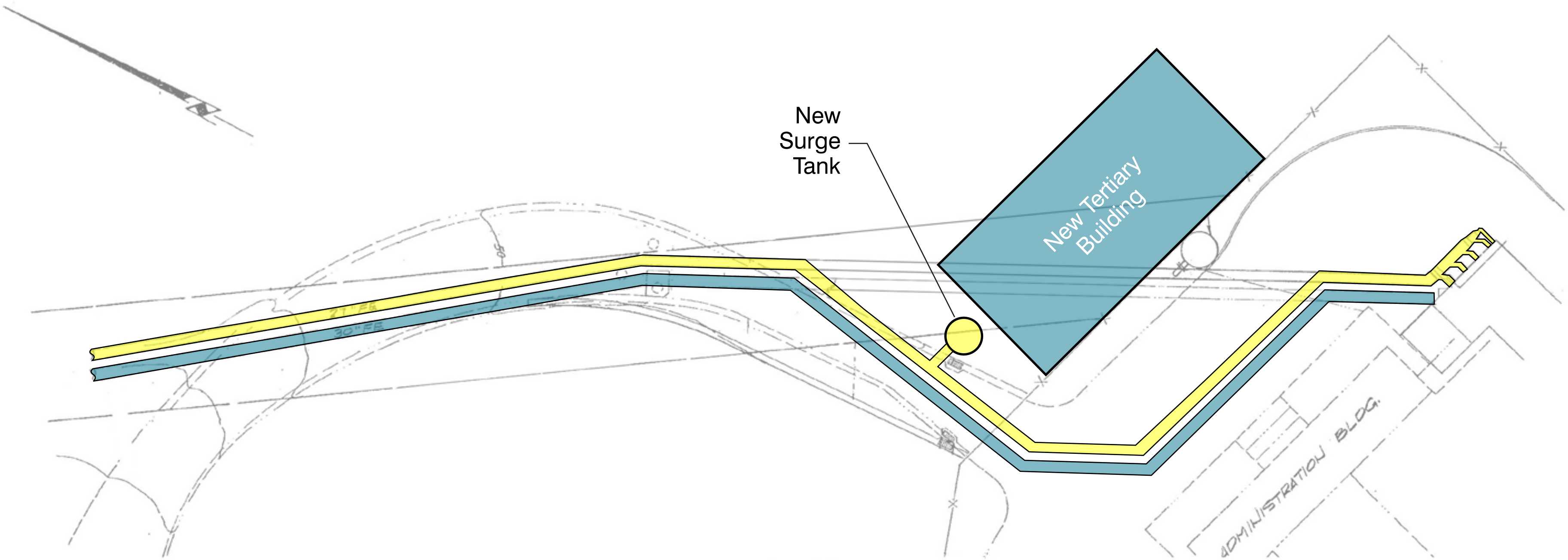


EXISTING EFFLUENT PIPELINE ROUTE

FIGURE 1.18

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

dc0117-10076rf5.ai



Plan View

PROPOSED PIPELINE ROUTE

FIGURE 1.19

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

The re-routed force main will also need to be buried deeper than it currently is to accommodate new yard piping required with this project. These requirements are discussed further in Section 8.4. Additionally, as shown in Figure 1.19, the existing surge tank will be relocated as shown.

Figure 1.20 shows the existing lines that will be impacted by this effluent pipe re-routing. All of these impacted pipes are small, ranging in size from 1 inch to 3 inches. It is likely that they are buried no more than 1 foot below grade and thus will not conflict with the proposed effluent pipe relocation.

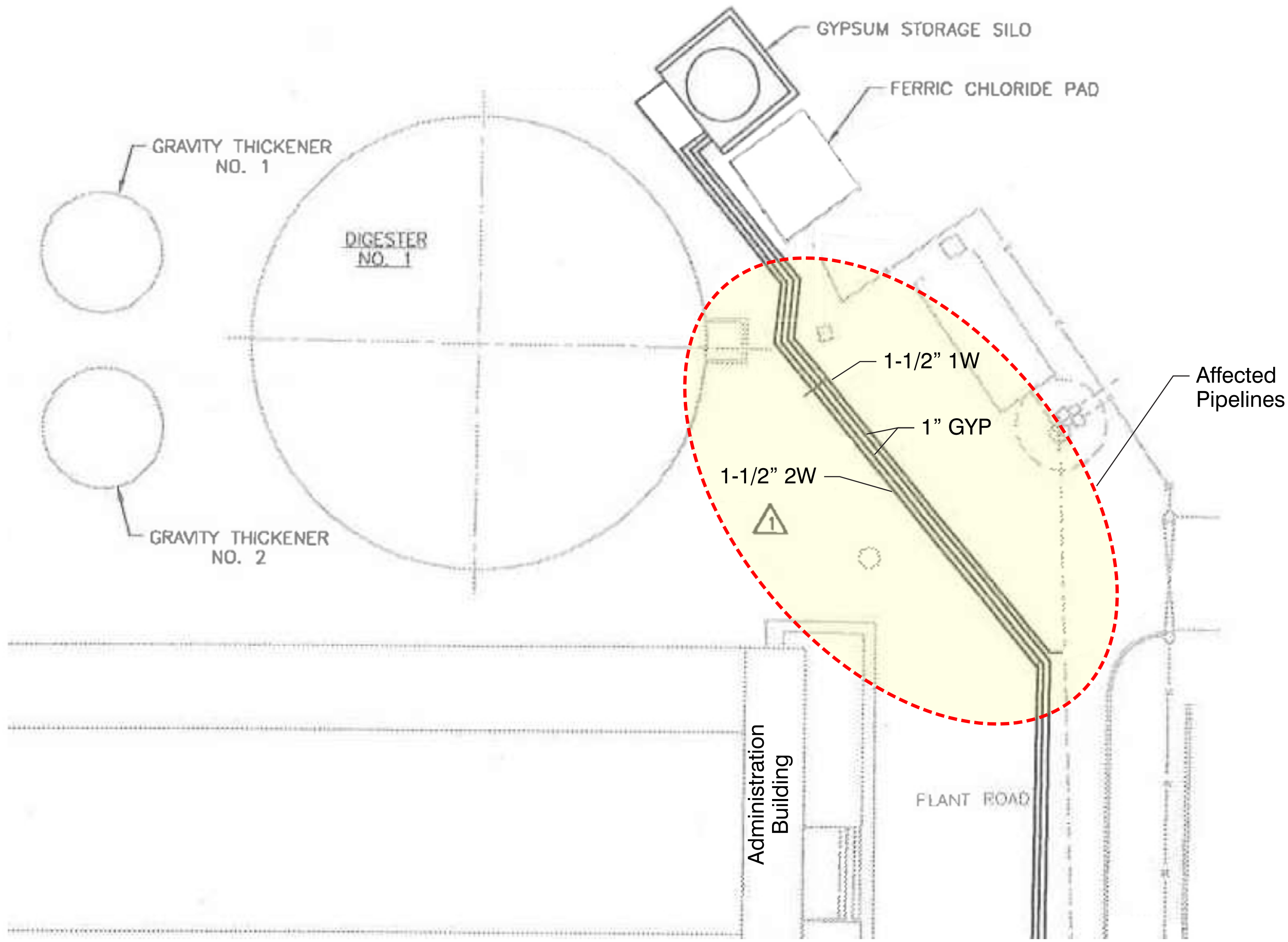
9.0 IMPACTS ON EXISTING PROCESSES

9.1 Outfall

The new tertiary system will treat up to 3.60 mgd of secondary effluent, which under existing conditions would have been disinfected and discharged to the ocean outfall. Therefore, when the available secondary effluent is equal to or less than the demand of the recycled water systems (maximum 6.37 mgd), there will be no water discharged to the ocean outfall. The ocean outfall has duckbill valves, so sediment intrusion during this no flow condition is likely not a concern. However, this mode of operation would affect the current outfall disinfection dosing strategy and the water surface elevation at the secondary effluent pump station.

Based on discussion with Daly City staff, it is understood that the outfall disinfection dosing is flow paced and has a minimum applied dose in case of flow instrument failure. The chemical dosing program would need to be adjusted to account for a no flow condition through Chlorine Contact Tank No. 1.

The secondary effluent pump station and the Chlorine Contact Tank No. 1 are hydraulically connected. The water surface elevation in the pump station is set by the weir at the end of the contact tank. Therefore, when there is no flow through the contact tank, the water surface elevation will be below the downstream weir and set by the membrane feed pumps. Programming would need to account for this change in water surface elevation.



AFFECTED PIPELINES

FIGURE 1.20

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

carollo

dc0117-10076rf7.ai

9.2 Plant Operation

Currently the Daly City WWTP diverts up to 2.77 mgd of flow to their existing tertiary treatment facility. With the addition of the new tertiary treatment facility, an additional flow of up to 3.60 mgd will be diverted as well. These flow diversions account for almost all of Daly City's effluent flow. This high level of flow diversion requires optimization of the equalization basin operation to ensure a sufficient recycled water supply.

Under current plant operation, operators try to fill and drain the equalization basins each day by slowly filling the equalization basins during the day and draining the equalization basins during the night. Throughout the day, the flow setpoints and corresponding flow to the secondary treatment process are constantly changing. However, the available secondary effluent flow is typically sufficient with this operating strategy to meet the existing tertiary system demand, so there has not been a need to optimize the equalization strategy.

With the new tertiary treatment facility, the current equalization basin operation strategy will need to be modified to maximize the water available for the tertiary treatment system. The goal of equalization is to provide a relatively constant flow to secondary treatment and tertiary treatment. This is achieved by following a drain and fill schedule and using a set of constants developed that are specific to the time of day and day of the week to determine the fill and drain flow rate. PM 07, titled "Feasibility of Expanded Tertiary Recycled Water Facilities" (Carollo, 2016) provides a detailed discussion of the proposed operating strategy. Full-scale implementation of this operation strategy would require SCADA programming changes to automate the equalization fill and equalization drain flow setpoint calculation.

9.3 No. 2 Water System

The No. 2 Water System provides a non-potable water supply for the plant. The system consists of an air gap tank, two pumps, and a hydropneumatic tank. The proposed Tertiary Building will be located in the current location of the No. 2 Water System, and thus this system and its associated piping connections will need to be relocated north of the existing Recycled Effluent Pump Station. The plant's property fence will be extended north to enclose the relocated system and provide access from within the plant.

10.0 ELECTRICAL

This section describes the electrical system upgrade needed to supply power to the new Tertiary Treatment Facilities.

10.1 Existing 12kV System

The Daly City WWTP is served by a single overhead, 12-kilovolt Pacific Gas and Electric (PG&E) feeder. Primary power is distributed through the plant by a medium voltage, metal enclosed switchgear. The metal enclosed switchgear contains the PG&E metering section, a main fused interrupter switch, and three fused interrupter distribution switches. The metal enclosed switchgear was installed during the original plant construction in the late 1970s. At that time, each distribution switch powered a single 12kV to 480V step-down transformer. Plant expansions in the late 1980s and early 2000s each added an additional step-down transformer so there are currently a total of five. The feeders and transformer that feed the Operations Building and the Effluent Pump Station do not appear to have been modified. Transformers and load centers for the Primary Sedimentation Basins, and the Tertiary Facilities were added to the original feeder that served the Maintenance Building. Load break switches located in the plant at the transformers were used to extend the 12kV power feeds. The only modifications to the metal enclosed switchgear were new fuses. Figure 1.21 shows the current medium voltage distribution at the plant.

Standby power is provided at the 480 volt level by two standby generators. The generators are equipment with paralleling controls. Based on the existing plant one-line diagrams, standby power is available to all facilities except the Tertiary Facilities that were constructed in the early 2000s.

The metal enclosed switchgear is located in a concrete building near the plant front gate at the location of the proposed chemical staging area. There is no room in the building to expand the switchgear by adding additional switches. The working space in front of the switchgear also does not meet current electrical code requirements. As the switchgear is approximately 40 years old, Carollo recommends replacing the existing metal enclosed switchgear with a new metal-clad circuit breaker switchgear.

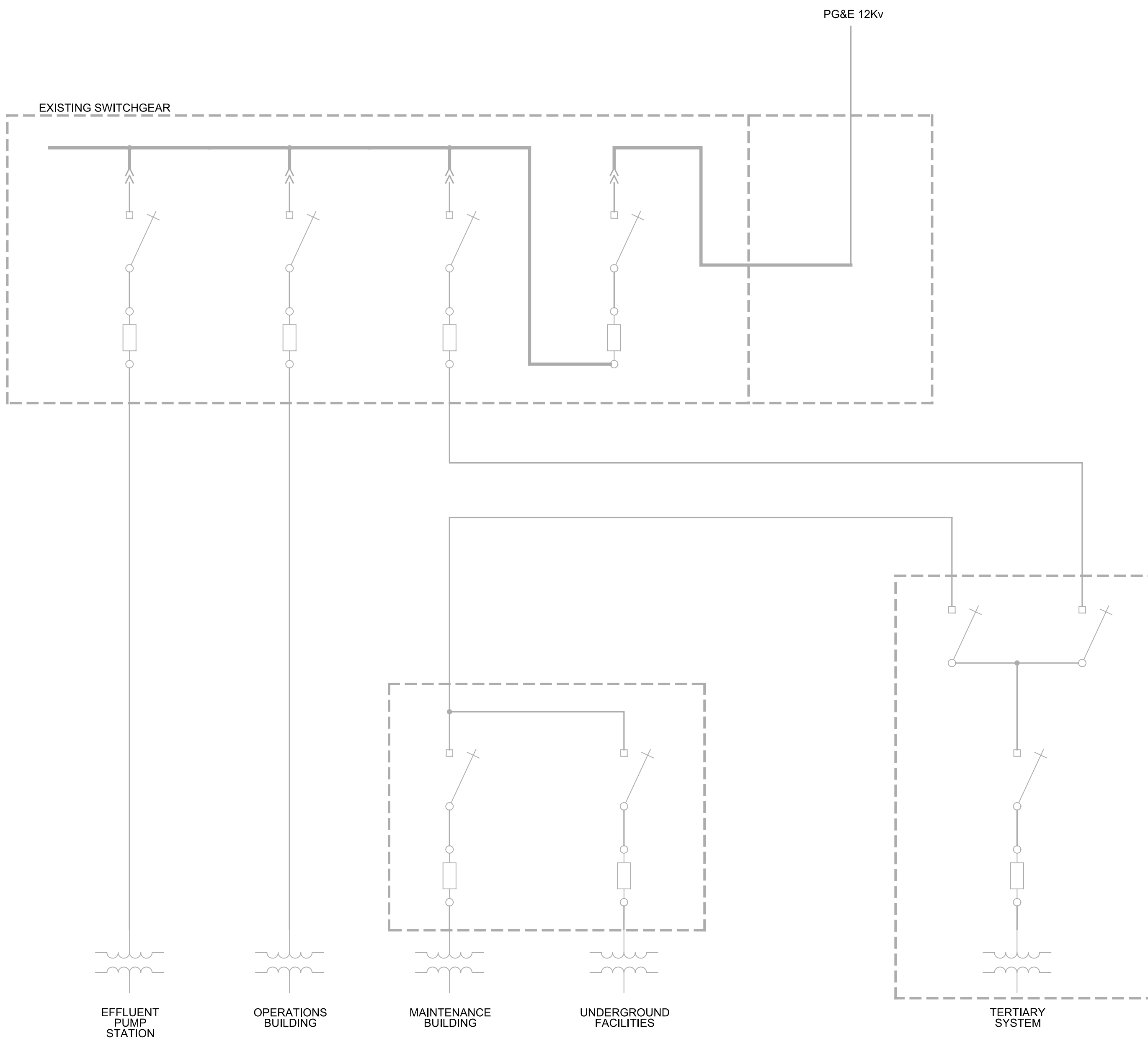
10.2 New 12kV System

10.2.1 <u>12kV Building</u>

A new 12kV switchgear building will be constructed just north of the proposed Tertiary Treatment building. This location may not be ideal for maintenance access, but the location does not interfere with construction of the new tertiary facilities and is close to the existing incoming PG&E service.

Figure 1.22 shows the proposed 12kV Building. The new switchgear building will be constructed with electrical safety in mind. The 12kV switchgear will be located in one room and a separate room will include controls and low voltage panels. The purpose of the low voltage control room is to remove the electrician from in front of the switchgear during maintenance operations such as opening or closing a circuit breaker or racking (inserting or removing) a circuit breaker. The majority of arc flash events occur during maintenance activities.

A third room for the switchgear batteries will also be provided. A separate battery room makes acid spill containment easier and reduces the size of the ventilation system required to meet Fire Code requirements. Batteries are used with medium voltage switchgear installations to provide reliable control power for the protective relays and for opening and closing the circuit breakers.

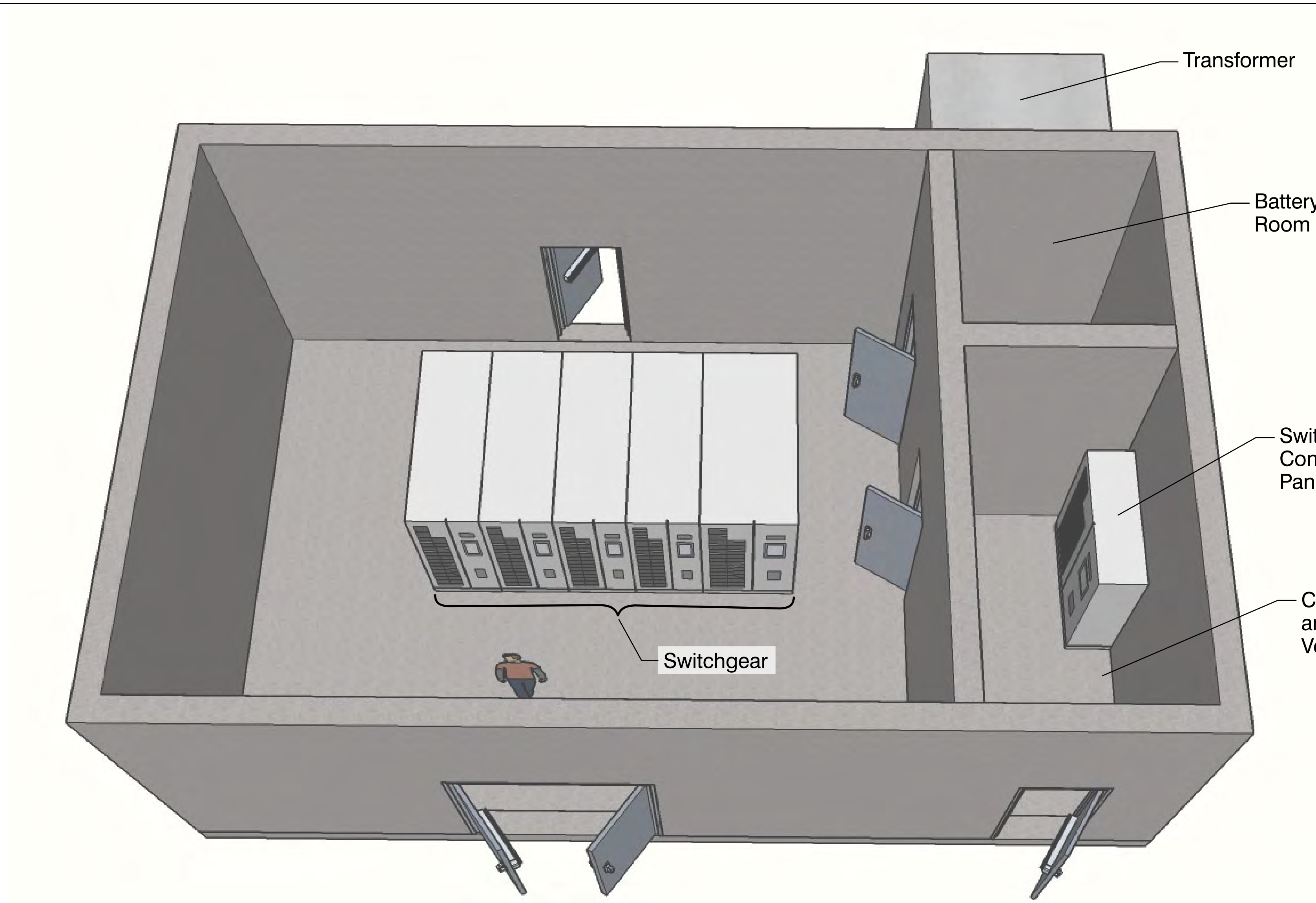


EXISTING SWITCHGEAR ONE-LINE

FIGURE 1.21

CITY OF DALY CITY
TM NO. 1
TERTIARY TREATMENT

carollo®



12KV SWITCHGEAR BUILDING LAYOUT

FIGURE 1.22

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

10.2.2 12kV Switchgear

The overall concept for the new 12kV switchgear will be similar to the existing switchgear with some important modifications.

The new 12kV switchgear will utilize medium voltage vacuum circuit breakers and microprocessor based protective relays. The protective relays can be adjusted to provide better electrical system coordination and protection. Load break switches with fuses as in the existing switchgear cannot be adjusted. Changing electrical system protection requires replacing the fuses. In the event of a fault, the protective relay opens the circuit breaker similar to a fuse opening to clear and electrical fault. Once the fault is repaired, the relay is reset and the circuit breaker closed. This requires less downtime than replacing fuses.

Bus differential protection is another protective feature that will be provided. The purpose of the bus differential protection is to quickly isolate electrical faults that occur within the switchgear limiting the arc flash event.

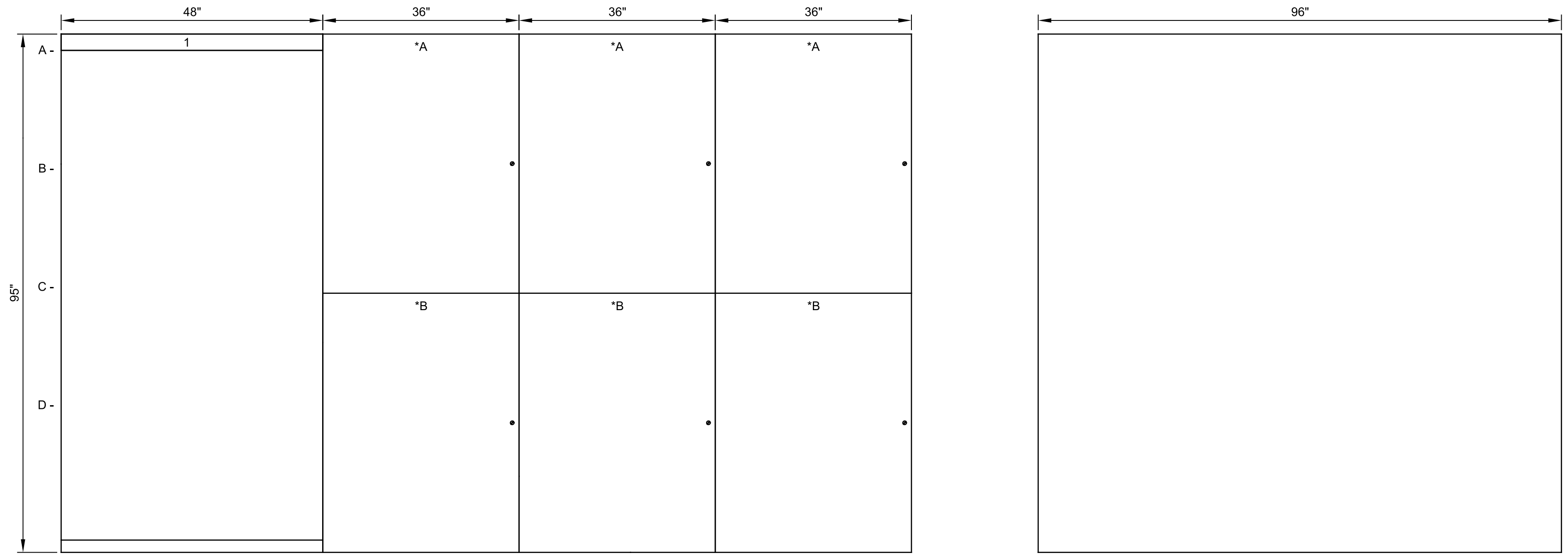
The new 12kV switchgear line up (Figure 1.23 and Figure 1.24) will include a PG&E metering section and a main circuit breaker. The number of feeders will be increased from three to six. The existing five transformers will be fed from individual circuit breakers. This is intended to increase overall system reliability and minimize the impact to plant operations in the event of an electrical fault. The sixth circuit breaker will feed the new tertiary facilities.

10.2.3 Power Transfer

One of the most crucial considerations when replacing the service equipment of a plant electrical system, is the impact on operations due to electrical interruptions. Careful planning and coordination with plant staff is required.

For the tertiary project, there are several steps that must occur before the electrical transfer can take place. Construction of the new 12kV switchgear building has to be completed, and the new 12kV switchgear installed. New ductbanks and raceway from the 12kV switchgear to the existing transformers must be completed and the new medium voltage cables installed. This work will be made easier by the using the existing tunnel system for much of the new installation.

The following additional work is required before the power transfer can occur. The electrical acceptance testing on the new 12kV switchgear and medium voltage cables must be completed and any deficiencies corrected. This ensures the new equipment can be expected to operate reliability. The other crucial work that must be completed is the Electrical Coordination Study. This study provides the settings required for the protective relays ensuring they will operate properly.



FRONT VIEW
SCALE: 3/4=1'-0"
FILE: 10076A1003E652

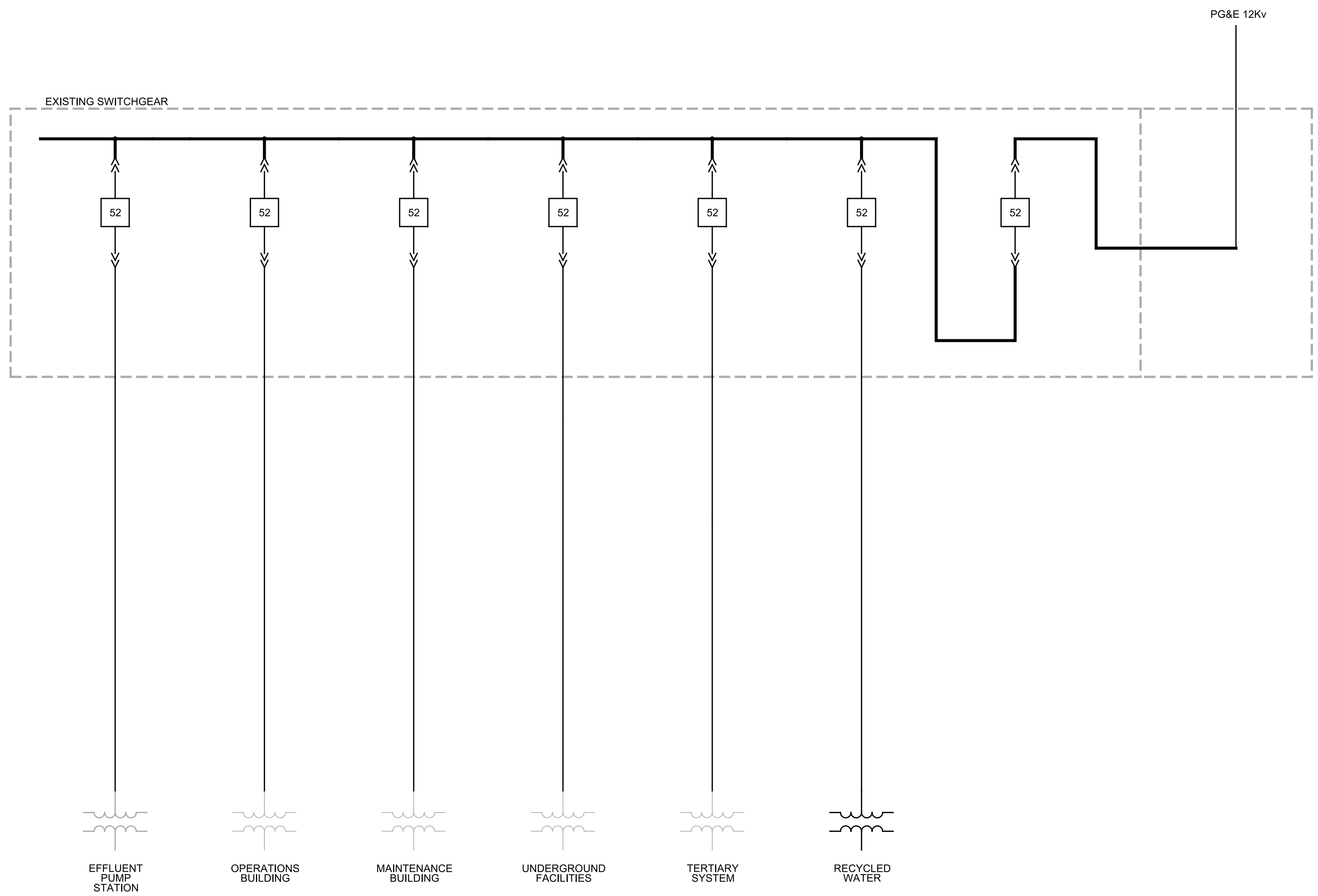
SIDE VIEW
SCALE: 3/4=1'-0"
FILE: 10076A1003E652

File: \\phx-pw-cfs-2\ICS\Model\2601\531403_7\10076A10FIG1-23.dgn
Plot Date: 01-MAR-2017 5:11:49 PM
User: svcPW

SWITCHGEAR ELEVATION

FIGURE 1.23

CITY OF DALY CITY
TM NO. 1
TERTIARY TREATMENT



SWITCHGEAR ONE-LINE

FIGURE 1.24

CITY OF DALY CITY
TM NO. 1
TERTIARY TREATMENT

Once the new electrical system is installed, tested, and programmed, the transfer to the new system can begin. The work can be scheduled to occur during low flow periods or during dry weather conditions to lessen the impact on plant operations. For outages that may result in a permitting violation or other unacceptable condition, temporary power (standby diesel generator) is often provided. Carollo recommends requiring the contractor to provide standby power rather than allowing them to use the Owner's existing generators.

The sequence for transferring to the new electrical service will be determined during final design; however the Maintenance Building and Underground Facilities should be transferred before the Tertiary Facility to avoid multiple power interruptions to those areas.

10.3 New Tertiary Facility Electrical System

The electrical equipment for the new Tertiary Facility will be located in the Tertiary Treatment building in a dedicated, conditioned, electrical room, as shown in Figure 1.25. The HVAC conditioning will help keep the equipment free of corrosion, dust, dirt and other contaminants and regulate the room temperature. The dedicated room will keep unauthorized people away from the electrical equipment reducing the potential for injury due to an arc flash event.

12kV power will be fed to the new Tertiary Building from the new 12kV switchgear. An oil-filled outdoor transformer will be used to step the voltage down to 480 volts for use by the process and HVAC equipment. 120V power for small loads, lighting and receptacles will be provided by a dry-type transformer located in the electrical room.

Variable frequency drives for motors larger than 60 horsepower will be "clean-power" equipment to mitigate the effects of harmonics on the rest of the electrical system.

LED lighting will be used and lighting power levels will comply with the California Energy Code, Title 24 Part 6.

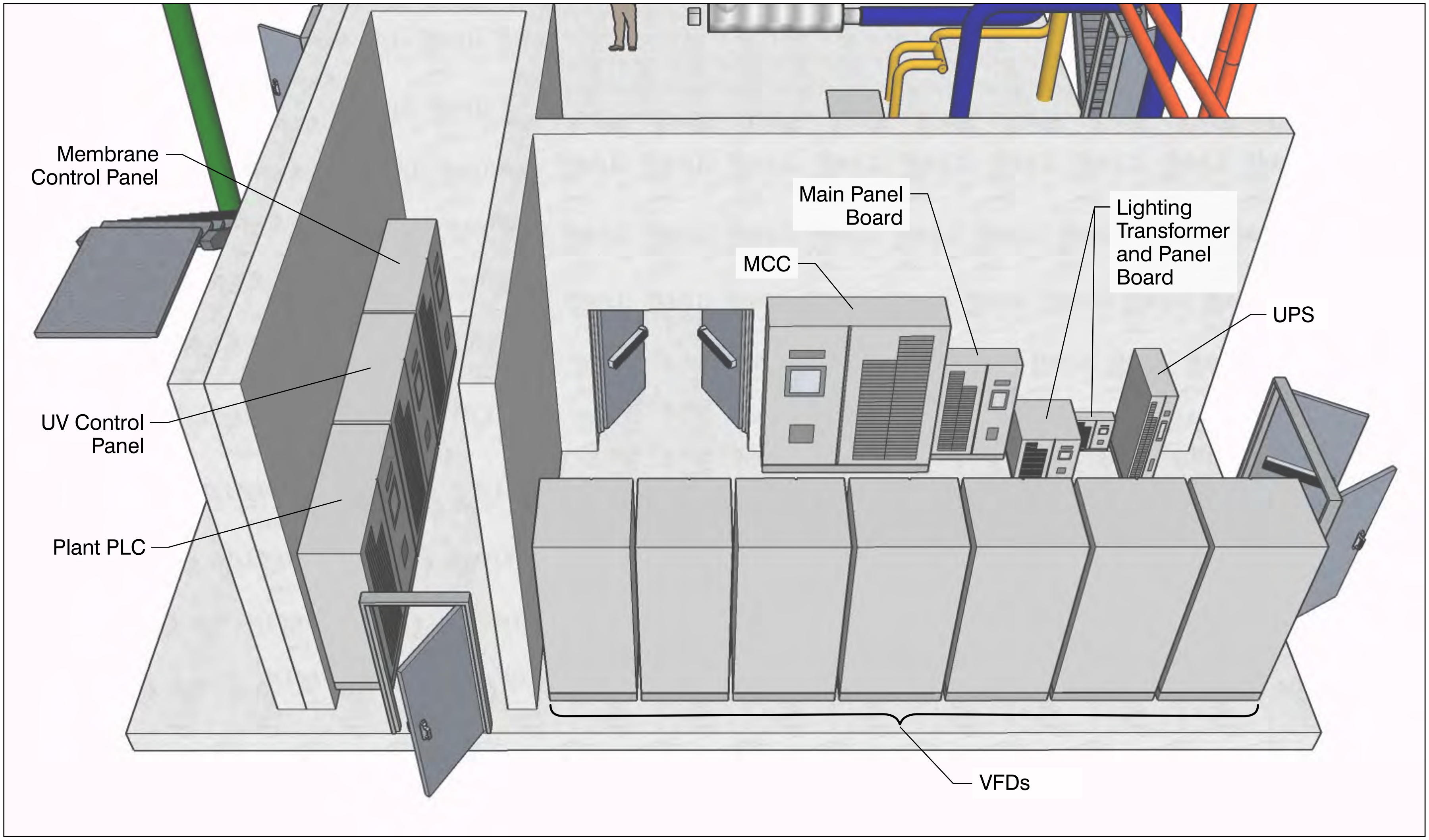
11.0 COST ESTIMATE

11.1 Basis for Estimate

The project is currently in the preliminary design phase and the design has not been developed in detail. The construction cost estimates are consistent with an AACE International Class 4 budget estimate with an accuracy range of +50 percent to -30 percent of the actual project cost.

11.1.1 <u>ENR Benchmark</u>

Providing a cost benchmark for construction estimates is useful in documenting the time of estimate preparation and in allowing for projections and escalations to later dates using the equivalent index value.



ELECTRICAL ROOM AND CONTROL ROOM LAYOUT

FIGURE 1.25

CITY OF DALY CITY
TM NO. 1 – TERTIARY TREATMENT

carollo

dc0117-10076rf22.ai

This preliminary design cost estimate is benchmarked to the Construction Cost Indices (CCI) published by the Engineering News Record (ENR) for August 2017, which is the most current ENR. We recommend using the ENR San Francisco CCI for the Daly City region, which was 12037 for August 2017.

11.1.2 Unit Costs

Unit costs have been researched and used for the major pipeline and structure components of the Project. These major components include water piping, pumps, valving, structures, and appurtenances. Unit costs have also been developed using preliminary quotations received from equipment and material manufacturers supplemented with installation costs based on past experience with similar projects, available recent bid data, or cost estimating guidelines derived from estimating guides such as the 2017 RS Means Heavy Construction Data publication, the most current publication to date.

11.1.3 Contingencies

Contingencies are typically applied to a construction estimate at the design development phase to account for construction items not yet identified, and construction design unknowns. As the design is refined and finalized, the contingency, typically expressed as a percent of the raw construction cost, will trend downward. At the completion of the design, the contingency should represent only a reasonable construction change order allowance. Agencies typically retain contingency within their project budgets, even when construction contract award values are known, to cover the cost or deal with unforeseen conditions.

A 30 percent contingency, calculated based on the raw construction cost, has been included in the cost estimate. This is in alignment with the recommendations for a project at an AACE Class 4 level of development.

11.2 Cost Estimates

The total estimated construction cost is estimated at $23,752,000 for the Tertiary Facilities at the WWTP. This cost estimate includes a +50 / -30 percent accuracy and the cost ranges from $16,626,000 - $35,628,000. Table 1.28 provides a summary of the Tertiary Treatment cost estimate. Appendix B includes a detailed breakdown of the construction cost estimates.

Table 1.28 Tertiary Treatment Construction Cost Summary
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

No.	Item		Estimated Cost
01	Secondary Effluent Pump Station		$401,000
02	Membrane Filtration System(1)		$4,236,000
03	Disinfection		$1,615,000
04	Tertiary Building		$1,790,000
05	Recycled Effluent Pump Station		Included in TM 2(2)
06	Chemical Systems		$373,000
07	Yard Piping		$747,000
08	Existing Equipment Relocation		$533,000
09	Electrical		$2,893,000
	TOTAL DIRECT COST		**$12,588,000**
	Contingency	30%	$3,776,000
	Subtotal		**$16,364,000**
	General Contractor Overhead, Profit & Risk	12%	$1,964,000
	Subtotal		**$18,328,000**
	Escalation to Mid-Point(2)	12.6%	$2,313,000
	Subtotal		**$20,641,000**
	Sales Tax (Applied to 50% of Total Direct Cost)	9.0%	$566,000
	Subtotal		**$21,207,000**
	General Conditions	12%	$2,545,000
	TOTAL ESTIMATED CONSTRUCTION COST		**$23,752,000**
	Cost Range		***$16,626,000 - $35,628,000***
	Engineering, Legal & Administration Fees	20%	$4,750,000
	Owner's Reserve for Change Orders	5%	$1,188,000
	TOTAL ESTIMATED PROJECT COST		**$29,690,000**

Notes:
(1) Based on the polymeric membrane system
(2) This cost is included in TM 2 titled, "Colma Delivery System" (Carollo, 2017) because it helps differentiate between the alternatives considered.
(3) Based on a compound annual escalation rate of 4%, a design duration of 18 months starting in January 2018, and a construction duration of 24 months starting in June 2019.

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

11.3 Cost Estimate Comparison to 2009 Feasibility Study

The Tertiary Treatment costs developed in this TM are comparable to the costs developed in the 2009 Feasibility Study (Carollo, 2009) when escalated to 2017 dollars. Table 1.29 provides a comparison of the 2009 and 2017 cost estimates.

As shown in Table 1.29, the total estimated direct cost increased by $2 million in this study when compared to the escalated 2009 Feasibility Study cost estimate. This increase in cost is due to the following:

- The need for a larger building.
- The need for four membrane racks instead of three.
- Better defined electrical system modifications.

Table 1.29 Treatment Cost Comparison Table
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

	2009 Feasibility Study Cost Estimate (Sept. 2009 Dollars)	Escalated 2009 Feasibility Study Cost Estimate (Aug. 2017 Dollars)	2017 TM 1 Cost Estimate (Aug. 2017 Dollars)
Total Estimated Direct Cost	$8,584,000	$10,626,000	$12,588,000
Total Estimated Construction Cost	$16,601,000	$20,550,000	$23,752,000
Total Estimated Project Cost	$20,751,000	$25,687,000	$29,690,000

Notes:
(1) In all estimates the Recycled Effluent Pump Station is not included. The cost for this pump station is discussed in TM 2, titled "Colma Delivery System" (Carollo, 2017).

11.4 Operation and Maintenance Cost

The project team developed estimates for the operation and maintenance (O&M) costs for the Tertiary Facilities at the WWTP. The O&M costs include the power costs, chemical costs, membrane replacement, and annual maintenance of the equipment.

The O&M costs assume that recycled water is delivered 7 months out of the year. During this delivery period, it was assumed that the Tertiary Facility is operating 24 hours per day, 7 days per week. The O&M costs are presented in Table 1.30.

Table 1.30	**Annualized O&M Cost Estimate(1) Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City**	
Parameter	**Polymeric Membrane System**	**Ceramic Membrane System**
Power	$242,000	$255,000
Maintenance(2)	$195,000	$195,000
Chemicals	$312,000	$731,000
Membrane Replacement(3)	$674,000	$362,000
Total	**$1,423,000**	**$1,543,000**

Notes:

(1) Annualized based on a project life of 50 years and 2.5% annual inflation
(2) Assumed baseline maintenance cost (Year 1) as $100,000.
(3) Based on complete membrane replacement every 4 years for the polymeric membranes and 10 years for the ceramic membranes.

12.0 SCHEDULE

It is anticipated that final design would start in 2018 and last for approximately 18 months. This design period includes time for procurement of the membrane system. Construction would then begin in 2019 and last for approximately 24 months. A Project schedule is shown in Figure 1.26.

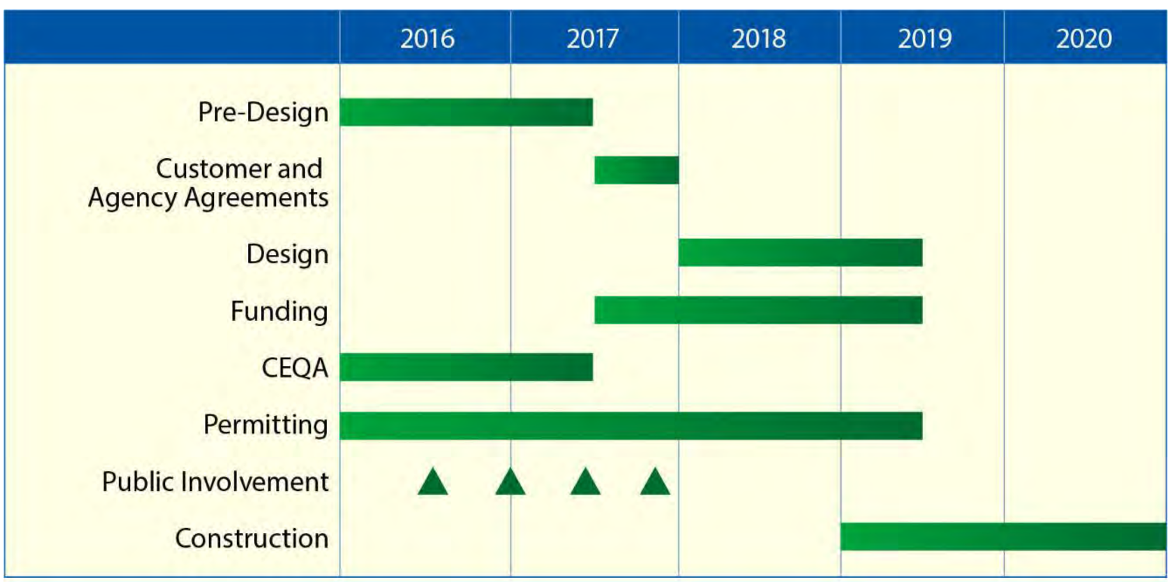


Figure 1.26 Project Schedule

13.0 DRAWINGS

Drawings of the proposed Tertiary System are included in Appendix A.

APPENDIX A – DRAWINGS

Provided as a separate document.

APPENDIX B – COST ESTIMATE

Engineers...Working Wonders With Water®

PROJECT SUMMARY

Project:	Daly City RW Pre-Design: Treatment Plant	Estimate Class:	4
Client:	North San Mateo County Sanitation District	PIC:	MJB
Location:	Daly City, CA	PM:	DGB
Zip Code:	94014	Date:	May 31, 2017
Carollo Job #	10076A.10	By:	EC
		Reviewed:	DGB

NO.	DESCRIPTION		TOTAL
01	SEPS		$401,000
02	Membrane Filtration System		$4,236,000
03	Disinfection		$1,615,000
04	Tertiary Building		$1,790,000
05	REPS		Included in TM 2
06	Chemical Systems		$373,000
07	Yard Piping		$747,000
08	Existing Equipment Relocatio		$533,000
09	Electrical		$2,893,000
	TOTAL DIRECT COST		**$12,588,000**
	Contingency	30.0%	$3,776,000
	Subtotal		**$16,364,000**
	General Contractor Overhead, Profit & Risk	12.0%	$1,964,000
	Subtotal		**$18,328,000**
	Escalation to Mid-Point	12.6%	$2,313,000
	Subtotal		**$20,641,000**
	Sales Tax (Applied to 50% of Total Direct Cost)	9.0%	$566,000
	Subtotal		**$21,207,000**
	General Conditions	12.0%	$2,545,000
	TOTAL ESTIMATED CONSTRUCTION COST		**$23,752,000**
	Engineering, Legal & Administration Fees	20.0%	$4,750,000
	Owner's Reserve for Change Orders	5.0%	$1,188,000
	TOTAL ESTIMATED PROJECT COST		**$29,690,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

Carollo Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: Daly City RW Pre-Design: Treatment Plant
Client: North San Mateo County Sanitation District
Date : May 31, 2017
Location: Daly City, CA
By : EC
Element: 01 SEPS
Reviewed: DGB

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02000	Rental Piping and Associated Equipment	3.29	LS	$41,980.00	$137,934	
02000	Temporary Sewer Plugs	3.00	EA	$2,000.00	$6,000	
02000	Temporary Road Crossings Trench and Plate	2.00	EA	$5,000.00	$10,000	
02000	Temporary Piping Mob, Install, Removal, and Demob	1.00	LS	$47,750.00	$47,750	
02220	Demo Concrete Walls, Heavy Rebar, 12"	30	SF	$29.96	$899	
02220	Demo Concrete Housekeeping Pads	30	SF	$1.25	$38	
02220	12" Metal Pipe, Rem From Bldg Or Process Area	10	LF	$37.84	$378	
02220	Remove Valves From A Building, 12"	1	EA	$185.04	$185	
	Total					**$203,184**
	Division 03 - Concrete					
03300	12" Elevated Slab To 20'	4.44	CY	$553.50	$2,458	
	Total					**$2,458**
	Division 05 - Metals					
05120	Structural Steel Shapes & Plates - Gc	527.00	LB	$2.11	$1,111	
	Total					**$1,111**
	Division 11 - Equipment					
11000	200 HP Vertical Turbine SE Pump	2	EA	$65,734.00	$131,468	
	Total					**$131,468**
	Division 15 - Mechanical					
15112	12" 150# Fxf Awwa Butterfly Valve, No Op	3.00	EA	$3,669.84	$11,010	
15114	12"- 200 Psi Ci Fxf Swing Check Valve	2.00	EA	$8,565.04	$17,130	
15121	12" Flex Cplg, Above Ground	3.00	EA	$1,635.24	$4,906	
15267	12" Sdr11 Hdpe Fabricated Tee	2.00	EA	$2,221.23	$4,442	
15267	12" Sdr11 Hdpe Fabricated 90° Elb	3.00	EA	$1,620.57	$4,862	
15267	12" Sdr 11 Hdpe Pipe In Open Trench	48.00	LF	$48.54	$2,330	
	Total					**$44,679**
	Division 17 - Instrumentation and Controls					
17000	I&C Contingency for SE Pump Station	1.00	LS	$18,121.54	$18,122	
	Total					**$18,122**
	Grand Total					**$401,021**

Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: Daly City RW Pre-Design: Treatment Plant
Client: North San Mateo County Sanitation District
Location: Daly City, CA
Element: 02 Membrane Filtration System

Date : May 31, 2017
By : EC
Reviewed: DGB

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02260	Sheet Piling, 22#/Sf To 15' Deep, Driven, Pulled & Salvaged (Pits Only)	1,426.00	SF	$40.74	$58,091	
02260	Sheet Piling, 22#/Sf To 15' Deep, Driven, Pulled & Salvaged (Pits Only)	483.00	SF	$40.74	$19,676	
02260	Sheet Piling, 22#/Sf To 15' Deep, Driven, Pulled & Salvaged (Pits Only)	992.00	SF	$40.74	$40,411	
02300	Structure/Pit Excavation, 4Cy Wheel Loader, Class B & C Material	199.33	CY	$2.08	$414	
02300	Structure/Pit Excavation, 4Cy Wheel Loader, Class B & C Material	46.00	CY	$2.08	$96	
02300	Structure/Pit Excavation, 4Cy Wheel Loader, Class B & C Material	146.96	CY	$2.08	$306	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	199.33	CY	$14.02	$2,794	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	46.00	CY	$14.02	$645	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	146.96	CY	$14.02	$2,060	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	49.41	CY	$88.36	$4,366	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	16.19	CY	$88.36	$1,431	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	34.44	CY	$88.36	$3,043	
	Total					**$133,332**
	Division 03 - Concrete					
03300	18" Edge Forms, Slab On Grade, Add	108.00	LF	$26.19	$2,829	
03300	18" Structural Flat Mat On Grade	19.56	CY	$549.30	$10,744	
03300	12" Straight Wall >8' High	37.04	CY	$1,172.98	$43,447	
03300	12" Elevated Slab To 14' High	13.04	CY	$810.20	$10,565	
03300	18" Structural Flat Mat On Grade	3.89	CY	$549.30	$2,137	
03300	18" Edge Forms, Slab On Grade, Add	34.00	LF	$26.19	$891	
03300	12" Straight Wall >8' High	11.11	CY	$1,172.98	$13,032	
03300	12" Elevated Slab To 14' High	2.59	CY	$810.20	$2,098	
03300	18" Edge Forms, Slab On Grade, Add	56.00	LF	$26.19	$1,467	
03300	18" Structural Flat Mat On Grade	10.89	CY	$549.30	$5,982	
03300	12" Straight Wall >8' High	26.96	CY	$1,172.98	$31,623	
03300	12" Elevated Slab To 14' High	7.26	CY	$810.20	$5,882	
	Total					**$130,697**
	Division 11 - Equipment					
11000	Strainers	1.00	EA	$57,722.50	$57,723	
11000	Membrane Package System	1.00	LS	$2,749,554.00	$2,749,554	
11000	Neutralization Equipment	1.00	LS	$9,972.00	$9,972	
11312	75Hp Vertical Turbine Pump	2.00	EA	$110,529.74	$221,059	
11312	10Hp Submersible Sump Pump	2.00	EA	$10,818.24	$21,636	
11312	5Hp Vertical Turbine Pump	2.00	EA	$15,048.68	$30,097	
11312	40Hp Vertical Turbine Pump	2.00	EA	$67,218.24	$134,436	
	Total					**$3,224,478**
	Division 14 - Conveying Systems					
14624	0.5Ton Lug Mounted 27' Lift Dc, .75 Hp Electric Hoist W/Cable	1.00	EA	$21,274.85	$21,275	
	Total					**$21,275**
	Division 15 - Mechanical					
15000	Allowance for Utility Water Piping	1.00	LS	$50,000.00	$50,000	
15114	12"- 200 Psi Ci Fxf Swing Check Valve	2.00	EA	$8,565.04	$17,130	
15265	6" Sch 40 Pvc Pipe In A Bldg	659.25	LF	$26.75	$17,635	
15265	6" Sch 40 Pvc Tee	20.00	EA	$291.18	$5,824	
15265	6" Sch 40 Pvc 90° Elbow	64.00	EA	$190.62	$12,200	
15267	12" Sdr11 Hdpe Fabricated Tee	7.00	EA	$2,221.23	$15,549	
15267	12" Sdr11 Hdpe Fabricated 90° Elb	10.00	EA	$1,620.57	$16,206	
15267	12" Sdr 11 Hdpe Pipe In Open Trench	214.58	LF	$48.54	$10,416	
15267	6" Sdr11 Hdpe Molded Tee	10.00	EA	$1,051.06	$10,511	

Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: Daly City RW Pre-Design: Treatment Plant
Client: North San Mateo County Sanitation District
Location: Daly City, CA
Element: 02 Membrane Filtration System

Date : May 31, 2017
By : EC
Reviewed: DGB

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
15267	6" Sdr 11 Hdpe Molded 90° Elbow	33.00	EA	$713.57	$23,548	
15267	6" Sdr 11 Hdpe Pipe In Open Trench	315.33	LF	$17.98	$5,669	
15267	10" Sdr11 Hdpe Fabricated Tee	4.00	EA	$1,958.03	$7,832	
15267	10" Sdr11 Hdpe Fabricated 90° Elb	22.00	EA	$1,411.67	$31,057	
15267	10" Sdr 11 Hdpe Pipe In Open Trench	219.33	LF	$37.97	$8,329	
15267	10" Sdr11 Hdpe Fabricated Tee	12.00	EA	$1,958.03	$23,496	
15267	10" Sdr11 Hdpe Fabricated 90° Elb	30.00	EA	$1,411.67	$42,350	
15267	10" Sdr 11 Hdpe Pipe In Open Trench	303.08	LF	$37.97	$11,509	
15267	12" Sdr11 Hdpe Fabricated Tee	6.00	EA	$2,221.23	$13,327	
15267	12" Sdr11 Hdpe Fabricated 90° Elb	6.00	EA	$1,620.57	$9,723	
15267	12" Sdr 11 Hdpe Pipe In Open Trench	183.67	LF	$48.54	$8,915	
	Total					**$341,225**
	Division 17 - Instrumentation and Controls					
17000	I&C Contingency for Membranes	1.00	LS	$385,100.69	$385,101	
	Total					**$385,101**
	Grand Total					**$4,236,108**

Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: Daly City RW Pre-Design: Treatment Plant
Client: North San Mateo County Sanitation District
Date : May 31, 2017
Location: Daly City, CA
By : EC
Element: 03 Disinfection
Reviewed: DGB

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 11 - Equipment					
11000	UV Reactors (4+1)	1	LS	$1,339,375.00	$1,339,375	
11000	UV Spare Parts (4+1)	1	LS	$21,975.00	$21,975	
11000	Startup and Training (4+1)	1	LS	$21,600.00	$21,600	
	Total					**$1,382,950**
	Division 15 - Mechanical					
15112	Add For Motor Operator 12" Through 20"	5.00	EA	$6,584.32	$32,922	
15112	12" 150# Fxf Awwa Butterfly Valve, No Op	5.00	EA	$3,669.84	$18,349	
15267	12" Sdr11 Hdpe Fabricated Tee	4.00	EA	$2,221.23	$8,885	
15267	12" Sdr11 Hdpe Fabricated 90° Elb	11.00	EA	$1,620.57	$17,826	
15267	12" Sdr 11 Hdpe Pipe In Open Trench	147.42	LF	$48.54	$7,156	
	Total					**$85,137**
	Division 17 - Instrumentation and Controls					
17000	I&C Contingency for Disinfection System	1.00	LS	$146,808.75	$146,809	
	Total					**$146,809**
	Grand Total					**$1,614,896**

carollo
Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: Daly City RW Pre-Design: Treatment Plant
Client: North San Mateo County Sanitation District
Date : May 31, 2017
Location: Daly City, CA
By : EC
Element: 04 Tertiary Building
Reviewed: DGB

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02220	Remove 20' Set Chain Link Swing Gates	2.00	EA	$435.82	$872	
02220	8' High Chain Link Fencing Demolition	150.00	LF	$3.51	$527	
02220	Concrete Curb/Gutter Demolition	415.00	LF	$7.47	$3,099	
02220	Remove 4"-6" Asphalt Pavement	3,500.00	SF	$.89	$3,129	
02300	Structure/Pit Excavation, 4Cy Wheel Loader, Class B & C Material	1,244.44	CY	$2.08	$2,588	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	1,244.44	CY	$14.02	$17,445	
02742	8" Ac Paving On Native Soil	373.11	SY	$37.44	$13,968	
02820	8' H Double Swing Gate, Chain Link, 20' Opening	2.00	EA	$3,536.50	$7,073	
02820	8' H X 4' Clear Opening Galvanized Chain Link Walk Gate	1.00	EA	$685.87	$686	
02820	Galv. Chain Link Fence, 8' W/Barbed Wire, No Gates	250.00	LF	$57.23	$14,307	
	Total					**$63,692**
	Division 03 - Concrete					
03300	12" Elevated Slab To 20'	190.67	CY	$553.50	$105,535	
03300	12" Straight Wall >8' High	349.56	CY	$1,172.98	$410,026	
03300	12" Straight Wall >8' High	22.04	CY	$1,172.98	$25,852	
03300	12" Elevated Slab To 20'	7.50	CY	$553.50	$4,151	
03300	18" Structural Flat Mat On Grade	207.78	CY	$549.30	$114,133	
03300	12" W X 30" D Conc Beam	21.67	CY	$2,050.82	$44,441	
03300	12" Straight Wall >8' High	73.06	CY	$1,172.98	$85,698	
	Total					**$789,836**
	Division 05 - Metals					
05126	Open Web Steel Joists, K Series, Spans 50' 20 To 29 Tons	28,080.00	LB	$1.67	$46,904	
05126	Fabricated Trusses 20 To 29 Tons	28,080.00	LB	$4.64	$130,281	
05310	Steel Deck, 1-1/2" X 22 Ga.	3,120.00	SF	$3.83	$11,943	
05500	Fixed Galv. Steel Ladder - With Safety Cage	19.00	VLF	$176.66	$3,357	
05500	Steel Stairs, Including Railing And Supports	52.00	RSR	$548.11	$28,502	
05500	Galvanized Steel Pit Frame & Cover	128.00	SF	$35.09	$4,492	
	Total					**$225,479**
	Division 07 - Thermal and Moisture					
07000	Wall Insulation and Finish System	9,438.00	SF	$17.04	$160,819	
07200	3" Composite Roof Insulation	3,362.00	SF	$4.31	$14,484	
07400	24 Ga Mr3-36 Versacor Roofing	3,362.00	SF	$12.12	$40,763	
	Total					**$216,065**
	Division 08 - Doors and Windows					
08110	3/0 X 7/0 X 1.75" 1.5 Hr "B" Label Single Hollow Metal Door W/Frame & Hdwre	9.00	EA	$1,253.61	$11,283	
08110	7/0 X 7/0 X 1.75" "B" Label Double Hollow Metal Door W/Frame & Hdwre	2.00	PR	$2,593.42	$5,187	
08110	Add For Door Closer, Aluminum Body	13.00	EA	$169.70	$2,206	
08310	48" X 48" Fire Rated Steel Access Door, "B" Rated With Masonry Anchors	1.00	EA	$1,052.49	$1,052	
08332	Electric Door Operator For Chain Lift Roll-Up Overhead Door, No Wiring	1.00	EA	$2,237.64	$2,238	
08332	Cylinder Lock, For Roll-Up & Sectional Overhead Doors	1.00	EA	$192.90	$193	
08332	Bottom Weather Strip, For Roll-Up & Sectional Overhead Doors	12.00	LF	$5.14	$62	
08332	Top Weather Seal, For Roll-Up & Sectional Overhead Doors	12.00	LF	$6.43	$77	
08332	Draft Stop Molding, For Roll-Up & Sectional Overhead Doors	48.00	LF	$5.14	$247	

DETAILED COST ESTIMATE

Project: Daly City RW Pre-Design: Treatment Plant
Client: North San Mateo County Sanitation District
Date : May 31, 2017
Location: Daly City, CA
By : EC
Element: 04 Tertiary Building
Reviewed: DGB

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
08332	12'-0" X 12'-0" Roll-Up Overhead Door, Chain Lift, 22 Gauge Galvanized Steel/Aluminum	1.00	EA	$4,192.36	$4,192	
	Total					**$26,737**
	Division 15 - Mechanical					
15000	Sprinkler heads	24.00	EA	$78.45	$1,883	
15114	1" 125# Bronze Thrd Check Valve	4.00	EA	$220.76	$883	
15265	1" Sch 80 Cpvc Pipe In A Bldg	320.00	LF	$8.55	$2,736	
	Total					**$5,501**
	Division 16 - Electrical					
16000	HVAC Adder	1.00	LS	$300,000.00	$300,000	
	Total					**$300,000**
	Division 17 - Instrumentation and Controls					
17000	I&C Contingency for Tertiary Building	1.00	LS	$162,731.12	$162,731	
	Total					**$162,731**
	Grand Total					**$1,790,042**

Carollo Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: Daly City RW Pre-Design: Treatment Plant
Client: North San Mateo County Sanitation District — **Date :** May 31, 2017
Location: Daly City, CA — **By :** EC
Element: 06 Chemical Systems — **Reviewed:** DGB

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02220	Remove 4"-6" Asphalt Pavement	300.00	SF	$.89	$268	
02220	Concrete Curb/Gutter Demolition	20.00	LF	$7.47	$149	
02220	8' High Chain Link Fencing Demolition	85.00	LF	$3.51	$299	
02220	Concrete Building Demolition To 10,000 Cf Volume	2,600.00	CF	$1.64	$4,256	
02220	Wood Building Demolition To 10,000 Cf Volume	1,445.00	CF	$1.48	$2,131	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	11.06	CY	$14.02	$155	
02300	Structure/Pit Excavation, 4Cy Wheel Loader, Class B & C Material	11.06	CY	$2.08	$23	
02300	Structure/Pit Excavation, 4Cy Wheel Loader, Class B & C Material	19.04	CY	$2.08	$40	
02300	Structure/Pit Excavation, 4Cy Wheel Loader, Class B & C Material	40.74	CY	$2.08	$85	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	40.74	CY	$14.02	$571	
02742	8" Ac Paving On Native Soil	61.94	SY	$37.44	$2,319	
02820	Galv. Chain Link Fence, 8' W/Barbed Wire, No Gates	85.00	LF	$57.23	$4,864	
02820	Galv. Chain Link Fence, 8' W/Barbed Wire, No Gates	85.00	LF	$57.23	$4,864	
	Total					**$20,025**
	Division 03 - Concrete					
03300	12" Edge Forms, Slab On Grade, Add	68.00	LF	$13.50	$918	
03300	12" Flat Non-Formed S.O.G.	10.70	CY	$489.40	$5,237	
03300	12" Straight Wall, To 8' High	7.11	CY	$1,325.17	$9,422	
03300	12" Edge Forms, Slab On Grade, Add	60.00	LF	$13.50	$810	
03300	12" Flat Non-Formed S.O.G.	8.33	CY	$489.40	$4,077	
03300	12" Straight Wall, To 8' High	4.15	CY	$1,325.17	$5,499	
03300	12" Edge Forms, Slab On Grade, Add	70.67	LF	$13.50	$954	
03300	12" Flat Non-Formed S.O.G.	5.53	CY	$489.40	$2,706	
03300	12" Straight Wall, To 8' High	6.96	CY	$1,325.17	$9,223	
03300	12" Edge Forms, Flat Mat On Grade, Add	31.40	LF	$14.88	$467	
03300	12" Structural Flat Mat On Grade	2.91	CY	$816.40	$2,376	
03300	12" Edge Forms, Flat Mat On Grade, Add	25.12	LF	$14.88	$374	
03300	12" Structural Flat Mat On Grade	1.86	CY	$816.40	$1,519	
03300	12" Edge Forms, Flat Mat On Grade, Add	56.00	LF	$14.88	$833	
03300	12" Structural Flat Mat On Grade	3.56	CY	$816.40	$2,906	
	Total					**$47,321**
	Division 05 - Metals					
05500	Aluminum Stairs, Including Railing And Supports	14.00	RSR	$712.72	$9,978	
	Total					**$9,978**
	Division 11 - Equipment					
11000	Eyewash	1.00	EA	$2,500.00	$2,500	
11000	Gypsum System Modifications	1.00	LS	$15,000.00	$15,000	
11000	ACH Pretreatment Chemical Pumps	1.00	LS	$6,580.00	$6,580	
11000	SBS Neutralization Tank Chemical Pumps	1.00	LS	$6,120.00	$6,120	
11000	Hypo Pretreatment Chemical Pumps	1.00	LS	$11,440.00	$11,440	
11000	Hypo CIP Tank Chemical Pumps	1.00	LS	$6,410.00	$6,410	
11000	Hypo Post Treatment Chemical Pumps	1.00	LS	$11,440.00	$11,440	
11000	NaOH CIP and Neutralization Tank Chemical Pumps	1.00	LS	$7,250.00	$7,250	
11000	CA CIP Tank Chemical Pumps	1.00	LS	$6,820.00	$6,820	

Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: Daly City RW Pre-Design: Treatment Plant
Client: North San Mateo County Sanitation District
Date : May 31, 2017
Location: Daly City, CA
By : EC
Element: 06 Chemical Systems
Reviewed: DGB

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
11000	HCL CIP and Neutralization Tank Chemical Pumps	1.00	LS	$6,650.00	$6,650	
11000	Misc valves, appurtenances, and injectors	1.00	LS	$20,000.00	$20,000	
11000	Chemical Pump Installation and Startup	3.00	DAY	$1,000.00	$3,000	
11000	Inline Mixer	1.00	LS	$24,200.00	$24,200	
11000	Chemical Area Sump Pumps	1.00	LS	$7,292.00	$7,292	
11000	Chemical tank transducers	1.00	LS	$6,570.00	$6,570	
11312	1.5Hp Vertical Centrifugal Pump	1.00	EA	$2,188.68	$2,189	
	Total					**$143,461**
	Division 13 - Special Construction					
13000	Sodium Hypochlorite 4000 Gal Tank	1.00	EA	$41,301.00	$41,301	
13000	Sodium Hydroxide 1200 Gal Tank	1.00	EA	$33,898.80	$33,899	
13000	Citric Acid or Hydrochloric Acid 330 Gal Tank	2.00	EA	$18,769.40	$37,539	
	Total					**$112,739**
	Division 15 - Mechanical					
15265	.5" Sch 80 Cpvc Pipe In A Trench	1,475.00	LF	$3.71	$5,469	
	Total					**$5,469**
	Division 17 - Instrumentation and Controls					
17000	I&C Contingency for Chemical Systems	1.00	LS	$33,899.24	$33,899	
	Total					**$33,899**
	Grand Total					**$372,892**

Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: Daly City RW Pre-Design: Treatment Plant
Client: North San Mateo County Sanitation District
Location: Daly City, CA
Element: 07 Yard Piping

Date : May 31, 2017
By : EC
Reviewed: DGB

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02220	Demo D.I. Pipe From Trench, 20" - 36" Incl Fittings	250.00	LF	$27.92	$6,981	
02220	Demo D.I. Pipe From Trench, 4" - 18" Incl. Fittings	60.00	LF	$11.17	$670	
02260	Sheet Piling, 22#/Sf To 15' Deep, Drive, Pull & Salvage (Trenches Only)	9,441.00	SF	$17.49	$165,099	
02300	Structure/Pit Excavation, 4Cy Wheel Loader, Class B & C Material	158.33	CY	$2.08	$329	
02300	Structure/Pit Excavation, 4Cy Wheel Loader, Class B & C Material	221.72	CY	$2.08	$461	
02300	Structure/Pit Excavation, 4Cy Wheel Loader, Class B & C Material	240.74	CY	$2.08	$501	
02300	20 Cy Dump Truck, 30 Miles/Round Trip	620.80	CY	$14.02	$8,703	
02300	Imported Pipe Bed & Zone/Confined Structure Backfill, Class B Material	620.80	CY	$88.36	$54,855	
02580	48" X 6' Deep Precast Manhole, No Ring & Cover, No Earthwork	2.00	EA	$2,444.77	$4,890	
02580	24" Dia. X 400 Lb Heavy Traffic Manhole Frame & Cover	2.00	EA	$575.24	$1,150	
02580	48" Manhole Precast Slab Top Or Bottom, 8" Thick	4.00	EA	$542.34	$2,169	
02580	48" Precast Manhole, Xtra Depth Over 8'	4.38	VLF	$336.46	$1,474	
02580	48" X 8' Deep Precast Manhole, No Ring & Cover, No Earthwork	1.00	EA	$3,329.52	$3,330	
02580	24" Dia. X 400 Lb Heavy Traffic Manhole Frame & Cover	1.00	EA	$575.24	$575	
02580	48" Manhole Precast Slab Top Or Bottom, 8" Thick	2.00	EA	$542.34	$1,085	
02742	3" Pavement Replacement On 6" Abc Over Trench	377.89	SY	$114.45	$43,251	
	Total					**$295,522**
	Division 15 - Mechanical					
15251	24" 45° 125# Cldi Fxf Ell	8.00	EA	$8,119.62	$64,957	
15251	30" Flg Cldi Pipe In Open Trench	320.00	LF	$783.12	$250,598	
15251	16" Flg Cldi Pipe In Open Trench	60.00	LF	$221.43	$13,286	
15267	12" Sdr11 Hdpe Fabricated 90° Elb	8.00	EA	$1,620.57	$12,965	
15267	12" Sdr 11 Hdpe Pipe In Open Trench	307.00	LF	$48.54	$14,901	
15267	4" Sdr 11 Hdpe Pipe In Open Trench	250.00	LF	$12.24	$3,060	
15267	6" Sdr 11 Hdpe Pipe In Open Trench	300.00	LF	$17.98	$5,393	
15267	8" Sdr 11 Hdpe Pipe In Open Trench	250.00	LF	$24.99	$6,247	
15267	8" Sdr11 Hdpe Molded 45° Elbow	1.00	EA	$887.42	$887	
15267	8" Sdr 11 Hdpe Molded 90° Elbow	5.00	EA	$887.42	$4,437	
15267	6" Sdr 11 Hdpe Molded 90° Elbow	5.00	EA	$713.57	$3,568	
15267	4" Sdr 11 Hdpe Molded 90° Elbow	5.00	EA	$603.13	$3,016	
	Total					**$383,315**
	Division 17 - Instrumentation and Controls					
17000	I&C Contingency for Yard Piping	1	LS	$67,883.68	$67,884	
	Total					**$67,884**
	Grand Total					**$746,720**

Carollo Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: Daly City RW Pre-Design: Treatment Plant
Client: North San Mateo County Sanitation District
Date : May 31, 2017
Location: Daly City, CA
By : EC
Element: 08 Existing Equipment Relocatio
Reviewed: DGB

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 11 - Equipment					
11000	2W Replacement	1	LS	$175,000.00	$175,000	
11000	Surge Tank Replacement	1	LS	$109,756.09	$109,756	
	Total					**$284,756**
	Division 15 - Mechanical					
15000	Allowance for Outfall Pipeline Modifications	1	LS	$200,000.00	$200,000	
	Total					**$200,000**
	Division 17 - Instrumentation and Controls					
17000	I&C Contingency for Existing Equipment Relocation	1	LS	$48,475.61	$48,476	
	Total					**$48,476**
	Grand Total					**$533,232**

Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: Daly City RW Pre-Design: Treatment Plant
Client: North San Mateo County Sanitation District
Location: Daly City, CA
Element: 09 Electrical

Date : May 31, 2017
By : EC
Reviewed: DGB

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02300	20 Cy Dump Truck, 30 Miles/Round Trip	64.81	CY	$14.02	$909	
02300	Structure/Pit Excavation, 4Cy Wheel Loader, Class B & C Material	64.81	CY	$2.08	$135	
02300	Clearing & Grubbing Equipment Move-On Cost	1.00	LS	$1,761.82	$1,762	
02300	Remove Grass & Shrubs Medium Density, 2" Depth To 1 Acre	1,750.00	SF	$.04	$62	
02742	8" Ac Paving On Native Soil	83.33	SY	$37.44	$3,119	
02820	8' H Double Swing Gate, Chain Link, 12' Opening	1.00	EA	$2,411.25	$2,411	
02820	Galv. Chain Link Fence, 8' W/Barbed Wire, No Gates	220.00	LF	$57.23	$12,590	
	Total					**$20,988**
	Division 03 - Concrete					
03300	12" Edge Forms, Flat Mat On Grade, Add	126.00	LF	$14.88	$1,875	
03300	12" Structural Flat Mat On Grade	37.04	CY	$816.40	$30,239	
03300	8" Edge Forms Slabs On Grade, Add	40.00	LF	$6.08	$243	
03300	8" Flat Non-Formed S.O.G.	3.70	CY	$486.01	$1,798	
	Total					**$34,156**
	Division 04 - Masonry					
04220	Integral Cmu Color Adder	2,400.00	SF	$1.85	$4,444	
04220	Full Grout (All Cells)	2,400.00	SF	$1.62	$3,889	
04220	Pilaster 16" X 16"	390.00	VLF	$103.66	$40,428	
04220	Seismic Reinforcement Adder	2,400.00	SF	$1.82	$4,370	
04220	Block Insulation	2,400.00	SF	$15.35	$36,852	
04220	Standard Concrete Block, 12"	2,400.00	SF	$24.72	$59,327	
	Total					**$149,311**
	Division 05 - Metals					
05126	Open Web Steel Joists, Cs Series, Spans To 30' 1 To 4 Tons	4,080.00	LB	$2.52	$10,288	
05310	Steel Deck, 2" X 20 Ga.	1,000.00	SF	$4.76	$4,759	
	Total					**$15,047**
	Division 08 - Doors and Windows					
08110	7/0 X 7/0 X 1.75" "B" Label Double Hollow Metal Door W/Frame & Hdwre	1.00	PR	$2,593.42	$2,593	
08110	3/0 X 7/0 X 1.75" 1.5 Hr "B" Label Single Hollow Metal Door W/Frame & Hdwre	5.00	EA	$1,253.61	$6,268	
08110	Add For Door Closer, Aluminum Body	7.00	EA	$169.70	$1,188	
	Total					**$10,049**
	Division 16 - Electrical					
16000	Electrical Contingency	1.00	LS	$787,959.54	$787,960	
16000	Switchgear	1.00	LS	$660,000.00	$660,000	
16000	VFDs	7.00	EA	$93,500.00	$654,500	
16000	PLC	1.00	LS	$275,000.00	$275,000	
16000	MCC	1.00	LS	$94,496.60	$94,497	
	Total					**$2,471,956**
	Division 17 - Instrumentation and Controls					
17000	I&C Contingency for Electrical Equipment	1.00	LS	$191,354.86	$191,355	
	Total					**$191,355**
	Grand Total					**$2,892,863**

APPENDIX C – SECONDARY EFFLUENT WATER QUALITY DATA

Secondary Effluent Water Quality Data
City of Daly City

Parameter[1]		Avg.	Range			Percentiles 5th	50th	95th	Count
pH	-	6.6	6.02	-	8.82	6.25	6.57	6.85	224
Temperature	°C	22	14.9	-	24.7	18.1	22.3	24.0	224
Turbidity	NTU	6.5	0.11	-	53.2	3.4	5.8	10.7	223
UV Transmittance	%	47.9	9.4	-	61.7	39.9	47.9	55.2	218
ORP	mV	407	72.1	-	566	189	416	521	223
Dissolved Oxygen	mg/L	4.83	2.13	-	9.10	2.97	4.65	6.95	222
Total Chlorine	mg/L	3.0	0.0	-	19.6	0.6	2.9	5.4	222
Total Suspended Solids	mg/L	8.4	4.3	-	14.0	5.1	7.5	12.4	12
Total Organic Carbon	mg/L	21.3	14.3	-	36.2	14.9	22.1	25.2	30
Dissolved Organic Carbon	mg/L	14.8	10.1	-	20.0	12.1	14.7	17.7	14
Silica	mg/L	18	16	-	18	16	18	18	8
Reactive Silica	mg/L	15	13	-	15	13	15	15	7
Total Iron	mg/L	0.95	0.15	-	14.00	0.31	0.58	1.30	42
Dissolved Iron	mg/L	0.19	0.10	-	0.50	0.11	0.15	0.36	20
Total Dissolved Solids	mg/L	424	400	-	460	400	420	456	9
Alkalinity	mg/L	274	220	-	370	238	260	343	19
Total Aluminum	mg/L	7.84	0.06	-	52.0	0.07	3.3	25.9	34
Dissolved Aluminum	mg/L	0.43	0.05	-	3.30	0.05	0.13	1.70	17
Total Manganese	mg/L	0.05	0.04	-	0.06	0.04	0.05	0.06	8
Dissolved Manganese	mg/L	0.05	0.04	-	0.07	0.04	0.05	0.06	8
Ammonia as N	mg/L	53	35	-	75	39	49	72	8
Total Calcium	mg/L	18	12	-	25	12	17	24	9
Total Magnesium	mg/L	8.5	3.6	-	14.0	3.7	7.4	13.6	9
Total Sodium	mg/L	75	74	-	75	74	75	75	2
Orthophosphate	mg/L	7.8	4.6	-	11.0	4.9	7.8	10.7	2
Total Hardness	mg/L	80	45	-	118	45	74	116	9
Chloride	mg/L	92	90	-	94	90	92	94	2
Nitrate as N	mg/L	ND	ND	-	ND		ND		2
Sulfate as SO4	mg/L	50	48	-	52	48	50	52	2

Notes:
(1) Data from grab samples collected during pilot testing 3/1/16 - 3/17/17.

APPENDIX D – PROJECT MEMORANDUM 08 - SECONDARY EFFLUENT PUMP STATION CONSTRUCTABILITY

Engineers...Working Wonders With Water®

DRAFT PROJECT MEMORANDUM - 08

Project Name:	Feasibility of Expanded Tertiary Recycled Water Facilities (Project)	**Updated Date:**	January 6, 2017
Client:	City of Daly City	**Project Number:**	10076A.10
Prepared By:	Elizabeth Charbonnet		
Reviewed By:	Darren Baune, Katie Ottoboni		
Subject:	Secondary Effluent Pump Station Constructability		

1.0 PURPOSE

The purpose of this project memorandum (PM) is to evaluate the constructability of the proposed Secondary Effluent Pump Station (SEPS). Construction of this pump station is difficult because all secondary effluent is currently routed through the proposed pump station location without an existing diversion.

2.0 BACKGROUND

In order to supply feed water for the proposed tertiary treatment facility, two new pumps will need to be located in the existing secondary effluent splitter box. The existing splitter box is divided into four quadrants. Secondary effluent enters the splitter box in the southeast quadrant where it flows over a weir wall into the southwest quadrant. From there, flow is routed through a gate to the northwest quadrant and then through a pipe to Chlorine Contact Basin No. 1. Additionally two pumps are currently located in the southeast quadrant of the splitter box to supply water to the existing recycled water facility. Tertiary treated water from this facility is then routed back to the secondary effluent splitter box's northeast quadrant and from there flows to Chlorine Contact Basin No. 2.

The 2009 Feasibility Study (Carollo, 2009), considered locating the new SEPS in either the southwestern or northwestern quadrant of the secondary effluent splitter box. Both of these locations have constructability challenges that should be considered at this time.

3.0 NEW PUMP LOCATION

Before the SEPS constructability can be assessed, a location for the proposed pump station must be determined.

The 2009 Feasibility Study initially located the proposed pumps in the southwestern quadrant of the secondary effluent splitter box as shown in Figure 1. However, after the Feasibility Study was completed, the following question was raised by City Staff and responded to accordingly in the report addendum:

Question: *Verify input associated with chlorine contact basin splitter box cannot move the SEPS to this location. The plant effluent splits and goes to CC#1. Presently, there is no way to divert or stop plant flow during construction if the SEPS is constructed at this location. Instead, staff suggests removing the water champ (which is not used) and then move the SEPS to that location. This appears to allow for the construction of the SEPS without having to stop plant flow.*

Response: *From discussion with staff, it is now understood that the chlorination point for the final effluent is not currently used and therefore does not need to be relocated. This allows the pumps to be moved into the location proposed in the staff comment.*

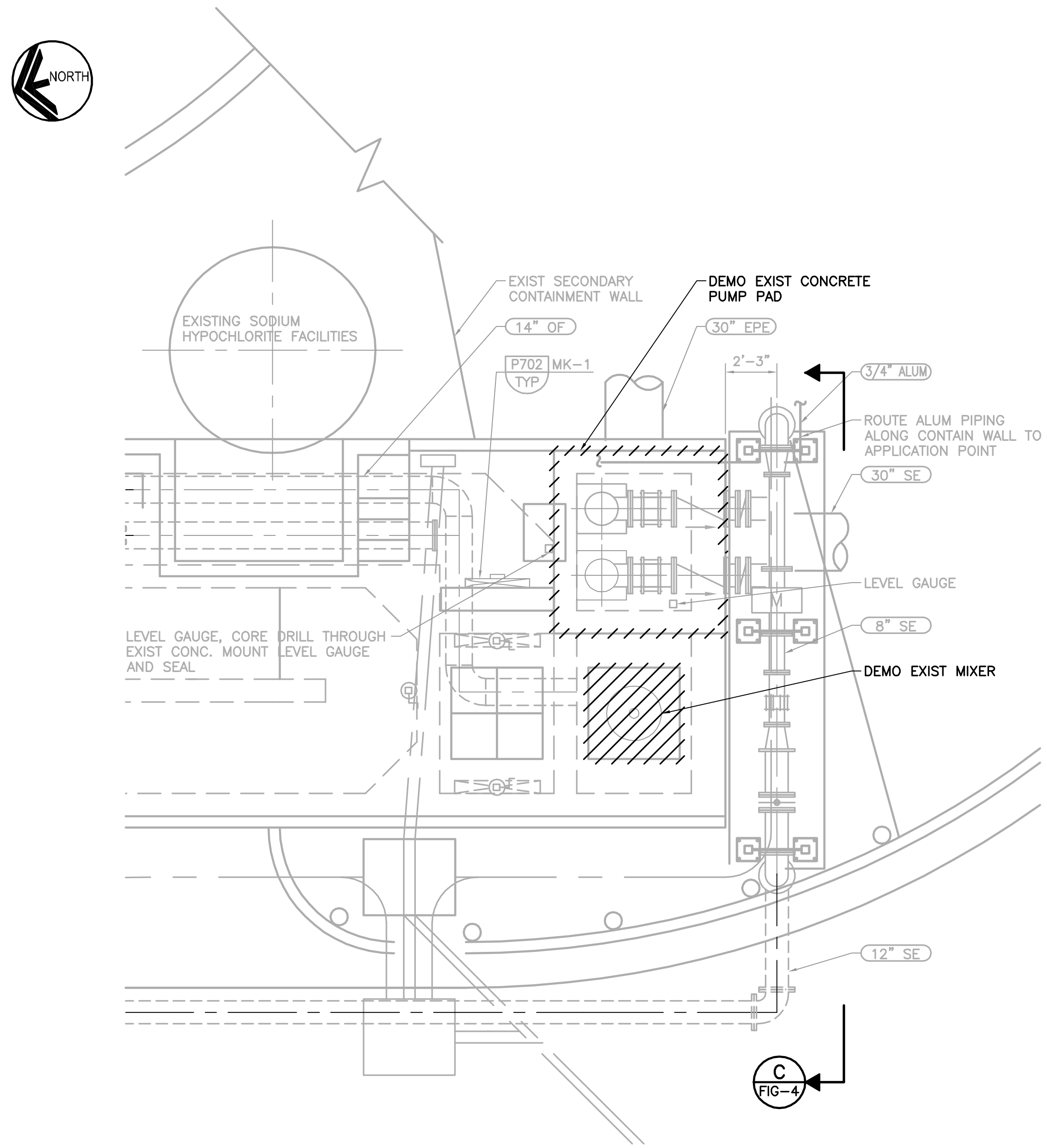
Figure 2 shows the proposed pump relocation. The question/response above implies that flow could not be diverted during construction if the SEPS was located in the southwest quadrant but that flow could be diverted during construction if the SEPS was located in the northwest quadrant. At this time, this logic is unclear and does not appear to be the case. Thus, in this discussion both SEPS locations are considered.

In the northwest quadrant, the space available for pump installation is 4 feet 8 inches square. In the southwest quadrant, the space available for pump installation is 4 feet 9 inches square. This available space is quite limited in both locations and would likely require custom pump baseplates. Additionally, in the northwest quadrant there are existing gates with hand cranks on each side limiting access. There is also a 30 inch opening at the bottom of the chamber that sends flow to the chlorine contact basin. Locating new pumps in this quadrant would require hydraulic modifications to ensure the pump intake design meets the American National Standards Institute / Hydraulic Institute (ANSI/HI) standards. For these reasons, locating the pumps in the southwest quadrant is preferred.

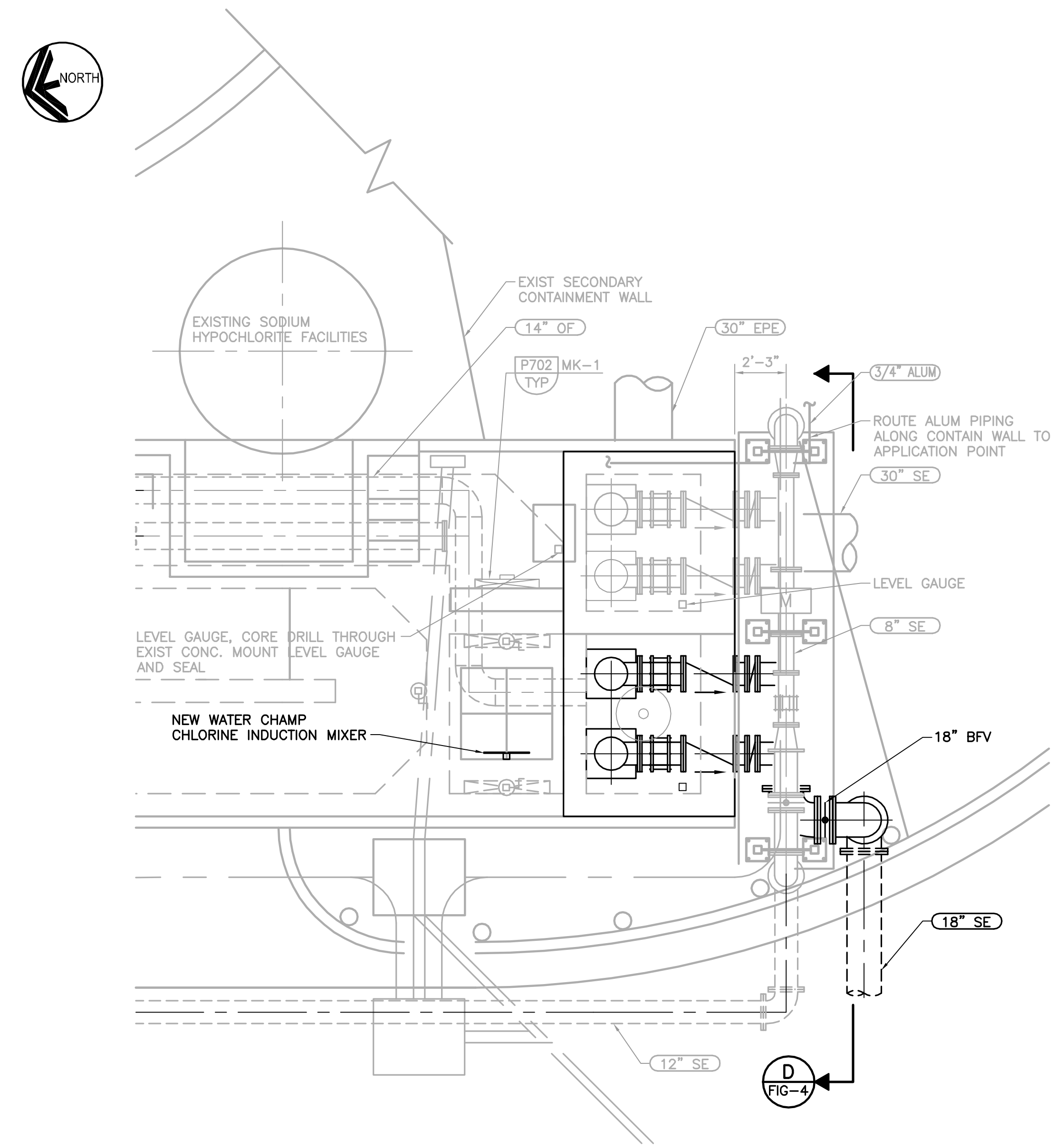
To locate the new pumps in the southwest quadrant, the pumps will likely require custom baseplates to fit in the space available. Hydraulically, however, the existing southwest splitter box quadrant should sufficiently meet ANSI/HI standards. The required submergence for minimizing surface vortices can be met, as can the minimum required trench length and maximum allowable trench velocity.

4.0 CONSTRUCTION OPTIONS

Construction of these pumps is difficult as all secondary effluent is routed through the SEPS without an existing diversion. Thus a temporary diversion will need to be developed for use during the construction of these pumps. There are two possible diversion options: temporary bypass pumping or temporary use of existing abandoned piping. Both of these options are described in the following sections. Ultimately which option is chosen is the City's decision.



A PARTIAL DEMOLITION PLAN
SCALE: 1/8" = 1'-0"
FILE: WMDC102rev



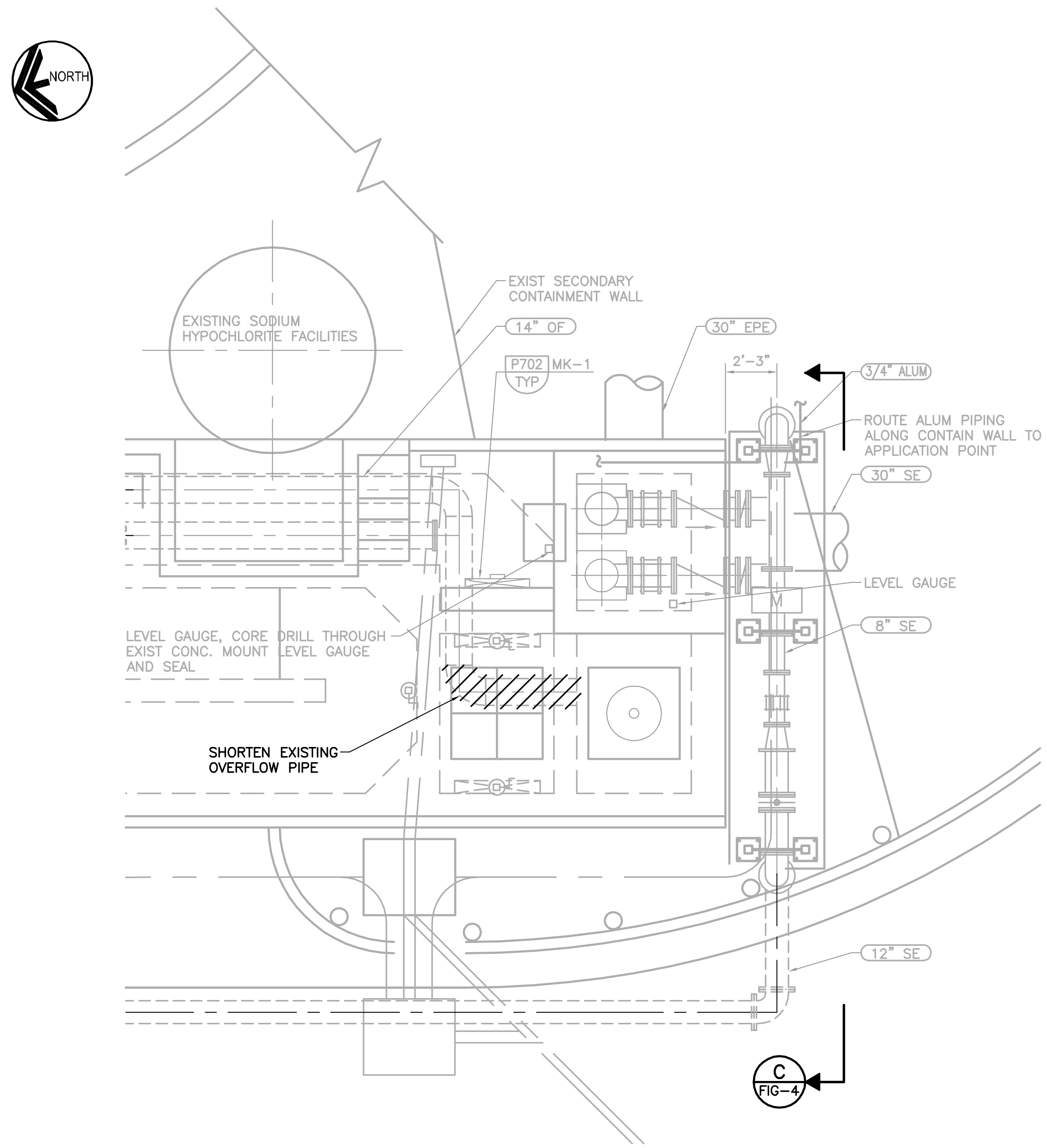
B PARTIAL MODIFICATION PLAN
SCALE: 1/8" = 1'-0"
FILE: 00-M-100

PLAN VIEW - SECONDARY EFFLUENT PUMP STATION MODIFICATIONS (ORIGINAL)

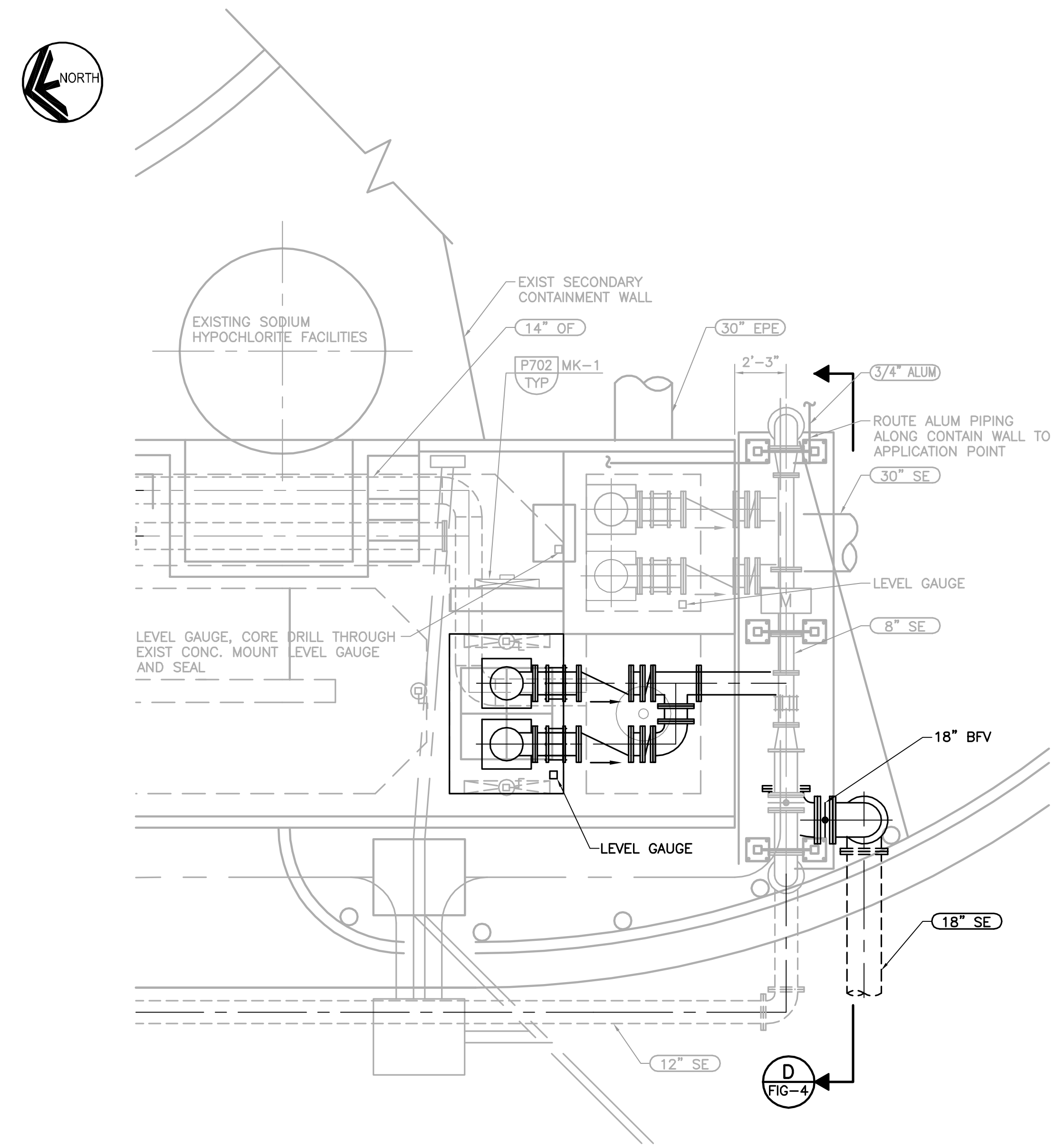
FIGURE 1

City of Daly City
PM 09 Secondary Effluent Pump Station Constructability

carollo
Engineers...Working Wonders With Water™



A PARTIAL DEMOLITION PLAN
SCALE: 1/8" = 1'-0"
FILE: WMDC102rev



B PARTIAL MODIFICATION PLAN
SCALE: 1/8" = 1'-0"
FILE: 00-M-100

PLAN VIEW - SECONDARY EFFLUENT PUMP STATION MODIFICATIONS (ADDENDUM)

FIGURE 2

City of Daly City
PM 09 Secondary Effluent Pump Station Constructability

carollo
Engineers...Working Wonders With Water ™

4.1 Option 1: Temporary Bypass Pumping

The first option is to install temporary bypass pumping. This bypass pumping would divert secondary effluent from the secondary clarifiers directly to both the Chlorine Contact Basin No. 1 and the existing recycled water treatment system.

While this option is the simplest and most reliable, it is also more expensive. Rain for Rent provided a preliminary quote for bypass pumping which is summarized in Table 1 below. If this option is chosen, as the project develops further, these costs will be refined.

The quote provided assumes plugs would be placed in each of the three clarifier effluent boxes to stop flow to the SEPS. While this is the simplest way of stopping flow to the SEPS, it does create three points of failure for this option. Submersible pumps would then be placed in each clarifier effluent box to pump flow through temporary 18 inch piping to both the chlorine contact mixing chamber and to the filter influent piping. Figure 3 shows the location of the three submersible pumps. Each pump will have a VFD and be operated by a PLC pump control system. Figure 4 shows the possible discharge location to the chlorine contact basin and Figure 5 shows the possible discharge location to the filter influent.

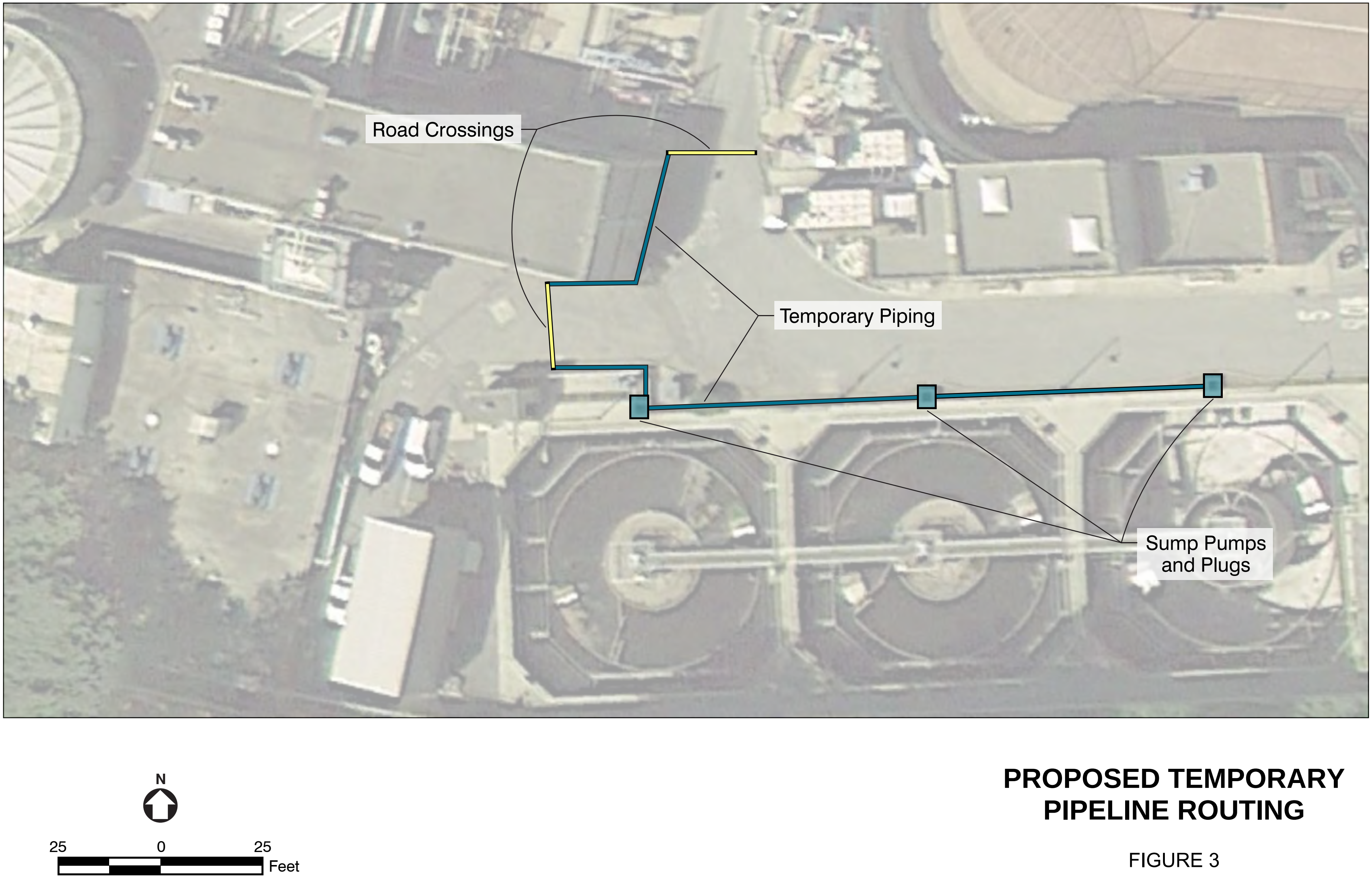
Temporary piping will be routed along the north side of the secondary clarifiers and cross the street, as shown in Figure 3, to reach the chlorine contact mixing chamber. Flow will then be routed across another street to the filters, also shown in Figure 3. For the two street crossings, the piping would need to be partially buried in a trenched and plated configuration to allow for truck traffic.

Unless plant power is used, two generators (main and backup) will need to be located on site as well. For the preliminary cost estimate provided, generator power was assumed.

Table 1 Cost Estimate for SEPS Bypass Pumping
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Item	Qty.	Unit Cost	Unit	Extended Cost
Rental Equipment[(1)]	3.29	$ 41,980	per 28 days	$ 137,934
Sewer Plugs[(2)]	3	$ 2,000	EA	$ 6,000
Road Crossings Trench and Plate	2	$ 5,000	EA	$ 10,000
Mobilization, Installation, Removal, and Demobilization	1	$ 47,750	LS	$ 47,750
Total Cost for 3 Months				**$ 201,684**

Notes:
(1) Includes 2 generators, switchgear, generator fuel, pumps (3 duty + 3 standby), fittings, hose, valves, HDPE pipe, and control systems.
(2) Quote provided by Petersen, not Rain for Rent.



PROPOSED TEMPORARY PIPELINE ROUTING

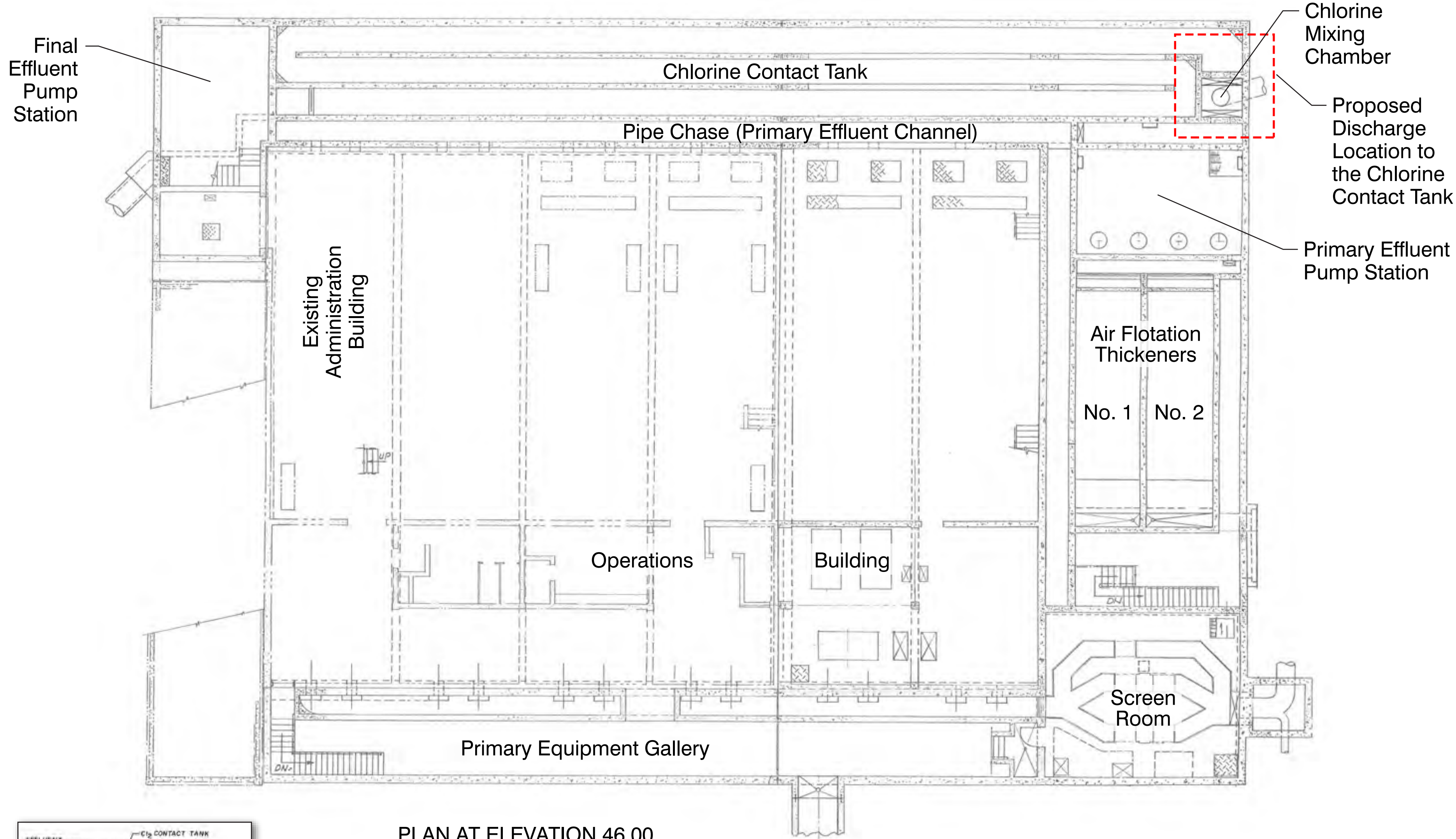
FIGURE 3

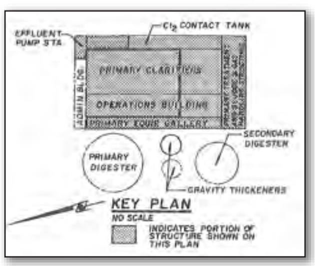
CITY OF DALY CITY

PM 09 – SECONDARY EFFLUENT PUMP STATION CONSTRUCTABILITY

carollo

dc0117-10076rf8.ai





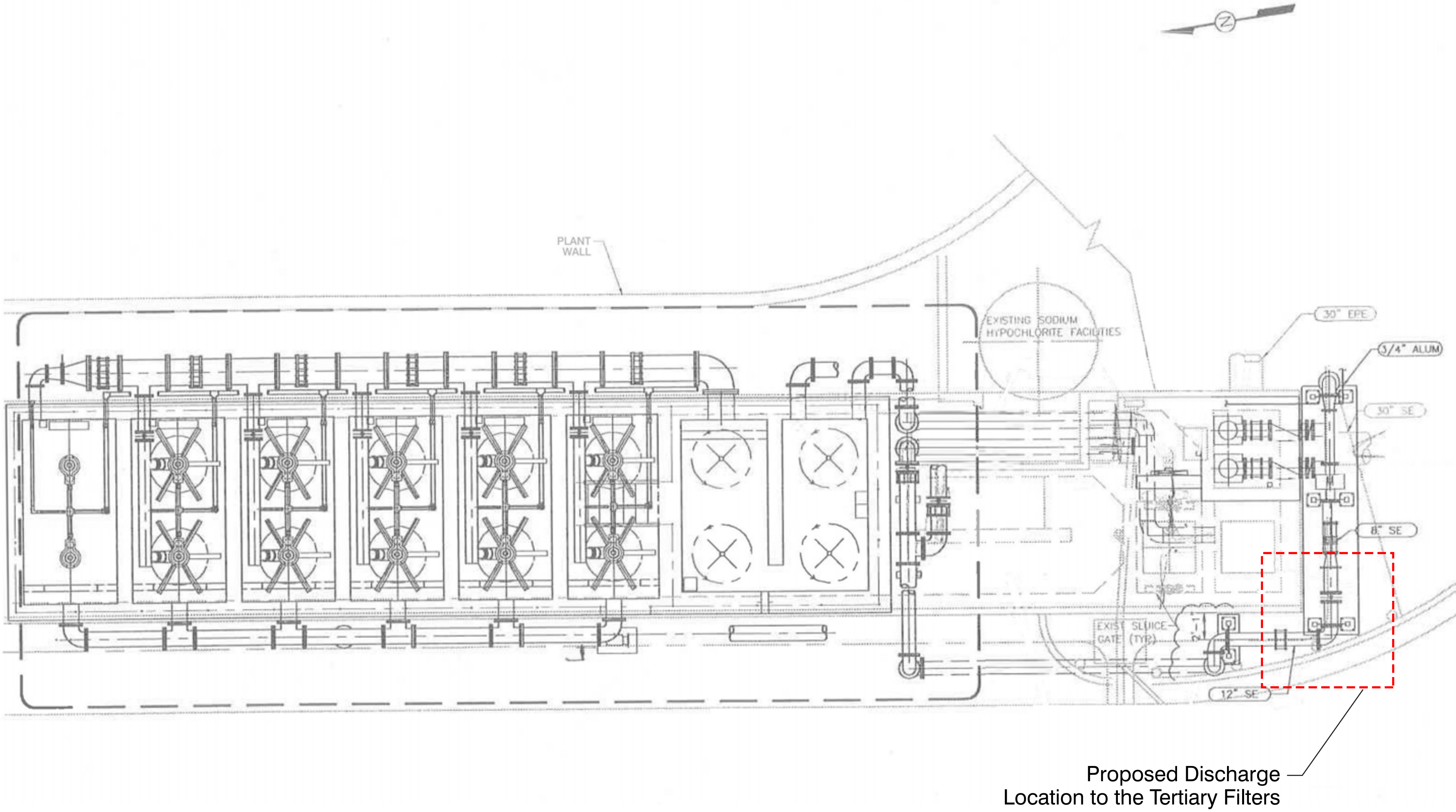
PLAN AT ELEVATION 46.00

PROPOSED LOCATION FOR DISCHARGE TO THE CHLORINE CONTACT CHAMBER

FIGURE 4

CITY OF DALY CITY
PM 09 – SECONDARY EFFLUENT PUMP STATION CONSTRUCTABILITY

dc0117-10076rf9.ai



PROPOSED LOCATION FOR DISCHARGE TO THE TERTIARY FILTRATION

FIGURE 5

CITY OF DALY CITY
PM 09 – SECONDARY EFFLUENT PUMP STATION CONSTRUCTABILITY

dc0117-10076rf10.ai

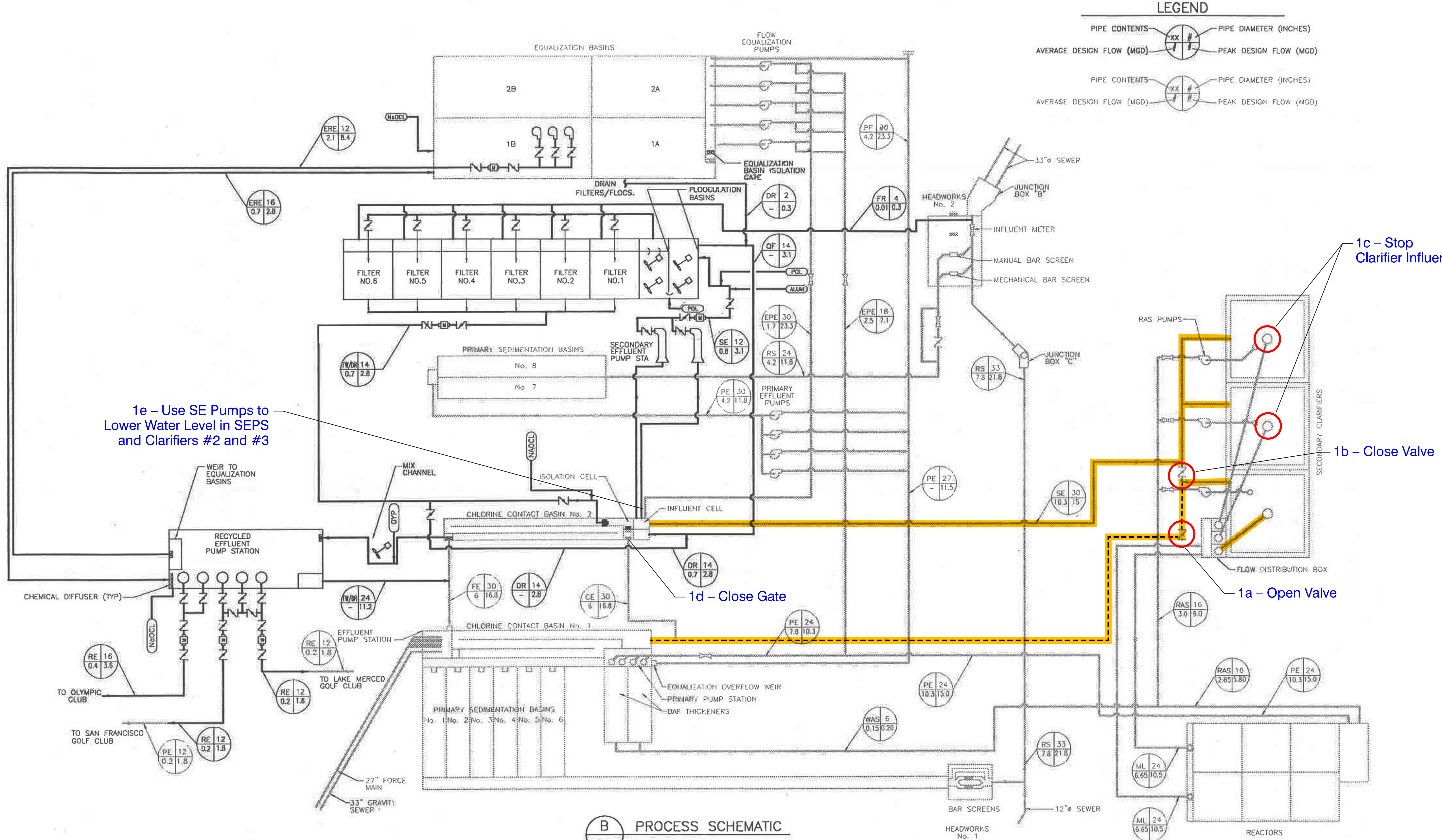
4.2 Option 2: Use Existing Abandoned Pipe

A riskier and likely lower cost solution would be to bypass flow around the SEPS using existing abandoned piping and a temporary plug. A proposed construction sequence is as follows:

1. Lower level in southeast quadrant of the splitter box (Figure 6):
    a. Open valve to direct secondary effluent flow through original 30 inch pipe to Chlorine Contact Basin #1.
    b. Isolate Secondary Clarifier No. 1 from 2 and 3 by closing the isolation valve.
    c. Stop influent to Secondary Clarifier No. 2 and 3.
    d. Close gate at splitter box to Chlorine Contact Basin #1.
    e. Use existing secondary effluent pumps to lower level in southeast quadrant and secondary clarifiers. It is estimated that it will take 4.5 hours to draw down the water level in this area.
2. Install temporary steel plate barrier between southwest and southeast quadrant (Figure 7):
    a. Stop pumping to existing tertiary treatment system.
    b. Install inflatable plug in 30 inch splitter box influent by accessing the box through the 4 foot by 4 foot hatch in the southwest quadrant.
    c. Open valve to no longer isolate Secondary Clarifier effluents.
    d. Resume influent to Secondary Clarifiers No. 2 and 3
    e. Install temporary steel plate barrier between southwest and southeast quadrant. Install all but the steel plate itself at this time so installed plug is still accessible.
3. Plant Operation during construction of the new SEPS pumps (Figure 8):
    a. Remove plug in 30 inch splitter box influent and install steel plate between the southeast and southwest quadrants.
    b. Resume pumping to existing tertiary treatment system.
    c. The remaining flow will continue to be routed through the original 30 inch pipe to Chlorine Contact Basin #1.
4. Plant Operation after construction of the new SEPS pumps (Figure 9):
    a. Lower level in southeast quadrant of the splitter box, as described in step 1.
    b. Remove temporary steel plate barrier between southwest and southeast quadrant by accessing it through the 4 foot by 4 foot hatch in the northwest quadrant.
    c. Open gate at splitter box to Chlorine Contact Basin #1.
    d. Open valve to no longer isolate Secondary Clarifier effluents.
    e. Close valve to stop secondary effluent flow through original 30 inch pipe to Chlorine Contact Basin #1.
    f. Resume influent to Secondary Clarifiers No. 2 and 3
    g. Resume pumping to existing tertiary treatment system.

One important consideration with this option is the amount of time available for operation with only one clarifier. Each clarifier has a hydraulic capacity of 3.5 mgd. Hydraulically, during average dry weather flows (ADWF), the equalization basins (Basins 1A, 2A, and 2B) have enough capacity to store ADWFs over 3.5 mgd for about 12 hours. It takes the two secondary effluent pumps 4.5 hours to draw down the water level in Clarifiers No. 2 and 3, which leaves around 7.5 hours for installing the temporary 30 inch plug and around 7.5 hours for removing the temporary 30 inch plug.

Additionally, it is important to note that hydraulically this can be done; however, from a solids perspective, it is unclear if it is possible to run with just one clarifier. The solids loading rate needs to be considered before this option is chosen.



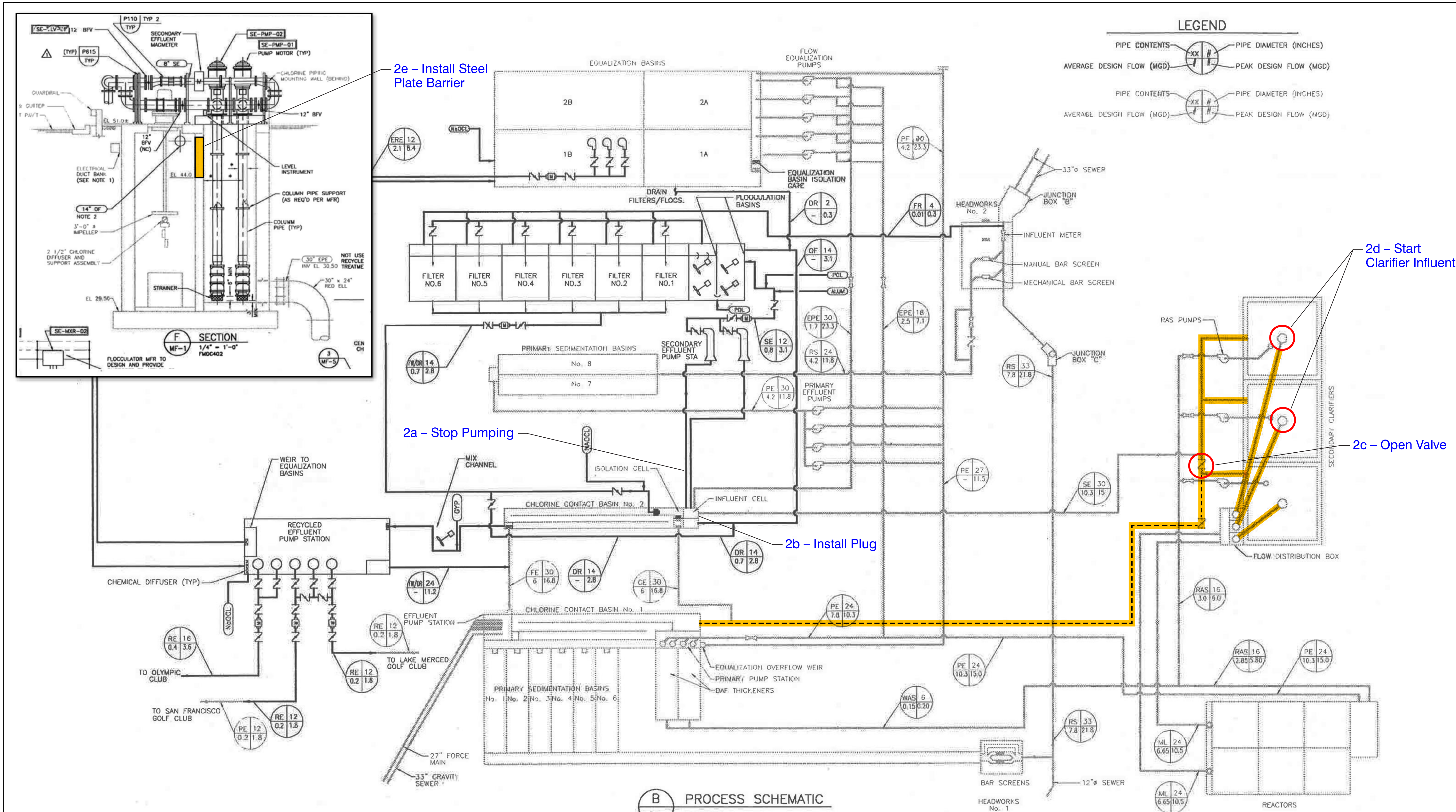
STEP 1 IN OPTION 2

FIGURE 6

CITY OF DALY CITY
PM 09 – SECONDARY EFFLUENT PUMP STATION CONSTRUCTABILITY

carollo

dc0117-10076rf11.ai



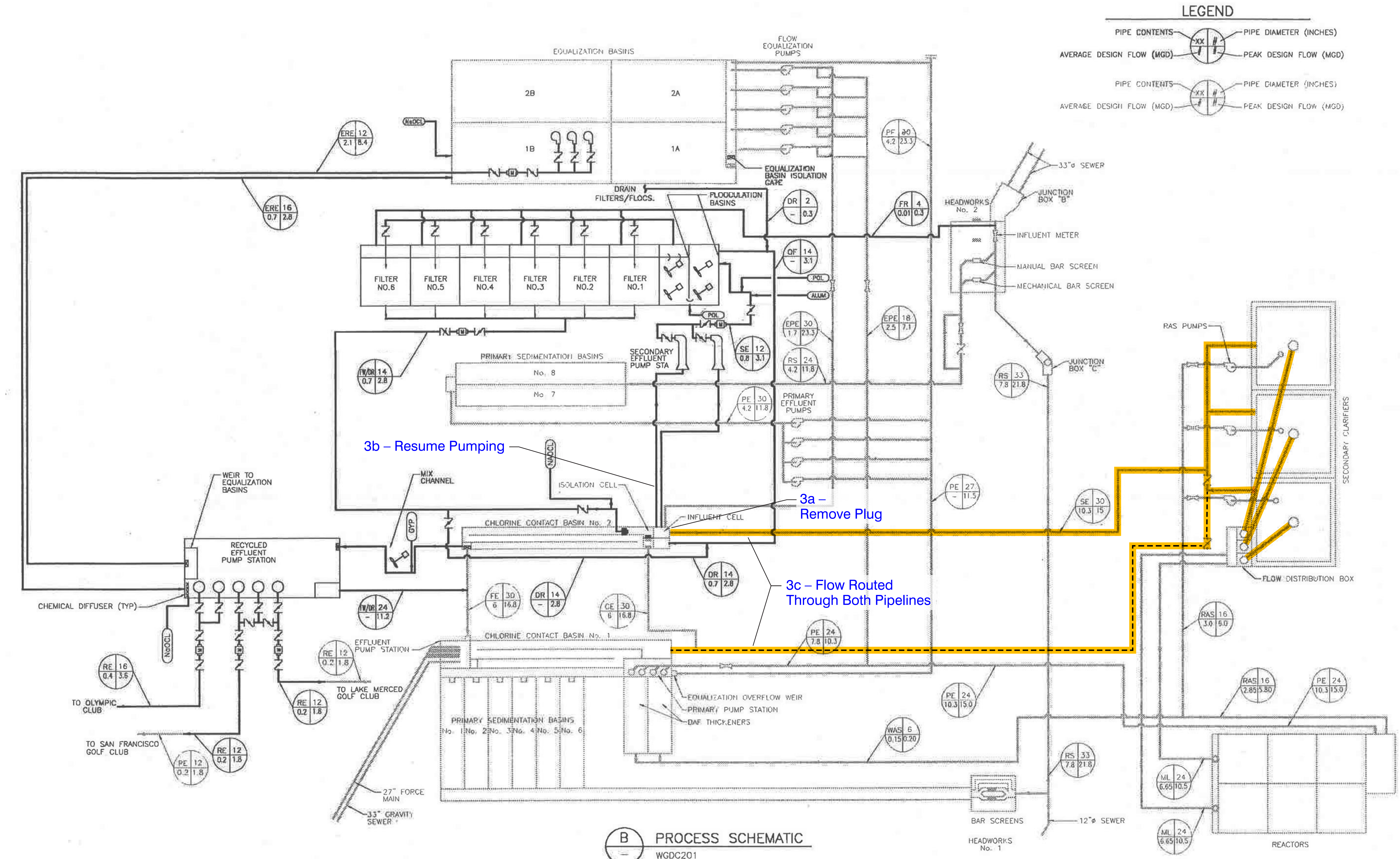
STEP 2 IN OPTION 2

FIGURE 7

CITY OF DALY CITY
PM 09 – SECONDARY EFFLUENT PUMP STATION CONSTRUCTABILITY

carollo

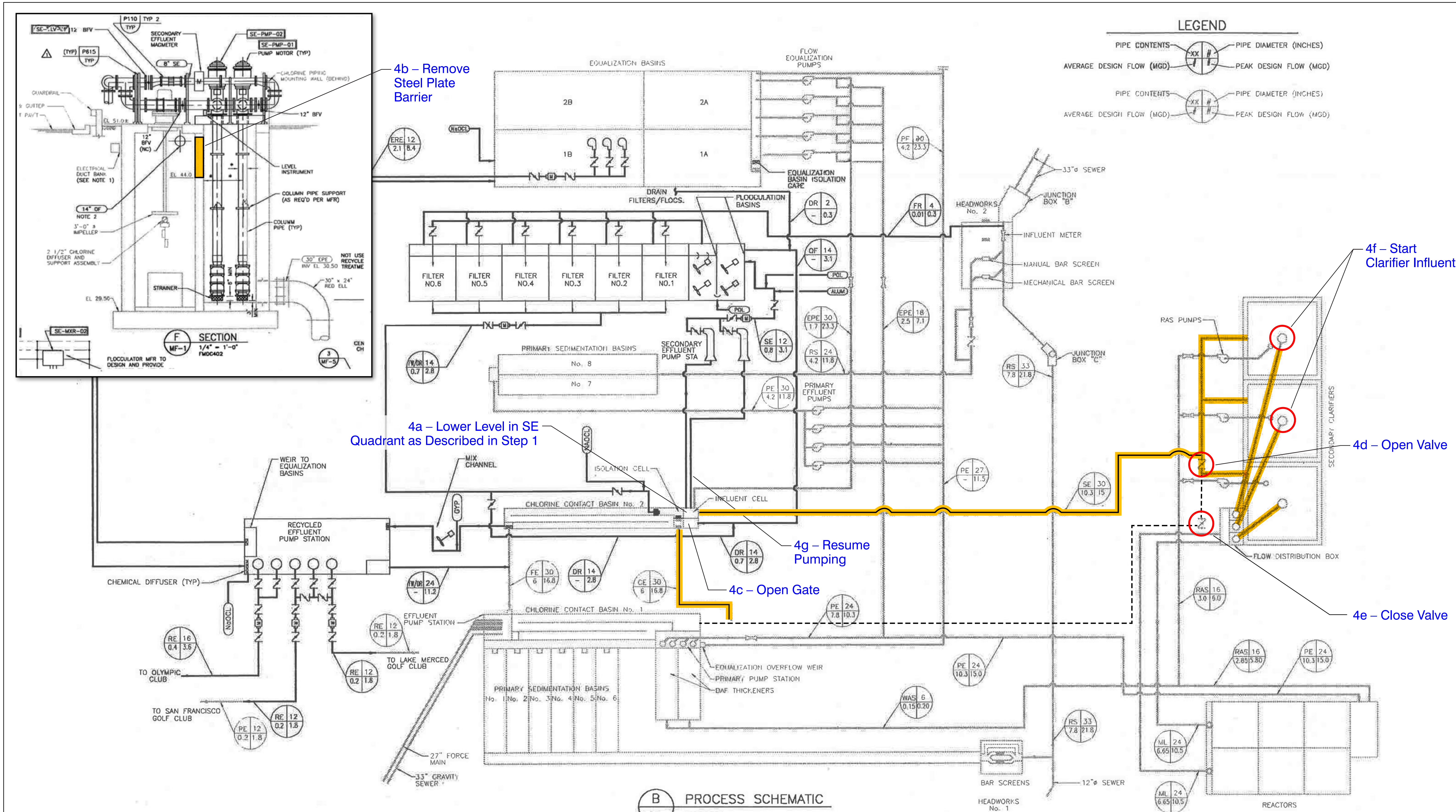
dc0117-10076rf12.ai



STEP 3 IN OPTION 2

FIGURE 8

CITY OF DALY CITY
PM 09 – SECONDARY EFFLUENT PUMP STATION CONSTRUCTABILITY



STEP 4 IN OPTION 2

FIGURE 9

CITY OF DALY CITY
PM 09 – SECONDARY EFFLUENT PUMP STATION CONSTRUCTABILITY

carollo

dc0117-10076rf14.ai

APPENDIX E – DALY CITY MEMBRANE PILOT RESULTS

This document is released for the purpose of information exchange review and planning only under the authority of Katherine Ottoboni, September 18, 2017, California PE 82739

CITY OF DALY CITY

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

MEMBRANE PILOT TESTING RESULTS

DRAFT
September 2017

CITY OF DALY CITY

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

MEMBRANE PILOT TESTING RESULTS

TABLE OF CONTENTS

Page No.

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

MEMBRANE PILOT TESTING RESULTS

1.0 EXECUTIVE SUMMARY

Daly City (City) plans to expand its recycled water treatment facility by approximately 3 million gallon per day (mgd) to provide irrigation water to nearby cemeteries. The new recycled facility will treat secondary effluent from the City's wastewater treatment plant (WWTP) to meet Title 22 recycled water requirements. The expansion train will include membrane filtration and ultraviolet disinfection. This report documents the results of two membrane filtration pilot studies that were conducted at Daly City's WWTP from March 2016 to March 2017. The first pilot study focused on polymeric membranes and the second focused on ceramic membranes. The results from these studies were used to develop design criteria for the expansion project.

The WWTP uses high purity oxygen (HPO) for secondary treatment. HPO facilities are characterized by short solids retention times, resulting in water qualities that have the potential to foul membrane filters and limit production. The pilot studies focused on developing pretreatment and membrane cleaning strategies that reduce and reverse fouling.

The first study tested the performance of four polymeric hollow fiber membrane modules selected for their competitive cost and compatibility with the proposed pretreatment and chemical cleaning strategies. Modules from Toray, Scinor, Dow, and BASF were tested on a membrane pilot skid supplied by WesTech Engineering. Table 1 summarizes the key design criteria developed from the polymeric membrane study. Based on this design criteria, the projected annual operations and maintenance (O&M) cost is $560,000 - $690,000. This annual cost includes energy usage, chemical usage, and membrane replacement. The cost is similar to applications with comparable feed water qualities, however it is 1.9 to 2.4 times higher than applications with lower concentrations of total organic carbon (TOC) in the secondary effluent. For comparison, a lower TOC application is able to operate at a higher loading rate, does not need inline coagulation, and requires less frequent chemical cleans. As a result, the annual O&M costs to treat a lower TOC secondary effluent would be $290,000 for a similar sized facility.

Since the O&M cost for polymeric membranes is high in this application, a second pilot study was performed to evaluate the potential benefits of a ceramic membrane. Ceramic membranes are developed from robust materials and have the potential to offer a higher loading rate and reduce the O&M cost. Table 2 summarizes the key design criteria developed from the ceramic membrane evaluation. Based on this design criteria, the projected annual O&M cost for a ceramic membrane system is $550,000 - $690,000. Although the ceramic membranes have a lower replacement cost due to their long life expectancy, the chemical cost will be greater due to the high coagulant doses required. The projected O&M cost for a ceramic system was only 2% lower than the O&M cost for a polymeric system. The capital cost for the two systems were within 5% of each other, so the overall lifecycle costs were comparable.

Table 1 Key Findings and Resulting Design Criteria - Polymeric Membranes
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

	Membrane Manufacturer				
Operating Condition	**Toray**[(1)]	**Scinor**[(1)]	**Dow**[(1)]	**BASF**[(1)]	**Design Criteria**
Flux (gfd)	31	31	31	32	31/32
Crossflow (%)	0	10	0	0	10
Sodium Hypochlorite Dose (Pretreatment) (mg/L)	3.5	3.5	3.5	3.5	3.5
Coagulant Dose (Pretreatment) (mg/L)	5	5	5	5	5
Low-pH CEB Frequency (Per Rack, Per Week)	1	2	3	3	3
High-pH CEB Frequency (Per Rack, Per Week)	1	1	1	1	1
Observed CIP Interval (days)	31	25	26	28	N/A
Observed CIP Interval Range (days) [(2)]	4 - 31	21 - 25	17 - 28	9 - 28	14 - 30

Notes:
(1) Operating conditions reflect periods of improved performance.
(2) Range of CIP interval throughout duration of pilot, including operation at lower flux of 15.5 gallons per square foot per day (gfd).

Table 2 Key Findings and Resulting Design Criteria - Ceramic Membranes
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Operating Condition	**Design Criteria**[(1)]
Flux (gfd)	70/91
Crossflow (%)	N/A
Sodium Hypochlorite Dose (Pretreatment) (mg/L)	6.5
Coagulant Dose (Pretreatment) (mg/L)	34 - 64
Low-pH CEB Frequency (Per Rack, Per Week)	3.5
High-pH CEB Frequency (Per Rack, Per Week)	7
Observed CIP Interval (days)	28[(2)]

Notes:
(1) Operating conditions reflect periods of improved performance.
(2) Observed CIP interval was limited due to scheduling constraints. The final CIP was performed based on pilot schedule rather than operating conditions.

In addition to cost, the project team considered other criteria including:

- Installation Base: The polymeric membranes are more prevalent in the recycled water industry and have a larger installation base.
- Open Platform Compatibility: The polymeric membranes are compatible with an open platform system, while the ceramic membranes are not.
- Membrane Life: The life expectancy of the ceramic membranes is 2 to 6 times longer than the polymeric membranes in this application.
- Solids Generation: The solids generated by the recycled water systems and returned to the headworks are expected to increase by 10 to 20% if polymeric membranes are used or 100% if ceramic membranes are used.

The overall assessment of both membrane systems was comparable, each with unique strengths and limitations. Therefore, it is recommended that both membrane systems be included in the predesign. If the project continues to final design, the project team and City would rank the criteria (life cycle cost, installation base, open platform compatibility, etc.) and screen membrane suppliers for the preselection process.

2.0 INTRODUCTION

Carollo Engineers, Inc. (Carollo) is developing the preliminary design of a 3 million gallons per day (mgd) expansion of Daly City's recycled water treatment and distribution system. The existing wastewater treatment plant (WWTP) is mostly built out, leaving little room for expansion. The 2009 Feasibility Study (Carollo, 2009) recommended membrane filtration as the preferred technology since it has a relatively compact footprint.

Conceptual layouts were developed based on the available footprint to determine the required membrane flux rate. Because the target flux rate was fixed, pilot testing focused on pretreatment and membrane cleaning strategies that reduce and reverse fouling.

The study's objectives were to:

1. Evaluate the use of coagulation and pre-oxidation (combined chlorine) to maximize membrane flux and efficiency.
2. Determine the sustainable flow (flux) rates through each membrane module used in the study.
3. Use the sustainable flux rates to refine previous system layouts and costs and support membrane system procurement.
4. Evaluate membrane chemical cleaning strategies to define residuals handling criteria, chemical storage, and feed system criteria.

5. Evaluate filtrate water quality and chlorine demand.

6. Provide a hands-on training opportunity for City staff.

3.0 TEST DESCRIPTION

3.1 Process Overview

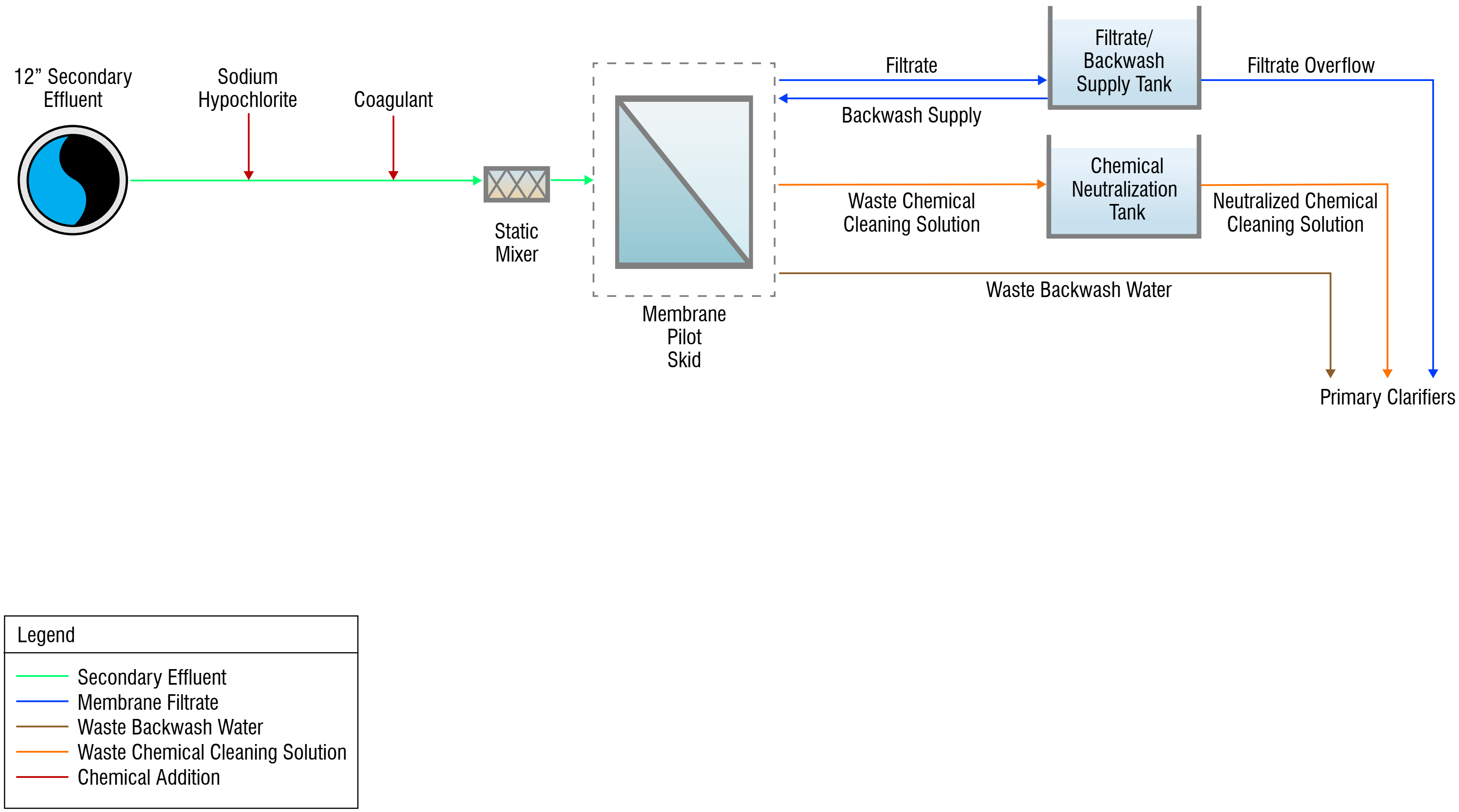
The polymeric membrane pilot skid independently operated two membrane modules concurrently. Figure 1 shows a schematic of the pilot setup, which is further explained in the Membrane Pilot Testing Protocol (Appendix A). The ceramic pilot skid was supplied by Nanostone and operated one membrane module.

3.2 Membrane Modules

From March to September 2016, four polymeric hollow fiber membranes (Toray, Scinor, Dow, BASF) were tested. These membranes were selected for their competitive cost and compatibility with the proposed pretreatment and chemical cleaning strategies. This type of membrane is the most widely used in the recycled water industry and most readily available for pilot testing.

Based on the design criteria developed during the polymeric pilot, the projected operations and maintenance costs were higher than expected. A ceramic membrane (Nanostone) was also evaluated from November 2016 to March 2017 to determine the potential benefits of this alternative technology.

Table 3 summarizes the characteristics of each membrane tested.



MEMBRANE PILOT SCHEMATIC

FIGURE 1

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

carollo

dc0116f2-10076.ai

Table 3 Membrane Module Characteristics
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

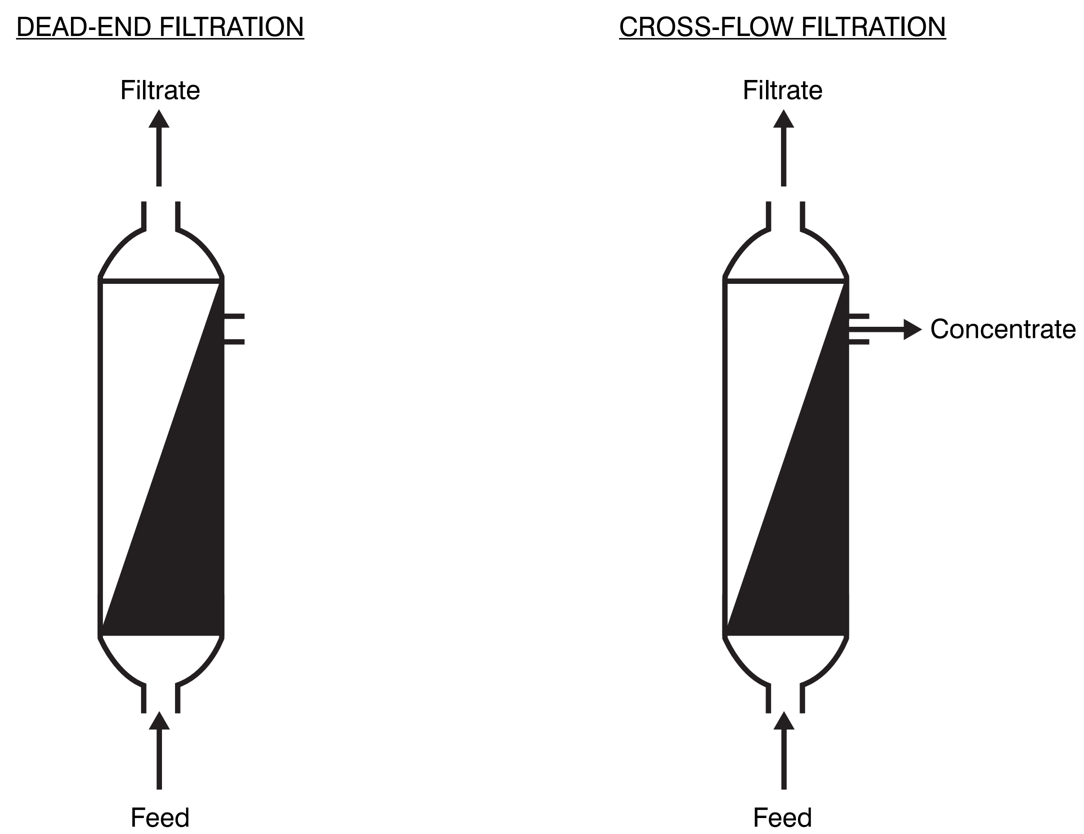
Characteristic	Membrane Manufacturer				
	Toray	Scinor	Dow	BASF	Nanostone
Membrane model	HFU-2020N	SMT600-P80	SFD-2880XP	Inge, dizzer XL 0,9 MB 70 WT	CM-131
Membrane type	Ultrafiltration	Ultrafiltration	Ultrafiltration	Ultrafiltration	Ultrafiltration
Membrane material	PVDF	PVDF	PVDF	PES	Ceramic (Al_2O_3)
Nominal pore size	0.01 µm	0.1 µm	0.03 µm	0.02 µm	0.03 µm
Operation mode	Outside-In	Outside-In	Outside-In	Inside-Out	Inside-Out
Filtrate turbidity	≤ 0.1 NTU	≤ 0.1 NTU	≤ 0.1 NTU	≤ 0.1 NTU	≤ 0.1 NTU
Module membrane area	775 ft^2	861 ft^2	829 ft^2	753 ft^2	205 ft^2
Module length	85.0 inch	92.9 inch	92.9 inch	75.4 inch	66.1 inch
Module diameter	8.5 inch	8.9 inch	8.9 inch	9.9 inch	10.4 inch
Maximum feed pressure	43.5 psi	60 psi	90.65 psi	73 psi	150 psi
Maximum trans-membrane pressure (TMP)	43.5 psi	45 psi	30.5 psi	22 psi	150 psi

3.3 Testing Plan

Each membrane was piloted for a minimum of two months to allow adequate time for an experimental period and a period of continuous operation. To establish initial cleaning demands and fouling rates, the membranes were first operated at half of the design flux rate under the manufacturers' recommended operating conditions. Then, the initial operating conditions were adjusted until membrane performance appeared stable at the lower flux rate. Once stable, the flux rate was increased to the design flux rate and the operating conditions were adjusted as necessary.

To improve membrane performance, the operating conditions were adjusted in the following order:

- Sodium hypochlorite dose: Adding sodium hypochlorite upstream of the membranes minimizes biological fouling and oxidizes some organics. The sodium hypochlorite dosage was adjusted to maintain a total chlorine concentration of at least 2 milligrams per liter (mg/L).
- Backwash intensity and sequences: Hydraulic backwashes and air scour remove solids that accumulate during filtration.
- Chemical cleaning solutions and frequencies: Chemical cleans remove foulants not removed with hydraulic backwashes. Foulants include colloidal material, organic material, biological growth, and precipitated inorganic material.
- Coagulant dose: Adding coagulant creates a more permeable and backwashable solids layer on the membrane surface. Coagulants can further reduce membrane fouling by binding organic carbon and preventing its contact with the membrane surface.
- Filtration mode: The pilot can operate in either dead-end or cross-flow filtration mode, as illustrated in Figure 2. In dead-end filtration, all feed water is filtered through the membrane. In cross-flow filtration, most feed water is filtered through the membrane, but a percentage of the feed water flows tangentially across the membrane's surface and is discharged. When necessary, this pilot study used cross-flow filtration mode to minimize plugging the membrane with solids.



DEAD-END FILTRATION VS CROSS-FLOW FILTRATION

FIGURE 2

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

3.4 Evaluation Criteria

Pretreatment, backwash, and chemical cleaning strategies were adjusted to improve membrane performance. Membrane performance was assessed based on the criteria presented in Table 4 and discussed below.

Table 4 Evaluation Criteria
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Criteria	Value
Minimum Permeability	1 gfd/psi
Maximum Permeability Decline within MC/CEB Interval	50%
Minimum Permeability Restoration following MC/CEB	95%
Minimum MC/CEB Interval	0.5 days
Minimum CIP Interval	30 days

3.4.1 Permeability

Permeability: Permeability is calculated as the temperature corrected flux divided by the transmembrane pressure for an individual membrane filtration unit. Permeability is expressed in terms of volume per unit membrane area per unit time per unit pressure, expressed in gallons per square foot per day/pounds per square inch (gfd/psi) at 20°C.

Permeability is important because it reflects the capacity and TMP of the membrane system. With a constant flux system, low permeability reflects a high transmembrane pressure which requires increased pumping energy. Once the pumping energy is maxed out, the capacity will begin to decline. Therefore it is beneficial to maintain a high permeability so that energy efficiency and capacity are not compromised.

3.4.2 Chemically Enhanced Backwash

Chemically Enhanced Backwash (CEB): The periodic application of a chemical solution to a membrane for the intended purpose of increasing membrane permeability. CEB has the following characteristics:

- CEB utilizes the backwash system.
- CEB uses a single chemical cleaning solution, which is added to the backwash flow.
- CEB has a maximum duration of 60 minutes, from the time the rack is taken out of production to the time it is made ready for the next filtration cycle.

As the membrane filtration unit operates, the membrane permeability will decline and a CEB will be required to recover the permeability loss. It is important to limit the permeability decline between CEBs to ensure that the membrane fouling can be reversed with the relatively short duration, low chemical concentration CEB. Additionally, it is important that the cleaning recipe is effective in restoring permeability in order to decrease the frequency of long duration, high chemical concentration CIPs.

3.4.3 Maintenance Clean

Maintenance Clean (MC): The periodic application of a chemical solution to a membrane for the intended purpose of increasing membrane permeability. MC has the following characteristics:

- MC utilizes the CIP system.
- MC uses a single chemical cleaning solution, which is batched in the CIP tank.
- MC has a maximum duration of 60 minutes, from the time the rack is taken out of production to the time it is made ready for the next filtration cycle.

A MC is similar to a CEB, except that is utilizes the CIP system instead of the backwash system.

3.4.4 Clean-in-Place

Clean-In-Place (CIP) or Recovery Clean (RC): The periodic application of one or more chemical solutions to a membrane for the intended purpose of increasing membrane permeability.

- CIP is differentiated from a CEB by its duration (requiring more than 60 minutes downtime including rinsing), by the number of different chemical cleaning solutions used, and by the method of application of the cleaning solution.
- A single CIP (CIP) event may include consecutive use of acidic and caustic and/or chlorinated cleaning solutions with rinse steps in between.
- CIP is synonymous with the term recovery clean (RC).

Over time the post-CEB/MC permeability will gradually decline and a CIP will be required to restore the permeability to its clean state. The CIP interval, or days in between CIPs, is an important industry standard and a way of measuring the reliability of the process. Since CIPs require significant downtime, maximizing the CIP interval is essential to maximize production and reliability.

Typically in potable water applications the standard CIP interval is 30 days, which was the initial criterion for this pilot. This criteria is a balance between flux and fouling rates that usually results in minimum lifecycle costs. Daly City's secondary effluent is a difficult to treat water that causes elevated fouling rates because flux is fixed and higher than desirable for this application. Therefore, more frequent CIPs are required. Other HPO recycled water facilities in California, such as West Basin Municipal Water District (MWD), operate with shorter CIP intervals and more intense daily CEB/MCs.

4.0 RESULTS

4.1 Membrane Feed Water Quality

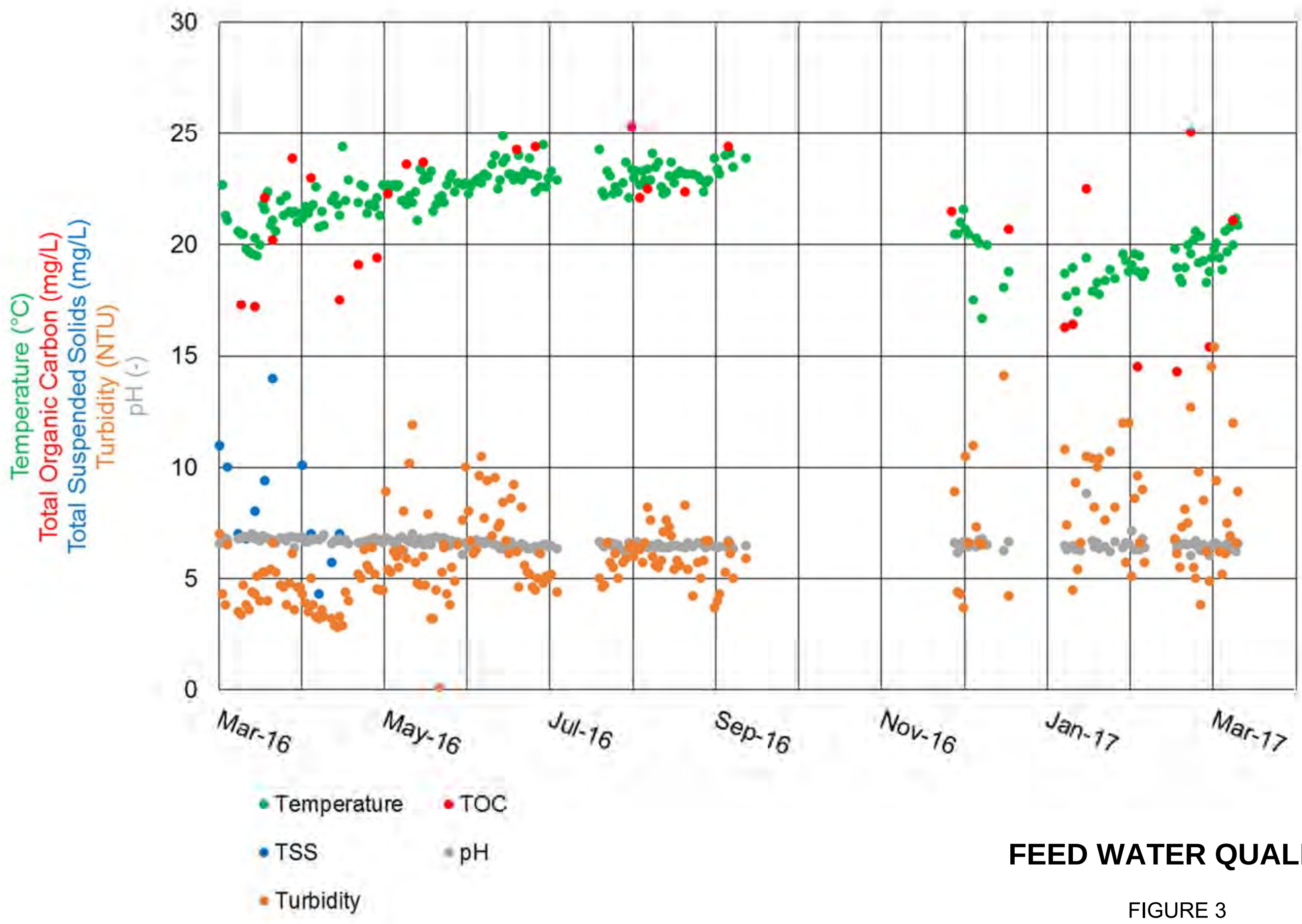
As previously mentioned, the membrane feed water was secondary effluent from Daly City's WWTP. Prior to clarification, the wastewater is treated by a high purity oxygen (HPO) activated sludge process. HPO facilities are characterized by short solids retention times (SRT), resulting in water qualities that have the potential to rapidly foul membrane filters and reduce capacity. Similar short SRTs at West Basin MWD have caused rapid fouling of their membrane filters.

Grab samples of membrane feed water were collected and analyzed for a variety of parameters per the water quality monitoring plan presented in the Membrane Pilot Protocol (Appendix A). Membrane feed water samples were collected after pretreatment. Table 5 summarizes the membrane feed water quality and Figure 3 presents the time series of key water quality parameters The secondary effluent wastewater contained on average 8.4 mg/L of total suspended solids (TSS), 21 mg/L of total organic carbon (TOC), and had an average turbidity of 6.5 nephelometric turbidity units (NTUs). The TSS, TOC, and turbidity were two to four times greater in Daly City's secondary effluent than in similar WWTP's secondary effluent (West Basin MWD).

4.2 Membrane Filtrate Water Quality

Grab samples of membrane filtrate were collected and analyzed for a variety of parameters per the water quality monitoring plan presented in the Membrane Pilot Protocol (Appendix A). Table 6 summarizes the membrane filtrate water quality. The membranes removed the suspended solids and 30-40 percent of the total organic carbon. Additionally, the UV Transmittance (UVT) increased across the polymeric membranes to 60 percent (average) and across the ceramic membrane to 69 percent (average). The UVT data collected will be used to design the UV system.

Table 5	Membrane Feed Water Quality Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City				
Parameter	**Units**	**Average**	**Min.**	**Max.**	**No. of Samples**
pH	-	6.6	6.02	8.82	224
Temperature	°C	22	14.9	24.7	224
Turbidity	NTU	6.5	0.11	53.2	223
UV Transmittance	%	47.9	9.4	61.7	218
ORP	mV	407	72.1	566	223
Dissolved Oxygen	mg/L	4.83	2.13	9.10	222
Total Chlorine	mg/L	3.0	0.0	19.6	222
Total Suspended Solids	mg/L	8.4	4.3	14.0	12
Total Organic Carbon	mg/L	21.3	14.3	36.2	30
Dissolved Organic Carbon	mg/L	14.8	10.1	20.0	14
Silica	mg/L	18	16	18	8
Reactive Silica	mg/L	15	13	15	7
Total Iron	mg/L	0.95	0.15	14.00	42
Dissolved Iron	mg/L	0.19	0.10	0.50	20
Total Dissolved Solids	mg/L	424	400	460	9
Alkalinity	mg/L	274	220	370	19
Total Aluminum	mg/L	7.84	0.06	52.0	34
Dissolved Aluminum	mg/L	0.43	0.05	3.30	17
Total Manganese	mg/L	0.05	0.04	0.06	8
Dissolved Manganese	mg/L	0.05	0.04	0.07	8
Ammonia as N	mg/L	53	35	75	8
Total Calcium	mg/L	18	12	25	9
Total Magnesium	mg/L	8.5	3.6	14.0	9
Total Sodium	mg/L	75	74	75	2
Orthophosphate	mg/L	7.8	4.6	11.0	2
Total Hardness	mg/L	80	45	118	9
Chloride	mg/L	92	90	94	2
Nitrate as N	mg/L	ND	ND	ND	2
Sulfate as SO4	mg/L	50	48	52	2



FEED WATER QUALITY

FIGURE 3

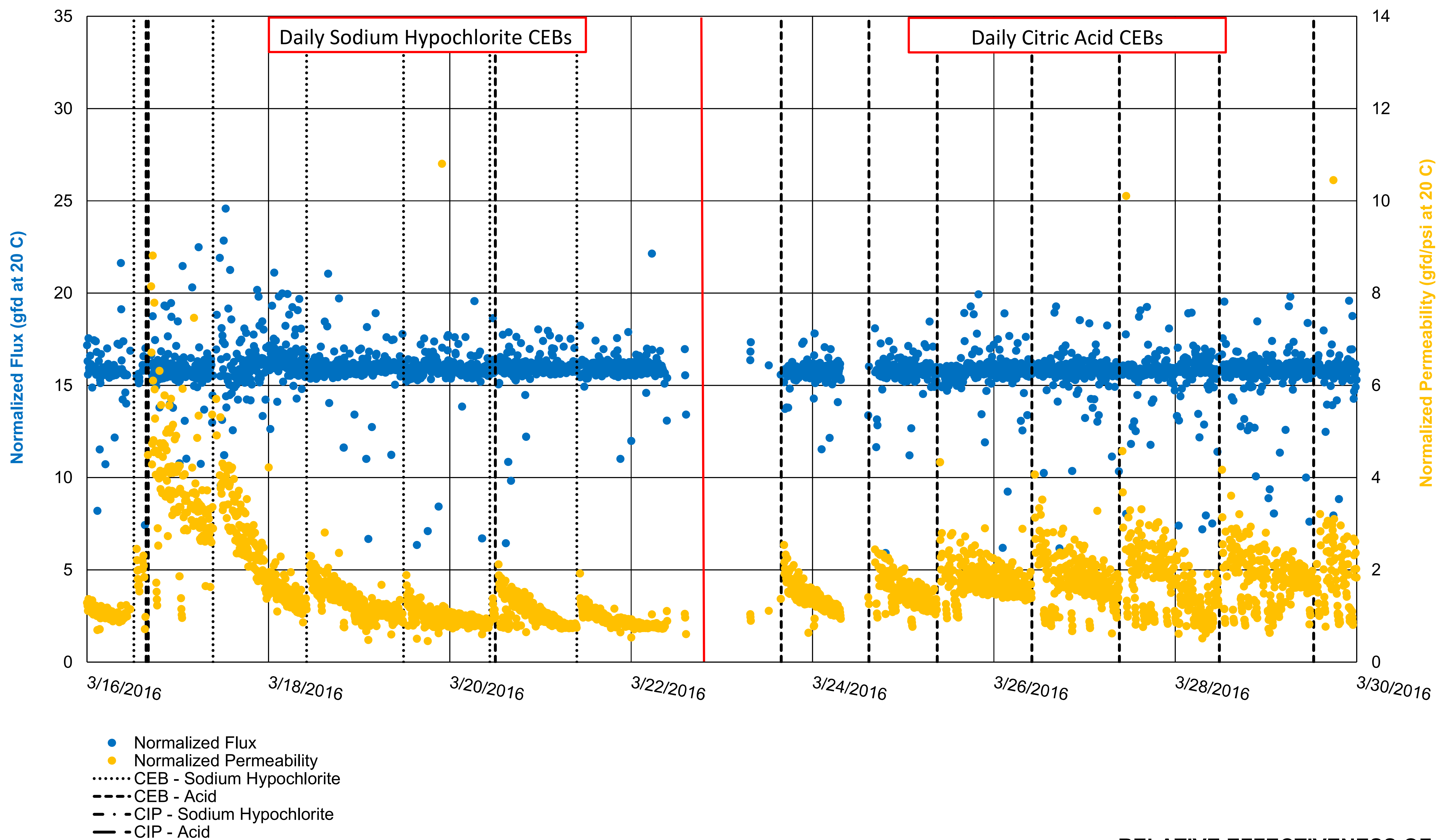
CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

carollo

Table 6	Membrane Filtrate Water Quality Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City				
Parameter	**Units**	**Average**	**Min.**	**Max.**	**No. of Samples**
UV Transmittance	%	62.3	26.7	79.1	352
Total Chlorine	mg/L	2.8	0.0	10.5	365
Total Suspended Solids	mg/L	0.2	0.0	0.9	22
Total Organic Carbon	mg/L	14	9	22	45
Dissolved Organic Carbon	mg/L	12.5	10.6	15.7	24
Silica	mg/L	16	15	17	2
Reactive Silica	mg/L	14	13	14	2
Total Iron	mg/L	0.11	ND	0.78	48
Dissolved Iron	mg/L	0.14	0.13	0.16	3
Total Dissolved Solids	mg/L	403	380	430	3
Alkalinity	mg/L	320	280	360	2
Total Aluminum	mg/L	0.05	ND	2.10	48
Dissolved Aluminum	mg/L	ND	ND	ND	3
Total Manganese	mg/L	0.05	0.04	0.06	2
Dissolved Manganese	mg/L	0.06	0.04	0.07	2
Total Calcium	mg/L	24	23	25	3
Total Magnesium	mg/L	13.7	13.0	14.0	3
Total Sodium	mg/L	76	74	78	2
Total Hardness	mg/L	116	112	120	3
Chloride	mg/L	95	92	97	2
Sulfate as SO4	mg/L	50	48	52	2

4.3 Key Foulants

At the beginning of the study, organic fouling was anticipated to be the leading fouling agent due to the high total organic carbon (TOC) present in the secondary effluent. Daily sodium hypochlorite CEBs were performed to target organic fouling. However, this chemical cleaning strategy was not effective and the post-CEB permeability continued to decline as shown in Figure 4.



RELATIVE EFFECTIVENESS OF CAUSTIC & ACIDIC CHEMICAL CLEANS

FIGURE 4

Therefore, the cleaning strategy was modified to consist of daily citric acid CEBs. This chemical cleaning strategy resulted in a steady increase in permeability following each CEB as shown in Figure 4. These results indicate that inorganics, were contributing to membrane fouling more than the organics and therefore citric acid was the more effective cleaning chemical. Feed, filtrate, and waste citric CEB cleaning solution samples were analyzed for a variety of parameters to identify the specific inorganic constituents contributing to membrane fouling. As shown in Table 7, iron had the relatively highest removal rate across the membrane surface and was the most highly concentrated constituent in the waste citric CEB cleaning solution. Citric acid has chelating properties that make it an effective cleaning chemical for removing metals, such as iron. City staff confirmed that within the WWTP, the only source of iron added is ferrous chloride that is added to the gravity thickeners.

Table 7 Foulant Concentration Summary
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Parameter	Concentration(1) (mg/L)			Removed Across Membrane (%)	Waste Acid CEB Concentration Factor(2)
	Feed	Filtrate	Waste Acid CEB		
Iron	0.34	0.13	25	62	192
Calcium	25	25	28	0	1.1
Magnesium	14	14	15	0	1.1
Sodium	74	74	77	0	1.0
Silica	16	15	17	6	1.1
Orthophosphate	4.6	4.3	62	7	14
Chloride	90	92	470	-2	5.1
Nitrate	ND	ND	ND	0	0.0
Sulfate	52	52	54	0	1.0

Notes:
(1) Samples collected April 15, 2016.
(2) Calculated as the ratio of waste acid CEB concentration to filtrate concentration. Waste Acid CEB was compared to filtrate, because filtrate was used as the make-up water for the CEB and therefore represents the background concentrations present in the CEB.

4.4 Toray Performance

Figure 5 summarizes Toray's Hydraulic Performance throughout pilot testing. Appendix B includes a detailed description of operating modifications and fouling responses.

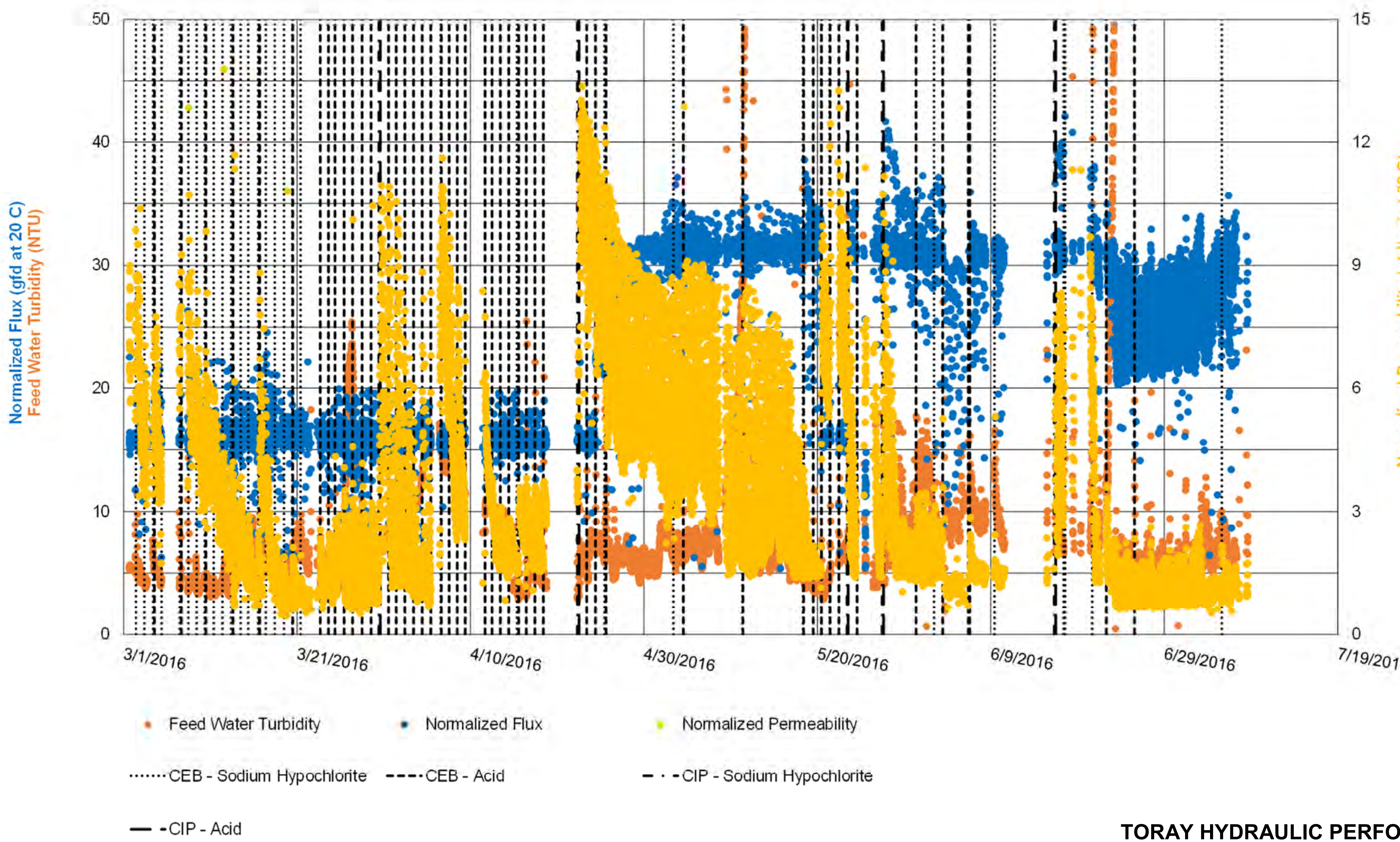
Key observations for Toray are as follows:

- **Backwash Flowrate:** The backwash flowrate was changed from a ratio (1.1 x Flux) to a flow setpoint (25 gallons per minute (gpm)). The increased flow during backwashes increased the overall permeability recovery.
- **Air Scrub:** Increasing the air scrub flowrate to 5.5 standard cubic feet per minute (scfm) in the backwashing sequence increased the backwashes' effectiveness.
- **Pretreatment:** Adding 5 mg/L of ACH decreased the fouling rate and the frequency of low pH cleans. Higher doses (30-60 mg/L) increased fouling rates, presumably from module plugging.

Table 8 summarizes the set of adjusted operating conditions that resulted in the best membrane performance at the design flux rate (31 gfd). Figure 6 shows the hydraulic performance under these revised operating conditions and Table 9 compares the actual performance to the evaluation criteria.

Under the revised set of operating conditions, the Toray module was able to meet a majority of the established criteria. The CEB strategy consisted of a high pH CEB followed by a low pH CEB. Although permeability was restored it was not sufficient to maintain the high permeability.

The Toray module operated stably for 22 days. At the end of this period an event occurred, which caused a dramatic decline in permeability. The cause of the event is unclear based on the pilot data collected. Following this event, the subsequent CEBs and CIPs were unable to restore and maintain the pre-event permeability.



TORAY HYDRAULIC PERFORMANCE

FIGURE 5

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

Table 8	**Toray Operating Conditions Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City**	
Operating Condition	**Initial**	**Revised**(1)
Pretreatment		
Sodium Hypochlorite Dose (mg/L)	3.5	3.5
Coagulant Dose (mg/L)	0	5
Production		
Flux (gfd)	15.5	31
Crossflow (%)	0	0
Production Cycle (min)	22	22
Backwash		
Air Scrub Flow (scfm)	3.5	5.5
Backwash Flow (BW Waste Port) (gpm)	1.1 x Flux	25
Backwash Flow (Lower Drain) (gpm)	N/A	20(2)
Drain (sec)	60	60
Chemically Enhanced Backwash		
Cleaning Solution Soak Time (min)	30	30
Sodium Hypochlorite/Caustic CEB		
Frequency (Per Week)	7	1
Sodium Hypochlorite Dose (mg/L)	900	800
Caustic Dose (mg/L)	400	525
Citric Acid/Hydrochloric Acid CEB		
Frequency (Per Week)	2	1
Citric Acid Dose (mg/L)	1,000	1,000
Hydrochloric Acid Dose (mg/L)	400	550
Clean-in-Place		
Cleaning Solution Recycle Time (min)	120	120
Cleaning Solution Soak Time (min)	N/A	N/A
Sodium Hypochlorite/Caustic CIP		
Temperature (°C)	38	38
Target pH	N/A	N/A
Sodium Hypochlorite Dose (mg/L)	3,000	3,000
Caustic Dose (mg/L)	N/A	N/A

Table 8 Toray Operating Conditions
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

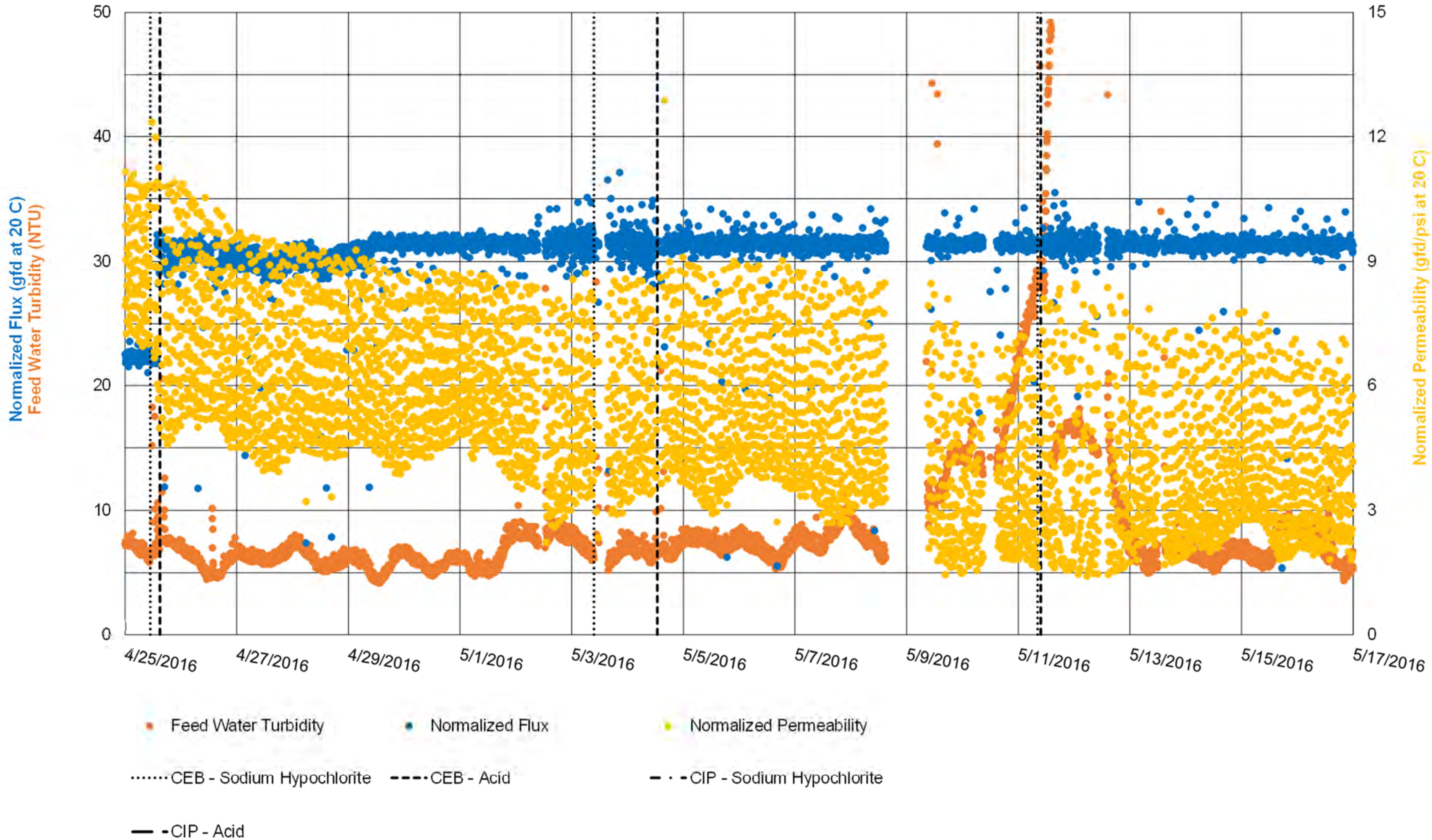
Operating Condition	Initial	Revised[1]
Citric Acid/Hydrochloric Acid CIP		
Temperature (°C)	38	38
Target pH	1.5	1.5
Citric Acid Dose (mg/L)	5,000	20,000
Hydrochloric Acid Dose[3] (mg/L)	Target pH	~9,900

Notes:

(1) Revised period reflects operating conditions from April 25, 2016 to May 16, 2016. CIP performed on May 23, 2016.

(2) Backwash flow through the lower drain was not implemented until the end of the testing period, and the module did not operate with it during revised operating conditions. It is a suggested operating condition.

(3) Chemical is dosed to achieve a target pH. The dose is not recorded automatically. Any value shown was calculated by manually timing the chemical pump, the chemical pump capacity and assuming a CIP volume of 50 gallons.



TORAY PERFORMANCE DURING REVISED OPERATING CONDITIONS

FIGURE 6

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

carollo

Table 9 Toray Membrane Performance
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Criteria	Value	Actual(1)	Criteria Met?
Minimum Permeability	1 gfd/psi	1.5 gfd/psi	Yes
Maximum Permeability Decline within CEB Interval	50%	24%	Yes
Minimum Permeability Restoration following CEB	95%	79%	No
Minimum CEB Interval	0.5 days	0.5 days(2)	Yes
Minimum CIP Interval	30 days	31 days(3)	Yes

Notes:
(1) Period from April 25, 2016 to May 16, 2016.
(2) CEB regime consisted of back to back high pH and low pH cleans.
(3) CIP performed outside of the revised operating period. Other criteria were not met during this time.

4.5 Scinor Performance

Figure 7 summarizes Scinor's Hydraulic Performance during pilot testing. Appendix C provides a detailed description of operating modifications and fouling responses.

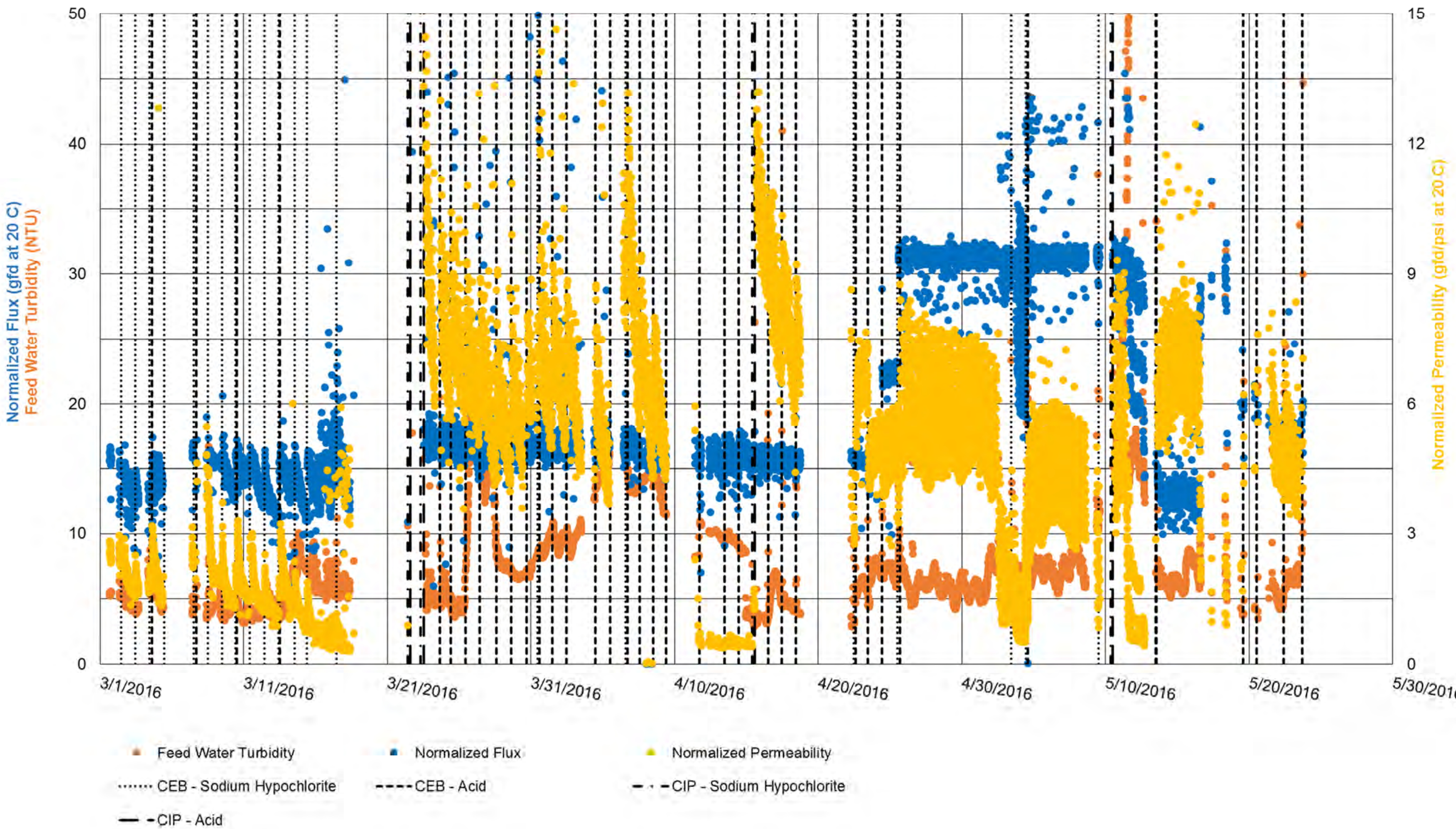
Key observations for Scinor are as follows:

Drain Step: Adding a 60-second drain step to the backwashing sequence helped Scinor maintain a constant flux rate and increase operational permeability.

Crossflow: Crossflow was required at the end of the test period to decrease the fouling rate. Although the manufacturer had recommended crossflow, it was not implemented initially.

Table 10 summarizes the operating conditions adjusted to improve membrane performance at the design flux rate (31 gfd). Figure 8 shows the hydraulic performance under these revised operating conditions and Table 11 compares the actual performance to the evaluation criteria.

Under the revised set of operating conditions, the Scinor module was unable to meet the established criteria. The Scinor module performed consistently with a gradual permeability decline for 7 days and then on May 2, 2016 after a brief shutdown (4 hours), the permeability quickly declined. The cause of the event is unclear based on the pilot data collected. Following this event, the Scinor module operated in declining flux mode until a set of low pH and high pH CEBs restored the permeability back to 6 gfd/psi. Then, the Scinor module performed consistently for 4 days before another unknown event caused a rapid decline in permeability. Following this event the module was unable to operate at the design flux rate.



SCINOR HYDRAULIC PERFORMANCE

FIGURE 7

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

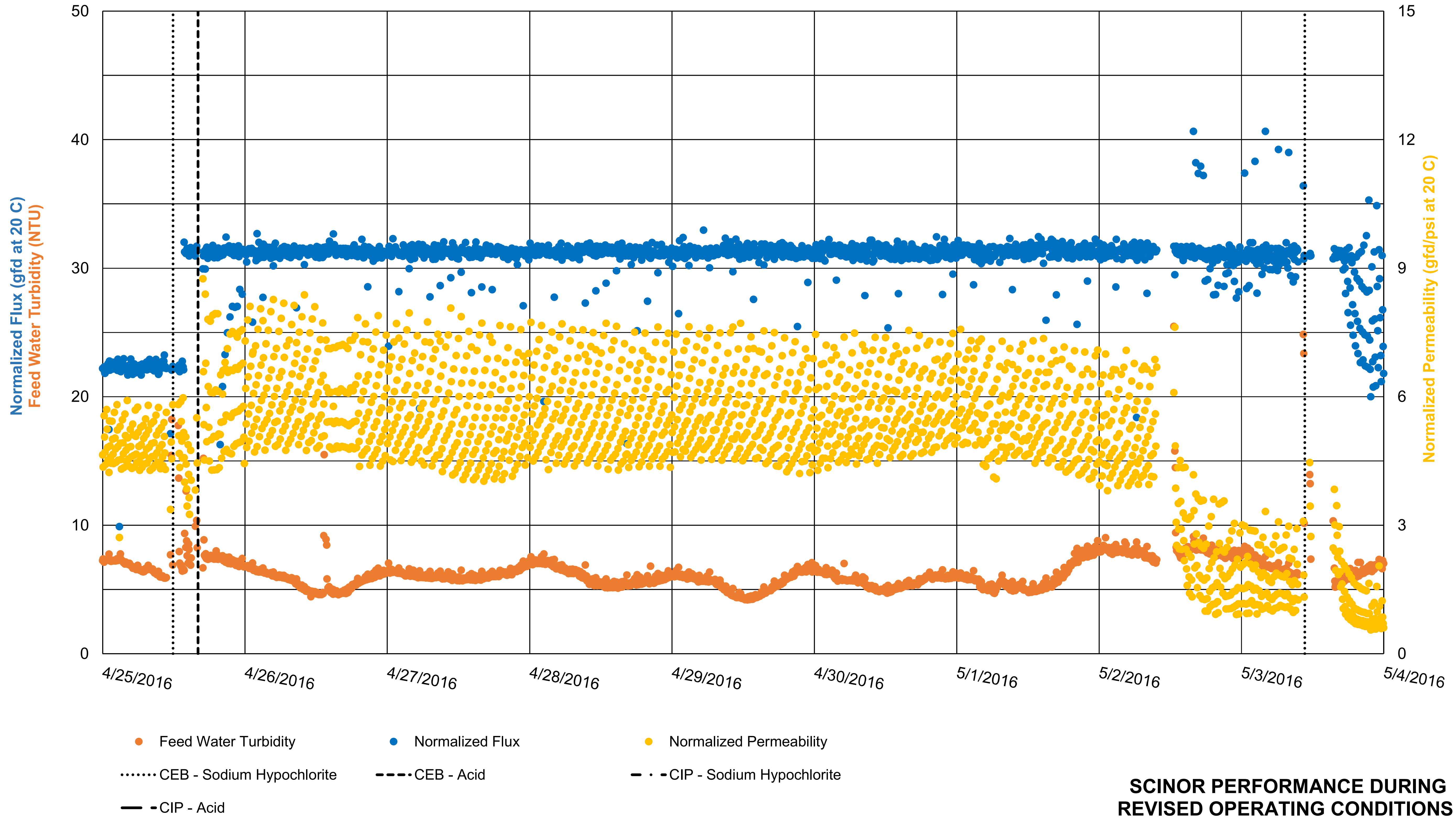
carollo

Table 10	Scinor Operating Conditions Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City	
Operating Condition	**Initial**	**Revised[1]**
Pretreatment		
Sodium Hypochlorite Dose (mg/L)	3.5	3.5
Coagulant Dose (mg/L)	0	5
Production		
Flux (gfd)	15.5	31
Crossflow (%)	0	10[2]
Production Cycle (min)	20	20
Backwash		
Air Scrub Flow (scfm)	3	3
Air/Water Flow (gpm)	1.1 x Flux	13
Backwash Flow (BW Waste Port) (gpm)	1.1 x Flux	25
Backwash Flow (Lower Drain) (gpm)	N/A	N/A
Drain (sec)	N/A	60
Chemically Enhanced Backwash		
Cleaning Solution Soak Time (min)	30	30
Sodium Hypochlorite/Caustic CEB		
Frequency (Per Week)	7	2
Sodium Hypochlorite Dose (mg/L)	900	800
Caustic Dose (mg/L)	400	525
Citric Acid/Hydrochloric Acid CEB		
Frequency (Per Week)	2	1
Citric Acid Dose (mg/L)	1000	1000
Hydrochloric Acid Dose (mg/L)	500	550
Clean-in-Place		
Cleaning Solution Recirculation Time (min)	30 x 3[3]	60
Cleaning Solution Soak Time (min)	30 x 3[3]	60
Sodium Hypochlorite/Caustic CIP		
Temperature (°C)	38	38
Target pH	12	12
Sodium Hypochlorite Dose (mg/L)	3,000	3,000
Caustic Dose[4] (mg/L)	Target pH	~2,200

Table 10	Scinor Operating Conditions Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City	
Operating Condition	**Initial**	**Revised**(1)
Citric Acid/Hydrochloric Acid CIP		
Temperature (°C)	38	38
Target pH	2	2
Citric Acid Dose (mg/L)	20,000	20,000
Hydrochloric Acid Dose(4) (mg/L)	Target pH	Target pH

Notes:

(1) Revised period reflects operating conditions from April 25, 2016 to May 3, 2016. CIP performed on May 10, 2016.
(2) Crossflow is considered a necessary operating condition. The membrane supplier initially recommended operating the module with 10 percent crossflow. However, crossflow was not implemented until the end of the testing period, and the module did not operate with it during revised operating conditions. Implementing crossflow earlier could have sustained or prolonged membrane performance.
(3) Alternating between recirculation and soak three times.
(4) Chemical was dosed to achieve a target pH. The dose was not automatically recorded. Any value shown was calculated by manually timing the chemical pump and, the chemical pump capacity and assuming a CIP volume of 50 gallons.



SCINOR PERFORMANCE DURING REVISED OPERATING CONDITIONS

FIGURE 8

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

carollo

Table 11 Scinor Membrane Performance
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Criteria	Value	Actual(1)	Criteria Met?
Minimum Permeability	1 gfd/psi	0.9 gfd/psi	No
Maximum Permeability Decline within CEB Interval	50%	67%	No
Minimum Permeability Restoration following CEB	95%	39%	No
Minimum CEB Interval	0.5 days	8 days	Yes
Minimum CIP Interval	30 days	25 days(2)	No

Notes:
(1) Period from April 25, 2016 to May 3, 2016.
(2) CIP performed outside of the revised operating period on April 15, 2016 and May 10, 2016. Other criteria were not met during this time.

4.5.1 Scinor Autopsy

After pilot testing, the Scinor module was sent to WesTech's workshop for further study. On June 9th, 2016, Carollo and WesTech representatives visually inspected the Scinor module.

Representatives observed significant clogging near the module's feed side, next to the lower drain. This clogging could be from insufficient backwash velocities or insufficient draining after a backwash. A pressurized backwash out of the lower drain was then added to the backwash sequence for remaining modules (Toray and Dow).

Additionally, fiber samples were collected from the top and bottom of the module and shipped to Avista Technologies, Inc. for a detailed autopsy. The autopsy consisted of stereoscope imaging, Fourier Transform Infrared Spectroscopy analysis, and Energy Dispersive X-ray analysis. Appendix D provides the autopsy report.

Key observations from the report are as follows:

- Organic matter was detected on the feed and filtrate side of the fibers.
- A high pH cleaner targeting hydrophobic material such as organics, oil, and grease successfully removed the visible foulant and increased permeability.

After drawing these conclusions, pilot feed and filtrate samples were collected and analyzed for oil and grease. The results were non-detect, meaning that oil and grease were not contributing foulants.

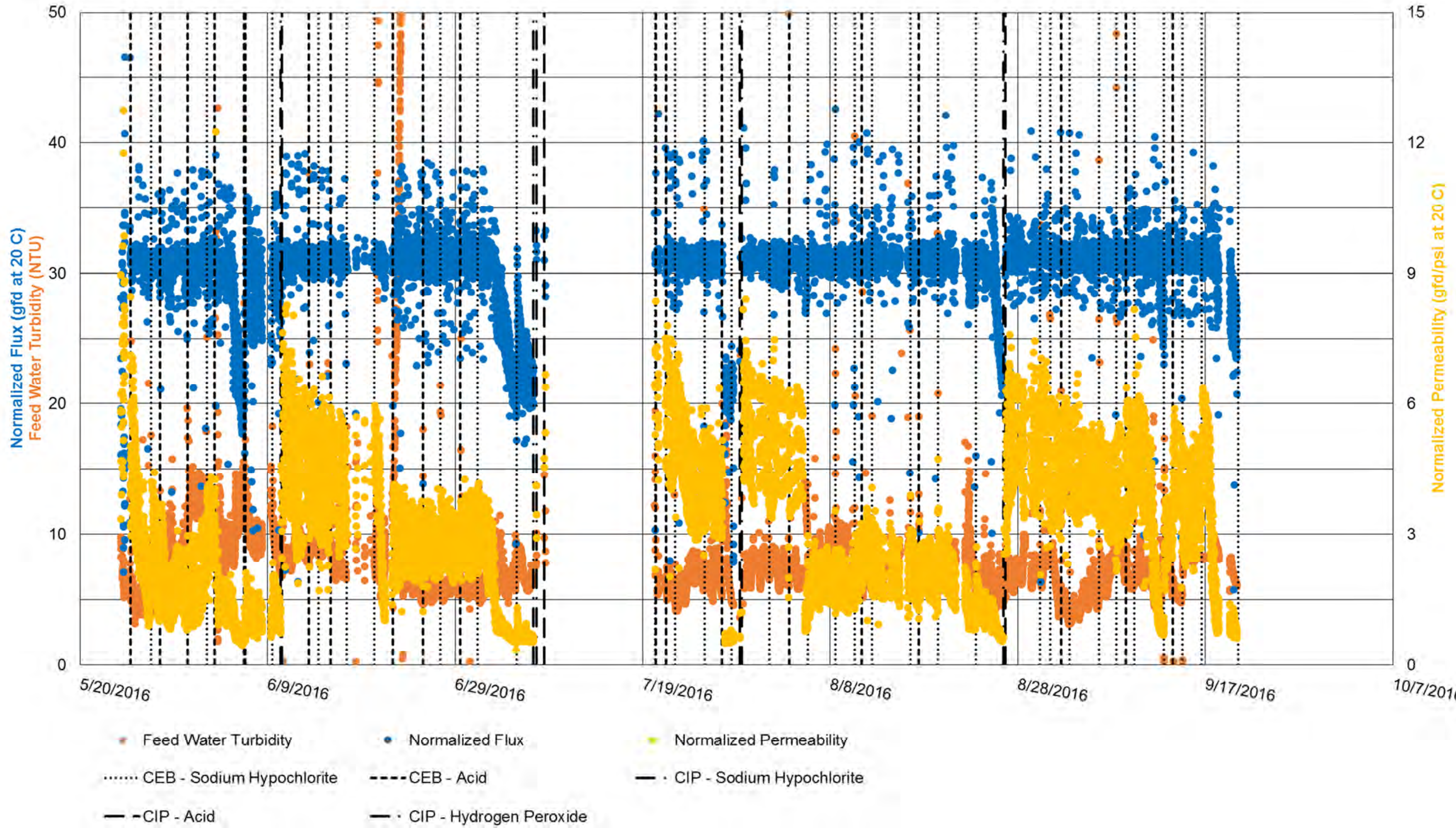
4.6 Dow Performance

Figure 9 summarizes Dow's Hydraulic Performance during pilot testing. Appendix E provides a detailed description of operating modifications and fouling responses.

Key observations for Dow are as follows:

- **Crossflow:** Crossflow was not necessary because it did not decrease the fouling rate.
- **Backwash Flowrate**: The backwash flowrate was increased from 25 gpm to 35 gpm, which allowed Dow to maintain a constant flux and decrease its fouling rate.

Table 12 summarizes the set of adjusted operating conditions that resulted in the best membrane performance at the design flux rate (31 gfd). Figure 10 shows the hydraulic performance from the revised operating conditions and Table 13 compares the actual performance to the evaluation criteria.



DOW HYDRAULIC PERFORMANCE

FIGURE 9

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

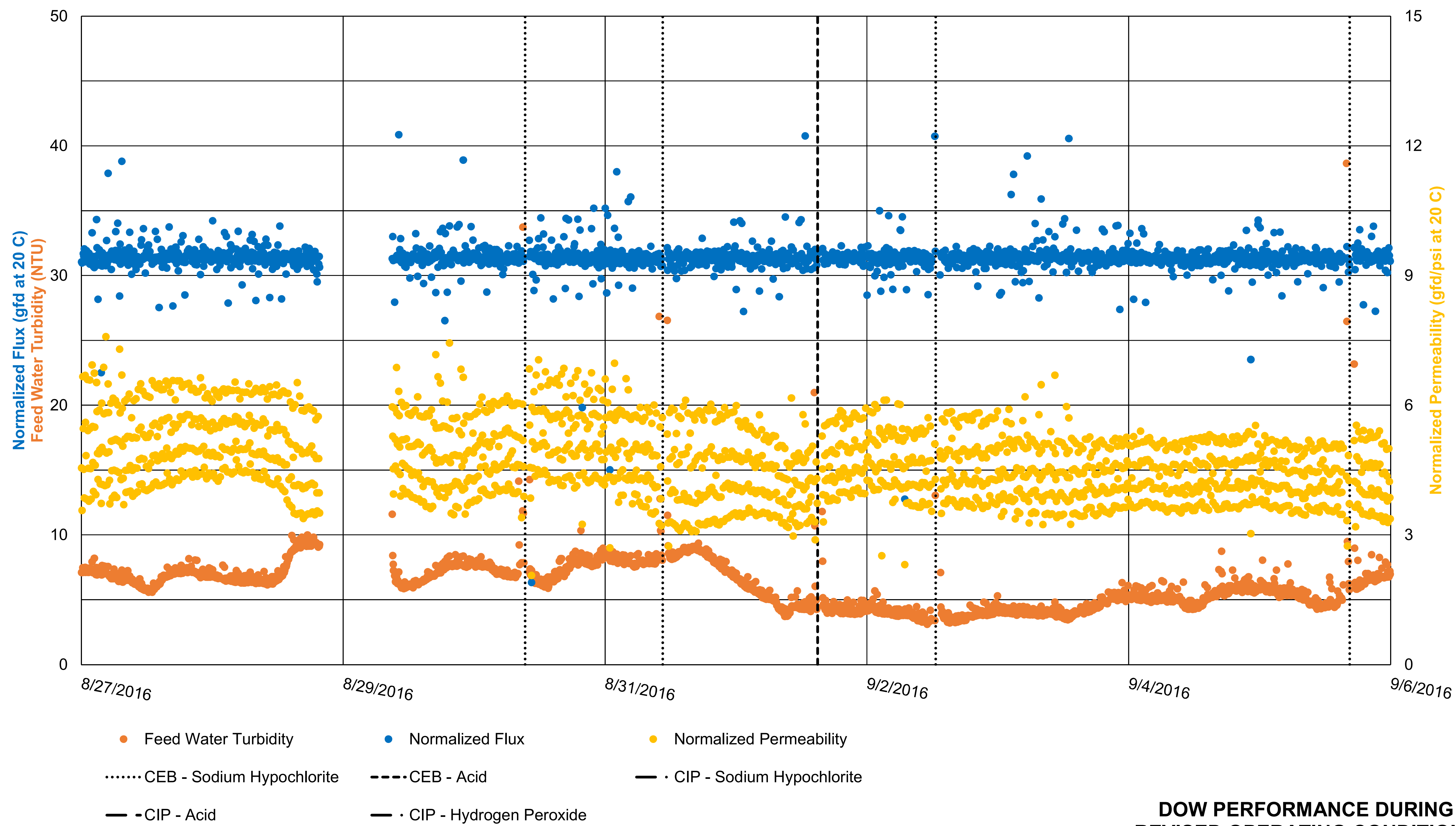
Table 12	Dow Operating Conditions Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City	
Operating Condition	**Initial**	**Revised(1)**
Pretreatment		
Sodium Hypochlorite Dose (mg/L)	3.5	3.5
Coagulant Dose (mg/L)	2.5	5
Production		
Flux (gfd)	17.5	31
Crossflow (%)	10	0
Production Cycle (min)	20	20
Backwash		
Air Scrub Flow (scfm)	2.5-3	2.5-3
Air/Water Flow (gpm)	13	13
Backwash Flow (BW Waste Port) (gpm)	25	35
Backwash Flow (Lower Drain) (gpm)	N/A	20
Drain (sec)	60	60
Chemically Enhanced Backwash		
Cleaning Solution Soak Time (min)	30	30
Sodium Hypochlorite/Caustic CEB		
Frequency (Per Week)	1	3
Sodium Hypochlorite Dose (mg/L)	800	1300
Caustic Dose (mg/L)	525	550
Citric Acid/Hydrochloric Acid CEB		
Frequency (Per Week)	2	1
Citric Acid Dose (mg/L)	1,000	1,000
Hydrochloric Acid Dose (mg/L)	550	550
Clean-in-Place		
Cleaning Solution Recirculation Time (min)	60	60
Cleaning Solution Soak Time (min)	60	60
Sodium Hypochlorite/Caustic CIP		
Temperature (°C)	38	38
Target pH	11-12	11-12
Sodium Hypochlorite Dose (mg/L)	3,000	3,000
Caustic Dose(2) (mg/L)	~2,130	~2,500

Table 12 Dow Operating Conditions Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City		
Operating Condition	**Initial**	**Revised(1)**
Citric Acid/Hydrochloric Acid CIP		
Temperature (°C)	38	38
Target pH	1.7	1.7
Citric Acid Dose (mg/L)	20,000	20,000
Hydrochloric Acid Dose(2) (mg/L)	~5,780	~5,000

Notes:

(1) Revised period reflects operating conditions from August 27, 2016 to September 5, 2016. CIP performed August 26, 2016.

(2) Chemical was dosed to achieve a target pH. The dose was not recorded automatically. Any value shown was calculated by manually timing the chemical pump, the chemical pump capacity and by assuming a CIP volume of 50 gallons.



DOW PERFORMANCE DURING REVISED OPERATING CONDITIONS

FIGURE 10

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

carollo

Table 13	Dow Membrane Performance Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City		
Criteria	**Value**	**Actual(1)**	**Criteria Met?**
Minimum Permeability	1 gfd/psi	3 gfd/psi	Yes
Maximum Permeability Decline within CEB Interval	50%	21%	Yes
Minimum Permeability Restoration following CEB	95%	86%	No
Minimum CEB Interval	0.5 days	1 day	Yes
Minimum CIP Interval	30 days	26 days	No

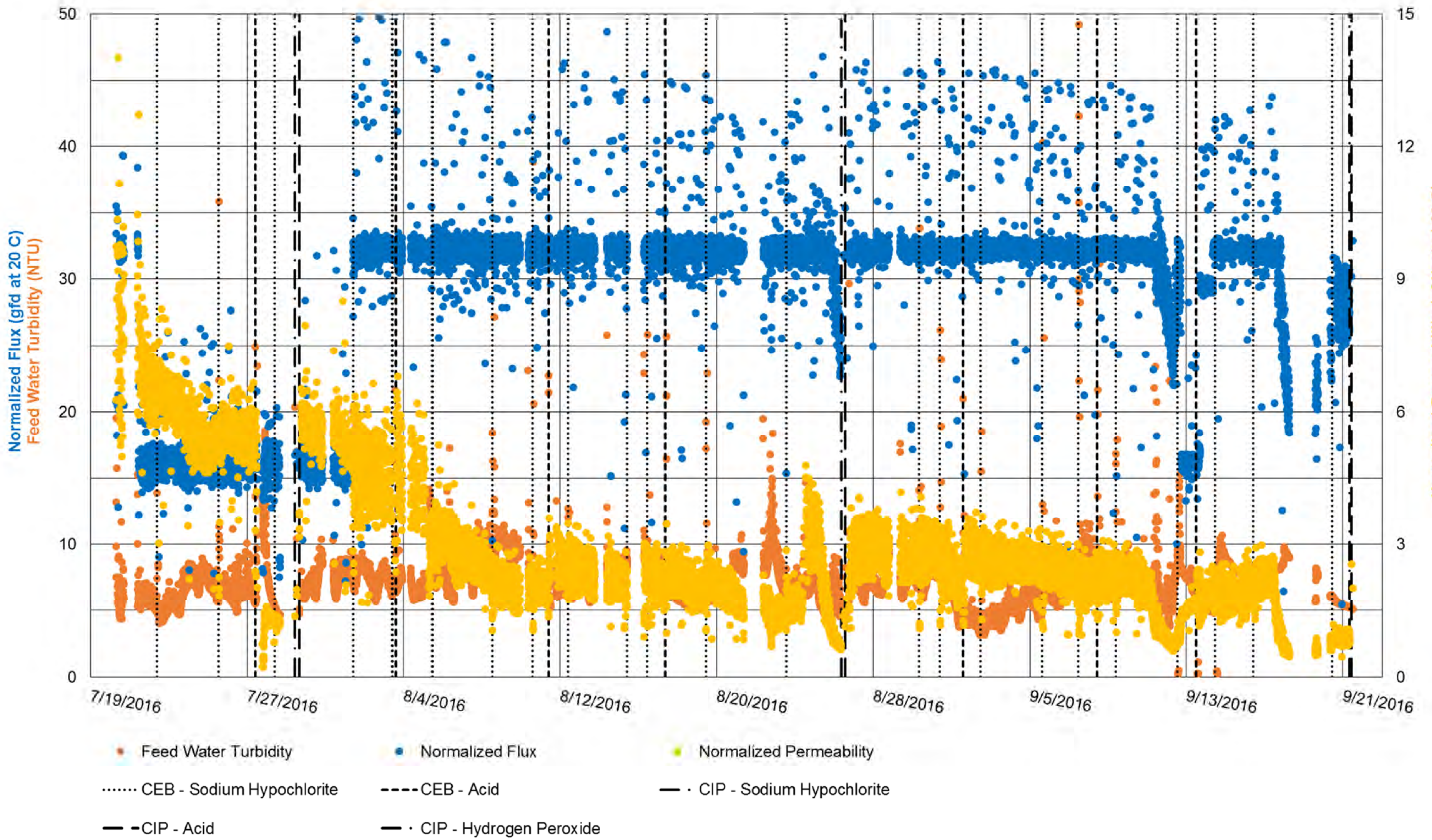
Notes:
(1) Period from August 27, 2016 to September 5, 2016.
(2) CIP performed outside of the revised operating period on August 26, 2016 to September 21, 2016.

4.7 BASF Performance

Figure 11 summarizes BASF's Hydraulic Performance during pilot testing. Appendix F provides a detailed description of operating modifications and fouling responses.

Major operational differences between BASF and the other membranes tested are as follows:

- **Cleaning frequency:** Initial testing conditions operated with a reduced cleaning frequency, which did not sufficiently clean the membrane. The increased high pH cleaning frequency was used to decrease organic and biological fouling.
- **Increased backwash flowrate:** BASF's backwash flowrate was 72 gpm compared to Dow's backwash flowrate of 35 gpm. The increased backwash flowrate did not improve permeability recovery while the modules operated simultaneously.
- **High-pH CEBs:** Because PES has a lower chlorine tolerance, the cleaning strategy was focused on high pH CEBs. The difference in cleaning chemical concentrations reduced permeability recovery.



BASF HYDRAULIC PERFORMANCE

FIGURE 11

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

carollo

Table 14 summarizes the operating conditions adjusted to improve membrane performance at the design flux rate (32 gfd). Figure 12 shows the hydraulic performance under these revised operating conditions and Table 15 compares the actual performance to the evaluation criteria.

Under the revised set of operating conditions, the BASF module was able to meet all but one of the established criteria. However, the BASF module typically operated at a low permeability ranging from 1 to 4 gfd/psi. Similar to the other modules, the BASF module encountered several events which resulted in a rapid decline of permeability. The permeability was recovered to the pre-event permeability following the CEB.

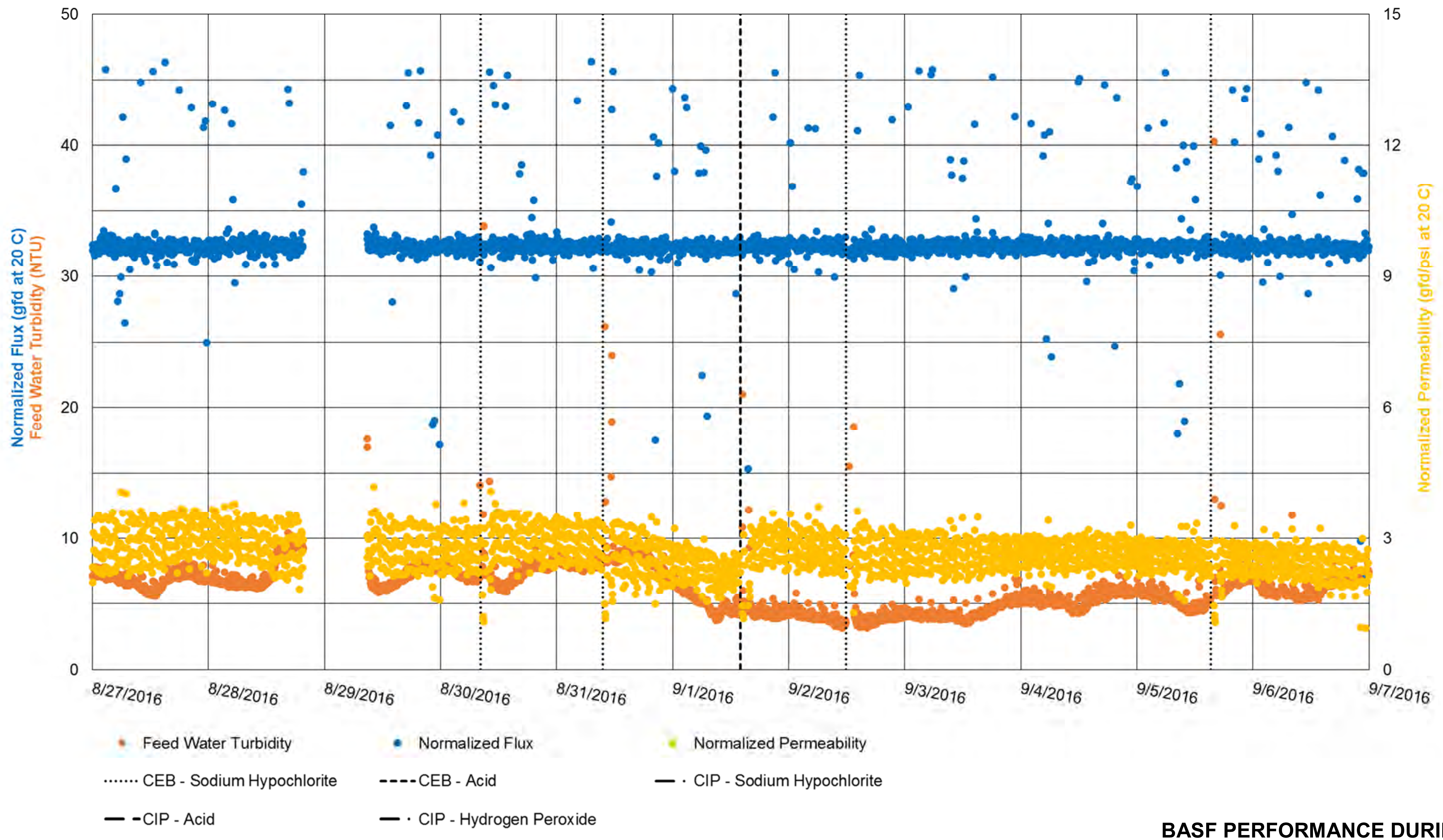
Table 14 BASF Operating Conditions
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Operating Condition	Initial	Revised[(1)]
Pretreatment		
Sodium Hypochlorite Dose (mg/L)	3.5	3.5
Coagulant Dose (mg/L)	5	5
Production		
Flux (gfd)	16	32
Crossflow (%)	N/A	N/A
Production Cycle (min)	20	20
Backwash		
Air Scrub Flow (scfm)	N/A	N/A
Backwash Flow (BW Waste Port) (gpm)	72	72
Backwash Flow (Lower Drain) (gpm)	72	72
Drain (sec)	0	0
Chemically Enhanced Backwash		
Cleaning Solution Soak Time (min)	15	15
Sodium Hypochlorite/Caustic CEB		
Frequency (Per Week)	2	3
Target pH	12.1	--
Sodium Hypochlorite Dose (mg/L)	150	200
Caustic Dose (mg/L)	1400	1460

Table 14 BASF Operating Conditions
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Operating Condition	Initial	Revised(1)
Citric Acid/Hydrochloric Acid CEB		
Frequency (Per Week)	1	1
Target pH	1.9	--
Citric Acid Dose (mg/L)	1,500	1,500
Hydrochloric Acid Dose (mg/L)	1,200	1,500
Clean-in-Place		
Cleaning Solution Recirculation Time (min)	120	120
Cleaning Solution Soak Time (min)	N/A	N/A
Sodium Hypochlorite/Caustic CIP		
Temperature (°C)	Ambient	Ambient
Target pH	12.5	12.5
Sodium Hypochlorite Dose (mg/L)	200	200
Caustic Dose(2) (mg/L)	~2,500	Target pH
Citric Acid/Hydrochloric Acid CIP		
Temperature (°C)	Ambient	Ambient
Target pH	1.5	1.5
Citric Acid Dose (mg/L)	2,000	2,000
Hydrochloric Acid Dose(2) (mg/L)	~16,500	~26,000

Notes:
(1) Revised period reflects operating conditions from August 27, 2016 to September 6, 2016. CIP performed August 26, 2016.
(2) Chemical was dosed to achieve a target pH. The dose was not recorded automatically. Any value shown was calculated by manually timing the chemical pump, the chemical pump capacity and assuming a CIP volume of 50 gallons.



BASF PERFORMANCE DURING REVISED OPERATING CONDITIONS

FIGURE 12

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

carollo

Table 15	BASF Membrane Performance Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City		
Criteria	Value	Actual(1)	Criteria Met?
Minimum Permeability	1 gfd/psi	1.5 gfd/psi	Yes
Maximum Permeability Decline within CEB Interval	50%	21%	Yes
Minimum Permeability Restoration following CEB	95%	86%	No
Minimum CEB Interval	0.5 days	1 day	Yes
Minimum CIP Interval	30 days	26 days(2)	No

Notes:
(1) Period from August 27, 2016 to September 6, 2016.
(2) CIP performed outside of the revised operating period on August 26, 2016 and September 21, 2016. The target flux was not maintained throughout this period.

4.8 Nanostone Performance

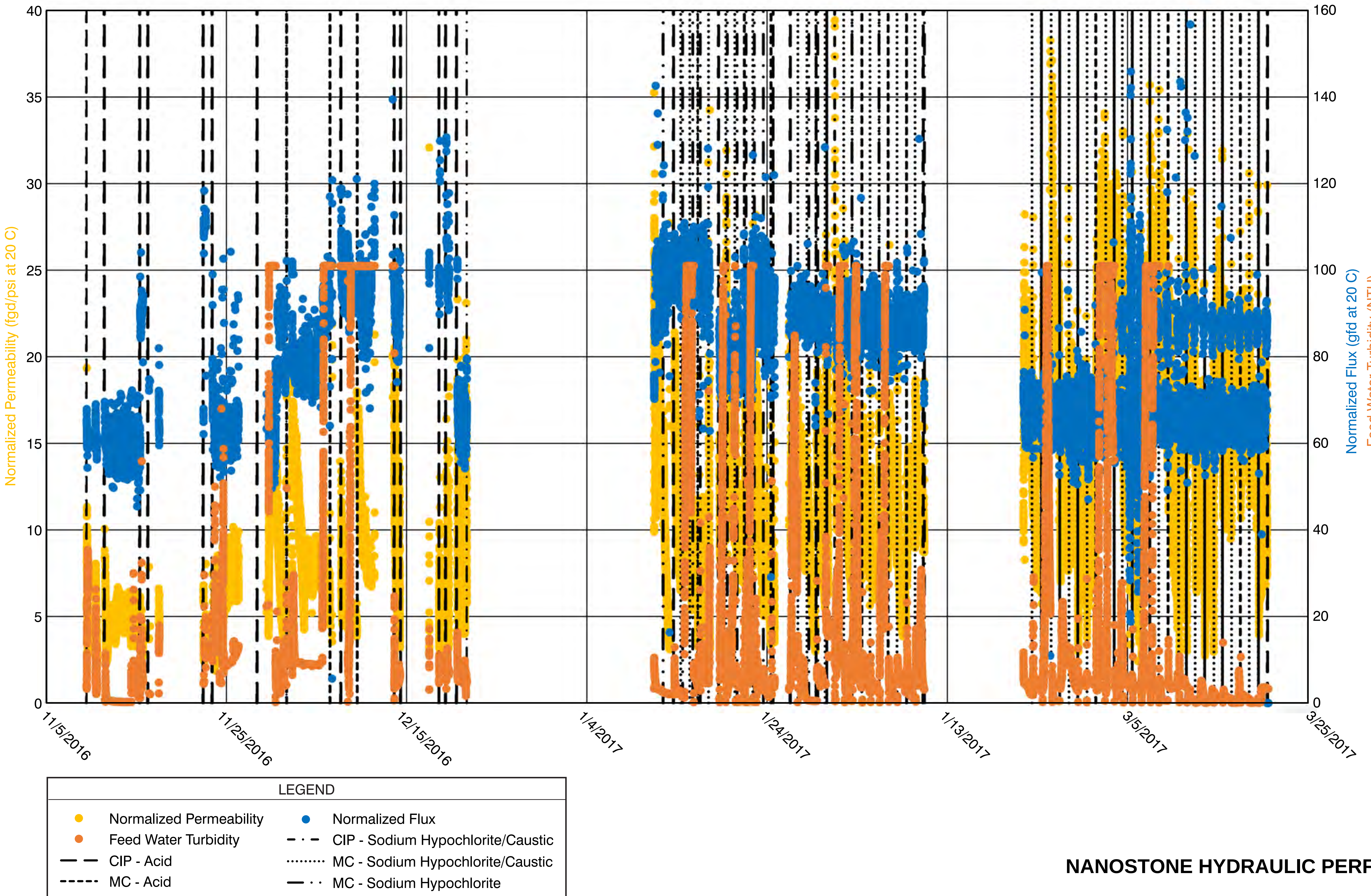
Figure 13 summarizes Nanostone's Hydraulic Performance during pilot testing. Appendix G provides a detailed description of operating modifications and fouling responses.

Key observations for Nanostone are as follows:

- **Pretreatment:** Adding 34 - 64 mg/L of ACH decreased the fouling rate and was critical to achieve the final flux rate.
- **Flux**: The initial target flux of 115 gfd was not sustainable. The maximum sustainable flux was 91 gfd.
- **Chemical Cleans:** Daily high-pH cleans and low-pH cleans every other day were required to minimize fouling.

Table 16 summarizes the set of adjusted operating conditions that resulted in the best membrane performance. Figure 14 shows the hydraulic performance from the revised operating conditions and Table 17 compares the actual performance to the evaluation criteria.

Prior to pilot testing, a target flux of 115 gfd was determined based on the design capacity (3 mgd) and the available footprint. The Nanostone module was unable to sustain operation at the target flux, so the rack design was modified. The number of modules per rack was increased to account for the lower flux rate. However, the geometry of Tertiary Treatment Building is unable to accommodate a redundant module rack with the new configuration. A redundant rack is typically recommended, so that the flow remains constant when one rack is offline for a backwash, chemical clean, or integrity test. Another way to achieve constant flow to the membrane system, is to adjust the flux based on the number of racks online. To mimic this type of operation during pilot testing, the module was operated at 70 gfd for 20 hours each day and 91 gfd (maximum sustainable flux) for the remaining four hours.



NANOSTONE HYDRAULIC PERFORMANCE

FIGURE 13

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

carollo

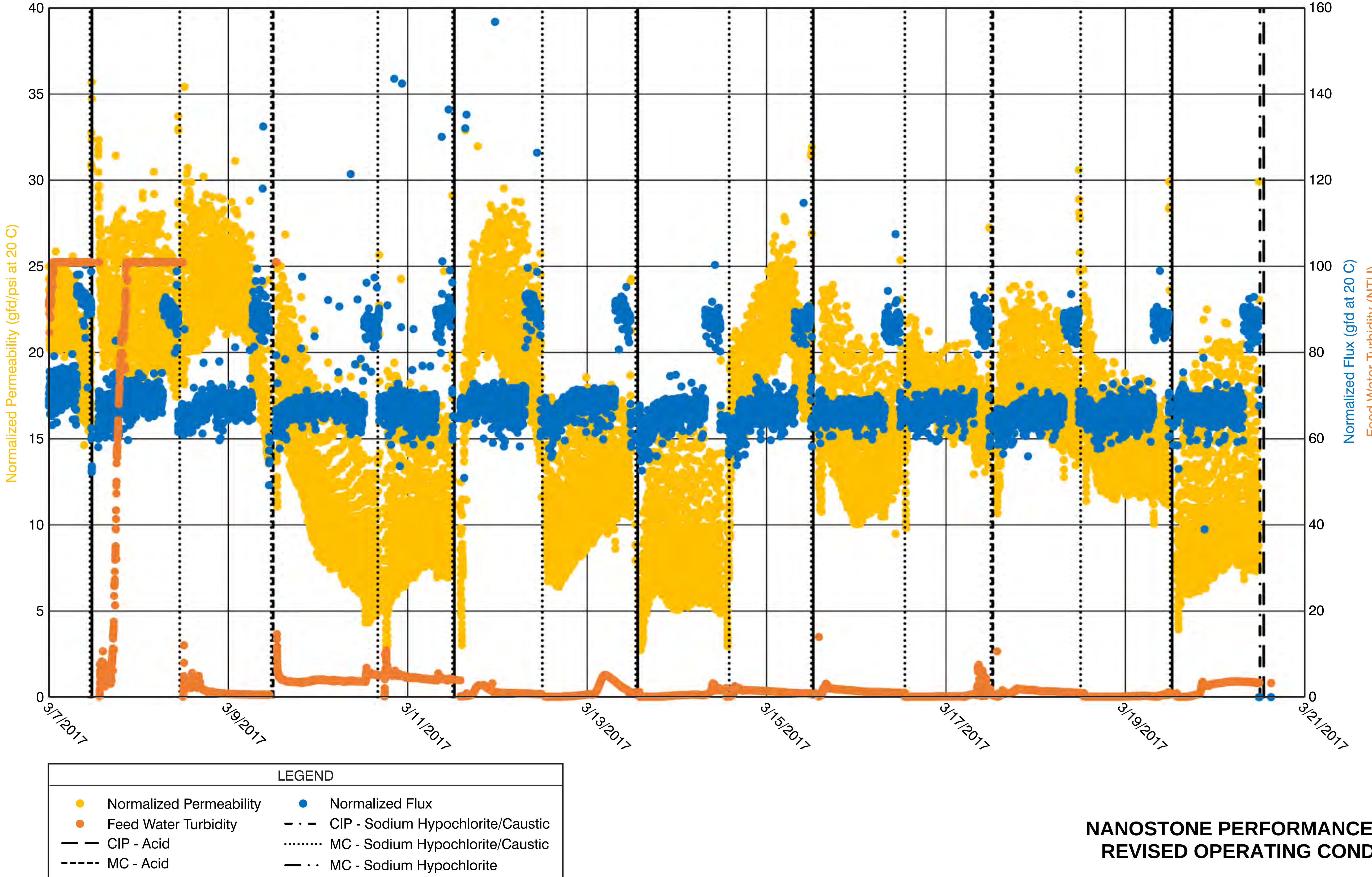
dc0717rf2-10076.ai

Table 16 Nanostone Operating Conditions
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Operating Condition	Initial	Revised(1)
Pretreatment		
Sodium Hypochlorite Dose (mg/L)	0	6.5
Coagulant Dose (mg/L)	40	34 - 64
Production		
Flux (gfd)	60 - 110	70/91
Crossflow (%)	N/A	N/A
Production Cycle (min)	15	15
Backwash		
Backwash Flow (gpm)	20	40
Backwash Duration (sec)	20	18
Feed Flush Flow (gpm)	10	17
Feed Flush Duration (sec)	20	40
Maintenance Clean		
Cleaning Solution Recirculation Time (min)	30	30
Sodium Hypochlorite/Caustic MC		
Frequency (Per Week)	7	7
Sodium Hypochlorite Dose (mg/L)	600	600
Caustic Dose (mg/L)	1200	1200
Sodium Hypochlorite MC		
Frequency (Per Week)	7	0
Sodium Hypochlorite Dose (mg/L)	600	N/A
Citric Acid/Hydrochloric Acid MC		
Frequency (Per Week)	2.3	0.9
Citric Acid Dose (mg/L)	1000	1000
Hydrochloric Acid Dose (mg/L)	1000 - 1500	1000 - 1500
Hydrochloric Acid MC		
Frequency (Per Week)	0	2.6
Hydrochloric Acid Dose (mg/L)	1000 - 1500	1000 - 1500

Table 16	**Nanostone Operating Conditions Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City**	
Operating Condition	**Initial**	**Revised[(1)]**
Clean-in-Place		
Cleaning Solution Recirculation Time (min)	60	60
Cleaning Solution Soak Time (min)	N/A	N/A
Sodium Hypochlorite/Caustic CIP		
Temperature (°C)	35	35
Target pH	12	12
Sodium Hypochlorite Dose (mg/L)	600	600
Caustic Dose[(2)] (mg/L)	1200	1200
Citric Acid/Hydrochloric Acid CIP		
Temperature (°C)	Ambient	Ambient
Target pH	2	2
Citric Acid Dose (mg/L)	1000	1000
Hydrochloric Acid Dose[(2)] (mg/L)	1000 - 1500	1000 - 1500

Notes:
(1) Revised period reflects operating conditions from March 7, 2017 to March 20, 2017.



NANOSTONE PERFORMANCE DURING REVISED OPERATING CONDITIONS

FIGURE 14

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

carollo

dc0717rf3-10076.ai

Table 17	Nanostone Membrane Performance Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City		
Criteria	**Value**	**Actual(1)**	**Criteria Met?**
Minimum Permeability	1 gfd/psi	3 gfd/psi	Yes
Maximum Permeability Decline within MC Interval	50%	49%(2)	Yes
Minimum Permeability Restoration following MC	95%	76%	No
Minimum MC Interval	0.5 days	0.5 days	Yes
Minimum CIP Interval	30 days	28 days	Yes(3)

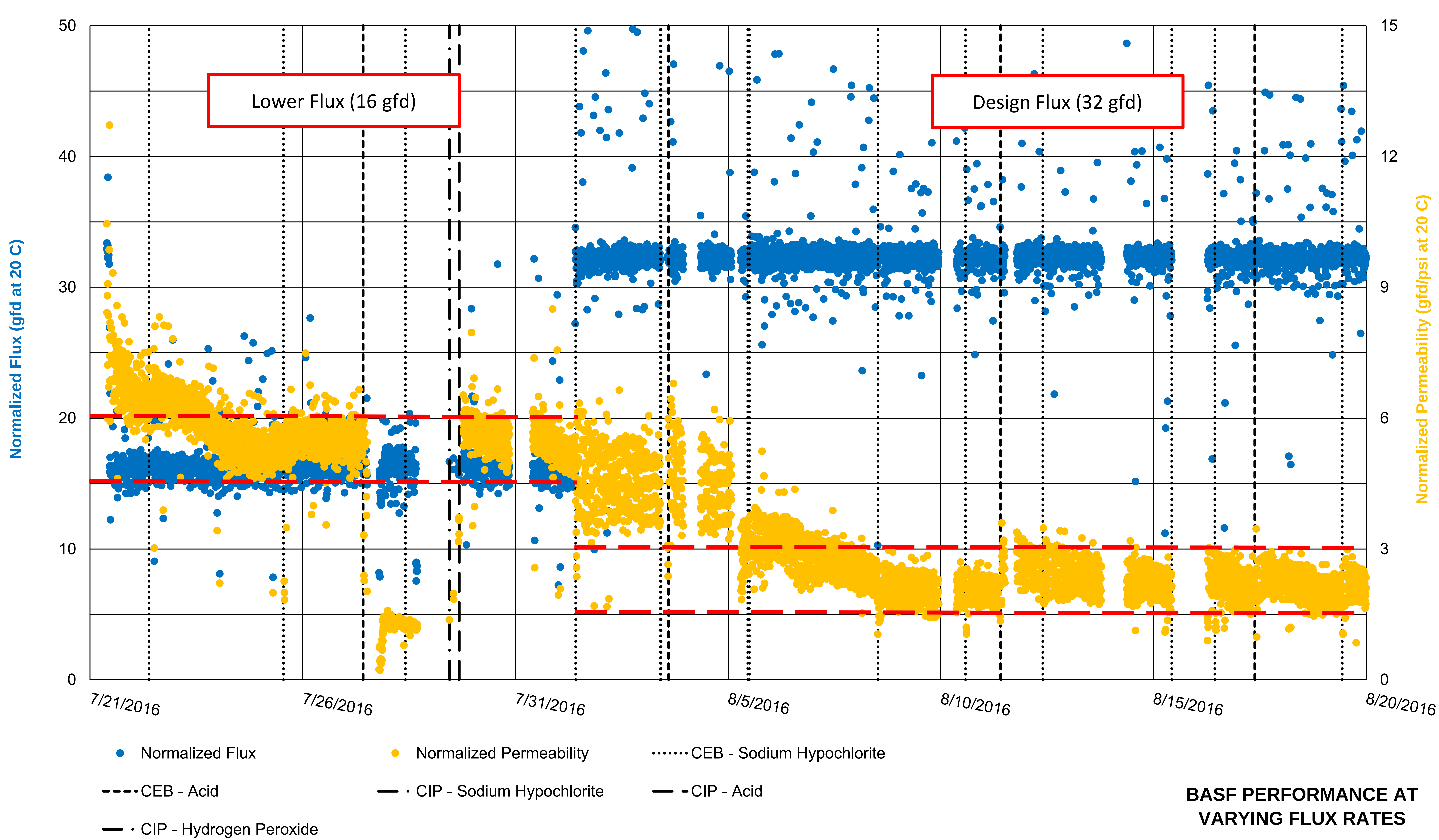
Notes:

(1) Period from March 7, 2017 to March 20, 2017.
(2) Flux increased at end of MC interval.
(3) CIP interval was limited due to scheduling constraints. The final CIP was performed based on pilot schedule rather than operating conditions.

5.0 DISCUSSION

5.1 Minimize Flux Rate

When operating at lower flux rates, membranes generally have lower rates of fouling and higher permeability. There is a critical flux where the membranes begin to experience higher rates of fouling and decreased permeability. These trends were observed in all of the membrane modules tested, but most notably in the BASF module. The BASF module operated at 16 gfd and 32 gfd under the same set of operating conditions (backwash sequence, CEB cleaning solution, etc.). As shown in Figure 15, once the permeability stabilized at each flux rate, the range at the lower flux rate was 4.5 - 6 gfd/psi compared to 1.5 - 3 gfd/psi at the design flux. The corresponding transmembrane pressure was four to six times greater at the design flux. Also, one additional sodium hypochlorite CEB per week was required to manage the increased fouling rate while operating at the design flux. It can be concluded that the critical flux rate for the BASF module is between 16 gfd and 32 gfd. Therefore, it is recommended to maximize the membrane surface area in order to reduce the maximum instantaneous flux rate required to achieve the target capacity. Since the site is limited by footprint, the surface area will be maximized by rack design optimization and building layout development.



BASF PERFORMANCE AT VARYING FLUX RATES

FIGURE 15

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

carollo

dc0217f2-10076.ai

5.2 Iron Fouling

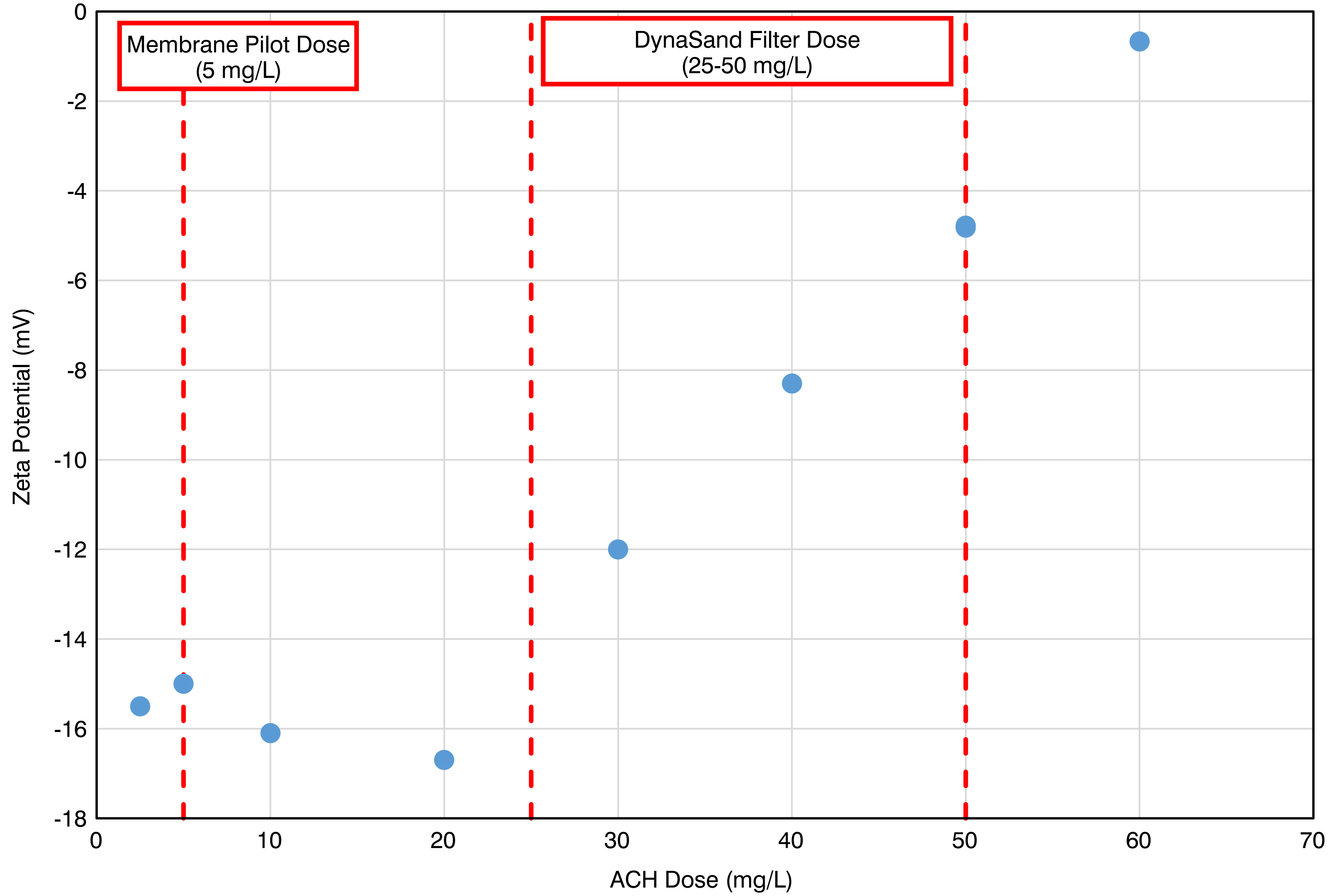
Pilot investigations revealed that iron significantly contributed to membrane fouling. The fouling was resolved pro-actively by pretreatment or reactively with citric acid CEBs. Pretreatment with ACH minimized iron fouling by binding the organically bound iron and preventing its contact with the membrane surface. Citric acid CEBs effectively removed the iron fouling due to its chelating properties. Since the pilot CEBs and associated neutralization required operator assistance, daily citric CEBs were not practical. Therefore, in the pilot study pretreatment was critical in minimizing the effects of iron fouling. It is recommended that the full-scale system have the flexibility to counter iron fouling with either approach.

5.3 Coagulation

As previously discussed, ACH was used to pro-actively minimize iron fouling. A cost analysis was performed to determine that 5 mg/L of ACH pretreatment was equivalent to the daily citric acid CEBs that were being performed on the polymeric membrane pilot. Therefore 5 mg/L of ACH was used as the initial coagulant dose. This low dose resulted in a decreased fouling rate and a decrease in the frequency of low pH cleans. Conversely, the ceramic membrane pilot required 34 - 64 mg/L of ACH to decrease the fouling rate. It is interesting to note that the existing tertiary treatment system, which includes DynaSand filters, requires 25 - 50 mg/L of ACH depending on the quality of the secondary effluent. A bench scale, zeta potential analysis was performed to determine a correlation between the coagulant dose and particle charge. The results, shown in Figure 16, indicated that at doses less than 20 mg/L of ACH there was no change in particle charge and that charge neutralization wasn't achieved until 60 mg/L of ACH.

5.4 Preoxidation

Throughout the duration of the pilot, sodium hypochlorite was added upstream of the membranes to minimize biological fouling and oxidize some organics. The dose varied between 3 to 5 mg/L in order to achieve a total chlorine residual of 2 mg/L in the filtrate. It is recommended that preoxidation be included in the full-scale design.



ZETA POTENTIAL ANALYSIS

FIGURE 16

CITY OF DALY CITY
MEMBRANE PILOT TESTING RESULTS

carollo®

dc0217f3-10076.ai

5.5 Cleaning System

There were several observations made during the pilot study that should be considered during the design of the membrane cleaning system. Each observation and corresponding design recommendation is detailed below.

The frequency of CEBs and CIPs varied throughout the pilot to account for fluctuations in membrane fouling rates. It is recommended that the cleaning system be designed for the range of frequencies to ensure all racks are cleaned as necessary to maintain capacity and energy efficiency.

During the pilot study, a breakpoint chlorination analysis was performed. It determined that approximately 600 mg/L of sodium hypochlorite was required to overcome the chlorine demand that ammonia and organics created in the CEB/CIP makeup water (membrane filtrate). In order to reduce the sodium hypochlorite usage, it is recommended that the full-scale system utilize utility water to create the chemical cleaning solutions. Note that maintenance cleans will replace chemically enhance backwashes in order to utilize the CIP system for both low intensity maintenance cleans and high intensity CIPs.

Lastly, the Scinor module autopsy report (Appendix D) indicated that organic material was detected on both the feed and filtrate side of the membrane fibers. Two possible causes for this observation are as follows: 1) If the organic absorption capacity of the membrane surface is exceeded, there could have been break through, allowing organics to migrate across the membrane surface or 2) During the acid CEB, the low pH solution could have changed the charge of the dissolved organics in the membrane filtrate, allowing them to absorb to the filtrate side of the membrane fibers. As previously discussed, coagulation and frequent chemical cleans will mitigate organic build-up to address the first possible cause. To address the second possible cause, it is once again recommended that the CEBs be replaced with maintenance cleans (MC) which apply the cleaning solution from the feed side of the membrane surface and utilize utility water.

5.6 Fouling Events

As discussed within the specific membrane performance sections, there were several events that occurred throughout the pilot test resulting in a rapid decline in membrane permeability. The cause of these events is unclear based on the water quality collected for the pilot test. The project team discussed the events with plant staff and collected additional information to further investigate and understand the cause of these events. The additional information included mixed liquor concentration, final effluent TSS, notable changes to the oxygen system, equalization basin level, and equalization flow to the secondary process. There was no correlation between this information and the observed fouling events.

5.7 Polymeric vs. Ceramic Comparison

A conclusion of the polymeric pilot test was that the projected operations and maintenance costs were relatively high, but in line with the feed water quality. A separate ceramic membrane pilot was evaluated to determine potential benefits of this alternative technology on operating costs. Ceramic membranes are developed from a more robust material and have the potential to offer a higher solids loading tolerance.

A life cycle cost analysis was performed using the design criteria developed during pilot testing to compare the two membrane systems. This analysis considered capital cost, power costs, chemical costs, and membrane replacement costs. Table 18 summarizes the results for each system. The ceramic membranes are expected to have a higher chemical cost due to the daily chemical cleans and use of 34 - 64 mg/L ACH for pretreatment. The polymeric membranes are expected to have a higher membrane replacement cost due to the short life expectancy (4 - 6 years) based on the maximum sodium hypochlorite.

Table 18 Life Cycle Cost Comparison - Polymeric and Ceramic Membranes
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Parameter	Polymeric	Ceramic
Assumptions		
Present Worth Interest Rate (%)	5	5
Present Worth Evaluation Period (yr)	30	30
Capital Cost		
Membrane Racks & Modules ($)	$2,363,000	$2,255,000
Operations and Maintenance Cost		
Power		
Power Consumption (kWh/yr)	621,900	656,500
Annual Power Cost ($/yr)	$124,000	$131,000
Present Worth Power Cost ($)	$1,906,000	$2,014,000
Chemicals		
Pretreatment ($/yr)	$55,000	$316,000
CEB/MC ($/yr)	$32,000	$56,000
CIP ($/yr)	$73,000	$3,000
Annual Chemical Cost ($/yr)	$160,000	$375,000
Present Worth Chemical Cost ($)	$2,460,000	$5,765,000

Table 18 Life Cycle Cost Comparison - Polymeric and Ceramic Membranes Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City		
Parameter	**Polymeric**	**Ceramic**
Membrane Replacement		
Membrane Lifetime (yr)	4 - 6	10 - 30
Annual Replacement Cost ($/yr)	$277,000 - $410,000	$44,000 - $183,000
Present Worth Replacement Cost ($)	$4,258,000 - $6,303,000	$676,000 - $2,813,000
Present Worth Summary		
Capital Cost ($)(1)	$2,363,000	$2,255,000
Power ($)	$1,906,000	$2,014,000
Chemicals ($)	$2,460,000	$5,765,000
Membrane Replacement ($)	$4,258,000 - $6,303,000	$676,000 - $2,813,000
Total Present Worth ($)	**$10,987,000 - $13,032,000**	**$10,710,000 - $12,847,000**

Notes:

(1) Capital cost based on the following scope of supply: membrane modules, skid frames, rack instruments (turbidimeters, flow meters, pressure transmitters, switches, gauges), rack valves/actuators, rack piping, local control panels, and a master control panel

The project team also considered the following criteria to compare the systems, as summarized in Table 19:

- **Fits inside building:** Both systems fit within the Tertiary Treatment Building.
- **Installation Base:** The polymeric membrane systems are more prevalent in the recycled water industry and have a larger installation base.
- **Open Platform Compatibility:** An open platform system is designed to accommodate multiple membrane modules. Each of the polymeric modules that were tested has similar design criteria and would be compatible with an open platform system. Interchanging one module for another would only require programming modifications. Conversely, the ceramic membrane would require a different backwash pump and rack configuration. Therefore, the ceramic membrane is not considered to be compatible with an open platform system in this application.
- **Anticipated Membrane Life:** The polymeric membranes are anticipated to have a short life (4 - 6 years) due to the frequent, high concentration sodium hypochlorite cleans. Conversely, the ceramic membranes have a life expectancy of 10 - 30 years.

- **Solids Generation/Handling:** The ceramic membranes require 34 - 60 mg/L of ACH pretreatment. These doses are similar to the doses required for the existing recycled water system. If the existing and the new recycled water system both use similar coagulant doses, the solids generated from the recycled water system and returned to the headworks will double. The polymeric membranes require 5 mg/L of ACH, so the solids generated from the recycled water system would only increase 10 to 20 percent.

Table 19 Comparison - Polymeric and Ceramic Membranes
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Criteria	Polymeric	Ceramic
Fits inside building	✓	✓
Life Cycle Cost	✓	✓
Installation Base	✓	
Open Platform Compatibility	✓	
Anticipated Membrane Life		✓
Solids Generation/Handling	✓	

The overall assessment of both membrane types was comparable, each had unique strengths and limitations. Therefore, it is recommended that both membrane systems be included in the predesign. If the project moves forward, the project team and City would rank the criteria and screen membrane suppliers for the preselection process.

6.0 DESIGN CRITERIA

The backwash and chemical treatment strategies were adjusted to reduce and reverse fouling at the design flux rate. These revised operating strategies were used to develop the preliminary design criteria of the full-scale membrane system outlined in Table 20.

Table 20 Design Criteria
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

	Design Criteria		
Operating Condition	Toray, Dow, Scinor	BASF	Nanostone
Pretreatment			
Sodium Hypochlorite Dose (mg/L)	3.5	3.5	6.5
Coagulant Dose (mg/L)	5	5	34 - 64

Table 20 Design Criteria
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Operating Condition	Design Criteria		
	Toray, Dow, Scinor	**BASF**	**Nanostone**
Production			
Flux (gfd)	31	32	70/91
Crossflow (%)	10	N/A	N/A
Production Cycle (min)	22	20	15
Backwash			
Air Scrub Flow (scfm/module)	6(1)	N/A	N/A
Backwash Flow (BW Waste Port) (gpm/module)	35	72	40(6)
Backwash Flow (Lower Drain) (gpm/module)	20	72	17(6)
Drain	Yes	No	No
Chemically Enhanced Backwash			
Cleaning Solution Soak Time (min)	30	15	30
Sodium Hypochlorite/Caustic MC(2)			
Frequency – Average/Max(3) (Per Rack, Per Week)	3/5	3/5	7
Sodium Hypochlorite Dose (mg/L)	1,150(4),(5)	200	600
Caustic Dose (mg/L)	540(4)	1,460	1,200
Citric Acid/Hydrochloric Acid MC(2)			
Frequency – Average/Max(3) (Per Rack, Per Week)	1/3	1/3	3.5
Citric Acid Dose (mg/L)	1,000(4)	1,500	1000
Hydrochloric Acid Dose (mg/L)	550(4)	1,500	1000 - 1500

Table 20 Design Criteria Feasibility of Expanded Tertiary Recycled Water Facilities City of Daly City			
	Design Criteria		
Operating Condition	**Toray, Dow, Scinor**	**BASF**	**Nanostone**
Clean-in-Place			
Cleaning Solution Contact Time (Recycle/Soak) (min)	120	120	120
Sodium Hypochlorite/Caustic CIP			
Temperature (°C)	38	Ambient	35
Target pH	11.5	12.5	12
Sodium Hypochlorite Dose (mg/L)	3,000(4),(5)	200	600
Caustic Dose (mg/L)	2,325(4)	2,500	1,200
Citric Acid/Hydrochloric Acid CIP			
Temperature (°C)	38	Ambient	Ambient
Target pH	1.7	1.5	2.0
Citric Acid Dose (mg/L)	20,000(4)	2,000	1,000
Hydrochloric Acid Dose (mg/L)	6,200(4)	26,000	1000 - 1500

Notes:

(1) Air scrub flow rate based on pilot results from Toray, which had the highest pilot setpoint.
(2) The plant will be designed for maintenance cleans (MC) instead of chemically enhanced backwashes (CEB). MC is differentiated from a CEB because it utilizes the CIP system instead of the backwash system.
(3) Chemical storage based on two weeks of storage at average chemical dose and maximum cleaning frequency.
(4) Chemical doses are based on pilot testing results from Dow.
(5) During the pilot study, a breakpoint chlorination analysis was performed. It determined that approximately 600 mg/L of sodium hypochlorite was required to overcome the chlorine demand ammonia and organics created in the MC/CIP makeup water (membrane filtrate). For full-scale design, utility water was assumed, reducing ammonia and organics in the MC/CIP makeup water. This reduces the applied chlorine dose by about 600 mg/L.
(6) Flow based on membrane model CM-131, 205 ft^2.

APPENDIX A – MEMBRANE PILOT PROTOCOL

This document is released for the purpose of information exchange review and planning only under the authority of Katherine B. Ottoboni, February 1, 2017, California P.E. No. 82739

CITY OF DALY CITY

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

MEMBRANE PILOT TESTING PROTOCOL

DRAFT
February 2016

2700 YGNACIO VALLEY ROAD, SUITE 300 • WALNUT CREEK, CALIFORNIA 94598 • P. 925.932.1710 • F. 925.930.0208

CITY OF DALY CITY

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

MEMBRANE PILOT TESTING PROTOCOL

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

MEMBRANE PILOT TESTING PROTOCOL

1.0 INTRODUCTION

1.1 General

Carollo has been tasked to perform the preliminary design of a 3 million gallon per day (mgd) expansion of Daly City's Recycled Water Treatment and Distribution System. The expansion will consist of a new tertiary treatment membrane filtration system. A membrane pilot study will be conducted to verify criteria necessary to define membrane system sizing and verify the feasibility of the 2008 conceptual design. The pilot study will take place concurrently with the preliminary design.

Membrane filtration was selected for the plant expansion because of the limited footprint available on the site. Conceptual layouts developed in the 2008 feasibility study were reviewed and updated for larger surface area membrane modules that have the potential to provide the smallest footprint, lowest flux rates, and most reliable operation. The flux rates established from the updated layout drawings will be tested as described herein.

Since the membrane flux rates are fixed based on site constraints, the testing will focus on the pretreatment and membrane cleaning procedures that maximize output (flux) and minimize footprint. The key feed water constituents that will foul the membranes and limit capacity are feed water solids, organic compounds in the feed water, and microbes that can establish on membrane surfaces.

The following processes will be utilized to minimize the impact of the feed water constituents:

- *Pre-oxidation:* The addition of sodium hypochlorite upstream of the membranes will facilitate the inactivation of microbes and provide some oxidation of organics. A minimum total chlorine concentration of 2 milligrams per liter (mg/L) will be maintained.

- *Coagulant:* The addition of coagulant will provide organic carbon removal that is difficult to remove from the membrane surface with hydraulic backwashes. The coagulant dose will be varied up to a maximum of 30 mg/L. If necessary, alternative coagulants will be utilized.

- *Backwashes:* Hydraulic backwashes will remove solids from the membrane surface that accumulate during filtration. Backwash intensity and frequency will be varied.

- *Chemical Cleaning:* Chemical cleaning with combinations of hypochlorite (organics oxidation and disinfection), sodium hydroxide (combined with hypochlorite for organic removal, and citric acid (for removal of residual coagulant and scale caused by caustic cleaning cycles) will be evaluated for their ability to reverse the fouling that cannot be reversed by backwashing.

1.2 Participants

The pilot study participants are as follows:

- WesTech Engineering (WesTech), WesTech is providing the membrane pilot plant to be used in the study. WesTech is principally responsible for providing the necessary equipment, delivery and placement, setup assistance, training, and operational support necessary to conduct the pilot study. WesTech will also procure the membrane modules used in the study.

- Carollo Engineers, is responsible for establishing the pilot protocol, establishing pretreatment conditions, evaluating membrane performance, establishing membrane system design criteria, and developing the preliminary design documents. Carollo will also be providing on-site operational assistance to the City.

- Daly City, the Owner, is responsible for providing the pilot site, coordinating and assisting in site setup, day to day pilot plant operations under the direction of WesTech and Carollo, water quality sampling, and engaging in regular communications with the WesTech and Carollo.

1.3 Objectives

The objectives of the pilot study are to:

1. Evaluate the use of coagulation and pre-oxidation (combined chlorine) for maximizing membrane flux and efficiency.

2. Determine the sustainable flow (flux) rates through each of the membrane modules being used in the study. Use this data to refine previous system layouts and costs, and to support membrane system procurement.

3. Evaluate membrane chemical cleaning strategies in order to define residuals handling criteria, chemical storage and feed system criteria.

4. Evaluate filtrate water quality and chlorine demand.

5. Provide a hands-on training opportunity for the City staff that will be engaged in the operation of the treatment plant.

1.4 Definitions

Select membrane process-specific terms are defined in this section.

1. Backwash: The periodic reversal of flow through the membrane, typically done sequentially or simultaneously with air scour, rack drains and/or feed water flushes for the purpose of removing accumulated solids from the membrane surface.
    a. Backwashes shall not include any chemical addition.
    b. "Backpulse" and "reverse filtration" shall be considered synonymous with backwash.
    c. Waste from backwashing is referred to as Waste Backwash Water.
2. Clean-In-Place (CIP) or Recovery Clean (RC): The periodic application of one or more chemical solutions to a membrane for the intended purpose of increasing membrane permeability.
    a. CIP (CIP) is differentiated from a MC by its duration (requiring more than 60 minutes downtime including rinsing) or by the number of different chemical cleaning solutions used.
    b. A single CIP (CIP) event may include consecutive use of acidic and caustic and/or chlorinated cleaning solutions with rinse steps in between.
    c. CIP is synonymous with the term recovery clean (RC).
3. Feed Water Recovery (Recovery): Recovery = Net Filtrate (mgd)/Gross Feed (mgd) times 100. Exclusive of cross flow, excess recirculation, bleed or recirculation flows.
    a. Gross Feed includes the daily totalized volume through the membrane feed water pumps less the strainer waste washwater volume.
    b. Net Filtrate is the total daily membrane filtered water volume minus filtered water volumes used for backwashing, chemical cleaning and associated rinsing/flushing sequences.
    c. Minimum recovery shall be met over a 24-hour period.
4. Filtrate (or Permeate): That portion of the feed water that passes through the membrane from the feed side to the filtered water side.
5. Fouling: Loss of normalized membrane permeability.
6. Instantaneous Flux ($J_{INSTANT}$): The gross filtrate production capacity in gallons per day of a membrane filtration rack measured at any given time that the rack is in production divided by the active membrane surface area (feed side) of the membrane filtration rack. Instantaneous flux is expressed in gallons per day per square foot (gfd).

7. Maintenance Clean: The periodic application of a single chemical solution to a membrane for the intended purpose of increasing membrane permeability. MC has the following characteristics:
    a. MCs utilize the CIP system.
    b. MC uses a single chemical cleaning solution.
    c. MC has a maximum duration of 60 minutes, from the time the rack is taken out of production to the time it is made ready for the next filtration cycle.
8. Membrane: An engineered porous media of polymeric materials of hollow fiber construction that may be backwashed.
9. Module: A collection of multiple hollow fibers with a common filtrate outlet structure. A module is the smallest operable unit containing membrane fibers.
10. Net Flux (J_{NET}): Shall equal the Net Production Capacity in gallons per day, divided by the membrane surface area (feed water side) in square feet. Net flux is expressed in gallons per day per square foot (gfd).
11. Specific Flux or Permeability: The value obtained when dividing the temperature corrected flux by the transmembrane pressure for an individual membrane filtration unit. Specific flux is expressed in terms of volume per unit membrane area per unit time per unit pressure, expressed in gfd/psi at 10°C.
12. Transmembrane Pressure (TMP): The pressure drop across the hollow fiber membranes. Measured as the difference between the pressures on the feed side of a membrane filtration rack minus the pressure downstream of the membranes. The units of TMP are pounds per square inch (psi)

2.0 PILOT SYSTEM DESCRIPTIONS

2.1 Source Water

Secondary effluent is pumped from the secondary effluent wet well to the DynaSand filters. A tie-in to the pressurized 12" Secondary Effluent/Filter Influent line will be established to supply 10-75 gallons per minute (gpm) to the pilot skid.

2.2 WesTech Pilot Skid

2.2.1 <u>Process Overview</u>

The pilot skid will be located on the concrete deck southeast of the primary clarifiers. The skid mounted feed pump will draw water from the process line and provide adequate pressure for pre-filtration. Pre-filtration is a commonly used pretreatment step for membrane filtration that removes larger particles that could damage the hollow fiber membranes. The pilot prescreen has a 200 micron mesh screening element and is automatically backwashed based on time or differential pressure. Prescreened water then flows to the membrane modules. The pilot is designed to independently operate two different membrane modules side by side. Flow control valves are used to operate each module at its own unique flow rate.

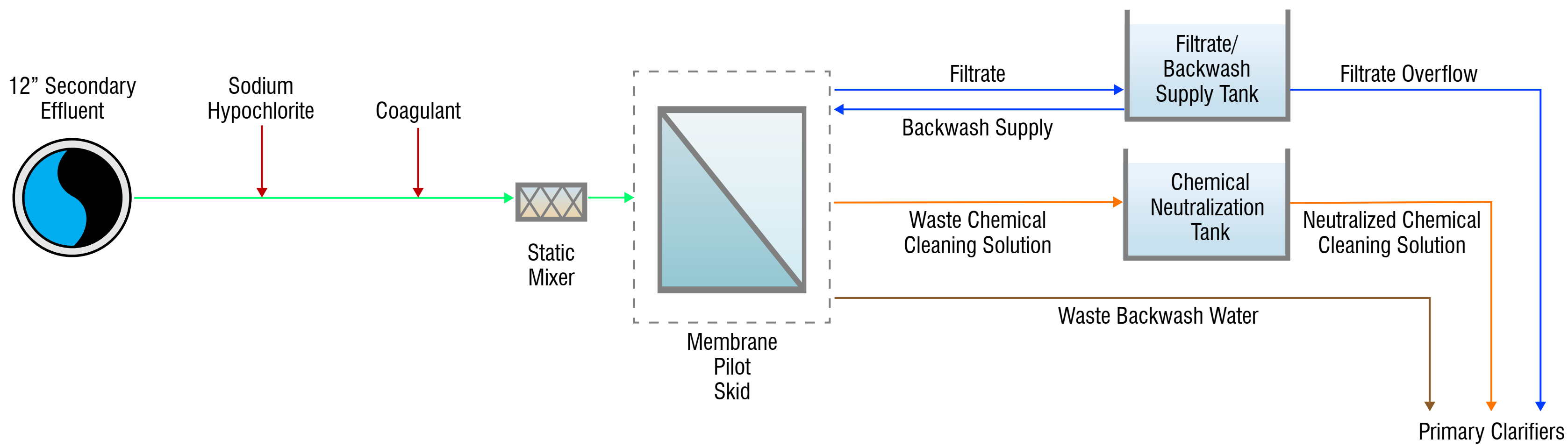
Filtered water (filtrate) from each membrane module will be sent to a 240 gallon filtrate/backwash supply tank. Backwash water will be drawn from this tank. Waste backwash water will be routed directly to the primary treatment train. In addition to normal backwashes, chemical cleans will be performed to maintain and restore membrane permeability. These cleans will consist of sodium hypochlorite, sodium hydroxide, and citric acid solutions. The waste chemical cleaning solutions will be routed to a 240 gallon chemical neutralization tank, dechlorinated, and then sent to the primary treatment train. Figure 1 shows the pilot system schematic.

2.2.2 Membrane Modules

Over the course of the pilot study three different membrane modules will be tested: Toray, Scinor, and Dow. All membrane modules tested will be pressurized, ultrafiltration type membranes manufactured from Poly vinylidene fluoride (PVDF) polymer. The membranes will be operated in an outside-in flow pattern, i.e. the feed water will be pumped to the outside of the fibers, and filtrate will collect inside the lumen of the fibers. A summary of the membrane fibers and module characteristics is provided in Table 1.

Table 1 Characteristics of UF Membrane Fibers and Modules
Membrane Pilot Testing Protocol
City of Daly City

Characteristic	Membrane Manufacturer		
	Toray	Scinor	Dow
Membrane model	HFU-2020N	SMT600-P80	SFD-2880XP
Membrane type	Ultrafiltration	Ultrafiltration	Ultrafiltration
Membrane material	PVDF	PVDF	PVDF
Nominal pore size	0.01μm	0.1μm	0.03μm
Operation mode	Outside-In	Outside-In	Outside-In
Filtrate turbidity	≤ 0.1 NTU	≤ 0.1 NTU	≤ 0.1 NTU
Module membrane area	775 ft^2	861 ft^2	829 ft^2
Module length	85.0 inch	92.9 inch	92.9 inch
Module diameter	8.5 inch	8.9-inch	8.9-inch
Maximum feed pressure	43.5 psi	60 psi	90.65 psi
Maximum trans-membrane pressure (TMP)	43.5 psi	45 psi	30.5 psi



Legend

- Secondary Effluent
- Membrane Filtrate
- Waste Backwash Water
- Waste Chemical Cleaning Solution
- Chemical Addition

MEMBRANE PILOT SCHEMATIC

FIGURE 1

CITY OF DALY CITY
MEMBRANE PILOT TESTING PROTOCOL

Engineers...Working Wonders With Water®

DC0116-10076 (FIG 1).ai

2.2.3 Modes of Operation

2.2.3.1 Filtration

All three membrane modules will only be operated in the dead-end filtration mode. Rejected materials will accumulate on the outside of the membrane fibers as filtered water is forced across the membrane. Filtrate will be collected in a 240 gallon filtrate tank. Filtrate not used for backwash, maintenance clean or clean-in-place sequences will overflow into the full scale plant's primary treatment train through the filtrate tank overflow.

Flow to each individual module is controlled by a dedicated flow meter and flow control valve, allowing unique flow rates through each module to be tested.

2.2.3.2 Backwash

During filtration, solids accumulate on the membrane surface. A backwash is periodically performed with filtered water (from the filtrate tank) to remove accumulated solids. Backwash procedures vary slightly between the membrane modules tested. Table 2 provides the initial backwash parameters for each membrane module. These parameters will be adjusted as dictated by membrane performance.

A backwash generally consists of the following steps:

- Reverse flow. The backwash pump is used to pump water into the filtrate port of the module and forced water to flow from the inside of the fiber to the outside. In this process solids are dislodged from the membrane surface and partially flushed out of the module.
- Air scour. Air is fed to the membranes.
- Drain. Solids are evacuated from the module by draining the liquid contents of the rack at a rapid rate.
- Refill. Prior to going back into production the membrane air is evacuated from the module and refilled with feed water.

The backwash residuals are discharged to the full scale plant's primary treatment train.

2.2.3.3 Maintenance Clean (MC)

Backwashing does not remove all materials that accumulate on the membrane surface. Colloidal material, organic material, biological growth, and precipitated or complexed inorganic materials (together known as "foulants") can remain on the membrane surface after backwashing. These materials can cause rapid increases in transmembrane pressure and decrease the intervals between time intensive off-line recovery cleanings, and ultimately impact system capacity.

Maintenance cleans (MC) are used periodically to remove foulants from the membrane. MCs are automatically triggered at a user defined frequency. Frequency is selected based on the rate of membrane fouling. A portion of the MC duration is dedicated to recirculating and soaking the membranes in cleaning solution. The remaining time are dedicated to rack preparation, rinsing and flushing steps. All waste solutions, rinse and flush volumes are routed to the neutralization tank, neutralized, and discharged to the full scale plant's primary treatment train.

Table 2 Initial Backwash Parameters
Membrane Pilot Testing Protocol
City of Daly City

Parameter	Membrane Manufacturer		
	Toray	**Scinor**	**Dow**
Interval(1)	21.75 min	20 min	20.25 min
Reverse Flow(2)			
Duration	30 sec	60 sec	N/A
Flow Rate	17.76 gpm	13 gpm	N/A
Air Scour(2)			
Duration	30 sec	60 sec	30 sec
Flow Rate	3.53 scfm	5.5 scfm	6 scfm
Reverse Flow			
Duration	N/A	20 sec	30 sec/30 sec(3)
Flow Rate	N/A	29 gpm	34 gpm/34 gpm(3)
Drain Estimate			
Duration	45 sec	45 sec	45 sec
Fill			
Duration	60 sec	60 sec	60 sec
Flush			
Duration	NA	30 sec	30 sec

Notes:
(1) Backwashes intervals are based on equivalent filtrate volumes. Times vary to account for differences in surface area.
(2) Reverse flow and air scour occur simultaneously in the Scinor system.
(3) Dow system reverses flow from the top of the module and then through the bottom of the module to remove remaining foulants out the drain port.

2.2.3.4 Clean-in-Place (CIP)

Clean-in-Place (CIP) is a rigorous chemical cleaning procedure that is carried out when the membranes become too fouled to operate efficiently. CIP procedures are similar to MC, but generally utilize more concentrated chemical solutions, heated makeup water, and longer soaking/recirculation durations. Cleaning strategies are selected to return the membranes to a clean state as measured by permeability.

In practice, CIPs are triggered by either a maximum elapsed time since the previous CIP, meeting a minimum acceptable membrane permeability criteria, or in extreme cases, when membranes foul rapidly and reach their maximum transmembrane pressure. A CIP is manually initiated and automatically controlled by the membrane control system.

2.2.3.5 Membrane Integrity Testing

Membrane integrity tests will be automatically performed weekly to verify that the membrane is intact over the course of the pilot study. If required, fiber repairs will be performed following each integrity test.

2.2.4 Monitoring Equipment

The pilot skid includes the following continuous, process and water quality monitoring equipment:

1. Shared instrumentation between the two membrane modules:
    a. Feed turbidimeter (Hach 1720E).
    b. pH sensor.
    c. Temperature transmitter.
    d. Heater.
2. Dedicated instrumentation for each membrane module:
    a. Flow control valves to set individual flow rates.
    b. Filtrate turbidimeter (Hach 660sc).
    c. Feed and backwash flowmeters.
    d. Feed and filtrate pressure transmitters for independent TMP measurements.

3.0 TESTING PLAN

3.1 Pretreatment Chemicals

The pilot skid has the ability to add sodium hypochlorite and a coagulant to the common membrane feed water. Both chemical metering pumps are flow paced to achieve an operator adjustable dose. Sodium hypochlorite will be dosed to achieve a minimum 2 mg/L total chlorine residual at the effluent to control biological growth on the membranes and piping. This dose may be increased to address membrane fouling.

Direct application of coagulated water has been shown to enhance membrane performance on secondary wastewaters similar to Daly City's, and is expected to provide similar benefits for this project. Initial operations will use the Clarifloc WE-289 ACH that Daly City currently uses as pretreatment for its media filters. Coagulant dose will be varied up to a maximum of 30 mg/L. If necessary, alternative coagulants will be utilized.

3.2 Flux Rate

Conceptual full scale membrane system layouts were developed prior to the pilot study to determine to establish the maximum number of membrane modules that could be fit into the space available for the expansion, and thus the minimum sustainable flux that the membranes would need to achieve to be considered viable for the project.

This flux may vary slightly between the manufacturers due to differences in membrane surface areas. Based on the approximate membrane building dimensions at this time (48 feet x 35 feet) and the Toray system surface area, the membrane modules will be required to operate at an instantaneous flux rate of at least 31.06 gfd. This instantaneous flux rate assumes that the full scale system would be comprised of 4 membrane racks, 3 duty and 1 standby, with 54 installed modules per rack.

For the first week, the membranes will operate at 50 percent of the target flux rate, 15.5 gallons per square foot per day (gfd), to establish initial cleaning demands and fouling rates. Then, over the next three weeks, the flux rate will be gradually increased up to the target flux rate. The membranes will operate at the target flux rate for at least one month. The test conditions are summarized in table 3 below. During the pilot study three membrane modules will be tested. The Toray module will be tested all four months to provide longer term data set on permeability retention and chemical cleaning effectiveness. The two other membranes, Scinor and Dow, will be tested for two months each.

Table 3 Flux Testing Matrix
Membrane Pilot Testing Protocol
City of Daly City

	Membrane Manufacturer		
Weeks in Operation	**Toray**	**Scinor**	**Dow**
Week 1	15.5 gfd	15.5 gfd	-
Weeks 2 - 4	TBD	TBD	-
Weeks 5 - 8	31.1 gfd	31.1 gfd	
Week 9	31.1 gfd	-	15.5 gfd
Weeks 10 - 12	31.1 gfd	-	TBD
Weeks 13 - 16	31.1 gfd	-	31.1 gfd

3.3 Cleaning Strategy

A summary of the initial cleaning strategies for all membrane modules is provided in Table 4. These parameters will be adjusted as dictated by permeability restoration.

Table 4 Initial Cleaning Strategies
Membrane Pilot Testing Protocol
City of Daly City

Parameter	Value
Sodium Hypochlorite MC	
Interval	24 hrs
Chemical Contact Duration	30 min
Heated Water Temperature	N/A
Target pH(1)	>10
Minimum Free Chlorine Residual(2)	300 mg/L
Acid MC	
Interval	72 hrs
Chemical Contact Duration	30 min
Heated Water Temperature	N/A
Target pH(3)	2 - 3
Minimum Citric Acid Dose	1,000 mg/L
Sodium Hypochlorite CIP	
Interval	30 days
Minimum Chemical Contact Duration	120 min
Heated Water Temperature	95 F
Target pH(1)	>10
Minimum Free Chlorine Residual(2)	1,000 mg/L
Acid CIP	
Interval	30 days
Chemical Contact Duration	120 min
Heated Water Temperature	95 F
Target pH(4)	2 - 3
Minimum Citric Acid Dose	5,000 mg/L

Notes:
(1) Sodium hydroxide will be dosed to achieve target pH
(2) Sodium hypochlorite dose will be adjusted to achieve free chlorine residual target.
(3) Hydrochloric acid will be dosed to achieve target pH

3.4 Filtration Mode

The pilot has the ability to operate in dead-end filtration mode or crossflow filtration mode. In dead-end filtration mode all of the flow is directed through the membrane. In crossflow filtration mode, while a majority of the flow is directed through the membrane, a percentage of the feed water flows tangentially across the surface of the membrane and is discharged. Scinor prefers to operate their membranes in crossflow filtration mode.

At the beginning of the pilot, since the initial flux rates will be low, all membranes will be operated in dead-end filtration mode. As the flux rates are increased, the Scnior membrane module may be operated in crossflow filtration mode.

3.5 Water Quality Monitoring

The water quality monitoring plan is presented in Table 5. Additionally, a weekly breakpoint chlorination test will be performed to determine the required sodium hypochlorite MC dose.

4.0 EVALUATION CRITERIA

The membrane performance will be based on the criteria presented in Table 6. The pretreatment, backwash, and chemical cleaning strategies will adjusted weekly, at a minimum, based on the membrane performance in order to optimize the flux rate. The adjustments will be made as described in Table 7.

5.0 SCHEDULE

The pilot study schedule is presented in Table 8.

6.0 TASK LIST

Responsibilities for the major tasks in this pilot study are presented in Table 9.

Table 5 Water Quality Monitoring Plan
Membrane Pilot Testing Protocol
City of Daly City

Parameter	UF Feed	UF Filtrate(1)	Total No. of Samples(2)
On-Site Analysis			
pH	D		80
Temperature	D		80
Turbidity	D		80
UV Transmittance	D	D	240
ORP	D		80
Dissolved Oxygen	D		80
Total Chlorine	D	D	240
Total Suspended Solids	2/W	2/W	96
Laboratory Analysis			
Total Organic Carbon	1/W	1/W	48
Dissolved Organic Carbon	1/W	1/W	48
Silica	2/W		32
Reactive Silica	2/W		32
Iron (total)	2/W		32
Iron (dissolved)	2/W		32
Total Dissolved Solids	2/W		32
Alkalinity as $CaCO_3$	2/W		32
Aluminum (total)	2/W		32
Aluminum (dissolved)	2/W		32
Manganese (total)	2/W		32
Manganese (dissolved)	2/W		32
Ammonia as N	2/W		32

Notes:
(1) Sample each membrane module separately
(2) Based on 16 weeks of testing
D = daily, #/W = # of times per week

Table 6 Evaluation Criteria
Membrane Pilot Testing Protocol
City of Daly City

Criteria	Value
Minimum Permeability	1 gfd/psi
Maximum Permeability Decline within MC Interval	50%
Minimum Permeability Restoration following MC	95%
Minimum MC Interval	0.5 days
Minimum CIP Interval	30 days
Minimum Recovery Rate	90%

Table 7 Pilot Adjustments
Membrane Pilot Testing Protocol
City of Daly City

Issue	Possible Adjustment
High permeability decline within MC interval	Decrease backwash interval (more frequent) Utilize coagulant pretreatment Adjust pre-oxidation chlorine dose
Low permeability restoration following MC	Modify MC strategy (chemical dose, duration)
Low recovery rate	Increase backwash interval (less frequent)

Table 8 Pilot Testing Schedule
Membrane Pilot Testing Protocol
City of Daly City

Event	Date	Duration
Daly City to prepare for pilot: • Setup electrical and hydraulic connections (tie-in to secondary effluent pipe, discharge piping) • Setup bottles for sampling • Order any additional chemicals required	By February 15, 2015	-
Deliver pilot skid to site	February 16, 2016	1 day
Pilot unit setup	February 17-19, 2016	3 days
Test Toray and Dow modules	February 22, 2016 - April 15, 2016	8 weeks
Remove Dow module/Install Scinor module	April 18, 2016	1 day
Test Toray and Scinor modules	April 18, 2016 - June 10, 2016	8 weeks

Table 9 Summary of Responsibilities for Pilot Testing Tasks
Membrane Pilot Testing Protocol
City of Daly City

Task	Responsible Entity		
	Daly City	**Carollo**	**WesTech**
Draft/Final Pilot Testing Protocol		X	
Labor and materials for hydraulic and electrical connections	X		
UF pilot shipment to site			X
UF pilot unit unloading/loading			X
UF pilot unit installation	X		X
UF pilot start-up and training			X
Power Supply	X		
Chemical Supply	X		
Collecting Samples	X	X	
Draft/Final Pilot Test Report		X	
Review Draft/Final Pilot Test Report	X		

APPENDIX A – MEMBRANE MODULE SPECIFICATION SHEETS

Dec. 2011

TORAY Membrane Module Specification Sheet

- Model: PVDF Hollow Fiber Membrane Module HFU series (type N)

Table 1. Membrane Properties

Membrane Material	PVDF (Polyvinylidene fluoride)
Nominal Molecular Weight Cut Off	150,000

Table 2. Cleaning Limits

Cleaning pH Range	0 – 12
Maximum Cleaning Temperature	40 degree C (104 degree F)
Maximum Concentration of NaClO Cleaning as Cl_2	3,000 mg/L (10 $\leq$ pH $\leq$ 12)
Maximum NaClO Exposure (lifetime contact time) as Cl_2	1,000,000 mg/L hours
Maximum Acid Exposure Contact Time	1,000 hours (pH $\geq$ 0)

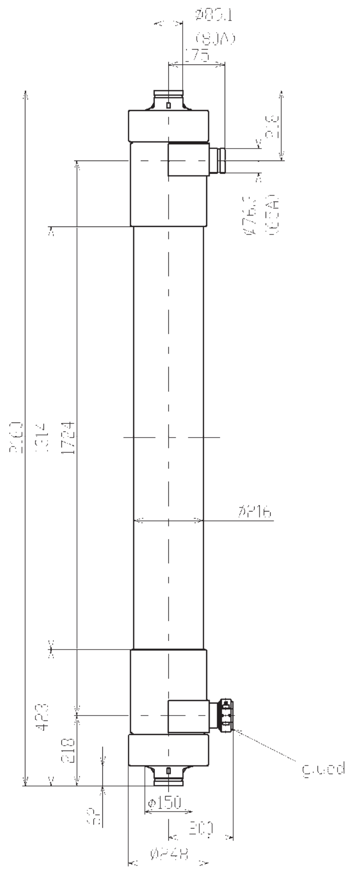
Table 3. Module Specifications

Module Type		HFU-2020N	HFU-1020N	HFU-1010N (small module for pilot test)	HFU-2008N (small module for pilot test)
Membrane Surface Area (Outer Surface)		72 m^2 (775 ft^2)	29 m^2 (312 ft^2)	7.0 m^2 (75 ft^2)	11.5 m^2 (124 ft^2)
Dimensions	Diameter	216 mm (8.50 inches)	216 mm (8.50 inches)	114 mm (4.49 inches)	89 mm (3.50 inches)
	Length	2,160 mm (7.087 ft.)	1,120 mm (3.675 ft.)	1,078 mm (3.537 ft.)	2,000 mm (6.562 ft.)
Weight	Full of water	110 kg (243 lbs)	60 kg (132 lbs)	15 kg (33 lbs)	18 kg (40 lbs)
	Drainied	67 kg (148 lbs)	40 kg (88 lbs)	9 kg (20 lbs)	11 kg (24 lbs)
Materials	Housing	PVC and/or ABS			
	Potting Material	Epoxy Resin or Urethane Resin			
Operating Conditions	Filtration Method	Outside to inside, dead end			
	Maximum Inlet Pressure	300 kPa (43.5 psi)			
	Maximum Trans Membrane Pressure	300 kPa (43.5 psi)			
	Typical Operating Trans-Membrane Pressure	< 200 kPa (< 29.0 psi)			
	Operating Temperature Range	0 – 40 degree C (32 – 104 degree F)			
	Operating pH Range	1 – 10			

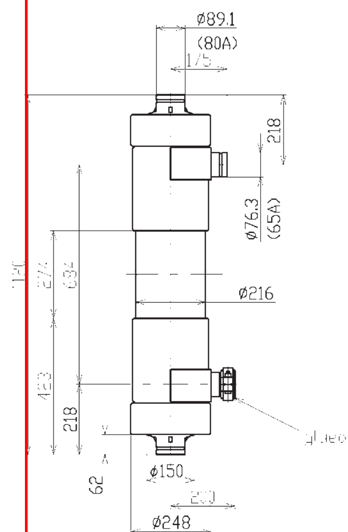
Note) This specification sheet will be updated by TORAY from time to time.

TORAY

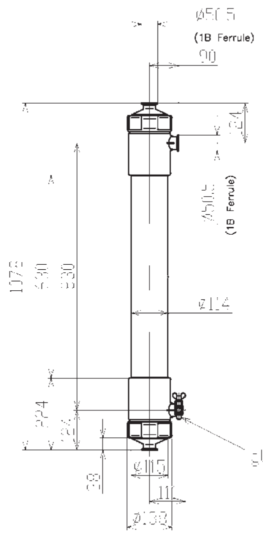
Dec. 2011



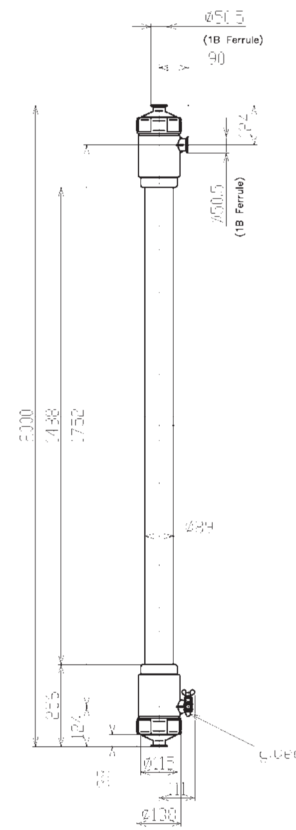
HFU-2020N



HFU-1020N



HFU-1010N



HFU-2008N

<u>Module Configuration</u>

Scinor® SMT600–P80

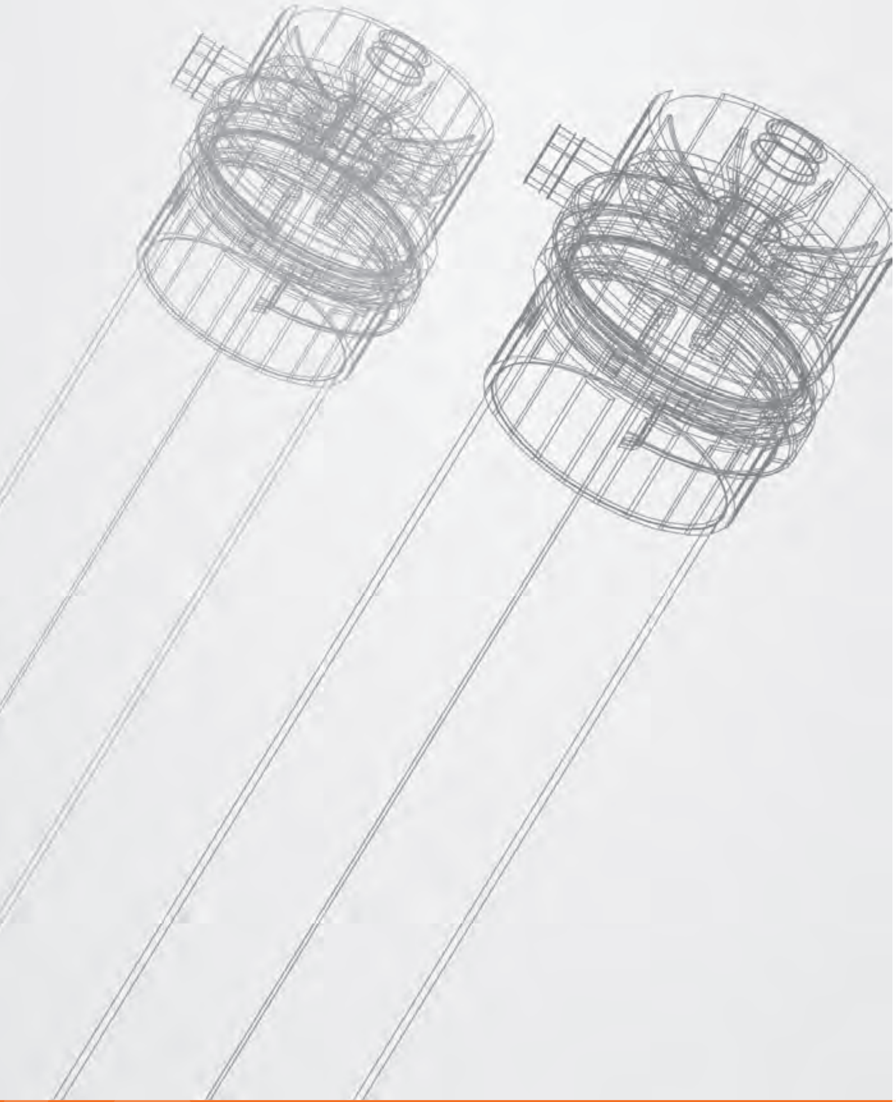
Pressurized Ultrafiltration Module

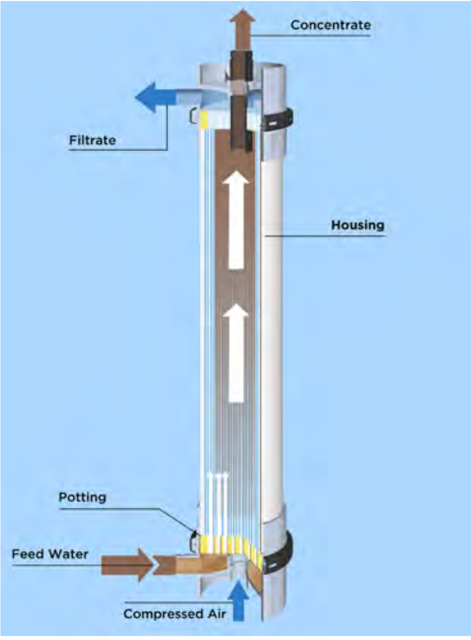
One of the largest pressurized ultrafiltration modules in the market

Scinor SMT600 series ultrafiltration modules utilizing our state-of-the-art Thermally Induced Phase Separation (TIPS) PVDF membranes provide the highest permeability, mechanical strength, and chemical tolerance in the industry. These modules are ideal for use in potable water, wastewater, desalination, and industrial applications. The SMT600-P80 retrofits major membrane vendor installations giving end-users a choice when replacing membranes.

The large and reliable SMT600-P80 pressurized ultrafiltration module is suitable for large-scale water treatment plants due to high permeability and high fiber packing density which reduces overall system footprint and lowers system capital cost.

The SMT600-P80 is an outside-in configuration module that operates in dead-end or cross-flow mode depending on specifics of the application. Cleaning processes used are simple backwash, maintenance clean, and Clean-in-Place.





Product Advantages

Excellent Filtered Water Quality
- Tight 0.1 µm pore size distribution
- Low fiber breakage rate

Long Operational Life
- High mechanical strength and durability
- >5000 mg/L Sodium Hypochlorite tolerance

Low Requirements for Pretreatment
- Outside-in configuration
- Optimal flow channel

Low Operating and Maintenance Requirements
- Low energy and chemical consumption due to higher permeability
- Automatic operation

Low Capital Cost
- High flux rates on all water sources

Small Footprint
- High hollow-fiber packing density
- Large $80m^2$ module building blocks

Retrofit modules available for all major membrane suppliers

Scinor Water America, LLC

1440 Broadway, 23rd Floor
New York, NY 10018
800.774.1385

Please visit **scinor.com** for further information.

Certified to NSF/ANSI 61

SYSTEM CERTIFICATION ISO 9001 SGS

SYSTEM CERTIFICATION ISO 14001 SGS

Specifications

Parameters

Scinor® Module	Part Number	SMT600-P80
	Fiber Material	Polyvinylidene Fluoride (PVDF)
	Effective Area	861 ft^2 (80 m^2)
	Nominal Pore Size	0.1 μm
	Fiber ID/OD	0.7 mm/1.3 mm
	Geometry	Φ225 mm × 2360 mm
	Port Size	DN50
	Housing/Head Material	U-PVC/ABS
	Potting Material	Epoxy Resin
Operating Parameters	Temperature	33-104° F (1-40 C)
	pH Range	1-11 Continuous
	Max. NaClO	5000 mg/L
	Backwash Flux	30-70 gfd (50-120 lmh)
	Air Scour Flow	3.1-7.5 scfm/module (5-12 Nm^3/hr/module)
	CIP pH Range	1-13
	Max. Feed Pressure	60 psi (0.4 MPa)
	Max. TMP	45 psi (0.3 MPa)
	Operating TMP	3-22 psi (0.02-0.15 MPa)
	Max. Air Scour Pressure	36 psi (0.25 MPa)
	Max. Backwash Pressure	36 psi (0.25 MPa)
Filtered Water Performance	Turbidity	≤0.1 ntu
	Silt Density Index	≤3
	E.Coli Removal	non-detect


Drinking Water


Wastewater


Desalination


Industrial

Scinor

Product Data Sheet

DOW IntegraFlux™ Ultrafiltration Modules

Model SFP-2860XP, SFD-2860XP, SFP-2880XP and SFD-2880XP

Features

DOW IntegraFlux™ Ultrafiltration (UF) modules with XP fiber are made from high permeability, high mechanical strength, hollow fiber PVDF membranes. The modules provide excellent performance, industry leading membrane area with low energy and chemical consumption. IntegraFlux modules have the following general properties and characteristics:

- Up to 35% higher permeability than previous generation modules helping to improve operating efficiencies and productivity
- 0.03 µm nominal pore diameter for removal of bacteria, viruses, and particulates including colloids to protect downstream processes such as RO
- PVDF polymeric hollow fibers for high mechanical strength with excellent chemical resistance providing long membrane life and reliable operation
- Outside-In flow configuration allowing a wide range of solids in the feed water minimizing the need for pretreatment processes and reducing the backwash volume compared to Inside-Out configurations

These modules are an excellent choice for systems with capacities greater than 50 m^3/hr (220 gpm). The shorter SFP-2860XP or SFD-2860XP modules are well suited for installations with limited height. Larger and longer, 8 inch diameter and 80 inch in length, the SFP-2880XP or SFD-2880XP modules offer a high effective membrane area combined with high permeability that provides the most economical and efficient membrane system design.

DOW IntegraFlux Ultrafiltration Modules can be used for a wide variety of treatment applications such as industrial and municipal wastewaters, surface water, and seawater.

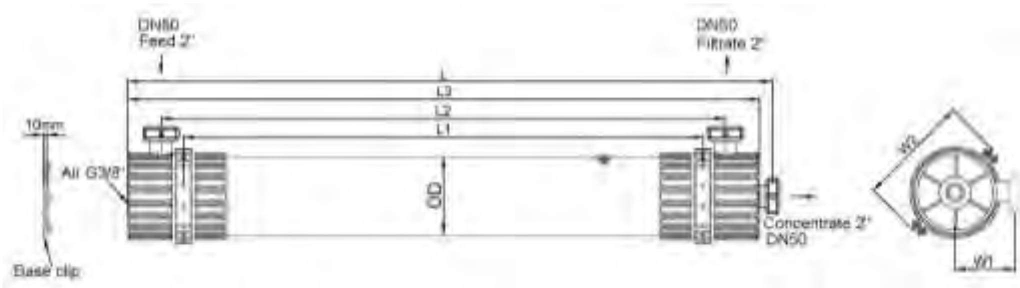
Product Specifications

Product	Type	Membrane Area		Volume		Weight (empty/water filled)	
		m^2	ft^2	liters	gallons	kg/lbs	kg/lbs
SFP-2860XP	Industrial	51	549	35	9.3	48/83	106/183
SFD-2860XP	NSF/ANSI 61 and 419	51	549	35	9.3	48/83	106/183
SFP-2880XP	Industrial	77	829	39	10.3	61/100	135/220
SFD-2880XP	NSF/ANSI 61 and 419	77	829	39	10.3	61/100	135/220

Form No. 795-50222, Rev 2
September 2015

Figure 1

SFP-2860XP, SFD-2860XP, SFP-2880XP, and SFD-2880XP (8-inch diameter)



Product	Units	Length				Diameter	Width	
		L	L1	L2	L3	D	W1	W2
SFP-2860XP and SFD-2860XP	SI (mm)	1860±3	1500	1630±3	1820±3	225	180	342
	US (inch)	73.2±0.1	59.1	64.2±0.1	71.7±0.1	8.9	7.1	13.5
SFP-2880XP and SFD-2880XP	SI (mm)	2360±3	2000	2130±3	2320±3	225	180	342
	US (inch)	92.9±0.1	78.7	83.9±0.1	91.3±0.1	8.9	7.1	13.5

Operating Limits

	SI Units	US Units
Filtrate Flux (25°C)	40 – 110 l/m^2hr	24 – 65 gfd
Flow Range Per Module[1]	2.0 – 8.5 m^3/hr	8.8 – 37.4 gpm
Temperature	1 – 40°C	34 – 104°F
Maximum Inlet Module Pressure (20°C)	6.25 bar	90.65 psi
Maximum Operating TMP	2.1 bar	30.5 psi
Maximum Operating Air Scour Flow	12 Nm^3/hr	7.1 scfm
Maximum Backwash Pressure	2.5 bar	36 psi
Operating pH	2 – 11	
Maximum NaOCl	2,000 mg/L	
Maximum Particle Size	300 µm	
Flow Configuration	Outside in, dead end flow	
Expected Filtrate Turbidity	≤ 0.1 NTU	
Expected Filtrate SDI	≤ 2.5	

[1] Flow range represents DOW™ Ultrafiltration SFP-2860XP, SFD-2860XP, SFP-2880XP, and SFP-2880XP Modules for filtrate flux range shown

Important Information

Proper start-up of an ultrafiltration system is essential to prepare the membranes for operating service and to prevent membrane damage. Following the proper start-up sequence also helps ensure that system operating parameters conform to design specifications so that system water quality and productivity goals can be achieved.

Before initiating system start-up procedures, membrane pretreatment, installation of the membrane modules, instrument calibration and other system checks should be completed.

Please refer to the DOW™ UF Product Manual.

Form No. 795-50222, Rev 2
September 2015

Operation Guidelines

Avoid any abrupt pressure variations during start-up, shutdown, cleaning or other sequences to prevent possible membrane damage. Flush the ultrafiltration system to remove shipping solution prior to start-up. Remove residual air from the system prior to start-up. Manually start the equipment. Depending on the application, filtrate obtained from initial operations should be discarded.

Please refer to the DOW™ UF Product Manual.

General Information

- If operating limits and guidelines given in this bulletin are not strictly followed, the limited warranty will be null and void.
- To control biological growth during extended system shutdowns, it is recommended that storage solution be injected into the membrane modules.

Please refer to the DOW UF Product Manual and Technical Service Bulletins.

Regulatory Note

NSF/ANSI 61 and 419 certified drinking water modules require specific conditioning procedures prior to producing potable water. Please refer to the product technical manual flushing section for specific procedures. Drinking water modules may be subjected to additional regulatory restrictions in some countries. Please check local regulatory guidelines and application status before use and sales.

Product Stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products - from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

Customer Notice

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.

DOW™ Ultrafiltration
For more information, call the Dow Water & Process Solutions business:
North America: 1-800-447-4369
Latin America: (+55) 11-5188-9222
Europe: +800-3-694-6367
Italy: +800-783-825
South Africa: +0800 99 5078
Pacific: +800 7776 7776
China: +400 889-0789
www.dowwaterandprocess.com

Form No. 795-50222, Rev 2
September 2015

APPENDIX B – TORAY FOULING SUMMARY

CITY OF DALY CITY

MEMBRANE PILOT

TORAY DATA SUMMARY

WATER QUALITY SUMMARY

Table 1. Water Quality Summary

Parameter		UF Feed				Toray Filtrate			
		Avg.	Min.	Max.	Count	Avg.	Min.	Max.	Count
pH		6.60	6.07	7.02	163				
Temperature	°C	22.6	19.2	24.7	163				
Turbidity	NTU	5.70	0.11	20.0	163				
UV Transmittance	%	47.6	32.5	55.4	157	60.4	45.4 [1]	66.4	98
ORP	mV	384	72.1	566	162				
Dissolved Oxygen	mg/L	4.28	2.13	6.31	162				
Total Chlorine	mg/L	2.91	0.00	8.40	161	2.8	0.0	5.5	106
Total Suspended Solids	mg/L	8.36	4.30	14.0	12	0.1	0.0	0.4	12
Total Organic Carbon	mg/L	21.8	17.2	25.3	19	15	11	22	14
Dissolved Organic Carbon	mg/L	14.8	10.1	20.0	14	12.3	10.6	15.7	14
Silica	mg/L	18	16	18	8	16.0	15.0	17.0	2
Reactive Silica	mg/L	15	13	15	7				
Total Iron	mg/L	0.52	0.15	1.10	27	0.13	0.10	0.22	11
Dissolved Iron	mg/L	0.15	0.10	0.28	17	0.14	0.13	0.16	3
Total Dissolved Solids	mg/L	424	400	460	9	403	380	430	3
Alkalinity	mg/L	274	220	370	19	320	280	360	2
Total Aluminum	mg/L	3.06	0.06	15.0	20	0.07	0.02	0.13	2
Dissolved Aluminum	mg/L	0.13	0.05	0.24	12	ND	ND	ND	3
Total Manganese	mg/L	0.05	0.04	0.06	8	0.05	0.04	0.06	2
Dissolved Manganese	mg/L	0.05	0.04	0.07	8	0.06	0.04	0.07	2
Ammonia as N	mg/L	53	35	75	8				
Total Calcium	mg/L	18	12	25	9	24.0	23.0	25.0	3
Total Magnesium	mg/L	8.54	3.60	14.0	9	13.7	13.0	14.0	3

Parameter		UF Feed				Toray Filtrate			
		Avg.	Min.	Max.	Count	Avg.	Min.	Max.	Count
Total Sodium	mg/L	75	74	75	2	76.0	74.0	78.0	2
Orthophosphate	mg/L	7.80	4.60	11.0	2				
Total Hardness	mg/L	80	45	118	9				
Chloride	mg/L	92	90	94	2	94.5	92.0	97.0	2
Nitrate as N	mg/L	N/A	N/A	N/A	0	ND	ND	ND	2
Sulfate as SO4	mg/L	50	48	52	2	50.0	48.0	52.0	2

Notes:

(1) Lowest measurement of 26.7% UVT due to sampling or measurement error.

SUMMARY OF OPERATING CONDITIONS AND FOULING RESPONSE

Operating Conditions

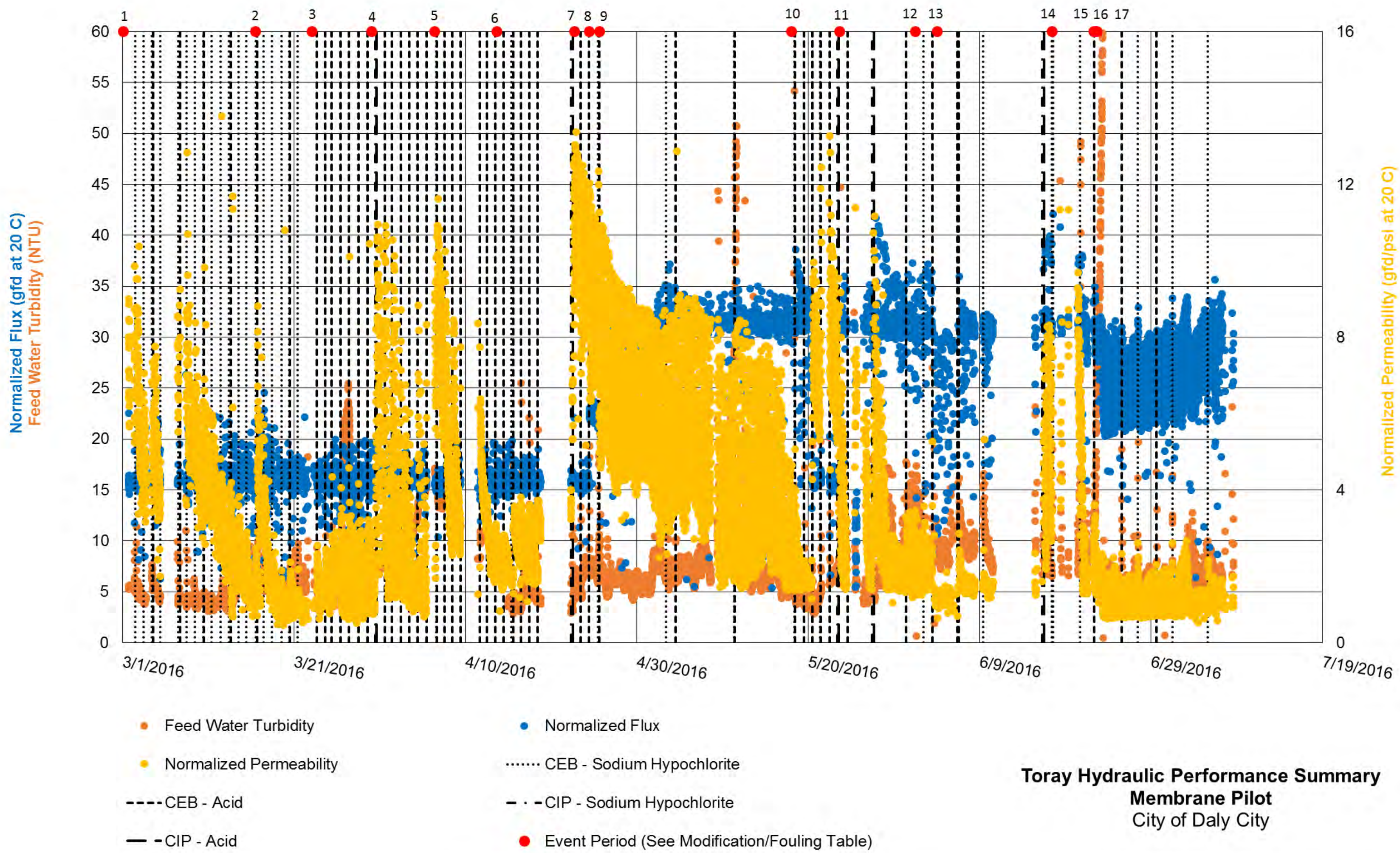
Table 2. Toray Initial and Revised Operating Conditions

Operating Condition		**Initial**	**Revised** [1]
Pretreatment			
Sodium Hypochlorite Dose	mg/L	3.5	3.5
Coagulant Dose	mg/L	0	5
Production			
Flux	gfd	15.5	31
Crossflow	%	0	0
Production Cycle	min	22	22
Backwash			
Air Scrub Flow	scfm	3.5	5.5
Backwash Flow (BW Waste Port)	gpm	1.1 x Flux	25
Backwash Flow (Lower Drain)	gpm	N/A	20 [2]
Drain	sec	60	60
Chemically Enhanced Backwash			
Chemical Soak Time	min	30	30
Sodium Hypochlorite/Caustic CEB			
Frequency	Per Week	7	1
Sodium Hypochlorite Dose	mg/L	900	800
Caustic Dose	mg/L	400	525
Citric Acid/Hydrochloric Acid CEB			
Frequency	Per Week	2	1
Citric Acid Dose	mg/L	1,000	1,000
Hydrochloric Acid Dose	mg/L	400	550
Clean-In-Place			
Recycle Time	min	120	120

Operating Condition		Initial	Revised [1]
Soak Time	min	N/A	N/A
Sodium Hypochlorite/Caustic CIP			
Temperature	°C	38	38
Target pH		N/A	N/A
Sodium Hypochlorite Dose	mg/L	3,000	3,000
Caustic Dose	mg/L	N/A	N/A
Citric Acid/Hydrochloric Acid CIP			
Temperature	°C	38	38
Target pH		1.5	1.5
Citric Acid Dose	mg/L	5,000	20,000
Hydrochloric Acid Dose [3]	mg/L	Target pH	~9,900

Notes:

(1) Revised period from April 25, 2016 - May 16, 2016. CIP performed on May 23, 2016.
(2) Backwash flow through the lower drain was not implemented until the end of the testing period, and the module did not operate with it during revised operating conditions. It is a suggested operating condition.
(3) Chemical is dosed to achieve a target pH. The dose is not automatically recorded. Values shown, if any, were calculated based on a manual timing of the chemical pump, the chemical pump capacity, and an assumed CIP volume of 50 gallons.



Toray Hydraulic Performance Summary
Membrane Pilot
City of Daly City

Figure 1. Toray Hydraulic Performance Summary

Table 3. Toray System Modifications and Fouling Response

Classification	Event/Modification	Observations
Period 1	Flux Rate 15.5 gfd Crossflow 0% 2/wk Citric Acid/Hydrochloric Acid CEBs Daily Sodium Hypochlorite/Sodium Hydroxide CEBs No Pretreatment	High fouling rate
Period 2	Increased air scrub flow 3.5 sfcm to 5.0 sfcm Increased backwash flowrate from at 1.1 Ratio to 1.5 Ratio	No change in fouling rate
Period 3	Daily Citric Acid/Hydrochloric Acid CEBs	Decreased fouling rate
Period 4	Daily Citric Acid/Hydrochloric Acid CEBs	Increased permeability recovery following CIP. Unable to maintain high permeability, increased fouling rate
Period 5	Daily Citric Acid/Hydrochloric Acid CEBs 1/wk Sodium Hypochlorite/Sodium Hydroxide CEBs Replaced 100 micron strainer with 200 micron strainer Changed backwash flowrate to a flow setpoint of 25 gpm, instead of 1.5 Ratio. Changed refill from being based on valve position, 28%, to being based on flowrate, 13 gpm.	Increased permeability recovery following CEB, increased fouling rate
Period 6	Increased Pretreatment to 2.5 mg/L ACH	Decreased fouling rate, increased permeability recovery following CEB
Period 7	Increased Pretreatment to 5.0 mg/L ACH	Decrease in fouling rate, increased permeability recovery following CIP
Period 8	Increased flux to 22 gfd	No change in fouling rate
Period 9	Increased flux to 31 gfd 1/wk Citric Acid/Hydrochloric Acid CEBs 1/wk Sodium Hypochlorite/Sodium Hydroxide CEBs	No change in fouling rate for one week and then level off
Period 10	Decreased Pretreatment to 0 mg/L ACH Daily Citric Acid/Hydrochloric Acid CEBs 3/wk Sodium Hypochlorite/Sodium Hydroxide CEBs	Increased fouling rate, unable to maintain constant flux rate

Classification	Event/Modification	Observations
Period 11	Increased Pretreatment to 2.5 mg/L ACH 1/wk Citric Acid/Hydrochloric Acid CEBs	Initial decrease in permeability, Decreased fouling rate
Period 12	Increased Pretreatment to 3.75 mg/L ACH	No change in fouling rate
Period 13	Pilot ran out of pretreatment chemicals, ACH and Sodium Hypochlorite	Unable to maintain constant flux rate, drop in permeability
Period 14	Added backwash out drain step	Programming issues caused sporadic cleans and shutdowns.
Period 15	Increased Pretreatment to 60 mg/L ACH (5 hours)	Increased fouling rate
Period 16	Decreased Pretreatment to 30 mg/L ACH (4.5 hours)	No change in fouling rate
Period 17	Decreased Pretreatment to 5 mg/L ACH 1/wk Citric Acid/Hydrochloric Acid CEBs 2/wk Sodium Hypochlorite/Sodium Hydroxide CEBs	Low permeability, Fouling rate near 0, unable to maintain flux rate

CLEANING PERMEABILITY RECOVERY

Table 4. Toray Cleaning Permeability Recovery

	Date	Clean Type (CEB/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)
Period 1	3/2/2016	CEB	Sodium Hypochlorite	900	Caustic	400		7.6	9.5	N/A	N/A
	3/3/2016	CEB	Sodium Hypochlorite	900	Caustic	400	9.5	4.5	7.1	53%	74%
	3/4/2016	CEB	Sodium Hypochlorite	950	Caustic	600	7.1	5.3	6.8	25%	97%
	3/4/2016	CEB	Citric Acid	1000	Hydrochloric Acid	400	6.8	5.9	7.2	13%	105%
	3/5/2016	CEB	Sodium Hypochlorite	950	Caustic	650	7.2	4.7	N/A	34%	N/A
	3/7/2016	CEB	Sodium Hypochlorite	950	Caustic	650	N/A	8.5	8.5	N/A	N/A
	3/7/2016	CEB	Citric Acid	1000	Hydrochloric Acid	400	8.5	8.8	9.3	-4%	109%
	3/8/2016	CEB	Sodium Hypochlorite	900	Caustic	600	9.3	8.7	9.6	6%	104%
	3/9/2016	CEB	Sodium Hypochlorite	800	Caustic	525	9.6	6.1	7.7	36%	80%
	3/10/2016	CEB	Sodium Hypochlorite	800	Caustic	525	7.7	4.1	6.3	46%	82%
	3/10/2016	CEB	Citric Acid	1000	Hydrochloric Acid	450	6.3	6.0	6.9	5%	109%
	3/11/2016	CEB	Sodium Hypochlorite	800	Caustic	525	6.9	4.4	6.0	36%	86%
	3/12/2016	CEB	Sodium Hypochlorite	800	Caustic	525	6.0	3.0	4.8	49%	81%
	3/13/2016	CEB	Sodium Hypochlorite	800	Caustic	525	4.8	2.1	4.1	56%	84%
	3/13/2016	CEB	Citric Acid	1000	Hydrochloric Acid	450	4.1	3.4	4.2	17%	103%
	3/14/2016	CEB	Sodium Hypochlorite	800	Caustic	525	4.2	2.0	3.6	53%	85%
	3/15/2016	CEB	Sodium Hypochlorite	800	Caustic	525	3.6	1.4	2.9	60%	81%
	3/16/2016	CEB	Sodium Hypochlorite	800	Caustic	525	2.9	1.1	2.5	60%	85%
	3/16/2016	CEB	Citric Acid	2000	Hydrochloric Acid	450	2.5	2.3	8.1	6%	332%
	3/16/2016	CEB	Citric Acid	2000	Hydrochloric Acid	600					
Period 2	3/17/2016	CEB	Sodium Hypochlorite	800	Caustic	525	8.1	3.4	5.7	59%	70%
	3/18/2016	CEB	Sodium Hypochlorite	800	Caustic	525	5.7	1.4	2.3	76%	40%
	3/19/2016	CEB	Sodium Hypochlorite	800	Caustic	525	2.3	1.1	1.9	55%	82%
	3/20/2016	CEB	Sodium Hypochlorite	800	Caustic	525	1.9	0.8	1.4	56%	73%
	3/20/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	1.4	1.1	2.1	18%	153%
	3/21/2016	CEB	Sodium Hypochlorite	800	Caustic	525	2.1	0.8	1.4	60%	65%
Period 3	3/23/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	1.4	1.1	2.5	20%	183%
	3/24/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	2.5	1.3	2.4	51%	96%
	3/25/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	2.4	1.4	2.8	44%	115%
	3/26/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	2.8	2.0	3.5	30%	125%
	3/27/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	3.5	1.9	3.3	46%	94%
	3/28/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	3.3	1.7	3.6	48%	109%
	3/29/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	3.6	2.0	3.2	45%	89%

	Date	Clean Type (CEB/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)
Period 4	3/30/2016	CIP	Sodium Hypochlorite	3000			3.2	1.8	8.2	43%	256%
	3/30/2016	CIP	Citric Acid	5000	Hydrochloric Acid	Target pH 1.5	8.2	7.5	10.9	9%	133%
	3/31/2016	CEB	Citric Acid	1000	Hydrochloric Acid	575	10.9	8.9	10.9	19%	100%
	4/1/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	10.9	4.4	10.5	60%	97%
	4/2/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	10.5	1.7	8.7	84%	83%
	4/3/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	8.7	1.3	5.2	86%	60%
	4/4/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	5.2	1.3	8.8	74%	170%
	4/5/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	8.8	4.2	8.3	52%	94%
Period 5	4/6/2016	CEB	Sodium Hypochlorite	900	Caustic	550	8.3	9.5	10.6	-14%	128%
	4/6/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	10.6	10.6	10.9	0%	103%
	4/7/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	10.9	6.6	9.7	40%	88%
	4/8/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	9.7	3.6	8.5	63%	88%
	4/9/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	8.5	3.2	N/A	62%	N/A
	4/11/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	N/A	N/A	6.4	N/A	N/A
	4/12/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	6.4	3.3	3.8	48%	60%
Period 6	4/13/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	3.8	1.8	3.1	53%	81%
	4/14/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	3.1	1.5	2.8	52%	91%
	4/15/2016	CEB	Sodium Hypochlorite	800	Caustic	525	2.8	1.7	1.8	38%	65%
	4/15/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	1.8	1.9	3.5	-4%	190%
	4/16/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	3.5	2.2	3.8	36%	109%
	4/17/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	3.8	2.0	3.6	49%	95%
	4/18/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	3.6	1.9	3.7	47%	102%
Period 7	4/22/2016	CIP	Sodium Hypochlorite	3000			3.7	4.0	7.2	-8%	194%
	4/22/2016	CIP	Citric Acid	20000	Hydrochloric Acid	Target pH 1.5	7.2	7.2	13.0	0%	182%
	4/23/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	13.0	12.3	12.5	6%	96%
Period 8	4/24/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	12.5	11.8	12.0	5%	96%
	4/25/2016	CEB	Sodium Hypochlorite	800	Caustic	525	12.0	10.8	12.0	10%	100%
Period 9	4/25/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	12.0	11.3	10.8	6%	90%
	5/3/2016	CEB	Sodium Hypochlorite	800	Caustic	525	10.8	8.2	8.5	24%	79%
	5/4/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	8.5	7.6	8.6	11%	101%
	5/11/2016	CEB	Sodium Hypochlorite	800	Caustic	525	8.6	6.9	8.1	20%	94%
	5/11/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550					
Period 10	5/18/2016	CEB	Sodium Hypochlorite	800	Caustic	525	8.1	3.5	4.0	56%	49%
	5/18/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550					
	5/19/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	4.0	1.6	2.1	60%	54%
	5/20/2016	CEB	Sodium Hypochlorite	3000	Caustic	525	2.1	1.6	10.0	25%	463%

	Date	Clean Type (CEB/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)
	5/20/2016	CEB	Citric Acid	20000	Hydrochloric Acid	500					
	5/21/2016	CEB	Sodium Hypochlorite	3000	Caustic	525	10.0	7.9	10.8	21%	108%
	5/21/2016	CEB	Citric Acid	20000	Hydrochloric Acid	500					
	5/22/2016	CEB	Citric Acid	20000	Hydrochloric Acid	550	N/A	N/A	11.2	N/A	N/A
	5/23/2016	CIP	Sodium Hypochlorite	3000			11.2	8.5	9.2	24%	82%
	5/23/2016	CIP	Citric Acid	20000	Hydrochloric Acid	550					
Period 11	5/24/2016	CEB	Citric Acid		Hydrochloric Acid		9.2	3.2	N/A	65%	N/A
	5/27/2016	CIP	Sodium Hypochlorite	3000			N/A	2.6	10.0	N/A	N/A
	5/27/2016	CIP	Citric Acid	20000	Hydrochloric Acid	Target pH 1.5					
	5/31/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	10.0	1.9	3.3	81%	33%
Period 12	6/2/2016	CEB	Sodium Hypochlorite	800	Caustic	525	3.3	2.5	3.6	23%	109%
	6/3/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	3.6	2.4	1.4	34%	38%
Period 13	6/6/2016	CEB	Citric Acid	1000	Caustic	550	1.4	1.3	1.5	5%	108%
	6/6/2016	CEB	Citric Acid	20000	Caustic	550	1.5	1.5	2.9	0%	195%
	6/9/2016	CEB	Sodium Hypochlorite	800	Caustic	525	2.9	1.6	2.4	45%	85%
	6/16/2016	CIP	Sodium Hypochlorite	3000			N/A	1.9	7.7	N/A	N/A
	6/16/2016	CIP	Citric Acid	20000	Hydrochloric Acid	Target pH 1.5					
Period 14	6/17/2016	CEB	Sodium Hypochlorite	1500			7.7	7.7	N/A	0%	NA
	6/17/2016	CEB	Sodium Hypochlorite	1500	Caustic	550	N/A	N/A	N/A	N/A	N/A
	6/20/2016	CEB	Sodium Hypochlorite	1500	Caustic	550	N/A	5.5	7.9	N/A	N/A
Period 15, 16, 17	6/22/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	7.9	2.7	3.3	66%	42%
Period 17	6/25/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	3.3	1.3	1.4	62%	42%
	6/27/2016	CEB	Sodium Hypochlorite	1500	Caustic	550	1.4	1.6	2.6	-13%	188%
	6/29/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	2.6	1.2	2.0	55%	78%
	7/1/2016	CEB	Sodium Hypochlorite	1500	Caustic	550	2.0	1.1	2.1	46%	102%
	7/5/2016	CEB	Sodium Hypochlorite	1500	Caustic	550	2.1	1.2	2.2	41%	103%

APPENDIX C – SCINOR FOULING SUMMARY

CITY OF DALY CITY

MEMBRANE PILOT

SCINOR DATA SUMMARY

WATER QUALITY SUMMARY

Table 1. Water Quality Summary

Parameter		UF Feed				Scinor Filtrate			
		Avg.	Min.	Max.	Count	Avg.	Min.	Max.	Count
pH		6.60	6.07	7.02	163				
Temperature	°C	22.6	19.2	24.7	163				
Turbidity	NTU	5.70	0.11	20.0	163				
UV Transmittance	%	47.6	32.5	55.4	157	60.5	45.8	67.0	61
ORP	mg/L	384	72.1	566	162				
Dissolved Oxygen	mg/L	4.28	2.13	6.31	162				
Total Chlorine	mg/L	2.91	0.00	8.40	161	3.13	0.00	7.00	68
Total Suspended Solids	mg/L	8.36	4.30	14.0	12	0.23	0.00	0.90	10
Total Organic Carbon	mg/L	21.8	17.2	25.3	19	14.1	11.5	16.9	8
Dissolved Organic Carbon	mg/L	14.8	10.1	20.0	14	12.6	10.6	15.6	8
Silica	mg/L	18	16	18	8				
Reactive Silica	mg/L	15	13	15	7				
Total Iron	mg/L	0.52	0.15	1.10	27	0.12	0.10	0.13	4
Dissolved Iron	mg/L	0.15	0.10	0.28	17				
Total Dissolved Solids	mg/L	424	400	460	9				
Alkalinity	mg/L	274	220	370	19				
Total Aluminum	mg/L	3.06	0.06	15.0	20	ND	ND	ND	4
Dissolved Aluminum	mg/L	0.13	0.05	0.24	12				

SUMMARY OF OPERATING CONDITIONS AND FOULING RESPONSE

Operating Conditions

Table 2. Scinor Initial and Revised Operating Conditions

Operating Condition		Initial	Revised [1]
Pretreatment			
Sodium Hypochlorite Dose	mg/L	3.5	3.5
Coagulant Dose	mg/L	0	5
Production			
Flux	gfd	15.5	31
Crossflow	%	0	10 [2]
Production Cycle	min	20	20
Backwash			
Air Scrub Flow	scfm	3	3
Air/Water Flow	gpm	1.1 x Flux	13
Backwash Flow (BW Waste Port)	gpm	1.1 x Flux	25
Backwash Flow (Lower Drain)	gpm	N/A	N/A
Drain	sec	N/A	60
Chemically Enhanced Backwash			
Chemical Soak Time	min	30	30
Sodium Hypochlorite/Caustic CEB			
Frequency	Per Week	7	2
Sodium Hypochlorite Dose	mg/L	900	800
Caustic Dose	mg/L	400	525
Citric Acid/Hydrochloric Acid CEB			
Frequency	Per Week	2	1

Operating Condition		Initial	Revised [1]
Citric Acid Dose	mg/L	1000	1000
Hydrochloric Acid Dose	mg/L	500	550
Clean-In-Place			
Recirculation Time	min	30 x 3	60
Soak Time	min	30 x 3	60
Sodium Hypochlorite/Caustic CIP			
Temperature	°C	38	38
Target pH	-	12	12
Sodium Hypochlorite Dose	mg/L	3,000	3,000
Caustic Dose[3]	mg/L	Target pH	~2,200
Citric Acid/Hydrochloric Acid CIP			
Temperature	°C	38	38
Target pH	-	2	2
Citric Acid Dose	mg/L	20,000	20,000
Hydrochloric Acid Dose[3]	mg/L	Target pH	Target pH

Notes:

(1) Revised period from 4/25/16-5/2/16. CIP performed on 5/10/16.

(2) Operation of module with 10% crossflow was initially recommended by the membrane supplier. Crossflow was not implemented until the end of the testing period, and the module was not operating with crossflow during the period of revised operating conditions above. Earlier implementation of crossflow could have sustained or prolonged membrane performance and is considered a necessary operating condition.

(3) Chemical is dosed to achieve a target pH. The dose is not automatically recorded. Values shown, if any, were calculated based on a manual timing of the chemical pump, the chemical pump capacity, and an assumed CIP volume of 50 gallons.

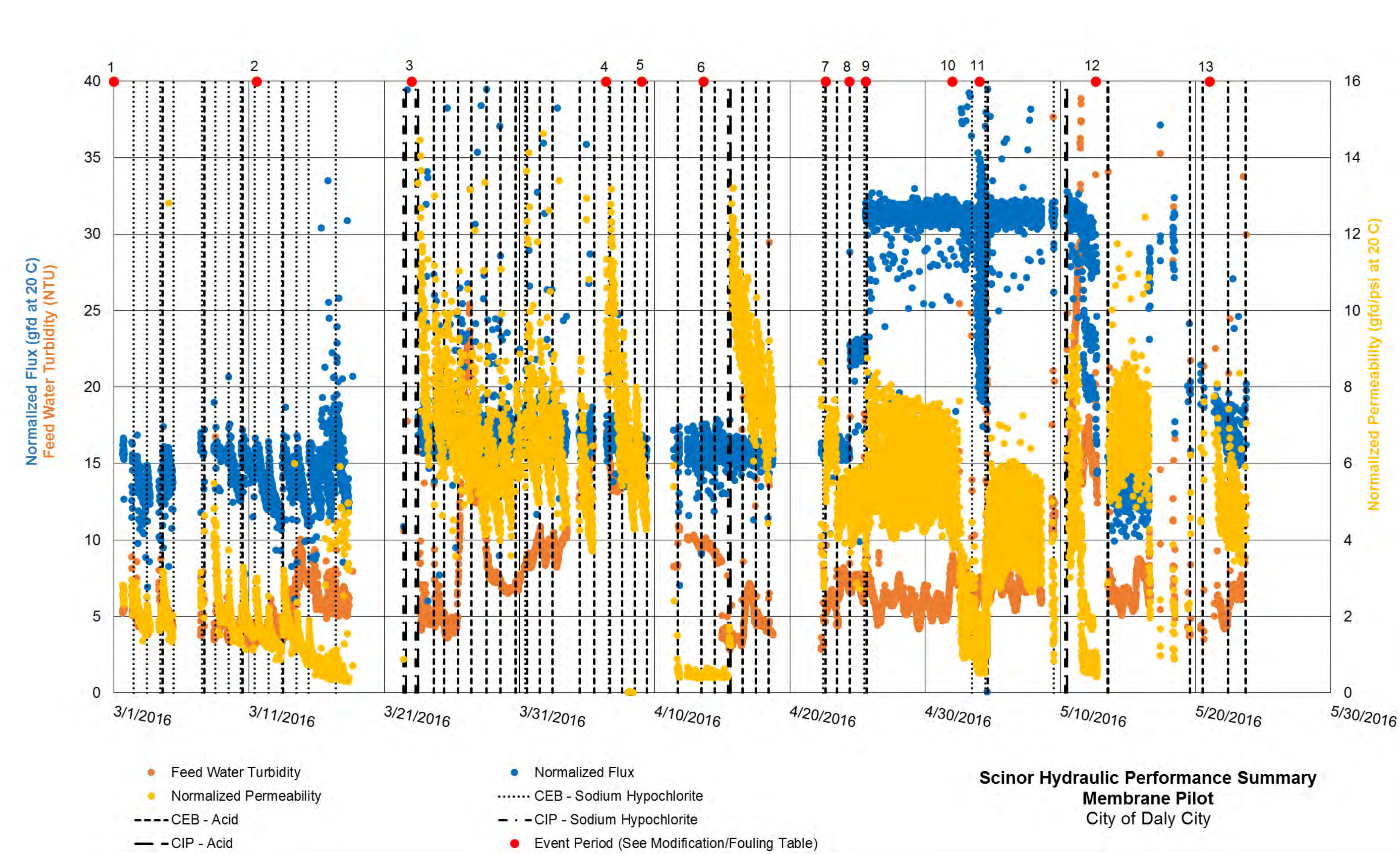


Figure 1. Scinor Hydraulic Performance Summary

Table 3. Scinor System Modifications and Fouling Response

Classification	Events and Modifications	Observations
Period 1	Flux Rate 15.5 gfd Crossflow 0% 2/wk Citric Acid/Hydrochloric Acid CEBs Daily Sodium Hypochlorite/Sodium Hydroxide CEBs No Pretreatment	Unable to maintain constant flux rate
Period 2	Changed backwash flowrate to a flow setpoint, instead of 1.1 Ratio. Low Flow = 13 gpm, High Flow = 25 gpm	Unable to maintain constant flux rate, No change in fouling rate
Period 3	Daily Citric Acid/Hydrochloric Acid CEBs 1/wk Sodium Hypochlorite/Sodium Hydroxide CEBs Added Drain Step to Backwash Sequence	Able to maintain constant flux rate
Period 4	Replaced 100 micron strainer with 200 micron strainer	Increased fouling rate
Period 5	No modifications Pilot shutdown for 2 days	Low permeability upon restart
Period 6	Increased Pretreatment to 2.5 mg/L ACH	Decreased fouling rate
Period 7	Increased Pretreatment to 5.0 mg/L ACH	Decreased fouling rate, permeability increasing
Period 8	Increased Flux to 22 gfd	Initial decrease in permeability, no change in fouling rate, permeability increasing
Period 9	Increased Flux to 31 gfd No CEBs	Increased fouling rate, however steady decline of only 1 gfd/psi over 5 days
Period 10	Unknown event (following weir clean upstream)	Rapid permeability decrease, increase in fouling rate, decrease in flux rate
Period 11	1/wk Citric Acid/Hydrochloric Acid CEBs 2/wk Sodium Hypochlorite/Sodium Hydroxide CEBs	Decreased fouling rate
Period 12	Unknown event	Unable to maintain constant flux rate, increased fouling rate
Period 13	Decreased Flux to 17.5 gfd Increased Crossflow to 25% Daily Citric Acid/Hydrochloric Acid CEBs	Decreased fouling rate

CLEANING PERMEABILITY RECOVERY

Table 4. Scinor Cleaning Permeability Recovery

	Date	Clean Type (CEB/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)
Period 1	3/2/2016	CEB	Sodium Hypochlorite	900	Caustic	400		2.2	2.9	N/A	N/A
	3/3/2016	CEB	Sodium Hypochlorite	900	Caustic	400	2.9	1.6	2.5	46%	87%
	3/4/2016	CEB	Sodium Hypochlorite	950	Caustic	600	2.5	1.6	2.3	35%	90%
	3/4/2016	CEB	Citric Acid	1000	Hydrochloric Acid	500	2.3	1.9	3.2	14%	141%
	3/5/2016	CEB	Sodium Hypochlorite	950	Caustic	650	3.2	1.5	N/A	54%	N/A
	3/7/2016	CEB	Sodium Hypochlorite	950	Caustic	650	N/A	2.2	2.6	N/A	N/A
	3/7/2016	CEB	Citric Acid	1000	Hydrochloric Acid	450	2.6	2.6	4.6	0%	180%
	3/8/2016	CEB	Sodium Hypochlorite	900	Caustic	600	4.6	3.8	4.3	18%	94%
	3/9/2016	CEB	Sodium Hypochlorite	800	Caustic	525	4.3	2.1	3.7	51%	86%
	3/10/2016	CEB	Sodium Hypochlorite	800	Caustic	525	3.7	1.4	2.3	63%	61%
	3/10/2016	CEB	Citric Acid	1000	Hydrochloric Acid	450	2.3	2.0	3.3	13%	145%
Period 2	3/11/2016	CEB	Sodium Hypochlorite	800	Caustic	525	3.3	1.6	2.9	53%	88%
	3/12/2016	CEB	Sodium Hypochlorite	800	Caustic	525	2.9	1.4	2.5	53%	87%
	3/13/2016	CEB	Sodium Hypochlorite	800	Caustic	525	2.5	1.1	2.0	57%	78%
	3/13/2016	CEB	Citric Acid	1000	Hydrochloric Acid	450	2.0	1.8	3.2	7%	163%
	3/14/2016	CEB	Sodium Hypochlorite	800	Caustic	525	3.2	1.4	2.4	58%	74%
	3/15/2016	CEB	Sodium Hypochlorite	800	Caustic	525	2.4	1.0	1.9	58%	80%
	3/17/2016	CEB	Sodium Hypochlorite	800	Caustic	525	1.9	0.4	1.1	77%	61%
	3/22/2016	CIP	Sodium Hypochlorite	3000	Caustic	600 +	N/A	N/A	N/A	N/A	N/A
	3/22/2016	CIP	Citric Acid	20000	Hydrochloric Acid	Target pH 2					
Period 3	3/23/2016	CIP	Sodium Hypochlorite	3000	Caustic	600 +	N/A	N/A	14.5	N/A	N/A
	3/23/2016	CIP	Citric Acid	20000	Hydrochloric Acid	Target pH 2					
	3/24/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	14.5	7.2	11.8	50%	82%
	3/25/2016	CEB	Citric Acid	1000	Hydrochloric Acid	625	11.8	8.2	10.4	31%	88%
	3/26/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	10.4	7.5	9.3	28%	89%
	3/27/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	9.3	6.3	8.8	32%	95%
	3/28/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	8.8	5.3	9.1	40%	103%
	3/29/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	9.1	4.7	9.9	48%	109%
	3/30/2016	CEB	Citric Acid	1000	Hydrochloric Acid	600	9.9	5.3	8.0	47%	81%
	3/31/2016	CEB	Sodium Hypochlorite	800	Caustic	525	8.0	7.8	12.3	2%	154%
	3/31/2016	CEB	Citric Acid	1000	Hydrochloric Acid	525					
	4/1/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	12.3	6.8	9.7	45%	78%

	Date	Clean Type (CEB/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)
	4/2/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	9.7	5.7	8.8	42%	91%
	4/4/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	8.8	4.9	8.7	45%	99%
	4/5/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	8.7	5.1	11.3	42%	130%
Period 4	4/6/2016	CEB	Sodium Hypochlorite	1000	Caustic	550	11.3	10.2	13.2	10%	116%
	4/6/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550					
	4/7/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	13.2	6.2	9.4	53%	72%
	4/8/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	9.4	5.5	7.8	42%	83%
Period 5	4/9/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	7.8	4.5	N/A	42%	N/A
	4/11/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	N/A	0.7	0.7	N/A	N/A
	4/12/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	0.7	0.4	0.5	39%	73%
	4/13/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	0.5	0.4	0.5	19%	101%
Period 6	4/14/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	0.5	0.4	0.5	15%	100%
	4/15/2016	CIP	Sodium Hypochlorite	3000	Caustic	700 +	0.5	0.4	12.8	16%	2476%
	4/15/2016	CIP	Citric Acid	20000	Hydrochloric Acid	Target pH 2					
	4/16/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	12.8	10.0	10.7	22%	83%
	4/17/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	10.7	8.0	9.6	25%	90%
	4/18/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	9.6	6.7	9.2	31%	96%
	4/22/2016	CEB	Sodium Hypochlorite	800	Caustic	525	9.2	3.6	6.5	61%	71%
	4/22/2016	CEB			Hydrochloric Acid	600					
Period 7	4/23/2016	CEB			Hydrochloric Acid	600	6.5	7.2	5.2	-11%	80%
Period 8	4/24/2016	CEB			Hydrochloric Acid	600	5.2	5.7	5.0	-8%	95%
Period 9	4/25/2016	CEB	Sodium Hypochlorite	800	Caustic	525	5.0	5.6	6.0	-13%	121%
	4/25/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	6.0	5.5	8.8	8%	147%
Period 10	5/3/2016	CEB	Sodium Hypochlorite	800	Caustic	525	8.8	2.9	3.4	67%	39%
Period 11	5/4/2016	CEB	Sodium Hypochlorite	800	Caustic	525	3.4	3.0	4.2	14%	123%
	5/4/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	4.2	2.0	5.2	52%	124%
	5/9/2016	CEB	Sodium Hypochlorite	800	Caustic	525	5.2	2.4	4.1	54%	78%
	5/10/2016	CIP	Sodium Hypochlorite	3000	Caustic	700 +	4.1	N/A	9.3	N/A	227%
	5/10/2016	CIP	Citric Acid	20000	Hydrochloric Acid	Target pH 2					

	Date	Clean Type (CEB/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)
Period 12	5/13/2016	CEB	Citric Acid	20000	Hydrochloric Acid	500	9.3	0.8	7.6	91%	81%
	5/13/2016	CEB	Citric Acid	20000	Hydrochloric Acid	500					
	5/19/2016	CEB	Citric Acid	20000	Hydrochloric Acid	500	7.6	2.3	6.2	69%	82%
	5/20/2016	CEB	Citric Acid	20000	Hydrochloric Acid	500	6.2	6.4	7.6	-3%	123%
Period 13	5/21/2016	CEB	Citric Acid	20000	Hydrochloric Acid	500	7.6	6.5	7.2	14%	94%
	5/22/2016	CEB	Citric Acid	20000	Hydrochloric Acid	500	7.2	5.0	7.4	30%	103%
	5/23/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	7.4	4.9	7.0	34%	94%

APPENDIX D – SCINOR AUTOPSY RESULTS

Avista TECHNOLOGIES

Creative Chemistry. Smart Solutions.

7/21/2016

Libbie Linton
WesTech Engineering
3665 South West Temple
Salt Lake City Utah 84115

Hello Libbie,

Thank you for sending in Scinor ultrafiltration hollow fibers to Avista Technologies for evaluation. Attached please find the hollow fiber analysis report. Know that we take great pride in our UF/MF and membrane autopsy program and often use the findings from membranes like yours to develop new cleaners and chemical formulations, particularly as separation technology continues to expand into new and exciting applications. I have reviewed this report and have the following comments:

Fibers were provided from the top (sample 2) and bottom (sample 1) of the module. Both were brown in color but the fibers from the bottom of the module were darker in color. The Foulant could not be scraped from the UF surfaces but CEI did detect organic material on both the feed and filtrate side of the fibers.

Avista 165 is a liquid high pH cleaner designated to target hydrophobic material such as organics, oil and grease. It is still currently in the research and development process but did remove much of the visual foulant and increased permeability by approximately three times the initial flux. Please let me know if you have any questions in regards to the findings or the cleaning study.

Thanks again for permitting our organization to evaluate your membrane. We appreciate your business.

Best regards,

Rob Goodlett
Applications and Sales
Avista Technologies, Inc.

140 Bosstick Boulevard
San Marcos, California 92069, United States

Tel. | +1.760.744.0536

www.avistatech.com

Avista TECHNOLOGIES

Hollow Fiber Analysis Report

Completed for:

WesTech Engineering

Daly City

07/19/2016 WO#060916-3

CORPORATE OFFICES

Avista Technologies, Inc.
Global Headquarters

+1.760.744.0536
info@avistatech.com

Avista Technologies (UK) Ltd

+44 (0) 131 449 6677
info@avistatech.co.uk

Creative Chemistry. Smart Solutions.

Summary

WesTech Engineering provided two sets of hollow fibers harvested from a Scinor Ultrafiltration (UF) module for analysis. The fibers were harvested from the UF module onsite and only fibers were provided to Avista Technologies. The type of UF fibers provided are "outside-in" meaning the fibers are submerged in the feed water and filtrate is collected on the interior of the fibers. The module was chosen for analysis because it was experiencing increased transmembrane pressure (TMP). The sets were labeled "Sample 1 - Bottom of the Module" and "Sample 2 - Top of the Module." A list of results for the analysis is provided below.

The fibers were provided in disposable plastic bags. Each bag contained approximately 30 fibers which were six inches in length. All of the fibers were discolored (brown); however, no removable foulant material was coating the feed side (exterior) of the fibers. The Sample 1 fibers were slightly darker in color compared to the Sample 2 fibers. Stereoscope imaging was performed on both sets of fibers. The feed sides of both of the fibers were brown in color. Black colored particles were also visible, but more prevalent on fibers from Sample 1. The brown discoloration penetrated through the fiber walls to the filtrate side (interior) of the fibers. The fibers from Sample 1 appeared to be more fouled.

Due to the lack of removable foulant material, the loss on ignition (organic content) could not be determined. Acid testing for the presence of carbonates was negative. Sufficient foulant material was not present on the fiber surfaces to perform a microbiological analysis. Fourier Transform Infrared Spectroscopy (FT-IR) Analysis was performed on the Sample 1 and Sample 2 fibers. A comparison of the spectra for the fibers matched, indicating the same functional groups were present on both sets of fibers. The spectra for both of the fibers was compared to a new PVDF fiber and also matched. No strong foreign peaks were observed. Energy Dispersive X-ray (EDX) analysis was performed on the feed (exterior) and filtrate (interior) sides of the Sample 1 and Sample 2 fibers. All of the analyses detected the materials (carbon, oxygen, fluorine) associated with the fiber itself (polyvinylidene fluoride). Carbon can also be contributed by the presence of organics.

Summary

Scanning Electron Microscope (SEM) imaging of the feed side of the Sample 1 and Sample 2 fibers did not reveal the presence of obvious contamination of the fibers. Imaging of the interior fibers also appeared to only show the fiber material itself. Chromatic Elemental Imaging (CEI) of the cross section of both the Sample 1 and Sample 2 fibers revealed regions rich in carbon (dark blue), indicating the presence of organics within the fiber. This suggests that organics are migrating through the fibers. Organics were also identified on the feed and filtrate sides of both sets of fibers. The element representative of the fiber material, fluorine (red), was largely visible, indicating a thin or absent foulant layer.

UF fibers harvested from the module were cleaned with various Avista cleaners to determine the best method for removing the foulant material and increasing single fiber permeability. The fibers were cleaned using a 2% by weight solution of Avista 165 for two hours. This cleaning regimen increased the permeability of the fibers by three times.

Visual Inspection

The fibers were provided in disposable plastic bags. Each bag contained approximately 30 fibers which were six inches in length. All of the fibers were discolored (brown); however, no removable foulant material was coating the feed side (exterior) of the fibers. The Sample 1 fibers were slightly darker in color compared to the Sample 2 fibers.

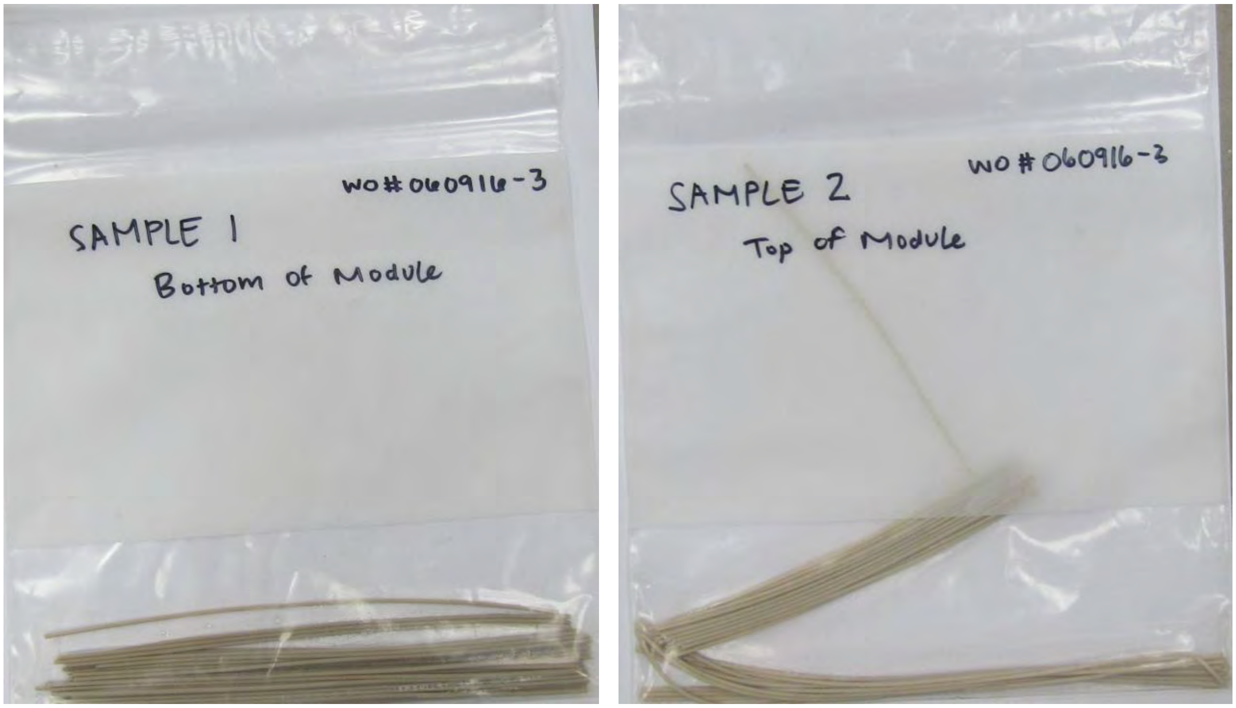


Image of the packaging for Sample 1 (left) and Sample 2 (right)

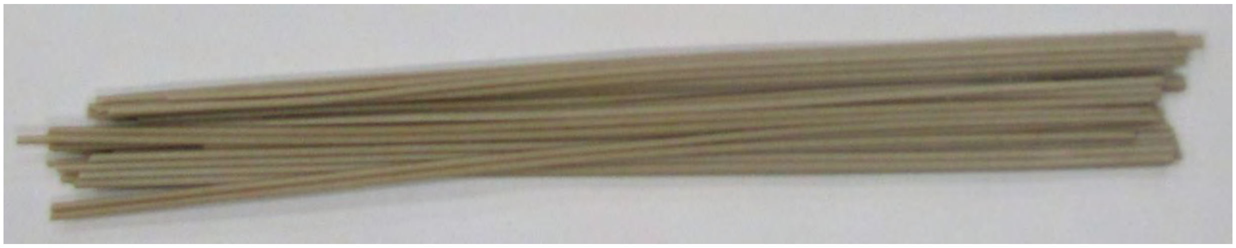
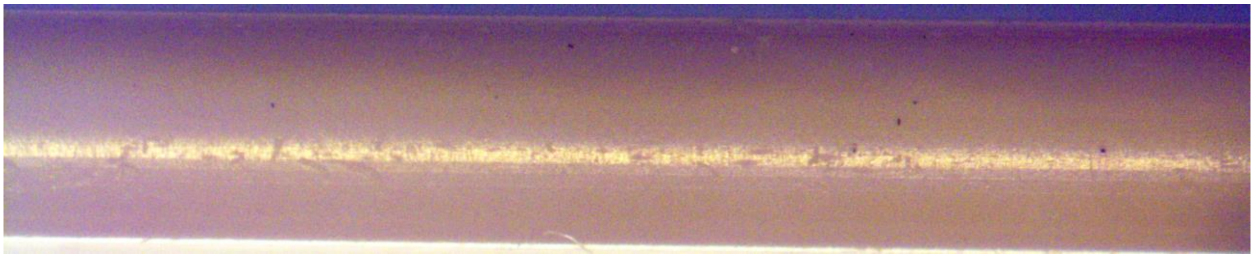


Image of the Sample 1 fibers

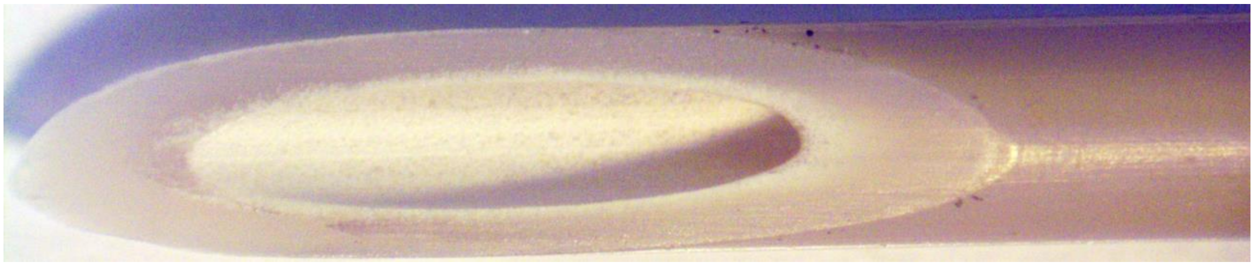

Image of the Sample 2 fibers

Stereoscope Analysis

Stereoscope imaging was performed on both sets of fibers. The feed sides of both of the fibers were brown in color. Black colored particles were also visible, but more prevalent on fibers from Sample 1. The brown discoloration penetrated through the fiber walls to the filtrate side (interior) of the fibers. The fibers from Sample 1 appeared to be more fouled.



Stereoscope image (20x) of the feed side of a fiber from Sample 1



Stereoscope image (20x) of the filtrate side of a fiber from Sample 1

Stereoscope image (20x) of the feed side of a fiber from Sample 2

Stereoscope image (20x) of the filtrate side of a fiber from Sample 2

Foulant Analysis

Organic Content Testing

Loss on ignition (LOI) testing gives an approximation of the organic content of the foulant. Values higher than 65% represent notable organic fouling.

Foulant material could not be removed from the fibers in order to determine the organic content.

Testing for the Presence of Carbonates

Acid testing is used to determine the presence of carbonates on the membrane surface. In this test, several drops of dilute hydrochloric acid were placed on the foulant surfaces. Effervescing indicates a positive test result.

No effervescing was observed when acid was applied to either sets of fibers.

Testing for the Presence of Microbiological Organisms

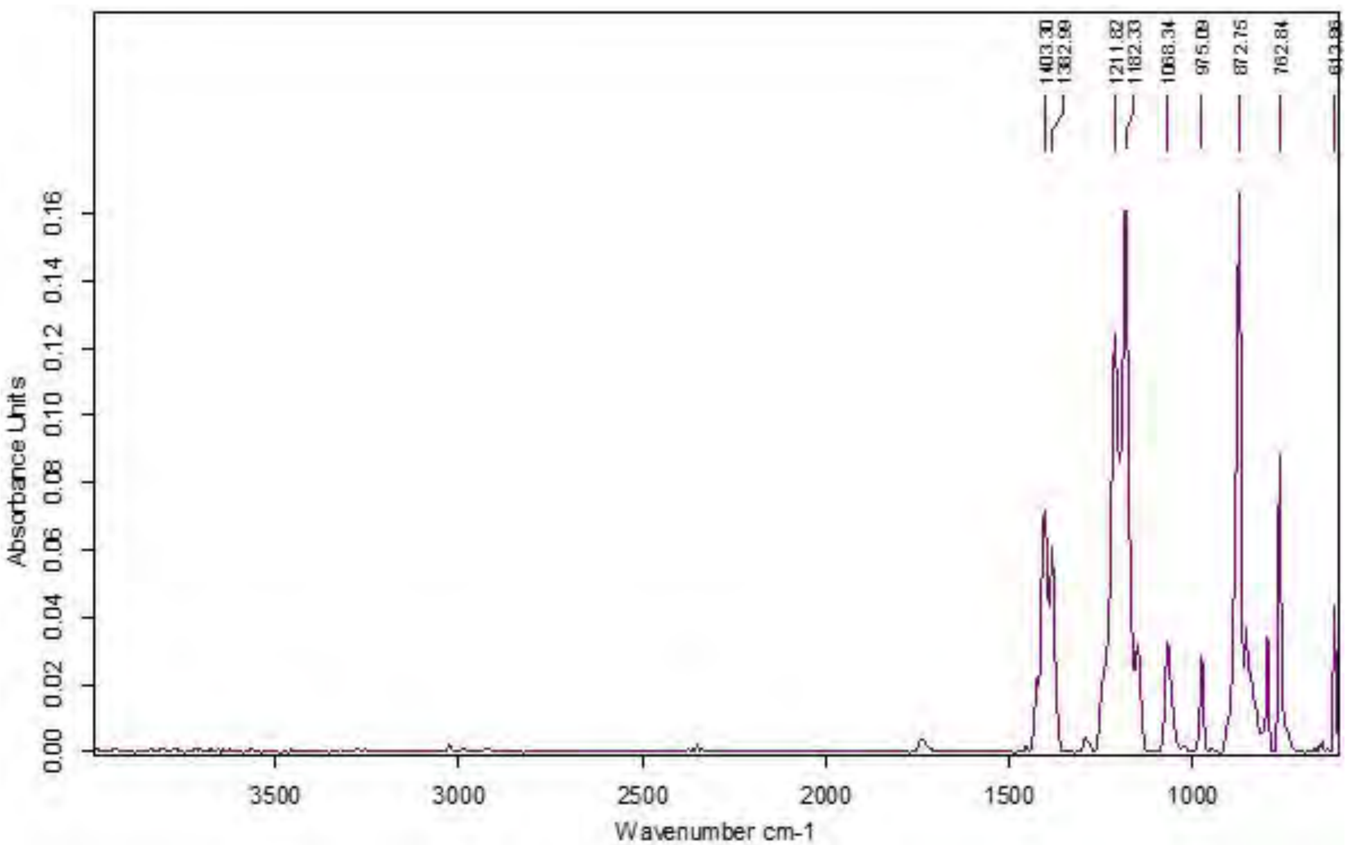
Foulant samples were stained and examined with a light microscope at 1000x using an oil immersion lens. Gram positive bacteria are stained blue while Gram negative bacteria are stained red.

The microscope analysis could not be performed as foulant could not be removed from the fibers.

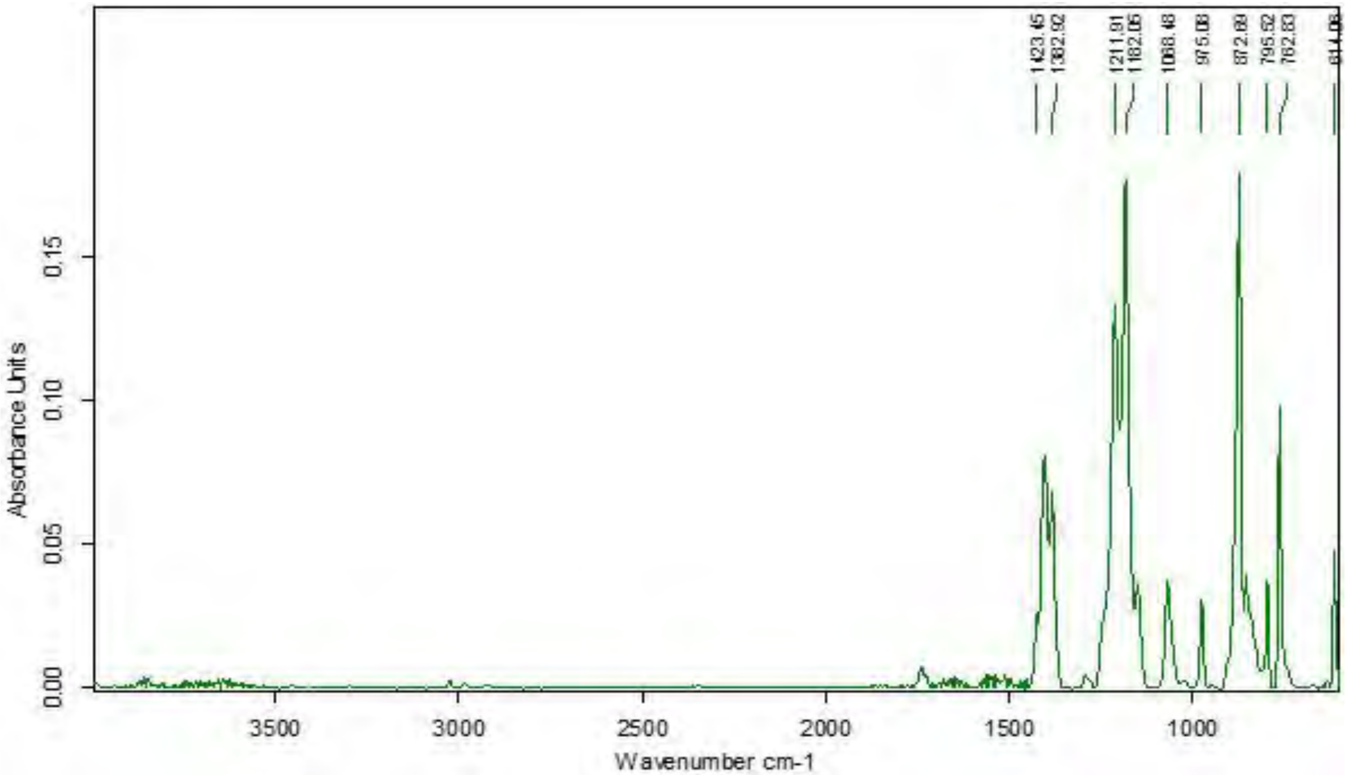
Fourier Transform Infrared Spectroscopy Analysis

Fourier Transform Infrared Spectroscopy (FT-IR) is an analytical technique used to identify functional groups (specific groups of atoms or bonds within molecules). Infrared radiation passes through a sample, with some of the radiation absorbed and some transmitted. A measurement and interpretation of this data produces a spectrum which can then be compared and matched to the known spectra for functional groups based on the wavenumber at which bands appear and their shape (e.g. sharp, broad, strong, weak).

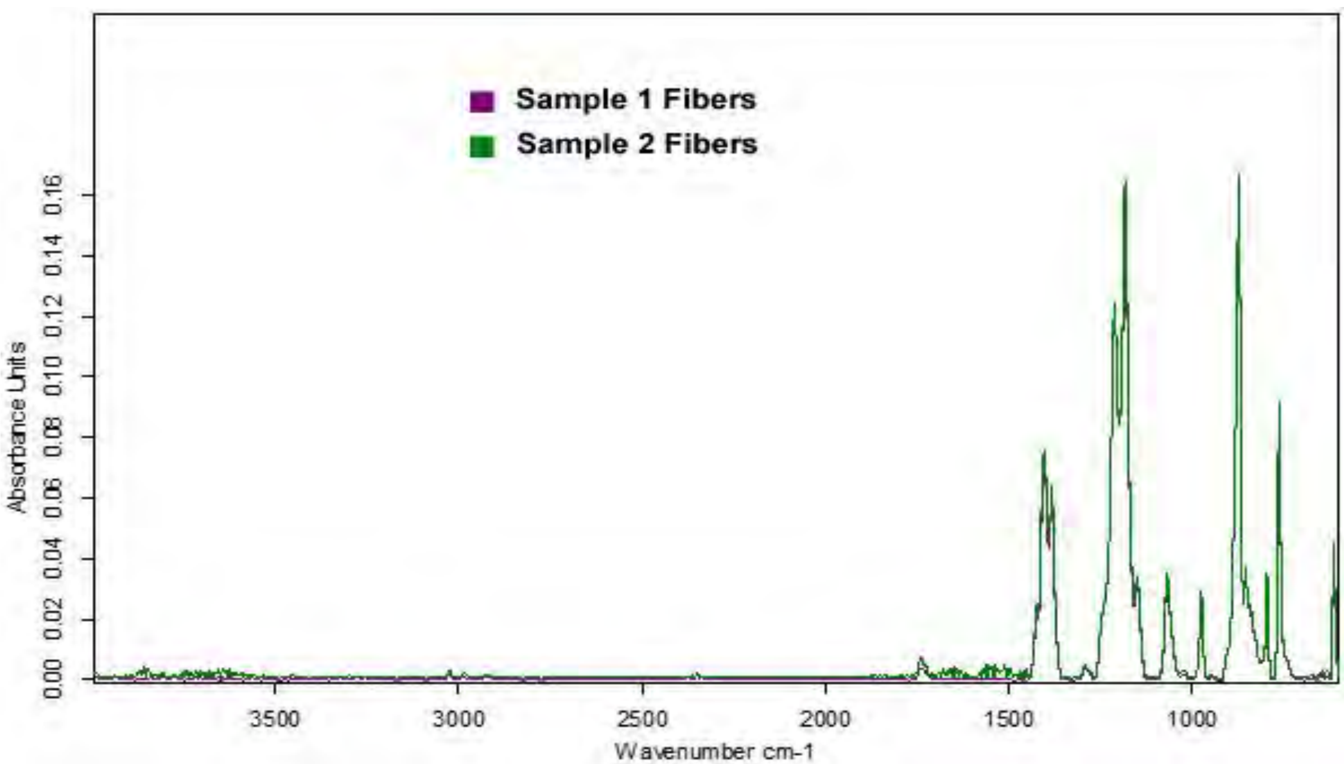
FT-IR Analysis was performed on the Sample 1 and Sample 2 fibers. A comparison of the spectra for the fibers matched, indicating the same functional groups were present on both sets of fibers. The spectra for both of the fibers was compared to a new PVDF fiber and also matched. No strong foreign peaks were observed.



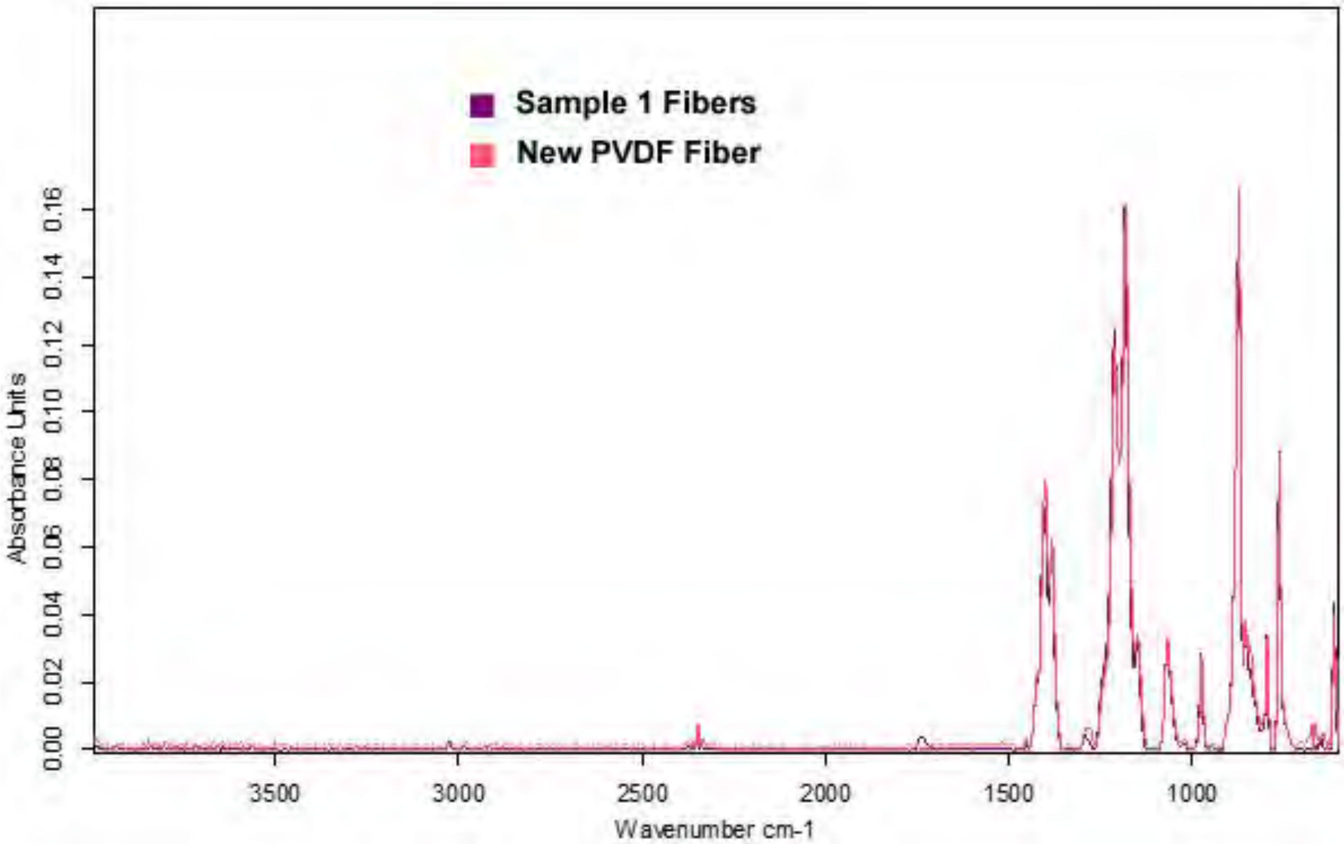
FT-IR spectrum of Sample 1 Fibers



FT-IR spectrum of Sample 2 Fibers



Overlay of the spectra for Sample 1 and Sample 2 Fibers



Overlay of the spectra for Sample 1 and a new PVDF fiber

Testing to Identify Inorganic Foulant Constituents

Energy Dispersive X-ray (EDX) analysis is conducted in conjunction with scanning electron microscopy (SEM) to identify inorganic foulant constituents. The electron beam in the microscope causes specimens to emit x-rays including those from the k, l and m atomic shells. Spectrometer counts of these x-rays, which are said to be "characteristic" of the elements present in the specimen, can be used to calculate composition for a full qualitative analysis.

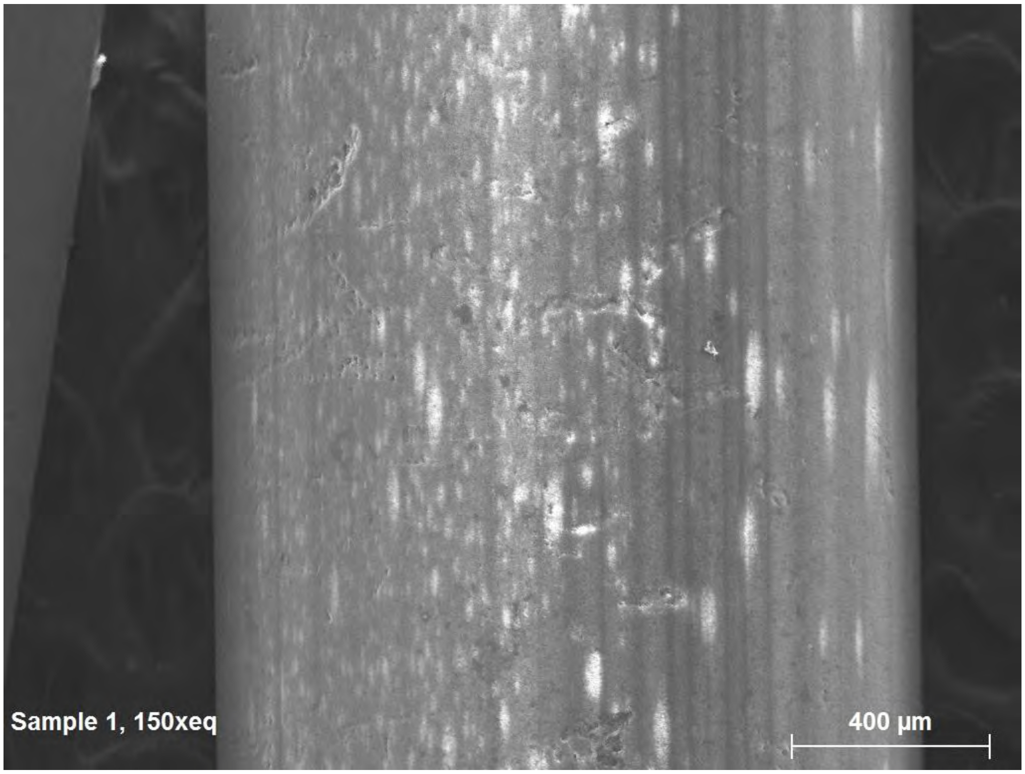
Chromatic Elemental Imaging (CEI) is an analytical technique used to resolve the spatial distribution of elements in a foulant sample. In this technique, a beam of focused electrons is accelerated across the surface of a foulant sample and interacts with the sample's inorganic elements by causing the elements to emit electrons. Since each element has its own unique atomic shell, a particular element's electron emission from its atomic shell generates a characteristic X-ray spectrum that allows for its identification. CEI assigns each element a color (colors for each element are shown in a legend on the bottom left corner of a CEI image) and provides a high resolution image where the colors correspond to the exact location of the elements in the sample. An element's color intensity in a Chromatic Elemental Image is largely influenced by its concentration in the foulant sample; elements present in a higher percentage will be displayed with greater intensity in the image. CEI can uniquely identify the distinct elements in a mixed foulant sample containing a number of inorganic deposits. This technique also reveals the location and concentration of different elements relative to each other in a sample.

Inorganic Foulant Constituents Test Results

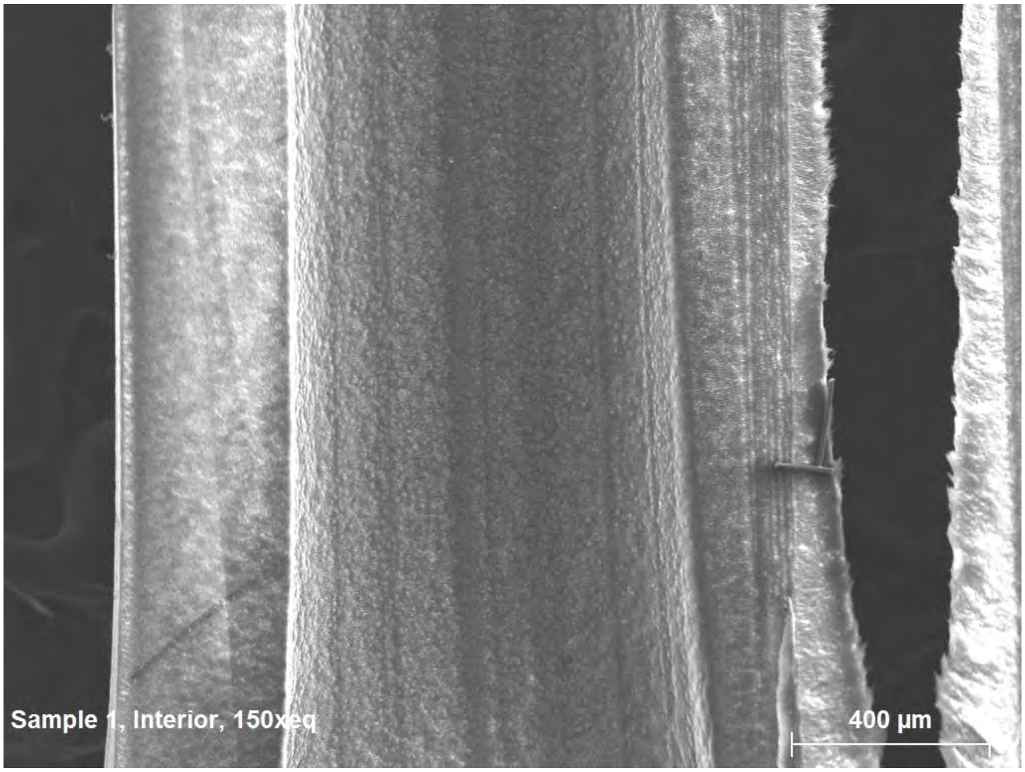
Elements	**Feed Side of Sample 1*** (Weight Percentage, MAG: 150x)	**Filtrate Side of Sample 1*** (Weight Percentage, MAG: 150x)	**Feed Side of Sample 2*** (Weight Percentage, MAG: 150x)	**Filtrate Side of Sample 2*** (Weight Percentage, MAG: 150x)
Carbon	47.37	46.11	46.15	45.90
Oxygen	3.05	2.95	3.22	1.82
Fluorine	49.58	50.94	50.63	52.28

*EDX average of three fibers

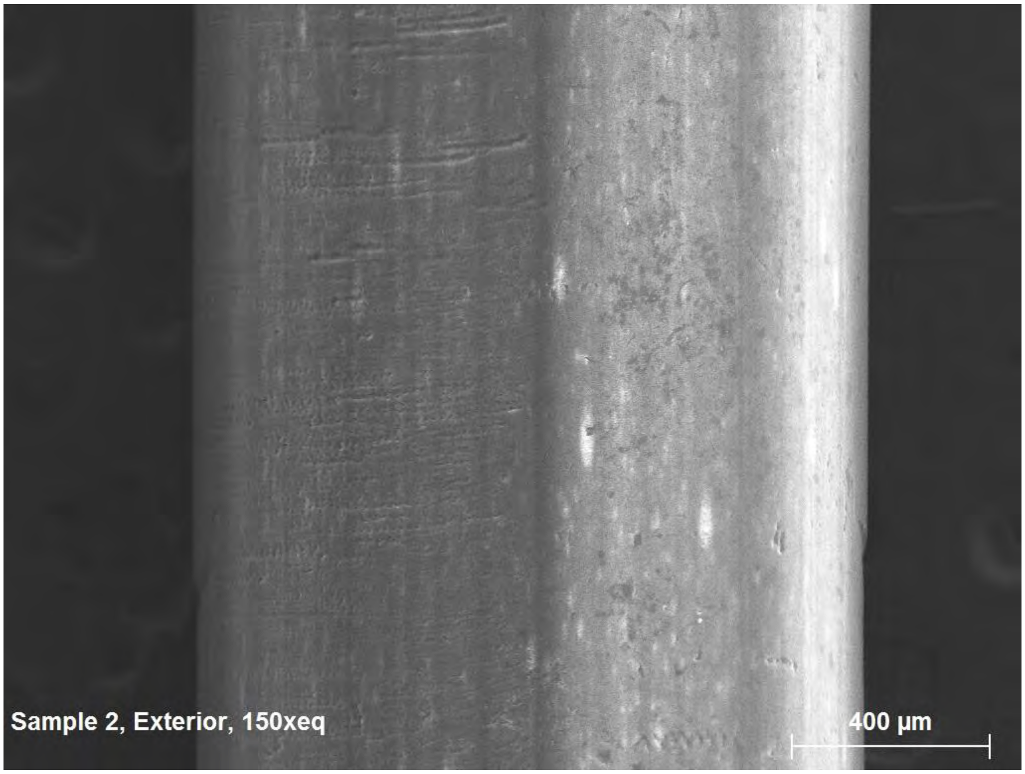
†ND: Below the detection limit



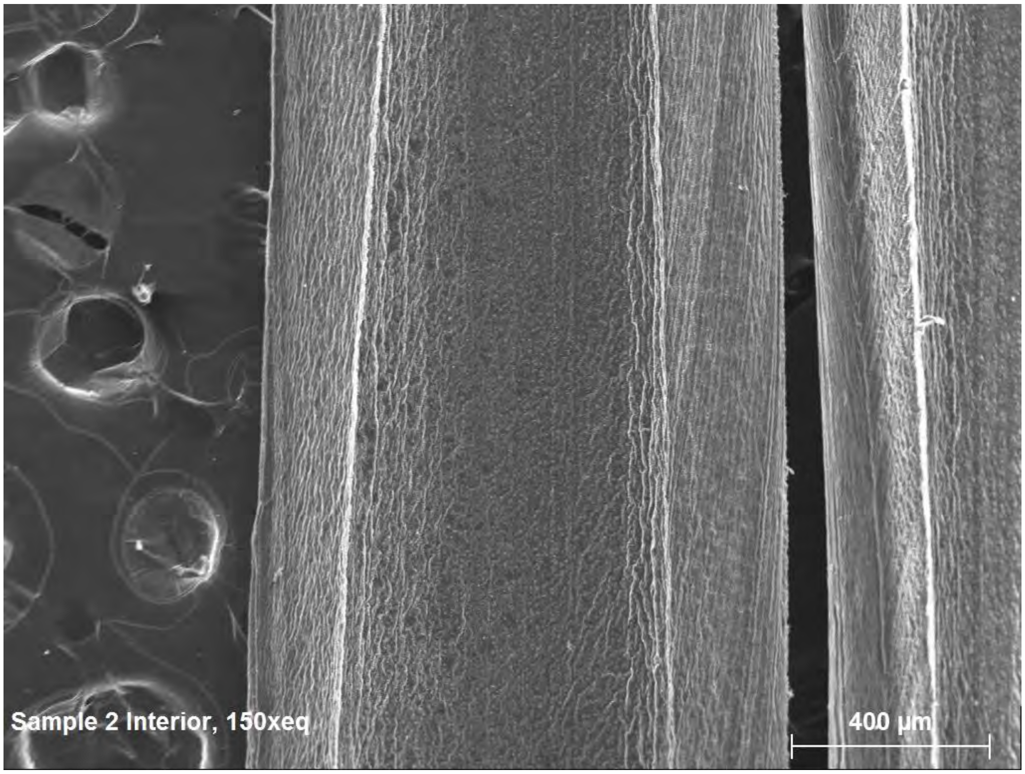
SEM image (150x) of the feed side of a Sample 1 fiber



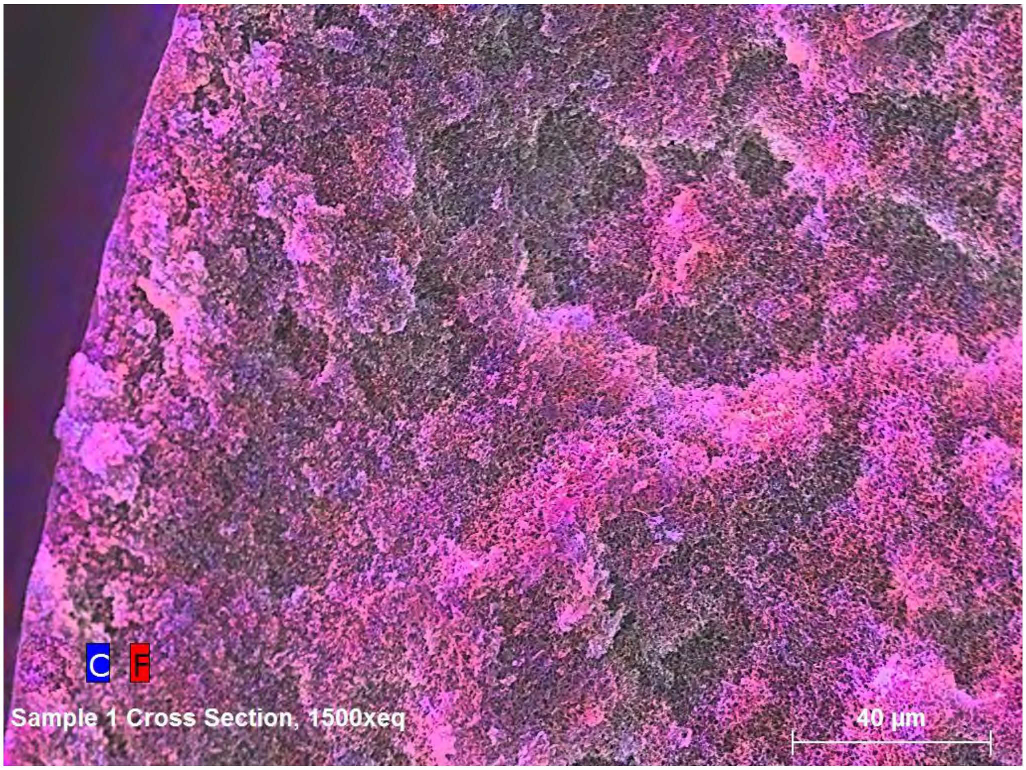
SEM image (150x) of the filtrate side of a Sample 1 fiber



SEM image (150x) of the feed side of a Sample 2 fiber

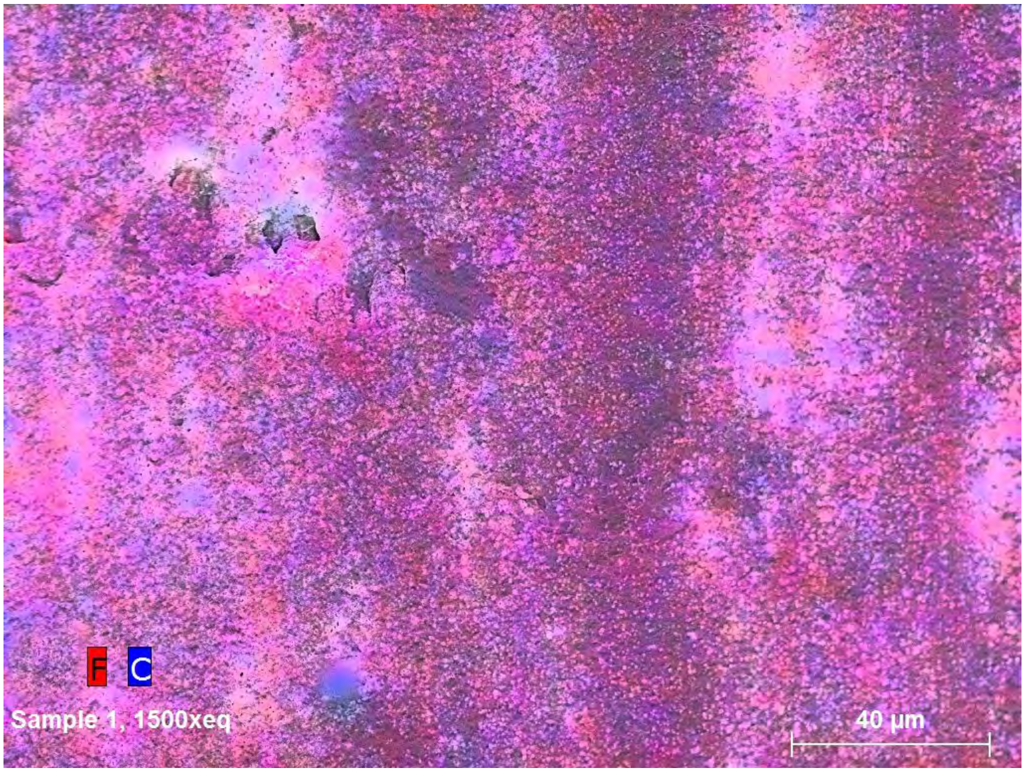


SEM image (150x) of the filtrate side of a Sample 2 fiber

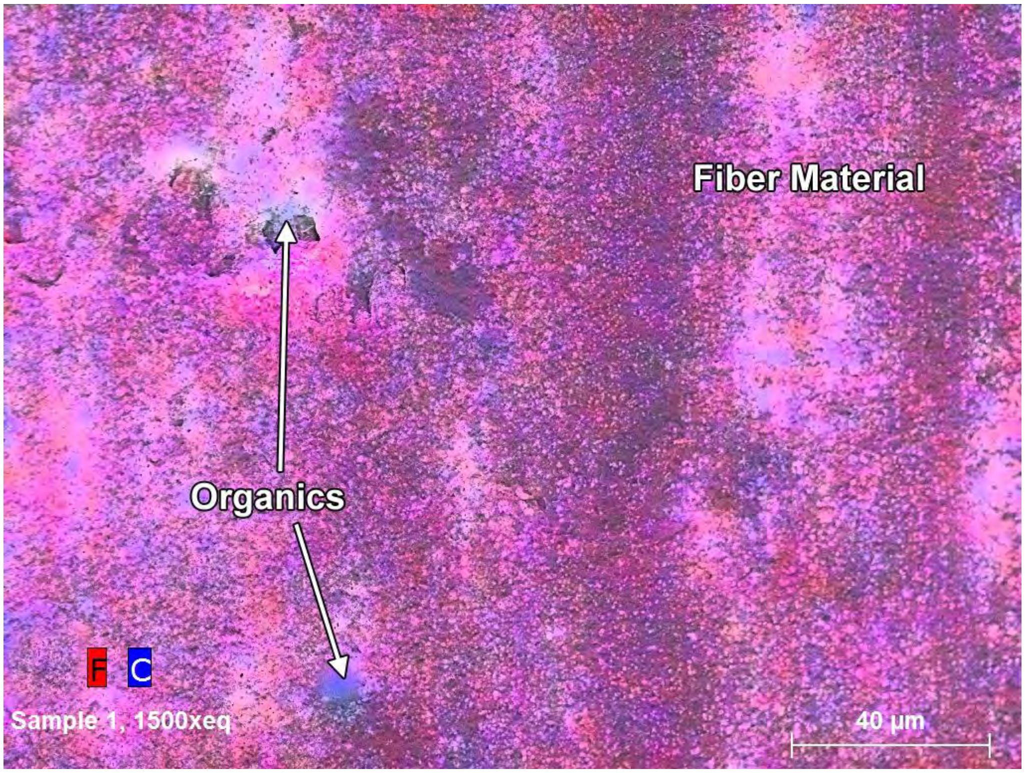


CEI image (1500x) of the cross section of a Sample 1 fiber

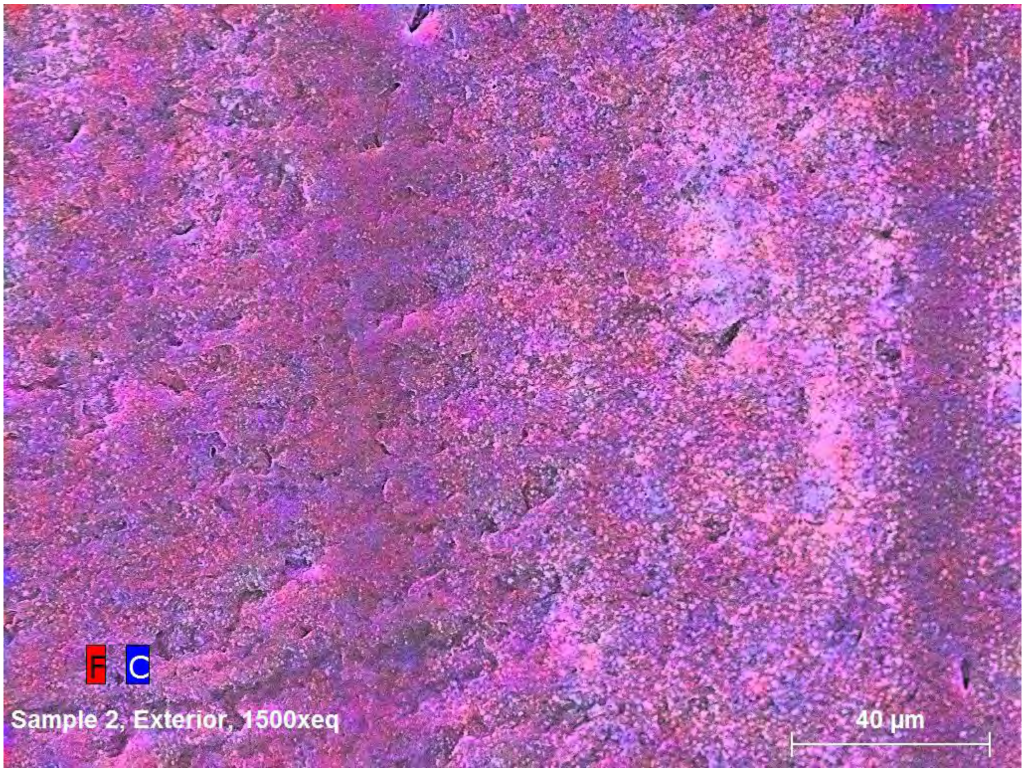
CEI image (1500x) of the cross section of a Sample 2 fiber



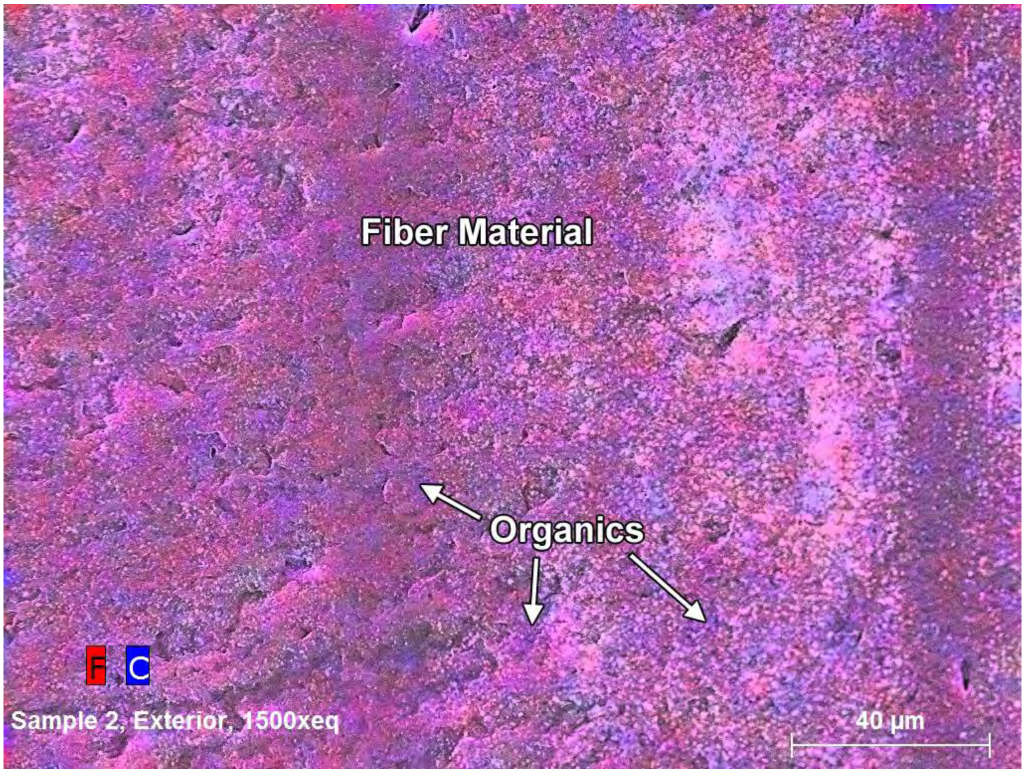
CEI image (1500x) of the feed side of a Sample 1 fiber



CEI image (1500x) of the feed side of a Sample 1 fiber with labels

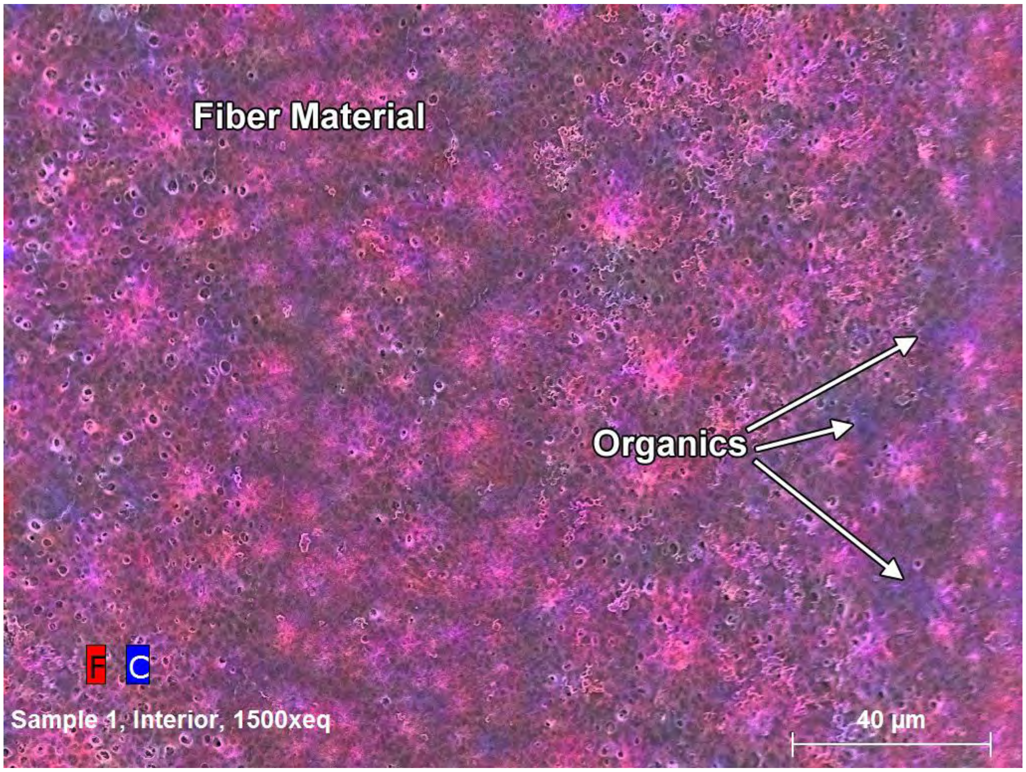


CEI image (1500x) of the feed side of a Sample 2 fiber

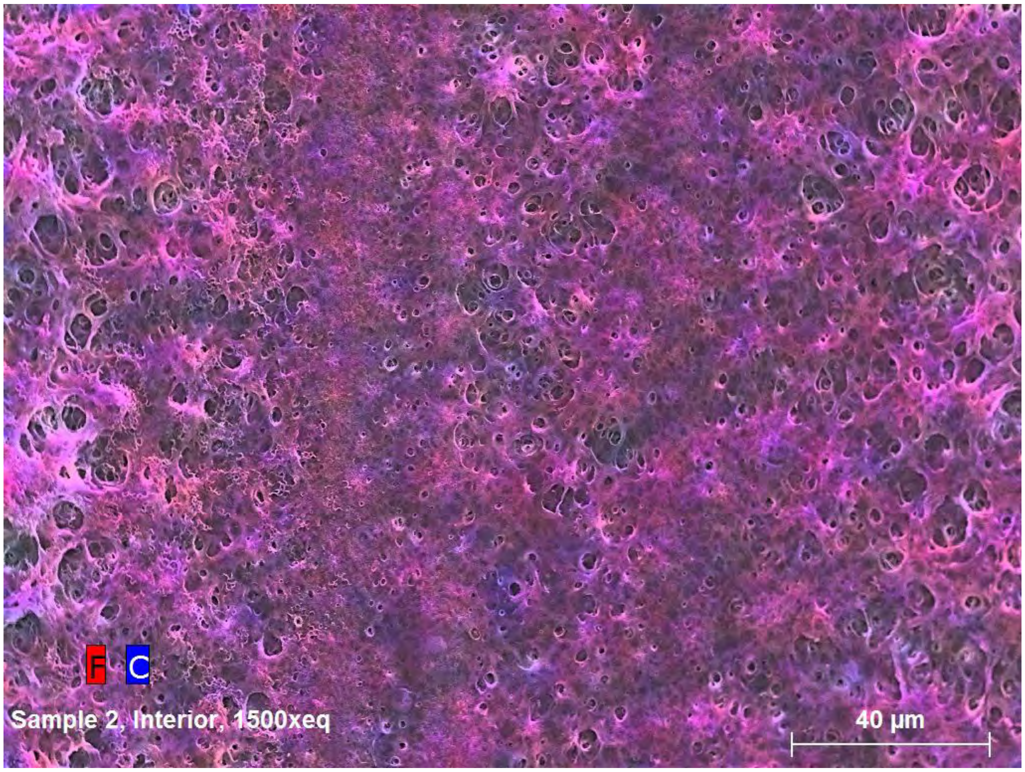


CEI image (1500x) of the feed side of a Sample 2 fiber with labels

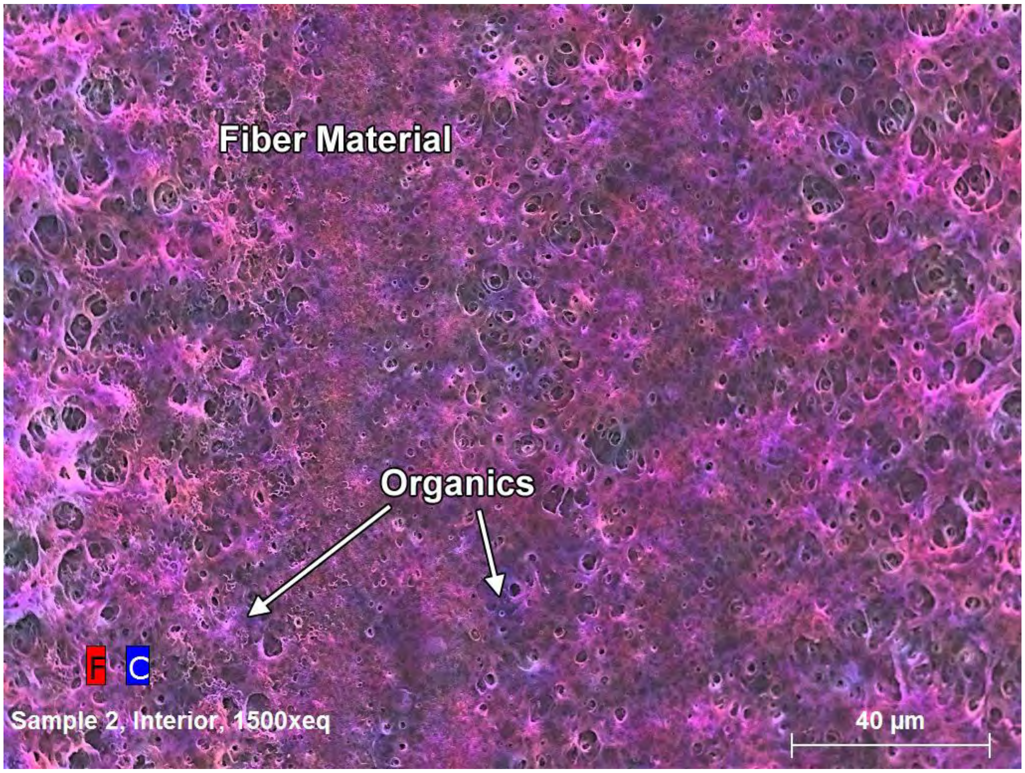
CEI image (1500x) of the filtrate side of a Sample 1 fiber



CEI image (1500x) of the filtrate side of a Sample 1 fiber with labels



CEI image (1500x) of the filtrate side of a Sample 2 fiber



CEI image (1500x) of the filtrate side of a Sample 2 fiber with labels

Testing Comments and Interpretation

Energy Dispersive X-ray (EDX) analysis was performed on the feed (exterior) and filtrate (interior) sides of the Sample 1 and Sample 2 fibers. All of the analyses detected the materials (carbon, oxygen, fluorine) associated with the fiber itself (polyvinylidene fluoride). Carbon can also be contributed by the presence of organics.

Scanning Electron Microscope (SEM) imaging of the feed side of the Sample 1 and Sample 2 fibers did not reveal the presence of obvious contamination of the fibers. Imaging of the interior fibers also appeared to only show the fiber material itself.

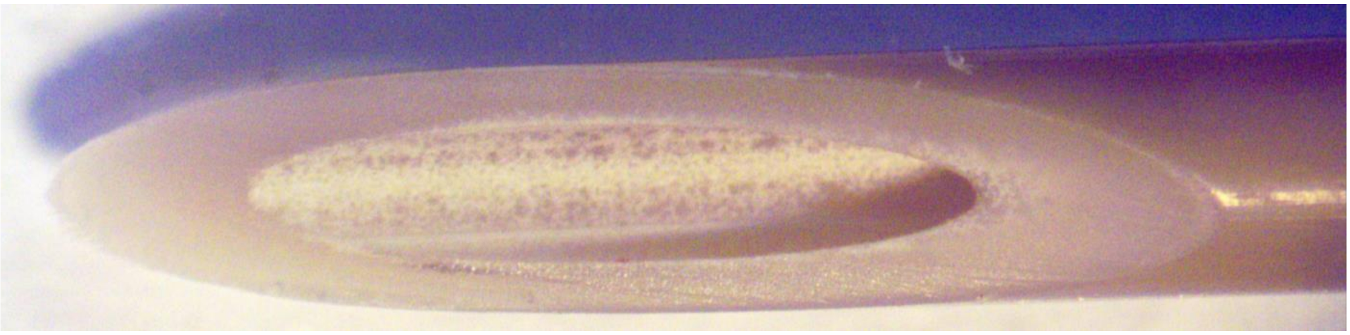
Chromatic Elemental Imaging (CEI) of the cross section of both the Sample 1 and Sample 2 fibers revealed regions rich in carbon (dark blue), indicating the presence of organics within the fiber. This suggests that organics are migrating through the fibers. Organics were also identified on the feed and filtrate sides of both sets of fibers. The element representative of the fiber material, fluorine (red), was largely visible, indicating a thin or absent foulant layer.

UF Fiber Cleaning Study

UF fibers harvested from the module were cleaned with various Avista cleaners to determine the best method for removing the foulant material and increasing the single fiber permeability. The baseline permeability was obtained using the average of eight fibers. The remaining fibers were cleaned with various Avista cleaners to determine the best method for removing the visual foulant and increasing the permeability of the fibers. The fibers were then tested to determine the post clean permeability. The fibers were cleaned using a 2% by weight solution of Avista 165 for two hours. This cleaning regimen increased the permeability of the fibers by three times.

Single Fiber	Permeability (gfd/psi)
Pre Clean Top	1.11
Pre Clean Bottom	1.83
Post Clean Top	**3.18**
Post Clean Bottom	**3.30**

*Pre clean data based on the average of eight single fibers, post clean data based on the average of four single fibers



Stereoscope image (20x) of a fiber before cleaning

Stereoscope image (20x) of a fiber after cleaning

Certification by Laboratory

Report Number	Report Content	Report Date
WO#060916-3	UF Fiber Analysis	July 19, 2016

We the undersigned being the Technical Specialists in Membrane Autopsy and related testing procedures and protocol for Avista Technologies certify to the best of our knowledge and belief that the tests listed above have been conducted following Avista standard testing practices and that the results are accurate and complete.

By signing this certificate neither the laboratory employees nor their employer makes any warranty, expressed or implied, concerning the cleaning study results.

Date: 07/19/2016

Signed:

Sara Pietsch
Laboratory Services Manager

Megan Lee
Laboratory Services Chemist

APPENDIX E – DOW FOULING SUMMARY

CITY OF DALY CITY

MEMBRANE PILOT

DOW DATA SUMMARY

WATER QUALITY SUMMARY

Table 1. Water Quality Summary

Parameter		UF Feed				Dow Filtrate			
		Avg.	Min.	Max.	Count	Avg.	Min.	Max.	Count
pH		6.60	6.07	7.02	163				
Temperature	°C	22.6	19.2	24.7	163				
Turbidity	NTU	5.70	0.11	20.0	163				
UV Transmittance	%	47.6	32.5	55.4	157	60.2	27.1	68.0	72
ORP	mV	384	72.1	566	162				
Dissolved Oxygen	mg/L	4.28	2.13	6.31	162				
Total Chlorine	mg/L	2.91	0.00	8.40	161	2.4	0.0	4.5	72
Total Suspended Solids	mg/L	8.36	4.30	14.0	12				
Total Organic Carbon	mg/L	21.8	17.2	25.3	19	15	13	16	6
Dissolved Organic Carbon	mg/L	14.8	10.1	20.0	14	13.2	12.2	14.2	2
Silica	mg/L	18	16	18	8				
Reactive Silica	mg/L	15	13	15	7				
Total Iron	mg/L	0.52	0.15	1.10	27	0.13	0.11	0.16	7
Dissolved Iron	mg/L	0.15	0.10	0.28	17				
Total Dissolved Solids	mg/L	424	400	460	9				
Alkalinity	mg/L	274	220	370	19				
Total Aluminum	mg/L	3.06	0.06	15.0	20	ND	ND	ND	8
Dissolved Aluminum	mg/L	0.13	0.05	0.24	12				

SUMMARY OF OPERATING CONDITIONS AND FOULING RESPONSE

Operating Conditions

Table 2. DOW Initial and Revised Operating Conditions

Operating Condition		**Initial**	**Revised** [1]
Pretreatment			
Sodium Hypochlorite Dose	mg/L	3.5	3.5
Coagulant Dose	mg/L	2.5	5
Production			
Flux	gfd	17.5	31
Crossflow	%	10	0
Production Cycle	min	20	20
Backwash			
Air Scrub Flow	scfm	2.5-3	2.5-3
Air/Water Flow	gpm	13	13
Backwash Flow (BW Waste Port)	gpm	25	35
Backwash Flow (Lower Drain)	gpm	N/A	20
Drain	sec	60	60
Chemically Enhanced Backwash			
Chemical Soak Time	min	30	30
Sodium Hypochlorite/Caustic CEB			
Frequency	Per Week	1	3
Sodium Hypochlorite Dose	mg/L	800	1300
Caustic Dose	mg/L	525	550
Citric Acid/Hydrochloric Acid CEB			

Table 2. DOW Initial and Revised Operating Conditions

Operating Condition		Initial	Revised [1]
Frequency	Per Week	2	1
Citric Acid Dose	mg/L	1,000	1,000
Hydrochloric Acid Dose	mg/L	550	550
Clean-In-Place			
Recirculation Time	min	60	60
Soak Time	min	60	60
Sodium Hypochlorite/Caustic CIP			
Temperature	°C	38	38
Target pH		11-12	11-12
Sodium Hypochlorite Dose	mg/L	3,000	3,000
Caustic Dose[2]	mg/L	~2,130	~2,500
Citric Acid/Hydrochloric Acid CIP			
Temperature	°C	38	38
Target pH		1.7	1.7
Citric Acid Dose	mg/L	20,000	20,000
Hydrochloric Acid Dose[2]	mg/L	~5,780	~5,000

Notes:

(1) Revised period from 8/27/16 - 9/6/16. CIP performed 8/26/16.

(2) Chemical is dosed to achieve a target pH. The dose is not automatically recorded. Values shown, if any, were calculated based on a manual timing of the chemical pump, the chemical pump capacity, and an assumed CIP volume of 50 gallons.

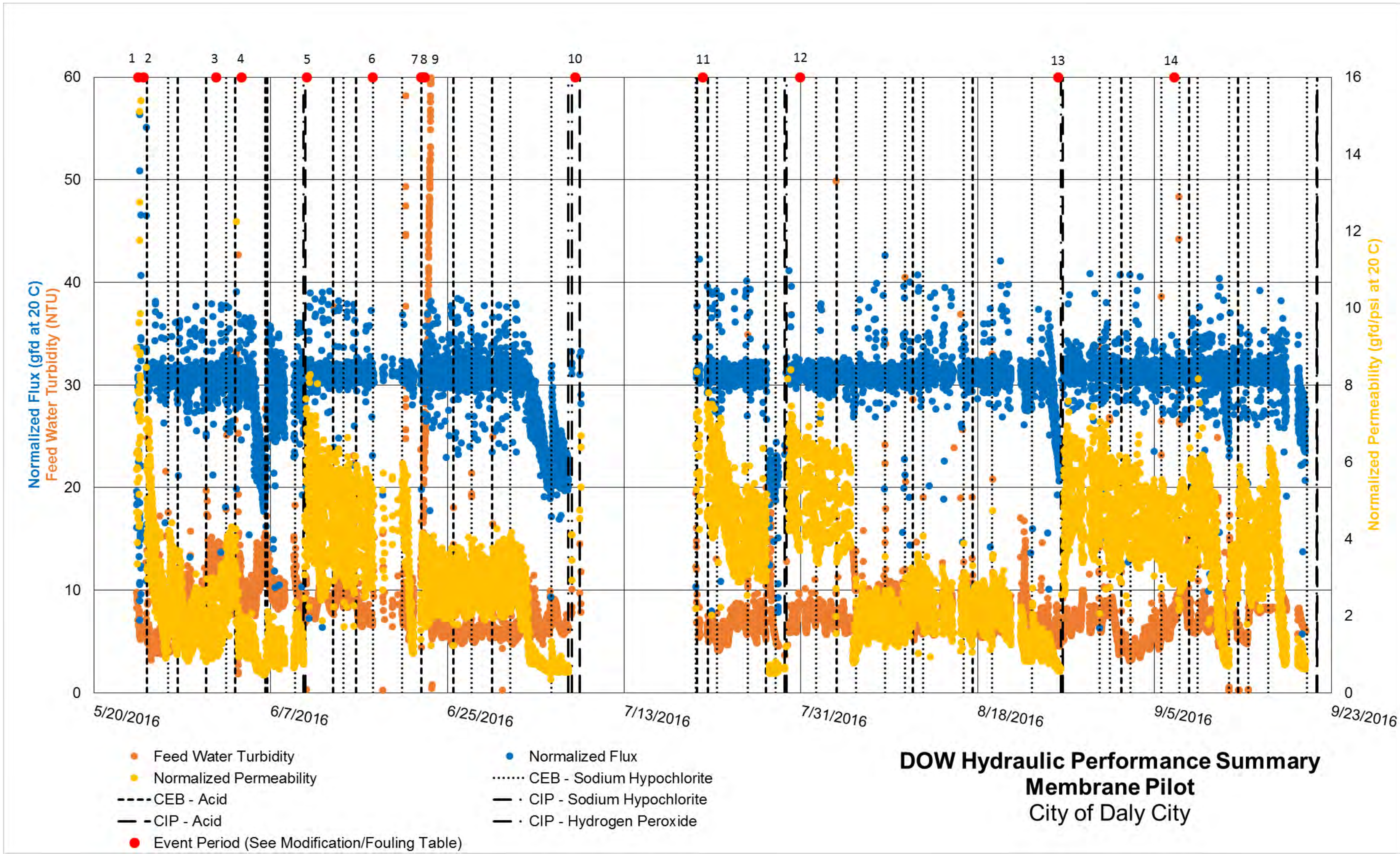


Figure 1. DOW Hydraulic Performance Summary

Table 3. DOW System Modifications and Fouling Response		
Classification	**Event/Modification**	**Observations**
Period 1	Flux Rate 17.5 gfd Crossflow 10% 2/wk Citric Acid/Hydrochloric Acid CEBs 1/wk Sodium Hypochlorite/Sodium Hydroxide CEBs Pretreatment 2.5 mg/L ACH	Steep initial fouling rate
Period 2	Increased flux rate to 31 gfd	Steep initial fouling rate, leveled out
Period 3	Increased Pretreatment to 3.75 mg/L ACH	No change in fouling rate
Period 4	Pilot ran out of pretreatment chemicals, ACH and Sodium Hypochlorite	Unable to maintain constant flux rate, drop in permeability
Period 5	Increased backwash flow rate through BW waste port to 35 gpm Increased Pretreatment to 7 mg/L ACH 2/wk Citric Acid/Hydrochloric Acid CEBs 2/wk Sodium Hypochlorite/Sodium Hydroxide CEBs	Decrease in fouling rate
Period 6	Added backwash out drain step	Programming issues caused sporadic cleans and shutdowns
Period 7	Increased Pretreatment to 60 mg/L ACH (5 hours)	No change in fouling rate
Period 8	Decreased Pretreatment to 30 mg/L ACH (4.5 hours)	No change in fouling rate
Period 9	Decreased Pretreatment to 5 mg/L ACH	Steady operation until unknown event on 7/3 caused steep decrease in permeability and module was unable to maintain flux rate
Period 10	Modules Stored in Chlorine Solution (End of Phase 2)	No production

Table 3. DOW System Modifications and Fouling Response		
Classification	**Event/Modification**	**Observations**
Period 11	Restart Pilot (Beginning of Phase 3) 1/wk Citric Acid/Hydrochloric Acid CEBs 2/wk Sodium Hypochlorite/Sodium Hydroxide CEBs	Increased fouling rate upon restart
Period 12	Series of pilot shutdowns due to leaking air line and other causes for approximately two weeks Plant power outage (8/5/16)	Steep decrease permeability, Decrease in fouling Rate
Period 13	Stopped crossflow mode 1/wk Citric Acid/Hydrochloric Acid CEBs 3/wk Sodium Hypochlorite/Sodium Hydroxide CEBs	Steady operation until unknown event on 9/11 caused steep decrease in permeability and module was unable to maintain flux rate
Period 14	Pilot ran out of Hydrochloric Acid for CEBs Modified CEB cleaning parameters	Increasing the CEB chemical concentrations to CIP values almost doubled the permeability recovery Increasing the CEB chemical concentration and chemical contact time to CIP values increased the permeability recovery 30% more than increasing the chemical concentration alone

CLEANING PERMEABILITY RECOVERY

Table 4. Scinor Cleaning Permeability Recovery

	Date	Clean Type (CEB/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)
Period 2	5/25/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550		7.1	7.1	N/A	N/A
	5/27/2016	CEB	Sodium Hypochlorite	800	Caustic	525	7.1	2.7	4.2	62%	60%
	5/28/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	4.2	2.3	3.7	45%	88%
	5/31/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	3.7	1.8	2.4	52%	64%
Period 3	6/2/2016	CEB	Sodium Hypochlorite	800	Caustic	525	2.4	3.1	4.0	-32%	171%
	6/3/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	4.0	3.9	4.3	3%	106%
Period 4	6/6/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	4.3	0.7	1.3	84%	31%
	6/6/2016	CEB	Citric Acid	20000	Hydrochloric Acid	550	1.3	1.1	2.1	18%	160%
	6/9/2016	CEB	Sodium Hypochlorite	800	Caustic	525	2.1	1.1	2.3	48%	111%
	6/10/2016	CIP	Sodium Hypochlorite	3000	Caustic	700	2.3	1.3	7.6	45%	325%
	6/10/2016	CIP	Citric Acid	20000	Hydrochloric Acid	--					
Period 5	6/13/2016	CEB	Citric Acid	20000	Hydrochloric Acid	500	7.6	5.3	6.2	31%	82%
	6/14/2016	CEB	Sodium Hypochlorite	1300	Caustic	525	6.2	5.0	5.7	19%	92%
	6/15/2016	CEB	Citric Acid	1000	Hydrochloric Acid	525	5.7	5.5	5.7	4%	100%
Period 6	6/17/2016	CEB	Sodium Hypochlorite	1300	Caustic	525	5.7	4.9	N/A	15%	N/A
	6/20/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	N/A	5.5	5.8	N/A	N/A
Period 7, 8, 9	6/22/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	5.8	2.3	4.1	60%	71%
Period 9	6/25/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	4.1	3.2	3.3	22%	81%
	6/27/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	3.3	3.2	3.9	3%	117%
	6/29/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	3.9	3.3	3.8	15%	97%
	7/1/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	3.8	3.2	3.9	15%	103%
	7/5/2016	CEB	Sodium Hypochlorite	1500	Caustic	550	3.9	0.7	1.2	83%	31%
	7/7/2016	CIP	Sodium Hypochlorite	3000	Caustic	Target pH 11-12	1.2	0.6	4.1	52%	345%
	7/7/2016	CIP	Sodium Hypochlorite	3000	Caustic	Target pH 11-12					
Period 10	7/8/2016	CIP	Citric Acid	20000	Hydrochloric Acid	Target pH 1.7	4.1	4.7	6.7	-15%	162%
	7/20/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	N/A	6.4	7.2	N/A	N/A
	7/20/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	7.2	7.2	8.4	0%	115%
Period 11	7/21/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	8.4	7.5	7.5	10%	90%
	7/22/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	7.5	6.4	7.0	14%	93%
	7/25/2016	CEB	Sodium Hypochlorite	1500	Caustic	550	7.0	5.4	5.2	23%	75%

	Date	Clean Type (CEB/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)
	7/27/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	5.2	4.6	5.2	11%	100%
	7/28/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	5.2	0.7	0.7	87%	14%
	7/29/2016	CIP	Sodium Hypochlorite	3000	Caustic	Target pH 11.5	0.7	0.6	6.9	16%	935%
	7/29/2016	CIP	Citric Acid	20000	Hydrochloric Acid	Target pH 1.5					
Period 12	8/1/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	6.9	6.2	6.4	10%	92%
	8/3/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	6.4	5.0	6.1	21%	96%
	8/5/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	6.1	1.5	2.8	76%	46%
	8/8/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	2.8	2.0	2.7	27%	95%
	8/10/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	2.7	1.9	3.0	29%	113%
	8/11/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	3.0	2.8	3.2	8%	106%
	8/12/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	3.2	2.8	3.3	13%	104%
	8/16/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	3.3	2.5	3.1	24%	94%
	8/17/2016	CEB	Citric Acid	1000	Hydrochloric Acid	550	3.1	2.2	2.7	28%	87%
	8/19/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	2.7	2.2	3.6	17%	133%
	8/23/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	3.6	1.3	2.3	65%	64%
Period 13	8/26/2016	CIP	Hydrogen Peroxide	3000			2.3	0.6	6.9	72%	301%
	8/26/2016	CIP	Citric Acid	20000	Hydrochloric Acid	Target pH 1.7					
	8/30/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	6.9	6.0	6.8	13%	99%
	8/31/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	6.8	5.7	5.9	17%	86%
	9/1/16	CEB	Citric Acid	1000	Hydrochloric Acid	550	5.9	4.7	5.6	21%	95%
	9/2/2016	CEB	Sodium Hypochlorite	1300	Caustic	800	5.6	5.1	5.7	9%	101%
	9/5/2016	CEB	Sodium Hypochlorite	1300	Caustic	800	5.7	4.8	5.5	15%	98%
Period 14	9/7/2016	CEB	Sodium Hypochlorite	3000	Caustic	2000	5.5	4.9	5.3	12%	96%
	9/8/2016	CEB	Citric Acid	11300			5.3	5.0	6.4	7%	119%
	9/9/2016	CEB	Sodium Hypochlorite	3000	Caustic	2000	6.4	5.6	6.0	11%	95%
	9/12/2016	CEB	Sodium Hypochlorite	3000	Caustic	2000	6.0	1.1	3.8	82%	63%
	9/13/2016	CEB	Citric Acid	11300			3.8	3.5	5.7	8%	149%
	9/14/2016	CEB	Sodium Hypochlorite	1300	Caustic	550	5.7	5.0	5.1	12%	89%
	9/16/2016	CEB	Sodium Hypochlorite	3000	Caustic	2000	5.1	4.7	6.2	9%	122%
	9/20/2016	CEB	Sodium Hypochlorite	3000	Caustic	2000	6.2	1.0	3.8	84%	61%
	9/21/2016	CIP	Sodium Hypochlorite	3000	Caustic	Target pH 11-12	3.8	3.0	N/A	20%	N/A
	9/21/2016	CIP	Citric Acid	20000							

APPENDIX F – BASF FOULING SUMMARY

CITY OF DALY CITY

MEMBRANE PILOT

BASF DATA SUMMARY

WATER QUALITY SUMMARY

Table 1. Water Quality Summary

Parameter		UF Feed				BASF Filtrate			
		Avg.	Min.	Max.	Count	Avg.	Min.	Max.	Count
pH		6.60	6.07	7.02	163				
Temperature	°C	22.6	19.2	24.7	163				
Turbidity	NTU	5.70	0.11	20.0	163				
UV Transmittance	%	47.6	32.5	55.4	157	62.1	47.4	66.8	33
ORP	mV	384	72.1	566	162				
Dissolved Oxygen	C	4.28	2.13	6.31	162				
Total Chlorine	mg/L	2.91	0.00	8.40	161	2.7	1.6	4.1	32
Total Suspended Solids	mg/L	8.36	4.30	14.0	12				
Total Organic Carbon	mg/L	21.8	17.2	25.3	19	14	13	16	4
Dissolved Organic Carbon	mg/L	14.8	10.1	20.0	14				
Silica	mg/L	18	16	18	8				
Reactive Silica	mg/L	15	13	15	7				
Total Iron	mg/L	0.52	0.15	1.10	27	0.13	0.11	0.17	6
Dissolved Iron	mg/L	0.15	0.10	0.28	17				
Total Dissolved Solids	mg/L	424	400	460	9				
Alkalinity	mg/L	274	220	370	19				
Total Aluminum	mg/L	3.06	0.06	15.0	20	ND	ND	ND	6
Dissolved Aluminum	mg/L	0.13	0.05	0.24	12				

SUMMARY OF OPERATING CONDITIONS AND FOULING RESPONSE

Operating Conditions

Table 2. BASF Initial and Revised Operating Conditions

Operating Condition		Initial	Revised [1]
Pretreatment			
Sodium Hypochlorite Dose	mg/L	3.5	3.5
Coagulant Dose	mg/L	5	5
Production			
Flux	gfd	16	32
Crossflow	%	N/A	N/A
Production Cycle	min	20	20
Backwash			
Air Scrub Flow	scfm	N/A	N/A
Backwash Flow (BW Waste Port)_	gpm	72	72
Backwash Flow (Lower Drain)	gpm	72	72
Drain	sec	0	0
Chemically Enhanced Backwash			
Chemical Soak Time	min	15	15
Sodium Hypochlorite/Caustic CEB			
Frequency	Per Week	2	3
Target pH		12.1	--
Sodium Hypochlorite Dose	mg/L	150	200
Caustic Dose	mg/L	1400	1460
Citric Acid/Hydrochloric Acid CEB			

Operating Condition		**Initial**	**Revised** [1]
Frequency	Per Week	1	1
Target pH		1.9	--
Citric Acid Dose	mg/L	1,500	1,500
Hydrochloric Acid Dose	mg/L	1,200	1,500
Clean-In-Place			
Recirculation Time	min	120	120
Soak Time	min	N/A	N/A
Sodium Hypochlorite/Caustic CIP			
Temperature	°C	Ambient	Ambient
Target pH		12.5	12.5
Sodium Hypochlorite Dose	mg/L	200	200
Caustic Dose[2]	mg/L	~2,500	Target pH
Citric Acid/Hydrochloric Acid CIP			
Temperature	°C	Ambient	Ambient
Target pH		1.5	1.5
Citric Acid Dose	mg/L	2,000	2,000
Hydrochloric Acid Dose[2]	mg/L	~16,500	~26,000

Notes:

(1) Revised period from 8/27/16-9/6/16. CIP performed on 8/26/16.
(2) Chemical is dosed to achieve a target pH. The dose is not automatically recorded. Values shown, if any, were calculated based on a manual timing of the chemical pump, the chemical pump capacity, and an assumed CIP volume of 50 gallons.

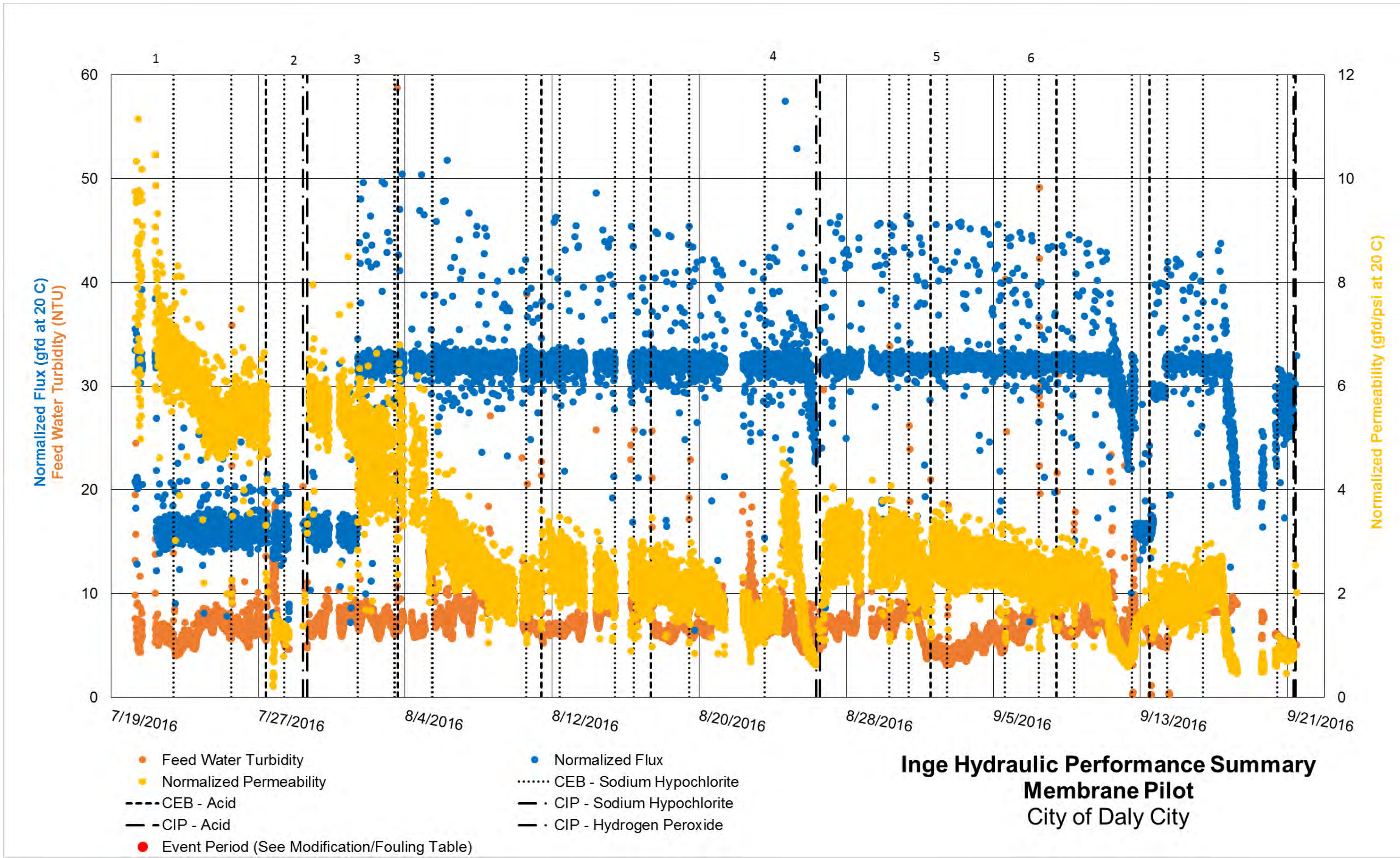


Figure 1. BASF Hydraulic Performance Summary

Table 3. BASF System Modifications and Fouling Response

Classification	Event/Modification	Observations
Period 1	Flux Rate 16 gfd Crossflow 0% 1/wk Citric Acid/Hydrochloric Acid CEBs 2/wk Sodium Hypochlorite/Sodium Hydroxide CEBs Pretreatment 5 mg/L ACH	High initial fouling rate, eventually leveled out
Period 2	Series of pilot shutdowns due to leaking air line and other causes for approximately two weeks	No change in fouling rate
Period 3	Flux increased to 32 gfd 1/wk Citric Acid/Hydrochloric Acid CEBs 3/wk Sodium Hypochlorite/Sodium Hydroxide CEBs Plant power outage (8/5/16)	Increased fouling rate
Period 4	Backwash sequence modified - Closed BW Waste Valve during the backwash out drain step	Initial increase in permeability until unknown event on 8/25 caused steep decrease in permeability and module was no longer able to maintain flux rate
Period 5	Modified CEB cleaning parameters	Increasing the CEB chemical concentration and chemical contact time to CIP values more than doubled the permeability recovery
Period 6	Pilot ran out of Hydrochloric Acid for CEBs	Steady operation until unknown event on 9/11 caused steep decrease in permeability and module was unable to maintain flux rate

CLEANING PERMEABILITY RECOVERY

Table 4. BASF Cleaning Permeability Recovery

	Date	Clean Type (CEB/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)
Period 1	7/22/2016	CEB	Sodium Hypochlorite	150	Caustic	1400		6.55	7.59	N/A	N/A
	7/25/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	7.59	5.64	5.96	26%	79%
	7/27/2016	CEB	Citric Acid	1500	Hydrochloric Acid	1200	5.96	5.84	5.45	2%	91%
	7/28/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	5.45	1.34	1.31	75%	24%
Period 2	7/29/2016	CIP	Sodium Hypochlorite	200	Caustic	Target pH 12.5	1.31	1.27	6.41	3%	490%
	7/29/2016	CIP	Citric Acid	2000	Hydrochloric Acid	Target pH 1.5					
Period 3	8/1/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	6.41	5.33	6.35	17%	99%
	8/3/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	6.35	4.94	6.40	22%	101%
	8/3/2016	CEB	Sodium Hypochlorite	150	Caustic	1400					
	8/3/2016	CEB	Citric Acid	1500	Hydrochloric Acid	1200					
	8/5/2016	CEB	Sodium Hypochlorite	150			6.40	3.50	3.65	45%	57%
	8/5/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	3.65	3.71	3.70	-2%	101%
	8/8/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	3.70	2.47	2.59	33%	70%
	8/10/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	2.59	2.43	2.54	6%	98%
	8/11/2016	CEB	Citric Acid	1500	Hydrochloric Acid	1200	2.54	2.32	3.60	9%	142%
	8/12/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	3.60	2.94	3.48	18%	97%
	8/15/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	3.48	2.42	N/A	30%	N/A
	8/16/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	N/A	2.95	2.88	N/A	N/A
	8/17/2016	CEB	Citric Acid	1500	Hydrochloric Acid	1200	2.88	2.50	2.74	13%	95%
	8/19/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	2.74	2.42	2.78	12%	102%
	8/23/2016	CEB	Sodium Hypochlorite	150	Caustic	1400	2.78	1.70	2.26	39%	81%
Period 4	8/26/2016	CIP	Hydrogen Peroxide	500			N/A	N/A	N/A	N/A	N/A
	8/26/2016	CIP	Citric Acid	2000	Hydrochloric Acid	Target pH 1.5					
	8/30/2016	CEB	Sodium Hypochlorite	200	Caustic	1460	3.83	3.25	3.80	15%	99%
	8/31/2016	CEB	Sodium Hypochlorite	200	Caustic	1460	3.80	3.30	3.28	13%	86%

	Date	Clean Type (CEB/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)
	9/1/2016	CEB	Citric Acid	1500	Hydrochloric Acid	1500	3.28	2.58	3.42	21%	104%
Period 5	9/2/2016	CEB	Sodium Hypochlorite	200	Caustic	1460	3.42	3.08	3.32	10%	97%
	9/5/2016	CEB	Sodium Hypochlorite	200	Caustic	1460	3.32	2.89	2.94	13%	88%
Period 6	9/7/2016	CEB	Sodium Hypochlorite	200	Caustic	2000	2.94	2.69	2.71	8%	92%
	9/8/2016	CEB	Citric Acid	2000			2.71	2.49	2.71	8%	100%
	9/9/2016	CEB	Sodium Hypochlorite	200	Caustic	2000	2.71	2.66	2.65	2%	98%
	9/12/2016	CEB	Sodium Hypochlorite	200	Caustic	2000	2.65	1.03	1.24	61%	47%
	9/13/2016	CEB	Citric Acid	2000			1.24	1.79	2.36	-44%	190%
	9/14/2016	CEB	Sodium Hypochlorite	200	Caustic	1460	2.36	2.41	2.37	-2%	101%
	9/16/2016	CEB	Sodium Hypochlorite	200	Caustic	2000	2.37	2.41	2.57	-2%	108%
	9/20/2016	CEB	Sodium Hypochlorite	200	Caustic	2000	2.57	0.81	0.97	68%	38%
	9/21/2016	CIP	Sodium Hypochlorite	200	Caustic	Target pH 12.5	0.97	N/A	N/A	N/A	N/A
	9/21/2016	CIP	Citric Acid	2000							

APPENDIX G – NANOSTONE FOULING SUMMARY

CITY OF DALY CITY

MEMBRANE PILOT

NANOSTONE DATA SUMMARY

WATER QUALITY SUMMARY

Table 1. Water Quality Summary

Parameter		UF Feed				Nanostone Filtrate			
		Avg.	Min.	Max.	Count	Avg.	Min.	Max.	Count
pH	-	6.5	6.02	8.82	61				
Temperature	°C	19	14.9	21.1	61				
Turbidity	NTU	8.7	3.70	53.2	61				
UV Transmittance	%	48.5	9.4	61.7	61	69.3	60.7	79.1	61
ORP	mV	468	162.6	531	61				
Dissolved Oxygen	mg/L	6.30	4.65	9.10	60				
Total Chlorine	mg/L	3.1	0.0	19.6	61	3.0	0.0	10.5	61
Total Organic Carbon	mg/L	20.4	14.3	36.2	11	12	9	16	11
Total Iron	mg/L	1.73	0.41	14.00	15	0.15	ND	0.19	14
Dissolved Iron	mg/L	0.38	0.30	0.50	3				
Total Aluminum	mg/L	14.66	2.10	52.0	14	ND	ND	ND	15
Dissolved Aluminum	mg/L	1.14	0.05	3.30	5				

Notes:
(1) Data from grab samples collected during pilot testing 11/30/16 - 3/17/17

SUMMARY OF OPERATING CONDITIONS AND FOULING RESPONSE

Operating Conditions

Table 2. Initial and Final Operating Conditions

Operating Condition		**Initial**	**Revised**
Pretreatment			
Sodium Hypochlorite Dose	mg/L	0	6.5
Coagulant Dose	mg/L	40	34-64
Production			
Flux	gfd	60 - 110 (Target 115)	20 hr: 70 4 hr: 91
Crossflow	%	N/A	N/A
Production Cycle	min	15	15
Backwash			
Backwash Flow Rate	gpm	20	40
Backwash Duration	sec	20	18
Feed Flush Flow Rate	gpm	10	17
Feed Flush Duration	sec	20	40
Maintenance Clean			
Chemical Recirculation Time	min	30	30
Sodium Hypochlorite/Caustic MC			
Frequency	Per Week	7	7
Target pH		12	12
Sodium Hypochlorite Dose	mg/L	600	600
Caustic Dose	mg/L	1200	1200
Sodium Hypochlorite MC			

Operating Condition		Initial	Revised
Frequency	Per Week	7	0
Sodium Hypochlorite Dose	mg/L	600	N/A
Citric Acid/Hydrochloric Acid CEB			
Frequency	Per Week	2.333	0.875
Target pH		2	2
Citric Acid Dose	mg/L	1000	1000
Hydrochloric Acid Dose	mg/L	1000-1500	1000-1500
Hydrochloric Acid CEB			
Frequency	Per Week	0	2.625
Target pH		2	2
Hydrochloric Acid Dose	mg/L	1000-1500	1000-1500
Clean-In-Place			
Recirculation Time	min	60	60
Soak Time	min	N/A	N/A
Sodium Hypochlorite/Caustic CIP			
Temperature	°C	35	35
Target pH	-	12	12
Sodium Hypochlorite Dose	mg/L	600	600
Caustic Dose	mg/L	1200	1200
Citric Acid/Hydrochloric Acid CIP			
Temperature	°C	Ambient	Ambient
Target pH	-	2	2
Citric Acid Dose	mg/L	1000	1000
Hydrochloric Acid Dose	mg/L	1000-1500	1000-1500

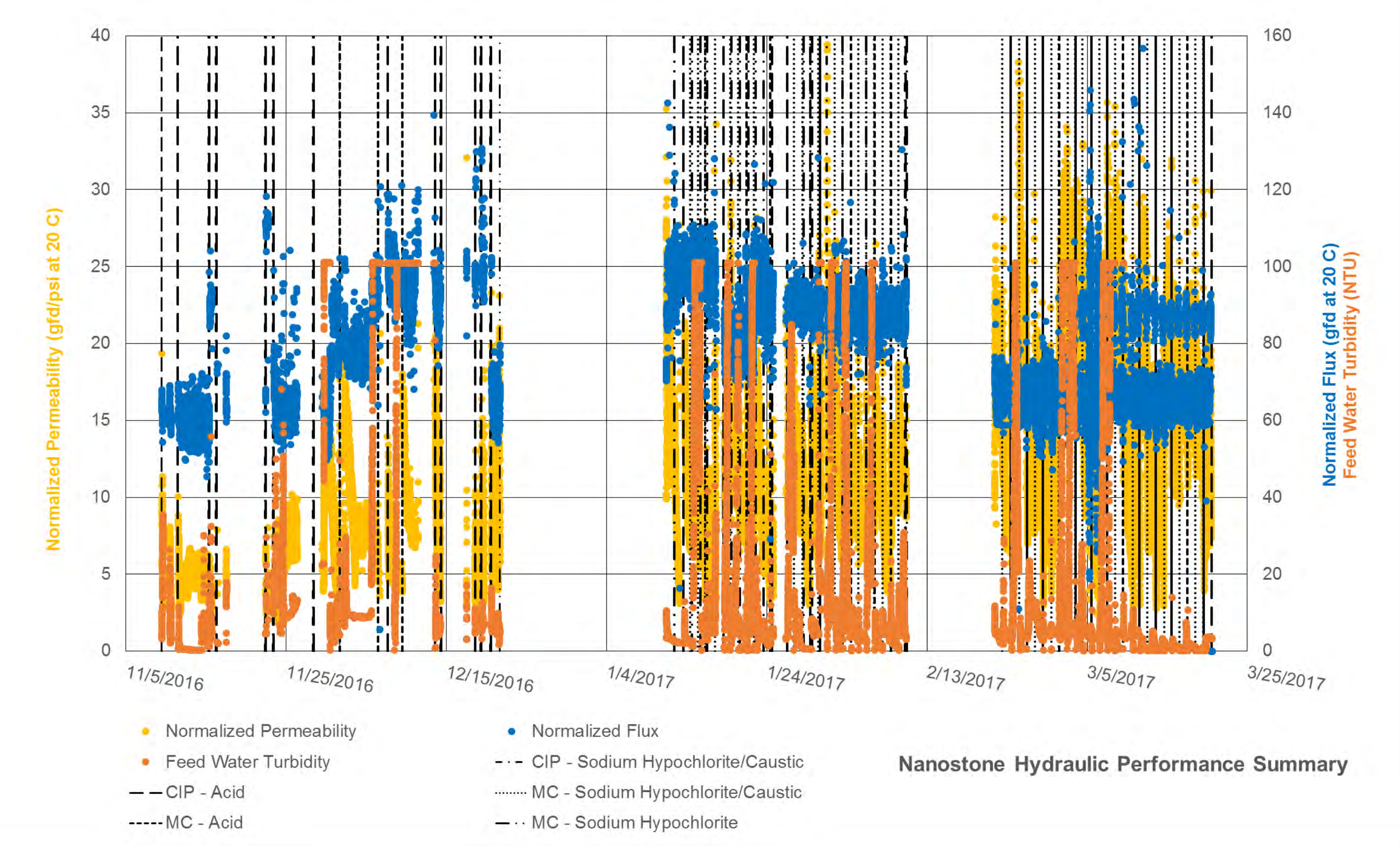


Figure 1. Nanostone Hydraulic Performance Summary

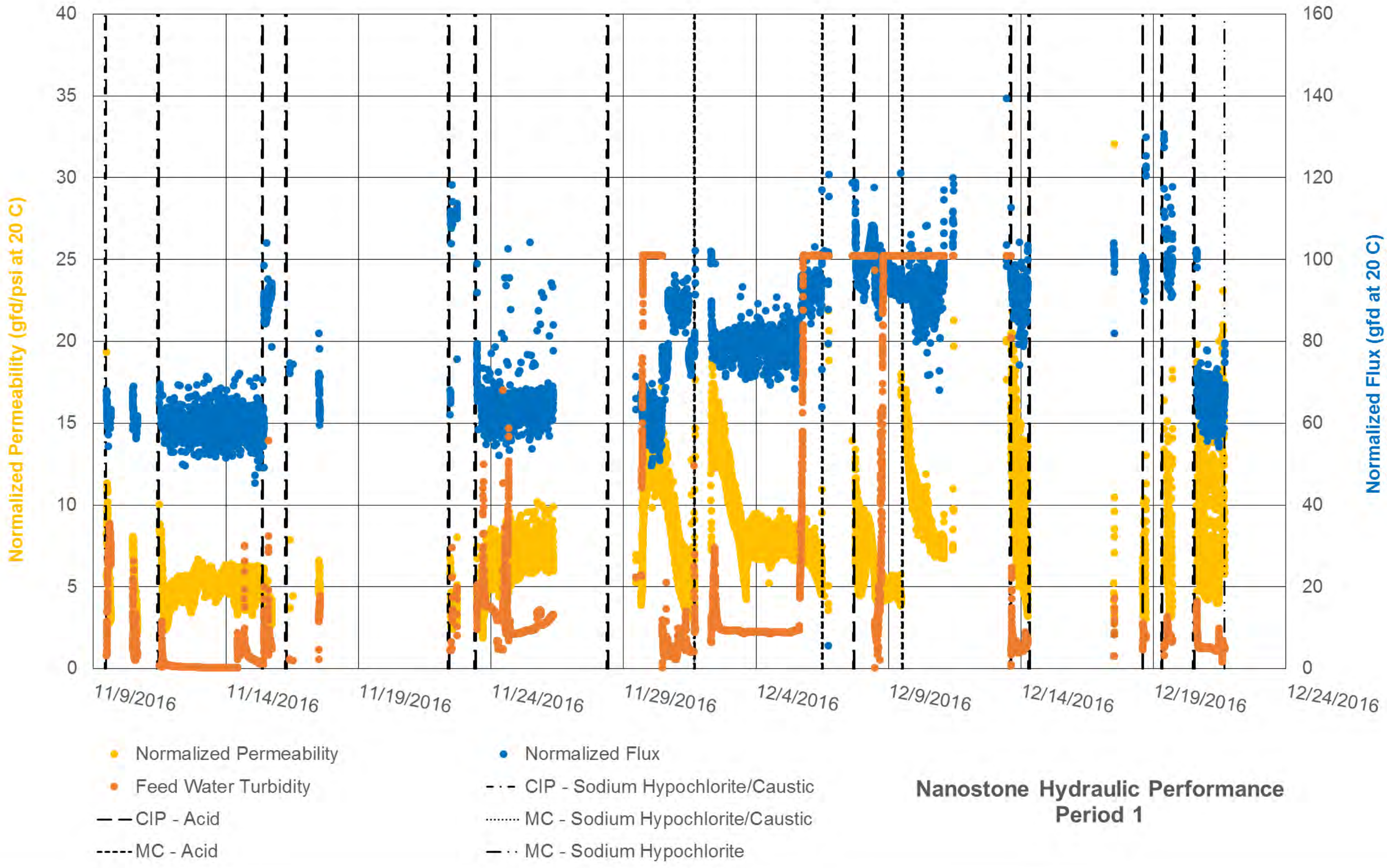


Figure 2. Nanostone Hydraulic Performance Period 1

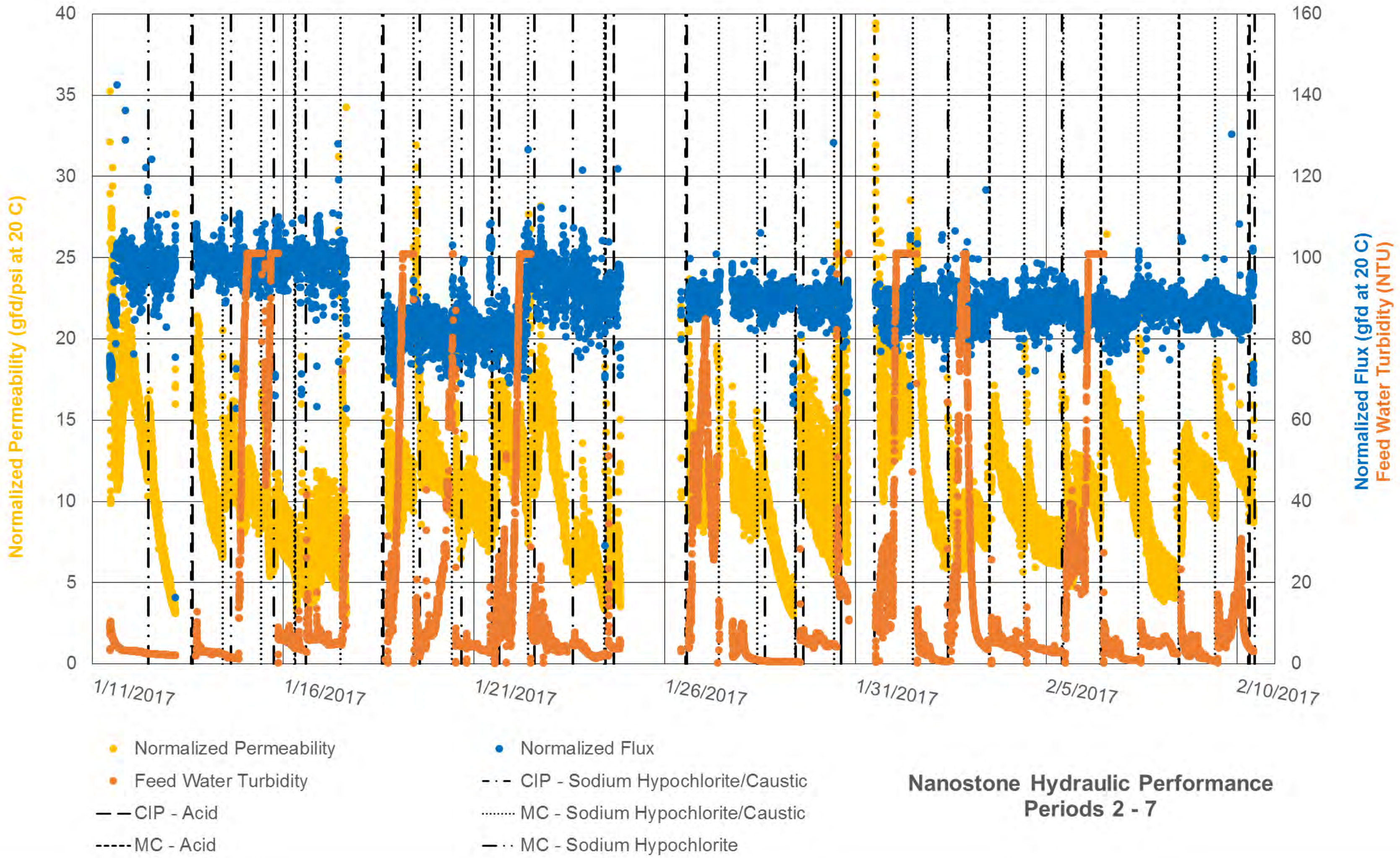


Figure 3. Nanostone Hydraulic Performance Periods 2 - 7

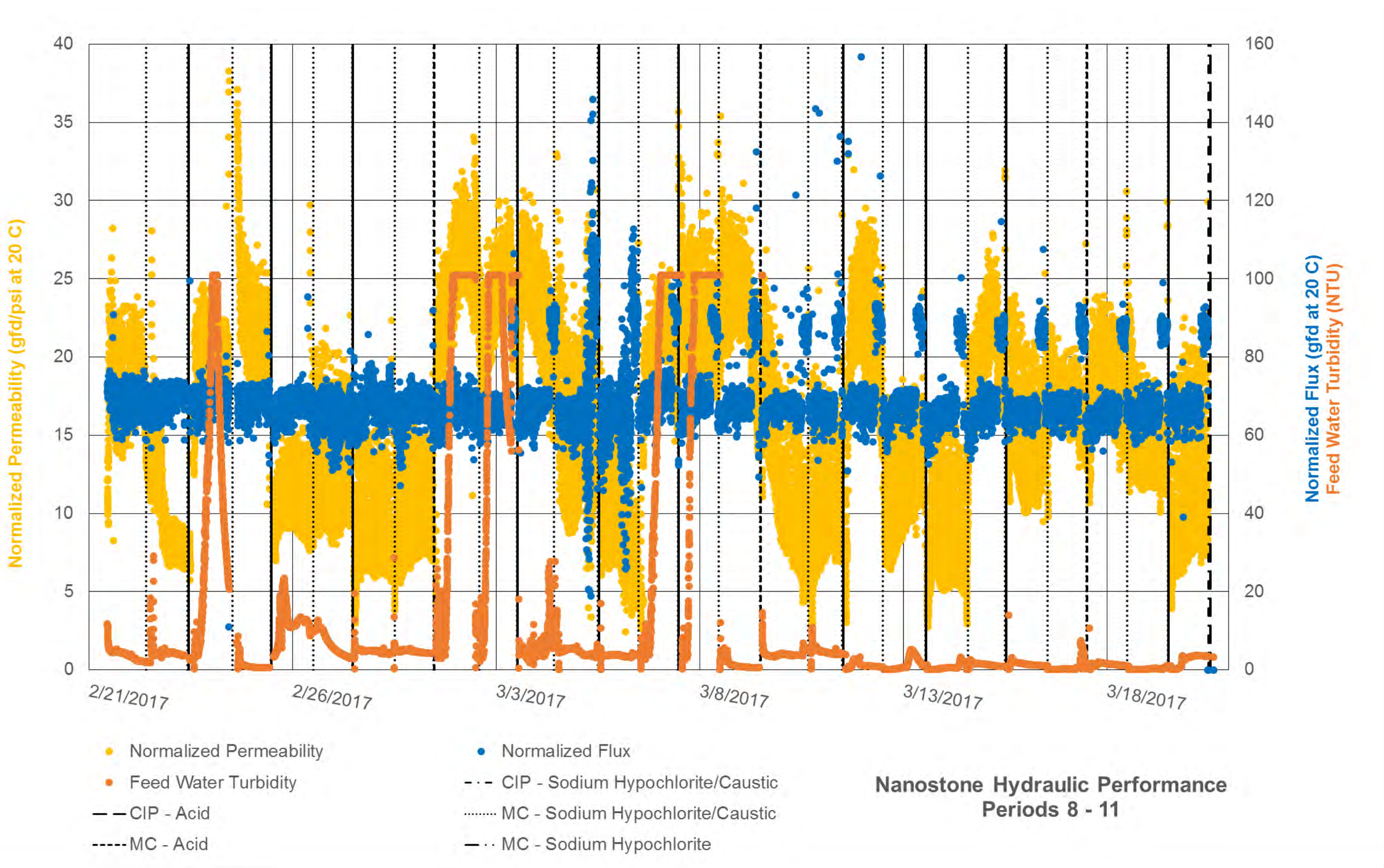


Figure 4. Nanostone Hydraulic Performance Periods 8 - 11

Table 3. System Modifications and Fouling Response

Classification	Events and Modifications	Observations
Period 1 (11/9/2016 - 12/21/2016)	Flux Rate: 60 - 110 gfd Adjusted pretreatment: 0 to 5 mg/L Sodium Hypochlorite 40 to 34 mg/L ACH (based on jar tests) Adjusted backwash settings: Backwash: 20 to 18 seconds Backwash: 20 to 50 gpm Feed Flush: 20 to 40 seconds Feed Flush: 10 to 17 gpm CIPs as needed	Adjusted settings in order to achieve stable operation as the flux increased to the initial target flux rate of 115 gfd Frequent CIPs were required during this trial period
Period 2 (1/11/2017 - 1/13/2017)	Flux Rate: 99 gfd Daily MCs: Sodium Hypochlorite MCs Increased Pretreatment to 54 mg/L ACH (based on jar tests)	Reached maximum TMP within less than 24 hours. More frequent cleans are required
Period 3 (1/13/2017 - 1/17/2017)	Flux Rate: 99 gfd 2X/Day MCs: 7X/week Sodium Hypochlorite/Caustic MCs (AM) 2.3X/week Citric Acid/Hydrochloric Acid MCs (AM) (every 3rd MC) 7X/week Sodium Hypochlorite MCs (PM)	PM Sodium Hypochlorite MC's were not effective
Period 4 (1/18/2017 - 1/24/2017)	Flux Rate: 85/99/91 gfd Implemented feed overflow during downtime to prevent solids buildup in feed tank	No difference observed with feed overflow during downtime 99 gfd not sustainable
Period 5 (1/26/2017 - 1/29/2017)	Flux Rate: 91 gfd	Observed fouling event 1/29 - reached max TMP PM Sodium Hypochlorite MC's were not effective
Period 6 (1/30/2017)	2X/Day MCs: Sodium Hypochlorite/Caustic MCs (AM) Citric Acid/Hydrochloric Acid MCs (PM)	Following acid MC, TMP dramatically increased within minutes of operation and the backwash was unable to recover the permeability.

Classification	Events and Modifications	Observations
Period 7 (2/2/2017 - 2/10/2017	Daily MCs: 7X/week Sodium Hypochlorite/Caustic MCs (AM) 2.3X/week Citric Acid/Hydrochloric Acid MCs (AM) (every 3rd MC) Increased Pretreatment to 64 mg/L ACH	Sodium Hypochlorite MC/Acid MC is effective in recovering permeability following a fouling event
Period 8 (2/22/2017 - 3/2/2017)	Flux Rate: 70 gfd Adjusted backwash settings: Backwash: 50 to 40 gpm Daily MCs: 7X/week Sodium Hypochlorite/Caustic MCs (AM) 3.5X/week Acid MCs (AM) (every other MC) 2.625X/week Hydrochloric Acid MCs (3X/8days) 0.875X/week Citric Acid/Hydrochloric Acid MCs (every 4th acid clean MC or 1X/8days)	Sodium Hypochlorite MCs are effective in recovering permeability Following a Sodium Hypochlorite MC/Acid MC the permeability continues to increase with each backwash
Period 9 (3/3/2017 - 3/4/2017)	Flux Rate: 70 gfd/2.5-4 hours at 91 gfd	Able to recover permeability loss with MC following increase in flux
Period 10 (3/5/2017 - 3/6/2017)	Flux Rate: 70 gfd/4 hours at 105 gfd	Unable to maintain 105 gfd flux rate
Period 11 (3/7/2017 - 3/20/2017)	Flux Rate: 70 gfd/4 hours at 91 gfd	Able to recover permeability loss with MC

CLEANING PERMEABILITY RECOVERY

Table 4. Cleaning Permeability Recovery

Date, Start Time	Clean Type (MC/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)	Comment
11/9/16 10:30	CIP	Sodium Hypochlorite	600	Caustic	1200						
11/9/16 11:30	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
11/11/16 10:00	CIP	Sodium Hypochlorite	600	Caustic	1200						
11/11/16 11:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
11/15/16 8:30	CIP	Sodium Hypochlorite	600	Caustic	1200						
11/15/16 9:30	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
11/16/16 6:00	CIP	Sodium Hypochlorite	600	Caustic	1200						
11/16/16 7:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
11/22/16 9:15	CIP	Sodium Hypochlorite	600	Caustic	1200						
11/22/16 10:15	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
11/23/16 9:15	CIP	Sodium Hypochlorite	600	Caustic	1200						
11/23/16 10:15	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
11/28/16 9:00	CIP	Sodium Hypochlorite	600	Caustic	1200						
11/28/16 10:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
12/1/16 16:00	MC	Sodium Hypochlorite	600	Caustic	1200						
12/1/16 16:30	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
12/6/16 11:30	MC	Sodium Hypochlorite	600	Caustic	1200						
12/6/16 12:00	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
12/7/16 16:00	CIP	Sodium Hypochlorite	600	Caustic	1200						
12/7/16 17:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
12/9/16 12:00	MC	Sodium Hypochlorite	600	Caustic	1200						
12/9/16 12:30	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
12/13/16 14:00	CIP	Sodium Hypochlorite	600	Caustic	1200						
12/13/16 15:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
12/14/16 7:00	CIP	Sodium Hypochlorite	600	Caustic	1200						
12/14/16 8:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
12/17/16 11:00	CIP	Sodium Hypochlorite	600	Caustic	1200						
12/18/16 14:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
12/19/16 7:00	CIP	Sodium Hypochlorite	600	Caustic	1200						
12/19/16 8:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
12/20/16 12:00	CIP	Sodium Hypochlorite	600	Caustic	1200						

Date, Start Time	Clean Type (MC/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)	Comment
12/20/16 13:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
12/21/16 16:00	MC	Sodium Hypochlorite	600	N/A							
1/12/17 11:00	MC	Sodium Hypochlorite	600	N/A							
1/13/17 14:00	CIP	Sodium Hypochlorite	600	Caustic	1200			20.9			
1/13/17 15:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
1/14/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	20.9	9.5	15.1	55%	72%	
1/14/17 18:20	MC	Sodium Hypochlorite	600	N/A		15.1	14.0	13.0	7%	86%	Permeability decrease after clean
1/15/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	13.0	10.5	17.2	19%	132%	
1/15/17 19:15	MC	Sodium Hypochlorite	600	N/A		17.2	9.3	11.0	46%	64%	
1/16/17 8:45	MC	Sodium Hypochlorite	600	Caustic	1200	11.0	8.2	7.9	25%	72%	
1/16/17 9:15	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
1/16/17 11:30	MC	Sodium Hypochlorite	600	N/A		7.9	8.4	10.0	-6%	127%	
1/17/17 11:00	MC	Sodium Hypochlorite	600	Caustic	1200	10.0	10.3	20.0	-3%	200%	
1/18/17 14:00	CIP	Sodium Hypochlorite	600	Caustic	1200	20.0	3.0	14.1	85%	71%	
1/18/17 15:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
1/19/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	14.1	12.3	26.6	13%	189%	
1/19/17 18:00	MC	Sodium Hypochlorite	600	N/A		26.6	14.2	14.6	47%	55%	
1/20/17 10:35	MC	Sodium Hypochlorite	600	Caustic	1200	14.6	11.2	19.0	23%	130%	
1/20/17 18:00	MC	Sodium Hypochlorite	600	N/A		19.0	11.9	12.0	37%	63%	
1/21/17 11:00	MC	Sodium Hypochlorite	600	Caustic	1200	12.0	10.6	17.4	12%	145%	Permeability increased w/ each BW
1/21/17 11:30	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
1/21/17 19:00	MC	Sodium Hypochlorite	600	N/A		17.4	16.5	16.5	5%	95%	
1/22/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	16.5	12.3	19.2	25%	116%	Increase in flux after clean to 99 gfd
1/22/17 18:15	MC	Sodium Hypochlorite	600	N/A		19.2	19.5	19.5	-2%	102%	
1/23/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	19.5	9.0	8.0	54%	41%	Increase in permeability decline at 95 - 99 gfd
1/23/17 14:00	MC	Sodium Hypochlorite	600	N/A		8.0	7.0	9.0	13%	113%	
1/24/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	9.0	5.0	8.2	44%	91%	
1/24/17 10:30	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
1/24/17 16:00	MC	Sodium Hypochlorite	600	N/A		8.2	8.0	N/A	2%	N/A	
1/26/17 13:00	CIP	Sodium Hypochlorite	600	Caustic	1200	N/A	N/A	15.0	N/A	N/A	
1/26/17 14:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
1/27/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	15.0	11.3	16.0	25%	107%	
1/28/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	16.0	11.0	14.1	31%	88%	
1/28/17 18:30	MC	Sodium Hypochlorite	600	N/A		14.1	9.0	9.1	36%	65%	PM Sodium Hypochlorite clean not effective (Permeability increase 9 to 9.1 gfd/psi)
1/29/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	9.1	4.3	19.1	53%	210%	

Date, Start Time	Clean Type (MC/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)	Comment
1/29/17 10:30	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
1/29/17 20:55	MC	Sodium Hypochlorite	600	N/A		19.1	16.4	16.2	14%	85%	PM Sodium Hypochlorite clean not effective (Permeability decreased after clean)
1/30/17 11:00	MC	Sodium Hypochlorite	600	Caustic	1200	16.2	13.9	24.8	14%	153%	
1/30/17 11:30	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
1/31/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	24.8	19.8	25.9	20%	104%	
2/1/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	25.9	16.4	26.7	37%	103%	
2/2/17 10:00	MC	Sodium Hypochlorite	600	N/A		26.7	7.3	13.6	73%	51%	
2/2/17 10:30	MC	Sodium Hypochlorite	600	Caustic	1200						
2/3/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	13.6	9.3	16.5	32%	121%	Permeability increase w/ each BW
2/3/17 12:30	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
2/4/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	16.5	10.6	13.6	36%	82%	
2/5/17 10:00	MC	Sodium Hypochlorite	600	N/A		13.6	8.6	14.6	37%	107%	
2/5/17 10:30	MC	Sodium Hypochlorite	600	Caustic	1200						
2/6/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	14.6	10.0	17.9	32%	123%	
2/6/17 10:30	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
2/7/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	17.9	11.3	14.8	37%	83%	
2/8/17 11:00	MC	Sodium Hypochlorite	600	Caustic	1200	14.8	6.0	14.8	59%	100%	Permeability increase w/ each BW
2/8/17 11:30	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
2/9/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	14.8	11.0	17.8	26%	120%	
2/10/17 7:00	CIP	Sodium Hypochlorite	600	Caustic	1200	17.8	11.9	N/A	33%	N/A	
2/10/17 8:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						
2/10/17 11:00	MC	Sodium Hypochlorite	600	N/A		N/A	N/A	N/A	N/A	N/A	
2/22/17 13:00	MC	Sodium Hypochlorite	600	Caustic	1200	24.0	14.0	18.0	42%	75%	
2/23/17 10:00	MC	Sodium Hypochlorite	600	Caustic	1200	18.0	8.9	24.5	51%	136%	Permeability increase w/ each BW
2/23/17 10:30	MC	N/A		Hydrochloric Acid	1000-1500						
2/24/17 12:30	MC	Sodium Hypochlorite	600	Caustic	1200	24.5	21.2	32.9	13%	134%	
2/25/17 11:00	MC	Sodium Hypochlorite	600	Caustic	1200	32.9	23.7	14.6	28%	44%	Drop in permeability following clean, increase w/ each BW
2/25/17 11:30	MC	N/A		Hydrochloric Acid	1000-1500						
2/26/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	14.6	14.1	19.9	3%	136%	
2/27/17 11:00	MC	Sodium Hypochlorite	600	Caustic	1200	19.9	18.6	15.2	7%	76%	Drop in permeability following clean, increase w/ each BW
2/27/17 11:30	MC	N/A		Hydrochloric Acid	1000-1500						
2/28/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	15.2	13.0	16.0	14%	105%	
3/1/17 11:00	MC	Sodium Hypochlorite	600	Caustic	1200	16.0	12.6	22.7	21%	142%	Increase in permeabilty w/ each BW up to 31 gdf/psi

Date, Start Time	Clean Type (MC/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)	Comment
3/1/17 11:30	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
3/2/17 11:00	MC	Sodium Hypochlorite	600	Caustic	1200	22.7	27.1	30.5	-19%	134%	
3/3/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	30.5	24.8	29.0	19%	95%	Perm Decline: Flux increase at end of MC cycle
3/3/17 12:30	MC	N/A		Hydrochloric Acid	1000-1500						
3/4/17 11:30	MC	Sodium Hypochlorite	600	Caustic	1200	29.0	22.6	24.2	22%	83%	Perm Decline: Flux increase at end of MC cycle
3/5/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	24.2	N/A	15.8	#VALUE!	65%	Perm Decline: Flux increase at end of MC cycle
3/5/17 12:30	MC	N/A		Hydrochloric Acid	1000-1500						
3/6/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	15.8	9.9	21.0	37%	133%	Perm Decline: Flux increase at end of MC cycle, Permeabiliy increase w/ each BW up to 25 gfd/psi
3/7/17 11:00	MC	Sodium Hypochlorite	600	Caustic	1200	21.0	20.5	27.6	2%	131%	Perm Decline: Flux increase at end of MC cycle
3/7/17 11:30	MC	N/A		Hydrochloric Acid	1000-1500						
3/8/17 11:00	MC	Sodium Hypochlorite	600	Caustic	1200	27.6	23.8	29.9	14%	108%	Perm Decline: Flux increase at end of MC cycle
3/9/17 11:30	MC	Sodium Hypochlorite	600	Caustic	1200	29.9	17.5	24.5	41%	82%	Perm Decline: Flux increase at end of MC cycle
3/9/17 12:00	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
3/10/17 16:00	MC	Sodium Hypochlorite	600	Caustic	1200	24.5	12.6	18.6	49%	76%	Perm Decline: Flux increase at end of MC cycle
3/11/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	18.6	15.6	26.2	16%	141%	Perm Decline: Flux increase at end of MC cycle, Permeability increase w/ each backwash up to 28.5
3/11/17 12:30	MC	N/A		Hydrochloric Acid	1000-1500						
3/12/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	26.2	23.3	17.4	11%	66%*	Perm Decline: Flux increase at end of MC cycle, *Drop in permeability following clean, gradual increase with each BW up to 28 gfd/psi (107% recovery)
3/13/17 13:00	MC	Sodium Hypochlorite	600	Caustic	1200	17.4	16.7	15.4	4%	89%	Perm Decline: Flux increase at end of MC cycle, Drop in permeability following clean, gradual increase with each BW
3/13/17 13:30	MC	N/A		Hydrochloric Acid	1000-1500						
3/14/17 12:02	MC	Sodium Hypochlorite	600	Caustic	1200	15.4	14.1	20.8	8%	135%	Perm Decline: Flux increase at end of MC cycle, Drop in permeability following clean, gradual increase with each BW up to 26 gfd
3/15/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	20.8	21.4	23.6	-3%	113%	Perm Decline: Flux increase at end of MC cycle
3/15/17 12:30	MC	N/A		Hydrochloric Acid	1000-1500						
3/16/17 13:00	MC	Sodium Hypochlorite	600	Caustic	1200	23.6	19.8	20.9	16%	89%	Perm Decline: Flux increase at end of MC cycle

Date, Start Time	Clean Type (MC/CIP)	Chemical #1 (Sodium Hypochlorite/ Citric Acid)	Dose (mg/L)	Chemical #2 (Caustic/ Hydrochloric Acid)	Dose (mg/L)	Initial Permeability (Begin MC Cycle) (gfd/psi)	Final Permeability (End MC Cycle) (gfd/psi)	Permeability After Clean (gfd/psi)	Permeability Decline (within MC Cycle) (%)	Permeability Recovery (%)	Comment
3/17/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	20.9	18.1	23.0	13%	110%	Perm Decline: Flux increase at end of MC cycle, Drop in permeability following clean, gradual increase with each BW
3/17/17 12:30	MC	Citric Acid	1000	Hydrochloric Acid	1000-1500						
3/18/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	23.0	18.9	23.3	18%	101%	Perm Decline: Flux increase at end of MC cycle
3/19/17 12:00	MC	Sodium Hypochlorite	600	Caustic	1200	23.3	16.1	18.7	31%	80%	Perm Decline: Flux increase at end of MC cycle
3/19/17 12:30	MC	N/A		Hydrochloric Acid	1000-1500						
3/20/17 12:00	CIP	Sodium Hypochlorite	600	Caustic	1200						
3/20/17 13:00	CIP	Citric Acid	1000	Hydrochloric Acid	1000-1500						

APPENDIX F – PROJECT MEMORANDUM 09 - DISINFECTION TECHNOLOGY EVALUATION

DRAFT PROJECT MEMORANDUM - 09

Project:	Feasibility of Expanded Tertiary Recycled Water Facilities	**Date:**	December 18, 2015
Client:	City of Daly City	**Project No.:**	10076A.10
Prepared By:	Katie Belluomini, Darren Baune		
Reviewed By:	Andrew Salveson, Alan Domonoske		
Subject:	Disinfection Technology Evaluation		
Distribution:	Patrick Sweetland, Cynthia Royer, Manisha Kothari, Paula Kehoe, Mike Britten, Tracy Clinton		

1.0 PURPOSE

The purpose of this memorandum is to update the evaluation of disinfection technologies performed during the 2008 feasibility study (Carollo, 2008) for the Feasibility of Expanded Tertiary Recycled Water Facilities Project (Project). This update considers recent advances in technology, regulations, and cost information for each technology.

2.0 BACKGROUND

In 2008, Carollo Engineers performed a feasibility study (Carollo, 2008) that considered expanding the tertiary treatment capacity at the Daly City WWTP. The evaluation considered ultraviolet light (UV), pasteurization, and ozonation as potential disinfection technologies necessary downstream of the membrane filtration process. Ozonation was selected as the preferred technology based upon cost and footprint and UV was a close second. Cost was a significant factor in this selection. Since that time, technology advancements have improved UV efficiency and several new "Title 22" ozone systems have been validated. Accordingly, a new analysis for both UV and ozone has been completed for this current project.

Chlorination was not considered as a feasible technology in the 2008 study because it's not practical to achieve adequate contact time. The existing chlorine contact tank does not have additional capacity and there is no space on-site for a new contact basin. It's also not recommended to use the conveyance pipeline for contact time because it's not practical to shut down and drain non-compliant water if the chlorination system malfunctions.

3.0 DISINFECTION TECHNOLOGIES

3.1 General Design Criteria

This evaluation was performed based on 3.55 MGD, because that was the design flow rate at the beginning of the project. Since the project no longer includes SF State and Park Merced, the design flow rate has been reduced to 3.10 MGD. This slight difference in flow rate will not affect the results of this evaluation.

3.2 UV

There are two primary UV configurations on the market: in-vessel type systems and channel systems. Due to the space constraints of the site, only the more compact in-vessel type systems were considered in this study. Trojan, WEDECO, and ETS have low-pressure, high-output (LPHO), Title 22 validated systems. Aquionics, which was considered in the 2008 Study, has a medium pressure (MP), Title 22 validated system. Additionally, Calgon Carbon offers a MP system validated per EPA's UVDGM (but not Title 22) that may be a more cost effective option for an Indirect Potable Reuse (IPR) application due to its turndown ability. All of these systems were compared in terms of cost and footprint.

The following design criteria were assumed for preliminary cost and footprint estimates:

- Minimum UV transmittance - 65%
- Average UV transmittance - 70%
- Minimum MS2 RED (mJ/cm2) - 84
- In-vessel type system
- Number of trains - 2 or 3 duty + 1 standby

3.3 Ozone

Xylem and H_2O Engineering systems were evaluated since they have Title 22 validated, ozone disinfection systems. The following design criteria were assumed for preliminary cost and footprint estimates:

- 15 mg/L ozone dose (based on an ozone to TOC ratio of 1)
- 30 - 45 second contact time
- Redundancy on critical items: generators, dosing and mixing equipment, destruct units

4.0 EVALUATION CRITERIA

Each technology was evaluated based on the following six criteria:

- Prevalence in the Recycled Water Industry
- Operations and Maintenance
- Operator Safety
- Cost
- Footprint
- Potential for Indirect Potable Reuse

Each of these criteria is discussed in detail in the following sections.

4.1 Prevalence in Recycled Water Industry

Although ozone disinfection is commonly used for drinking water treatment, it is not as commonly used for recycled water applications. In California, there are only two plants that use ozone disinfection for non-potable recycled water (Anaheim's Water Sustainability Campus and San Simeon Community Services District's Reclamation Facility), and one plant that uses ozone disinfection for indirect potable reuse (West Basin's Edward C. Little Water Recycling Facility). Conversely, there are dozens of plants that use UV disinfection for Title 22 recycled water applications.

4.2 Operations and Maintenance

There are some distinct differences between the operations and maintenance of ozone and UV systems. UV systems have no moving parts, very few interrelated devices, and require little operator attention during normal operation. Maintenance is primarily associated with replacing UV lamps, which is a significant cost but requires no special training. The additional labor associated with UV system O&M is estimated to be 4 hours per week. O&M costs are primarily associated with electrical usage and lamp/ballast replacement.

Ozone systems are more complex than UV systems, with significantly more equipment and analyzers that function together for normal operations. Additional operator attention is required to verify proper operations and a greater of degree of experience and skill is required to troubleshoot problems. There are more equipment to maintain and analyzers to calibrate, some of which may require specialized training. The additional labor associated with ozone system O&M is estimated to be 25 hours per week. O&M costs are primarily associated with oxygen costs (whether liquid oxygen or the costs to produce oxygen on site) and electricity costs for producing and delivering the ozone.

4.3 Operator Safety

Both ozone and UV present their own local safety hazards, but these can be safely mitigated through proper design and enforcement of proper protocols. UV presents the risk of human exposure to UV light, which is mitigated through standard operating procedures and proper training. Ozone systems present the risk of human exposure to oxygen and ozone gas. Ozone off-gassing is mitigated with ozone destruct units and ambient ozone and oxygen monitors detect leaks. Operators need to be trained to recognize unsafe conditions and respond accordingly.

4.4 Footprint

In the 2008 Study, the space allocated to the disinfection system was 480 square feet (40 feet by 12 feet). Since the overall available space on site is limited, for this memorandum it is assumed that the maximum space available for the disinfection system is 480 square feet. The required footprint for each alternative is summarized in Table 1.

4.5 Cost

A cost comparison of the disinfection technologies evaluated is provided in Table 2. This table includes life cycle costs based on a 20-year life cycle and a 6 percent interest rate. UV disinfection is more cost effective based on both capital and operations and maintenance costs.

Table 1 Footprint Comparison of Disinfection Technologies
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Disinfection Technology	Area (square feet)	Fit within the available space (< 480 square feet)
Ozone		
Xylem	>1,000	No
H_2O Engineering	>1,000	No
UV - LPHO		
Trojan - UVFit	620	No
Wedeco - LBX	460	Yes
ETS - UVLW	420	Yes
UV - MP		
Aquionics	460	Yes
Calgon Carbon	560	No

Table 2 Cost Comparison of Disinfection Technologies
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Disinfection Technology	Capital Cost[1]	Annual O&M Cost[2]	Total Present Value[3] (Life Cycle Cost)	Annual Amortized[3]
Ozone				
Xylem	$3,392,000	$342,000	$7,315,000	$638,000
H_2O Engineering	$3,926,000	$342,000	$7,849,000	$684,000
UV - LPHO				
Trojan - UVFit	$2,340,000	$144,000	$3,986,000	$348,000
Wedeco - LBX	$2,029,000	$110,000	$3,291,000	$287,000
ETS - UVLW	$2,672,000	$127,000	$4,123,000	$359,000
UV - MP				
Aquionics	$1,761,000	$245,000	$4,575,000	$399,000
Calgon Carbon	$1,845,000	$212,000	$4,279,000	$373,000

Notes:
(1) Cost includes equipment, sales tax (8%), electrical and instrumentation allowance (20%), installation allowance (30%), general conditions (15%), and general contractor OH&P (12%)
(2) Assumed the following rates: Power = $0.10/kWh, Labor = $100/hr, LOX = $0.60/100 scf
(3) Interest rate = 6%, Period = 20 years

4.6 Potential for Indirect Potable Reuse

If Daly City pursues indirect potable reuse (IPR), reverse osmosis (RO), advanced oxidation (AOP), and disinfection will be required following the MF/UF membranes. The combined system would need to meet the following pathogen log reduction criteria and trace pollutant destruction criteria (IPR criteria):

- 12-log enteric virus reduction
- 10-log *Giardia* cyst reduction
- 10-log Cryptosporidium oocyst reduction
- <10 mg/L total nitrogen (concerns about NDMA)
- 0.5-log reduction of 1,4 Dioxane

Advanced oxidation can be provided with UV AOP. The UV dose required to meet the IPR criteria above will range from 600 to 1000 mJ/cm2, depending upon various water quality values. Although this is significantly higher than the non-potable reuse dose of 84 mJ/cm2, the significantly higher UV transmittance (UVT) following RO makes higher doses easier to achieve.

For instance, a UV system designed for a non-potable reuse dose of 84 mJ/cm2 in MF/UF filtrate (~65% UVT) can achieve a UV dose in excess of 500 mJ/cm2 in RO permeate (~98% UVT). Consequently, a UV system initially installed for non-potable reuse will require little to no expansion to meet IPR requirements.

Advanced oxidation can also be provided with ozone. However, there is less certainty that an ozone system can meet all the IPR criteria above. Ozone can provide substantial disinfection and 1,4-dioxane destruction, but may not be able to reduce N-nitrosodimethylamine (NDMA) concentrations sufficiently low to meet the 10 ng/L target. Therefore, if Daly City elects to pursue IPR in the future, the ozone system would need to be followed by a supplemental UV system for NDMA polishing.

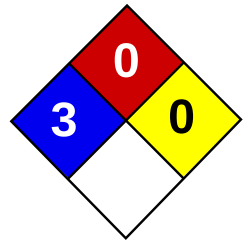
5.0 RECOMMENDATIONS

Table 3 provides a summary of the disinfection technology evaluation results. We recommend implementing UV disinfection because it out-performs ozone in almost all of the evaluation criteria.

Table 3 Disinfection Technology Evaluation Results
Feasibility of Expanded Tertiary Recycled Water Facilities
City of Daly City

Criteria	Ozone	UV
Prevalence in Recycled Water Industry	Rare	Prevalent
Operator Attention Required	High	Low
Operator Safety Concerns	Low	Low
Footprint	Too large	Acceptable
Cost (Capital and O&M)	High cost	Low Cost
Potential for Indirect Potable Reuse	Moderate	High

APPENDIX G – CHEMICAL SYSTEM MSDS



Health	3
Fire	0
Reactivity	0
Personal Protection	

Material Safety Data Sheet
Sodium Hypochlorite, 12% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium Hypochlorite, 12%

Catalog Codes: SLS3076

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Sodium hypochlorite; Water

CI#: Not applicable.

Synonym: Chlorine Bleach, Soda Bleach; Sodium Hypochlorite, Solution, 12% Available Chlorine.

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium hypochlorite	7681-52-9	12-14
Sodium hydroxide	1310-73-2	1
Water	7732-18-5	85-87

Toxicological Data on Ingredients: Sodium hypochlorite: ORAL (LD50): Acute: 5800 mg/kg [Mouse]. 8910 mg/kg [Rat]. Sodium hydroxide LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, . Hazardous in case of skin contact (corrosive), of eye contact (corrosive). Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Sodium hypochlorite]. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. [Sodium hypochlorite]. Mutagenic for mammalian somatic cells. [Sodium hydroxide]. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to lungs, mucous membranes, skin, eyes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: combustible materials, organic materials, metals

Explosion Hazards in Presence of Various Substances:
Slightly explosive in presence of heat. Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Releases chlorine when heated above 35 deg. C. The substance itself is non-combustible and does not burn. However, when heated to decomposition it emits corrosive and/or toxic fumes. May ignite combustibles. The heat of reaction with combustibles or organic materials may cause igniton. It may be a fire risk in contact with organic materials. Contact with metals may evolve flammable hydrogen gas.

Special Remarks on Explosion Hazards:

Anydrous Sodium Hypochlorite is very explosive. Primary amines and calcium hypochlorite or sodium hypochlorite react to form normal chloroamines, which are explosive. Interaction of ethyleneimine with sodium (or other) hypochlorite gives the explosive N-chloro cmpd. Removal of formic acid from industrial waste streams with sodium hypochlorite soln becomes explosive at 55 deg C. Several explosions involving methanol and sodium hypochlorite were attributed to formation of methyl hypochlorite, especially in presence of acid or other esterification catalyst. Use of sodium hypochlorite soln to destroy acidified benzyl cyanide residues caused a violent explosion, thought to have been due to formation of nitrogen trichloride. (Sodium hypochlorite)

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid.

Large Spill:
Corrosive liquid. Oxidizing material. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of acetic acid.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as reducing agents, combustible materials, organic materials, metals, acids.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Do not store above 20°C (68°F). Air Sensitive Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Face shield. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
Sodium hypochlorite TWA: 1 CEIL: 1 (ppm as Cl2) STEL: 1 (ppm as Cl2) from ACGIH (TLV) [United States] Sodium hydroxide STEL: 2 (mg/m3) from ACGIH (TLV) [United States] TWA: 2 CEIL: 2 (mg/m3) from OSHA (PEL) [United States] CEIL: 2 (mg/m3) from NIOSH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Clear Liquid.)

Odor: Characteristic. Chlorine-like (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Green to Yellowish. (Light.)

pH (1% soln/water): pH of 10% solution (100 g/l): 12 [Basic.]

Boiling Point: The lowest known value is 100°C (212°F) (Water).

Melting Point: Freezing pt: -3°C (26.6°F)

Critical Temperature: Not available.

Specific Gravity: 1.19 - 1.215 (Water = 1)

Vapor Pressure: 1.6 kPa (@ 20°C)

Vapor Density: The highest known value is 0.62 (Air = 1) (Water).

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, light, air, heat

Incompatibility with various substances: Slightly reactive to reactive with reducing agents, combustible materials, organic materials, metals, acids.

Corrosivity:
Extremely corrosive in presence of aluminum. Moderately corrosive in presence of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Decomposed by carbon dioxide from air. Slowly decomposes on contact with air. Unstable in air unless mixed with sodium hydroxide. Incompatible with ammonium acetate, ammonium carbonate, ammonium nitrate, ammonium oxalate, and ammonium phosphate. Decompostion of sodium hypochlorite takes place within a few seconds with these salts. Also incompatible with primary amines, phenyl acetonitrile, ethyleneimine, methanol, acidified benzyl cyanide, formic acid, urea, nitro compounds, methylscellulose, celloluse, aziridine, ether, ammonia. Mixing this product with chemicals (e.g. ammonia, acids, detergents, etc.) or organic matter (e.g. urine, feces, etc.) will release chlorine gas. Chloramine gas may be evolved when ammonia and bleach are mixed. Decomposed by hot water. Sensitive to light. Exposure to light accelerates decompositon.

Special Remarks on Corrosivity:
Sodium Hypochlorite is extremely corrosive to brass, and moderately corrosive to bronze. There is no corrosivity information for copper.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 5800 mg/kg [Mouse]. (Sodium hypochlorite).

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Sodium hypochlorite]. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. [Sodium hypochlorite]. Contains material which may cause damage to the following organs: lungs, mucous membranes, skin, eyes.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant), of ingestion, . Hazardous in case of skin contact (corrosive), of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May affect genetic material (mutagenic) (Sodium hypochlorite)

Special Remarks on other Toxic Effects on Humans:
Potential Health Effects: May cause severe irritation and burns to skin and eyes. Contact with skin may also cause vesicular eruptions and eczematoid dermatitis which becomes evident upon re-exposure. Prolonged or repeated eye contact may cause conjunctivitis. Ingestion causes burns to the digestive tract. Symptoms may include: 1. pain and inflammation of the mouth, pharynx, esophagus, and stomach, 2. erosion of the mucous membranes (chiefly of the stomach), nausea, vomiting, choking, coughing, hemorrhage, 3. circulatory collapse with cold and clammy skin (due to methemoglobinemia), cyanosis, and shallow respirations, 4. confusion, delirium, coma, 5. edema of the pharynx, glottis, larynx with stridor and obstruction, 6. perforation of the esophagus, or stomach, with mediastinitis or peritonitis. Inhalation causes severe respiratory tract irritation and pulmonary edema. Prolonged or repeated inhalation may cause allergic respiratory reaction (asthma). (Sodium hypochlorite)

Section 12: Ecological Information

Ecotoxicity: It is toxic to fish and aquatic organisms.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Do not discharge effluent containing this product into laks, streams, ponds, estuaries, oceans, or public waters unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product without previously notifying the sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA. Reduce with agents such as bisulfites or ferrous salt solutions. Some heat will be produced. Keep on alkaline side and dilute with copious amounts of water. The main end-product is salt water. Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hypochlorite solution UNNA: 1791 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Sodium hypochlorite Florida: Sodium hypochlorite Minnesota: Sodium hypochlorite Massachusetts RTK: Sodium hypochlorite New Jersey: Sodium hypochlorite TSCA 8(b) inventory: Sodium hypochlorite; Water CERCLA: Hazardous substances.: Sodium hypochlorite: 100 lbs. (45.36 kg);

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS C: Oxidizing material. CLASS E: Corrosive liquid.

DSCL (EEC):
R8- Contact with combustible material may cause fire. R31- Contact with acids liberates toxic gas. R34- Causes burns. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S28- After contact with skin, wash immediately with plenty of water. S36/37/39- Wear suitable protective clothing, gloves and eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 06:32 PM

Last Updated: 05/21/2013 12:00 PM

Michigan Gypsum
2840 Bay Road, Saginaw, Michigan 48603
Fax: (989) 792-8737

Product Safety: (989) 792-8734
Date: March 30, 2007

MATERIAL SAFETY DATA SHEET
Gypsum (Calcium Sulfate Dihydrate)

Section I: PRODUCT IDENTIFICATION

PRODUCT: Gypsum
CHEMICAL FAMILY: Gypsum (Calcium Sulfate Dihydrate, $CASO_4 \bullet 2H_20$)

Section II: INGREDIENTS

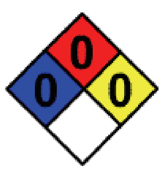
MATERIAL	%	TLV (MG/M^3)	PEL (MG/M^3)	CAS NUMBER
Calcium Sulfate Dihydrate	85-98	10	15(T)5(R)	10101-41-4
Limestone	0-10	10	15(T)/5(R)	1317-65-3
Crystalline Silica	<5	0.1(R)	0.1(R)	14808-60-7

(T) - Total (R) - Respirable

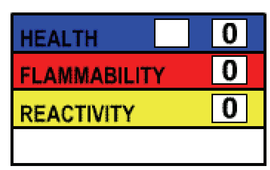
All ingredients of this product are included in the U.S. Environmental Protection Agency's Toxic Substances Control Act Chemical Substance Inventory. All components of this product are included in the Canadian Domestic Substances List (DSL) or the Canadian Non-Domestic Substances List (NDSL).

INFORMATION FOR HANDLING AND IDENTIFICATION OF CHEMICAL HAZARDS

NFPA Ratings:
Health: 0
Fire: 0
Reactivity: 0



HMIS Ratings:
Health: 0
Fire: 0
Reactivity: 0



0 = Minimal Hazard
1 = Slight Hazard
2 = Moderate Hazard
3 = Serious Hazard
4 = Severe Hazard

Personal Protection: Use eye and skin protection. Use NIOSH/MSHA—approved respiratory protection when necessary.

Section III: PHYSICAL DATA

Appearance and Odor: Off white to gray color. An odorless solid.
Melting Point: 1450°C - decomposes
Specific Gravity: 2.32 - 2.96
Solubility in Water: 0.26%

Section IV: FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used): Not combustive
Extinguishing Media: Use extinguishing media appropriate for surrounding fire.
Special Fire Fighting Procedures: None
Unusual Fire and Explosion Hazards: None

Michigan Gypsum
2840 Bay Road, Saginaw, Michigan 48603
Fax: (989) 792-8737

Product Safety: (989) 792-8734
Date: March 30, 2007

MATERIAL SAFETY DATA SHEET
Gypsum (Calcium Sulfate Dihydrate)

Section V: HEALTH HAZARD DATA

This product can release nuisance dust in handling or during use. Eye, skin, nose, throat, and upper respiratory irritation can occur with dust exposure.

EFFECTS OF OVEREXPOSURE:

ACUTE:

EYES: Direct contact can cause mechanical irritation of eyes. If burning, redness, itching, pain or other symptoms persist or develop, consult physician.

SKIN: No toxic effects from powdered gypsum are noticed where air contains contaminate to excess. Frequent exposure may have a drying effect on the skin. Possible itching and irritation may be experienced.

INHALATION: Inhalation of dusts from this product may irritate the nose, throat, lungs, and upper respiratory tract. Persons subjected to large amounts of this dust will be forced to leave area because of nuisance conditions such as coughing, sneezing, and nasal irritation. If respiratory symptoms persist, consult physician.

INGESTION: Gypsum is non-toxic, however, ingestion of a sufficient quantity could lead to mechanical obstruction of the gut, especially the pyloric region.

CHRONIC:

INHALATION: None known for gypsum. Prolonged and repeated exposure to respirable crystalline silica can result in lung disease (i.e., silicosis) and/or lung cancer.

EMERGENCY AND FIRST AID PROCEDURES:

EYES: Flush thoroughly with water for 15 minutes to remove particles. If irritation persists, consult physician.

SKIN: Wash with mild soap and water. A commercially available hand lotion may be used to treat dry skin areas. If skin has become cracked, take appropriate action to prevent infection and promote healing.

INHALATION: Leave the area of dust exposure and remain away until coughing and other symptoms subside. Other measures are usually not necessary, however, if conditions warrant, call physician.

INGESTION: Ingestion of sufficient quantity may result in mechanical obstruction of the gut. If there is any discomfort, consult physician.

TARGET ORGANS: Eyes, skin, lungs, and respiratory system.

MEDICAL CONDITIONS WHICH MAY BE AGGRAVATED: Pre-existing upper respiratory and lung diseases such as, but not limited to, bronchitis, emphysema, and asthma.

PRIMARY ROUTES OF ENTRY: Inhalation, eyes, and skin contact.

CARCINOGENICITY OF INGREDIENTS:

MATERIAL	IARC	NTP
Crystalline Silica	Group 1	Anticipated

In June, 1997, the International Agency for Research on Cancer (IARC) classified crystalline silica (quartz and cristobalite) as a human carcinogen. In making the overall evaluation, the IARC Working Group noted that carcinogenicity in humans was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs. IARC states that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1).

Michigan Gypsum
2840 Bay Road, Saginaw, Michigan 48603
Fax: (989) 792-8737

Product Safety: (989) 792-8734
Date: March 30, 2007

MATERIAL SAFETY DATA SHEET
Gypsum (Calcium Sulfate Dihydrate)

Section VI: REACTIVITY DATA

STABILITY:	Stable
INCOMPATIBILITY:	Acids
HAZARDOUS POLYMERIZATION:	Will not occur
HAZARDOUS DECOMPOSITION:	Above 1450°C could produce SO_2 & CaO

Section VII: SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
Avoid creating excessive dust. Wear appropriate protective equipment. Scoop up material from spillage into a waste container for disposal, or if not contaminated by foreign material it may be reclaimed.

WASTE DISPOSAL METHOD:
Dispose of in accordance with local, state, and federal regulations. Not a hazardous waste.

Section VIII: SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:
Not typically necessary under normal conditions of use. Avoid inhalation of dust. Dust created from mixing or handling may cause eye, nose, throat, or upper respiratory irritation. Wear a NIOSH/MSHA - approved dust respirator if TLV is exceeded and/or when dusty conditions exist. Provide general ventilation and/or local exhaust ventilation to meet TLV requirements.

PROTECTIVE EQUIPMENT:
Gloves or protective clothing are usually not necessary, but may be desirable in specific work situations. Wear adequate clothing to minimize drying of skin. Wear safety glasses or goggles to avoid irritation of the eye.

Section IX: SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:
Avoid creating dust. Keep dry to preserve usefulness. Minimize exposures in accordance with good industrial hygiene practice. During handling wear the appropriate respiratory, eye, and skin protection if warranted per environmental conditions.

CAUTIONS!
Dust may cause eye, skin, nose, throat, or upper respiratory irritation. Avoid inhalation of dust and eye contact. Provide good general ventilation and/or local exhaust to reduce dust exposure. If dusty conditions exist, use NIOSH/MSHA - approved respiratory protection. Wear eye protection to avoid particulate irritation of eye. If eye contact occurs, flush thoroughly with water for 15 minutes. If irritation persists, call physician. Product safety information (989) 792-8734. **KEEP OUT OF REACH OF CHILDREN.**

Material Safety Data Sheet

Material Name: Citric Acid, 50% Solution ID: C1-110L

* * * Section 1 - Chemical Product and Company Identification * * *

Part Number: Technical
Chemical Name: Citric Acid, 50% Solution
Product Use: For Manufacturing Use
Synonyms: 1,2,3-Propanetricarboxylic acid, 2-hydroxy-; 2-Hydroxy-1,2,3-propanetricarboxylic acid; Propane-1,2,3-tricarboxylic acid, 2-hydroxy-; beta-hydroxytricarballylic acid.

Supplier Information

Chem One Ltd.
14140 Westfair East Drive
Houston, Texas 77041-1104

Phone: (713) 896-9966
Fax: (713) 896-7540
Emergency # 1-800-424-9300 or (703) 527-3887

General Comments: FOR MANUFACTURING USE ONLY; NOT TO BE USED AS A PESTICIDE.

NOTE: Emergency telephone numbers are to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure, or accident involving chemicals. All non-emergency questions should be directed to customer service.

* * * Section 2 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
77-92-9	Citric Acid	50%
7732-18-5	Water	50%

Component Information/Information on Non-Hazardous Components

This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).

* * * Section 3 - Hazards Identification * * *

Emergency Overview

Citric Acid 50% Solution is a clear or yellow to brown liquid, with a faint sugary odor. Citric Acid is moderately to severely irritating to eyes, and moderately irritating to skin, and respiratory tract. Citric Acid Solution is not combustible. Use methods suitable for containing (diking) the solution in case of fire or spill. Firefighters should wear full protective equipment when fighting a fire involving this product.

Hazard Statements

DANGER! THIS SOLUTION CAUSES EYE, SKIN, AND RESPIRATORY TRACT IRRITATION OR BURNS. MAY CAUSE ALLERGIC SKIN SENSITIZATION REACTION. Do not breath or ingest mists, vapors, or aerosols. Do not allow contact with eyes, skin, or clothing. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling.

Potential Health Effects: Eyes

This solution may cause severe irritation to the eyes, with symptoms that include redness, tearing, and pain. Concentrated solutions may be corrosive to the eyes and cause corneal ulcerations.

Potential Health Effects: Skin

This product may cause moderate irritation of the skin. Citric Acid may cause allergic contact dermatitis with prolonged or repeated contact in sensitive individuals.

Potential Health Effects: Ingestion

Citric Acid may cause mild gastrointestinal irritation, with symptoms including nausea, diarrhea, vomiting, and abdominal pain. Concentrated solutions may cause necrotic and ulcerative lesions on oral mucous membranes. Chronic ingestion of high concentration Citric Acid can result in erosion of tooth enamel. Repeated ingestion of this solution can result in sensitization to the sun, causing sunburn.

Potential Health Effects: Inhalation

Aerosols and mists from solutions may cause mild to moderate irritation of the nose and throat. Overexposure could cause coughing, sneezing, and labored breathing.

Other Potential Health Effects

Chronic, high concentration overexposure to Citric Acid can result in a reduction of plasma calcium concentration, which can lead to cardiac arrhythmias, reduced cardiac output and, in severe cases, death.

HMIS Ratings: Health Hazard: 2* **Fire Hazard:** 0 **Physical Hazard:** 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

Immediately flush the contaminated eye with plenty of water for 15 minutes. Get medical attention if symptoms of pain, swelling, or tearing exist after flushing the eyes.

First Aid: Skin

For skin contact, immediately wash extremely thoroughly with soap and water. Get medical attention if irritation develops or persists.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Have victim rinse mouth with water, if conscious. Never give anything by mouth to a victim who is unconscious or having convulsions. Contact a physician or poison control center immediately.

First Aid: Inhalation

Remove source of contamination or move victim to fresh air. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Get immediate medical attention.

First Aid: Notes to Physician

There is no specific antidote. Care is symptomatic and supportive.

* * * Section 5 - Fire Fighting Measures * * *

Flash Point: Not applicable.
Method Used: Not applicable.
Upper Flammable Limit (UEL Not applicable.
Lower Flammable Limit (LEL): Not applicable.
Auto Ignition: Not applicable.
Flammability Classification: Not applicable.
Rate of Burning: Not applicable.

General Fire Hazards

Not considered flammable although if allowed to evaporate to dryness, residue may burn in presence of strong ignition source.

Hazardous Combustion Products

Applies to residue: Carbon dioxide and carbon monoxide are normal products of combustion. Incomplete combustion may produce irritating fumes and acrid smoke.

Extinguishing Media

Water, foam, dry chemical, or carbon dioxide. Dike and collect water used to fight fire; runoff may cause damage.

Fire Fighting Equipment/Instructions

Firefighters should wear full protective clothing including self contained breathing apparatus.

NFPA Ratings: Health: 2 **Fire:** 0 **Reactivity:** 0 **Other:**

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

* * * Section 6 - Accidental Release Measures * * *

Containment Procedures

Stop the flow of material, if this can be done without risk. Contain the discharged solution; dike runoff to prevent spill from contaminating storm drains, sewers, soil or groundwater waterways.

Clean-Up Procedures

Wear appropriate protective equipment and clothing during clean-up. Addition of sodium bicarbonate or lime (soda ash) will neutralize Citric Acid and precipitate calcium citrate. Test area of spill with pH paper to assure neutralization. Thoroughly wash the area after a spill clean-up with large quantities of water, flush to drain.

Evacuation Procedures

Evacuate the area promptly and keep upwind of the spilled material. Isolate the spill area to prevent people from entering. Keep incompatible materials away from spilled solution. In case of large spills, follow all facility emergency response procedures.

Special Procedures

Remove soiled clothing and launder before reuse. Avoid all skin contact with the spilled material. Have emergency equipment readily available.

* * * Section 7 - Handling and Storage * * *

Handling Procedures

All employees who handle this material should be trained to handle it safely. Do not breathe vapors or mists. Avoid all contact with skin and eyes. Use this product only with adequate ventilation. Wash thoroughly after handling.

Storage Procedures

Keep container tightly closed when not in use. Keep containers upright, do not drop, roll or skid. Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Material should be stored in secondary containers or in a diked area, as appropriate. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Storage areas should be made of fire- and corrosion-resistant materials. Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Use corrosion-resistant structural materials, lighting, and ventilation systems in the storage area. Floors should be sealed to prevent absorption of this material. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Have appropriate extinguishing equipment in the storage area (i.e., sprinkler system, portable fire extinguishers).

Empty containers may contain residual particulates; therefore, empty containers should be handled with care. Never store food, feed, or drinking water in containers which held this product. Keep this material away from food, drink and animal feed. Do not store this material in open or unlabeled containers. Limit quantity of material stored. Wipe down area of use periodically as area can become sticky.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Exposure Guidelines

A: General Product Information

No exposure guidelines have been established.

B: Component Exposure Limits

ACGIH, OSHA, and NIOSH have not developed exposure limits for any of this product's components.

Engineering Controls

Use mechanical ventilation such as dilution and local exhaust. Use a corrosion-resistant ventilation system and exhaust directly to the outside. Supply ample air replacement.

PERSONAL PROTECTIVE EQUIPMENT

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132). Please reference applicable regulations and standards for relevant details.

Personal Protective Equipment: Eyes/Face

Faceshields and goggles should be worn when working with solutions of Citric Acid. If necessary, refer to U.S. OSHA 29 CFR 1910.133.

Personal Protective Equipment: Skin

Use impervious gloves. Butyl rubber, natural rubber, neoprene, nitrile rubber, polyethylene, or PVC are recommended. If necessary, refer to U.S. OSHA 29 CFR 1910.138.

Personal Protective Equipment: Respiratory

None required where adequate ventilation conditions exist. If airborne concentration is high, use an appropriate respirator with acid dust/mist pre-filters. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

Personal Protective Equipment: General

Have an eyewash fountain and safety shower available in the work area. Use good hygiene practices when handling this material including changing and laundering work clothing after use. Wash hands thoroughly after handling material. Do not eat, drink, or smoke in work areas.

* * * Section 9 - Physical & Chemical Properties * * *

Physical Properties: Additional Information

The data provided in this section are to be used for product safety handling purposes. Please refer to Product Data Sheets, Certificates of Conformity or Certificates of Analysis for chemical and physical data for determinations of quality and for formulation purposes.

Appearance:	Colorless or yellow to brown	**Odor:**	Slight sugar odor.
Physical State:	Liquid	**pH:**	Approx 2.5 or lower
Vapor Pressure:	Not available.	**Vapor Density:**	Not available.
Boiling Point:	104°C (219°F)	**Melting Point:**	Not applicable.
Solubility (H2O):	162 g/100 ml water at 25°C	**Specific Gravity:**	1.24 @ 25°C (77° F)
Freezing Point:	0°C (32°F)	**Particle Size:**	Not applicable.
Softening Point:	Not applicable.	**Evaporation Rate:**	Similar to water.
Viscosity:	7.0 centipoise at 25°C	**Bulk Density:**	Not applicable.
Percent Volatile:	Not available.	**Molecular Weight:**	192.13 (Citric Acid, Anhydrous)
		Chemical Formula:	C6H8O7 (Citric Acid, Anhydrous)

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

Stable under normal conditions. Dilute aqueous solutions of Citric Acid may ferment if left standing for long period of time.

Chemical Stability: Conditions to Avoid

Heat, moisture and incompatible materials.

Incompatibility

Potentially explosive reaction with metal nitrates, strong bases, and oxidizers. Citric Acid is incompatible with reducing agents. Citric Acid Solution is corrosive to brass, copper, zinc, aluminum and their alloys, lead, cast iron and steel (not stainless steel).

Hazardous Decomposition

Residue: Carbon dioxide and carbon monoxide are normal products of combustion. Incomplete combustion may produce irritating fumes and acrid smoke.

Hazardous Polymerization

Hazardous polymerization will not occur.

* * * Section 11 - Toxicological Information * * *

Acute and Chronic Toxicity

A: General Product Information

Citric Acid has been reported to have allergenic properties, and might cause allergic contact dermatitis and sensitization to the sun. Irritation of the skin, eyes, and gastrointestinal tract may occur, but should not require extensive therapy beyond dilution/irrigation. Vapors and solution may cause severe irritation to the eyes, with symptoms that include redness, tearing, and pain. Concentrated solutions may be corrosive to the eyes and cause corneal ulcerations. This product may cause moderate irritation of the skin. Citric Acid may cause mild gastrointestinal irritation, with symptoms including nausea, diarrhea, vomiting, abdominal pain. Concentrated solutions may cause necrotic and ulcerative lesions on oral mucous membranes. Dusts and mists from solutions may cause mild to moderate irritation to the nose and throat. Higher concentrations could cause coughing, sneezing, and labored breathing.

Chronic, high concentration overexposure to Citric Acid can result in a reduction of plasma calcium concentration, which can lead to cardiac arrhythmias, reduced cardiac output and, in severe cases, death.

B: Component Analysis - LD_{50}/LC_{50}

Citric Acid (77-92-9)

LD_{50} (Oral-Rat) 3 gm/kg; LD_{50} (Oral-Mouse) 5040 mg/kg: Lungs, Thorax, or Respiration changes; Musculoskeletal changes; LD_{50} (Subcutaneous-Rat) 5500 mg/kg; LD_{50} (Subcutaneous-Mouse) 2700 mg/kg: Lungs, Thorax, or Respiration changes; Musculoskeletal changes; LD_{50} (Intraperitoneal-Rat) 290 mg/kg; LD_{50} (Intraperitoneal-Mouse) 903 mg/kg; LD_{50} (Intravenous-Mouse) 42 mg/kg: Behavioral: convulsions or effect on seizure threshold; Lungs, Thorax, or Respiration: cyanosis; Gastrointestinal: changes in structure or function of salivary glands; LD_{50} (Intravenous-Rabbit) 330 mg/kg

B: Component Analysis - TDLo/TCLo/LD/LDLo

Citric Acid (77-92-9)

LDLo (Oral-Rabbit) 7 gm/kg: Behavioral: tremor, convulsions or effect on seizure threshold, muscle contraction or spasticity

* * * Section 11 - Toxicological Information (Continued) * * *

Carcinogenicity

A: General Product Information

No information identified.

B: Component Carcinogenicity

None of this product's components are listed by ACGIH, IARC, OSHA, NIOSH, or NTP.

Epidemiology

No information available.

Neurotoxicity

Has not been identified.

Mutagenicity

Citric Acid would not be expected to be genotoxic at physiological concentrations because it is a normal metabolite. It was not mutagenic in Salmonella typhimurium, and did not induce chromosome aberrations in cultured Chinese hamster fibroblast cells.

Teratogenicity

Citric Acid did not cause reproductive effects when tested in experimental animals. The sodium salt did not cause birth defects in rats. When given to rats at 1.2% in the diet over 2 generations, it did not affect reproduction. It did not affect litter size or survival of mice with prenatal exposure to up to 5% in the diet.

Other Toxicological Information

Persons with pre-existing eye, skin, respiratory, or allergic conditions may be more sensitive.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

Water Solubility = 59.2% (20°C); 84% (100°C). Biological Oxygen Demand (BOD): 40%, 5 days; 60%, 10-20 days. Citric Acid biodegrades quite rapidly. It is dangerous to aquatic life in high concentrations. Lowers pH in water but does not dissociate to any great extent.

Food Chain Concentration Potential: Very Low

B: Ecotoxicity

TLm (immersion-shore crab) 48 hours = 160 ppm (salt water); TLm (immersion-goldfish) 4 hr = 894 ppm (fresh water/ killed); EC_0 (*Pseudomonas putida* bacteria) 16 hours = >10,000 mg/L; EC_0 (*Microcystis aeruginosa* algae) 8 days = 80 mg/L; EC_0 (*Scenedesmus quadricauda* green algae) 7 days = 640 mg/L; EC_0 (*Entosiphon sulcatum* protozoa) 72 hours = 485 mg/L; EC_0 (*Uronema parduczi* Chatton-Lwoff protozoa) = 622 mg/L; LD_0 (*Daphnia magna*) = 80 mg/L, long-time exposure in soft water; LD_0 (goldfish) = 625 mg/L, long-time exposure in hard water; LD_{100} (goldfish) = 894 mg/l, long-time exposure in hard water; LD_{100} (*Daphnia magna*) 120 mg/l long-time exposure in soft water; toxic (*Daphnia*) = 100 mg/L; period of survival at pH 4.0 (goldfish) 48 hours = 894 mg/L; period of survival at pH 4.5 (goldfish) 48 hours = 625 mg/L

Environmental Fate

Citric Acid is a naturally occurring chemical and is biodegradable. Octanol/Water Partition Coefficient Log P (oct): -1.72.

* * * Section 13 - Disposal Considerations * * *

US EPA Waste Number & Descriptions

A: General Product Information

Concentrated solutions may be considered D002 wastes (corrosive) by RCRA. Wastes should be tested prior to disposal to determine classification.

B: Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

Disposal Instructions

Review federal, provincial, and local government requirements prior to disposal.

* * * Section 14 - Transportation Information * * *

NOTE: The shipping classification information in this section (Section 14) are meant as a guide to the overall classification of the product. However, transportation classifications may be subject to change with changes in package size. Consult shipper requirements under I.M.O., I.C.A.O. (I.A.T.A.) and 49 CFR to assure regulatory compliance.

US DOT Information

UN #: 3265
Shipping Name: Corrosive liquid, acidic, organic, n.o.s. (Citric Acid)
Hazard Class: 8
Packing Group: II
Required Label(s): Class 8 (Corrosive)

International Air Transport Association (IATA)

UN Number: UN 3265
Proper Shipping Name: Corrosive liquid, acidic, organic, n.o.s. (Citric Acid)
Hazard Class: 8 (Corrosive)
Packing Group: II
Passenger & Cargo Aircraft Packing Instruction: 808
Passenger & Cargo Aircraft Maximum Net Quantity: 5 L
Limited Quantity Packing Instruction (Passenger & Cargo Aircraft): Y808
Limited Quantity Maximum Net Quantity (Passenger & Cargo Aircraft): 1 L
Special Provisions: A97
ERG Code: 8L

International Maritime Organization (I.M.O.) Classification

For shipments via marine vessel transport, the following classification information applies.
UN #: UN 3265
Proper Shipping Name: Corrosive liquid, acidic, organic, n.o.s. (Citric Acid)
Hazard Class: 8 (Corrosive)
Packing Group: II
Special Provisions: 223, 24, 944
Limited Quantities: 1L
Packing Instructions: P001, LP01
EmS: F-A, S-B
Stowage and Segregation: Category A. Clear of Living Quarters

* * * Section 15 - Regulatory Information * * *

US Federal Regulations

A: General Product Information
No additional information.

B: Component Analysis
None of this product's components are listed under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), or CERCLA (40 CFR 302.4).

SARA 302 (EHS TPQ) There are no specific Threshold Planning Quantities for Citric Acid. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs. (4,540 kg) therefore applies, per 40 CFR 370.20.

C: Sara 311/312 Tier II Hazard Ratings:

Component	CAS #	Fire Hazard	Reactivity Hazard	Pressure Hazard	Immediate Health Hazard	Chronic Health Hazard
Citric Acid	77-92-9	No	No	No	Yes	Yes

* * * Section 15 - Regulatory Information (Continued) * * *

State Regulations

A: General Product Information

Other state regulations may apply.

B: Component Analysis - State

California Proposition 65

Citric Acid is not on the California Proposition 65 chemical lists.

Citric Acid and Water are listed as follows: NJ4: New Jersey other (included in 5 predominant ingredients >1%); PA3: Pennsylvania (non-hazardous - present at 3% or greater)

Component	CAS #	CA	FL	MA	MN	NJ	PA
Citric Acid	77-92-9	No	No	No	No	Yes	Yes

Other Regulations

A: General Product Information

No additional information.

B: Component Analysis - Inventory

Component	CAS #	TSCA	DSL	EINECS
Citric Acid	77-92-9	Yes	Yes	Yes

C: Component Analysis - WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Citric Acid	77-92-9	1% item 409 (80)

ANSI Labeling (Z129.1):

DANGER! CORROSIVE. CAUSES EYE, SKIN, AND RESPIRATORY TRACT IRRITATION OR BURNS. MAY CAUSE ALLERGIC SKIN SENSITIZATION REACTION. Do not taste or swallow. Do not get on skin or in eyes. Avoid breathing aerosols or mists. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Keep from contact with clothing. Wear gloves, goggles, faceshields, suitable body protection, and NIOSH/MSHA-approved respiratory protection, as appropriate. **FIRST-AID:** In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. If inhaled, remove to fresh air. If ingested, do not induce vomiting. Get medical attention. **IN CASE OF FIRE:** Use water fog, dry chemical, CO_2, or “alcohol” foam. **IN CASE OF SPILL:** Neutralize spill and wash area. Place residue in suitable container. Consult Material Safety Data Sheet for additional information.

* * * Section 16 - Other Information * * *

Other Information

Chem One Ltd. ("Supplier") shall not be responsible for the use of any information, product, method, or apparatus herein presented ("Information"), and you must make your own determination as to its suitability and completeness for your own use, for the protection of the environment, and for health and safety purposes. You assume the entire risk of relying on this Information. In no event shall Supplier be responsible for damages of any nature whatsoever resulting from the use of this product or products, or reliance upon this Information. By providing this Information, Supplier neither can nor intends to control the method or manner by which you use, handle, store, or transport Supplier products. If any materials are mentioned that are not Supplier products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed. Supplier makes no representations or warranties, either express or implied of merchantability, fitness for a particular purpose or of any other nature regarding this information, and nothing herein waives any of Supplier's conditions of sale.
This information could include technical inaccuracies or typographical errors. Supplier may make improvements and/or changes in the product (s) and/or the program (s) described in this information at any time. If you have any questions, please contact us at Tel. 713-896-9966 or E-mail us at Safety@chemone.com.

Key/Legend

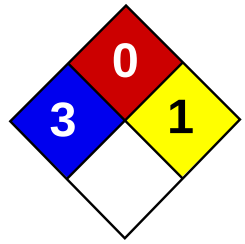
EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health; NA = Not available or not applicable g = grams; kg = kilograms GRAS = Generally regarded as safe

Contact: Sue Palmer-Koleman, PhD **Contact Phone:** (713) 896-9966

Revision log:

09/21/00 2:10 PM HDF Revision to health hazard information. Addition of 49 CFR information in Transportation Section (Section 14).
05/14/01 9:31 AM Checked exposure limits; made changes to Section 9; overall review, add SARA 311/312 Hazard Ratings.
08/12/03: 10:05 AM HDF General review and up-date of entire MSDS. Up-date of HMIS categories. Up-date of Section 8. Up-date of Section 14.
12/29/03 10:32 AM CLW Revised signal word from Warning to Danger so that it the signal word in the ANSI label is the same as the one on page 1 of this MSDS. Deleted pH value shown in Section 9, replaced with “Not Available”; In Section 14 deleted the statements in parentheses behind the hazard class for US DOT Information transport. Deleted the word "or in Bulk Packaging" in same section under Additional Info. In the International Air Transport Section deleted the default paragraph " For shipments by Air Transport...” .Corrected Contact name in Section 16 and in “Other Information” and deleted the last sentence “Revision date 05/30/01”.
12/29/03 02:47 PM CLW Section 14 changed Packing group , listed as III, to Packing group II, removed “Additional Info section on Limited Quantities & Exceptions, and changed UN/NA# to UN #.
12/29/03 03:57 PM CLW Added pH value in Section 9.
06/22/05 2:04PM SEP Updated IATA Section 14.
6/07/06 10:31 AM HDF Addition of Proposition 65 statement in Section 15
09/05/06 SEP 2:38 PM Updated DOT & IMO Section 14
10/10/08 3:07 PM DLY Changed Chem One Physical Address, Section 1

This is the end of MSDS # C1-110



Health	3
Fire	0
Reactivity	1
Personal Protection	

Material Safety Data Sheet
Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth. Repeated or prolonged exposure to the substance can produce target

organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Non combustible. Calcium carbide reacts with hydrogen chloride gas with incandescence. Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine. Rubidium acetylene carbides burns with slightly warm hydrochloric acid. Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved. Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammble gas. Cesium acetylene carbide burns hydrogen chloride gas. Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute. Reacts with most metals to produce flammable Hydrodgen gas.

Special Remarks on Explosion Hazards:

Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4 , Vinyl acetate. Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
CEIL: 5 (ppm) from OSHA (PEL) [United States] CEIL: 7 (mg/m3) from OSHA (PEL) [United States] CEIL: 5 from NIOSH CEIL: 7 (mg/m3) from NIOSH TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)] TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:
108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C @ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)

Melting Point:
-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:
1.1- 1.19 (Water = 1) 1.10 (20%and 22% HCl solutions) 1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl solution) 1.19 (37% and 38%HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:
Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalies (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothmeric reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the folloiwng can cause explosion or ignition on contact or

Special Remarks on Corrosivity:

Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinium, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, . Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (fetoxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Corrosive. Causes severe skin irritation and burns. Eyes: Corrosive. Causes severe eye irritation/conjuntivitis, burns, corneal necrosis. Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and larryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well has headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure, occur, particularly if exposure is prolonged. May affect the liver. Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomitting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophogeal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Hydrochloric acid Illinois toxic substances disclosure to employee act: Hydrochloric acid Illinois chemical safety act: Hydrochloric acid New York release reporting list: Hydrochloric acid Rhode Island RTK hazardous substances: Hydrochloric acid Pennsylvania RTK: Hydrochloric acid Minnesota: Hydrochloric acid Massachusetts RTK: Hydrochloric acid Massachusetts spill list: Hydrochloric acid New Jersey: Hydrochloric acid New Jersey spill list: Hydrochloric acid Louisiana RTK reporting list: Hydrochloric acid Louisiana spill reporting: Hydrochloric acid California Director's List of Hazardous Substances: Hydrochloric acid TSCA 8(b) inventory: Hydrochloric acid TSCA 4(a) proposed test rules: Hydrochloric acid SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R34- Causes burns. R37- Irritating to respiratory system. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 05:45 PM

Last Updated: 05/21/2013 12:00 PM

MATERIAL SAFETY DATA SHEET

Sodium Bisulfite, Solution

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Sodium Bisulfite Solution **Formula:** $NaHSO_3$ **Molecular Weight:** 104.06
Chemical Name: Sodium Bisulfite **Chemical Family:** Bisulfite, sodium salt
Synonyms: Sodium Bisulphite, Aqueous Solution; Sodium Hydrogen Sulfite; Sodium disulfite; Sulfurous acid, monosodium salt; Sodium acid sulfite
Product Use: For the manufacture of perfume, pharmaceuticals, photochemicals, bleaching agent, and papermaking.

Chemtrade Logistics
111 Gordon Baker Road
Suite 301
North York, ONT
M2H 3R1
(416) 496-5856
1-866-887-8805

Chemtrade Logistics
11450 Cherrier Street
Montreal East, PQ
H1B 1A6
1-888-840-4720

Emergency Telephone Number
Chemtrec 1-800-424-9300
Canutec (613) 996-6666

2. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Ingredients	**% by Wt.**	**CAS Number**
Sodium Bisulfite	35 - 44%	7631-90-5

Non-Hazardous Ingredients		
Water	56 – 65%	7732-18-5

3. HAZARD INFORMATION

EMERGENCY OVERVIEW:

Δ **Danger! Contains material, which causes damage to the following organs: mucous membranes, respiratory tract, skin, eye, lens or cornea. Incompatible with acids and oxidizers (acidification will liberate sulfur dioxide gas). Thermal decomposition products are corrosive and/or toxic and include oxides of sulfur.**

Sodium Bisulfite is a clear, colorless to light yellow liquid with distinctive odor. Pungent odor of Sulfur Dioxide.

Hazardous Material Information System (U.S.A.)

Health	*	2
Fire Hazard		0
Reactivity		0
Personal Protection		C

National Fire Protection Association (U.S.A.)

3. HAZARD INFORMATION (continued)

POTENTIAL HEALTH EFFECTS:

	ACGIH (TLV)(2003)	NIOSH REL (2001)	OSHA PEL (1989)
Sodium Bisulfite	5 mg/m^3 (TWA)	5 mg/m^3 (TWA -10 hrs)	Δ 5 mg/m^3 (TWA)

In contact with the skin: Sodium Bisulfite may cause symptoms of skin irritation such as reddening, swelling, rash, scaling or blistering.

In contact with the eyes: Vapors from this product are irritating to the eyes. This product causes irritation, redness, and pain. May cause burns if left untreated.

Inhaled: Product is irritating to the nose, throat and respiratory tract.

Ingested: May cause allergic reaction in some asthmatics. Ingestion of large amounts may cause nausea, gastrointestinal upset and abdominal pain. May cause central nervous system(CNS) depression, nausea and vomiting, diarrhea, violent colic and death.

Long Term Exposure:

Existing Medical Conditions Possibly Aggravated By Exposure: Breathing of fumes may aggravate acute or chronic asthma and chronic pulmonary disease such as emphysema and bronchitis. May cause allergic reactions in sulfide sensitive individuals.

Carcinogenicity Data:

Sodium bisulfite is not classified by NTP (National Toxicology Program), not regulated as carcinogenic by OSHA (Occupational Safety and Health Administration), and has been evaluated by IARC (International Agency for Research on Cancer) as a Group 3 (are not classifiable as to their carcinogenicity to humans). ACGIH (American Conference of Governmental Industrial Hygienists) classifies it as an A4= Not classifiable as a human carcinogen.

4. FIRST AID MEASURES

Precaution: Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.

Skin contact: Flush skin with running water for a **minimum** of 20 minutes. Start flushing while removing contaminated clothing. If irritation persists, repeat flushing. Obtain medical attention IMMEDIATELY. Do not transport victim unless the recommended flushing period is completed or flushing can be continued during transport.

4. FIRST AID MEASURES (continued)

For minor skin contact, avoid spreading material on unaffected skin. Discard heavily contaminated clothing and shoes in a manner which limits further exposure. Otherwise, wash clothing separately before reuse.

Eye contact: Immediately flush eyes with running water for a **minimum** of 20 minutes. Hold eyelids open during flushing. If irritation persists, repeat flushing. Obtain medical attention IMMEDIATELY. Do not transport victim until the recommended flushing period is completed unless flushing can be continued during transport.

Inhalation: Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give Cardiopulmonary Resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical attention IMMEDIATELY.

Ingestion: DO NOT INDUCE VOMITING. If victim is alert and not convulsing, rinse mouth and give ½ to 1 glass of water to dilute material. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus, rinse mouth and administer more water. IMMEDIATELY contact local poison control centre. Vomiting may need to be induced but should be directed by a physician or a poison control centre. IMMEDIATELY transport victim to an emergency facility.

5. FIRE FIGHTING MEASURES

Flash Point (method): Not applicable, product is non-flammable
Autoignition Temperature: Not combustible
Flammability Limits in air(%): UEL: Not applicable **LEL:** Not applicable

Fire Extinguishing Media: For small fires use dry chemical, carbon dioxide or water spray. For large fires, use dry chemical, carbon dioxide, alcohol-resistant foam or flood fire area with water. Do not get solid stream of water on spilled material.

Special Fire Fighting Procedures: Oxides of Sulfur may be present during a fire. Use self-contained breathing apparatus and full protective clothing are recommended. Gas tight suits are required in extreme (>1000 ppm) concentrations of Sulfur dioxide. Evacuate residents who are downwind of fire. Prevent unauthorized entry to fire area. Dike area to contain runoff and prevent contamination of water sources. Neutralize runoff with lime, soda ash or other suitable neutralizing agents (see Deactivating Chemicals, Section 6). Cool containers that are exposed to flame with streams of water until fire is out.

Other Fire or Explosion Hazards: Thermal decomposition products are toxic and include oxides of Sulfur. Sodium sulfide may be formed after dried solution residues are heated. This is an explosive hazard and strongly alkaline in contact with water.

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken in the event of a spill or leak: Remove all ignition sources. Ventilate area. Use appropriate Personal Protection Equipment. Prevent liquid from entering sewers or waterways. Dike with inert material (sand, earth, etc.). Stop or reduce leak if safe to do so. Collect into containers for reclamation or disposal only if container is suitable to withstand the material. Consider insitu neutralization and disposal. Ensure adequate decontamination of tools and equipment following clean up. Comply with Federal, Provincial/State and local regulations on reporting releases.

Deactivating Chemicals: Alkali materials such as dilute sodium hydroxide, Lime, limestone, sodium carbonate (soda ash), sodium bicarbonate, dilute aqua ammonia. Sulfur dioxide may be released during neutralization.

Waste Disposal Methods: Dispose of waste material at an approved waste treatment/disposal facility, in accordance with applicable regulations. Do not dispose of waste with normal garbage or to sewer systems.

Note - Clean-up material may be a RCRA Hazardous Waste on disposal.
- Spills are subject to CERCLA reporting requirements: RQ = 5000 lbs (2270 kg)

7. HANDLING AND STORAGE

Precautions: Wear appropriate Personal Protection Equipment. Keep ignition sources away from Sodium Bisulfite storage, handling and transportation equipment. Keep containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Ensure all containers are labeled. **Do not expose to strong acids as this will liberate sulfur dioxide gas.**

Handling Procedures and Equipment: Rubber lined carbon steel or certain stainless steel materials are suitable for use. Contact CHEMTRADE LOGISTICS for specific recommendations when handling Sodium Bisulfite.

Storage Temperature: Store above freezing point (Section 9). Ideal storage temperatures are between and 20 and 27 degrees Centigrade.

Storage Requirements: Store in corrosion-proof area away from incompatible substances. Store in tightly closed container, preferably the supplier container. Store in a cool, well, ventilated location away from heat, sparks and flames. Storage tanks should be constructed from polyethylene, polypropylene, fiberglass-reinforced plastic (FRP), cross-linked polyethylene (XLPE), or 316 stainless steel to avoid corrosion problems. Tanks should be vented into an alkaline fume recovery system or scrubber. Storage tanks should be protected from water ingress, and maintained structurally in a safe and reliable condition.

Other Precautions: On exposure to air the product will lose some sulfur dioxide and gradually oxidize to sulfate. Both acidification and heating accelerate the release of sulfur dioxide fumes.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Recommendations listed in this section indicate the type of equipment which will provide protection against over exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

∆ **Engineering Controls:** Provide exhaust ventilation or other controls to keep the airborne concentrations of vapors below their respective occupational exposure limits. Ensure the eyewash stations and safety showers are proximal to the workstation location.

Respiratory Protection: A NIOSH/MSHA approved air-purifying respirator equipped with acid gas/fume, dust, mist cartridges for concentrations up to 50mg/m ^{3} or 20 ppm as sulfur dioxide. A powered air-purifying respirator with acid gas cartridges for up to 50 ppm sulfur dioxide. A full-facepiece air-supplied respirator if concentrations are for up to and higher than 100 ppm sulfur dioxide.

Skin Protection: Impervious (i.e., neoprene, PVC, rubber) gloves, coveralls, boots and/or other acid resistant protective clothing.

Eye Protection: Tight-fitting chemical goggles and face shield.

Other Personal Protective Equipment: Where there is a danger of spilling or splashing, acid resistant aprons or suits should be worn. Trouser legs should be worn outside (not tucked in) rubber boots. Safety showers and eyewash fountains should be installed in storage and handling areas.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid

Appearance and Odour: Clear, colourless to light yellow liquid with distinctive odour. Pungent odour of Sulfur dioxide.

Odour Threshold: No data

Boiling Point: 104°C (220°F)

Melting/Freezing Point: Approximately 6°C (43°F)

Vapour Pressure: 32 mmHg at 20°C, 78 mm Hg (10.4 kPA)at 37.7°C

Specific Gravity at 25°C (77°F) 1.33 for 38%

∆ **Vapour Density: (Air=1):** Highest known value is 0.62 (Air=1) (Water)

Bulk Density: Not applicable (see specific gravity)

Evaporation Rate: Not applicable

Solubility: Miscible in all proportions in water.

pH: 3.8 to 5.2

10. STABILITY AND REACTIVITY

Stability: Under Normal Conditions: On exposure to air the product will lose some sulfur dioxide and gradually oxidize to sulfate. Under Fire Conditions: Decomposes to form oxides of sulfur.

Conditions to Avoid: High temperatures, sparks, open flames and all other sources of ignition. Temperatures at or near boiling point causes evolution of Sulfur dioxide.

Materials to Avoid: Strong oxidizers, may cause strong exothermic reaction. Lewis or mineral acids (acidification will liberate sulfur dioxide gas).

Hazardous Decomposition or Combustion Products: Thermal decomposition products are toxic and include oxides of Sulfur.

Hazardous Polymerization: Will not occur

11. TOXICOLOGICAL INFORMATION

Ingredient Name	Test	Result	Route	Species
∆ Sodium Bisulfite Solution	LD50	2000 mg/kg	Oral	Rat

Carcinogenicity Data: Sodium bisulfite is not classified by NTP (National Toxicology Program), not regulated as carcinogenic by OSHA (Occupational Safety and Health Administration), and has been evaluated by IARC (International Agency for Research on Cancer) as a Group 3 (are not classifiable as to their carcinogenicity to humans). ACGIH (American Conference of Governmental Industrial Hygienists) classifies it as an A4 = Not classifiable as a human carcinogen.

Reproductive Effects: Not available

Mutagenicity Data: Evidence of mutagenic activity in bacteria, microorganisms, and DNA.

Teratogenicity Data: Not available

Synergistic Materials: None known

12. ECOLOGICAL INFORMATION

Ingredient Name	Species	Period	Result
Sodium Bisulfite Solution	Mosquito fish. (LC50)	96 hour(s)	240 ppm

Products of : These products are sulfur oxides (SO2, SO3). Some metallic oxides.

Toxicity of the Products of Biodegradation : The products of degradation are toxic.

13. DISPOSAL CONSIDERATIONS

- Responsibility for proper waste disposal is with the owner of the waste. Work with the appropriate regulatory bodies to ensure compliance with regulations.
- Consider the collection of residual Sodium Bisulfite into containers for reclamation or disposal only if the container is suitable to withstand the material.
- Consider insitu neutralization and disposal.
- Clean-up material may be a RCRA Hazardous Waste on disposal.
- Provincial/State or local regulations or restrictions are complex and may differ from Federal regulations.
- The information applies to the material as manufactured; processing, neutralizing, use or contamination may make the information inappropriate, inaccurate or incomplete.

14. TRANSPORT INFORMATION

U.S. (Under DOT)

Shipping Name: RQ, Bisulfites, aqueous solutions, n.o.s.
Hazard Class or Division: 8
Product Identification No. (PIN): UN 2693
Packing Group: III
Reportable Quantity (RQ) = 5000 lbs (2270kg)

Canada (Under TC)

Shipping Name: Bisulfite, aqueous solution, n.o.s. (sodium bisulfite)
Classification(s): 8
Product Identification No. (PIN): UN 2693
Packing Group: III

∆ **ERG** 154

15. REGULATORY INFORMATION

U.S.A.

SARA Title III HAZARD CATEGORIES AND LISTS

Product Hazard Categories		Lists	
Acute (Immediate) Health:	Yes	Extremely Hazardous Substance (40 CFR 355, SARA Title III Section 302)	n/a
Chronic (Delayed) Health:	No		
Fire:	No	CERCLA Hazardous Substance (40 CFR 302.4)	Yes
Reactivity:	No		
Sudden Release of Pressure:	No	Toxic Chemical (40 CFR 372.65, SARA Title III Section 313)	Yes

Reportable Quantity (RQ) under U.S. EPA CERCLA: RQ=5000 lb

TSCA Inventory Status: Reported/Included

Right-To-Know: Illinois, Massachusetts, New Jersey, Pennsylvania

∆ **California prop. 65**: No products were found.

CANADA

Workplace Hazardous Materials Information System (WHMIS)

∆ **WHMIS Classification(s):** Class D-2B Material causing other toxic effects (TOXIC)
Class E – Corrosive

CEPA DSL: All components listed.

∆ **WHMIS Health Effects Index:** Corrosive Material
Sensitizing Material

WHMIS Ingredient Disclosure List: Confirmed A; Meets criteria for disclosure at 1% or greater.

EINECS Number: 231-548-0

16. OTHER INFORMATION

Additional Information and References

1. "CHEMINFO" through "CCINFOdisc", Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada, Aug 1999.

2. CHEMLIST, American Chemical Society, Nov 1999.

3. DOSE, Royal Society of Chemistry, Aug 1999

4. **HSDB-Hazardous Substances Data Bank** , through "CCINFO disc", Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada, (November, 1999).

5. RTECS- Registry of Toxic Effects of Chemical Substances, On-line search, Canadian Centre for Occupational Health and Safety RTECS database, Aug 1999.

6. Transportation of Dangerous Goods Act and Regulations, Canadian Centre for Occupational Health and Safety, Aug 1999.

7. Threshold Limit Values for Chemical Substances and Physical Agents, Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, 1999.

Revision Indicators:

∆ in the left margin indicates a revision or addition of information since the previous issue.

16. OTHER INFORMATION (continued)

Legend:

CAS #	- Chemical Abstracts Service Registry Number
CERCLA	- Comprehensive Environmental Response, Compensation, and Liability Act
CFR	- Code of Federal Regulations
DOT	- Department of Transportation
EPA	- Environmental Protection Agency
LC_{50}	- The concentration of material in air expected to kill 50% of a group of test animals
LD_{50}	- Lethal Dose expected to kill 50% of a group of test animals
LEL	- Lower Explosive Limit
MSHA	- Mine Safety and Health Administration
NIOSH	- National Institute for Occupational Safety and Health
PEL	- Permissible Exposure Limit
PVC	- Polyvinyl chloride
RCRA	- Resource Conservation and Recovery Act
SARA	- Superfund Amendments and Reauthorization Act of the U.S. EPA
STEL	- Short Term Exposure Limit
TC	- Transport Canada
TDG	- Transportation of Dangerous Goods Act/Regulations
TLV	- Threshold Limit Value
TSCA	- Toxic Substances Control Act
TWA	- Time-Weighted Average
UEL	- Upper Explosive Limit

Prepared by Chemtrade Logistics 1-866-887-8805

SAFETY DATA SHEET

1. Identification

Product identifier **Sodium Hydroxide Solution 10-30%**

Other means of identification

SDS number 10000014

Synonyms Caustic Soda, Caustic, Caustic soda solution, Sodium hydroxide, Caustic alkali, Lye, Caustic lye, Sodium Hydrate.

Recommended use Pulping and Bleaching, pH neutralizer, Detergent, Soaps.

Recommended restrictions None known.

Manufacturer / Importer / Supplier / Distributor information

Company name Olin Chlor Alkali Products
Address 490 Stuart Road, NE
Cleveland, TN 37312

Company name Pioneer Americas, LLC (d/b/a Olin Chlor Alkali Products)
Address 490 Stuart Road, NE
Cleveland, TN 37312

Company name Olin Canada ULC (d/b/a Olin Chlor Alkali Products)
Address 2020 University, Suite 2190
Montreal, Quebec H3A 2A5

General Information
Telephone (888) 658-6SDS (737)
Website olinchloralkali.com
Contact person ORC SDS Control Group
Emergency phone number CHEMTREC
US: 1-800-424-9300 Canada: 1-800-567-7455

2. Hazard(s) identification

Physical hazards	Corrosive to metals	Category 1
Health hazards	Acute toxicity, oral	Category 4
	Skin corrosion/irritation	Category 1
	Serious eye damage/eye irritation	Category 1
OSHA defined hazards	Not classified.	

Label elements

Signal word Danger

Hazard statement May be corrosive to metals. Harmful if swallowed. Causes severe skin burns and eye damage.

Precautionary statement

Prevention Keep only in original container. Wear protective gloves/protective clothing/eye protection/face protection. Do not eat, drink or smoke when using this product. Do not breathe mist or vapor. Wash thoroughly after handling.

Response If swallowed: Rinse mouth. Do NOT induce vomiting. If inhaled: Remove person to fresh air and keep comfortable for breathing. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor/. Wash contaminated clothing before reuse. Absorb spillage to prevent material damage.

Storage Store locked up.

Disposal Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC) Not classified.

Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 3

Supplemental information

Hazard statement	Harmful to aquatic life.
Precautionary statement	
Prevention	Avoid release to the environment.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Sodium hydroxide	1310-73-2	10 - 30

4. First-aid measures

Inhalation	Move to fresh air. If breathing is difficult, give oxygen. If breathing stops, provide artificial respiration. Do not use mouth-to-mouth method if victim inhaled the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Call a physician or poison control center immediately.
Skin contact	Take off immediately all contaminated clothing. Wash off IMMEDIATELY with plenty of water for at least 15-20 minutes. Get medical attention immediately! Wash clothing separately before reuse. Destroy or thoroughly clean contaminated shoes.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician or poison control center immediately.
Ingestion	Call a physician or poison control center immediately. Do not induce vomiting. Immediately rinse mouth and drink plenty of water. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Never give anything by mouth to an unconscious person. Do not use mouth-to-mouth method if victim ingested the substance.
Most important symptoms/effects, acute and delayed	Burning pain and severe corrosive skin damage. Permanent eye damage including blindness could result. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Shortness of breath.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Symptoms may be delayed. Keep victim under observation.
General information	In the case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO_2). Use extinguishing agent suitable for type of surrounding fire.
Unsuitable extinguishing media	Do not use a solid water stream as it may scatter and spread fire. Do not use halogenated extinguishing agents.
Specific hazards arising from the chemical	The product itself does not burn. May decompose upon heating to produce corrosive and/or toxic fumes. Contact with metal may release flammable hydrogen gas.
Special protective equipment and precautions for firefighters	Fire fighters should enter the area only if they are protected from all contact with the material. Full protective clothing, including self-contained breathing apparatus, coat, pants, gloves, boots and bands around legs, arms, and waist, should be worn. No skin surface should be exposed.
Fire-fighting equipment/instructions	In case of fire and/or explosion do not breathe fumes. Move containers from fire area if you can do so without risk. Use water spray to cool unopened containers.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Local authorities should be advised if significant spillages cannot be contained.
Methods and materials for containment and cleaning up	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb spill with inert material (e.g., dry sand or earth), then place in a chemical waste container. Following product recovery, flush area with water. Small Spills: Absorb spill with vermiculite or other inert material. Clean surface thoroughly to remove residual contamination. Never return spills in original containers for re-use. For waste disposal, see section 13 of the MSDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Use caution when combining with water; DO NOT add water to caustic; ALWAYS add caustic to water while stirring to minimize heat generation. Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Do not breathe mist or vapor. Use only with adequate ventilation. Wear appropriate personal protective equipment. Transfer and storage systems should be compatible and corrosion resistant. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Keep container tightly closed. Store in a cool, dry, well-ventilated place. Store in corrosive resistant container with a resistant inner liner. Store away from incompatible materials (See Section 10). Store at temperatures not exceeding 40°C/104°F. Compatible storage materials may include, but not be limited to, the following: nickel and nickel alloys, steel, plastics, plastic or rubber-lined steel, FRP, or Derakane vinyl ester resin. Do not allow material to freeze.

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Sodium hydroxide (CAS 1310-73-2)	PEL	2 mg/m3

US. ACGIH Threshold Limit Values

Components	Type	Value
Sodium hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m3

US NIOSH Pocket Guide to Chemical Hazards: Ceiling Limit Value and Time Period (if specified)

Components	Type	Value
Sodium hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m3

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear chemical goggles and face shield.

Skin protection

Hand protection Wear appropriate chemical resistant gloves.

Other Wear appropriate chemical resistant clothing.

Respiratory protection If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. Respirator type: Chemical respirator with organic vapor cartridge and full facepiece.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations When using, do not eat, drink or smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	Viscous liquid.
Physical state	Liquid.
Form	Liquid.
Color	Water white.
Odor	Odorless.
Odor threshold	Not available.
pH	14 (77°F (25°C)) (0.5% solution)
Melting point/freezing point	35 °F (1.67 °C) (30% solution)
Initial boiling point and boiling range	235 °F (112.78 °C) (30% solution)
Flash point	Not available.

Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	23.76 mm Hg (approximately) (77 °F (25 °C))
Vapor density	Not available.
Relative density	1.33 (30% solution)
Relative density temperature	68 °F (20 °C)
Solubility(ies)	Completely miscible with water.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	1.33 g/cm3 (68 °F (20 °C)) (30% solution)
Molecular formula	NaOH

10. Stability and reactivity

Reactivity	Contact with metal may release flammable hydrogen gas.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Reacts violently with strong acids. This product may react with oxidizing agents. Do not mix with other chemicals. Corrosive to aluminum, tin, zinc, copper and most alloys in which they are present including brass and bronze. Corrosive to steels at elevated temperatures above 40°C (104°F).
Incompatible materials	Oxidizing agents. Acids. Phosphorus. Aluminum. Zinc. Tin. Initiates or catalyzes violent polymerization of acetaldehyde, acrolein or acrylonitrile.
Hazardous decomposition products	Contact with metals (aluminum, zinc, tin) and sodium tetrahydroborate liberates hydrogen gas.

11. Toxicological information

Information on likely routes of exposure	
Ingestion	Causes digestive tract burns. Harmful if swallowed.
Inhalation	May cause irritation to the respiratory system.
Skin contact	Causes severe skin burns.
Eye contact 500 Standard Draize test Species: Rabbit Test Duration: 24 hours Severity: Severe	Causes severe eye burns. Causes serious eye damage.
Symptoms related to the physical, chemical and toxicological characteristics	Burning pain and severe corrosive skin damage. Permanent eye damage including blindness could result.
Information on toxicological effects	
Acute toxicity	Harmful if swallowed.

Product	Species	Test Results
Sodium Hydroxide Solution 10-30%		
Acute		
Dermal		
LD50	Rabbit	> 2 g/kg
Oral		
LD50	Rat	300 - 500 mg/kg
Other		
LD50	Mouse	40 mg/kg, Intraperitoneal

Skin corrosion/irritation Causes severe skin burns and eye damage. Standard Draize Test: 500 mg/24 hour(s) skin - rabbit severe.

Serious eye damage/eye irritation Causes severe eye burns. Causes serious eye damage. Standard Draize Test: 400 µg eyes - rabbit mild; 1 percent eyes - rabbit severe.

Respiratory sensitization No data available.

Skin sensitization No data available.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

Reproductive toxicity No data available.

Specific target organ toxicity - single exposure Not available.

Specific target organ toxicity - repeated exposure Not available.

Aspiration hazard Droplets of the product aspirated into the lungs through ingestion or vomiting may cause a serious chemical pneumonia.

Chronic effects Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity Harmful to aquatic life.

Product		Species	Test Results
Sodium Hydroxide Solution 10-30%			
Aquatic			
Fish	LC50	Bluegill (Lepomis macrochirus)	99 mg/l, 48 hours
		Mosquitofish (Gambusia affinis affinis)	125 mg/l, 96 hours

Persistence and degradability Expected to degrade rapidly in air.

Bioaccumulative potential The product is not expected to bioaccumulate.

Mobility in soil Not available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. This material and its container must be disposed of as hazardous waste. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazardous waste code The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number UN1824

UN proper shipping name	Sodium hydroxide solution
Transport hazard class(es)	8
Subsidiary class(es)	-
Packing group	II
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	B2, IB2, N34, T7, TP2
Packaging exceptions	154
Packaging non bulk	202
Packaging bulk	242

IATA

UN number	UN1824
UN proper shipping name	Sodium hydroxide solution
Transport hazard class(es)	8
Subsidiary class(es)	-
Packaging group	II
Environmental hazards	No
Labels required	8
ERG Code	8L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number	UN1824
UN proper shipping name	SODIUM HYDROXIDE SOLUTION
Transport hazard class(es)	8
Subsidiary class(es)	-
Packaging group	II
Environmental hazards	
Marine pollutant	No
Labels required	Not available.
EmS	F-A, S-B
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

CERCLA Hazardous Substance List (40 CFR 302.4)

Sodium hydroxide (CAS 1310-73-2)	LISTED

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - Yes

SARA 302 Extremely hazardous substance No

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)
Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA)	Not regulated.
Food and Drug Administration (FDA)	Not regulated.

US state regulations

US. Massachusetts RTK - Substance List

Sodium hydroxide (CAS 1310-73-2)

US. New Jersey Worker and Community Right-to-Know Act

Not regulated.

US. Pennsylvania RTK - Hazardous Substances

Sodium hydroxide (CAS 1310-73-2)

US. Rhode Island RTK

Sodium hydroxide (CAS 1310-73-2)

US. California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Not listed.

International Inventories

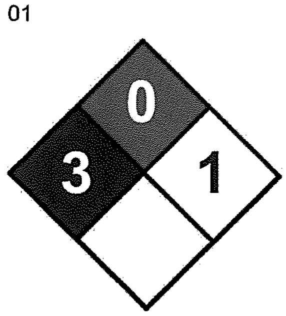
Country(s) or region	**Inventory name**	**On inventory (yes/no)***
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	20-December-2013
Revision date	-
Version #	01

NFPA Ratings



List of abbreviations

LD50: Lethal Dose, 50%.
LC50: Lethal Concentration, 50%.
EC50: Effective concentration, 50%.
TWA: Time weighted average.

References

EPA: AQUIRE database
HSDB® - Hazardous Substances Data Bank
US. IARC Monographs on Occupational Exposures to Chemical Agents
IARC Monographs. Overall Evaluation of Carcinogenicity
ACGIH Documentation of the Threshold Limit Values and Biological Exposure Indices

Disclaimer

This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment.

MATERIAL SAFETY DATA SHEET

Aluminum Chlorohydrate

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Manufacturer's Name and Address:

ALTIVIA Chemicals, LLC
1100 Louisiana, Ste. 4800
Houston, TX 77002
USA • (713) 658-9000
24 Hour Emergency – Chemtrec (800) 424-9300

PRODUCT NAME:	**Aluminum Chlorohydrate**
CHEMICAL NAME/ FAMILY:	Metal Salts
SYNONYMS:	Aluminum Chlorohydrate, Polyaluminum Chloride, Aluminum Chlorohydroxide
MOLECULAR FORMULA:	$Al_n(OH)_mCl_{3n-m}$
PRODUCT USE:	Coagulant/ Flocculant
MANUFACTURER:	ALTIVIA Chemicals, LLC, 1100 Louisiana, Suite 4800, Houston, TX 77002

SECTION 2: COMPOSITION/ INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS NUMBER	% RANGE
Aluminum Chlorohydrate	12042-91-0	< 50%
Water	7732-18-5	Balance

* Denotes chemical subject to reporting requirements of Section 313 of Title III of the 1986 Superfund Amendments and Reauthorization Act (SARA) and 40 CFR Part 372.

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Clear to slightly hazy, colorless to amber liquid with no appreciable odor. CAUTION! May cause skin, eye and respiratory irritation. May be harmful if swallowed.

POTENTIAL HEALTH EFFECTS

EYE
May cause irritation with redness and swelling. Prolonged exposure may cause conjunctivitis.

SKIN

Possible irritant. May cause irritation, especially on prolonged contact.

INGESTION
May be harmful if swallowed. Irritation of the mouth and stomach. May cause nausea, vomiting, and diarrhea.

INHALATION
Inhalation of mist or spray may cause irritation to the mucous membranes.
SIGNS AND SYMPTOMS OF EXPOSURE
Irritation to exposed tissue. Nausea, vomiting, stomach cramps, diarrhea.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
No available information for the product.

EFFECTS FOLLOWING REPEATED EXPOSURE
This product is expected to be an irritant to the skin, eyes and mucous membrane. Irritation may become severe on prolonged contact. Persons with kidney disorders have an increased risk from exposure based on general information found on aluminum salts.

SECTION 4: FIRST AID MEASURES

EYES
Hold the eyelids apart and flush the eye gently with a large amount of water for at least 15 minutes or until irritation subsides. If irritation persists get medical attention.

SKIN
Remove contaminated clothing and shoes. Rinse skin well with plenty of soap and water for 15-20 minutes. If irritation persists get medical attention. Wash clothing and thoroughly clean shoes before reuse.

INGESTION
Seek medical attention immediately. Have person sip a glass of water if able to swallow. **Do not induce vomiting unless told to do so by a poison control center of doctor**. Do not give anything by mouth to an unconscious person.

INHALATION
Remove person from exposure to fresh air. If person is not breathing, call 911 or an ambulance, and then give artificial respiration (CPR). If individual is breathing, but with difficulty, get immediate medical attention.

NOTES TO PHYSICIAN
Aluminum soluble salts may cause gastroenteritis if ingested. Treatment includes the use of demulcents. Treatment of overexposure should be directed at the control of symptoms and the clinical conditions.

Note: Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

See Section 11 for Toxicological Information.

SECTION 5: FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT
None

AUTO IGNITION TEMPERATURE
Not Flammable

FLAMMABLE LIMITS IN AIR (% BY VOLUME)
LEL: Not Flammable UEL: Not Flammable

EXTINGUISHING MEDIA
Dry chemical, carbon dioxide or water mist as appropriate for surrounding material.

HAZARDOUS COMBUSTION PRODUCTS
Oxides of aluminum and carbon. Thermal decomposition may release toxic and/ or hazardous gases such as hydrogen chloride gas.

FIRE FIGHTING INSTRUCTIONS
Use NIOSH/MSHA approved self-contained breathing apparatus and full protective clothing if involved in a fire. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Move container from fire area if it can be done without risk. Use water spray to cool closed containers and protect fire-fighters. Do not release runoff from fire control methods to sewers or waterways. Dike area to prevent runoff and water source contamination.

SECTION 6: ACCIDENTAL RELEASE MEASURES

WATER SPILL
Prevent additional discharge of material, if possible to do so without hazard. This material is water soluble/ dispersible and may not be recoverable.

LAND SPILL
Prevent additional discharge of material, if possible to do so without hazard. For small spills implement cleanup procedures; for large spills implement cleanup procedures and, if in public area, advise authorities.

GENERAL PROCEDURES
No smoking in spill areas. Isolate spill area and deny entry to unnecessary or unprotected personnel. Remove all sources of ignition, such as flames, hot glowing surfaces or electric arcs. Stop source of spill as soon as possible and notify appropriate personnel. Cleanup personnel must wear proper protective equipment (refer to Section 8). Decontaminate all clothing. Notify all downstream water users of possible contamination.

Create a dike or trench to contain all liquid material. Spill materials may be absorbed using clay, soil or nonflammable commercial absorbents. Treat as any dilute acid. **Aluminum Chlorohydrate** can be carefully neutralized with Soda Ash or Lime.

Do not place spill materials back in their original container. Containerize and label all spill materials properly.

RELEASE NOTES
Notify the National Response Center (800/424/8802) of uncontained releases to the environment in excess of the Reportable Quantity (RQ). See Section 15, Regulatory Information. Recycle or dispose of recovered material in accordance with all federal, state, and local, regulations.

For all transportation accidents, call CHEMTREC at 800/424-9300.

SECTION 7: HANDLING AND STORAGE

HANDLING

Do not get in eyes, or on skin, or clothing. Do not taste or swallow. Avoid breathing mists or fumes. Do not handle with bare hands. When preparing the working solution ensure there is adequate ventilation.

Carefully monitor handling, use and storage to avoid spills and leaks. Follow protective controls set forth in Section 8 when handling this product. Do not eat, drink, or smoke in work area. Wash hands prior to eating, drinking, or using restroom.

STORAGE

STORAGE CONDITIONS
Store in closed, properly labeled tanks or containers. Do not remove or deface labels or tags. Store in a cool, well ventilated place away from incompatible materials and sources of ignition. Keep drums upright. DO NOT reuse empty containers without commercial cleaning or reconditioning. Dry rubber-lined, plastic (HDPE) and FRP are all suitable storage materials for this product. Do not store in steel, mild stainless steel, aluminum, nickel, copper or brass containers. Product should be used within one year.

STORAGE TEMPERATURE
0^{o}C (32^{o}F) minimum to 30^{o}C (86^{o}F) maximum. Do not allow product to freeze. Freezing will affect the physical condition and may damage the material.

INCOMPATIBLE MATERIALS FOR STORAGE OR TRANSPORT
Oxidizing agents, reducing agents, metals and magnesium (evolves hydrogen gas).

SECTION 8: EXPOSURE CONTROLS PERSONAL PROTECTION

ENGINEERING CONTROLS

VENTILATION
Local exhaust ventilation is recommended if vapors, mists or aerosols are generated. Otherwise, use general exhaust ventilation.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

EYE AND FACE PROTECTION
Wear chemical goggles. A face shield should be worn in addition to goggles where splashing or spraying is possible.

SKIN PROTECTION
Wear chemical resistant clothing. Neoprene gloves, boots and apron or slicker suit.

RESPIRATORY PROTECTION
Not likely an inhalation hazard unless hydrogen chloride mist forms. If airborne exposures exceed the PEL, use a NIOSH/ MSHA approved negative pressure air-purifying respirator in accordance with OSHA Respiratory Protection Requirements under 29 CFR 1910.134.

GENERAL
Safety shower and eye wash station must be provided in the immediate work area. Protective equipment and clothing should be selected, used, and maintained according to applicable standards and regulations. For further information, contact the clothing or equipment manufacturer.

EXPOSURE GUIDELINES

Component Data Polyaluminum Chloride (1327-41-9):	OSHA PEL:	2.0 mg/m^3 soluble salts as Al
	ACGIH TLV:	2.0 mg/m^3 soluble salts as Al

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

CHEMICAL FORMULA	$Al_n(OH)_mCl_{3n\text{-}m}$
MOLECULAR WEIGHT	N/A
APPEARANCE	Clear to slightly hazy, colorless to amber liquid
ODOR	Odorless
pH	2.5 – 4.6
VAPOR PRESSURE	Not Established
VOLATILES, % BY VOLUME	Not Established
BOILING POINT	Not Established
FREEZING POINT	Not Established
SOLUBILITY IN WATER	Soluble
EVAPORATION RATE	Not Established
SPECIFIC GRAVITY	1.34
DENSITY	11.15 lb/gallon @ 25^{o}C (77^{o}F)
VISCOSITY	Not Established

SECTION 10: STABILITY AND REACTIVITY

CHEMICAL STABILITY
Stable under normal temperatures and pressure.

CONDITIONS TO AVOID
High temperature decomposition. Avoid contact with alkalies and metals.

INCOMPATIBILITY WITH OTHER MATERIALS
Bases (alkaline materials).

HAZARDOUS DECOMPOSITION PRODUCTS
Thermal decomposition may release toxic and/or hazardous gases such as hydrogen chloride gas.

HAZARDOUS POLYMERIZATION
Will not occur.

SECTION 11: TOXICOLOGICAL INFORMATION

ANIMAL TOXICOLOGY

EYES
No available data for product.

SKIN
No available data for product.

Component Data Aluminum Chlorohydrate (12042-91-0): Skin Irritation (human): 150 mg/3D-I Mild irritation effects (1) "Cutaneous Toxicity" Drill, V.A. and P. Lazar, eds., New York, NY, Academic Press, 1977.

ACUTE ORAL EFFECTS
No available data for product.

ACUTE INHALATION EFFECTS
No available data for product.

EFFECTS FOLLOWING PROLONGED OR REPEATED EXPOSURE
No available data for product.

CARCINOGENICITY
This product (or any component at a concentration of 0.1% or greater) is not listed by NTP, IARC, OSHA, EPA, or any other authority as a carcinogen.

MUTAGENICITY
No available data.

REPRODUCTIVE/DEVELOPMENTAL TOXICITY
No available data for product.

Component Data Aluminum Chlorohydrate (12042-91-0): Oral Rat TDLo 13g/kg (7-19 day(s) pregnant female continuous).

SECTION 12: ECOLOGICAL INFORMATION

GENERAL COMMENT
No available data for product.

Component Data Aluminum Chlorohydrate (12042-91-0): Fish 1000 ug/l 24 week(s) (mortality) coho salmon, silver salmon (oncorhynchus kisutch). Persistence and degradation, no data available.

ENVIRONMENTAL FATE
No available data for product.

SECTION 13: DISPOSAL CONSIDERATIONS

All disposals of this material must be done in accordance with Federal, state and local regulations. Waste characterization and compliance with disposal regulations are the responsibilities of the waste generator.

SPILL RESIDUES
Clean-up material may be a RCRA Hazardous waste on disposal if the pH is <2. Test waste for corrosivity, D002, prior to disposal.

EMPTY CONTAINERS
"Empty" containers retain product residue (liquid and/ or vapor). Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner, or properly disposed of.

SECTION 14: TRANSPORT INFORMATION

THIS MATERIAL IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.01 BY THE U.S DEPARTMENT OF TRANSPORTATION.

SECTION 15: REGULATORY INFORMATION

U S FEDERAL REGULATIONS

CERCLA REPORTABLE QUANTITY (RQ)
Not Applicable.

TSCA (TOXIC SUBSTANCES CONTROL ACT)
All components of this product are listed on the TSCA Inventory or are exempt from TSCA Inventory requirements.

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) TITLE III

SARA SECTION 302 (EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 302.4):
Not Applicable.

SARA SECTION 311/312 HAZARD CATEGORIES (40 CFR 370.2):

Fire Hazard	No
Reactivity Hazard	No
Release of Pressure	No
Acute Health Hazard	Yes
Chronic Health Hazard	No

SARA SECTION 313 (40 CFR 372.65):
Components identified with an asterisk (*) in Section 2 are subject to the reporting requirements of Section 313 of Title III of the 1986 Superfund Amendments and Reauthorization Act (SARA) and 40 CFR Part 372.

INTERNATIONAL REGULATIONS

CANADA

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA)
This product, or its components, are listed on or are exempt from the Canadian Domestic Substance List (DSL).

SECTION 16: OTHER INFORMATION

NFPA CODES	
HEALTH	1
FLAMMABILITY	0
INSTABILITY	0

HMIS CODES	
HEALTH	1
FLAMMABILITY	0
INSTABILITY	0
PROTECTION	C

RATING NOTES
Hazardous Materials Identification: 4 = Severe, 3 = Serious, 2 = Moderate, 1 = Slight, 0 = Minimal.

MATERIAL SAFETY DATA SHEET – Aluminum Chlorohydrate

Emergency Information:

Business Hours: 713-658-9000
After Hours: CHEMTREC: 800-424-9300

For Any Other Information Contact:

ALTIVIA, Technical Marketing, 1100 Louisiana, Suite 4800, Houston, TX 77002.

Phone: 713-658-9000

8 AM – 5 PM CST, Monday through Friday

Revisions

12/19/2005:	Prepared to ANSI Standard Z400.1-1998.
04/17/2012:	Revised product specifications.
05/22/2012:	Update of Address.
01/21/2014:	Update of Name & Contact Numbers. This MSDS replaces all previous MSDS for this product.

APPENDIX H – GEOTECHNICAL STUDY

FUGRO

Geotechnical Study
Feasibility of Expanded Tertiary
Recycled Water Facilities Project
Daly City, California

Fugro Project No. 04.72160021
Document No. 04.72160021-PR-001(Rev.00)

Carollo Engineers

FUGRO

Geotechnical Study
Feasibility of Expanded Tertiary
Recycled Water Facilities Project

Daly City, California

Fugro Project No. 04.72160021
Document No. 04.72160021-PR-001(Rev.00)

Prepared for:

Carollo Engineers
2700 Ygnacio Valley Road
Suite 300
Walnut Creek, California 94598

00	Final	RS	RLB	RLB	September 15, 2017
A	Draft	RS	RLB	RLB	September 12, 2017
Rev.	**Status**	**Prepared**	**Reviewed**	**Approved**	**Date**

FUGRO
1777 Botelho Drive, Suite 262
Walnut Creek, California 94596
T +1 925 949 7100
F +1 925 949 7070
www.fugro.com

Fugro Project No. 04.72160021
Document No. 04.72160021-PR-001(Rev.00)
September 12, 2017

Carollo Engineers
2700 Ygnacio Valley Road
Suite 300
Walnut Creek, California 94598

Attention: Mr. Darren Baune

Geotechnical Study,
Feasibility of Expanded Tertiary Recycled Water Facilities Project
Daly City, California

Dear Mr. Baune,

Fugro is pleased to submit this geotechnical study report presenting the results of our field exploration and laboratory-testing program for the Feasibility of Expanded Tertiary Recycled Water Facilities Project in Daly City, California.

This report was prepared to provide information to the Engineer for design purposes.

We appreciate this opportunity to be of continued service to Carollo Engineers. Please contact Mr. Ron Bajuniemi at (925) 949-7107 if you have any questions regarding the information presented in this report.

Sincerely,
Fugro USA Land, Inc.

REGISTERED PROFESSIONAL ENGINEER RUNE STORESUND GE 2855 6/30/19 GEOTECHNICAL STATE OF CALIFORNIA

Rune Storesund, D.Eng., P.E., G.E.
Principal Consultant

REGISTERED PROFESSIONAL ENGINEER RONALD L. BAJUNIEMI No. GE 112 Exp. 12/31/17 GEOTECHNICAL STATE OF CALIFORNIA

Ronald L. Bajuniemi, P.E., G.E.
Principal Consultant

Distribution: (1) electronic copy to Mr. Darren Baune

CONTENTS

TABLES IN THE MAIN TEXT

PLATES

APPENDICES

1. INTRODUCTION

This report presents the results of the geotechnical study conducted by Fugro USA Land, Inc., (Fugro) for the Feasibility of Expanded Teriary Recycled Water Facilities Project. The project limits initiate at the existing North San Mateo County Sanitation District Wastewater Treatment Plant (WWTP) at the Northeast corner of Lake Merced Boulevard and John Daly Boulevard, then extends roughly 3.5 miles southeast of the WWTP and traverses through the City of Daly City, Town of Broadmoor, Town of Colma, and South San Francisco ending near El Camino High School; the entire alignment can be seen on the Location Map – Plate 1 and Site Plan – Plate 2.

1.1 Project Description

The project consists of structural additions (Tertiary Treatment building, Switchgear building, and Chemical Storage) and miscellaneous upgrades at the existing North San Mateo County Sanitation District WWTP to accommodate the new tertiary treatment process as well as new main transmission and distribution lines.

The new Tertiary Treatment building will be located at the north margin of the existing treatment facility between two entrance gates. The building will be 2-stories with below-grade tanks and have an approximate footprint of 82 feet by 41 feet. This structure is anticipated to have a mat foundation with estimated loads of 2,400 pounds per square foot (psf) for dead load + water and 3,000 psf for dead + water +live load. Surface elevation at this location is approximately El. +51 feet.

The new electrical Switchgear building will be situated just north of the Tertiary Treatment building, in a landscape area immediately to the north of the access driveway. Surface elevation at this location is approximately El. +52 feet. The building footprint will be approximately 40 feet by 25 feet and situated on a shallow foundation system. Building loads are anticipated to be on the order of 2,000 psf (dead + live).

The Chemical Storage area will to consist of several pads to store citric acid (10 feet by 14 feet), hydrochloric acid (10 feet by 14 feet), sodium hypochlorite (18 feet by 18 feet), sodium hydroxide (16 feet by 16 feet), and a below-grade neutralization tank and pump pad (14 feet by 14 feet). Pads are anticipated to be structural slabs with loads on the order of 2,000 psf (dead + live). Surface elevation at this location is approximately El. +53 feet.

The main transmission line (14- to 16-inch ductile iron pipe) will generally be installed at depths of 5 to 10 feet below existing grade. The El Camino distribution lines (8- to 15-inch ductile iron pipe) will generally be installed at depths of 5 to 10 feet below existing grade. The Hillside distribution lines will be installed at depths between 5 to 10 feet below existing grade (15- to 18-inch ductile iron pipe).

Elevations discussed in this report refer to NAVD88 (NAD83).

1.2 Scope of Services

The purpose of our geotechnical field exploration was to obtain information on subsurface conditions in order to evaluate the geotechnical aspects of the project. The scope of our services performed included:

- Field exploration and information gathering, including obtaining drilling permits, encroachment permits, and drilling and obtaining soil samples and other field tests to inform geotechnical design;
- Perform field and geotechnical laboratory testing, including corrosion testing;
- Evaluate geologic and seismic hazards in general conformance with California Division of Mines and Geology Note 42, 1986; and
- Preparing this geotechnical report to present the results of our geotechnical field exploration, discussion of geotechnical issues, and geotechnical recommendations.

Our study was based on the assumption that the pipelines have minimal cover (5 to 10 feet in depth). Preliminary planning indicates that there will be pipeline crossings of utilities and infrastructure (highways, BART, storm water channels, etc.) along the alignments where pipeline depths may be significantly deeper and employ construction methods other than cut and cover. Once the locations of these crossings are finalized, they will require additional geotechnical study. These crossings are not included in the scope of this report.

2. DATA REVIEW AND EXPLORATION

The data review and geotechnical exploration program described herein was developed to provide general characterization of the subsurface materials.

2.1 Review of Existing Data

Prior to conducting our field exploration, Fugro reviewed relevant information relating to geotechnical, geologic, and seismic information, as well as results of previous explorations performed within the vicinity of the project, including the following reports:

- Alan Kropp & Associates, 1981. Geotechnical Investigation Communications Network.
- Cooper Clark & Associates, 1968. Soil Investigation Proposed Industrial Development.
- Earth Investigations Consultants, 2001. Geotechnical Investigation Proposed Water Storage Tank.
- EMCON Associates, 1982. Closure Plan Junipero Serra Solid Waste Disposal Site.
- Fugro, 2016. Geotechnical Desktop Study for Recycled Water Storage Tank, Feasibility Study of Expanded Tertiary Recycled Water Facilities Project.
- Harding Lawson Associates, 1988. Soil Investigation Our Lady of Peace Garden Crypt Additions Holy Cross Cemetery.
- Kleinfelder, 1990. Geotechnical Investigation Report Metro Bay Centre.
- Lowney/Kaldveer Associates, 1971. Foundation Investigation – Standard Brands Paint Store.
- Lowney/Kaldveer Associates, 1974. Foundation Investigation – Serra Vista Square.
- Peter Kaldveer and Associates, Inc. 1986. Geotechnical Engineering Services, Proposed Treatment Plant Expansion, Daly City, California (part of Fugro).

As noted in the above list of reports, Fugro performed geotechnical desktop study and site reconnaissance for the recycled water storage tank component of the Feasibility of Expanded Tertiary Recycled Water Facilities Project. Three potential storage tank sites were identified for further investigation in our study. A tank site has not been selected at the time of this report.

These reports contained limited information concerning the foundation conditions for the larger pipeline alignment.

2.2 Field Exploration

Fugro's field exploration consisted of two (2) geotechnical exploratory borings to a depth of 36.5 feet for the tertiary structures at the North San Mateo County Sanitation District WWTP, 20 geotechnical exploratory borings for the main transmission line and 21 geotechnical exploratory borings for the two distribution lines. The locations of the borings are shown on the Site Plan - Plate 2 through Plate 7.

The boring frequency along the transmission and distribution lines was a function of the land use of the site as defined by Carollo. Borings located within industrial and/or commercial zones were spaced every 500 feet and borings located in residential and/or cemetery zones were spaced every 1000 feet. Boring depths along the transmission and distribution lines were a function of the expected geologic conditions present along the proposed alignment path; borings were drilled to 25 foot depth in areas of potential liquefaction susceptibility such as alluvial channels, colluvium deposits or Artificial Fill and 10 feet deep outside of these areas. Shallow (10 feet) borings were drilled deeper than 10 feet if liquefiable material was encountered in the first 10 ft.

Borings were drilled using a CME-55 truck mounted drill rig. Hollow stem augers were used for the 41 borings along the transmission/distribution lines and Mud Rotary Wash for the borings at the North San Mateo County Sanitation District WWTP. In general, a Standard Penetration Test (SPT) sample or Modified California (ModCal) sample was collected continuously for the first 10 feet, then at approximately five-foot vertical intervals. For details about the type of samplers used at each location, percent recovery, and soil description refer to the boring logs presented in Appendix A.

The borings were backfilled with a neat cement grout upon completion in accordance with the San Mateo County Department of Health Services and Caltrans requirements. The boring surface on active roadways, and where government agencies explicitly requested, were cut and replaced using Hot Mix Asphalt (HMA) to restore the roadway to its original condition after completion of drilling actives.

3. SITE CONDITIONS

3.1 Regional and Site Geology

The project is located within the Coast Ranges Geomorphic Province of Northern California. The province is characterized by northwest-trending faults and folds, erosion and deposition within a broad transform boundary between the North American and Pacific tectonic plates. Translational motion along the plate boundary occurs across the distributed zone of right-lateral shear, expressed as a nearly 50-mile-wide zone of northwest-trending, near-vertical active strike-slip faults. This translational motion occurs primarily along the active San Andreas, Hayward, Calaveras, and San Gregorio faults.

Structurally, the region is dominated by the San Andreas Fault system that has created a northwest-trending structural grain of ridges and valleys. The San Andreas Fault system is the boundary between the Pacific and North American global tectonic plates. Strike-slip motion along this plate boundary replaced subduction several million years ago. The subduction-style faulting and deformation responsible for intercalating the various older rock types in this area are no longer active in the region.

The project limits are generally underlain by Quaternary age artificial fills and alluvium overlying the Pleistocene age Colma Formation. The Colma Formation in the general area of the project consists of friable, well sorted, fine to medium grained sand containing occasional beds of sandy silt, clay, and gravel. A Geologic Map is shown on Plate 8.

3.2 Regional Seismicity

Geologists and seismologists recognize the San Francisco Bay Area as one of the most active seismic regions in the United States. Dominated by the San Andreas fault system, the Bay Area is comprised of mostly northwest-trending strike-slip faults derived by the interaction of the Pacific and North American Tectonic Plates. Movement between these two plates is predominantly accommodated on the San Andreas, Hayward-Rogers Creek, Calaveras, San Gregorio, and Concord-Green Valley faults. The major fault in the system is the San Andreas fault, a major rift in the earth's crust that extends for at least 750 miles.

In 2008, the United States Geological Survey (USGS), in conjunction with Southern California Earthquake Center and the California Geological Survey, published the Uniform California Earthquake Rupture Forecast (UCERF). UCERF updated the forecast made in 2003 by the Working Group for California Earthquake Probabilities (WGCEP). The UCERF report evaluated the probabilities of significant earthquakes occurring in the Bay Area over the next three decades (2007-2036). UCERF found a 63 percent probability that at least one magnitude 6.7 or greater earthquake will occur in the San Francisco Bay region before 2036. This probability is an aggregate value that considers eight principal Bay Area fault systems and unknown faults (background values). The San Francisco Bay region continues to be seismically active. The principal active faults in the Bay Area include the San Andreas, Hayward, Calaveras, and the San Gregorio faults. Earthquakes occurring along these faults are capable of generating strong ground shaking at the project site. The approximate locations of significant Bay Area faults are shown on Plate 9 – Regional Fault Map.

The San Andreas Fault runs generally parallel to the pipeline alignment 1.5 miles to the southwest. Other faults in the project include the Serra Fault located about 800 feet to the west, the Hillside Fault located about 2,400 feet to the east, and unnamed fault that crosses the project where near the junction of Hillside Boulevard distribution line and main transmission line. The unnamed fault and the Hillside fault are pre-Quaternary and inactive faults. The Serra fault is Quaternary age and is considered potentially active. These faults are shown on Plate 10.

The approximate distance of the site from the nine closest known mapped faults[1] is summarized in Table 1. The project site is not located within an Alquist-Priolo Earthquake Fault Zone although, as mentioned previously, a possible northwest striking fault has been mapped in the area.

Table 1. Regional Faults and Seismicity[2]

Fault	Approximate Distance from Site	Direction from Site	Maximum Moment Magnitude
San Andreas (Peninsula)	1.5 miles (2.4 km)	SW	7.8
San Gregorio	7.4 miles (12 km)	W	7.5
Hayward-Rogers Creek	16 miles (25.7 km)	NE	7.3
Calaveras	25 miles (40 km)	NE	6.9

Earthquakes on these or other smaller, more distant or unmapped faults could cause strong ground shaking at the site. Earthquake intensities vary throughout the Bay Area depending upon the magnitude of the earthquake, the distance of the site from the causative fault, the type of materials underlying the site, and other factors.

3.3 Surface Conditions

The project site extends roughly 35,000 feet southeast of the North San Mateo County Sanitation District WWTP and paths through the City of Daly City, Town of Broadmoor, Town of Colma, and South San Francisco. An overview of the project is shown on Plate 2.

Surface conditions at the existing WWTP consist of asphalt concrete parking lots, landscaped medians, sidewalks, and existing miscellaneous utilities and structures. Site grades are approximately El. +50 ft. The proposed Chemical Storage facility is planned to be constructed at the base of a fairly steep hillside (with slope of approximately 1.5 H to 1 V) that plateaus at El. +75 feet. A fire station is situated on the plateau.

The main transmission line is approximately 20,000 feet in length and extends southeast from the North San Mateo County Sanitation District WWTP. The main transmission line alignment follows existing streets and roadways from the WWTP through commercial and residential developments along Lake Merced

[1] According to the Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada, prepared by California Department of Conservation, Division of Mines and Geology, (1998).

Boulevard, Washington Street, and Edgeworth Avenue to Interstate Highway 280. Elevations increase from about El. +57 feet at the WWTP to about El. +210 feet along this portion of the alignment. The main transmission line crosses Interstate Highway 280 via a pipeline bridge. From Interstate Highway 280 the main transmission line follows B Street and D Street to the Woodlawn Cemetery, where the main transmission line traverses the cemetery (along an existing SFPUC right-of-way) continuing southeast to about Villa Avenue then turning northeast crossing State Highway 82 and follows Olivet Parkway to Hillside Boulevard. Elevations from Interstate Highway 280 to State Highway 82 decrease from about El. +210 feet to El. +160 feet. Elevations then increase from about El. +160 to El. +210 feet along Olivet Parkway to Hillside Boulevard.

The El Camino distribution line approximately 14,000 feet in length and is located along State Highway 82 and Mission Road from about Olivet Parkway to McLellan Drive and Evergreen Drive. Elevations along the distribution line from Olivet Parkway to Evergreen Drive range from about El. +120 to El. +70 feet.

The Hillside distribution line is approximately 9,250 feet in length and is located along Hillside Boulevard, southward from Olivet Parkway. Elevations along Hillside Boulevard range from about El. +220 to El. +260 feet.

3.4 Subsurface Conditions

The subsurface conditions encountered in our field exploration for the project were consistent with Quaternary geologic mapping of the project vicinity. Subsurface soils encountered in our borings were primarily sands (granular) with varying amounts of silt and clay. These materials comprised artificial fills, alluvium and the underlying Colma sand.

Borings TPB-01 and TPB-02 were performed at the existing WWTP for the proposed Tertiary Treatment building, Switchgear building, and associated Chemical Storage pads. At the proposed Tertiary Treatment building location, approximately 12 1/2 feet of artificial fill was encountered. This consisted of about 4 inches of asphalt underlain by 12 inches of medium dense silty sand with gravel (aggregate base, or AB). Below the AB, the artificial fill consisted of poorly graded fine sand with silt, dry, and very loose to medium dense. The loose to very loose material was encountered from about 4 to 8 feet in depth. Beneath the artificial fill was alluvium consisting poorly graded sand, medium dense, and dry extending to about 23 feet in depth. Below 23 feet the alluvium was very dense and moist to 35 1/2 feet where practical refusal was achieved.

The Switchgear building location encountered about two feet of fill consisting of medium dense, silty sand, underlain by medium dense to very dense, dry to moist, poorly graded sand with silt to a depth of 36 feet where practical refusal was achieved. The sand graded very dense at about 20 feet.

In general, subsurface conditions encountered along the transmission and distribution lines consisted of 4 to 12 inches of asphalt underlain by 1 to 2 feet of aggregate base where borings were located within streets and along roadways. Below pavement sections, soils primarily of medium to very dense sands with varying amounts of silt, clay, and occasional gravels to the depths investigated. Occasional 1 to 2 feet thick intervals of loose to very loose sands were encountered in borings between 3 to 8 feet in depth below ground surface.

The soils were generally observed to be dry to moist. The following variations in these described conditions are noted:

- Main Transmission Line – Between MB-3 and MB-6 (North of Daly Boulevard to Coronado Avenue) loose to very loose sands were encountered to depths of 10 to 25 depth.
- El Camino Distribution Line – At boring location DB-8 sands with gravels and cobbles up to 4 inches were encountered to a depth of 8 feet.

The subsurface conditions encountered in the borings are summarized on the Cross-Section presented on Plate 11. The attached boring logs and related information depict location specific subsurface conditions encountered during our field investigation. Detailed data of the soil properties encountered in each of the Fugro exploratory borings are presented on the boring logs in Appendix A. The approximate locations of the borings were determined by measuring wheel from key landmarks and intersection and, therefore, be considered accurate only to the degree implied by the method used. The passage of time could result in changes in the subsurface conditions due to environmental changes.

3.5 Groundwater

The groundwater table was not encountered in our borings during our field investigation. The hollow stem borings were not left open for a sufficient period of time to establish equilibrium groundwater conditions.

Some samples adjacent to landscaping or low points adjacent to streets encountered moist to wet subgrade or perched water condition, but groundwater was not observed. These observations were made along the El Camino distribution line in borings DB-2, DB-3, and DB-4 where wet soils were observed at depths 15 to 25 feet, 5 feet, and 5 feet respectively. At the end of the main transmission line; near Hillside Boulevard, at boring MB-26 wet soils were observed at 5 feet in depth.

Groundwater levels were monitored as part of the 1986 geotechnical exploration program. Two soil borings were converted to piezometers (Borings 1 and 6). These piezometers found groundwater to be at a depth of approximately 40 and 22 feet below grade (or El. +7 and El. +24 feet, datum not established). This indicates that groundwater is not near surface and is not anticipated to be a significant issue for shallow improvements associated with the WWTP tertiary expansion structures.

A review of the Department of Water Resources Water Data Library, indicates that groundwater table levels are greater than 50 feet below ground surface in the vicinity of the project. Groundwater elevations range from -40 to -100 feet referenced from vertical datum NAVD88.

We do note that fluctuations in the groundwater level could occur due to changes in seasons, variations in rainfall, and other factors.

4. DISCUSSIONS AND CONCLUSIONS

We believe that the project is feasible from a geotechnical and geological engineering standpoint, provided that the conclusions and recommendations presented in this report are incorporated into the project design and specifications. The principal geotechnical considerations are discussed in the following sections.

4.1 Seismicity and Geologic Hazards

The site is located in a seismically active region of California. Significant earthquakes in the Bay Area have been associated with movements within the fault zones. Earthquakes occurring along faults in the area have the potential to produce moderate to strong ground shaking at the site. Practically all structures within the San Francisco Bay Area will experience similar ground shaking effects during a moderate to strong earthquake.

Based on the results of our review and evaluation, the primary geologic hazard at the project site is a potential for moderate to strong ground shaking. In addition, we identified several regions along the main transmission alignment (STA 15+00 to STA 30+00) that are susceptible (based on Pradel (1998); Tokimatsu and Seed (1987)) to dynamic settlement (on the order of inches) in the near-surface soils.

However, the potential for liquefaction, significant landsliding, and flooding at the project site appeared to be low to moderate in our opinion.

4.2 Foundation Support

The new Tertiary Treatment and Switchgear structures at the WWTP may be founded on shallow foundation such as footings or structural slab/mat. We note that undocumented artificial fill was encountered at the location of the new Tertiary Treatment building. Undocumented fills may contain deleterious materials, oversized fragments such as rocks and boulders, and/or void space that can result in unanticipated differential settlements. This material must be removed and recompacted in accordance with the criteria in this report in order to be deemed suitable for new foundations. Removal of artificial fill would extend to a minimum of 13 feet in depth and excavation would require temporary side slopes of 1.5H:1V. If there is insufficient space to open cut then excavation would need to be shored. Alternatively, new buildings in areas with undocumented fill may be founded on drilled piers deriving support from skin friction below the undocumented fill.

The new chemical storage pads are currently situated at the base of the 1.5H to 1V hillslope leading up to the fire station may impact slope stability by excavating at the toe of this slope. Consideration should be given to offsetting these features from the toe of slope, founding the pads on drilled piers to minimize disturbance at the toe of the slope, and/or performing a targeted geotechnical assessment of the slope and potential impacts associated with excavations for foundations.

4.3 Pipeline Structure Crossings

As noted earlier, preliminary planning indicates that there will be pipeline crossings of utilities and infrastructure (highways, BART, storm water channels, etc.) along the alignments where pipeline depths may be significantly deeper than the anticipated five to ten feet below grade and may require the use of construction methods other than conventional cut and cover. Once the locations and configuration of these crossings are advanced, it may be necessary to perform additional study and provide targeted geotechnical recommendations.

4.4 Corrosion Potential

Soluble sulfate concentration, chloride ion concentration and pH tests were performed on selected samples. These tests provide an indication of the corrosion potential of the soil environment on buried concrete structures. The table below presents the depth at which the samples were collected and the laboratory test results.

Table 2. Summary of Corrosion Test Results for Buried Concrete

Test No.	Boring	Depth (ft)	Sulfate (mg/kg)	Chloride (mg/kg)	pH
1	TPB-02	4.5	29	27	8.11
2	MB-01	2.0	31	17	5.44
3	MB-04	1.5	31	16	7.31
4	MB-07	1.5	15	N.D.	7.50
5	MB-10-ALT	2.0	N.D.	N.D.	7.40
6	MB-13	1.5	25	N.D.	6.94
7	MB-17	5.0	24	20	6.33
8	MB-24	1.0	N.D.	N.D.	6.33
9	MB-26	4.5	N.D.	N.D.	7.40
10	DB-05	2.5	40	N.D.	8.04
11	DB-09	4.5	28	N.D.	7.92
12	DB-11	4.5	36	33	7.87
13	DB-15	4.5	17	N.D.	7.36
14	DB-18	1.0	71	15	7.10

Based on CERCO's evaluation, the detected sulfate ion concentrations range from none to 71 mg/kg, and in their opinion, is determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations.

Corrosion potential to the reinforcing steel in concrete should be evaluated with consideration to the chloride content of the soils tested. Chloride content detection results for selected soil samples, presented in Table 2, are between none to 23 mg/kg; the concentrations are low enough, below 300 mg/kg, such that they are insufficient to attack steel embedded in a concrete mortar coating.

Based on CERCO's evaluation, the pH of the soils was 5.44 to 8.11; soils with pH values less than 6.0 are considered to be corrosive to buried iron, steel, mortar-coated steel and reinforced concrete structures. CERCO recommends a degree of corrosion protection for structures in the acidic soils.

For specific long-term corrosion control design recommendations, we recommend that a Corrosion Engineer evaluate the corrosion potential of the soil environment on buried concrete structures and steel pipe coated with cement-mortar.

4.4.1 Tests for Buried Ferrous Metals

In addition to the pH tests described above, resistivity and redox tests were also performed on the soil samples. These tests may be evaluated together to provide an indication of the corrosion potential of the soil environment on buried ferrous metals such as steel or cast-iron pipes. The results of these tests are presented in the table below.

Table 3. Summary of Corrosion Test Results for Buried Ferrous Metal

Test No.	Boring/Sample	Depth (ft)	Resistivity (ohm-cm)	Redox Potential (mV)	pH
1	TPB-02	4.5	6,100	310	8.11
2	MB-01	2.0	5,800	360	5.44
3	MB-04	1.5	4,100	330	7.31
4	MB-07	1.5	4,600	400	7.50
5	MB-10-ALT	2.0	13,000	310	7.40
6	MB-13	1.5	5,300	300	6.94
7	MB-17	5.0	3,100	330	6.33
8	MB-24	1.0	5,400	340	6.33
9	MB-26	4.5	7,500	310	7.40
10	DB-05	2.5	3,900	300	8.04
11	DB-09	4.5	2,200	300	7.92
12	DB-11	4.5	3,700	290	7.87
13	DB-15	4.5	3,000	310	7.36
14	DB-18	1.0	3,100	300	7.10

Based on the resistivity measurement, CERCO classified the soil samples from Test No. 5, as "mildly corrosive" and all other soil samples as "moderately corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron pipeline should be protected against corrosion as well.

The measured soil redox potentials were 290 to 400 mV, with Test No. 4 as indiciative of aerobic soil conditions. All other samples are indicative of potentially “slightly corrosive” soils resulting from anaerobic conditions.

Based on the general results of the above tests, we recommend that the corrosion engineer consider the corrosion potential of the soil environment on buried ferrous metals in design of the project.

4.4.2 Previous Corrosion Testing at Treatment Plant

Previously, during the November 1988 geotechnical investigation at the treatment plant, the corrosion potential evaluation consisted of three resistivity traverses that were made at the site using a four-electrode Vibroground apparatus. Generally, the traverse shows that the approximate resistivity of the soils in this area are from 2443 to 6706 ohm-cm. Therefore, as shown on the table below, the soils are slightly to moderately corrosive.

Table 4. Corrosion Potential Based on Resistivity

Conductivity (mho-cm)	Resistivity (ohm-cm)	Corrosivity	Life Span (years)
>2500	<400	Extremely Severe	<5
1100-2500	400-900	Very Severe	5-10
670-1100	900-1500	Severe	10-15
300-670	1500-3500	Moderate	15-20
125-300	3500-8000	Mild	20-30
50-125	8000-20,000	Slight	30-50
<50	>20,000	Very Slight	>50

Sulfate content determinations were performed on two selected samples of the subsurface soils. These tests indicated sulfate contents ranging from less than 0.001 to 0.007 percent. Therefore, as shown below, these results indicate that the soils underlying the site have a negligible potential for sulfate attack on concrete.

Table 5. Potential for Sulfate Attack on Concrete

Relative Degree of Sulfate Attack	Water-Soluble Sulfate, as SO_4. (%)
Negligible	0.00-0.10
Positive +	0.10-0.20
Considerable ++	0.20-0.50
Severe	Over 0.50
+ Use type II cement ++ Use type V cement	

4.5 Construction Considerations

Excavations will be required to construct foundations and may be needed to install utilities and remove existing utilities. All excavations that will be deeper than 5 feet and will be entered by workers should be shored or sloped for safety in accordance with Occupational Safety and Health Administration (OSHA) standards.

Temporary underpinning and shoring will be required at locations where subsurface structures and pipelines are constructed adjacent to existing facilities. Excavations which extend below the foundation influence of nearby structures would require shoring and/or underpinning of the neighboring facilities. The bottom of the excavation should be no closer than 1-1/2 times the depth of the overexcavation from the bottom of exterior wall foundation of the adjacent structure.

If earthwork is performed during the dry season, moisture conditioning will be required to raise the in-situ moisture contents to near optimum moisture content (per ASTM D1557). If earthwork is performed during or shortly after wet weather conditions, the moisture content of the onsite soils could be appreciably above optimum. Consequently, subgrade preparation and fill placement may be difficult. Additional recommendations for wet weather construction can be provided at the time of construction, if required.

5. RECOMMENDATIONS

5.1 Seismic Design

The proposed structures should be designed to resist the lateral forces generated by earthquake shaking in accordance with local design practice. This section presents seismic design criteria for use with the 2016 California Building Code (CBC) and its companion document, ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures*.

The site seismic design criteria were determined based on the site latitude and longitude using the public domain computer software, United States Geological Survey Hazard Calculator (NSHMP_HazardApp.jar). Based on the subsurface conditions encountered at the site, a Site Class "D" should be assumed for design for the proposed. The seismic parameters are provided for the WWTP, Woodlawn Cemetery and McLellan Drive in Tables 6, 7, and 8, respectively.

Table 6. North San Mateo County Sanitation District WWTP, PGA=0.939g

LATITUDE: 37.7033 LONGITUDE: -122.4846	ASCE 7-10 TABLE/FIGURE	FACTOR/COEFFICIENT	VALUE
Short-Period MCE at 0.2s	Figure 22-3	S_s	2.443g
1.0s Period MCE	Figure 22-4	S_1	1.174g
Soil Profile Type	Table 20.3-1	Site Class	D
Site Coefficient	Table 11.4-1	F_a	1.0
Site Coefficient	Table 11.4-2	F_v	1.5
Adjusted MC Spectral Response Parameters	Equation 11.4-1	S_{MS}	2.443g
	Equation 11.4-2	S_{M1}	1.761g
Long-period Transition	Figure 22-16	T_L	12 sec
Design Spectral Acceleration Parameters	Equation 11.4-3	S_{DS}	1.629g
	Equation 11.4-4	S_{D1}	1.174g

Table 7. Woodlawn Cemetery, PGA=0.944 g

LATITUDE: 37.6808 LONGITUDE: -122.4668	ASCE 7-10 TABLE/FIGURE	FACTOR/COEFFICIENT	VALUE
Short-Period MCE at 0.2s	Figure 22-3	S_s	2.457g
1.0s Period MCE	Figure 22-4	S_1	1.181g
Soil Profile Type	Table 20.3-1	Site Class	D
Site Coefficient	Table 11.4-1	F_a	1.0
Site Coefficient	Table 11.4-2	F_v	1.5
Adjusted MC Spectral Response Parameters	Equation 11.4-1	S_{MS}	2.457g
	Equation 11.4-2	S_{M1}	1.771g
Long-period Transition	Figure 22-16	T_L	12 sec
Design Spectral Acceleration Parameters	Equation 11.4-3	S_{DS}	1.638g
	Equation 11.4-4	S_{D1}	1.181g

Table 8. McLellan Drive, PGA=0.904 g

LATITUDE: 37.67382 LONGITUDE: -122.47287	ASCE 7-10 TABLE/FIGURE	FACTOR/COEFFICIENT	VALUE
Short-Period MCE at 0.2s	Figure 22-3	S_s	2.343g
1.0s Period MCE	Figure 22-4	S_1	1.124g
Soil Profile Type	Table 20.3-1	Site Class	D
Site Coefficient	Table 11.4-1	F_a	1.0
Site Coefficient	Table 11.4-2	F_v	1.5
Adjusted MC Spectral Response Parameters	Equation 11.4-1	S_{MS}	2.343g
	Equation 11.4-2	S_{M1}	1.686g
Long-period Transition	Figure 22-16	T_L	12 sec
Design Spectral Acceleration Parameters	Equation 11.4-3	S_{DS}	1.562g
	Equation 11.4-4	S_{D1}	1.124g

Based on the seismic design parameters calculated by the USGS Hazard Calculator, and per 2010 CBC § 1613.5.6, structures of Occupancy Category I, II, III, and IV (defined in 2010 CBC Table 1604.5) should be designed according to Seismic Design Category "E".

5.2 Site Preparation and Grading

5.2.1 Site Preparation

The site should be cleared of all obstructions, including utility lines, trees and associated root systems, and debris. It should be anticipated that holes resulting from the removal of root systems of larger trees could extend to depths of three feet, and laterally to the drip line of each tree. Holes resulting from the removal of underground obstructions extending below the proposed finish grade should be cleared and backfilled with suitable material compacted to the requirements in Section 5.2.5 - Fill Placement and Compaction. We recommend backfilling operations for any excavations to remove deleterious material be carried out under the observation of the geotechnical engineer.

After clearing, the portions of the site in the median area/landscaping containing surface vegetation or organic laden topsoil should be stripped to an appropriate depth to remove these materials. At the time of our field investigation, we estimated that a stripping depth of approximately 6 inches would be required. The amount of actual stripping should be determined in the field by the geotechnical engineer at the time of construction. Stripped materials should be removed from the site, or stockpiled for later use in landscaping, if approved by the owner.

5.2.2 Subgrade Preparation

Following excavation to the required grades, soil subgrades in areas to receive engineered fill, slabs-on-grade or pavements be scarified to a depth of at least 6 inches, moisture conditioned to within 2 percent of optimum moisture content, and compacted to at least 95 percent relative compaction (per ASTM D1557). The top 6 inches of subgrade in areas to receive pavements should be moisture conditioned and compacted to at least 95 percent relative compaction. Locally weak soils, if encountered, should be excavated and replaced, or otherwise stabilized as recommended by the geotechnical engineer at the time of construction. The compacted surface should be firm and unyielding and should be protected from damage caused by traffic or weather. Soil subgrades should be kept moist during construction. If the subgrade is allowed to become dry, it should be moisture conditioned to eliminate shrinkage cracks.

In order to achieve satisfactory compaction of the subgrade and fill materials, it may be necessary to adjust the water content at the time of construction. This may require that water be added to soils that are too dry, or that scarification and aeration be performed in any soils that are too wet.

Areas to be paved should be scarified to a depth of at least 6 inches, moisture conditioned to slightly above optimum moisture content, and compacted to at least 95 percent relative compaction. In order to achieve satisfactory compaction of fill materials, it may be necessary to adjust the water content at the time of construction. This may require that water be added to soils that are too dry, or that scarification and aeration be performed in any soils that are too wet.

5.2.3 Removal and Recompaction of Undocumented Fill

The new Tertiary Treatment building, switchgear building, and likely the chemical storage areas are planned to be constructed in an area that likely contains undocumented fill. Should shallow foundations be desired, the undocumented fill shall be removed and recompacted. In our boring at the Tertiary Treatment building, a maximum thickness of undocumented fill was encountered to about 12 ½ feet. At the Switchgear building, little or no undocumented fill was encountered. Based upon this limited information, overexcavation at the Tertiary Treatment building would extend to a minimum of 13 feet and sides of excavation would require temporary slopes of 1.5H:1V. If there is insufficient space for open cut- excavation, then excavation slopes would need to be shored. Removal of the fill should be carried out under the observation of the Geotechnical Engineer in the field at the time of construction. The excavated material may be used as fill as long as it satisfies the recommendations provided in Section 5.2.4 - Engineered Fill Materials. Holes resulting from the removal of materials below finished grade should be cleared and backfilled with suitable material compacted to the requirements in Section 5.2.5 - Fill Placement and Compaction. Backfilling excavations should be carried out under the observation of the Geotechnical Engineer.

5.2.4 Engineered Fill Materials

All fill placed at the site should consist of engineered fill meeting the requirements presented in this report, except for landscaping materials which are placed on level ground. Onsite soil below the stripped layer and having an organic content of less than 3 percent by volume can be used as fill except where “non-expansive” import is required beneath the slabs. All engineered fill placed at the site, including onsite soils, should not contain rocks or lumps larger than 3 inches in greatest dimension and contain no more than 15 percent larger than 2.5 inches. “Non-expansive” fill should be predominantly granular have an organic content of less than 3 percent by volume, should have a liquid limit less than 40 percent, have a plasticity index not exceeding 15, and should contain no environmental contaminants or debris. Imported fill should consist of “non-expansive” fill/ or have a maximum plasticity index of 12.

5.2.5 Fill Placement and Compaction

Engineered fill less than 5 feet thick should be compacted to at least 95 percent relative compaction as determined by ASTM Designation D1557-91. Fill material should be spread and compacted in lifts not exceeding 8 inches in uncompact thickness. However, thicker lifts can be used, provided the method of compaction is approved by the geotechnical engineer, and the required minimum degree of compaction is achieved.

In order to achieve satisfactory compaction of onsite excavated soils from near or below the existing groundwater level will require drying at the time of construction.

5.2.6 Pipe Bedding and Trench Backfill

Pipeline trenches should be backfilled with materials satisfying the criteria described below for fill, placed in lifts of approximately 8 inches in uncompacted thickness. However, thicker lifts may be used provided the method of compaction is approved by the project geotechnical engineer and the required minimum degree of compaction is achieved. Onsite soil used for trench backfill should be compacted to at least 90 percent relative compaction by mechanical means only (jetting should not be permitted). Sand can be used for trench backfill if it is compacted to at least 95 percent relative compaction and sufficient water is added during backfilling operations to prevent the soil from “bulking” during compaction. The upper 3 feet of trench backfill below slab and pavements should be compacted to at least 95 percent relative compaction.

Where utility trenches backfilled with sand enter building pads, the trenches should be backfilled by an impermeable plug at the exterior wall foundation. The plugs can be composed of compacted clayey soil, compacted bentonite, or a bentonite-cement or sand-cement slurry mixture. The plugs should be at least 2 feet thick and should extend at least 2 feet beyond the edges and bottom of the trench to ‘key in’ the plug. The plug should also extend to within 1 foot of the lowest adjacent grade.

All utility trenches that extend below curbs and gutters should also be plugged as described above. The plug should be located below the curb and gutter.

Bedding material should consist of Caltrans Class 2 Aggregate Base or Aggregate Base Course (ABC) meeting the requirements of Section 26 of Caltrans Standard Specifications. All bedding material shall have 3/4-inch maximum aggregate size and be free from organic or vegetable matter, lumps, or balls of silt/clay, or any other deleterious matter. ABC material shall conform to the following gradations when tested in accordance with ASTM C136 or California Test 202.

Sieve Size (Square Openings)	Percentage by Weight Passing Sieves
1 inch Screen	100
3/4 inch Screen	90-100
No. 4 Sieve	35 to 55
No. 30 Sieve	10-30
No. 200 Sieve	2 to 9

In addition to the above requirements, all material used shall conform to the following quality requirements:

- Resistance (R-Value) with the minimum test results of 78;
- Sand Equivalent with the minimum test result of 22; and
- Durability Index with the minimum test result of 35.

5.2.7 Surface Drainage

Positive surface gradients shall be designed adjacent to the structures to direct surface water away from foundations and slabs toward suitable discharge facilities. Ponding of surface water should not be allowed adjacent to the structures or on pavements.

5.3 Shallow Foundation Supported Structures

5.3.1 Spread Footings

Structures may be supported on conventional continuous spread footings bearing on undisturbed native soils or engineered fill. Exterior walls should be underlain by a continuous spread footing providing total enclosure of the perimeter of the buildings.

Footings should be at least 12 inches wide and should be founded at least 18 inches below lowest adjacent finished grade. Footings located adjacent to other footings or utility trenches should bear below an imaginary 1.5:1 (horizontal to vertical) plane projected upward from the bottom edge of the adjacent footings or utility trench. Allowable bearing pressures are presented in Table 9, below.

Table 9. Spread Footing Allowable Bearing Pressures

Load Condition	Allowable Bearing Pressure (psf)
Dead Load	3,000
Dead plus Live Loads	4,500
Total Loads (including wind or seismic)	6,000

Based on these loads we estimate that ultimate settlements of the structure will be on the order of ½ inch.

Resistance to lateral loads for footings founded on a leveling course of 6 inches of Class 2 Aggregate Base may be provided by friction along the base of foundations and by passive pressures acting on the sides of foundations. A friction coefficient of 0.30 (FS=1.5) times the dead load may be used to evaluate the allowable (FS=1.5) frictional resistance along the bottom of foundations. A passive pressure equal to an equivalent fluid pressure of 300 pcf can be used for lateral load resistance against the sides of footings perpendicular to the direction of loading where the footing is poured neat against undisturbed material or engineered fill. The upper 1-foot of soil should be ignored, unless it is confined by a pavement or slab. The passive resistance is based on a factor of safety of 2.0. However, relatively large deflections would be required to mobilize this passive resistance. Therefore, to limit deformations to less than about ¼-inch, we recommend that the passive resistance should be considered as an ultimate value (FS=1.0).

Any visible cracks in the bottoms of the footing excavations should be closed by wetting prior to construction of the foundations. We recommend that we observe the footing excavations prior to placing reinforcing steel or concrete, to check that footings are founded on appropriate material. All foundation excavations should be cleaned of loose material and should be free of water. The footings should be kept moist prior to concrete placement.

5.3.2 Structural Slab/Mat Foundations

New improvements may be founded on a structural slab or mat foundation. The structural slab/mat foundations should be founded on a leveling course of 6 inches of Class 2 Aggregate Base. The mat foundations may be designed with a modulus of subgrade reaction of 250 pci (with an anticipated vertical deflection of ¼ inch for the dead plus live load condition). Allowable bearing pressures are presented in Table 10, below.

Table 10. Mat Foundation Allowable Bearing Pressures

Load Condition	Allowable Bearing Pressure (psf)
Dead Load	2,000
Dead plus Live Loads	3,000
Total Loads (including wind or seismic)	4,000

Based on these loads we estimate that settlements of the structure will be on the order of ½ inch.

Resistance to lateral loads may be provided by friction along the base of foundations and by passive pressures acting on the face of below grade foundations perpendicular to the direction of loading. Allowable (FS=1.5) lateral resistance for structural slabs/mats may be derived using a friction coefficient of 0.30. A passive pressure equal to an equivalent fluid pressure of 250 pcf can be used for lateral load resistance against the sides of mats perpendicular to the direction of loading where the foundation is poured neat against undisturbed material. The upper one-foot of soil should be ignored, unless it is confined by a pavement or slab. The passive resistance is based on a factor of safety of 2.0. However, relatively large deflections would be required to mobilize the ultimate passive resistance. Therefore, in order to limit deformations to less than about ¼-inch, we recommend that the passive resistance should be considered as an ultimate value.

Subgrade soils to support the structural slab/mat foundation should be undisturbed, firm and non-yielding, and should be checked by the geotechnical engineer for proper depth, bearing, and clean out prior to the placement of the reinforcing steel. All foundation excavations should be kept moist and free of loose soils and standing water prior to concrete placement.

5.3.3 Drilled Pier Foundations

Structures founded on drilled piers will develop foundation support through skin friction. Drilled pier capacity should be estimated using an ultimate (FS=1.0) skin friction of 800 psf for native soils. Skin friction of piers in undocumented fill should be ignored. We recommend a minimum factor of safety of two (FS=2.0) be used for design. An ultimate (FS=1.0) skin friction value of 1,000 psf may be used for all load combinations that include wind or seismic loads. Uplift loads may be resisted using 80 percent of the allowable skin friction values. We also recommend that new piers have a minimum diameter of 12 inches. Pier reinforcing should be based on structural requirements.

An ultimate (FS=1.0) passive pressure equal to an equivalent fluid pressure of 300 pcf can be used for lateral load resistance against the sides of piers. The pressure should be assumed to act on a width equal to one and one-half times the pier or pile diameter. In addition, the upper one foot of passive soil resistance should be neglected in design where the adjacent soil is not covered with a slab or pavement. The aforementioned values are ultimate values that assume a deflection at the ground surface on the order of 1/2 to 1 inch, in order to fully mobilize the passive resistance.

Installation of drilled piers or piles should be performed under the observation of our geotechnical engineer to confirm that the foundations are constructed in appropriate materials and extend the required distance into competent material. The actual design depth of drilled piers should be confirmed and adjusted in the field based on the subsurface conditions exposed during excavation.

5.3.4 Below-Grade Walls and Other Retaining Structures

Below-grade walls and other retaining structures should be checked for lateral earth pressures. An “at-rest” equivalent fluid pressure of 65 pcf should be used above the groundwater table. An “at-rest” equivalent fluid pressure of 95 pcf should be used above the groundwater table. For purposes of this report, given that no reliable measurement of groundwater has been achieved, we recommend assuming a groundwater table at a depth of ten feet below grade.

For walls requiring seismic increment, an additional uniform pressure of 15H, in pounds psf, should be added to the at-rest condition, where H is the height of the wall (whether the wall is restrained or unrestrained).

Below grade wall backfill should be entirely compacted to at least 95 percent relative compaction. If heavy compaction equipment is used, the walls should be appropriately designed to withstand loads exerted by the heavy equipment, and/or temporarily braced.

Retaining structures protecting moisture-sensitive improvements located below the design groundwater table should be waterproofed as appropriate.

Generally, for restrained walls any adjacent surcharge loading should be calculated as uniform lateral load applied to the top 10 feet of the structure and equal to ½ of the surcharge load.

5.3.5 Miscellaneous Slabs-on-Grade

Walkway slabs and other exterior slabs may be supported directly on properly prepared engineered fill or on properly prepared onsite soils. All slab subgrade areas containing loose/soft soils should be overexcavated and backfilled using engineered fill. The subgrade soils should be moisture conditioned to about 2 to 3 percent over optimum water content immediately prior to concrete placement. The condition of subgrade soils should be evaluated in the field by the Geotechnical Engineer prior to placing concrete.

5.3.6 Pavement

One “R” (resistance) value test was previously performed at the treatment plant on a representative bulk sample of the surface materials. The results of this test indicated an “R” value of 66. However, because of the durability of the sands, we recommend using a maximum “R” value of 50 for design. Combining this information with an appropriate traffic index for the proposed heavy truck access areas, we have developed the following alternative pavement sections using Procedure 301-F of the State of California Department of Public Works, Division of Highways for a pavement life of 20 years.

Table 11. Recommended Pavement Design Alternatives

	Pavement Components		
Location	**Asphaltic Concrete (inches)**	**Aggregate Base Class 2 (inches)**	**Total Thickness (inches)**
Truck Access Areas (T.I. = 6.5 for 20-year life)	3	6	9*
*Minimum recommended section			

The traffic indices used in our pavement designs are considered reasonable values for the proposed development and should provide the indicated pavement lives with only a normal amount of pavement maintenance. Selection of the design traffic parameters, however, were based on engineering judgement and not on an equivalent wheel load analysis developed from a traffic study or furnished to us.

In areas where the pavements will abut planted areas, the pavement baserock layer should be protected against saturation from water in the planters. This can be accomplished by extending the concrete curbs to the bottom of the baserock layer, forming a cut-off wall between the planter and the pavement section.

The Aggregate Base for use in flexible pavements should conform to Caltrans Standard Specification Section 26-1.02A for Class 2 Aggregate Base. The Aggregate Base used in the pavement sections should be compacted to 95 percent of the soil's maximum dry density (ASTM D1557) and should be firm and unyielding.

5.4 Additional Geotechnical Services

Per our scope of services, we have identified geotechnical issues within the current extents of the project. These issues include aerial extend and depth of undocumented fills at the WWTP, potential for dynamic settlements along the main transmission line, and lack of or insufficient depth of subsurface information for alternative routes, trenchless crossings, and tank site that is yet to be determined. Based on current project alignment the following additional geotechnical investigations are recommended:

- Additional borings at the North San Mateo County Sanitation District WWTP to define depth and aerial extent of undocumented fills.
- Additional borings/CPTs along Merced Lake Boulevard where dynamic settlement potential in very loose to loose sands have been identified. These investigations would further define extent and quantify magnitude of settlement and differential settlements over about a 1,500 feet section of the current main transmission line alignment.
- Additional borings at trenchless crossing locations once they have been identified to appropriate depths document subsurface conditions and provide geotechnical recommendations.
- Additional borings at the recommended tank site.
- Additional borings within SFPUC right-of-way; through Woodlawn Cemetery, where no subsurface information has been obtained if this alternative is selected (see Plate 5).
- Additional borings on the alternative Colma Boulevard alignment of main transmission line if selected where no subsurface information has been collected.

Fugro should review geotechnical aspects of the plans and specifications to check for conformance with the intent of our recommendations. The analyses, designs, opinions, and recommendations submitted in this report are based in part upon the data obtained from the subsurface explorations conducted for the Feasibility of Expanded Tertiary Recycled Water Facilities Project, and upon the conditions existing when services were conducted. Variations of subsurface conditions from those analyzed or characterized in the report are possible, as may become evident during construction. In that event, it may be advisable to revisit certain analyses or assumptions.

We understand project design is at an approximately 30 percent level of development at the time of issuance of this report.

We recommend that Fugro be retained to provide geotechnical services during foundation installation to observe compliance with the design concepts, specifications, and recommendations presented in this report. Our presence will also allow us to modify design if unanticipated subsurface conditions are encountered. During construction, our field engineer should observe and/or test the following:

- Soil conditions exposed by site grading and foundation excavations, to check that they are consistent with those encountered during the field exploration;
- Removal and recompaction of undocumented fills;
- Foundation excavations;
- Pier/pile foundation installation;
- Subgrade preparation; and
- Fill placement and compaction, including backfill of utilities and compaction of aggregate base.

6. LIMITATIONS

Our services consist of professional opinions, conclusions, and recommendations that are made in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

The analyses and recommendations contained in this report are based on the data obtained from the subsurface explorations conducted for this study and relevant previous explorations. These explorations indicate subsurface conditions only at specific locations and times, and only to the depths penetrated. Variations may exist and conditions not observed or described in this report could be encountered during construction. Our conclusions and recommendations are based on our analysis of the observed conditions. If conditions other than those described in this report are encountered, we should be notified so that we can provide additional recommendations, if warranted.

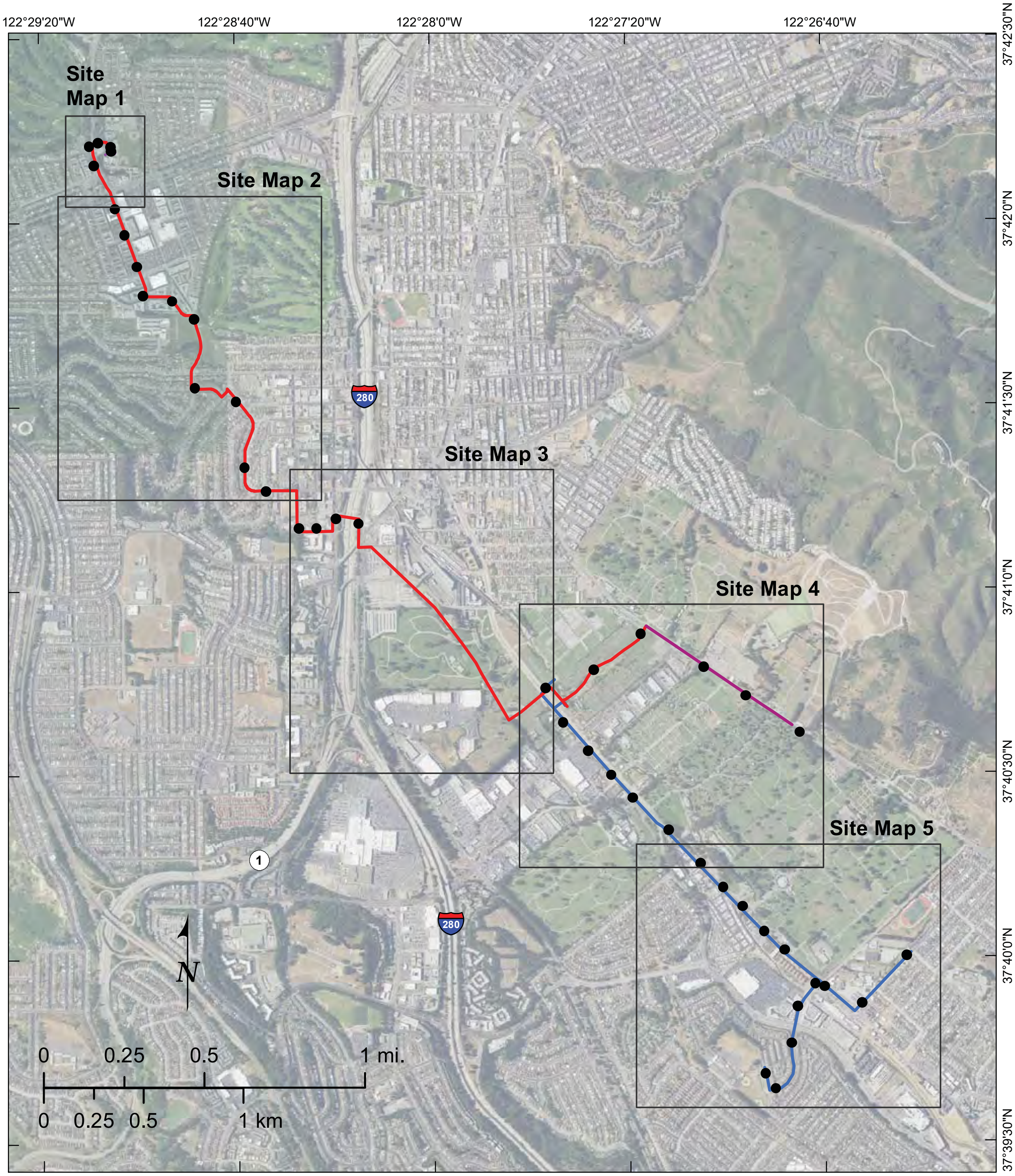
This report has been prepared for the exclusive use of Daly City and Carollo Engineers and their consultants for specific application to the Feasibility of Expanded Tertiary Recycled Water Facilities Project in Daly City, California as described herein. In the event that there are any changes in the ownership, nature, design, or location of the proposed project, or if any future additions are planned, the conclusions and recommendations contained in this report should not be considered valid unless 1) the project changes are reviewed by Fugro, and 2) conclusions and recommendations presented in this report are modified or verified in writing. Reliance on this report by others must be at their risk unless we are consulted on the use or limitations. We cannot be responsible for the impacts of any changes in geotechnical standards, practices, or regulations subsequent to performance of services without our further consultation. We can neither vouch for the accuracy of information supplied by others, nor accept consequences for unconsulted use of segregated portions of this report.

PLATES

LOCATION MAP

PLATE 1

\\oakpfclfs01\data\Public08\jobdocs\04.72160021 Daly City Colma Pipeline Project\02_Task 2\10_GIS\Outputs\2017_08_22_Report\mxd\01_DalyCity_LocationMap.mxd; j.holmberg; 9/11/2017



Legend

● Completed boring

Proposed Pipelines

Main transmission line
Distribution lines

SITE PLAN INDEX

PLATE 2

\\oakpfclfs01\data\Public08\jobdocs\04.72160021 Daly City Colma Pipeline Project\02_Task 2\10_GIS\Outputs\2017_08_22_Report\mxd\02_DalyCity_SiteMap_Index.mxd; j.holmberg; 9/11/2017

Legend

SITE PLAN - MAP 1

PLATE 3

\\oakpfclfs01\data\Public08\jobdocs\04.72160021 Daly City Colma Pipeline Project\02_Task 2\10_GIS\Outputs\2017_08_22_Report\mxd\03_DalyCity_SiteMap_1.mxd; j.holmberg; 9/11/2017

Legend

Completed boring

Proposed main transmission pipeline

SITE PLAN - MAP 2

PLATE 4

\\oakpfclfs01\data\Public08\jobdocs\04.72160021 Daly City Colma Pipeline Project\02_Task 2\10_GIS\Outputs\2017_08_22_Report\mxd\04_DalyCity_SiteMap_2.mxd; j.holmberg; 9/11/2017

Legend

Completed boring

Proposed Pipelines

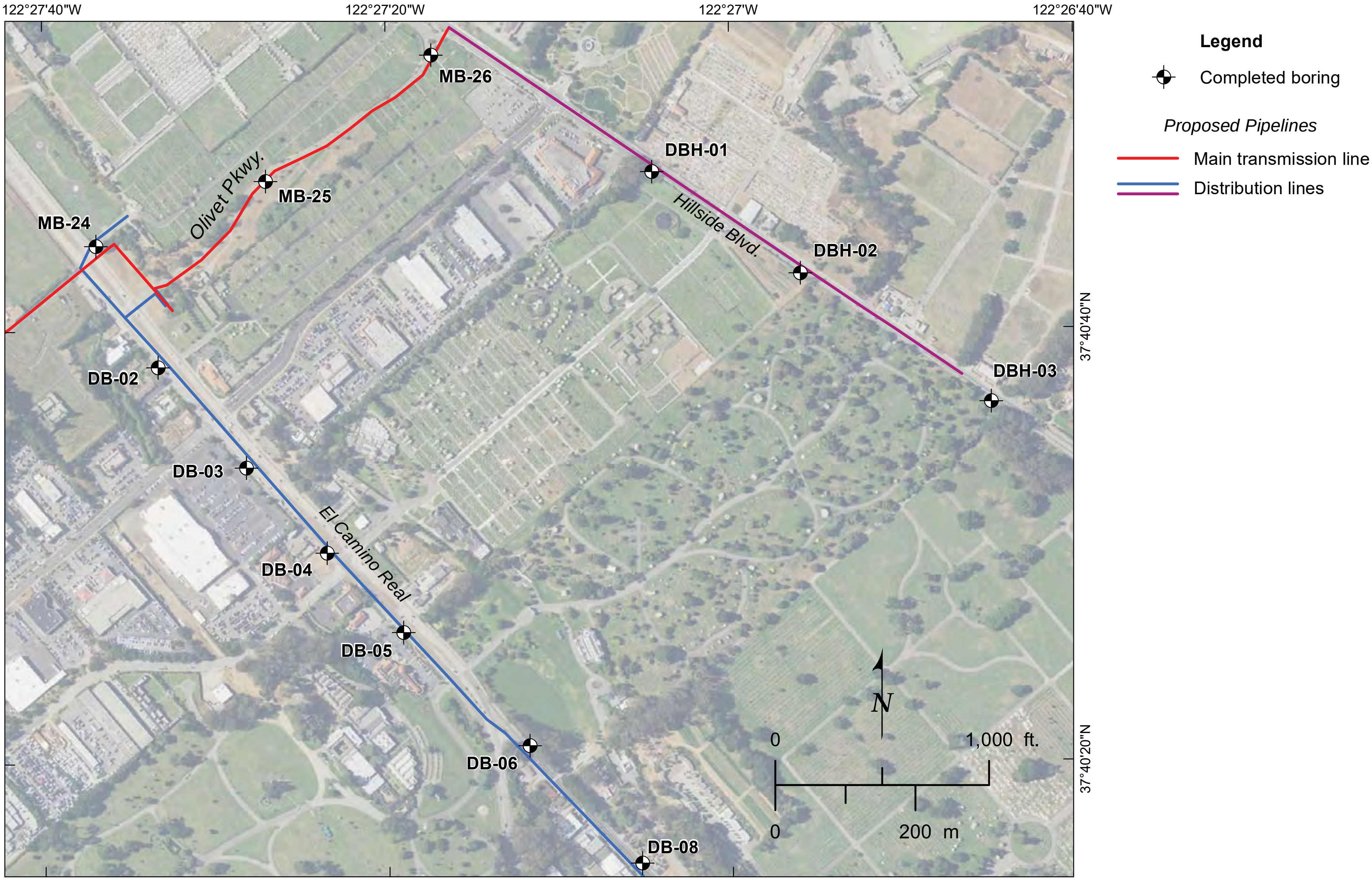
Main transmission line

Distribution line

SITE PLAN - MAP 3

PLATE 5

CITY OF DALY CITY
FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES PROJECT
DALY CITY, CALIFORNIA

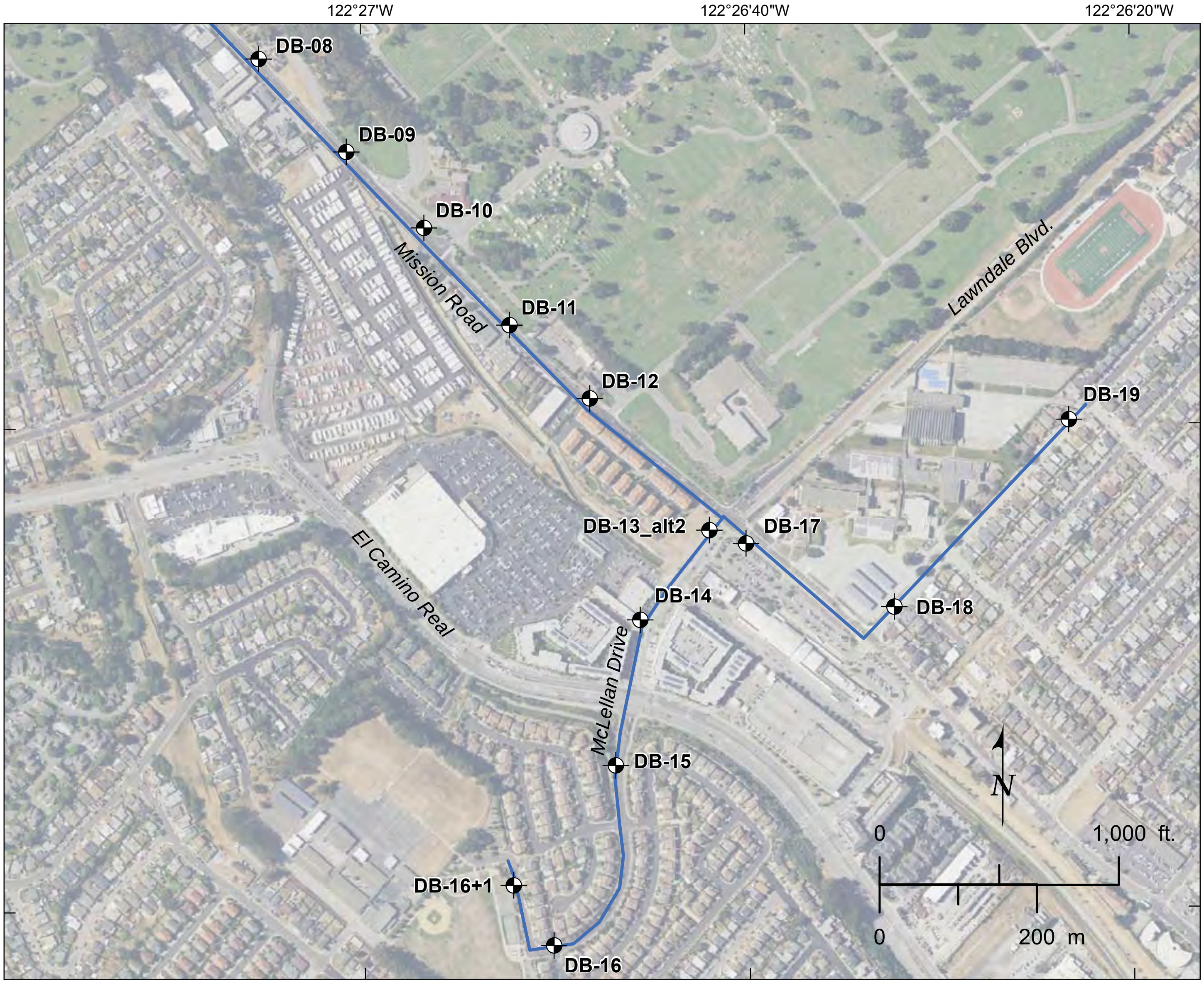


SITE PLAN - MAP 4

PLATE 6

\\oakpfclfs01\data\Public08\jobdocs\04.72160021 Daly City Colma Pipeline Project\02_Task 2\10_GIS\Outputs\2017_08_22_Report\mxd\06_DalyCity_SiteMap_4.mxd; j.holmberg; 9/11/2017

CITY OF DALY CITY
FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES PROJECT
DALY CITY, CALIFORNIA



Legend

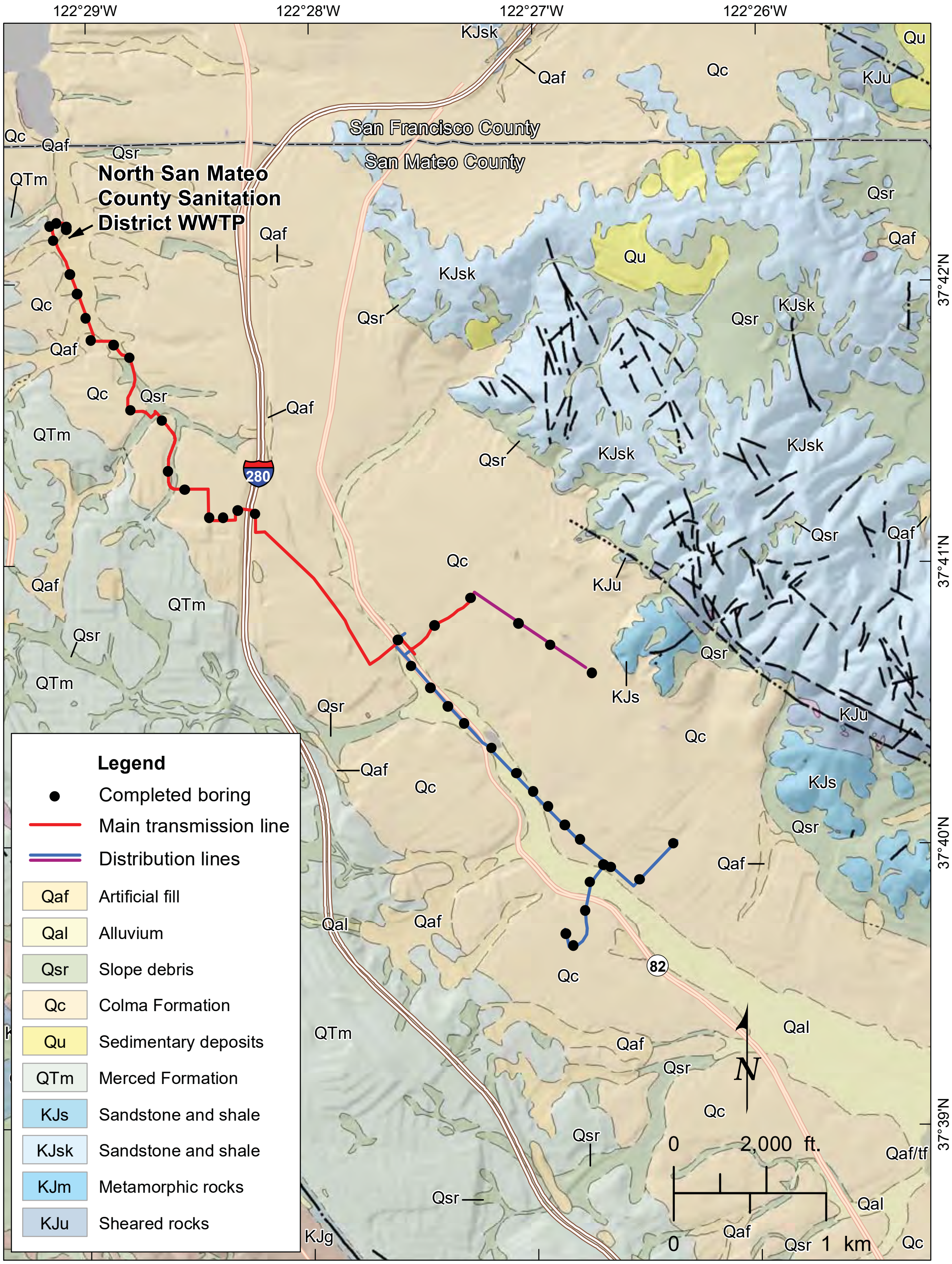
Completed boring

Proposed distribution pipeline

SITE PLAN - MAP 5

PLATE 7

\\oakpfclfs01\data\Public08\jobdocs\04.72160021 Daly City Colma Pipeline Project\02_Task 2\10_GIS\Outputs\2017_08_22_Report\mxd\07_DalyCity_SiteMap_5.mxd; j.holmberg; 9/11/2017

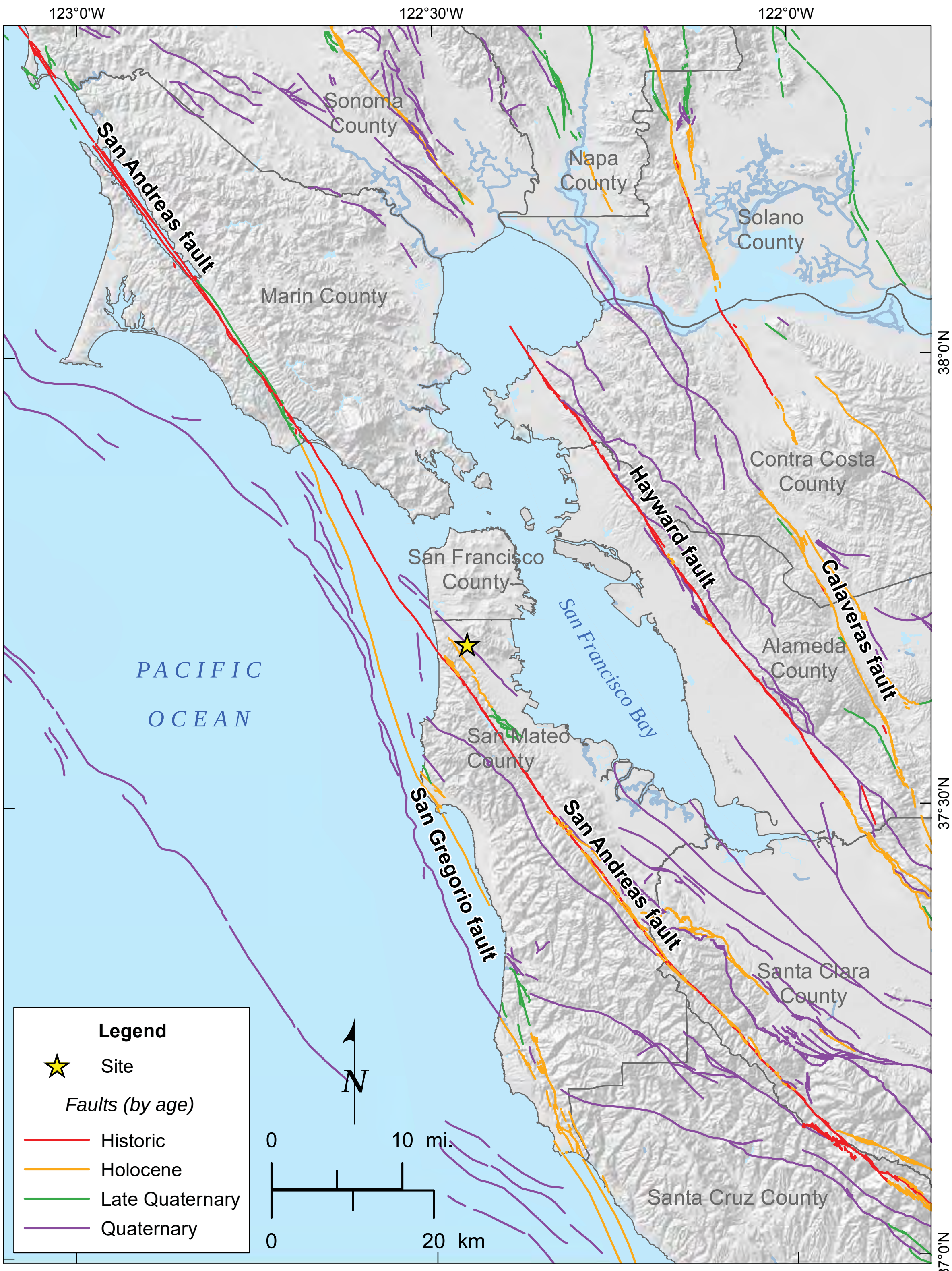


Geologic data from USGS OFR 98-354.

GEOLOGIC MAP

PLATE 8

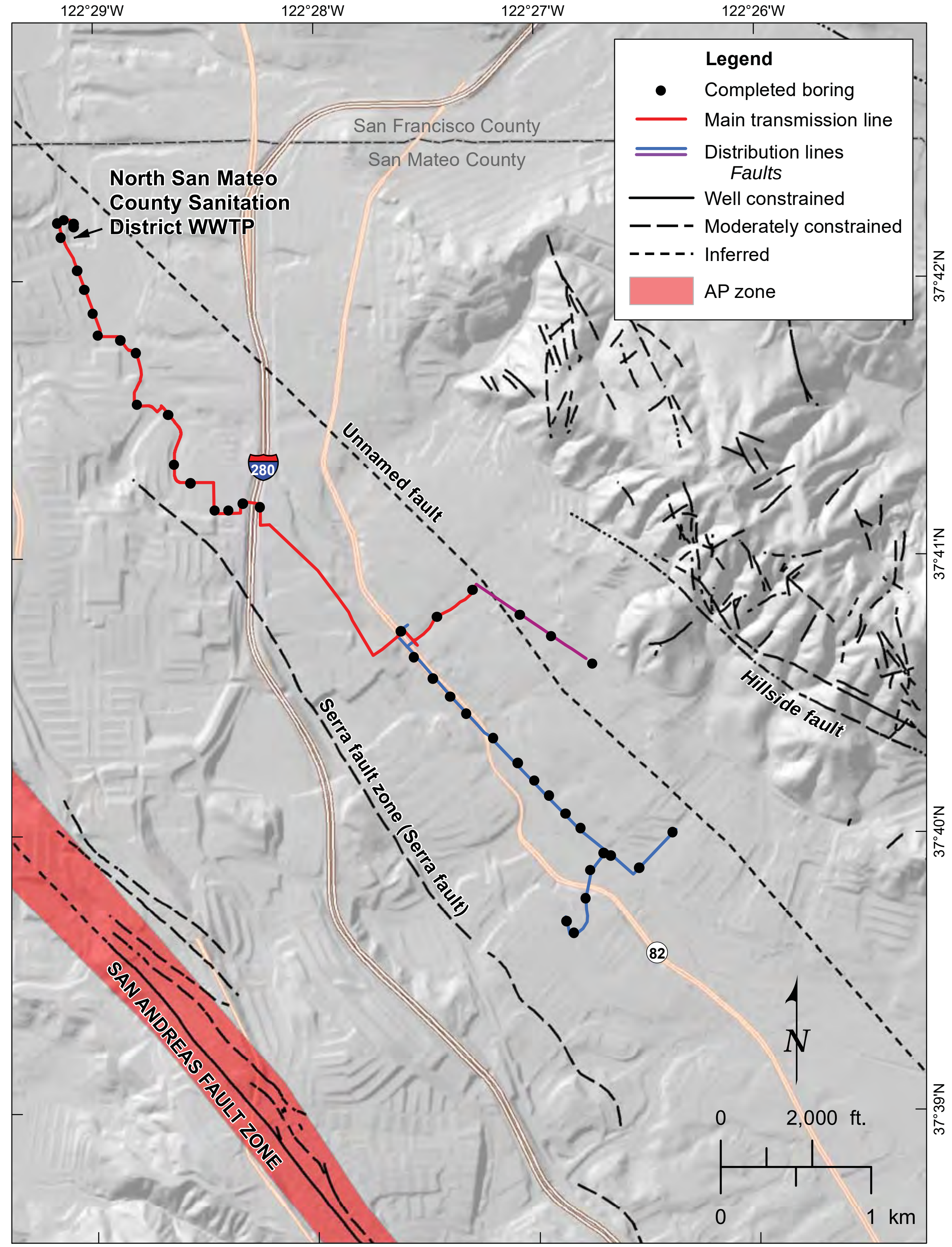
\\oakpfclfs01\data\Public08\jobdocs\04.72160021 Daly City Colma Pipeline Project\02_Task 2\10_GIS\Outputs\2017_08_22_Report\mxd\08_DalyCity_Geology.mxd; j.holmberg; 9/11/2017



Fault data from USGS Quaternary Fault and Fold Database.

REGIONAL FAULT MAP

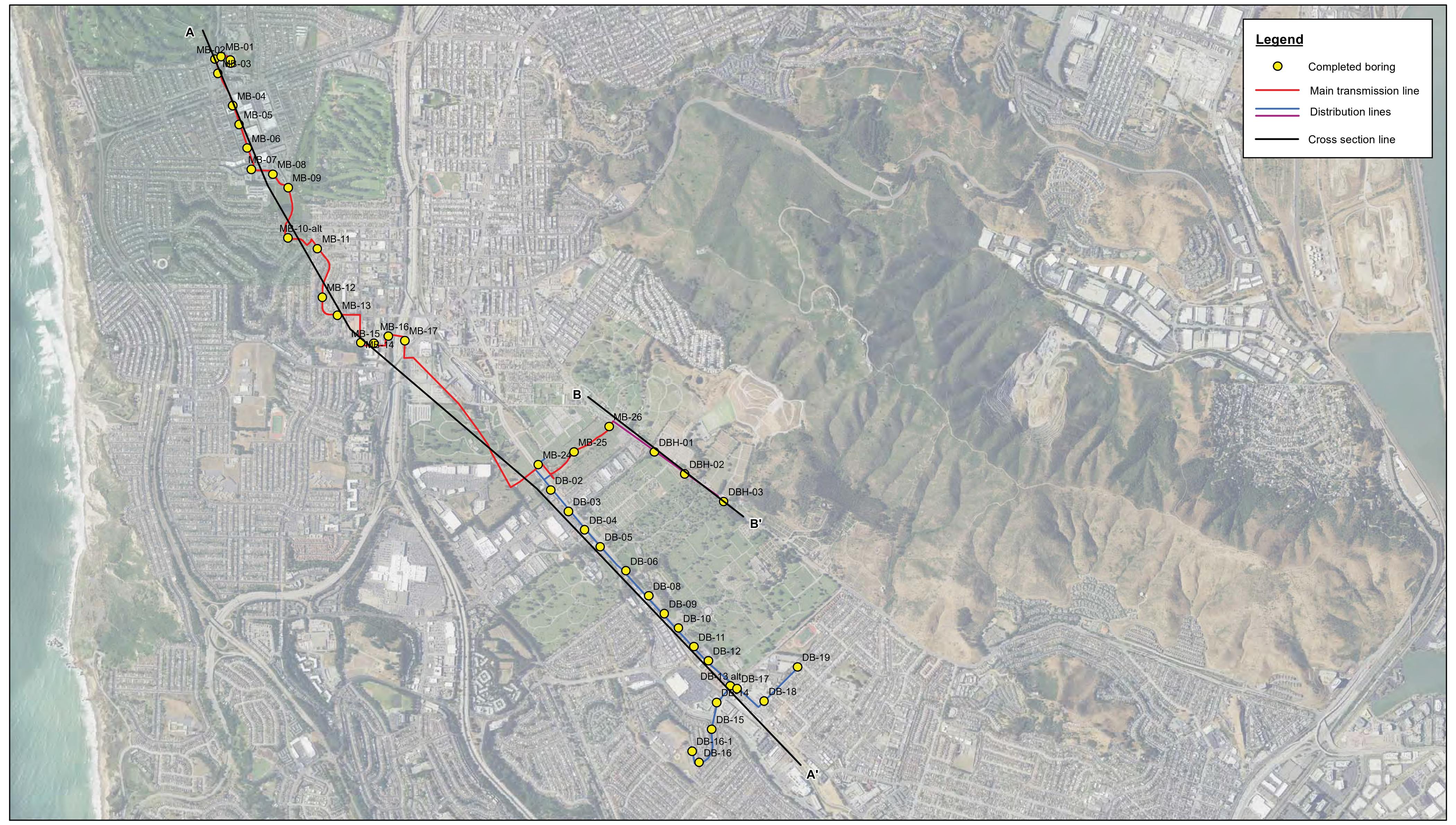
PLATE 9

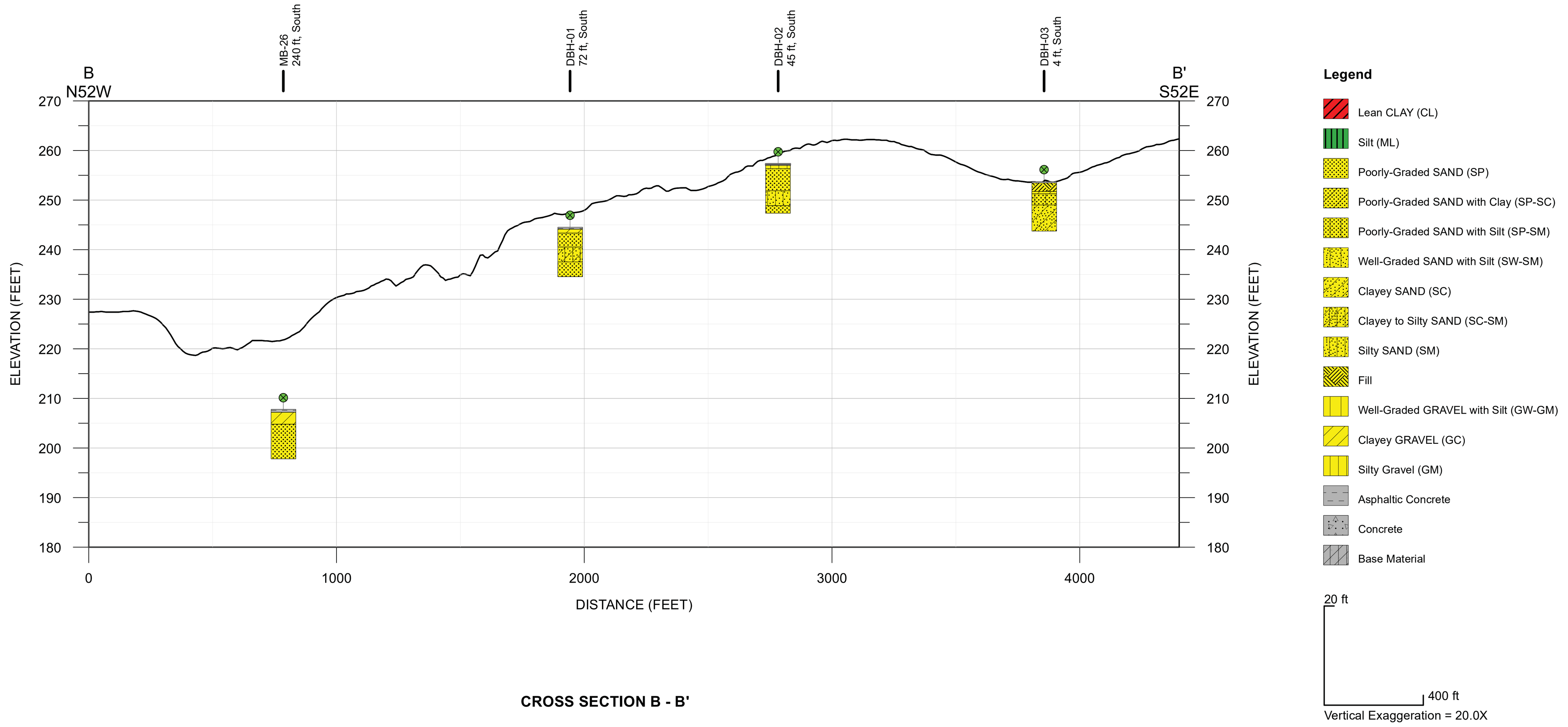


Fault data from USGS Quaternary Fault and Fold Database and from Bonilla, 1998.
AP Zone from California Geological Survey.

FAULT MAP OF THE PROJECT AREA PLATE 10

\\oakpfclfs01\data\Public08\jobdocs\04.72160021 Daly City Colma Pipeline Project\02_Task 2\10_GIS\Outputs\Working\mxd\DalyCity_VicinityFaults_20170906.mxd; j.holmberg; 9/11/2017





CROSS SECTION B - B'

CROSS SECTION A - A'

CROSS SECTIONS

PLATE 11

\\oakpfclfs01\data\Public08\jobdocs\04.72160021 Daly City Colma Pipeline Project\02_Task 2\10_GIS\Outputs\2017_08_22_Report\mxd\11_Profile_PipelineAB.mxd; j.holmberg; 9/11/2017

APPENDIX A
FIELD EXPLORATIONS

APPENDIX A
FIELD EXPLORATIONS

The field exploration program consisted of a surface reconnaissance and a subsurface exploration program. As a part of the geotechnical exploration for the project, two exploratory borings, designated B-1 through B-2, were conducted on August 19, 2011. The borings were advanced to maximum depths of about 36.5. The borings were drilled with a truck-mounted drill rig equipped with hollow stem auger drilling equipment and automatic hammer.

Representative soil samples were obtained from the boring using a Modified California split-barrel drive sampler (outside diameter of 3.0 inches, inside diameter of 2.5 inches), and a Standard Penetration Test (SPT) split-barrel drive sampler (outside diameter of 2.0 inches, inside diameter of 1.375 inches). All samples were transmitted to our laboratory for evaluation and appropriate testing. The sampler types are indicated in the "Sampler" column of the boring log as designated in Plate A-1.

Resistance blow counts were obtained with the samplers by dropping a 140-pound hammer through a 30-inch free fall using a wire-line safety hammer. The sampler was driven 18 inches, or a shorter distance where hard resistance was encountered, and the number of blows were recorded for each 6 inches of penetration. The blows per foot recorded on the boring logs represent the accumulated number of blows that were required to drive the last 12 inches. Due to the large diameter of the Modified California sampler, the blow counts for this sampler are converted to standard penetration resistance values. In order to convert these values to approximate standard penetration resistance values, the indicated blow counts were multiplied by a factor of about 0.6.

Upon completion of our field explorations, the borings were backfilled with neat cement grout. The logs of the borings, as well as a key for the classification of the soil (Plate A-1) are included as part of this appendix. The boring and related information show our interpretation of the subsurface conditions at the dates and locations indicated, and it is not warranted that they are representative of subsurface conditions at other locations and times.

The approximate locations of the exploratory borings are shown on the Site Plan, Plate 2.

CLASSIFICATION AND MATERIAL SYMBOLS

MAJOR DIVISIONS PER ASTM D2488-06			MAJOR GROUP NAMES AND MATERIAL SYMBOLS	
COARSE-GRAINED SOILS More than 50% retained on the No. 200 sieve	GRAVELS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	Clean gravels less than 5% fines	GW	Well-Graded GRAVEL
			GP	Poorly Graded GRAVEL
		Gravels with more than 12% fines	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SANDS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	Clean sand less than 5% fines	SW	Well-Graded SAND
			SP	Poorly Graded SAND
		Sands with more than 12% fines	SM	SILTY SAND
			SC	CLAYEY SAND
FINE-GRAINED SOILS 50% or more passes the No. 200 sieve	SILTS AND CLAYS Liquid Limit Less than 50%		ML	SILT
			CL	Lean CLAY
			OL	ORGANIC SILT
	SILTS AND CLAYS Liquid Limit Greater than 50%		MH	Elastic SILT
			CH	Fat CLAY
			OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS			PT	Peat or Highly Organic Soils

Notes:
Classification of soils on the boring logs is in general accordance with ASTM D2488, or D2487 if appropriate laboratory data are available.
The geologic formation is noted in bold font at the top of interpreted interval on the boring logs.

OTHER MATERIAL SYMBOLS

- Debris or Mixed Fill
- Pavement with Aggregate Base

SAMPLER TYPE

SPT (Driven) 1-3/8" ID 2" OD	Modified California (Driven) 2-3/8" ID 3" OD	Modified California (Driven) 1-7/8" ID 2-1/2" OD
Shelby Tube (Pushed) 2-7/8" ID 3" OD	Pitcher Barrel (Rotary-cut) 2-7/8" ID	Osterberg (Piston) 2-7/8" ID
101 Geobarrel (Rotary-cut) 2-7/8" ID	Rock Core (Rotary-cut) See log for size	Vibracore (Vibrated) See log for size
Push-core (Pushed) See log for size	Collected from Auger	Other See log for details

Note: Refer to text of report for additional details or other sampler types.

BLOW COUNT

Number of blows required to drive sampler each of three 6-in. intervals, as measured in the field (uncorrected). An SPT hammer (140 lb., falling 30-in.) was used unless otherwise noted on the boring log. For example:

Blow Count	Description
5 7 8	5, 7, and 8 blows for first, second, and third interval, respectively.
35 50/3"	35 blows for the first interval. 50 blows for the first 3 inches of the second interval. Lack of third value implies that driving was stopped 3 inches into the second interval.
WOH WOH 5	"WOH" indicates that the weight of the hammer was sufficient to advance the sampler over the first two intervals. 5 blows were required to advance the sampler over the third interval.

N-VALUE

The N-Value represents the blowcount for the last 12 inches of the sample drive if three 6-inch intervals were driven. N-value presented is independant of impact energy. If 50 hammer blows were insufficient to drive through either the second or the third interval, the total number of blows and total length driven are reported (excluding the first interval). "ref" (refusal) indicates that 50 blows were insufficient to drive through the first 6-inch interval.

Parenthesis indicate that an approximate correction has been applied for non-SPT drive samplers. For example, a factor of 0.63 is commonly used to adjust blow counts obtained using a 3-inch outside diameter modified California sampler to correspond to Standard Peneteration Test.

UNDRAINED SHEAR STRENGTH

A value of undrained shear strength is reported. The value is followed by a letter code indicating the type of test that was performed, as follows:

U - Unconfined Compression
Q - Unconsolidated Undrained Triaxial
T - Torvane
P - Pocket Penetrometer
M - Miniature Vane
F - Field Vane
R - R-value

OTHER TESTS

Field or laboratory tests without a dedicated column on the boring log are reported in the Other Tests column. A letter code is used to indicate the type of test. For certain tests, a value representing the test result is also provided. Typical letter codes are as follows. Additional codes may be used. Refer to the report text and the laboratory testing results for additional information.

k - Permeability (cm/s)
Consol - Consolidation
Gs - Specific Gravity
MA - Particle Size Analysis
EI - Expansion Index
OVM - Organic Vapor Meter

WATER LEVEL SYMBOLS

▽ Initial water level
▼ Final water level
Seepage encountered

INCREASING MOISTURE CONTENT

Dry
Moist
Wet

CONSISTENCY OF COHESIVE SOIL

CONSISTENCY	UNDRAINED SHEAR STRENGTH (KIPS PER SQUARE FOOT)
Very Soft	< 0.25
Soft	0.25 to 0.50
Medium Stiff	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	> 4.0

Note: In absence of test data, consistency has been estimated based on manual observation.

APPARENT DENSITY OF COHESIONLESS SOIL

APPARENT DENSITY	N-VALUE
Very Loose	0 to 4
Loose	5 to 9
Medium Dense	10 to 29
Dense	30 to 49
Very Dense	> 49

TERMS AND SYMBOLS USED ON BORING LOGS

PLATE A-1

LOCATION:

DEPTH, ft	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
					10 inches of Reinforced Concrete							
					2 inches of Aggregate Base							
					FILL Poorly-graded SAND with CLAY (SP-SC): medium dense, dark brown, moist, fine-grained sand, darker color with increasing depth, no odor, no staining, debris present							
					ALLUVIUM (Qal) Poorly-graded SAND with CLAY (SP-SC): medium dense, brown, moist to wet, fine-grained sand, no odor, no staining							
5	1	4 6 7	17	10/18"								
10	2	3 5 7	15	13/18"	-light brown sand nodules present		9					Gs = 2.7
					Poorly-graded SAND with CLAY (SP-SC): dense, brown, moist to wet, fine-grained sand, no odor, no staining							
15	3	6 10 15	33	18/18"	-wet							
					Poorly-graded SAND with SILT and GRAVEL (SP-SM): medium dense, brown, wet, less than 10% fine-grained gravel, fine-grained sand, no odor, no staining							
20	4 5	10 18 17	(29)	18/18"		128	12	7				Gs = 2.7 MA
					Poorly-graded SAND (SP): dense, brown, wet, medium-grained sand, no odor, no staining							
25	6 7	20 34 38	(60)	18/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 26.5 ft
BACKFILL: Grout, Concrete Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: July 12, 2017
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: C Anderson
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-02
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						10 inches of Concrete							
						2 inches of Aggregate Base							
						FILL Poorly-graded SAND (SP): medium dense, dark brown, dry to moist, fine-grained sand, no odor, no staining, debris and trace gravel present							
						ALLUVIUM (Qal) SILTY SAND (SM): very loose to loose, brown, moist to wet, fine-grained sand, gray to light gray clay nodules, no odor, no staining							
5		1	2 2 2	5	8/18"			6					
						Poorly-graded SAND (SP): medium dense, light brown, moist, medium-grained sand, brown clay nodules, no odor, no staining							
10		2	4 7 6	17	15/18"								
						SILTY SAND (SM): dense to very dense, light brown, moist, medium-grained sand, brown clay nodules, no odor, no staining							
15		3 4	8 17 31	(40)	16/18"		113	7	25				MA
20		5	13 24 38	80	15/18"								
25		6 7	6 24 45	(58)	16/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 26.5 ft
BACKFILL: Grout, Concrete Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: July 12, 2017
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: C Anderson
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-03
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						6 inches of Asphalt Concrete							
						6 inches of Aggregate Base							
						FILL Poorly-graded SAND (SP): medium dense, dark brown, dry to moist, fine-grained sand, organic odor, no staining, wood and concrete present							
5		1	1 1 1	2	8/18"	**ALLUVIUM (Qal)** Poorly-graded SAND (SP): very loose to loose, brown, moist to wet, fine-grained sand, no odor, no staining							
						Poorly-graded SAND (SP): medium dense, light brown, moist, fine-grained sand, no odor, no staining							
10		2 3	2 5 6	(9)	15/18"	-slightly darker color	107	7					
15		4	5 7 8	19	18/18"								
						SILTY SAND (SM): loose to medium dense, brown, moist, poorly graded fine-grained sand, brown and orange staining, no odor							
20		5 6	8 19 21	(33)	18/18"		115	18	13	NP	NP		MA
25		7	4 7 12	24	15/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 26.5 ft
BACKFILL: Grout, Concrete Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: July 13, 2017
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: C Anderson
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-04
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						2.5 inches of Asphalt Concrete							
						9.5 inches of Concrete							
						6 inches of Aggregate Base							
						FILL CLAYEY SAND (SC): medium dense, light brown, moist, well graded fine-grained sand, no odor, no staining							
						ALLUVIUM (Qal) Poorly-graded SAND (SP): loose to medium dense, dark gray, moist, poorly graded fine-grained sand with clay and rock debris, no odor, no staining							
5		1	2 9 11	26	11/18"								
						ALLUVIUM (Qal) CLAYEY SAND (SC): medium dense, dark gray, moist, fine-grained sand, no odor, no staining							
10		2	5 9 12	(17)	6/18"		100	16	33				MA
						Lean CLAY with GRAVEL (CL): medium dense, dark gray to black, moist, low plasticity clay, organic odor, no staining, fine gravel							
15		3	2 9 12	27	12/18"			12		NP	NP		
						Poorly-graded SAND with CLAY (SP-SC): medium dense, brown, wet, fine-grained sand, no odor, no staining							
20		4	5 10 12	28	18/18"								
25		5 6	4 8 13	(17)	18/18"	-orange and gray staining present							

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 26.5 ft
BACKFILL: Grout, Concrete Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: July 13, 2017
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: C Anderson
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-05
Daly City Colma Pipeline Project
Daly City, California

FCLP STANDARD LOG G:\JOBDOCS\04.72160021 DALY CITY COLMA PIPELINE PROJECT\02_TASK 2\04_ENGINEERING\04 72160021 BORING LOGS_UPDATED.GPJ OGEM_LIB_JAN2012.GLB 8/31/17 05:28 p

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						3 inches of asphalt							
			28 30 23	(44)	16/18"	Poorly-graded SAND with SILT and GRAVEL (SP-SM): dense, reddish brown, moist, gravels are fine and angular							
			6 6 10	20	13/18"	Poorly-graded SAND (SP): medium dense, reddish brown, dry	132	5					
						unable to advance drill auger							
5													
10													
15													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 16.5 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 13, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-06
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						4 inches of asphalt							
						CLAYEY SAND with GRAVEL (SC): medium dense, dark red, dry to moist, gravel is fine							
				0	54/54"	moist, cobbles up to 4" in diameter							
						decreased gravel content							
						cobble layer approximate 8 inches thick							
5			4 4 7 10/ 5/ 14/	(9) 24	18"		108	8					
						auger refusal							

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

FCLP STANDARD LOG G:\JOBDOCS\04.72160021 DALY CITY COLMA PIPELINE PROJECT\02_TASK 2\04_ENGINEERING\04 72160021 BORING LOGS_UPDATED.GPJ OGEM_LIB_JAN2012.GLB 8/31/17 05:28 p

BORING DEPTH: 8.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 19, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-08
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						8 inches of asphalt							
			12 13 15	(23)	14/18"	SILTY GRAVEL with SAND (GM): medium dense, reddish brown, moist							
			8 9 11	26	17/18"	Poorly-graded SAND with SILT (SP-SM): medium dense, dark reddish brown, moist, trace fine gravel and asphalt decreased fines content							
5			5 9 10	(16)	15/18"	asphalt present	113	13					
			4 5 9	18	15/18"	increased fines content							
			5 5 4	(7)	0/18"	loose							
			3 3 5	10	16/18"	wet		13	21				MA
10													
						refusal with augers, SPT attempted--no penetration, rubber scraps found in shoe							

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 14.5 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 13, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-09
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						4 inches of asphalt							
						SILTY SAND with GRAVEL (SM): reddish brown, moist, gravel is fine, sub-angular, some angular gravels up to 4" in diameter [FILL]							
				0	60/60"								
						SILTY SAND with GRAVEL (SM): orange brown, moist, some sub-rounded to sub-angular gravels							
5			13 25 31	(47)	17/18"	Poorly-graded SAND with SILT and GRAVEL (SP-SM): dense, orange brown with light brown matrix, moist	107	7					
			12 16 20	46	17/18"								
			15 26 39	(54)	15/18"		111	10					
10			17 25 36	79	18/18"	very dense, 1 to 1.5 inch layering defined by color changes (alternating light brown and orange brown)							

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 11.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 13, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-10
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						3 inches of asphalt							
						CLAYEY GRAVEL with SAND (GC): medium dense, reddish brown, moist, fine gravel							
			13 10 11	(17)	17/18"	Poorly-graded SAND with SILT (SP-SM): medium dense, reddish brown, moist, trace gravel and silt							
			5 4 8	15	15/18"								
5			10 17 22	(32)	16/18"		112	13					
			11 13 17	39	18/18"	dense							
			3 7 20	(22)	16/18"	medium dense							
						light brown	109	16					
			11 13 14	35	18/18"								
10						NOTES: 1. Terms and symbols defined on Plate A-1. 2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig							

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 14, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-11
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						6 inches of asphalt							
			14 14 11	(21)	16/18"	Poorly-graded SAND with CLAY (SP-SC): medium dense, light reddish brown, moist							
			6 10 15	32	15/18"								
5			15 27 36	(52)	16/18"	dense orange to orange brown, slight increase in fines	114	11					
			15 15 17	41	18/18"	light brown and reddish brown mottling 2 inch layer of SAND (fine, well-rounded)							
			5 20 25	(37)	15/18"	Poorly-graded SAND with SILT (SP-SM): dense, light brown, moist, fine, well-rounded	115	12					
10			14 17 25	54	15/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 13, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-12
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						2.5 inches of asphalt							
			17 22 13	(29)	16/18"	CLAYEY SAND with GRAVEL (SC): medium dense, dark brown, moist, with interlayers of CLAYEY GRAVEL with SAND (GC) [FILL]							
			2 6 6	15	14/18"								
5			3 3 2	(4)	13/18"	CLAYEY SAND with GRAVEL (SC): medium dense, mottled brown and yellowish brown, moist, gravel is fine and subangular very loose	110	12					
			1 1 2	4	11/18"	light reddish brown, decreased fines content							
			3 3 3	(5)	13/18"		105	12	22				MA
			2 3 4	9	16/18"	loose, mottled brown and yellowish brown, increased fines content							
10						Poorly-graded SAND with SILT (SP-SM): loose, dark brown, moist							

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 11, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-13 alt
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						9 inches of concrete wtih 1/4 inch welded wire mesh							
				0	54"	CLAYEY GRAVEL with SAND (GC): dark brown, moist, gravel is fine and angular [FILL]							
5			15 10 12	(18)	13/18"	CLAYEY SAND with GRAVEL (SC): medium dense, mottled orange brown and dark brown, moist, contains clast of serpentinite up to 3 inches thick, locally wet							
			8 12 14	33	17/18"	SANDY Lean CLAY (CL): stiff to very stiff, interlayered orange brown and dark gray, moist, high-angle clay-filled veins up to 1/4 inch wide							
			5 9 16	(21)	13/18"		108	16	56				MA
			7 7 15	28	13/18"	layers of laminated clay with silty partings up to 1.5 inches thick							
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 10, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-14
Daly City Colma Pipeline Project
Daly City, California

Carrollo Engineers
Project No. 04.72160021

LOCATION:

DEPTH, ft	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
				5 inches of AC							
	38 50/3	50/3"	8/9"	Well-graded GRAVEL with SILT and SAND (GW-GM): very dense, greenish brown, dry, fine, well rounded gravel [FILL]							
				Poorly-graded SAND with SILT (SP-SM): very dense, light reddish brown, dry to moist, sand is fine with trace coarse sand and fine gravel, uniformly well rounded grains							
	11 15 16	40	0/18"								
	4 9 12	(17)	15/18"								
5					112	11					
	5 5 5	13	16/18"	loose							
	4 11 19	(25)	17/18"	medium dense							
					106	7	10				
	3 7 9	20	16/18"	CLAYEY SAND (SC) to SILTY SAND (SM): medium dense, light reddish brown with dark reddish brown mottles, moist, low to medium plasticity							
10											
				Poorly-graded SAND with SILT (SP-SM): medium dense, light reddish brown, moist, sand is fine grained with thin layers of medium grained, small diameter inclusions of light red clayey sand							
	11 18 26	(37)	18/18"		108	15	30				MA
15											
	18 31 35	85	18/18"								
20				very dense							
	21 35 45	(67)	15/18"	dense							
25											

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 25.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 5, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-15
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			24 50/3	50/3"	6/9"	SANDY SILT with GRAVEL (ML): hard, greenish brown, dry to moist, subangular gravels, well graded [FILL]							
			22 50/3	50/3"	6/9"	Poorly-graded SAND with SILT and GRAVEL (SP-SM): very dense, mottled orange brown, yellow, greenish brown, dry, well cemented and subangular gravels	106	16	32				
			2 10 20	(25)	14/18"	SILTY SAND with GRAVEL (SM): medium dense, dark reddish brown, moist, fine sands and fine subrounded gravel							
5			14 12 7	24	11/18"	CLAYEY SAND (SC): loose, reddish gray to reddish brown, fine sands							
			4 7 10	(14)	8. 25/18"		106	14					
			2 2 4	7	9. 5/18"								
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

FCLP STANDARD LOG G:\JOBDOCS\04.72160021 DALY CITY COLMA PIPELINE PROJECT\02_TASK 2\04_ENGINEERING\04 72160021 BORING LOGS_UPDATED.GPJ OGEM_LIB_JAN2012.GLB 8/31/17 05:28 p

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 4, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-16
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			25 15 9	(20)	12/18"	SANDY SILT with GRAVEL (ML): stiff, greenish brown, dry to moist, well graded, fine gravels subangular to subrounded							
			5 11 10	27	15/18"	Poorly-graded SAND with CLAY (SP-SC): medium dense, orange brown, moist, massive							
			3 5 6	(9)	12/18"	loose	111	15					
5			4 8 8	(13)	12/18"	decrease in fines, high angle veins of fine sand, material color varies from uniform orange brown to mottled light brown, dark greenish brown, and orange brown							
			6 6 9	(12)	12/18"		108	13					
						medium grained, decrease in fines							
10			3 8 8	(13)	16/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.5 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 4, 2016
DRILLING METHOD: 9-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-16-1
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						2 inches of asphalt							
				0	60/60"	Poorly-graded SAND with CLAY (SP-SC): very loose, dark red to dark reddish brown, dry, some cobbles, gravel is fine, rounded to angular [FILL] moist, slight decrease in gravel content 5-inch steel scrap exposed in side wall							
5			1 1 2	(2)	18/18"		94	12					
			1 2 3	6	18/18"								
			5 3 9	(10)	15/18"	Poorly-graded SAND with CLAY (SP-SC): medium dense, light red with dark brown and orange brown mottles, moist thin layer of dark reddish brown SILTY SAND (SM)	110	18	48				MA
10			3 6 9	19	14/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

FCLP STANDARD LOG G:\JOBDOCS\04.72160021 DALY CITY COLMA PIPELINE PROJECT\02_TASK 2\04_ENGINEERING\04 72160021 BORING LOGS_UPDATED.GPJ OGEM_LIB_JAN2012.GLB 8/31/17 05:29 p

BORING DEPTH: 11.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 20, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-17
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						3" of asphalt							
			17 14 10	(20)	14/18"	CLAYEY SAND (SC): medium dense, dark brown to dark reddish brown, moist, trace fine angular to rounded gravel							
			4 3 4	9	14/18"	loose							
			2 4 5	(7)	12/18"		108	17					
5			2 2 3	6	14/18"								
			1 5 7	(10)	9/18"	locally wet	117	14					
			0 1 3	5	7/18"	very loose							
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 5, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-18
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						3 inches of AC							
			10 9 8	22	17/18"	Poorly-graded SAND with CLAY (SP-SC): medium dense, light reddish brown, moist, fine sands							
			5 10 16	(21)	13/18"	locally wet							
			6 10 11	27	15/18"	mottled dark reddish brown and light reddish brown							
5			5 9 11	(16)	15/18"		112	14					
			6 8 8	20	12/18"	Poorly-graded SAND with CLAY (SP-SC): medium dense, light reddish brown, dry to moist, fine, well rounded							
			3 7 8	(12)	15/18"	Poorly-graded SAND with CLAY (SP-SC): loose, greenish gray, moist, fine	120	12					
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

FCLP STANDARD LOG G:\JOBDOCS\04.72160021 DALY CITY COLMA PIPELINE PROJECT\02_TASK 2\04_ENGINEERING\04 72160021 BORING LOGS_UPDATED.GPJ OGEM_LIB_JAN2012.GLB 8/31/17 05:29 p

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 5, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DB-19
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						5 inches of asphalt							
						CLAYEY GRAVEL with SAND (GC): medium dense, moist, gravel is fine and sub-angular, sand is uniformly well-rounded							
			8 8 9	(14)	18/18"	Poorly-graded SAND (SP): medium dense, reddish brown, moist							
			2 2 3	6	15/18"	loose							
			4 9 12	(17)	16/18"	SILTY, CLAYEY SAND (SC-SM): medium dense, orange brown with black to dark brown mottling, moist							
5							102	22					
			4 7 8	19	18/18"	reddish brown							
			2 9 12	(17)	14/18"	Poorly-graded SAND with SILTY CLAY (SP-SC): medium dense, reddish brown, moist, trace fines	105	18					
			7 10 13	30	13/18"								
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 14, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DBH-01
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						4 inches of asphalt							
						SILTY GRAVEL with SAND (GM): medium dense, greenish gray, moist							
			9 9 8	(14)	17/18"	Poorly-graded SAND with CLAY (SP-SC): medium dense, dark red, sand is fine, trace fince sub-angular gravel							
			2 2 3	6	10/18"	loose, orange brown to light reddish brown							
			Not Recorded		14/18"								
5							108	9					
			1 2 3	6	18/18"	Poorly-graded SAND with SILT (SP-SM): loose, orange brown to light reddish brown, moist		13					
			7 13 18	(26)	18/18"	medium dense, reddish to orange brown, decrease silt content	107	14					
			9 12 14	33	18/18"	Poorly-graded SAND (SP): medium dense, reddish to orange brown, moist							
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 19, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DBH-02
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						4 inches of asphalt							
			27 18 8	(21)	16/18"	SILTY SAND (SM): medium dense, dark reddish brown, moist, orange brown sand inclusions [FILL]							
						CLAYEY GRAVEL with SAND (GC): medium dense, greenish gray, moist, [FILL]							
			1 1 2	4	15/18"	Poorly-graded SAND with CLAY (SP-SC): very loose, dark reddish brown, moist		11					
			2 6 11	(14)	14/18"	medium dense							
5						Poorly-graded SAND with SILT (SP-SM): medium dense, reddish brown with dark brown to black mottles, moist							
			8 9 10	24	18/18"								
			2 14 21	(29)	14/18"		114	14					
			14 16 13	37	18/18"								
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 14, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. DBH-03
Daly City Colma Pipeline Project
Daly City, California

Carrollo Engineers
Project No. 04.72160021

LOCATION:

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						4 inches of asphalt							
			25 20 17	(31)	18/18"	SILTY SAND with GRAVEL (SM): medium dense, reddish brown, dry to moist							
			6 5 6	14	15/18"	Poorly-graded SAND with SILT (SP-SM): medium dense, reddish brown, dry to moist							
			1 5 7	(10)	13/18"	light brown		2					
5													
			6 16 25	53	18/18"	reddish brown							
			23 29 35	(53)	18/18"		105	3	9				MA
			24 20 42	80	18/18"	very dense							
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 20, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-01
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						4 inches of asphalt over 3 inches of crushed asphalt							
			31 27 24	(42)	14/18"	CLAYEY GRAVEL with SAND (GC): dense, dark reddish brown to dark greenish brown, moist, fine, angular gravel [FILL]							
						Poorly-graded SAND with CLAY (SP-SC): very dense, brown to light reddish brown, dry, fine to medium grained, well rounded							
			12 11 13	31	11/18"	medium dense							
5			7 12 20	(26)	14/18"	orange to brown matrix with light reddish brown weathering stains, increasingly orange with depth, trace silts	95	5					
			18 20 20	52	18/18"	dense							
			13 31 30	(51)	18/18"		100	8	12				MA
			15 12 14	33	18/18"	medium dense							
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 7, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-02
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						5 inches of asphalt, 2-3 inches of crushed old asphalt							
			19 19 13	(27)	17/18"	CLAYEY GRAVEL with SAND (GC): medium dense to dense, dark reddish brown to light reddish brown, moist, gravel is fine and angular [FILL]							
			4 3 4	9	13/18"	Poorly-graded SAND with SILT (SP-SM): medium dense, brown, dry, fine, well-rounded, no internal stratification very loose							
5			1 3 3	(5)	13/18"	orange brown to reddish brown	91	2	5				MA
			1 2 2	5	12/18"								
			2 3 4	(5)	15/18"		87	3					
			1 2 3	6	14/18"								
10													
			3 4 5	(7)	15/18"	loose							
15													
			2 4 4	10	14/18"	dark reddish brown, with 1/4-inch-thick laminated light brown layering		2	8				
20													
			3 5 6	(9)	17/18"								
25						NOTES: 1. Terms and symbols defined on Plate A-1. 2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig							

BORING DEPTH: 25.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 7, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-03
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
				7 inches of asphalt							
				CLAYEY GRAVEL with SAND (GC): brown, moist, gravel is fine and subrounded [FILL]							
	10 15 13	(23)	15/18"	Poorly-graded SAND with SILT (SP-SM): medium dense, dark reddish brown, moist							
	4 8 9	22	18/18"								
5	5 7 7	(11)	17/18"	loose, orange brown, increased silt content	102	9					
	3 3 4	9	17/18"								
	3 7 10	(14)	17/18"	medium dense, stratified by color changes (dark reddish brown, orange brown, brown) less than 1 inch thick	105	9	8				MA
	5 10 8	23	17/18"	stratified by color changes (dark reddish brown and dark brown) less than 1 inch thick							
10											
15	6 5 9	(11)	15/18"	loose							
20	1 6 13	24	18/18"	medium dense, orange brown to light reddish brown							
25	6 6 6	(10)	17/18"	loose							
				SANDY Lean CLAY (CL): medium stiff, dark brown to dark reddish brown, moist, sand is medium grained							

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 26.5 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 12, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-04
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
				5 inch layer of asphalt							
				CLAYEY GRAVEL with SAND (GC): medium dense, dark reddish brown, moist							
	13 11 7	(15)	13/18"	Interlayered SILTY SAND (SM) and Poorly-graded SAND (SP): medium dense, orange brown and dark brown, moist							
	3 4 3	9	17/18"	very loose, brown to dark reddish brown, decreased fines content							
5	3 2 3	(4)	15/18"		101	13					
	0 0 0	0	18/18"								
	0 0 0	(0)	14/18"		87	12					
	0 0 0	0	18/18"	4-inch layer of orange and reddish brown oxidation staining							
10											
15	0 1 2	(2)	15/18"	slight increase in silt content							
20	12 25 23	62	18/18"	dense, thin interlayer (up to 2-inches thick) of SILTY SAND (SM), weak itnernal layering							
25	10 26 50	(63)	18/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 26.5 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 12, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-05
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
0				6 inches of asphalt							
	11 16 24	(33)	18/18"	Poorly-graded SAND with SILT (SP-SM): medium dense, orange brown, moist, with infrequent interlayers of thin (less than 1") interlayers of SILTY SAND (SM)							
	7 9 10	24	17/18"								
5	6 7 11	(15)	18/18"		100	14					
	5 7 6	17	18/18"								
	1 10 15	(21)	15/18"		99	8					
10	9 10 12	28	18/18"								
15	11 12 9	(17)	16/18"								
20	12 17 20	48	18/18"	dense, laminations and layering (1/2" to 3/4" thick) defined by color variations (orange, light brown, and dark reddish brown) and clay laminae (gray to greenish gray)							
25	14 29 39	(57)	17/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 26.5 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 12, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-06
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						0.25 inches of asphalt							
						[FILL]							
			10 17 21	(32)	17/18"	Poorly-graded SAND with CLAY (SP-SC): dense, orange brown to light reddish brown, moist, fine, well-rounded							
			7 12 15	35	18/18"	medium dense							
			6 18 24	(35)	18/18"	dense							
5							102	8	3				MA
			11 13 10	30	18/18"	medium dense layer of 2-inch-thick dark red to dark orange highly oxidized fine Poorly-graded SAND (SP)							
			2 6 19	(21)	13/18"	interlayers of LEAN CLAY (CL) to fine Sandy LEAN CLAY (CL) up to 3 inches thick	101	18					
			12 15 19	44	18/18"	dense							
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 11, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-07
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						4 inches of asphalt							
			7 13 13	(21)	17/18"	CLAYEY GRAVEL with SAND (GC): reddish brown, moist, fine [FILL]							
						CLAYEY SAND (SC): medium dense, greenish brown, moist orange brown oxidation							
			6 8 8	20	14/18"								
			12 19 18	(31)	17/18"	Poorly-graded SAND with SILT (SP-SM): dense, orange brown, moist, sand is uniformly well rounded							
5							106	13					
			5 4 5	11	18/18"	loose							
			10 18 22	(33)	15/18"	dark reddish brown to dark red	107	11					
			9 15 17	41	18/18"								
10													
15			6 9 10	(16)	18/18"	medium dense, interlayers of fine CLAYEY SAND (SC)							
20			3 6 5	14	18/18"	dark reddish brown, 5-inch thick layer of orange brown, fine CLAYEY SAND (SC)							
25			4 7 16	(19)	14/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 26.5 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 11, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-08
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
				6" of asphalt							
				SILTY GRAVEL with SAND (GM): dark brown, moist, fine							
	9 14 17	(26)	15/18"	Poorly-graded SAND with CLAY (SP-SC): medium dense, orange brown, moist, sand is fine and well-rounded, decreasing fines with depth							
	7 12 10	28	15/18"	3-inch layer of clean fine sand							
5	9 14 12	(21)	16/18"		110	11	9				MA
				2-inch angular gravel clast (coarse grained sandstone, well cemented)							
	5 6 4	13	17/18"	loose							
	2 3 3	(5)	16/18"	Poorly-graded SAND with SILT (SP-SM): loose, orange brown, moist	102	4					
10	3 4 3	9	17/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 10, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-09
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						3 inches of asphalt							
			12 18 20	(32)	17/18"	CLAYEY SAND with GRAVEL (SC): medium dense, reddish brown, moist, gravel is fine [FILL]							
			7 10 11	27	18/18"	Poorly-graded SAND with SILT (SP-SM): medium dense, orange brown to light reddish brown, moist, variable silt content up to approximately 5%							
						light brown, slight decrease in fines content							
5			4 16 24	(33)	17/18"	sand ranges from fine to medium	109	6					
			10 16 20	46	16/18"								
			13 20 23	(36)	17/18"	CLAYEY SAND (SC): medium dense, reddish brown, moist, fine dark brown staining	106	18					
			6 12 20	41	12/18"	layers of fine to medium sand up to 2 inches thick, increased silt content							
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 18, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-10-alt
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						5 inches of asphalt							
						SILTY GRAVEL with SAND (GM): medium dense, reddish brown, dry to moist, increasing moisture with depth, gravel is fine and sub-angular to sub-rounded							
			12 15 22	(31)	18/18"								
						CLAYEY SAND (SC): medium dense, orange brown with streaks of light brown, moist							
			9 12 16	36	17/18"	faint layering defined by color (orange brown and light brown)							
			11 21 29	(42)	13/18"	silt content variable with depth							
5							112	14					
			13 17 17	44	16/18"								
			6 13 22	(29)	14/18"	light red Lean CLAY (CL) layers ranging in thickness from 1" to 2"	101	25					
			8 13 17	39	18/18"								
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

FCLP STANDARD LOG G:\JOBDOCS\04.72160021 DALY CITY COLMA PIPELINE PROJECT\02_TASK 2\04_ENGINEERING\04 72160021 BORING LOGS_UPDATED.GPJ OGEM_LIB_JAN2012.GLB 8/31/17 05:29 p

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 18, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-11
Daly City Colma Pipeline Project
Daly City, California

Carrollo Engineers
Project No. 04.72160021

LOCATION:

DEPTH, ft	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
				4 inches of asphalt							
				CLAYEY GRAVEL (GC): [BASE]							
	5 13 15	(23)	17/18"	Poorly-graded SAND with CLAY (SP-SC): medium dense, reddish brown, moist, [FILL]							
	7 10 14	31	18/18"	increased clay content, decreased silt content							
				increased silt content, decreased clay content							
5	13 18 19	(31)	17/18"		110	8					
	9 10 13	30	18/18"	trace fine gravel and asphalt							
				Poorly-graded SAND with CLAY (SP-SC): medium dense, reddish brown, moist							
	5 19 24	(36)	13/18"	light reddish brown	106	13					
	11 18 17	45	17/18"								
10											
15	6 24 26	(42)	16/18"	interlayered light brown and reddish to orange brown, alternating wet and moist layers							
20	11 13 14	35	18/18"								
				Poorly-graded SAND (SP): medium dense, reddish brown, moist							
25	10 20 37	(47)	18/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 26.5 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 18, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-12
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						5 inches of asphalt							
						GRAVELLY SILT with SAND (ML): stiff, reddish brown, moist, gravel is fine and coarse							
			8 16 17	(27)	16/18"	SILTY, CLAYEY SAND with GRAVEL (SC-SM): medium dense, reddish brown, moist							
			6 10 13	30	17/18"								
5			7 13 20	(27)	16/18"	increased silt content, decreased clay content	110	12					
			11 16 19	45	18/18"	dense							
			4 16 24	(33)	17/18"		110	14					
			10 13 21	44	17/18"								
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 18, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-13
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						3 inches of asphalt							
			6 11 20	(26)	11/18"	CLAYEY GRAVEL with SAND (GC): medium dense to dense, brown, dry, gravel is fine and subrounded [FILL]							
			2 2 2	5	14/18"	SILTY SAND (SM): medium dense, dark brown, moist, sand is fine, trace angular fine gravel [FILL] loose							
5			5 11 13	(20)	13/18"	SILTY SAND (SM): medium dense, reddish brown, moist, fine	100	10	36				MA
			5 5 5	13	15/18"								
			6 9 7	(13)	13/18"	mottled light brown and reddish brown	104	12					
10			2 3 5	10	13/18"	SILTY, CLAYEY SAND (SC-SM): loose, orange brown with light red brown mottling, moist							

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 7, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-14
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						approximately 3 inches of asphalt							
						approximately 3 inches of aggregate base							
			5 4 3	(5)	16/18"	CLAYEY GRAVEL with SAND (GC): loose to medium dense, brown, dry, [FILL]							
			1 2 3	6	13/18"	Poorly-graded SAND with CLAY (SP-SC): loose, dark brown, moist, sand is fine and well-rounded, trace root fragments, trace rounded gravel							
5			2 3 5	(6)	14/18"	reddish brown	109	11					
			4 6 7	17	11/18"	Poorly-graded SAND (SP): medium dense, reddish brown, moist, fine, well-rounded							
			9 15 26	(34)	14/18"	SILTY, CLAYEY SAND (SC-SM): dense, reddish brown to orange, moist, fine, well-rounded	114	15	20				MA
10			11 18 18	46	18/18"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 7, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-15
Daly City Colma Pipeline Project
Daly City, California

Carrollo Engineers
Project No. 04.72160021

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						12 inches of asphalt							
						Poorly-graded SAND with CLAY (SP-SC): dark reddish brown, dry to moist							
						light brown							
5			12 13 14	(22)	12/18"	medium dense, reddish brown, dry, trace fine gravel	109	9					
			7 7 9	20	16/18"	mottled dark reddish brown, light brown, and reddish brown							
			22 30 38	(57)	18/18"	orange brown with minor light brown mottling	97	8	11				MA
10			14 11 17	36	18/18"	mottled light brown and orange, dry to moist							

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 11.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 19, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-16
Daly City Colma Pipeline Project
Daly City, California

Sheet 1 of 1

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						12 inches of asphalt							
			11 20 17	(31)	16/18"	CLAYEY GRAVEL (GC): medium dense, dark red, dry to moist, coarse, fine, angular							
			6 8 10	23	18/18"	SILTY SAND (SM): medium dense, orange brown with red and light brown mottling, dry to moist							
5			6 12 17	(24)	16/18"		107	15					
			7 11 12	30	18/18"	moist light brown with minor orange brown mottles							
			7 14 21	(29)	14/18"								
			7 12 13	32	18/18"	Poorly-graded SAND with CLAY (SP-SC): medium dense, orange brown, dry to moist, fine	109	6					
10						NOTES: 1. Terms and symbols defined on Plate A-1. 2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig							

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 20, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-17
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						3 inches of asphalt							
						5 inches of base							
			11 14 12	(21)	12/18"	Poorly-graded SAND with SILT (SP-SM): medium dense, orange brown matrix with reddish brown oxide staining, dry to moist, trace fine, rounded gravel and organics							
			5 3 4	9	18/18"	loose							
5			4 10 17	(22)	12/18"	medium dense	105	4					
			9 12 9	27	15/18"								
			6 9 10	(16)	10/18"		102	6					
			6 50/3	50/3"	0/9"	well-rounded fine gravel (chert and greenstone) in shoe of sample barrel							

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 9.3 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 6, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-24
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						1 inch of asphalt							
						7 inches of base							
			8 9 11	(16)	14/18"	Poorly-graded SAND with CLAY (SP-SC): medium dense, orange brown to greenish brown, moist, rootlets, trace angular clasts of asphalt [FILL]	107	7					
			8 11 9	26	17/18"								
5			4 12 17	(26)	12/18"								
			8 12 13	32	18/18"	Poorly-graded SAND with SILT (SP-SM): medium dense, moist, light layering defined by color - light greenish, orange brown, and light red							
			6 13 20	(27)	13/18"	dense, light reddish brown, fine, well rounded grains	101	16	8				
			6 10 12	28	1/18"	medium dense							
10													

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 6, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-25
Daly City Colma Pipeline Project
Daly City, California

LOCATION:

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						7 inches of asphalt							
			23 39 25	(53)	5/18"	CLAYEY GRAVEL with SAND (GC): very dense, black to dark brown, dry, abundant asphalt chunks [FILL]							
			5 3 3	7	16/18"	SILTY CLAYEY SAND (SCSM): loose, light reddish brown to orange brown, dry to moist, well rounded, no internal stratification							
5			2 5 5	(8)	14/18"	loose, moist, increased fines	110	12	37				MA
			3 4 5	11	17/18"	decreased fines, sand is fine to medium grained							
			5 11 20	(26)	18/18"	dense, 6 inch layer of (SP-SC)	109	7					
10			10 13 17	39	11/18"	medium dense, wet							

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

BORING DEPTH: 10.0 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 6, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. MB-26
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						ARTIFICIAL FILL (af) Asphalt:							
			5 15 12	(22)	14/18"	**ARTIFICIAL FILL (af)** SILTY SAND with GRAVEL (SM): medium dense, dark reddish brown, moist, fine to coarse sand, fine angular gravel							
			5 2 3	6	10/18"	**ARTIFICIAL FILL (af)** Poorly-graded SAND with SILT (SP-SM): medium dense, reddish brown, dry, fine sand							
5			3 5 4	(7)	9/18"	loose	107	5					
						moist							
			1 2 2	5	9/18"	very loose							
			3 5 5	(8)	9/18"	loose	106	7	11				
			3 4 7	14	11/18"	medium dense							
10													
						ALLUVIUM (Qal) Poorly-graded SAND (SP): medium dense, light brown, dry							
15			10 16 31	(39)	12/18"								
20			10 12 16	36	12/18"	weak layering up to 1/4-inch thick defined by alternating light brown and reddish brown colors concentrations of magnetite							
						ALLUVIUM (Qal) Poorly-graded SAND with SILT (SP-SM): very dense, reddish brown, moist, fine sand							
25			25 46 50/5.5"	80/11.5"	15/17.5"		109	16					

Continued

BORING DEPTH: 35.5 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 17, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. TPB-01
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			16 28 46	96	13/18"								
35			50	ref	6/6"	fine to medium sand color change to orange brown	105	20					

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

FCLP STANDARD LOG G:\JOBDOCS\04.72160021 DALY CITY COLMA PIPELINE PROJECT\02_TASK 2\04_ENGINEERING\04 72160021 BORING LOGS_UPDATED.GPJ OGEM_LIB_JAN2012.GLB 8/31/17 05:29 p

LOG OF BORING NO. TPB-01
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						SILTY SAND (SM): medium dense, dark brown to dark reddish brown, moist, fine sand, trace fine angular gravel [FILL]							
			4 8 15	(19)	14/18"	Poorly-graded SAND with SILT (SP-SM): medium dense, light reddish brown, dry to moist	84	6					
			16 14 14	36	14/18"								
5			17 18 21	(32)	13/18"								
			10 16 19	45	12/18"	dense							
			23 30 42	(60)	13/18"		101	14	6				
			12 18 26	57	12/18"								
10													
						Poorly-graded SAND with SILT (SP-SM): dense, dark reddish brown with thin light brown layers, moist, fine							
15			16 23 29	(43)	0/18"	4-inch thick interval of thin layers up to 1/4 inch thick defined by alternating light brown and dark reddish brown colors							
20			13 26 43	93	12/18"	very dense							
25			34 50/5	50/5"	9.5/11"		105	15	7				

Continued

BORING DEPTH: 35.8 ft
BACKFILL: Grout, Cold-Patch Surface
DEPTH TO WATER: Not Encountered
FIELDWORK DATE: October 17, 2016
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: Mobile CME-55
DRILLED BY: Pitcher Drilling, James
LOGGED BY: J Goodman
CHECKED BY: M Bajuniemi

LOG OF BORING NO. TPB-02
Daly City Colma Pipeline Project
Daly City, California

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	LOCATION: MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			24 43 50/5	78/11"	12/17"	laminations and thin layering up to 1/4 inch thick							
35			48 50/4	50/4"	8/10"								

NOTES:
1. Terms and symbols defined on Plate A-1.
2. N-Value corrected to N_{60} using 80% hammer effeciency based on Pile Dynamics, Inc SPT energy analysis performed on 9/26/2016 for Mobile CME-55 Drill Rig

FCLP STANDARD LOG G:\JOBDOCS\04.72160021 DALY CITY COLMA PIPELINE PROJECT\02_TASK 2\04_ENGINEERING\04 72160021 BORING LOGS_UPDATED.GPJ OGEM_LIB_JAN2012.GLB 8/31/17 05:29 p

LOG OF BORING NO. TPB-02
Daly City Colma Pipeline Project
Daly City, California

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS — MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVEL WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS — MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT IS LESS THAN 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS — LIQUID LIMIT IS GREATER THAN 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

DEFINITION OF TERMS

U.S. STANDARD SERIES SIEVE: 200, 40, 10, 4 — CLEAR SQUARE SIEVE OPENINGS: 3/4", 3", 12"

SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

GRAIN SIZES

SANDS AND GRAVELS	BLOWS/FOOT†
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

RELATIVE DENSITY

SILTS AND CLAYS	STRENGTH‡	BLOWS/FOOT†
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32

CONSISTENCY

†Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1-3/8 inch I.D.) split spoon (ASTM D-1586).
‡Unconfined compressive strength in tons/sq. ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation.

PETER KALDVEER AND ASSOCIATES, INC. *Geotechnical Consultants*	KEY TO EXPLORATORY BORING LOGS Unified Soil Classification System (ASTM D-2487)		
	PROPOSED TREATMENT PLANT EXPANSION Daly City, California		
	PROJECT NO. K363-13	DATE November 1986	Figure A-1

DRILL RIG Rotary Wash	SURFACE ELEVATION ±47 Feet	LOGGED BY DYR
DEPTH TO GROUNDWATER 38½' (see note 2)	BORING DIAMETER 5 Inches	DATE DRILLED 7/16/86

DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SAND (fine grained), traces of silt	orange yellow tan	loose	SM	1					
(FILL)				5		8	15		
SAND (fine grained), some silt	dark brown	loose	SM						
		medium dense		10		12			
SAND (fine grained), some silt	orange brown	very dense	SM						
				15		67	14		
(grading with more silt)									
(interbedded lenses with more silt and trace of clay and of clayey SILT with sand)	grey			20		87/11½"			
				25					
				30					
(grading to traces of silt)	orange brown								
				35					
						63/6"	▽		
				40					

Peter Kaldveer and Associates

Geotechnical Consultants

EXPLORATORY BORING LOG

PROPOSED TREATMENT PLANT EXPANSION
Daly City, California

PROJECT NO.	DATE	BORING NO.
K363-13	November 1986	1

DRILL RIG Rotary Wash	SURFACE ELEVATION ±47 Feet	LOGGED BY DYR
DEPTH TO GROUNDWATER 38½' (see note 2)	BORING DIAMETER 5 Inches	DATE DRILLED 7/16/86

DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT)	WATER CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SAND (fine grained), traces of silt (continued)	orange brown	very dense	SM	41					
				45					
	brown					89/11"	19	112	
				50					
						48/6"			
				55					
				60					
	grey brown					70/6"			
Notes: 1. The stratification lines represent the approximate boundaries between soil types and the transition may be gradual. 2. Groundwater level was measured at 38½ feet one day after drilling. This boring was converted into a 70 foot piezometer.				65					
				70					
						50/5½"			
Bottom of Boring = 73½ Feet				75					
				80					

PETER KALDVEER AND ASSOCIATES, INC.
Geotechnical Consultants

EXPLORATORY BORING LOG

PROPOSED TREATMENT PLANT EXPANSION
Daly City, California

PROJECT NO.	DATE	BORING NO.
K363-13	November 1986	1

PLATE A-48 (cont'd)

DRILL RIG Rotary Wash	SURFACE ELEVATION	LOGGED BY DYR
DEPTH TO GROUNDWATER	BORING DIAMETER 5 Inches	DATE DRILLED 7/17/86

DESCRIPTION AND CLASSIFICATION

DESCRIPTION AND REMARKS	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	DRY DENSITY (PCF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SAND (fine grained), some silt (FILL)	orange tan	medium dense	SM	1					
SAND (fine grained), traces of silt, trace of organics and pea gravel (thin lenses of clayey SILT) Passing #200 Sieve = 10%	dark grey	medium dense	SP-SM	5		16	22		
				10		10	14		
		loose				4			
Passing #200 Sieve = 11%				15		7			
CLAY, silty, trace of organics	grey black	firm	CL				56		
SAND (fine grained), some silt and organics Passing #200 Sieve = 23%	dark grey	loose	SM	20		15*	22	91	
		dense				45			
Notes: See Boring 5 for Notes 1 and 2 3. This boring as converted into a 38 foot piezometer. The groundwater level was measured at 22 feet on July 29, 1986.				25					
SAND (fine grained), silty, trace of clay	dark grey	medium dense	SM-SC						
SAND (fine), clayey	turquoise grey	medium dense	SC	30		21	25		
SAND (fine grained), some silt	dark grey	dense	SM	35		34			
SAND (fine grained), clayey	olive grey	very dense	SC						
SAND (fine grained), trace of silt	orange tan	very dense	SM			67			
Bottom of Boring = 39½ Feet				40					

Peter Kaldveer and Associates

Geotechnical Consultants

EXPLORATORY BORING LOG

PROPOSED TREATMENT PLANT EXPANSION
Daly City, California

PROJECT NO.	DATE	BORING NO.
K363-13	November 1986	6

PLATE A-49

APPENDIX B
LABORATORY TESTING

APPENDIX B
LABORATORY TESTING PROGRAM

The laboratory testing program was directed toward a quantitative and qualitative evaluation of the physical and mechanical properties of the soils underlying the site.

The natural water content was determined on seven samples of the materials recovered from the borings in accordance with ASTM Test Designation D-2216. This water content is recorded on the boring logs at the appropriate sample depths.

Dry density determinations were performed on one sample of the subsurface soils to evaluate its physical properties. The results of this test are shown on the boring logs at the appropriate sample depths.

Atterberg limit determinations were performed on one of the subsurface soil samples to determine the range of water content over which these materials exhibit plasticity. The Atterberg limits were determined in accordance with ASTM Test Designations D-428 and D-424. These values are used to classify the soil in accordance with the Unified Soil Classification System and to indicate the soil's compressibility and expansion potentials. The results of the test are presented on Plate B-3 in this Appendix, and on the logs of the borings at the appropriate sample depths.

Gradation tests were performed on two samples of the subsurface soils to assist the classification of the sandy soils and to determine the grain size distribution. The results of these tests are presented on Plate B-2 in this Appendix.

Corrosion tests were performed by Cerco Analytical, Inc. on samples of the near-surface soils from Previous Borings B-2 collected by URS. Tests conducted included chloride content, sulfate content as SO_4, pH, Redox, and resistivity. Complete results of the corrosion tests performed by Cerco are included in this Appendix C.

Chemical tests were performed by Test America Laboratories on samples of near-surface soils from Borings B-1 and B-2. Tests conducted included Asbestos using CARB 435 Method and TPH diesel and motor oil with Silica Gel. Complete results of the chemical tests performed by Test America are included in the Appendix C.

Carrollo Engineers
Project No. 04.7216021

DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC%	FINES %	ATTERBURG LIMITS LL	ATTERBURG LIMITS PI	COMPACTION TEST MAX DD pcf	COMPACTION TEST OPT MC %	DIRECT SHEAR C ksf	DIRECT SHEAR PHI deg	COMPRESSIVE STRENGTH TESTS Qu, ksf	COMPRESSIVE STRENGTH TESTS S_U (Cell Prs.) ksf	CORROSIVITY TESTS R	CORROSIVITY TESTS pH	CORROSIVITY TESTS Cl	CORROSIVITY TESTS So_4	R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
DB-02	10.0	2	Poorly graded SAND (SP)			9																	M
DB-02	21.0	4	Poorly graded SAND with silt and gravel	144	128	12	7																T, S
			(SP-SM)																				
DB-03	5.0	1	Silty SAND (SM)			6																	M
DB-03	16.0	4	Silty SAND (SM)	121	113	7	25																T, S
DB-04	11.0	3	Poorly graded SAND (SP)	115	107	7																	T
DB-04	20.5	6	Silty SAND (SM)	136	115	18	13	NP	NP														T, A, S
DB-05	11.0	2	Clayey SAND (SC)	115	100	16	33																T, S
DB-05	15.0	3	Lean CLAY with gravel (CL)			12		NP	NP														M, A
DB-06	2.0	1	SILTY SAND with GRAVEL (SM), Dark	139	132	5																	T
			Brown																				
DB-08	5.5	4	CLAYEY SAND (SC), Dark Brown	117	108	8																	T
DB-09	5.0	3	SILTY SAND (SM), Dark Brown	127	113	13																	T
DB-09	8.5	6	SILTY SAND (SM), Dark Brown			13	21																M, S
DB-10	6.0	5	Poorly-graded SAND with SILT (SP-SM),	115	107	7																	T
			Strong Brown																				
DB-10	9.0	7	Poorly-graded SAND with SILT (SP-SM),	122	111	10																	T
			Strong Brown																				
DB-11	5.0	3	Poorly-graded SAND with SILT (SP-SM),	127	112	13																	T
			Strong Brown																				
DB-11	8.0	5	Poorly-graded SAND with SILT (SP-SM),	127	109	16																	T
			Light Yellowish Brown																				
DB-12	4.5	3	CLAYEY SAND (SC), Strong Brown	127	114	11																	T
DB-12	8.0	5	Poorly-graded SAND with SILT (SP-SM),	128	115	12																	T
			Light Olive Gray																				
DB-13 alt	4.5	3	CLAYEY SAND with GRAVEL (SC), Dark	123	110	12																	T
			Brown																				
DB-13 alt	7.5	5	CLAYEY SAND with GRAVEL (SC), Dark	117	105	12	22																T, S
			Brown																				
DB-14	4.5	3	Missing Sample																				

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
MC = Moisture Content
Fines = % Passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Direct Shear Test
C = Assigned Cohesion, ksf
PHI = Assigned Friction Angle, degrees

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-Value
SE = Sand Equivelant

SUMMARY OF LABORATORY TEST RESULTS

Daly City Colma Pipeline Project
Daly City, California

PLATE B-1a

SUM-1 LAB_SUMMRY (G:\JOBDOCS\04.7216021 DALY CITY COLMA PIPELINE PROJECT\02_TASK 204_ENGINEERING\04 7216021 BORING LOGS_UPDATED.GPJ) -VTA- 8/31/17 03:46 PM

Carrollo Engineers
Project No. 04.72160021

DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC%	FINES %	ATTERBURG LIMITS LL	ATTERBURG LIMITS PI	COMPACTION TEST MAX DD pcf	COMPACTION TEST OPT MC %	DIRECT SHEAR C ksf	DIRECT SHEAR PHI deg	COMPRESSIVE STRENGTH TESTS Qu, ksf	COMPRESSIVE STRENGTH TESTS S_u (Cell Prs.) ksf	CORROSIVITY TESTS R	CORROSIVITY TESTS pH	CORROSIVITY TESTS Cl	CORROSIVITY TESTS So_4	R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
DB-14	7.5	5	SANDY Lean CLAY with GRAVEL (CL),	125	108	16	56																T, S
			Yellowish Brown																				
DB-15	5.0	3	Poorly-graded SAND with SILT (SP-SM),	124	112	11																	T
			Light Olive Brown																				
DB-15	8.0	5	Poorly-graded SAND with SILT (SP-SM),	113	106	7	10																T, F
			Light Olive Brown																				
DB-15	14.5	7	SILTY SAND (SM), Pale Brown	124	108	15	30																T, S
DB-16	2.5	2B	SILTY SAND with GRAVEL (SM), Olive	123	106	16	32																T, F
			Brown																				
DB-16	7.5	5C	CLAYEY SAND (SC), Light Yellowish Brown	121	106	14																	T
DB-16-1	4.0	3B	SANDY Lean CLAY (CL), Strong Brown	127	111	15																	T
DB-16-1	7.5	5B	CLAYEY SAND (SC), Strong Brown	123	108	13																	T
DB-17	6.0	3	Poorly-graded SAND with CLAY (SP-SC),	105	94	12																	T
			Dark Grayish Brown																				
DB-17	8.5	5	CLAYEY SAND (SC), Olive Brown	129	110	18	48																T, S
DB-18	4.5	3	CLAYEY SAND (SC), Very Dark Grayish	127	108	17																	T
			Brown																				
DB-18	8.0	5	SANDY Lean CLAY (CL), Very Dark Grayish	133	117	14																	T
			Brown																				
DB-19	6.0	4	CLAYEY SAND (SC), Yellowish Brown	127	112	14																	T
DB-19	9.5	6	Poorly-graded SAND with CLAY (SP-SC),	135	120	12																	T
			Yellowish Brown																				
DBH-01	5.0	3	CLAYEY SAND (SC), Strong Brown	125	102	22																	T
DBH-01	8.0	5	CLAYEY SAND (SC), Strong Brown	124	105	18																	T
DBH-02	5.0	3	CLAYEY SAND (SC), Strong Brown	118	108	9																	T
DBH-02	5.5	4	SILTY SAND (SM), Olive Brown			13																	M
DBH-02	8.0	5	Poorly-graded SAND with SILT (SP-SM),	122	107	14																	T
			Strong Brown																				
DBH-03	3.5	2	CLAYEY SAND (SC), Very Dark Brown			11																	M
DBH-03	8.0	5	Poorly-graded SAND with SILT (SP-SM),	130	114	14																	T

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
MC = Moisture Content
Fines = % Passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Direct Shear Test
C = Assigned Cohesion, ksf
PHI = Assigned Friction Angle, degrees

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-Value
SE = Sand Equivelant

SUMMARY OF LABORATORY TEST RESULTS

Daly City Colma Pipeline Project
Daly City, California

PLATE B-1b

Carrollo Engineers
Project No. 04.72160021

DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC%	FINES %	ATTERBURG LIMITS LL	ATTERBURG LIMITS PI	COMPACTION TEST MAX DD pcf	COMPACTION TEST OPT MC %	DIRECT SHEAR C ksf	DIRECT SHEAR PHI deg	COMPRESSIVE STRENGTH TESTS Qu, ksf	COMPRESSIVE STRENGTH TESTS S_U (Cell Prs.) ksf	CORROSIVITY TESTS R	CORROSIVITY TESTS pH	CORROSIVITY TESTS Cl	CORROSIVITY TESTS So_4	R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
			Dark Olive Brown																				
MB-01	4.5	3	Poorly-graded SAND with SILT (SP-SM),			2																	M
			Light Olive Brown																				
MB-01	7.5	5	Poorly-graded SAND with SILT (SP-SM),	109	105	3	9																T, S
			Light Olive Brown																				
MB-02	4.5	3	Poorly-graded SAND with CLAY (SP-SC),	100	95	5																	T
			Dark Yellowish Brown																				
MB-02	7.5	5	Poorly-graded SAND with CLAY (SP-SC),	108	100	8	12																T, S
			Dark Yellowish Brown																				
MB-03	4.5	3	Poorly-graded SAND with SILT (SP-SM),	93	91	2	5																T, S
			Dark Yellowish Brown																				
MB-03	7.5	5	Poorly-graded SAND (SP), Dark Yellowish	90	87	3																	T
			Brown																				
MB-03	19.0	8	Poorly-graded SAND with SILT (SP-SM),			2	8																M, F
			Dark Yellowish Brown																				
MB-04	5.0	3	Poorly-graded SAND with SILT (SP-SM),	111	102	9																	T
			Dark Yellowish Brown																				
MB-04	8.0	5	Poorly-graded SAND with SILT (SP-SM),	115	105	9	8																T, S
			Dark Yellowish Brown																				
MB-05	4.5	3	Poorly-graded SAND with SILT (SP-SM),	114	101	13																	T
			Dark Yellowish Brown																				
MB-05	7.5	5	Poorly-graded SAND with SILT (SP-SM),	97	87	12																	T
			Dark Yellowish Brown																				
MB-06	4.5	3	Poorly-graded SAND with SILT (SP-SM),	114	100	14																	T
			Dark Yellowish Brown																				
MB-06	7.5	5	Poorly-graded SAND with SILT (SP-SM),	106	99	8																	T
			Olive Brown																				
MB-07	5.0	3	Poorly-graded SAND (SP), Olive Brown	110	102	8	3																T, S
MB-07	7.5	5	SANDY Lean CLAY (CL), Olive Brown	119	101	18																	T
MB-08	5.0	3	Poorly-graded SAND with SILT (SP-SM),	120	106	13																	T

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
MC = Moisture Content
Fines = % Passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Direct Shear Test
C = Assigned Cohesion, ksf
PHI = Assigned Friction Angle, degrees

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-Value
SE = Sand Equivelant

SUMMARY OF LABORATORY TEST RESULTS

Daly City Colma Pipeline Project
Daly City, California

SUM-1 LAB_SUMMARY (G:\JOBDOCS\04.72160021 DALY CITY COLMA PIPELINE PROJECT\02_TASK 2\04_ENGINEERING\04 72160021 BORING LOGS_UPDATED.GPJ) -VTA- 8/31/17 03:46 PM

DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC%	FINES %	ATTERBURG LIMITS LL	PI	COMPACTION TEST MAX DD pcf	OPT MC %	DIRECT SHEAR C ksf	PHI deg	COMPRESSIVE STRENGTH TESTS Qu, ksf	S_u (Cell Prs.) ksf	CORROSIVITY TESTS R	pH	Cl	So_4	R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
			Light Olive Brown																				
MB-08	7.5	5	Poorly-graded SAND with SILT (SP-SM),	118	107	11																	T
			Dark Olive Brown																				
MB-09	4.5	3	Poorly-graded SAND with CLAY (SP-SC),	122	110	11	9																T, S
			Dark Yellowish Brown																				
MB-09	8.0	5	Poorly-graded SAND with SILT (SP-SM),	106	102	4																	T
			Yellowish Brown																				
MB-10-alt	5.0	3	Poorly-graded SAND with SILT (SP-SM),	116	109	6																	T
			Yellowish Brown																				
MB-10-alt	8.0	5	CLAYEY SAND (SC), Yellowish Brown	125	106	18																	T
MB-11	5.0	3	CLAYEY SAND (SC), Yellowish Brown	128	112	14																	T
MB-11	8.0	5	Lean CLAY with SAND (CL), Strong Brown	127	101	25																	T
MB-12	5.0	3	Poorly-graded SAND with CLAY (SP-SC),	119	110	8																	T
			Dark Yellowish Brown																				
MB-12	8.0	5	Poorly-graded SAND with CLAY (SP-SC),	120	106	13																	T
			Dark Yellowish Brown																				
MB-13	5.0	3	CLAYEY SAND (SC), Strong Brown	124	110	12																	T
MB-13	8.0	5	CLAYEY SAND (SC), Strong Brown	125	110	14																	T
MB-14	4.5	3	SILTY SAND (SM), Dark Brown	110	100	10	36																T, S
MB-14	8.0	5	Poorly-graded SAND with CLAY (SP-SC),	116	104	12																	T
			Dark Brown																				
MB-15	4.5	3	Poorly-graded SAND with CLAY (SP-SC),	121	109	11																	T
			Dark Brown																				
MB-15	7.5	5	CLAYEY SAND (SC), Strong Brown	131	114	15	20																T, S
MB-16	5.5	3	CLAYEY SAND (SC), Strong Brown	119	109	9																	T
MB-16	8.5	5	Poorly-graded SAND with CLAY (SP-SC),	105	97	8	11																T, S
			Strong Brown																				
MB-17	4.5	3	CLAYEY SAND (SC), Strong Brown	123	107	15																	T
MB-17	8.0	5	Poorly-graded SAND with CLAY (SP-SC),	116	109	6																	T
			Strong Pale Brown																				

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
MC = Moisture Content
Fines = % Passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Direct Shear Test
C = Assigned Cohesion, ksf
PHI = Assigned Friction Angle, degrees

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-Value
SE = Sand Equivelant

SUMMARY OF LABORATORY TEST RESULTS

Daly City Colma Pipeline Project
Daly City, California

Carrollo Engineers
Project No. 04.72160021

DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC%	FINES %	ATTERBURG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	TEST LISTING
								LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_u (Cell Prs.) ksf	R	pH	Cl	So_4				
MB-24	5.0	3	SILTY SAND (SM), Dark Yellowish Brown	109	105	4																	T
MB-24	8.0	5	SILTY SAND with GRAVEL (SM), Dark	108	102	6																	T
			Brown																				
MB-25	2.0	1	CLAYEY SAND (SC), Strong Brown	115	107	7																	T
MB-25	8.0	5	Poorly-graded SAND with SILT (SP-SM),	117	101	16	8																T, F
			Light Olive Brown																				
MB-26	5.0	3	SILTY SAND (SM), Yellowish Brown	123	110	12	37																T, S
MB-26	8.0	5	CLAYEY SAND (SC), Yellowsih Brown	116	109	7																	T
TPB-01	5.0	3	Poorly-graded SAND with SILT (SP-SM),	112	107	5																	T
			Dark Brown																				
TPB-01	8.0	5	Poorly-graded SAND with SILT (SP-SM),	114	106	7	11																T, F
			Dark Yellowish Brown																				
TPB-01	25.5	9	Poorly-graded SAND with SILT (SP-SM),	127	109	16																	T
			Dark Yellowish Brown																				
TPB-01	35.0	11	Poorly-graded SAND with SILT (SP-SM),	126	105	20																	T
			Dark Yellowish Brown																				
TPB-02	1.5	1	Poorly-graded SAND with SILT (SP-SM),	90	84	6																	T
			Dark Yellowish Brown																				
TPB-02	7.5	5	Poorly-graded SAND with SILT (SP-SM),	115	101	14	6																T, F
			Olive																				
TPB-02	25.5	9	Poorly-graded SAND with SILT (SP-SM),	121	105	15	7																T, F
			Dark Yellowish Brown																				

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
MC = Moisture Content
Fines = % Passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Direct Shear Test
C = Assigned Cohesion, ksf
PHI = Assigned Friction Angle, degrees

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-Value
SE = Sand Equivelant

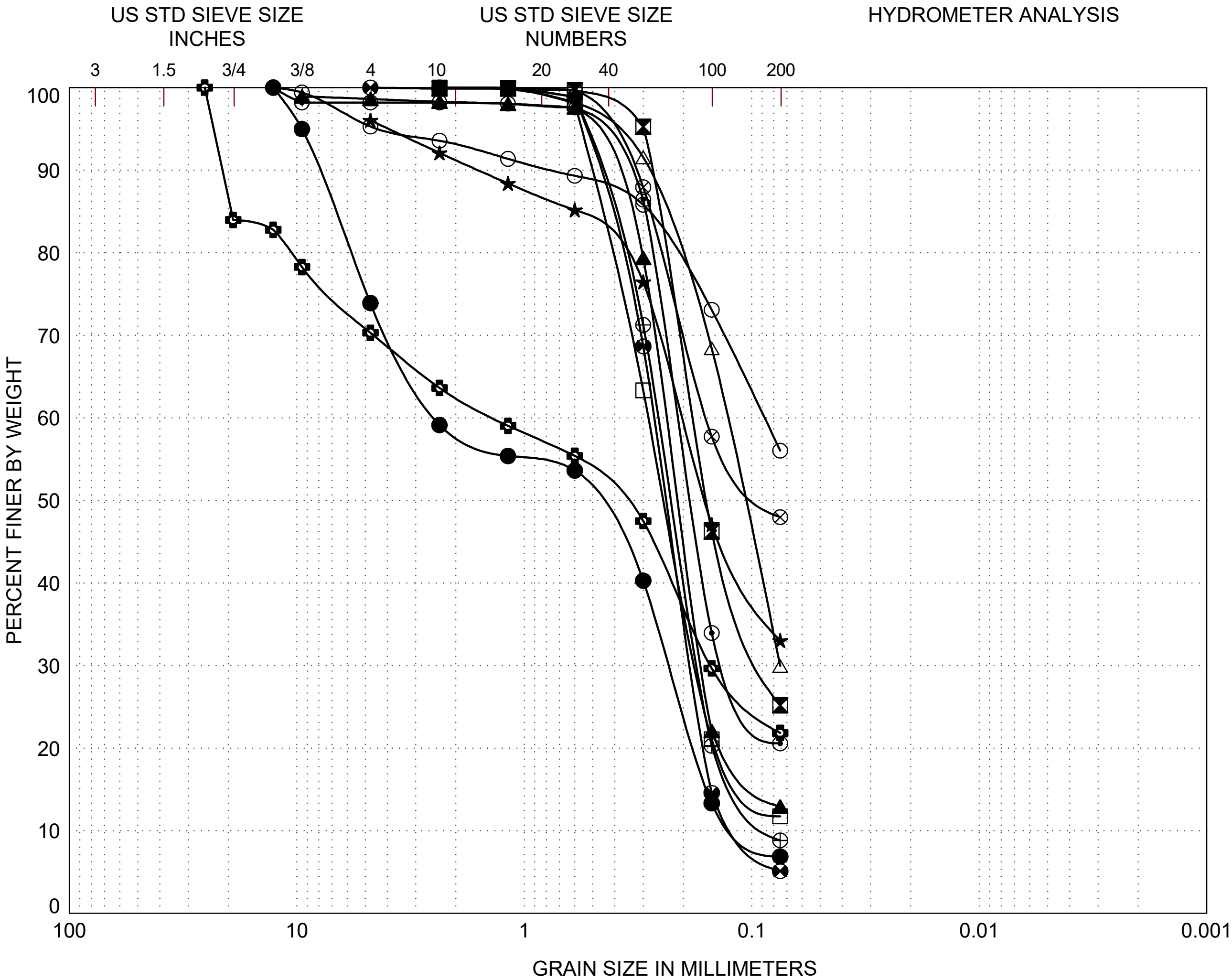
SUMMARY OF LABORATORY TEST RESULTS

Daly City Colma Pipeline Project
Daly City, California

PLATE B-1e

SUM-1 LAB_SUMMRY (G:\JOBDOCS\04.72160021 DALY CITY COLMA PIPELINE PROJECT\02_TASK 204_ENGINEERING\04 72160021 BORING LOGS_UPDATED.GPJ) -VTA- 8/31/17 03:46 PM

Carrollo Engineers
Project No. 04.72160021

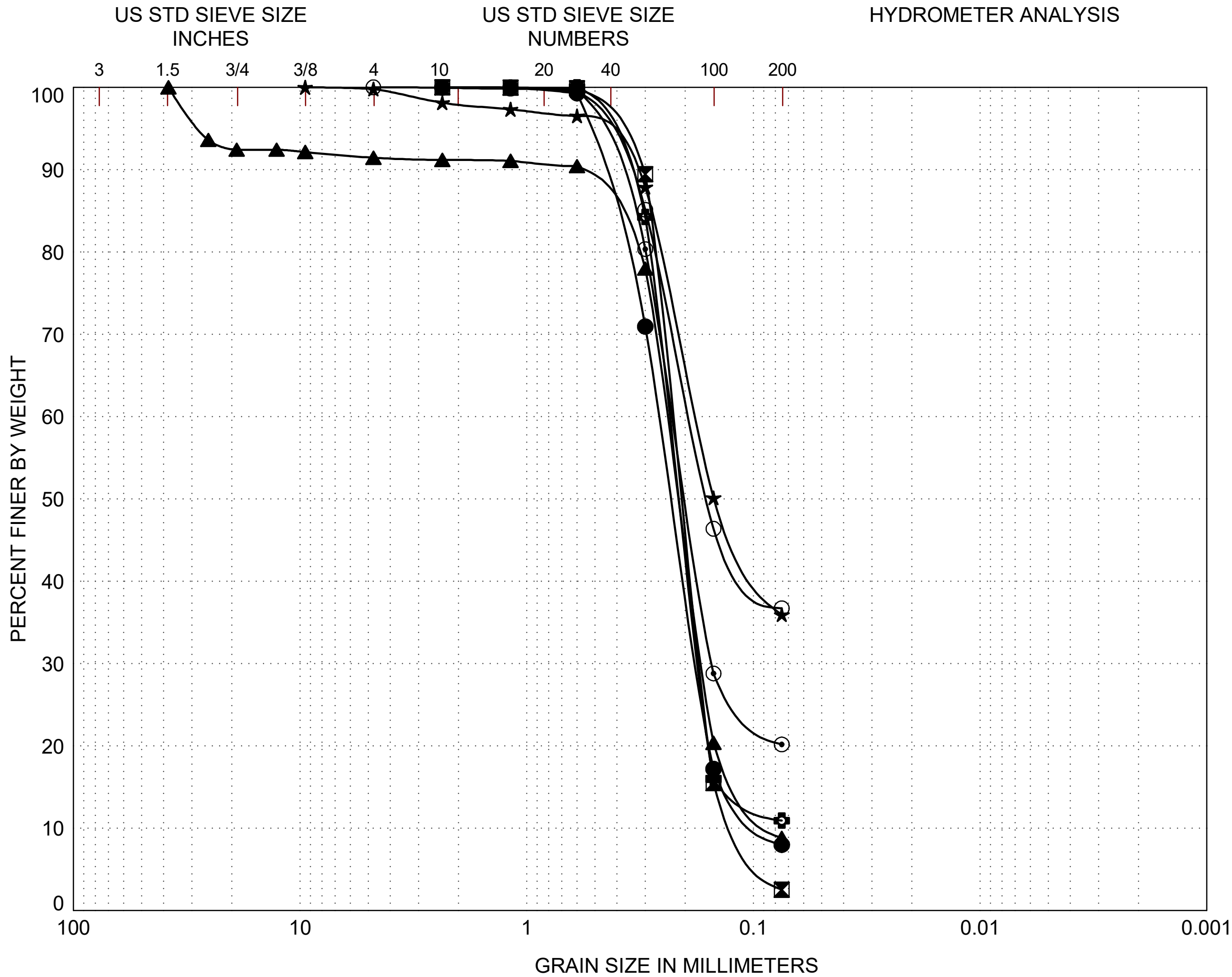


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)	CLASSIFICATION	Cc	Cu	D10	D30	D60
●	DB-02	21.0	Poorly graded SAND with silt and gravel (SP-SM)	0.2	23.4	0.10	0.23	2.46
⧗	DB-03	16.0	Silty SAND (SM)				0.09	0.18
▲	DB-04	20.5	Silty SAND (SM)				0.17	0.24
★	DB-05	11.0	Clayey SAND (SC)					0.20
⊙	DB-09	8.5	SILTY SAND (SM), Dark Brown				0.12	0.21
✚	DB-13 alt	7.5	CLAYEY SAND with GRAVEL (SC), Dark Brown				0.15	1.36
○	DB-14	7.5	SANDY Lean CLAY with GRAVEL (CL), Yellowish Brown					0.09
△	DB-15	14.5	SILTY SAND (SM), Pale Brown				0.08	0.13
⊗	DB-17	8.5	CLAYEY SAND (SC), Olive Brown					0.16
⊕	MB-01	7.5	Poorly-graded SAND with SILT (SP-SM), Light Olive Brown	1.4	3.2	0.08	0.17	0.26
□	MB-02	7.5	Poorly-graded SAND with CLAY (SP-SC), Dark Yellowish Brown	1.6	4.3		0.17	0.28
⊗	MB-03	4.5	Poorly-graded SAND with SILT (SP-SM), Dark Yellowish Brown	1.2	2.5	0.11	0.18	0.27

GRAIN SIZE CURVES
Daly City Colma Pipeline Project
Daly City, California

PLATE B-2a

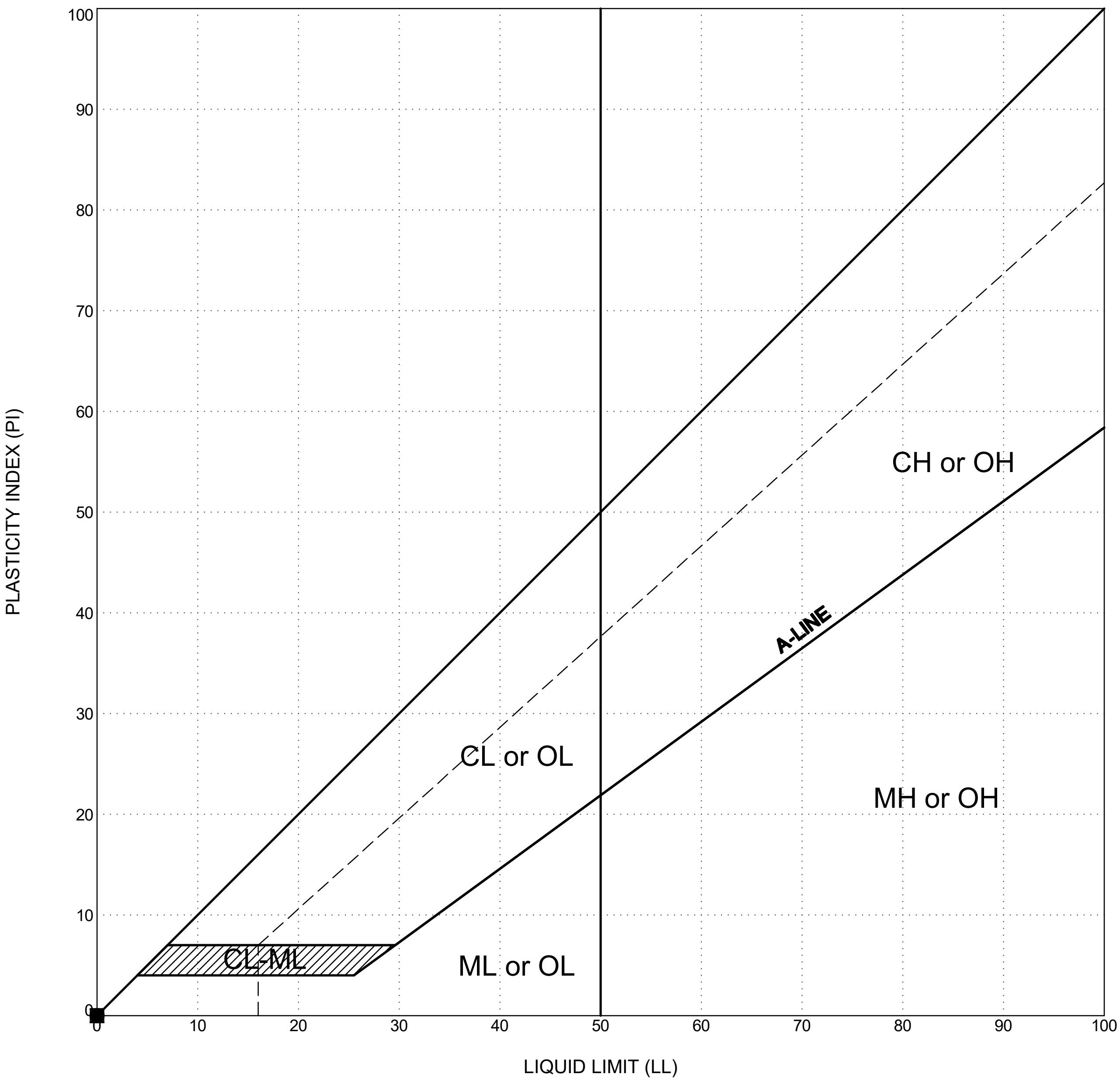


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (location)	(depth,ft)	CLASSIFICATION	Cc	Cu	D10	D30	D60
● MB-04	8.0	Poorly-graded SAND with SILT (SP-SM), Dark Yellowish Brown	1.4	3.0	0.09	0.18	0.26
⊠ MB-07	5.0	Poorly-graded SAND (SP), Olive Brown	1.2	2.0	0.11	0.17	0.23
▲ MB-09	4.5	Poorly-graded SAND with CLAY (SP-SC), Dark Yellowish Brown	1.5	3.0	0.08	0.17	0.24
★ MB-14	4.5	SILTY SAND (SM), Dark Brown					0.18
⊙ MB-15	7.5	CLAYEY SAND (SC), Strong Brown				0.15	0.23
✿ MB-16	8.5	Poorly-graded SAND with CLAY (SP-SC), Strong Brown	1.9	3.5		0.17	0.23
○ MB-26	5.0	SILTY SAND (SM), Yellowish Brown					0.19

GRAIN SIZE CURVES
Daly City Colma Pipeline Project
Daly City, California

PLATE B-2b

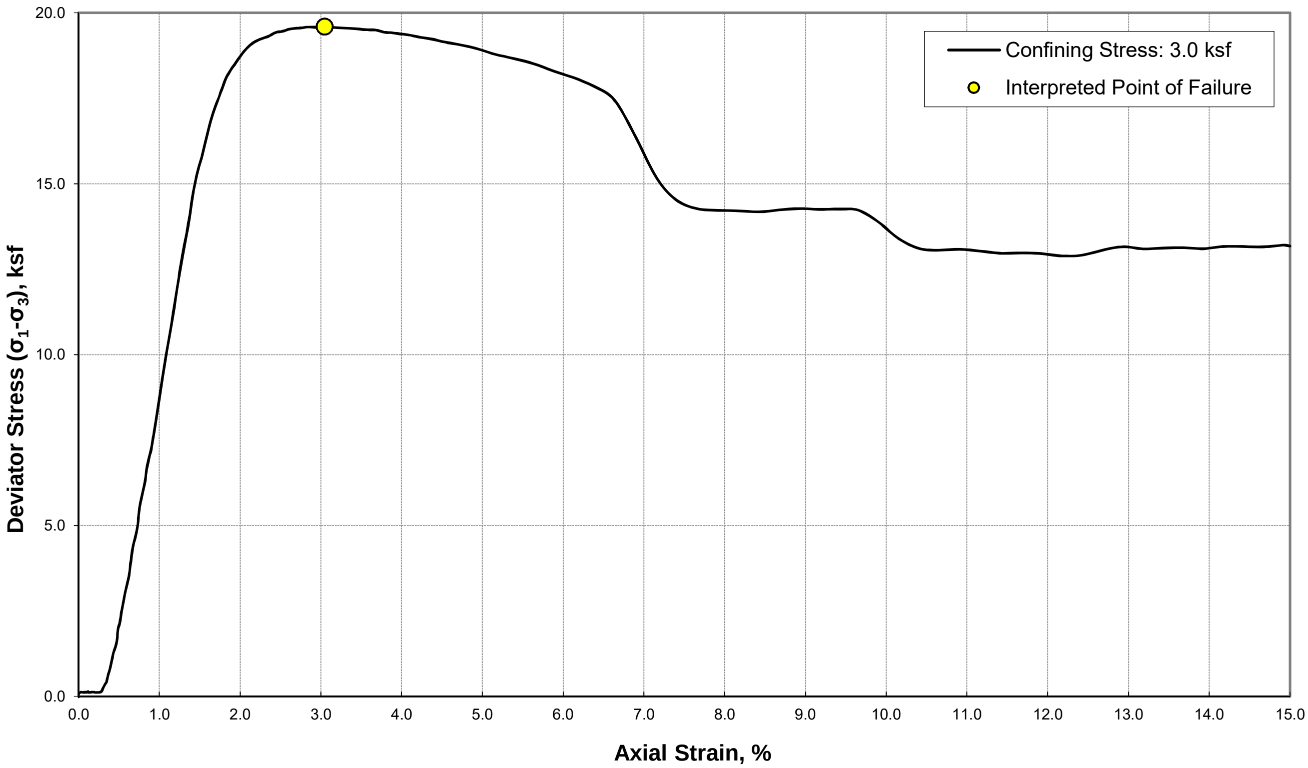


ATTERBERG LIMITS TEST RESULTS

LEGEND location	depth, ft	CLASSIFICATION	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
● DB-04	20.5	Silty SAND (SM)	NP	NP	NP
⊠ DB-05	15.0	Lean CLAY with gravel (CL)	NP	NP	NP

PLASTICITY CHART
Daly City Colma Pipeline Project
Daly City, California

PLATE B-3



SAMPLE ID

Boring Number:	TPB-01
Sample Number:	S-2
Sample Depth:	25.5 ft
USCS Classification:	Poorly-Graded SAND w/ Silt (SP-SM), Dark Yellowish Brown

SAMPLE PROPERTIES

Water Content, %	16.2%
Dry Unit Weight, pcf	109.3
Saturation, %	84%
Void Ratio	0.51
Diameter, in	2.40
Height, in	4.95

SAMPLE IMAGES

CLASSIFICATION

Sieve Size	% Passing	Other Parameters	
3/8-in. (9.5mm)	---	Liquid Limit	---
#4 (4.75mm)	---	Plastic Limit	---
#16 (1.18mm)	---	Plasticity Index	---
#30 (0.6mm)	---	Estimated Gs	2.65
#100 (0.150mm)	---	S_u from T_v, ksf	---
#200 (0.075mm)	6.8	S_u from PP, ksf	---

TEST SUMMARY

Maximum Deviator Stress, ksf	19.6
Undrained Shear Strength, ksf	9.8
Axial Strain at Failure, %	3.0
Strain Rate, %/min	0.6
Cell Pressure, ksf	3.0
Tested By:	WV
Date Tested:	2/28/17

REMARKS

Test Method: ASTM 2850

UNCONSOLIDATED, UNDRAINED TRIAXIAL TEST

Daly City Colma Pipeline Project

Daly City, California

APPENDIX C
CORROSION TESTING

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

14 September 2017

Job No. 1709015
Cust. No. 11608

Mr. Collin Anderson
Fugro Consultants, Inc.
1777 Botelho Dr., Suite 262
Walnut Creek, CA 94596-5132

Subject: Project No.: 04.72160021
Project Name: Daly City Colma Recycled Water Line
Corrosivity Analysis – ASTM Test Methods with Brief Evaluation

Dear Mr. Anderson:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on September 05, 2017. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurements, sample 005 is classified as "mildly corrosive" and all other samples are classified as "moderately corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations ranged from none detected to 33 mg/kg. Because the chloride ion concentrations are less than 300 mg/kg, they are determined to be insufficient to attack steel embedded in a concrete mortar coating.

The sulfate ion concentrations range from none detected to 71 mg/kg and are determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations.

The pH of the soils range from 5.44 to 8.11. Any soils with a pH of <6.0 is considered to be corrosive to buried iron, steel, mortar-coated steel and reinforced concrete structures. Therefore, corrosion prevention measures need to be considered for structures to be placed in this acidic soil.

The redox potentials range from 290 to 400-mV. Sample No. 004 is indicative of aerobic soil conditions All other samples are indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

Cheryl McMillen for

J. Darby Howard, Jr., P.E.
President
JDH/jdl
Enclosure

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client: Fugro West, Inc.
Client's Project No.: 04.72160021
Client's Project Name: Daly City Colma Recycled Water Line
Date Sampled: 10/05/16 - 07/13/17
Date Received: 5-Sep-17
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 14-Sep-2017

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1709015-001	TPB-02, 3 @ 4.5-5	310	8.11	-	6,100	-	27	29
1709015-002	MB-01, 1 @ 2-2.5'	360	5.44	-	5,800	-	17	31
1709015-003	MB-04, 1 @ 1.5-2	330	7.31	-	4,100	-	16	31
1709015-004	MB-07, 1 @ 1.5-2	400	7.50	-	4,600	-	N.D.	15
1709015-005	MB-10-alt, 1 @ 2-2.5	310	7.40	-	13,000	-	N.D.	N.D.
1709015-006	MP-13, 1 @ 1.5-2	300	6.94	-	5,300	-	N.D.	25
1709015-007	MB-17, 3 @ 5-5.5	330	6.33	-	3,100	-	20	24
1709015-008	MB-24, 1 @ 1-1.5	340	6.33	-	5,400	-	N.D.	N.D.
1709015-009	MB-26, 3 @ 4.5-5	310	7.40	-	7,500	-	N.D.	N.D.
1709015-010	DB-05, 1 @ 2.5	300	8.04	-	3,900	-	N.D.	40
1709015-011	DB-09, 3 @ 4.5-5	300	7.92	-	2,200	-	N.D.	28

	Redox	pH	Conductivity	Resistivity	Sulfide	Chloride	Sulfate
Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	15
Date Analyzed:	8-Sept-2017 & 12-Sep-2017	8-Sept-2017 & 12-Sep-2017	-	12-Sep-2017	-	8-Sept-2017 & 12-Sep-2017	8-Sept-2017 & 12-Sep-2017

Cheryl McMillen
Cheryl McMillen
Laboratory Director

* Results Reported on "As Received" Basis
N.D. - None Detected

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client: Fugro West, Inc.
Client's Project No.: 04.72160021
Client's Project Name: Daly City Colma Recycled Water Line
Date Sampled: 10/05/16 - 07/13/17
Date Received: 5-Sep-17
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 14-Sep-2017

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1709015-012	DB-11, 3 @ 4.5-5	290	7.87	-	3,700	-	33	36
1709015-013	DB-15, 3 @ 4.5-5	310	7.36	-	3,000	-	N.D.	17
1709015-014	DB-18, 1 @ 1-1.5'	300	7.10	-	3,100	-	15	71

	Redox	pH	Conductivity	Resistivity	Sulfide	Chloride	Sulfate
Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	15
Date Analyzed:	12-Sep-2017	12-Sep-2017	-	12-Sep-2017	-	12-Sep-2017	12-Sep-2017

Cheryl McMillen
Laboratory Director

* Results Reported on "As Received" Basis
N.D. - None Detected

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

1709015

11608

FF-02 CHAIN OF CUSTODY

PROJECT NAME: DALY CITY COLMA RECYCLED WATER LINE

PROJECT NO.: 04.72160021

LAB: CERCO ANALYTICAL

PROJECT CONTACT: COLLIN ANDERSON

TURNAROUND: NORMAL

SAMPLED BY: J. GOODMAN & C. ANDERSON

LABORATORY I.D. NUMBER	FIELD SAMPLE I.D.	MATRIX: WATER	MATRIX: SOIL	MATRIX: AIR	CONTAINERS: VOA	CONTAINERS: LITER	CONTAINERS: PINT	CONTAINERS: TUBE	CONTAINERS: JAR	CONTAINERS: Baggie	PRESERVATIVE: HCL	PRESERVATIVE: H_2SO_4	PRESERVATIVE: HNO_3	PRESERVATIVE: ICE	PRESERVATIVE: OTHER	PRESERVATIVE: NONE	SAMPLING DATE: MONTH	SAMPLING DATE: DAY	SAMPLING DATE: YEAR	SAMPLING DATE: TIME	NOTES	Redox Potential	pH	Sulfate	Chloride	Resistivity - 100% Saturated	EDF Reporting
001	TPB-02, 3@4.5-5		X					X								X	10	17	16			X	X	X	X	X	
002	MB-01, 1@2-2.5		X					X								X	10	20	16			X	X	X	X	X	
003	MB-04, 1@1.5-2		X					X								X	10	12	16			X	X	X	X	X	
004	MB-07, 1@1.5-2		X					X								X	10	11	16			X	X	X	X	X	
005	MB-10-alt, 1@2-2.5		X					X								X	10	18	16			X	X	X	X	X	
006	MB-13, 1@1.5-2		X					X								X	10	18	16			X	X	X	X	X	
007	MB-17, 3@5-5.5		X					X								X	10	20	16			X	X	X	X	X	
008	MB-24, 1@1-1.5		X					X								X	10	06	16			X	X	X	X	X	
009	MB-26, 3@4.5-5		X					X								X	10	06	16			X	X	X	X	X	
010	DB-05, 1@2.5		X							X						X	07	13	17			X	X	X	X	X	
011	DB-09, 3@4.5-5		X					X								X	10	13	16			X	X	X	X	X	
012	DB-11, 3@4.5-5		X					X								X	10	14	16			X	X	X	X	X	
013	DB-15, 3@4.5-5		X					X								X	10	05	16			X	X	X	X	X	
014	DB-18, 1@1-1.5		X					X								X	10	05	16			X	X	X	X	X	
~~015~~	~~DBH-01, 3@4.5-5~~		~~X~~					~~X~~								~~X~~	~~10~~	~~14~~	~~16~~			~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	DATE/TIME
[signature]	9/5 1515	[signature]	9/5 1515

Remove sample 15 per Collin 9/11 see email

ASTM test methods with brief evaluation

FUGRO USA LAND INC.
1777 Botelho Dr., Suite 262
Walnut Creek, CA
Tel: 925-949-7100 Fax: 925-949-7070

APPENDIX I – PUBLIC DRAFT IS/MND

Daly City
Expanded Tertiary Recycled Water Project

Public Draft
Initial Study/Mitigated Negative Declaration

Prepared by:

SMB Environmental, Inc.

July 2017

Table of Contents

List of Tables

List of Figures

Appendices

List of Abbreviations

ABWF	average base wastewater flow
ARB	Air Resources Board
BAAQMD	Bay Area Air Quality Management District
Basin	Bay Area Air Basin
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
Cal EPA	California Environmental Protection Agency
Cal/OSHA	State of California Occupational Safety and Health Administration
CALTRANS	California Department of Transportation
CAP	Clean Air Plan
CARB	California Air Resources Board
CCAA	California Clean Air Act
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CEQA- Plus	California Environmental Quality Act, Plus Federal Requirements
CESA	California Endangered Species Act
CGS	California Geological Survey
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society’s
CWA	Federal Clean Water Act
dBA	Outdoor Ambient Sound levels
DPM	Diesel particulate matter
DTSC	Department of Toxics Substances Control
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact

gpd	gallons per day
gpm	gallons per minute
HCP	Habitat Conservation Plan
I/I	infiltration/inflow
ISA	International Society of Arboriculture Standards
IS	Initial Study
Leq	Equivalent Sound Level
LU	Landscape Unit
mgd	million gallons per day
MND	Mitigated Negative Declaration
MRZ	Mineral Resource Zone 4
NAAQS	National Ambient Air Quality Standards
NBWRP	North Bay Water Recycling Program
ND	Negative Declaration
NEPA	National Environmental Quality Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NMFS	National Marine Fisheries Service
NOx	Nitrous Oxides
NPDES	National Pollutant Discharge Elimination System
OHWM	Ordinary High Water Mark
PWWF	Peak wet weather flow
ROG	reactive organic gases
RWQCB	Regional Water Quality Control Board
SR	State Route
SRF	State Revolving Funds
SWPPP	Stormwater Pollution Prevention Permit
SWRCB	State Water Resources Control Board
TAZ	Traffic Analysis Zones
TSP	Total Suspended Particles
USACE	United States Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service
VOC	Volatile Organic Compounds
WWTP	Wastewater Treatment Plant

Chapter 1 Introduction

This document is an Initial Study/Mitigated Negative Declaration (IS/MND) that addresses the potential environmental impacts of the City of Daly City's (City) proposed Expanded Tertiary Recycled Water Project (Proposed Project/Action and/or Preferred Alternative). The City operates an existing tertiary treatment facility with a permitted capacity of 2.77 million gallons per day (mgd). This Proposed Project/Action would add a new tertiary treatment process to provide an additional 3.0 mgd of tertiary treatment capacity during the irrigation season. The average yearly capacity of the system is 1.25 mgd or 1,400 acre-feet per year (afy) because the system will only operate during the irrigation season. The new treatment processes would include pressure membrane filtration followed by ultraviolet (UV) disinfection due to the small site constraints. New pipelines, pump stations and offsite storage would be constructed to complete the recycled water distribution system, delivering water to new customers for irrigation purposes in lieu of groundwater pumping. The purpose of the Proposed Project/Action is to reduce irrigation reliance on the groundwater basin; provide local, sustainable, and drought-proof water supply; to preserve available groundwater supplies for drinking water.

Many successful recycled water programs receive funding assistance in the form of low-interest loans and in some instances, grants are available to reduce the financial burden of initial capital and implementation costs. Funding programs are offered at times through the United States Department of Interior, Bureau of Reclamation (USBR), United States Department of Agriculture (USDA), the California State Water Resources Control Board (State Board), and/or the California Department of Water Resources (DWR). In addition, local and regional programs, statewide, occasionally offer additional incentives directed at actual deliveries to promote recycling as an offset to potable water demand. It is anticipated that the City will pursue federal funding from the State Revolving Fund (SRF) Loan Program that is administered by the State Board on behalf of the U.S. Environmental Protection Agency (USEPA). As a result, the Proposed Project/Action would be subject to the California Environmental Quality Act (CEQA) at a minimum where the City would be the CEQA Lead Agency to ensure that all of the applicable state environmental regulations are adhered to. Under the State Board's SRF Program, the State Board is responsible on behalf of the USEPA for ensuring that the project adheres to federal environmental regulations, including the Endangered Species Act, the National Historic Preservation Act (NHPA) and the General Conformity Rule for the Clean Air Act (CAA), among others. The USEPA has chosen to use the CEQA as the compliance base for California's SRF Loan Program, in addition to compliance with ESA, NHPA, and CAA. Collectively, the State Board calls these requirements CEQA-Plus. Additional federal regulations may also apply.

The purpose of this document is to provide project-level CEQA-Plus environmental analysis of the City's Proposed Project/Action to reduce irrigation reliance on the groundwater basin; provide local, sustainable, and drought-proof water supply; and preserve available groundwater supplies for drinking water. What follows is a review and analysis of the major state and federal environmental issues that may be a factor as a result in the construction and/or operation of the Proposed Project/Action. For this analysis, we have reviewed prior and relevant existing environmental documentation and have used a modified CEQA environmental checklist to assess the potential impacts on endangered/threatened species, public health or safety, natural resources, regulated waters, and cultural resources, among others to include and address specific issues associated with CEQA-Plus requirements. Based on our experience with evaluating these kinds of recycled water projects in California, most of the potential environmental issues appear to be short-term/temporary impacts due to construction activities, which can be avoided and/or mitigated to less-than-significant levels. For any potentially significant impact(s) identified, we have identified appropriate mitigation measures and strategies to attempt to avoid and/or reduce those impacts to less-than-significant levels. The information developed is designed to assist the City, and/or the State Board determine what the major potential environmental impacts are to comply with CEQA and/or CEQA-plus requirements.

1.1 Project Location, Setting, and Background

The City of Daly City (City) is a city of 108,383 people in northern San Mateo County, adjacent to the City and County of San Francisco, on the Pacific Ocean and just minutes away from San Francisco Bay. This enviable location inspired the nickname "Gateway to the Peninsula." Figure 1 illustrates the project location.

The San Francisco Public Utilities Commission (SFPUC) serves the San Francisco and Daly City area with surface water from the Hetch-Hetchy system. Daly City operates its own water system in which well water is blended with surface water supplied by the SFPUC. Beginning in 2017, groundwater wells within Daly City withdraw water from the Westside Groundwater Basin for potable water use in all years (San Francisco Groundwater Project). The Westside Basin is also being examined by the SFPUC as an emergency water supply during drought conditions. Due to common interest in reducing reliance on the Westside Basin, both the City and SFPUC have partnered to commission this Project.

The Project would expand the Daly City recycled water system to supply irrigation water to customers in Daly City, the Town of Colma, and South San Francisco. Recycled water would be used for landscape irrigation at cemeteries, parks, schools, and a golf course driving range. The customers currently use potable water from Cal Water, potable supply from Daly City, or groundwater from private wells. The Proposed Project would supply approximately 1,400 afy of recycled water.

1.2 Goal and Objective and Purpose and Need

The City is conducting a preliminary design of the Expanded Tertiary Recycled Water Project. The goals and objectives/purpose and need of the Proposed Project/Action are the following:

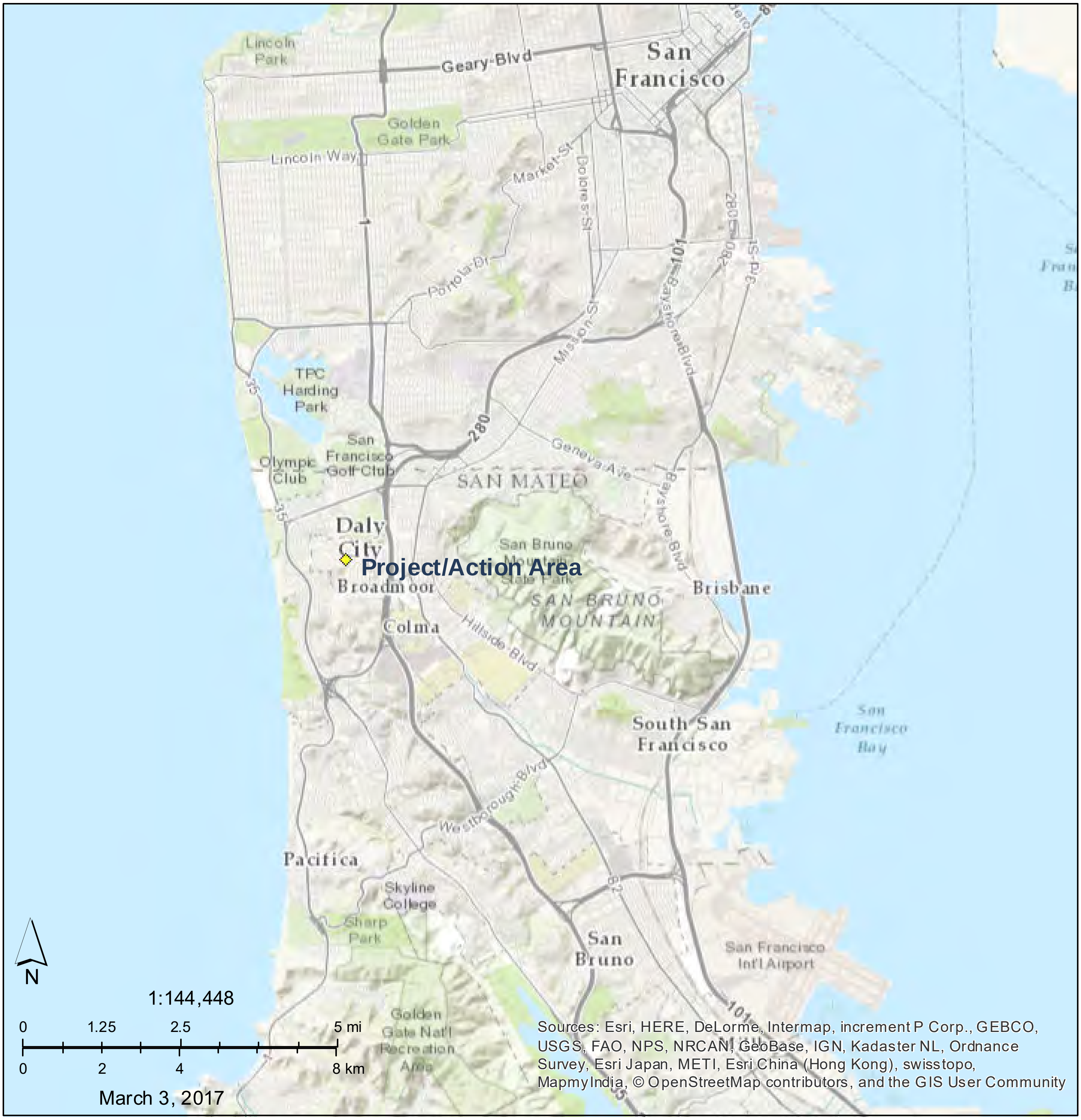
- Reduce irrigation reliance on the groundwater basin;
- Provide local, sustainable, and drought-proof water supply; and
- Preserve available groundwater supplies for drinking water.

1.3 Document Organization and Review Process

This document is intended to provide a preliminary environmental investigation of the Proposed Project/Action to determine if it may have a significant adverse impact on the environment. This document is organized into the following chapters:

- Chapter 1, Introduction. Chapter 1 describes the background, goals and objectives of the Proposed Project/Action, and document contents.
- Chapter 2, Proposed Project Description and Alternatives. Chapter 2 describes the major components of the Proposed Project/Action and describes the No Project/Action Alternative.
- Chapter 3, Environmental Review and Consequences. Chapter 3 discusses the potential environmental impacts associated with the construction and operation of the Proposed Project/Action. Each resource section of a modified CEQA checklist is followed by a discussion of each potential impact listed in that section. It also presents corresponding mitigation measures proposed to avoid or reduce potentially significant impacts to a less-than-significant level. This checklist has been modified to include additional topics to meet the CEQA-Plus requirements
- Chapter 4, Determination. Chapter 4 provides the proposed action as a result of this IS/MND.
- Chapter 5, Bibliography. Chapter 5 provides a list of reference materials and persons consulted during the preparation of the environmental issues and constraints evaluation.

Figure 1
General Location Map



Author: cnddb_com
Printed from http://bios.dfg.ca.gov

This Document will be available for a 30-day public review period, during which written comments may be submitted to the following address:

Mr. Patrick Sweetland
City of Daly City
153 Lake Merced Boulevard
Daly City, CA 94015
Phone: (650) 991-8201
psweetland@dalycity.org

Responses to written comments received by the end of the 30-day public review period will be prepared and included in the final document to be considered by the City and/or the State Board prior to taking any discretionary decision/action on the Proposed Project/Action.

Chapter 2 Proposed Project Description and Alternatives

This chapter provides a detailed description of Proposed Project/Action including a discussion of the construction considerations, compliance with the California Code of Regulations (CCR) Title 22 and State Board Requirements, operational plans, and potential approvals and permits that may be necessary. In addition, this section also describes the No Project/Action Alternative.

2.1 Proposed Project/Action Description

The City is conducting a preliminary design of the expansion of its tertiary recycled water facilities. The City operates an existing tertiary treatment facility with a permitted of 2.77 million gallons per day (mgd). This Proposed Project/Action would add a new tertiary treatment process to provide an additional 3.0 mgd of tertiary treatment capacity during the irrigation season. The average yearly capacity of the system is 1.25 mgd or 1,400 acre-feet per year (afy) because the system will only operate during the irrigation season. The new treatment process would include pressure membrane filtration followed by UV disinfection due to the small site constraints. New pipelines, pump stations and offsite storage would be constructed to complete the recycled water distribution system, delivering water to new customers primarily for irrigation purposes in lieu of groundwater pumping. Specifically, the goal of the project is to produce approximately 1,400 afy of recycled water to: reduce irrigation reliance on the groundwater basin; provide local, sustainable, and drought-proof water supply; and preserve available groundwater supplies for drinking water. The Project includes the following major components, which are described in further detail in the following sections:

- Daly City Wastewater Treatment Plant (WWTP) Expansion
- Recycled Water Conveyance System

2.1.1 Daly City Wastewater Treatment Plant Expansion

As shown on Figure 2, the Daly City WWTP is located at 153 Lake Merced Boulevard, Daly City, California, 94015. The WWTP is owned and operated by the North San Mateo County Sanitation District, a subsidiary of the City of Daly City. The Proposed Project/Action components for the Daly City WWTP expansion are listed below.

- Construction of a two-story tertiary treatment building located at Daly City's WWTP site. The facility would be located near the plant entrance and is approximately 82-feet by 41-feet and approximately 40-feet high. The final building size would be confirmed in final design.

- Construction of new electrical building located on vacant land owned by Daly City near the existing WWTP entrance. The electrical building size is approximately 40-feet by 25-feet and approximately 15-feet high. The final building size would be confirmed during final design.

- Construction of a new chemical and neutralization area, which is located inside the Daly City Wastewater Treatment Plant would be approximately 20-feet by 70-feet.

- Relocation of an existing surge tank and other facilities.

2.1.2 Recycled Water Conveyance/Distribution System

The other major component of the Project is the recycled water conveyance system consisting of pipelines, pumps, and a 2.41 million gallon storage tank. The purpose of the conveyance system is to deliver water from the Daly City WWTP to the customers. The conveyance system includes a 14-inch diameter pipeline from the Daly City WWTP to a recycled water storage tank located in Colma.

Project Facilities

Feet
0 25 50

TREATMENT PLANT EXPANSION FACILITIES

FIGURE 2

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo

The pipeline would be installed in streets within Daly City, the Town of Colma, Broadmoor, South San Francisco, and pipeline easements owned by the SFPUC. The distribution system, which delivers recycled water from the storage tank site to the customers in Colma and South San Francisco, is 4-inches to 18-inches in size. The customer service laterals, 1- to 4-inches in diameter size, would be installed along public roads and/or the private property of the recycled water customers. There are three sites under consideration for the recycled water storage tank. This project description summarizes three different minor variations of the pipeline alignment because the tank location has not been selected. Figure 3 shows all of the pipeline alignments and storage tanks under consideration. It is important to note that although there are three different pipeline alignments, the roads affected by all three alignments would be fairly similar. The minor difference lies in the pipeline alignment for one of the customer service laterals. The facilities associated with each alignment are summarized in the following subsections. The three tank sites described below are referred to by their current ownership names.

2.1.2.1 Storage Tank at the Atwood Property

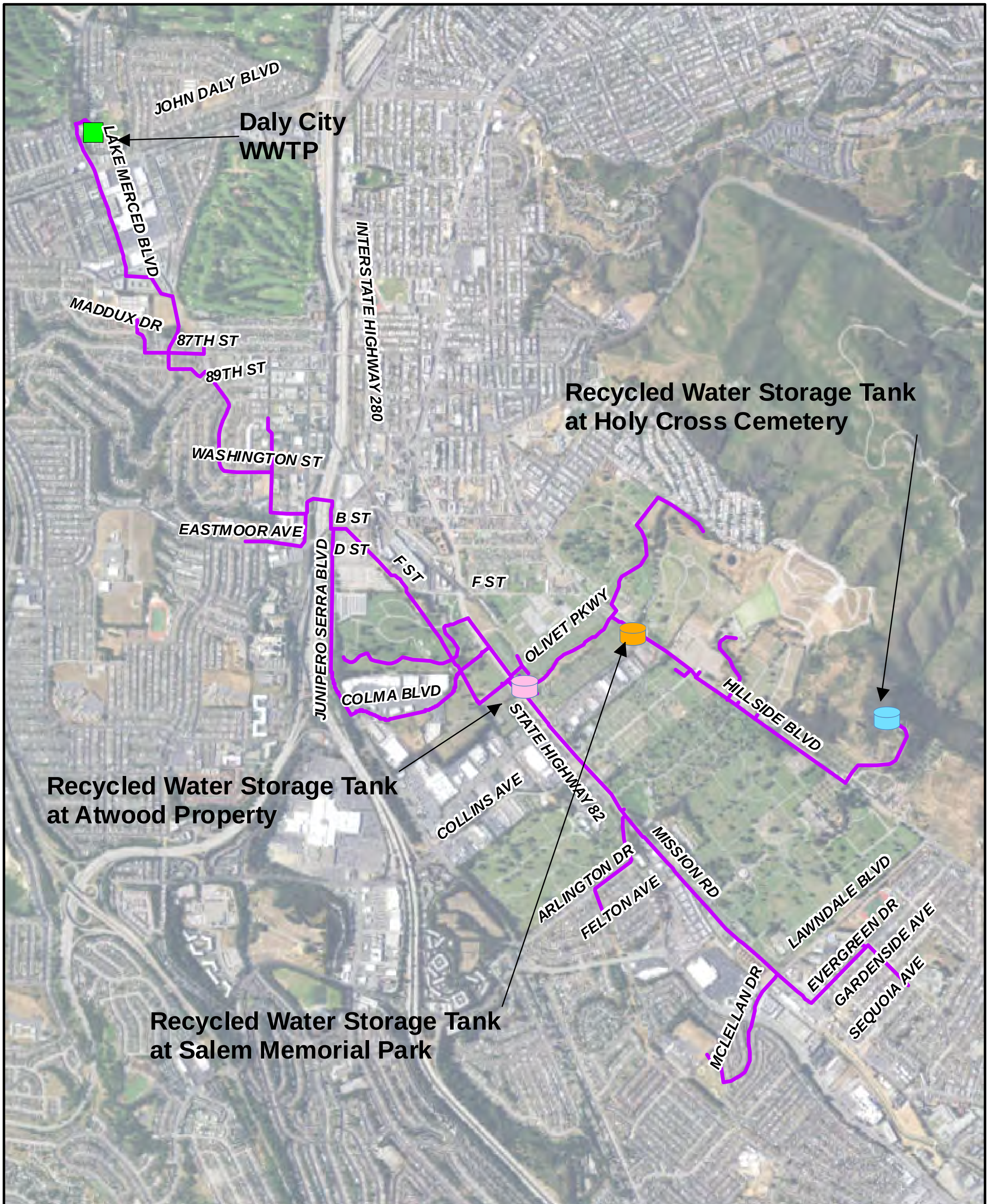
This alternative storage tank site assumes the storage tank would be located at the intersection of State Highway 82 and Olivet Parkway and would be approximately 200-feet long by 55-feet wide by 30-feet high and installed underground. The depth of excavation would be approximately 40-feet deep. The Atwood Property is adjacent to a Bay Area Rapid Transit (BART) underground rail line.

Recycled water would be pumped from the Daly City WWTP to the storage tank at the Atwood Property and then pumped to customers located in Colma and South San Francisco. The pump station building at the Atwood Property would be approximately 40-feet by 50-feet and above grade and approximately 20-feet high. The facility sizing will be finalized during Final Design. Figure 4 presents an overview of the conveyance system to/from the Atwood Property. Figure 5 presents an overview of the storage tank at the Atwood Property.

Table 1 presents a summary of the pipeline lengths for the Atwood property tank site alternative. From the WWTP to I-280, the new 14-inch transmission main would be installed in public streets owned by Daly City or San Mateo County. There are also customer service laterals along this section of the transmission main. In order to cross I-280, an existing 16-inch pipe located on a utility bridge maintained by the California Department of Transportation (Caltrans) would be utilized. The 16-inch pipe is owned by Daly City and not in service. From I-280 to State Highway 82, the 14-inch transmission main would be installed in either SFPUC owned property or along Junipero Serra Boulevard and Colma Boulevard. The 14-inch transmission main would eventually need to cross State Highway 82, which is owned by Caltrans, and a BART underground rail line to reach the storage tank. From the storage tank, the distribution system would deliver water to the customers in Colma and South San Francisco. The distribution system crosses three BART underground rail lines.

2.1.2.2 Storage Tank at the Salem Memorial Park Property

This alternative storage tank site assumes the storage tank would be located at vacant land at the intersection of Hillside Boulevard and Serramonte Boulevard, referred to herein as the Salem Memorial Park Property. Recycled water would be pumped from the WWTP to an underground storage tank, measuring approximately 115-feet long by 40-feet wide by 70-feet high (these dimensions assume the Lucky Chances parking lot cannot be used as a construction staging area). If the parking lot can be used as a staging area, the tank can be made shallower (dimensions of 145-feet long by 70-feet long by 33-feet high). The vacant land is adjacent to grave sites and a parking lot being used by the Lucky Chances Casino. From the Salem Memorial Park Property, the recycled water would be pumped to customers located in Colma and South San Francisco. The pump station



Daly City WWTP

Preferred Option - Holy Cross Cemetery Storage Tank

Alternative 1 - Atwood Property Storage Tank and PS

Alternative 2 - Salem Storage Tank and

Pipeline

N

Feet

0 1,250 2,500

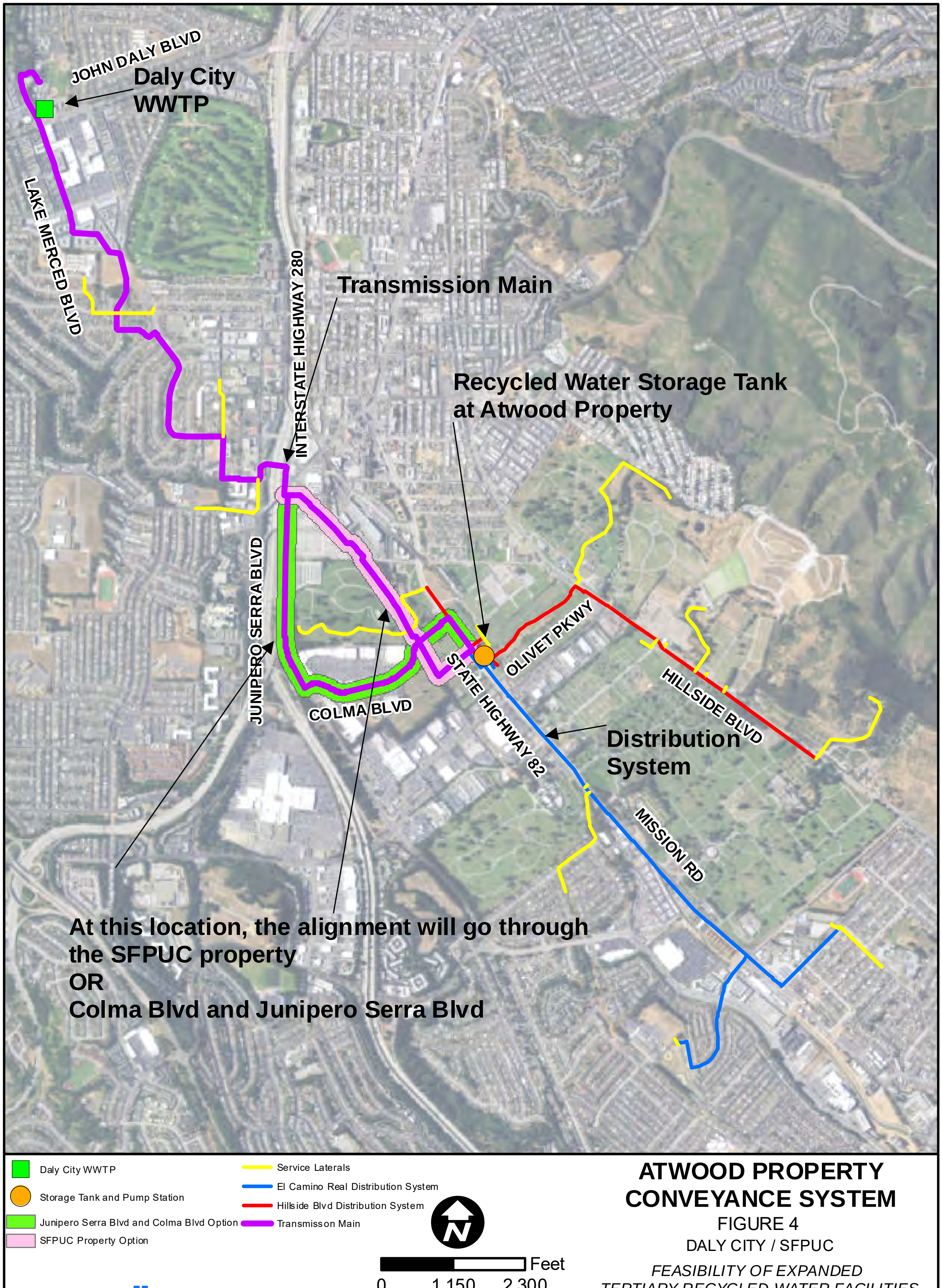
carollo

PROJECT OVERVIEW

FIGURE 3

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES



ATWOOD PROPERTY CONVEYANCE SYSTEM

FIGURE 4

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

ATWOOD PROPERTY STORAGE TANK SITE

FIGURE 5

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

building at the Salem Memorial Park Property would measure approximately 40-feet by 50-feet and would be aboveground, approximately 20-feet high. All facility sizing would be finalized during Final Design. Figure 6 presents an overview of the conveyance system to/from the Salem Memorial Park Property. Figure 7 presents an overview of the storage tank at the Salem Memorial Park Property.

Table 1
Conveyance System Pipe Lengths for Tank at Atwood Property
Expanded Tertiary Recycled Water Project

Description	Pipe Sizes (Inches)[1]	Length (Feet)
Transmission Main from WWTP to Storage Tank	14	16,345[2]
Pipe Bridge	16	320
Customer Laterals Along Transmission Main	1.5 - 4	4,160
Distribution System	4 - 18	20,865
Customer Laterals Along Distribution System	1 - 14	15,280
Total		**56,970**

1) Pipe sizes will be finalized in the Final Design.
2) This assumes the transmission main is installed on SFPUC land. If the pipeline is installed through Junipero Serra Boulevard and Colma Boulevard, the length is 18,331 ft.

Table 2 presents a summary of the pipeline lengths for the Salem Memorial Park property tank site alternative. From the WWTP to I-280, the new 14-inch transmission main would be installed in public streets owned by Daly City and/or San Mateo County; there are also customer service laterals along this section of the transmission main. In order to cross I-280, an existing 16-inch pipe located on a utility bridge maintained by the California Department of Transportation (Caltrans) would be utilized. The 16-inch pipe is owned by Daly City and not in service. From I-280 to State Highway 82, the 14-inch transmission main would be installed in either SFPUC owned property or along Junipero Serra Boulevard and Colma Boulevard. The 14-inch transmission main would eventually need to cross State Highway 82, which is owned by Caltrans, and a BART underground rail line to reach the storage tank. From the storage tank, the distribution system would deliver pumped water to the customers in Colma and South San Francisco. The distribution system crosses three BART underground rail lines.

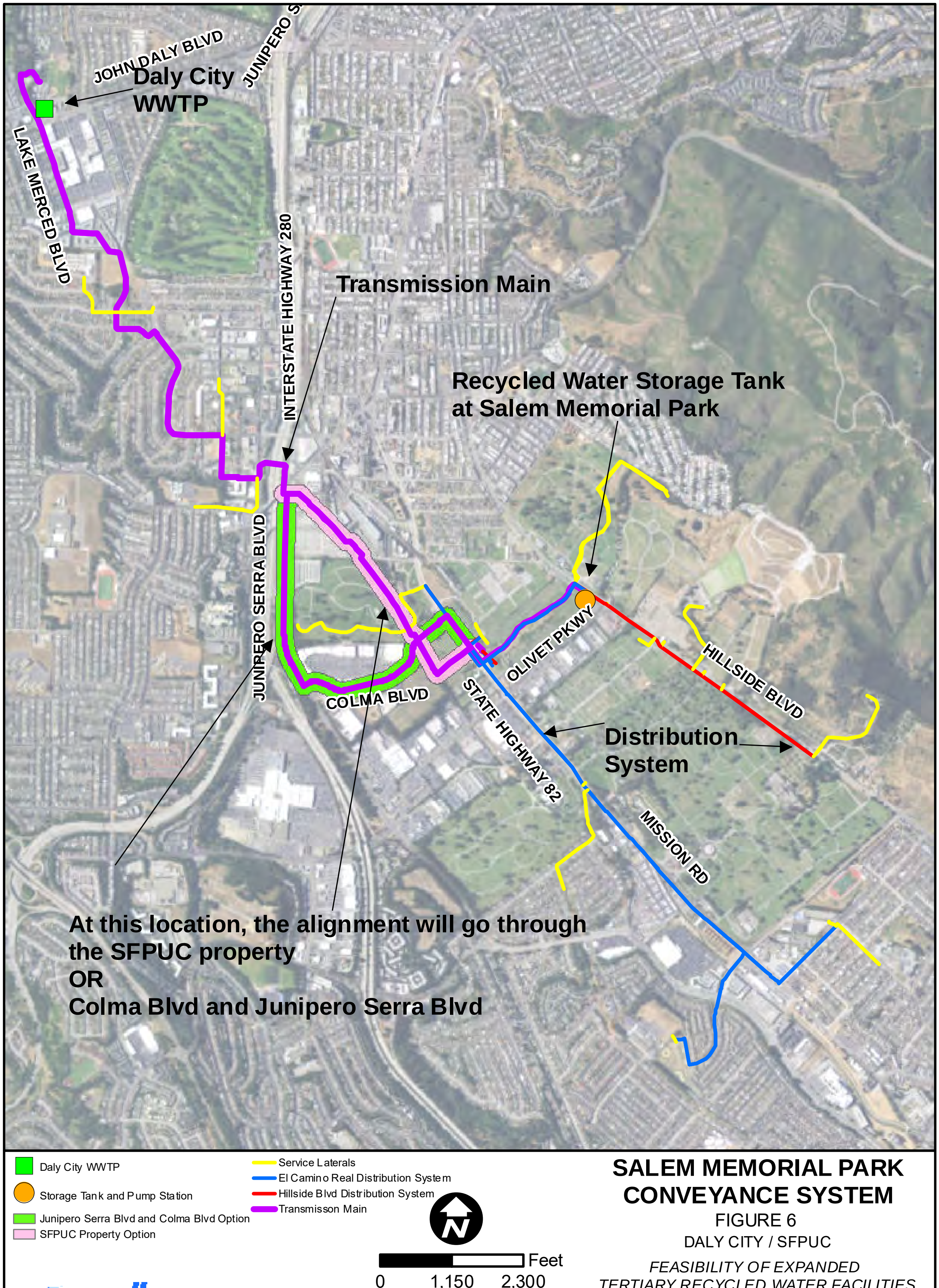
Table 2
Conveyance System Pipe Lengths for Tank at Salem Memorial Park Property
Expanded Tertiary Recycled Water Project

Description	Pipe Sizes (Inches)[1]	Length (Feet)
Transmission Main from WWTP to Storage Tank	14	16,070[2]
Pipe Bridge	16	320
Customer Laterals Along Transmission Main	1.5 - 4	4,160
Distribution System	4 - 16	22,950
Customer Laterals Along Distribution System	1 - 14	15,260
Total		**58,760**

1) Pipe sizes will be finalized in the Final Design.
2) This assumes the transmission main is installed on SFPUC land. If the pipeline is installed through Junipero Serra Boulevard and Colma Boulevard, the length is 18,056.

2.1.2.3 Storage Tank at the Holy Cross Cemetery Property

This preferred option assumes the storage tank is located at vacant land at the Holy Cross Cemetery property at Hillside Boulevard. Recycled Water would be pumped from the WWTP to an above



SALEM MEMORIAL PARK
CONVEYANCE SYSTEM

FIGURE 6

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED
TERTIARY RECYCLED WATER FACILITIES

Storage Tank
Pump Station
Salem Parcel
Vacant Land

N

Feet
0 40 80

SALEM MEMORIAL PARK STORAGE TANK SITE

FIGURE 7

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

ground storage tank, measuring approximately 118.5-foot diameter and 30-feet high located on a hill on Hillside Boulevard. From the Holy Cross Cemetery property, the recycled water would gravity flow to customers located in Colma and South San Francisco. A pump station would not be required for this alternative. All facility sizing would be finalized during Final Design. Figure 8 presents an overview of the conveyance system to/from the Holy Cross Cemetery property. Figure 9 presents an overview of the storage tank at the Holy Cross Cemetery property.

Table 3 presents a summary of the pipeline lengths for the Holy Cross property tank site alternative. From the WWTP to I-280, the new 14-inch transmission main would be installed in public roads owned by Daly City or San Mateo County; there are also customer service laterals along this section of the transmission main. In order to cross I-280, an existing 16-inch pipe located on a utility bridge maintained by the California Department of Transportation (Caltrans) would be utilized. The 16-inch pipe is owned by Daly City and not in service. From I-280 to State Highway 82, the 14-inch transmission main would be installed in either SFPUC owned property or along Junipero Serra Boulevard and Colma Boulevard. The 14-inch transmission main would eventually need to cross State Highway 82, which is owned by Caltrans, and a BART underground rail line to reach the storage tank. From the storage tank, the distribution system would deliver recycled water by gravity to the customers in Colma and South San Francisco. The distribution system crosses three BART underground rail lines.

Table 3
Conveyance System Pipe Lengths for Tank at Holy Cross Cemetery
Expanded Tertiary Recycled Water Project

Description	Pipe Sizes (Inches)[1]	Length (Feet)
Transmission Main from WWTP to Storage Tank	14	16,315[2]
Pipe Bridge	16	320
Customer Laterals Along Transmission Main	1.5 - 4	4,160
Distribution System	4 - 18	20,040
Customer Laterals Along Distribution System	1 - 14	12,360
Total		**53,195**

1) Pipe sizes will be finalized in the Final Design.
2) This assumes the transmission main is installed on SFPUC land. If the pipeline is installed through Junipero Serra Boulevard and Colma Boulevard, the length is 18,301.

2.2 Project Construction

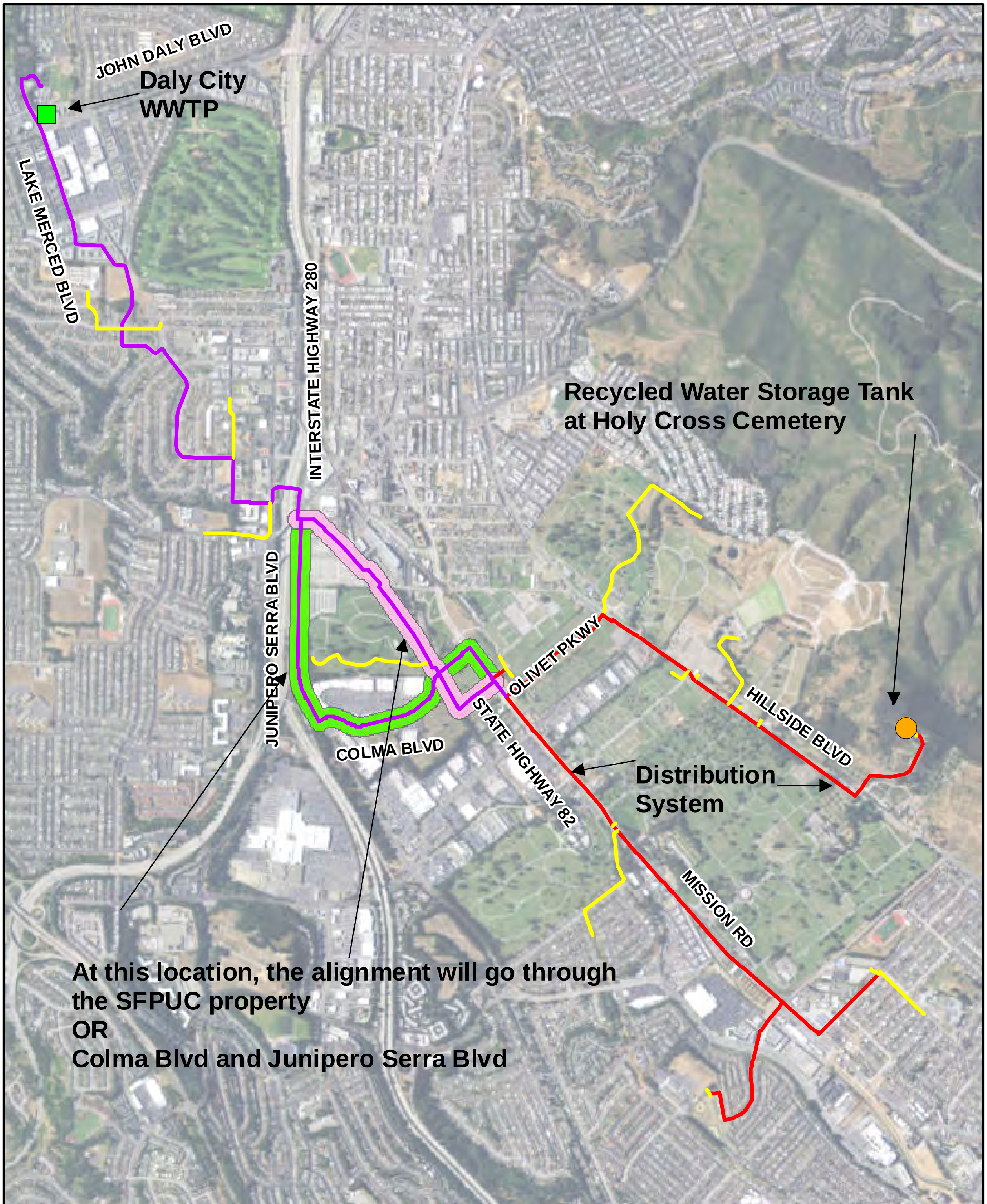
This section describes the construction activities associated with the Proposed Project’s major components.

2.2.1 Daly City WWTP Expansion

The Project components located at the Daly City WWTP include a tertiary treatment building, an electrical building, a surge tank, and a chemical and neutralization area. Typical construction activities include excavation, shoring, treatment process and electrical buildings construction, installation of treatment process equipment, testing, commissioning, and startup. Depending on the groundwater levels found during the geotechnical investigation and construction, excavations may require an excavation dewatering system. The dewatering system will be installed during construction to lower the groundwater below the excavated area. The groundwater will be disposed of according to local laws and regulations.

2.2.2 Conveyance Pipelines and Storage Tank

The majority of the new conveyance pipeline system would be installed using open trench methods



Daly City WWTP
Storage Tank and Pump Station
Junipero Serra Blvd and Colma Blvd Option
SFPUC Property Option
Service Laterals
Gravity Distribution System
Transmission Main

N

0 1,150 2,300 Feet

HOLY CROSS CEMETERY CONVEYANCE SYSTEM

FIGURE 8

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo

Storage Tank
Holy Cross Site

Feet
0 100 200

HOLY CROSS CEMETERY STORAGE TANK SITE

FIGURE 9

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

in streets and public right-of-ways. Typical construction activities include pavement cutting, excavation, pipeline installation, backfill and pavement repair. The typical trench size is expected to be 4-feet wide and 8-feet deep and trench shoring designed according to Occupational Safety and Health Administration (OSHA) requirements would be used in excavations deeper than 5-feet.

The project may include trenchless installation of the pipeline to cross certain areas. A commonly used trenchless installation method involves jack-and bore construction. Jack-and-bore construction involves digging a jacking pit, typically 35-feet by 12-feet, and a receiving pit, typically 10-feet by 10-feet. The jack and bore pits would be approximately 30-feet deep. Then, a boring machine will be used to simultaneously cut through the soil with an auger, and push a casing pipe into the soil. The pipe carrying the recycled water will eventually be installed through the casing pipe.

2.2.3 Construction Duration

It is anticipated that construction would begin in 2019 and last for approximately 24 months. The project would be constructed during normal working hours 8 AM - 5 PM Monday through Friday. However, it may be necessary for the Contractor to work night and/or weekends if required to meet critical schedule deadlines, or accelerate the schedule. It is estimated that 3 crews of approximately 12 workers each (i.e. 36 construction workers) would be required.

2.3 Facility Operations and Maintenance

The recycled water treatment and conveyance system will be operated by Daly City operations and maintenance staff. The system will operate 24 hours per day and 7 days per week and produce an average of 1,400 afy. It is anticipated that the irrigation schedule for all the users will occur 8 hours a day, from 9 PM to 5 AM. Operation and maintenance of the proposed facilities are not anticipated to increase the number of permanent workers or employees.

2.4 Compliance with CCR Title 22 and State Board's Recycled Water Policy

The Proposed Project/Action will be designed and operated in accordance with the applicable requirements of CCR Title 22 and any other state or local legislation that is currently effective or may become effective as it pertains to recycled water. The State Board adopted a Recycled Water Policy (RW Policy) in 2009 to establish more uniform requirements for water recycling throughout the State and to streamline the permit application process in most instances. As part of that process, the State Board prepared an Initial Study and Mitigated Negative Declaration for the use of recycled water. The newly adopted RW Policy includes a mandate that the State increase the use of recycled water over 2002 levels by at least 1,000,000 afy by 2020 and by at least 2,000,000 afy by 2030. Also included are goals for storm water reuse, conservation and potable water offsets by recycled water. The onus for achieving these mandates and goals is placed both on recycled water purveyors and potential users. The State Board has designated the Regional Water Quality Control Boards as the regulating entities for the Recycled Water Policy. In this case, the San Francisco Bay Regional Water Quality Control Board (San Francisco RWQCB) is responsible for permitting recycled water projects throughout the San Francisco Bay Area, including the City of Daly City

The Proposed Project/Action will provide high quality unrestricted use tertiary treated recycled water and make it available to users within the City. All irrigation systems will be operated in accordance with the requirements of Title 22 of the CCR, the State Board Recycled Water Policy, and any other local legislation that is effective or may become effective as it pertains to recycled water and any reclamation permits issued by the San Francisco RWQCB. Reclamation permits typically require the following:

- Irrigation rates will match the agronomic rates of the plants being irrigated;
- Control of incidental runoff through the proper design of irrigation facilities;
- Implementation of a leak detection program to correct problems within 72 hours or prior to the release of 1,000 gallons whichever occurs first;
- Management of ponds containing recycled water to ensure no discharges; and
- Irrigation will not occur within 50 feet of any domestic supply wells, unless certain conditions have been met as defined in Title 22.

2.5 Responsible Agencies, Permits and Approvals

Table 4 summarizes the potential permits and/or approvals that may be required prior to the construction of the Proposed Project/Action. Additional approvals and permits may also be required.

Table 4
Potential Permits and Approvals
Expanded Tertiary Recycled Water Facilities City of Daly City

Agency/Entity	Type of Approval
Bay Area Rapid Transit (BART)	• Construction Permit for Facilities Adjacent to BART Structures
California Department of Transportation (Caltrans)	• Encroachment Permit - El Camino Real / Hwy 82
California Division of Occupational Safety and Health (CAL/OSHA)	• Construction activities in compliance with CAL/OSHA safety requirements
City of South San Francisco	• Encroachment Permit - South San Francisco Roads
Daly City	• Encroachment Permit - Daly City Roads
San Francisco Bay Regional Water Quality Control Board	• National Pollutant Discharge Elimination System General Permit for Stormwater Discharge • Associated with Construction Activities Updated Recycled Water Use Permit
San Francisco Public Utilities Commission (SFPUC)	• Encroachment Permit - SFPUC Right-of-Way
San Mateo County	• Encroachment Permit - Broadmoor and County Roads
Town of Colma	• Encroachment Permit - Colma Roads

2.6 No Project/Action Alternative

Under the No Project/Action Alternative, the City's Proposed Project/Action would not be constructed and therefore impacts as a result of this specific Proposed Project/Action as described here within this document would not be encountered. For this analysis, it is assumed that the existing baseline condition and the future No Project/Action condition are the same. This No Project/Action Alternative assumes that none of the Proposed Project/Action facilities would be constructed. As a result, the impact description and summary compares the Proposed Project/Action to the No Project/Action.

Chapter 3 Environmental Review and Consequences

This chapter evaluates the potential for the Proposed Project/Action to have a significant effect on the environment. Using a modified CEQA Environmental Checklist Form as presented in Appendix G of the CEQA Guidelines as a framework, the checklist identifies the potential environmental impacts of the Proposed Project/Action pursuant to both CEQA and NEPA. This document compares the Proposed Project/Action against the No Project/Action Alternative as is required by CEQA and NEPA.

Environmental Impact Designations

For this checklist, the following designations are used to distinguish between levels of significance of potential impacts to each resource area:

Potentially Significant Impact. Adverse environmental consequences that have the potential to be significant according to the threshold criteria identified for the resource, even after mitigation strategies are applied and/or an adverse effect that could be significant and for which no mitigation has been identified. If any resultant potentially significant impacts are identified, an EIR/EIS may need to be prepared to meet CEQA and NEPA requirements, respectively.

Less-than-Significant Impact with Mitigation. Adverse environmental consequences that have the potential to be significant, but can be reduced to less-than-significant levels through the application of identified mitigation strategies that have not already been incorporated into the Proposed Project/Action description.

Less-than-Significant Impact. Potential adverse environmental consequences have been identified. However, they are not so adverse as to meet the significance threshold criteria for that resource. Therefore, no mitigation measures are required.

No Impact. No adverse environmental consequences have been identified for the resource or the consequences are negligible or undetectable. Therefore, no mitigation measures are required.

Environmental Resources Evaluated

The following are the key environmental resources that were evaluated in this document.

☒ Aesthetics	☒ Hazards/Hazardous Materials	☒ Population and Housing
☒ Agriculture Resources	☒ Hydrology / Water Quality	☒ Recreation
☒ Air Quality	☒ Land Use / Planning	☒ Socioeconomics
☒ Biological Resources	☒ Mineral Resources	☒ Transportation/Traffic
☒ Cultural Resources	☒ Noise	☒ Utilities and Service Systems
☒ Geology / Soils	☒ Public Services	☒ Mandatory Findings of Significance

3.1 Aesthetics

Would the Proposed Project/Action:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐
d) Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project/Action is not located in or near any designated scenic vistas and therefore would not have a substantial impact on a scenic vista. Important scenic resources in Daly City include views of the ocean and coastline as well as San Bruno Mountain. The construction activities of the Proposed Project/Action would not substantially interfere with views of these resources from surrounding publicly accessible areas. No impacts are anticipated and no specific mitigation measures are required.

(b) **No Impact.** The Proposed Project/Action is not located near or within a designated state scenic highway and therefore would not damage scenic resources, including but not limited to trees, outcroppings, and historic buildings within a state scenic highway. Designated scenic highways and routes are intended to protect and enhance the scenic beauty of the highways, routes and adjacent corridors. Designation ensures that new development projects along recognized scenic corridors are designed to maintain the route's scenic potential. Skyline Boulevard (Route 35), Cabrillo Highway (Route 1), and Junipero Serra Freeway (I-280) are eligible to be State-designated Scenic Highways under the State Scenic Highways program, but are not officially designated. Some of the scenic potential along these corridors are related to the views of the coast and San Bruno Mountain. The County of San Mateo's Visual Quality General Plan Element identifies these three highways as roadways that provide scenic views along with portions of John Daly Boulevard and Guadalupe Canyon Parkway. The Proposed Project/Action's construction activities would not be located within any area that has been designated as a scenic vista or scenic resource. Therefore, no impacts are anticipated and no specific mitigation measures are required.

(c) **Less-than-Significant Impact.** Construction of the Proposed Project/Action's facilities would be visible and would involve temporary negative aesthetic effects, including open trenches as well as the presence of construction equipment and materials. Construction of the new tertiary treatment facility, the electrical building, and a new chemical and neutralization areas, would be temporary and located inside the Daly City Wastewater Treatment Plant and is not considered to be a significant impact. Once constructed, the new facilities would not have any significant visual impacts. Construction impacts of the pipeline facilities would be temporary and are considered to be less-than-significant. Once built, the pipeline facilities would be buried underground and not visible. The storage tanks at the Atwood Property or at the Salem Memorial Park Property would be underground and thus would not have any significant visual impacts once constructed. Any construction visual impacts of either tank would be considered less than significant. The proposed storage tank at the Holy Cross Cemetery is the preferred alternative for a storage tank and would be an above ground facility located on a hillside next to an existing storage tank and thus would not have any additional new or significant visual impacts. Operation of the Proposed Project/Action would not affect any visual resources. Therefore, no significant impacts are anticipated and no specific mitigation measures are required.

(d) **No Impact.** The Proposed Project/Action would not create a new source of substantial light or glare that would adversely affect day or nighttime views in the area. The Proposed Project/Action would not be constructed during nighttime hours and once constructed, there would be no lights or other sources of significant light or glare. Therefore no impacts would occur and no mitigation is required.

3.2 Agricultural Resources

Would the Proposed Project/Action:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☒	☐
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☒	☐
c) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	☐	☐	☒	☐

Discussion

(a) **Less-than-Significant Impact.** The Proposed Project/Action would not convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use. The proposed storage tank at the Holy Cross Cemetery would be located on a small agricultural field that the Cemetery has contracted out to a local small nursery on a year-by-year basis. This small agricultural plot of land is less than an acre in size and is not considered to be a significant farmland resource. All of the other facilities considered to be part of the Proposed Project/Action will not be located on any existing agricultural fields or farmlands. As a result, the Proposed Project/Action would not convert any Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland) to non-agricultural usage. No mitigation is required or necessary.

(b) **Less-than-Significant Impact.** The Proposed Project/Action would not conflict with existing zoning for agricultural use or a Williamson Act contract. As stated above, the proposed storage tank at the Holy Cross Cemetery would be located on a small agricultural field that the Cemetery has contracted out to a local small nursery on a year-by-year basis. This small agricultural plot of land is less than an acre in size and is not considered to be a significant farmland resource. All of the other facilities considered to be part of the Proposed Project/Action will not be located on any existing agricultural fields or farmlands. As a result, the Proposed Project/Action would not conflict with agricultural practices and/or a Williamson Act Contract. No mitigation is required or necessary.

(c) **Less-than-Significant Impact.** As mentioned above, the proposed storage tank at the Holy Cross Cemetery would be located on a small agricultural field that the Cemetery has contracted out to a local small nursery on a year-by-year basis. This small agricultural plot of land is less than an acre in size and is not considered to be a significant farmland resource. All of the other facilities considered to be part of the Proposed Project/Action will not be located on any existing agricultural fields or farmlands. Therefore, the Proposed Project/Action would not involve changes in the existing environment, which, due to their location or nature, would result in the conversion of significant farmland or agricultural practices to non-agricultural use. No mitigation is required or necessary.

3.3 Air Quality

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☒	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☒	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☒	☐	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☒	☐
f) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☒	☐	☐
g) Conflict with an application plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☒

Discussion

(a) **Less-than-Significant Impact.** The Proposed Project/Action is located within the jurisdiction of the San Francisco Bay Area Air Quality Management District (BAAQMD), the regional agency empowered to regulate air pollutant emissions from stationary sources in the Bay Area. BAAQMD regulates air quality through its permit authority over most types of stationary emission sources and through its planning and review process. The Project site is located in the San Francisco Bay Area Air Basin. This Basin is currently designated “non-attainment” for the state 1-hour ozone standard. To meet planning requirements related to this standard, the BAAQMD developed a regional air quality plan, the Bay Area 2000 Clean Air Program (CAP), the BAAQMD’s most recent triennial update of the 1991 Clean Air Plan. A significant impact would occur if a project conflicted with the plan by not mirroring assumptions of the plan regarding population growth and vehicle-miles-traveled. The Proposed Project/Action could accommodate population growth because the Project would provide recycled water, making potable supplies more available, and thus increasing the overall supply of water. However, the addition of up to 1,400 acre-feet of recycled water for irrigation within the City would not significantly result in any increased growth or development.

Once constructed, the Proposed Project/Action would not generate any new significant operational vehicle trips. Any impacts are considered to be less-than-significant. No mitigation is required or necessary.

(b) **Less-than-Significant Impact with Mitigation.** The entire San Francisco Bay Area is currently designated "non-attainment" for the state PM_{10} and $PM_{2.5}$ standards, and the state 1-hour ozone standard. The Bay Area is in "attainment" or "unclassified" with respect to the other ambient air quality standards. As part of the effort to reach attainment of these standards, the BAAQMD has established thresholds of significance for several criteria air pollutants associated with both the construction and operation of projects[1]. Specifically, a project is considered to have a significant regional air quality impact if it would result in an increase in emissions of 80 pounds per day or 15 tons per year of PM_{10}, and/or of reactive organic gases (ROG) or nitrogen oxides (NO_X). ROG and NO_X are both ozone precursors.

Construction activities at the project site would begin in the summer/fall of 2019 and continue into 2020 and would include excavation and grading activities. Overall construction work would require the use of various types of mostly diesel-powered equipment, including bulldozers, wheel loaders, excavators, and various kinds of trucks.

Construction activities typically result in emissions of particulate matter, usually in the form of fugitive dust from activities such as trenching and grading. Emissions of particulate matter vary day-to-day, depending on the level and type of activity, silt content of the soil, and the prevailing weather. Estimated construction emissions for the pipeline construction were generated using the Sacramento Metropolitan Air Quality Management District's i.e. URBEMIS Construction Emissions Model (See Appendix A). Please note that this model was used because it has been recommended by BAAQMD. The URBEMIS Construction Emissions Model is a Microsoft Excel worksheet available to assess the emissions of linear construction projects. The estimated construction equipment fleet-mix and the acreage and soil volume were put into the URBEMIS model in order to determine potential emissions. Table 5 summarizes the Proposed Project/Action's estimated construction related emissions output from the URBEMIS model in maximum pounds per day as well as in estimated tons for the entire construction duration and compares that data with BAAQMD's daily and project/year thresholds. This estimate assumes the worst-case scenario where the maximum pipeline length and the largest storage tank would be built. As shown in Table 5, the Proposed

[1] BAAQMD's CEQA Guidelines were developed to assist local jurisdictions and lead agencies in complying with the requirements of CEQA regarding potentially adverse impacts to air quality. These CEQA Guidelines were updated in June 2010 to include reference to thresholds of significance ("Thresholds") adopted by the Air District Board on June 2, 2010. The Guidelines were further updated in May 2011. On March 5, 2012 the Alameda County Superior Court issued a judgment finding that the Air District had failed to comply with CEQA when it adopted the Thresholds. The court did not determine whether the Thresholds were valid on the merits, but found that the adoption of the Thresholds was a project under CEQA. The court issued a writ of mandate ordering the District to set aside the Thresholds and cease dissemination of them until BAAQMD had complied with CEQA. In view of the court's order, BAAQMD is no longer recommending that the Thresholds be used as a generally applicable measure of a project's significant air quality impacts. Lead agencies will need to determine appropriate air quality thresholds of significance based on substantial evidence in the record. Although lead agencies may rely on BAAQMD's CEQA Guidelines (updated May 2011) for assistance in calculating air pollution emissions, obtaining information regarding the health impacts of air pollutants, and identifying potential mitigation measures, BAAQMD has been ordered to set aside the Thresholds and is no longer recommending that these Thresholds be used as a general measure of a project's significant air quality impacts. Lead agencies may continue to rely on the Air District's 1999 Thresholds of Significance and they may continue to make determinations regarding the significance of an individual project's air quality impacts based on the substantial evidence in the record for that project.

Project/Action's construction emissions would not exceed BAAQMD's daily and/or annual significance thresholds.

BAAQMD's approach to analyses of construction impacts as noted in their BAAQMD CEQA Guidelines is to emphasize implementation of effective and comprehensive basic construction control measures rather than detailed quantification of emissions. With implementation of the mitigation measures below, the Proposed Project/Action's construction-related impacts would be further reduced to less-than-significant levels.

Table 5: Estimated Proposed Project/Action Construction Emissions					
		Construction Emissions (lbs/day)			
Construction Phase	ROG	CO	NOx	PM_{10}	$PM_{2.5}$*
Grubbing/Land Clearing	7.3	37.6	40.2	7.0	2.9
Grading/Excavation	7.5	43.5	39.8	7.1	2.9
Drainage/Utilities/Subgrade	6.5	38.4	36.0	6.9	2.7
Paving	5.6	34.2	29.1	1.8	1.6
Maximum (lbs/day)**	**7.5**	**43.5**	**40.2**	**7.1**	**2.9**
Total Tons Project/ Year	**1.8**	**10.5**	**9.8**	**1.6**	**0.7**
BAAQMD's Thresholds of Significance***					
Pounds per Day	80	550	80	80	80
Tons per Project/Year	15	100	15	15	15
Potentially Significant Impact?	**No**	**No**	**No**	**No**	**No**
Notes					
* BAAQMD does not have a threshold for $PM_{2.5}$; however, the same threshold for PM_{10} is used herein. **Maximum daily emissions refers to the maximum emissions that would occur in one day. Not all phases will be occurring concurrently; therefore, the maximum daily emissions are not a summation of the daily emission rates of all phases. *** BAAQMD's May 2011 Thresholds were invalidated by Alameda County Superior Court and BAAQMD recommends using its 1999 Thresholds.					

BAAQMD's approach to analyses of construction impacts as noted in their BAAQMD CEQA Guidelines is to emphasize implementation of effective and comprehensive basic construction control measures rather than detailed quantification of emissions. With implementation of the mitigation measures below, the Proposed Project/Action's construction-related impacts would be further reduced to less-than-significant levels.

Mitigation Measure AIR-1: Basic Construction Mitigation Measures Recommended for ALL Proposed Projects. During all phases of construction, the following procedures shall be implemented:

- All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
- All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 mph.

- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible.

- Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.

- All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.

- Post a publicly visible sign with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

Mitigation Measure AIR-2: Additional Construction Mitigation Measures for Projects with Emissions over the Thresholds. During all phases of construction, the following procedures shall be implemented as appropriate:

- All exposed surfaces shall be watered at a frequency adequate to maintain minimum soil moisture of 12 percent. Moisture content can be verified by lab samples or moisture probe.

- All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 mph.

- Windbreaks (e.g., trees, fences) shall be installed on the windward side(s) of actively disturbed areas of construction. Windbreaks should have at maximum 50 percent air porosity.

- Vegetative ground cover (e.g., fast-germinating native grass seed) shall be planted in disturbed areas as soon as possible and watered appropriately until vegetation is established.

- The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities on the same area at any one time shall be limited. Activities shall be phased to reduce the amount of disturbed surfaces at any one time.

- All trucks and equipment, including their tires, shall be washed off prior to leaving the site.

- Site accesses to a distance of 100 feet from the paved road shall be treated with a 6 to 12 inch compacted layer of wood chips, mulch, or gravel.

- Sandbags or other erosion control measures shall be installed to prevent silt runoff to public roadways from sites with a slope greater than one percent.

- Minimizing the idling time of diesel powered construction equipment to five (5) minutes.

- The project shall develop a plan demonstrating that the off-road equipment (more than 50 horsepower) to be used in the construction project (i.e., owned, leased, and subcontractor vehicles) would achieve a project wide fleet-average 20 percent NOx reduction and 45 percent PM reduction compared to the most recent Air Resources Board (ARB) fleet average. Acceptable options for reducing emissions include the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available.

- Use low volatile organic compounds (VOC) (i.e., ROG) coatings beyond the local requirements (i.e., Regulation 8, Rule 3: Architectural Coatings).

- Requiring that all construction equipment, diesel trucks, and generators be equipped with Best Available Control Technology for emission reductions of NOx and PM.

- Requiring all contractors use equipment that meets the California Air Resources Board's (CARB) most recent certification standard for off-road heavy-duty diesel engines.

Once operational, emission sources resulting from the Proposed Project/Action's operations would be associated with primarily regular maintenance and inspection work. BAAQMD does not have any specific criteria for operations for these kinds of projects. Operational impacts would be negligible and well below the less-than-significant impacts of the construction impacts and would be considered less-than-significant. With respect to project conformity with the federal Clean Air Act, the Proposed Project/Action's potential emissions are well below minimum thresholds and are below the area's inventory specified for each criteria pollutant designated non-attainment or maintenance for the Bay Area. As such, further general conformity analysis is not required.

(c) **Less-than-Significant Impact with Mitigation.** As stated above, the entire San Francisco Bay Area is currently designated "non-attainment" for the state PM_{10} and $PM_{2.5}$ standards, and the state 1-hour ozone standard. The Bay Area is in "attainment" or "unclassified" with respect to the other ambient air quality standards. The BAAQMD is active in establishing and enforcing air pollution control rules and regulations in order to attain all state and federal ambient air quality standards and to minimize public exposure to airborne toxins and nuisance odors. Air emissions would be generated during construction of the Proposed Project/Action, which could increase criteria air pollutants, including PM_{10}. However, construction activities would be temporary and would incorporate the implementation of **Mitigation Measure AIR-1 and AIR-2** as identified above.

As mentioned above, upon completion of construction activities emission sources resulting from Project operations would be associated with regular maintenance and inspection work. Given the limited number of trips that would be required, only limited emissions would be generated; these emissions would be expected to be well below BAAQMD guidelines. See Table 5 above. As such, the Proposed Project/Action would not result in a cumulatively considerable net increase of any criteria air pollutants, and the impacts would be even less-than-significant with implementation of **Mitigation Measure AIR-1 and AIR-2** as identified above.

(d) **Less-than-Significant Impact with Mitigation.** Diesel emissions would result both from diesel-powered construction vehicles and any diesel trucks associated with project operation. Diesel particulate matter (DPM) has been classified by the California Air Resources Board as a toxic air contaminant for the cancer risk associated with long-term (i.e., 70 years) exposure to DPM. Given that construction would occur for a limited amount of time and that only a limited number of diesel trucks would be associated with operation of the project, localized exposure to DPM would be minimal. As a result, the cancer risks from the project associated with diesel emissions over a 70-year lifetime are very small. Therefore, the impacts related to DPM would be less-than-significant. Likewise, as noted above, the Proposed Project/Action would not result in substantial emissions of any criteria air pollutants either during construction or operation. Therefore, the Proposed Project/Action would not expose sensitive receptors, including residents in the project vicinity, to substantial pollutant concentrations. With the implementation of **Mitigation Measure AIR-1 and AIR-2**, impacts to sensitive receptors would be further reduced and considered to be less-than-significant. No additional mitigation measures are required.

(e) **Less-than-Significant Impact.** During construction of the Proposed Project/Action, the various diesel-powered vehicles and equipment in use on-site could create minor odors. These odors are not likely to be noticeable beyond the immediate area and, in addition, would be temporary and short-lived in nature. In addition the use of recycled water would not produce any objectionable odors. Therefore, odor impacts would be less-than-significant. No specific mitigation measures are required.

(f) **Less-than-Significant Impact with Mitigation.** BAAQMD does not have an adopted threshold of significance for construction and/or operational-related GHG emissions for projects like this. Operation of the Proposed Project/Action is not expected to generate any significant amounts of GHG emissions. During construction of the Proposed Project/Action, the various diesel-powered vehicles and equipment in use on-site could generate greenhouse gas emissions. However, the Proposed Project/Action would not exceed the thresholds for NOx, which is an indicator for generating GHG emissions. BAAQMD's approach to analyses of construction impacts as noted in their BAAQMD CEQA Guidelines is to emphasize implementation of effective and comprehensive basic construction control measures rather than detailed quantification of emissions. As a result, with implementation of **Mitigation Measure AIR-1 and AIR-2,** any potential to generate greenhouse gas emissions would be reduced to less-than-significant levels. No additional mitigation measures are required.

(g) **No Impact.** The Proposed Project/Action would not conflict with an application plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases. No mitigation is necessary or required.

3.4 Biological Resources

Would the Proposed Project/Action:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife (CDFW) or U.S. Fish and Wildlife Service (USFWS)?	☐	☒	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFW or USFWS?	☐	☐	☐	☒
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☒
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☒	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

Discussion

A record search of CDFW's California Natural Diversity Database (CNDDB) and USFWS' Species List was conducted for the area within a five-mile radius of the Project area to identify previously reported occurrences of state and federal special-status plants and animals. In addition, a field visit of the pipeline alignment was conducted on January 25, 2017 to determine the potential for special-status species to occur within the general vicinity of the Proposed Project/Action Study Area (i.e. Construction Area) as described in Chapter 2 – Project Description. This field visit was not intended to be protocol-level surveys to determine the actual absence or presence of special-status species, but were conducted to determine the potential for special-status species to occur within the Proposed Project/Action Area. No special-status species were observed during the field visits. Figure 10 shows the location of known state and federal listed species within the Project/Action Area. Appendix B provides a summary of the potential for state and federal special status species to occur within the Proposed Project/Action Study Area. Appendix C provides an analysis of the potential for the Proposed Project/Action to adversely effect federal special status species in order to satisfy the requirements for CEQA-Plus and NEPA and the federal resource agencies.

(a) **Less-than Significant Impact with Mitigation.** The Proposed Project/Action would be primarily constructed in a highly urban area. While the Proposed Project/Action would occur in a highly urban area, the potential exists that construction activities could have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW and USFWS.

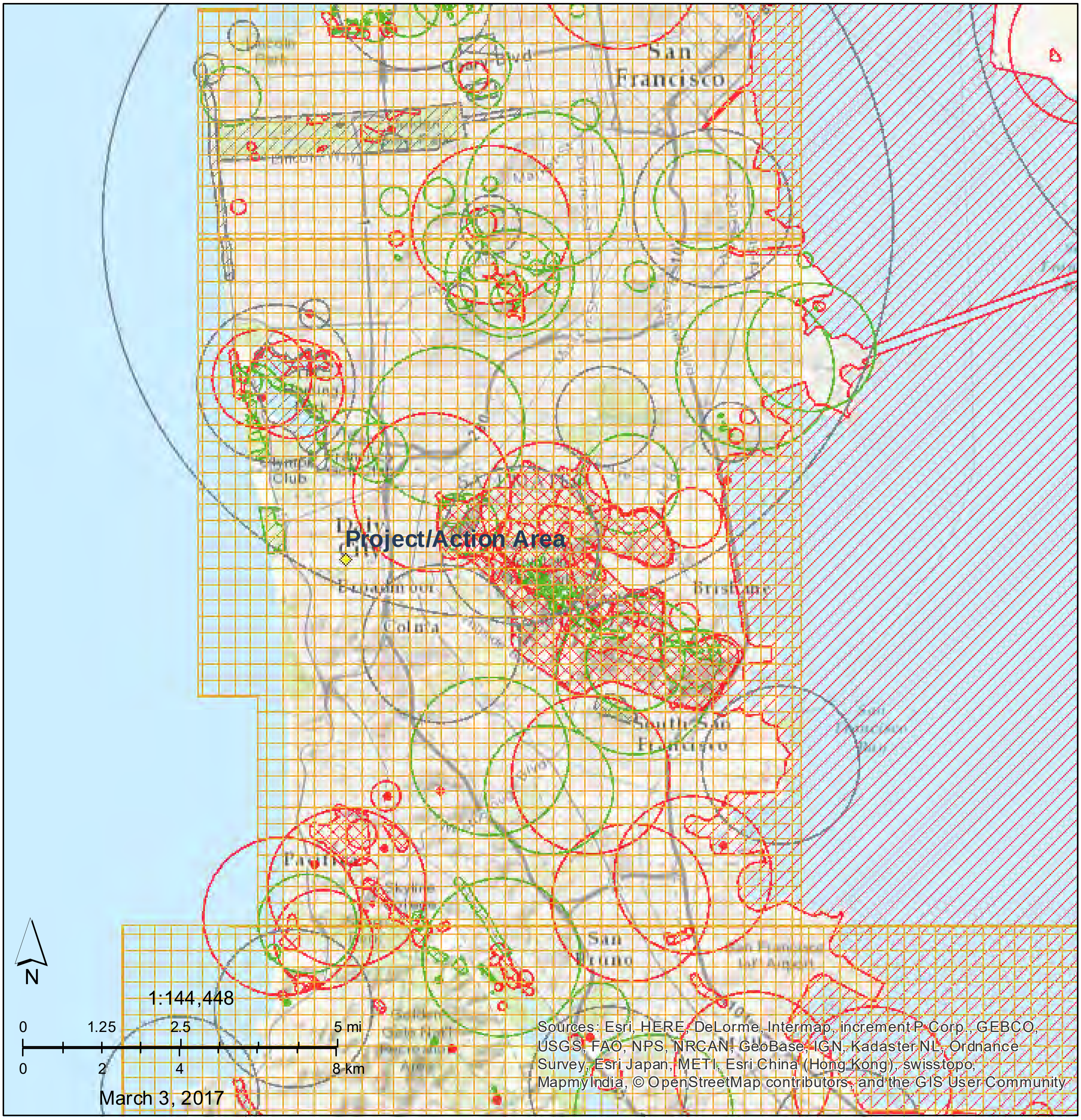
A review of the CDFW's CNDDB and USFWS' Species List and indicates that there is not suitable habitat for special status plant species (See Appendix B and Figure 11). However, there are numerous mature trees within and adjacent to the proposed construction activities which could affect special status bird species. Mature trees can serve as perching or nesting sites for migratory birds, including raptors, and their removal can adversely affect breeding behavior. Special Status bird species were not observed to be present in the Project Study Area, but they may occur within the area. Special Status bird species, including migratory birds are protected under the U.S. Fish and Wildlife Service, the California Fish and Wildlife Code and/or the Federal Migratory Bird Treaty Act. As such and as a precautionary measure, potential impacts to special status birds would be minimized to less-than-significant levels with the incorporation of the following mitigation measures and procedures:

Mitigation Measure BIO-1: Conduct Breeding Surveys. For construction activities that occur between February 1 and August 31, preconstruction breeding bird surveys shall be conducted by a qualified biologist prior to and within 10 days of any initial ground-disturbance activities. Surveys shall be conducted within all suitable nesting habitat within 250 feet of the activity. All active, non-status passerine nests identified at that time shall be protected by a 50-foot radius minimum exclusion zone. Active raptor or special-status species nests shall be protected by a buffer with a minimum radius of 200 feet. CDFW and USFWS recommend that a minimum 500-foot exclusion buffer be established around active white-tailed kite and golden eagle nests. The following considerations apply to this mitigation measure:

- Survey results are valid for 14 days from the survey date. Should ground disturbance commence later than 14 days from the survey date, surveys should be repeated. If no breeding birds are encountered, then work may proceed as planned.

- Exclusion zone sizes may vary, depending on habitat characteristics and species, and are generally larger for raptors and colonial nesting birds. Each

Figure 10
Location of Federal and State Listed Species



- Plant (80m)
- Plant (specific)
- Plant (non-specific)
- Plant (circular)
- Animal (80m)
- Animal (specific)
- Animal (non-specific)
- Animal (circular)
- Terrestrial Comm. (80m)
- Terrestrial Comm. (specific)
- Terrestrial Comm. (non-specific)
- Terrestrial Comm. (circular)
- Aquatic Comm. (80m)
- Aquatic Comm. (specific)
- Aquatic Comm. (non-specific)
- Aquatic Comm. (circular)
- Multiple (80m)
- Multiple (specific)
- Multiple (non-specific)
- Multiple (circular)
- Sensitive EO's (Commercial only)

Author: cnddb_com
Printed from http://bios.dfg.ca.gov

exclusion zone would remain in place until the nest is abandoned or all young have fledged.

- The non-breeding season is defined as September 1 to January 31. During this period, breeding is not occurring and surveys are not required. However, if nesting birds are encountered during work activities in the non-breeding season, disturbance activities within a minimum of 50 feet of the nest should be postponed until the nest is abandoned or young birds have fledged.

Mitigation Measure BIO-2: Conduct Nesting Surveys. For any construction activities initiated between March 15 and September 1, surveys for nesting special status species are required within 250 feet of areas of disturbance. If an active nest is found, a qualified biologist shall monitor the nest during construction activities within 250 feet of the nest to determine whether project construction may result in abandonment. The biologist shall continue monitoring the nest until construction within 250 feet of the nest is completed, or until all chicks have completely fledged. If the monitor determines that construction may result in abandonment of the nest, all construction activities within 250 feet shall be halted until the nest is abandoned or all young have fledged.

The implementation of the above mitigation measures would reduce impacts associated with the Proposed Project/Action to a level of less-than-significant. No additional mitigation measures are required.

(b) **No Impact.** The Proposed Project/Action would not have a substantial adverse effect on riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFW or USFWS. As a result, no impact is expected and no specific mitigation is required.

(c) **No Impact.** The Proposed Project/Action would not have an adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means. As a result, no impact is expected and no specific mitigation is required.

(d) **Less-than-Significant Impact with Mitigation.** The Proposed Project/Action would not interfere substantially with the movement of any native resident or migratory fish or wildlife corridors, or impede the use of native wildlife nursery sites. The USFWS, CDFW, and/or the National Marine Fisheries Service (NMFS) have not designated any critical habitat within the Project Study Area. The Project Study Area is located within the Central Coast Evolutionary Significant Unit of steelhead. However, no rivers or streams are present within the Project Study Area, which could support steelhead or any other migratory fish. However, construction activities could adversely affect special status and non-listed special-status nesting raptors and migratory birds. Many raptors are sensitive to loud construction noise such as that associated with grading and demolition. Such activities could cause nest abandonment or destruction of individual active raptor nests. Because all raptors and their nests are protected under 3503.5 of the California Fish and Wildlife Code, construction of the Proposed Project/Action could result in a significant impact to these species. However, with the implementation of **Mitigation Measures BIO-1 and BIO-2,** these potential impacts would be reduced to less-than-significant levels.

(e) **No Impact.** The Proposed Project/Action is not expected to conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance. As a result, no impact is expected and no specific mitigation is required.

(f) **No Impact.** The Proposed Project/Action would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan. Therefore, there is no impact and no mitigation is required.

3.5 Cultural Resources

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	☒
b) Cause a substantial adverse change in the significance of a unique archaeological resource pursuant to §15064.5?	☐	☒	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☒	☐	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐

Discussion

On January 24, 2017, a records search was conducted by staff at the Northwest Information Center, Sonoma State University, Rohnert Park, California (NWIC No: 16-1004). The record search included the Project Area of Potential Effect (APE) and a 0.50-mile radius outside the project boundaries. The record search included current inventories of National Register of Historic Places (NRHP), the California Register of Historical Resources (CRHR), California State Historic Landmarks, and the California Points of Historical Interest. Resources identified include:

- P-41-002278, Historic Archaeological Feature (privy)
- P-41-002219, Vista Grande Canal and Tunnel
- P-41-001718, Utilitarian Structure within Italian Cemetery
- P-41-000400, Italian Cemetery
- P-41-000401, Eternal Home Cemetery
- P-41-000402, Salem Memorial Park
- P-41-000403, Home of Peace Cemetery
- P-41-000404, Cypress Lawn Memorial Park
- P-41-000405, Holy Cross Cemetery

While the six Colma cemeteries are listed on the National Register of Historic Places, no archaeological resources are known within the project area.

In addition, Daniel Shoup (RPA) conducted a pedestrian archaeological survey of the project area between February 14 and 19, 2016. Dr. Shoup meets the Secretary of the Interior's standards for archaeology. All open areas were inspected for cultural evidence such as historic structures, artifacts, and features; and indicators of prehistoric archaeological deposits like midden soil, flaked lithics, groundstone, and shell. The archaeological survey covered the Daly City WWTP expansion area, both sides of the roads in which the proposed pipeline will be placed, and the three proposed storage tank locations. All proposed facilities were surveyed in 10-meter transects. No cultural resources were located in the scope of the survey. However, some areas of the survey corridor were inaccessible due to fences, lack of safe pedestrian access, or vegetation. Areas not surveyed included:

- Pipeline Corridor along Sullivan Avenue from Pierce Street to Eastmoor Street, Colma. This area does not have a sidewalk or enough shoulder for safe pedestrian access field reconnaissance survey.
- Pipeline corridor between B Street and F Street in Colma (west of Colma BART station). The corridor in this area runs through a fenced car lot.
- Pipeline corridor along western side of Hillside Boulevard from Olivet Parkway south to Lawndale Road. This area does not have a sidewalk or enough shoulder for safe pedestrian access.
- Proposed storage tank site at Holy Cross Cemetery. The proposed tank location is located on the grounds of a working nursery. Portions of the proposed site of the storage tank itself was inaccessible due to steep slopes and vegetation.

No archaeological materials were discovered during the survey. Because the project will not affect the built environment within the Colma cemeteries, the project does not appear to have the potential to affect historic structures or historic landscapes (Criteria 1-3). Therefore, the project area does not appear to have the potential to affect historical resources as defined in CEQA §15064.5. A more complete analysis is provided in Appendix D.

(a) **No Impact.** The Proposed Project/Action would not cause a substantial adverse change in the significance of a historical resource. No listed or historical properties exist within the Proposed Project/Action Area. As a result, there is no impact and no specific mitigation is required.

(b) **Less-than-Significant Impact with Mitigation.** No known significant archaeological resources are known to exist within the Project area. Therefore, the Proposed Project/Action is not likely to cause a substantial adverse change in the significance of unique archaeological resources. Nevertheless, there is a slight chance that construction activities of the Proposed Project/Action could result in accidentally discovering unique archaeological resources. However, to further reduce this less-than-significant impact, the following mitigation measures are recommended:

Mitigation Measure CR-1: Halt work if cultural resources are discovered. In the event that any prehistoric or historic subsurface cultural resources are discovered during ground disturbing activities, all work within 100 feet of the resources shall be halted and after notification, the City shall consult with a qualified archaeologist to assess the significance of the find. If any find is determined to be significant (CEQA Guidelines 15064.5[a][3] or as unique archaeological resources per Section 21083.2 of the California Public Resources Code), representatives of the City and a qualified archaeologist shall meet to determine the appropriate course of action. In considering any suggested mitigation proposed by the consulting archaeologist in order to mitigate impacts to historical resources or unique archaeological resources, the lead agency shall determine whether avoidance is necessary and feasible in light of factors such as the nature of the find, project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) shall be instituted. Work may proceed on other parts of the project site while mitigation for historical resources or unique archaeological resources is carried out.

With the implementation of the above mitigation measure, the Proposed Project/Action would not result in impacts to archeological resources.

(c) **Less-than-Significant Impact with Mitigation.** Paleontologic resources are the fossilized evidence of past life found in the geologic record. Despite the tremendous volume of sedimentary rock deposits preserved worldwide, and the enormous number of organisms that have lived through time, preservation of plant or animal remains as fossils is an extremely rare occurrence. Because of the infrequency of fossil preservation, fossils – particularly vertebrate fossils – are considered to be nonrenewable resources. Because of their rarity, and the scientific information they can provide, fossils are highly significant records of ancient life.

No known significant paleontological resources exist within the Project area. Also, because the Proposed Project/Action would result in minimal excavation in bedrock conditions, significant paleontologic discovery would be unlikely. However, fossil discoveries can be made even in areas of supposed low sensitivity. In the event a paleontologic resource is encountered during project activities, implementation of the following mitigation measure would reduce potential impacts to less-than-significant.

Mitigation Measure CR-2: Stop work if paleontological remains are discovered. If paleontological resources, such as fossilized bone, teeth, shell, tracks, trails, casts, molds, or impressions are discovered during ground-disturbing activities, work will stop in that area and within 100 feet of the find until a qualified paleontologist can assess the significance of the find and, if necessary, develop appropriate treatment measures in consultation with the City.

With the implementation of the above mitigation measure, the Proposed Project/Action would not result in impacts to unique paleontological or geological resources.

(d) **Less-than-Significant Impact with Mitigation.** There are no known burial sites within the specific Project Construction Area. Nonetheless, the possibility exists that subsurface construction activities may encounter undiscovered human remains. Accordingly, this is a potentially significant impact. Mitigation is proposed to reduce this potentially significant impact to a level of less-than-significant.

Mitigation Measure CR-3: Halt work if human remains are found. If human remains are encountered during excavation activities conducted for the Proposed Project/Action, all work in the adjacent area shall stop immediately and the San Mateo County Coroner's office shall be notified. If the Coroner determines that the remains are Native American in origin, the Native American Heritage Commission shall be notified and will identify the Most Likely Descendent, who will be consulted for recommendations for treatment of the discovered human remains and any associated burial goods.

3.6 Geology and Soils

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☒	☐
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☒	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☒	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐
c) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☒	☐	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☒	☐	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☒

Discussion

a) **Less-than-Significant Impact.** The Proposed Project/Action does not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

i) Rupture of a known earthquake fault. The Proposed Project/Action is located in an area of known faults in the region. The Peninsula portion of the San Andreas Fault passes through the center of San Mateo County. The Northern San Gregorio fault also passes through the western edge of the county. The San Andreas Fault has a 21% chance of creating a magnitude 6.7 or greater earthquake in the next 30 years. The Proposed Project/Action area is susceptible to strong ground shaking during an earthquake that could occur along known faults in the region. However, the Proposed Project/Action does not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death due to a seismic event over existing conditions.

ii) Strong seismic ground shaking. The Proposed Project/Action area is susceptible to strong ground shaking during an earthquake that could occur along known faults in the region, including the San Andreas and the Northern San Gregorio Faults. However, the Proposed Project/Action does not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death due to a seismic event over existing conditions.

iii) Seismic-related ground failure, including liquefaction. Liquefaction is defined as the transformation of a granular material from a solid state into a liquefied state as a consequence of increased pore pressure and decreased effective stress. Liquefaction typically is caused by strong ground shaking during an earthquake. The potential for liquefaction to occur depends on both the susceptibility of near-surface deposits to liquefaction, and the likelihood that ground motions will exceed a specified threshold level. Areas most susceptible to liquefaction are underlain by granular sediments within younger alluvium and include low-lying lands adjacent to creeks and estuaries. However, the Proposed Project/Action does not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death due to an event causing liquefaction over existing conditions.

iv) Landslides. Landslides and slope instability can also occur as a result of wet weather, weak soils, improper grading, improper drainage, steep slopes, adverse geologic structure, or a combination of any of these factors. Landslides are most likely to occur in areas where they have occurred previously. Landslides and debris flows can result in damage to property and cause buildings to become unsafe either due to distress or collapse during sudden or gradual slope movement. Construction on slopes steeper than about 15 percent typically require special grading, special foundation design, or site modification to mitigate slope ground conditions and reduce the potential for slope instability. Slope instabilities produced by seismically induced strong ground motions are likely to occur, given the occurrence of a moderate or large earthquake on the Hayward Fault or a nearby seismic source. The Proposed Project/Action does not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death due to an event causing landslides.

In summary, the Proposed Project/Action would not expose people or structures to potential adverse effects, including the risk of loss, injury, or death. Any impacts are less than significant and no mitigation is required.

(b) **Less-than-Significant Impact.** The operation of the Proposed Project/Action would not result in any excavation and earthmoving that could cause erosion or loss of topsoil. Construction activities associated with the Proposed Project/Action would involve excavation and earthmoving that could cause erosion or loss of topsoil. Construction activities would involve excavation, moving, filling, and the temporary stockpiling of soil. Earthwork associated with development construction could expose soils to erosion. However, the Proposed Project/Action would be constructed in existing roadways and utility corridors and would be covered and/or paved immediately after the pipeline and storage facilities have been installed. In addition, all areas not paved would be re-vegetated immediately after construction. As a result, any soil erosion or loss of topsoil would be considered less-than-significant.

(c) **Less-than-Significant Impact with Mitigation.** The Proposed Project/Action may be located in areas that consist of medium dense to dense fine granular soils. In addition, perched groundwater could be present. As such, the soil in some areas of the alignment may have a high susceptibility to liquefaction during seismic shaking. Other portions of the Proposed Project/Action may be less susceptible to liquefaction and related damage. Lateral spreading, often associated with liquefaction, is less likely because there are no steep banks or hard ground bordering the Proposed Project/Action area, but could still potentially be a hazard. As a result, the following mitigation is proposed:

> **Mitigation Measure GEO-1: Perform Geotechnical Investigation.** The City shall require a design-level geotechnical study to be prepared prior to project implementation to determine proper design and construction methods, including design of any soil remediation measures as required to reduce hazards caused by landslides, liquefaction, and/or lateral spreading.

With the incorporation of this mitigation measure, any resulting impacts would be considered to be less-than-significant.

(d) **Less-than-Significant Impact with Mitigation.** The Proposed Project/Action could be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994). However, with the incorporation of **Mitigation Measures GEO-1** above, any impacts would be less-than-significant.

(e) **Less-than-Significant Impact.** The Proposed Project/Action would not include the use of septic tanks or alternative wastewater disposal systems. Therefore, no adverse effects to soil resources are expected. No mitigation is required.

3.7 Hazards and Hazardous Materials

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☒	☐	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☒	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☒	☐
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☒	☐	☐
e) For a Project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project result in a safety hazard for people residing or working in the Project area?	☐	☐	☐	☒
f) For a Project within the vicinity of a private airstrip, would the Project result in a safety hazard for people residing or working in the Project area?	☐	☐	☒	☐
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☒	☐	☐
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☒	☐	☐

Discussion

(a) **Less-than-Significant Impact with Mitigation.** Operation of the Proposed Project/Action would not involve the routine transportation, use, storage, and/or disposal of hazardous materials. However, construction of the Proposed Project/Action could temporarily increase the transport of materials generally regarded as hazardous materials that are used in construction activities. It is anticipated that limited quantities of miscellaneous hazardous substances, such as gasoline, diesel fuel, hydraulic fluids, paint, and other similarly related materials would be brought onto the project site, used, and stored during the construction period. The types and quantities of materials to be used could pose a significant risk to the public and/or the environment. In addition, construction of the Proposed Project/Action could result in the exposure of construction workers and residents to potentially contaminated soils. As a result the following mitigation measures are proposed:

> **Mitigation Measure HAZ-1: Store, Handle, Use Hazardous Materials in Accordance with Applicable Laws.** The City shall ensure that all construction-related and operational hazardous materials and hazardous wastes shall be stored, handled, and used in a manner consistent with relevant and applicable federal, state, and local laws. In addition, construction-related and operational hazardous materials and hazardous wastes shall be staged and stored away from stream channels and steep banks to keep these materials a safe distance from near-by residents and prevent them from entering surface waters in the event of an accidental release.
>
> **Mitigation Measure HAZ-2: Properly Dispose of Contaminated Soil and/or Groundwater.** If contaminated soil and/or groundwater is encountered or if suspected contamination is encountered during project construction, work shall be halted in the area, and the type and extent of the contamination shall be identified. A contingency plan to dispose of any contaminated soil or groundwater will be developed through consultation with appropriate regulatory agencies.
>
> **Mitigation Measure HAZ-3: Properly Dispose of Hydrostatic Test Water.** Dewatering of the pipeline during hydrostatic testing during construction, as well as any dewatering as a result of operations and maintenance activities, shall be discharged to land or the sanitary sewer system and not into any creeks, drainages, or waterways and shall require prior approval from the San Francisco Bay Regional Water Quality Control Board.

(b) **Less-than-Significant Impact with Mitigation.** The operation of the Proposed Project/Action would not create an additional significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. However, with the incorporation of **Mitigation Measure HAZ-1** identified above, any potential impacts are considered to be less-than-significant. As with all construction activities, the potential exists for accidents to occur, which could result in the release of hazardous materials into the environment. With the incorporation of **Mitigation Measures HAZ-1 and HAZ-2** identified above, potential impacts are considered to be less-than-significant.

(c) **Less-than-Significant Impact.** Construction of portions of the pipeline segments of the Proposed Project/Action would be located within one-quarter mile and would serve recycled water to several schools for irrigation purposes. Although construction activities would require the use of some hazardous materials, due to the short duration and limited extent of construction activity, the potential for accidental release of hazardous materials associated with construction activities to affect nearby school children would be considered less-than-significant. Once constructed, the Proposed Project/Action would provide recycled water for irrigation and would not have any adverse impacts to any schools. No mitigation is required.

(d) **Less than Significant Impact with Mitigation.** The Proposed Project/Action is not located on a site that is known to be included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and therefore would not create a significant hazard to the public or the environment. However, a records search was conducted using the State of California Department of Toxic Substance Control's Envirostor Database and GIS mapping system and there are identified hazardous waste or materials within the Proposed Project/Action Area. See website at http://www.envirostor.dtsc.ca.gov/public/. However, the Proposed Project/Action pipeline alignment does not appear to pass through any identified hazardous wastes sites or materials. In addition, with the incorporation of **Mitigation Measure HAZ-2**, any potential impacts would be reduced to less than significant levels.

(e) **No Impact.** The Proposed Project/Action is not located within two miles of an airport. The closest airport is the San Francisco International Airport, which is approximately 11 miles from the center of the Project Study Area. As a result, construction and/or operation of the Proposed Project/Action would not adversely affect an airport or airport operations, including, noise, take-offs, landings, flight patterns, safety, light, navigation, or communications between aircraft and the control tower within the Project area. No impacts are anticipated. No specific mitigation is required.

(f) **No Impact.** The Proposed Project/Action is not located within two miles of an airport. The closest airport is the San Francisco International Airport, which is approximately 11 miles from the center of the Project Study Area. As a result, construction and/or operation of the Proposed Project/Action would not adversely affect an airport or airport operations, including, noise, take-offs, landings, flight patterns, safety, light, navigation, or communications between aircraft and the control tower within the Project area. No impacts are anticipated. No specific mitigation is required.

(g) **Less-than-Significant Impact with Mitigation.** The operation of the Proposed Project/Action would not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. As a result, no impacts are anticipated and no mitigation is required. However, when installing the pipelines in the existing roadways, the Proposed Project/Action could block access to nearby roadways for emergency vehicles. With the incorporation of the following mitigation, potential impacts are considered to be less-than-significant.

> **Mitigation Measure HAZ-4: Develop and Maintain Emergency Access Strategies.** In conjunction with Mitigation Measure Traffic-1: Develop a Traffic Control Plan identified below in the Traffic and Transportation section, comprehensive strategies for maintaining emergency access shall be developed. Strategies shall include, but not limited to, maintaining steel trench plates at the construction sites to restore access across open trenches and identification of alternate routing around construction zones. Also, police, fire, and other emergency service providers shall be notified of the timing, location, and duration of the construction activities and the location of detours and lane closures.

(h) **Less-than-Significant Impact with Mitigation.** Construction of the Proposed Project/Action would be located within an urban setting and is not generally located in an area where there is the risk of wildland fire. Specifically, a records search of the California Department of Forestry and Fire Protection Fire Severity mapping system does not regard the Proposed Project/Action Area to be in an area of moderate or high risk to wildfires. As a result, there is little potential to expose people or structures to a significant risk of loss, injury or death involving wildland fires.

However, the potential exists that construction activities could cause a fire, especially in a drought situation or in the dry season. With the incorporation of the following mitigation measure, any potential impacts are considered to be less than significant.

Mitigation Measure HAZ-5 Fire Prevention and Control: The City shall comply with all federal, state, county and local fire regulations pertaining to burning permits and the prevention of uncontrolled fires. The following measures shall be implemented to prevent fire hazards and control of fires:

- A list of relevant fire authorities and their designated representative to contact shall be maintained on site by construction personnel.
- Adequate firefighting equipment shall be available on site in accordance with the applicable regulatory requirements.
- The level of fire hazard shall be posted at the construction office (where visible for workers) and workers shall be made aware of the hazard level and related implications.
- The City or its contractor shall provide equipment to handle any possible fire emergency. This shall include, although not be limited to, water trucks; portable water pumps; chemical fire extinguishers; hand tools such as shovels, axes, and chain saws; and heavy equipment adequate for the construction of fire breaks when needed. Specifically, the City or its contractor shall supply and maintain in working order an adequate supply of fire extinguishers for each crew engaged in potentially combustible work such as welding, cutting, and grinding.
- All equipment shall be equipped with spark arrestors.
- In the event of a fire, the City or its contractor shall immediately use resources necessary to contain the fire. The City or contractor shall then notify local emergency response personnel.
- Any and all tree-clearing activities (if any) are to be carried out in accordance with local rules and regulations for the prevention of forest fires.
- Burning shall be prohibited.
- Flammable wastes shall be removed from the construction site on a regular basis.
- Flammable materials kept on the construction site must be stored in approved containers away from ignition sources.

3.8 Hydrology and Water Quality

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Violate any water quality standards or waste discharge requirements?	☐	☒	☐	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion of siltation on- or off-site?	☐	☒	☐	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☒	☐	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☒
f) Otherwise substantially degrade water quality? (erosion potential)	☐	☒	☐	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☒	☐
j) Inundation of seiche, tsunami, or mudflow?	☐	☐	☐	☒

Discussion

(a) **Less-than-Significant Impact with Mitigation.** Excavation, grading, and construction activities associated with the Proposed Project/Action could violate water quality as those activities would expose and disturb soils, resulting in potential increases in erosion and siltation in the Project area. Construction during the rainy season could result in increases in erosion, siltation, and water quality issues. Generally, excavation, grading, paving, and other construction activities would expose disturbed and loosened soils to erosion by wind and runoff. Construction activities could therefore result in increased erosion and siltation, including nutrient loading and increasing the total suspended solids concentration. Erosion and siltation from construction have the potential to impact the creeks and drainage crossings, therefore posing a potentially significant impact to water quality. With the incorporation of the following mitigation measures, any potential impacts to water quality as a result of construction are reduced to less-than-significant levels.

Mitigation Measure HWQ-1: Implement Construction Best Management Practices. To reduce potentially significant erosion and siltation, the City and/or its selected contractor(s) shall obtain a Stormwater Pollution Prevention Permit (SWPPP) and implement Best Management Practices and erosion control measures as required by the San Francisco RWQCB. Best Management Practices to reduce erosion and siltation shall include the following measures: Avoidance of construction activities during inclement weather; limitation of construction access routes and stabilization of access points; stabilization of cleared, excavated areas by providing vegetative buffer strips, providing plastic coverings, and applying ground base on areas to be paved; protection of adjacent properties by installing sediment barriers or filters, or vegetative buffer strips; stabilization and prevention of sediments from surface runoff from discharging into storm drain outlets; use of sediment controls and filtration to remove sediment from water generated by dewatering; and returning all drainage patterns to pre-existing conditions.

Mitigation Measure HWQ-2: Avoid Cutting Through Creeks/Drainages. As described in the Proposed Project/Action description, all creek and drainage crossings will be crossed by using trenchless technologies such as micro tunneling, directional drilling, or suspending the pipeline on the downstream side of a bridge. Construction crews shall avoid entering the stream channels during installation. With these mitigation measures in place, the Proposed Project/Action is unlikely to have a direct and/or indirect adverse effect on water quality standards and/or waste discharge requirements. Once constructed, the operation and maintenance of the Proposed Project/Action will not adversely affect water quality standards and/or waste discharge requirements.

In addition, the operation of the Proposed Project/Action and application of recycled water for irrigation on landscape will increase salts and nutrient loadings on the soils that could result in significant impacts to adjacent surface and groundwater resources. The City's existing potable water supply includes a combination of groundwater and surface water from the SFPUC. These two sources are blended and the City's water supply has an average TDS level of approximately 54 milligrams per liter (mg/l)[2]. The Proposed Project/Action would offset an approximately 1,400 afy of that supply with recycled water for irrigation purposes. The proposed new recycled water supply would have an average TDS level of approximately 510 million gallons per liter (mg/l)[3] which would

[2] City of Daly City. 2015 Annual Water Quality Report.
[3] Personal Communication from Katie Ottoboni, Carollo Engineers, April 6, 2017

result in an approximately 750 percent increase in salt loading for the 1,400 afy of water to be used for irrigation purposes. It is assumed that with proper irrigation best management practices, recycled water operations would have an 80 percent irrigation efficiency, meaning that 80 percent of the applied recycled water would be lost through evapotranspiration and the remaining 20 percent of the flow would percolate through the root zone. All of the applied salts are assumed to remain with the 20 percent flow and would eventually percolate into the groundwater as a result of winter rains. The increased salt loading would result in approximately 870 tons per year[4]. However, in context to the overall groundwater basin, this incremental increase is not considered to be a significant impact and would be blended with winter rain reducing the salinity concentration. Also, recycled water has higher amounts of nitrogen, phosphorus, and potassium than potable supplies. Thus, recycled water would help alleviate the need to use fertilizers that are more readily applied if potable supplies are used for irrigation and which are not accounted for in its TDS calculations. Further, with the implementation of the following recycled water best management practices, any of these impacts can be further reduced and remain to be less-than-significant.

Mitigation Measure HWQ-3: Implement Recycled Water Best Management Practices. In order to help reduce the potential effects of increased salt loading potential as a result of using recycled water, the City[5] shall:

- Apply water consistent with Title 22 requirements and in amounts (frequency and intensity) which meet the demands of the plant (agronomic rates), but not in excessive amounts such that salts buildup in the soil beyond the root zone and/or otherwise are leached to groundwater;
- Ensure that adequate soil drainage is maintained;
- Ensure that salt-sensitive plants (e.g. Colonial bentgrass) are not to be spray wet;
- Replace salt-sensitive plants with salt-tolerant plants (e.g, Bermudagrass);
- Addressing sodium and alkalinity concerns through addition of water and soil amendments, including addition of gypsum; and
- Comply with the State Board's General Waste Discharge Requirements of Recycled Water Use (Water Quality Order 2014-0090).

With the implementation of **Mitigation Measures HWQ-1, HWQ-2, and HWQ-3**, any water quality impacts as a result of the use of recycled water will be reduced to less-than-significant levels. No additional mitigation measures or demineralization facilities would be required.

Also, the Proposed Project Action would remove 1,400 afy or approximately 1.25 million gallons per day (mgd) and associated pollutants from being discharged to the Pacific Ocean. The WWTP is owned and operated by the North San Mateo County Sanitation District, a subsidiary of the City of Daly City, and which operates the sanitary sewage treatment plant and the sewage collection system serving the City of Daly City, portions of San Mateo County, the Town of Colma, San Francisco County Jail, and the Westborough Water District within the City of South San Francisco. The District's outfall has an overall discharge capacity of an average dry water flow of 8 mgd. To put this in perspective, the Proposed Project/Action would eliminate approximately 16% of its discharges of 1.25 mgd to the Pacific Ocean This reduction in discharge would generally represent a beneficial impact to the Pacific Ocean. However, the quantity of this

[4] 1,400 afy = 2,258,700 cubic yards, 54 mg/l = .000045510 tons/cubic yards, and 510 mg/l = .000429817 tons/cubic yards
[5] Many of these measures may be implemented by the customer through a Customer Services Agreement and verified and enforced by the City.

reduction is so small in comparison to the Pacific Ocean, that it is essentially unnoticeable and not measureable by any practical standards. This reduction in flow would not violate any water quality standards or wastewater discharge requirements.

(b) **No Impact.** Construction and/or operation of the Proposed Project/Action would not substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. The Project Study Area is located within the South Westside Groundwater Basin, which is managed by the local overlying agencies. South Westside Basin wells typically draw water from depths from between 300- to 700-feet below ground surface. Operation of the Proposed Project would help offset groundwater pumping for irrigation and would have a beneficial impact to the South Westside Basin. Construction of the proposed pipeline facilities would be done primarily within existing roadways and subsurface excavation would be limited to 3- to 6-feet below surface elevation and would not interfere with groundwater supplies. Construction of the storage tanks at either the Atwood Property or the Salem Memorial Park property would be installed underground requiring subsurface excavation of approximately 40- to 50-feet deep. The Proposed Project/Action will not adversely affect groundwater supplies. Therefore, no adverse impacts to groundwater resources are anticipated and no mitigation is required.

(c) **Less-than-Significant Impact with Mitigation.** Construction and/or operation of the Proposed Project/Action would not **s**ubstantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion of siltation on- or off-site. With the implementation of **Mitigation Measure HWQ-1**, above, the Proposed Project/Action would not significantly alter any existing drainage areas.

(d) **Less-than-Significant Impact with Mitigation.** Construction and/or operation of the Proposed Project/Action would not **s**ubstantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in flooding on- or off-site. With the implementation of **Mitigation Measures HWQ-1, HWQ-2, and HWQ-3**, above, the Proposed Project/Action would not significantly alter any existing drainage areas.

(e) **No Impact.** The Proposed Project/Action would not result in any new significant impervious surfaces and would not create new areas of low permeability. The Proposed Project/Action would be located primarily within existing roadways. The Proposed Project/Action would be returned to pre-construction conditions and would not increase the impervious surfaces and therefore would not create new areas of low permeability. The construction of the new treatment facilities would create a new, but very small impervious layer at the existing WWTP, which is not considered to be a significant impact. In addition, any additional run-off would be treated on-site at the WWTP. As a result, no significant additional runoff will be generated by the Proposed Project/Action. Therefore, the Proposed Project/Action would not result in exceeding the capacity of existing or planned storm water drainage systems. No impacts would occur and no mitigation is necessary.

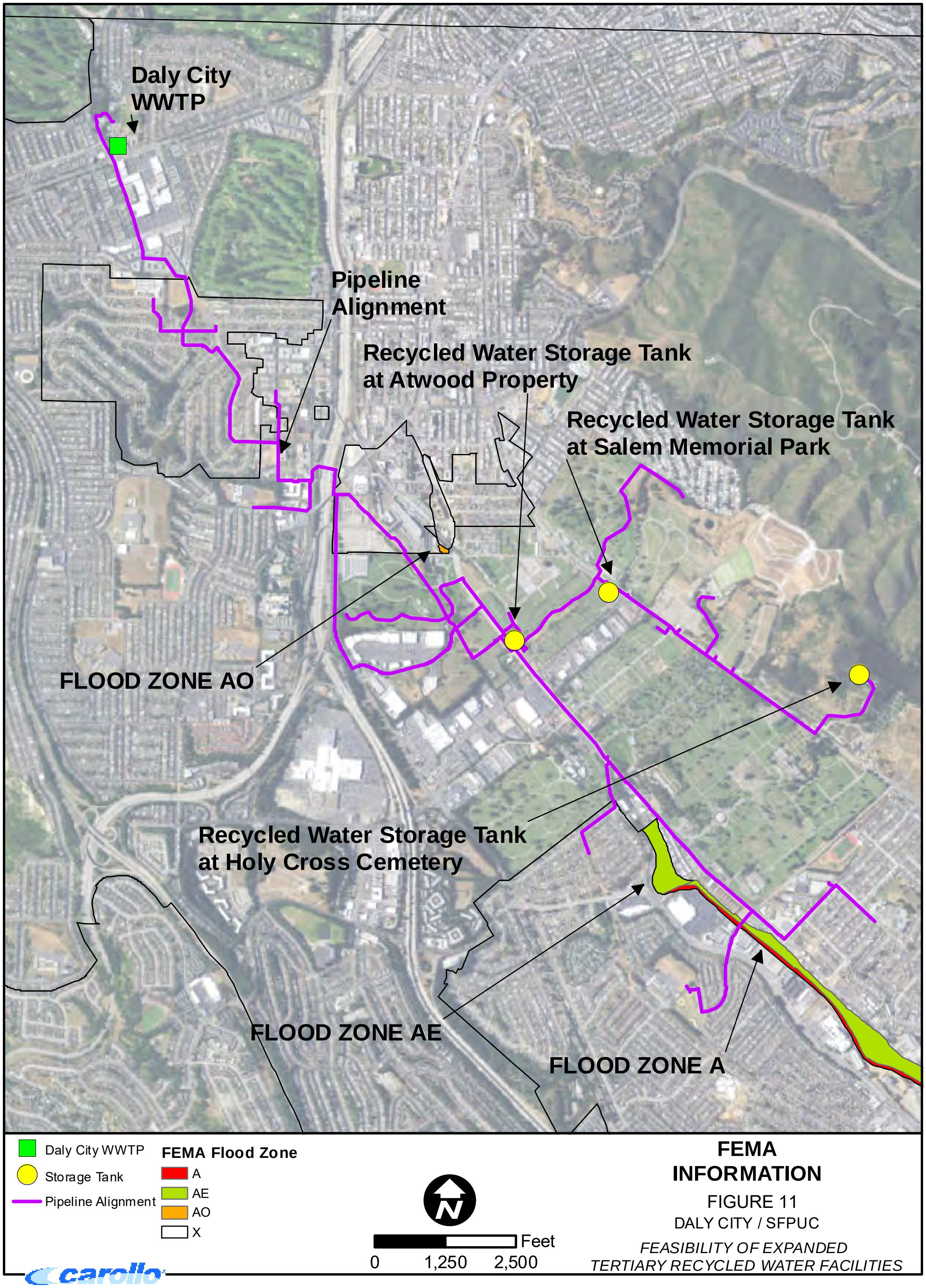
(f) **Less-than-Significant Impact with Mitigation.** The Proposed Project/Action would not substantially affect water quality. As discussed earlier, the construction of the Proposed Project/Action could result in minor, temporary, and highly localized soil erosion and siltation issues. However, with the incorporation of **Mitigation Measure HWQ-1, HWQ-2, and HWQ-3** above, potential impacts to water quality would be reduced to less-than-significant levels.

(g) **No Impact.** The Proposed Project/Action would not redirect flood flows or otherwise place housing within a 100-year flood hazard area. No impact is expected and no mitigation is required or necessary.

(h) **No Impact.** As shown on Figure 11, the Proposed Project/Action would generally not place exposed structures within a 100-year flood hazard area. The pipeline facilities would be primarily located underground and the new treatment facilities would be located at the City's existing WWTP and out of the 100-year flood hazard area. City standards require floor elevations of new development within the floodplain to be at least one foot above the 100-year flood height and/or prohibit development within the floodway (generally, the stream channel required to carry the 100-year flood waters). No impact is expected and no mitigation is required or necessary.

(i) **Less-than-Significant Impact.** The Proposed Project/Action would consist of a single 333,000-gallon storage tank located at either the Atwood Property, the Salem Memorial Park, or the Holy Cross Cemetery. The tanks located at the Atwood property or the Salem Memorial Park would be underground and would not expose people or structures to a significant risk of loss, injury, or death as a result of a failure. If the tank is located above ground as described for the Holy Cross Cemetery location, a failure would expose people or structures to potential flooding. However, due to the fact that it will be designed to current earthquake standards, the relatively small volume of water stored, and the lack of permanent structures or people located immediately down slope of the site, this is considered to be a less than significant impact. No mitigation is required or necessary.

(j) **No Impact.** The Proposed Project/Action would not expose people or structures to a significant risk of loss, injury, or death involving a seiche or tsunami. Tsunamis are a series of waves typically produced by an offshore earthquake, volcanic eruption, or landslide. A tsunami with a wave height of 20-feet at the Golden Gate Bridge, which is likely to occur approximately once every 200 years, would not affect the City or the Project Study Area. Areas most likely to be inundated by tsunami run-up within the city are marshlands, tidal flats, and former bay margin lands that are now artificially filled but are still at sea level. As a result, the Proposed Project/Action does not expose people or structures to potential substantial adverse effects, including the risk of loss and injury due to a tsunami event over existing conditions. In addition, the Proposed Project/Action area is essentially level, with minimal to no potential hazards from mudflows. No impact is expected and no mitigation is required or necessary.


Daly City WWTP
Pipeline Alignment
Recycled Water Storage Tank at Atwood Property
Recycled Water Storage Tank at Salem Memorial Park
FLOOD ZONE AO
Recycled Water Storage Tank at Holy Cross Cemetery
FLOOD ZONE AE
FLOOD ZONE A
Daly City WWTP
Storage Tank
Pipeline Alignment
FEMA Flood Zone
A
AE
AO
X
N
Feet
0
1,250
2,500
FEMA INFORMATION
FIGURE 11
DALY CITY / SFPUC
FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES
carollo

3.9 Land Use and Planning

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project/Action would not physically divide an established community. The Proposed Project/Action would not result in a disruption, physical division, or isolation of existing residential or open space areas. As a result, no impact is expected and no mitigation is required or necessary.

(b) **No Impact.** The Proposed Project/Action would not conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project area. In fact, the City has developed strategic plans and policies to encourage the use of recycled water. Therefore, no impacts are anticipated and no mitigation is required.

(c) **No Impact.** The Proposed Project/Action would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan. As stated above, the Proposed Project/Action would be constructed within existing roadways within the City. For this reason, no impacts are expected and no mitigation is required or necessary.

3.10 Mineral Resources

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project/Action site is not located on a site that is identified as a significant source of mineral resources. Specifically, the Proposed Project/Action is not located in an area identified as containing mineral resources classified MRZ-2 by the State Geologist that would be of value to the region and the residents of the state. As a result, the Proposed Project/Action would not result in the loss of availability of known mineral resources; therefore, no impact is expected. No mitigation is required.

(b) **No Impact.** The City's General Plan does not identify any locally important mineral resources or recovery sites in the Proposed Project/Action's area. Further, as discussed in (a), the Proposed Project/Action would be unlikely to result in the loss of availability of a mineral resource deposit that has been identified as a mineral resource of value. Therefore, no adverse impacts are anticipated and no mitigation is required.

3.11 Noise

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☒	☐	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☒	☐	☐
c) A substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project?	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project?	☐	☒	☐	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project expose people residing or working in the Project area to excessive noise levels?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the Project expose people residing or working in the Project area to excessive noise levels?	☐	☐	☐	☒

Discussion

(a) **Less-than-Significant Impact with Mitigation.** The Proposed Project/Action has the potential to generate noise during the construction phase through the use of equipment and construction vehicle trips. Construction of the Proposed Project/Action would generate temporary and intermittent noise. Noise levels would fluctuate depending on the particular type, number, and duration of use of various pieces of construction equipment. Back-up beepers associated with trucks and equipment used for material loading and unloading at the staging areas and along the whole pipeline alignment would generate significantly increased noise levels over the ambient noise environment in order to be discernable and protect construction worker safety as required by OSHA (29 CFR 1926.601 and 29 CFR 1926.602). Residences and/or businesses in the vicinity of the staging areas and along the whole pipeline alignment would thus be exposed to these elevated noise levels.

Construction activities associated with the Proposed Project/Action would be temporary in nature and related noise impacts would be short-term. However, since construction activities could substantially increase ambient noise levels at noise-sensitive locations, construction noise could result in potentially significant, albeit temporary, impacts to sensitive receptors. Compliance with the City noise ordinance and implementation of the following mitigation measures is expected to reduce impacts related to construction noise, to a less-than-significant level. The following mitigation measures are proposed:

Mitigation Measure NOI-1: **Limit Construction Hours.** Construction activities will be limited to the least noise-sensitive times and will comply with the City's noise ordinances. Construction, alteration, and other related activities shall be allowed on weekdays between the hours of 8 a.m. and 5 p.m., and on Saturdays between the hours of 10 a.m. and 6 p.m. Construction activities shall not exceed the outdoor ambient sound level (dBA) of 86 dBA.

Mitigation Measure NOI-2: Locate Staging Areas away from Sensitive Receptors. The City's construction specification shall require that the contractor select staging areas as far as feasibly possible from sensitive receptors. Currently, planned staging areas are at the City's WWTP.

Mitigation Measure NOI-3: Maintain Mufflers on Equipment. The City's construction specifications shall require the contractor to maintain all construction equipment with manufacturer's specified noise-muffling devices.

Mitigation Measure NOI-4: Idling Prohibition and Enforcement. The City shall prohibit and enforce unnecessary idling of internal combustion engines. In practice, this would mean turning off equipment if it will not be used for five or more minutes.

Mitigation Measure NOI-5: Equipment Location and Shielding. Locate all stationary noise-generating construction equipment such as air compressors and standby power generators as far as possible from homes and businesses.

With the incorporation of the above mitigation measures, noise impacts as result of construction-related activities of the Proposed Project/Action would be considered less-than-significant.

Once constructed, the Proposed Project/Action would not create any new sources of operational noise. Therefore, operation of the pipeline would not result in any significant noise impacts. No mitigation is required.

(b) **Less-than-Significant Impact with Mitigation.** Operation of the Proposed Project/Action would not result in exposing people to or generating excessive groundborne vibration or noise impacts. Construction of the Proposed Project/Action could likely result in minor and temporary increases in groundborne vibration or noise. However, construction activities would be temporary. With the incorporation of **Mitigation Measures NOI-1 through NOI-5** impacts associated with the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels would be reduced to a less-than-significant level.

(c) **No Impact.** The operation of the Proposed Project/Action would not increase noise in and around the Project area. Once constructed, the operation of the facilities would not result in any additional noise. The Proposed Project/Action would not cause a permanent increase in ambient noise levels in the project vicinity above levels existing without the Project. Therefore, no impacts would occur and no mitigation is required.

(d) **Less-than-Significant Impact with Mitigation.** Project construction activities may lead to a temporary increase in ambient noise levels in the project vicinity above levels existing without the project. With the implementation of **Mitigation Measures NOI-1 through NOI-5** impacts resulting in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project would be reduced to a less-than-significant level.

(e) **No Impact.** The Proposed Project/Action is not located within two miles of an airport. The closest airport is the San Francisco International Airport, which is approximately 11 miles from the center of the Project Study Area. As a result, construction and/or operation of the Proposed Project/Action would not adversely affect an airport or airport operations, including, noise, take-offs, landings, flight patterns, safety, light, navigation, or communications between aircraft and the control tower within the Project area. No impacts are anticipated. No specific mitigation is required.

(f) **No Impact.** The Proposed Project/Action is not located within two miles of an airport. The closest airport is the San Francisco International Airport, which is approximately 11 miles from the center of the Project Study Area. As a result, construction and/or operation of the Proposed Project/Action would not adversely affect an airport or airport operations, including, noise, take-offs, landings, flight patterns, safety, light, navigation, or communications between aircraft and the control tower within the Project area. No impacts are anticipated. No specific mitigation is required.

3.12 Population and Housing

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project/Action would provide recycled water, making potable supplies more available, thus increasing the overall supply of water indirectly. However, as growth in the City is controlled by the General Plan, the new use of a recycled water supply as a result of the Proposed Project/Action is not expected to result in increased development. Therefore, the Project is not anticipated to substantially change existing water demands and induce population growth in the area. The Proposed Project/Action would be to serve the City and surrounding areas with up to 1,400 afy of tertiary treated recycled water for irrigation purposes. This would help supplement the City's current water supplies and reduce reliance on SFPUC's water deliveries, but would not be a sufficient supply to induce urban growth in the area. In addition, construction, operation, and maintenance would not result in any substantial increase in numbers of permanent workers/employees. Therefore, no impacts are anticipated and no mitigation is required.

(b) **No Impact.** The Proposed Project/Action would not result in displacing substantial numbers of existing housing or necessitating the construction of replacement housing elsewhere. The Proposed Project/Action would be constructed within existing roadways and/or utility corridors within commercial, industrial, and residential zonings within the City. Construction of the Proposed Project/Action would avoid the need to demolish any existing houses and would not affect any other housing structures. As a result, the Proposed Project/Action would not displace existing housing, and therefore, no impacts are anticipated.

(c) **No Impact.** The Proposed Project/Action would not displace substantial numbers of people necessitating the construction of replacement housing elsewhere. The Proposed Project/Action would be constructed within existing roadways within the City. Construction of the Proposed Project/Action would not result in the demolition of existing housing and other housing structures. As a result, the Proposed Project/Action is not expected to displace people from their homes. Therefore, no impacts are anticipated and no mitigation is required.

3.13 Public Services

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
a) Would the Project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☐	☒
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project/Action will not generate population growth and the operation and maintenance of the Proposed Project/Action would not be labor intensive, requiring significant numbers of temporary workers to relocate to the area. In addition, the Proposed Project/Action would not increase the demand for the kinds of public services that would support new residents, such as schools, parks, fire, police, or other public facilities. As a result, no impacts are anticipated and no mitigation is required.

3.14 Recreation

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
a) Would the Project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the Project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project/Action will not contribute to population growth. Therefore, the Proposed Project/Action will not increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated. As a result, no impact is expected and no mitigation is required.

(b) **No Impact.** The Proposed Project/Action does not include or require construction or expansion of recreational facilities. Furthermore, as discussed in (a), the Proposed Project/Action will not increase the demand for recreational facilities. As a result, no impact is expected and no mitigation is required.

3.15 Socioeconomics

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Project/Action:				
a) Result in any adverse socioeconomic effects?	☐	☐	☐	☒
b) Conflict with Executive Order 12898 (Environmental Justice) policies?	☐	☐	☐	☒
c) Affect Indian Trust Assets?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project/Action would not have any adverse socioeconomic effects. The Proposed Project/Action would involve the construction and operation of a recycled water system to supplement the City's water supplies. This would ensure a reliable, long-term water supply that would help support the existing and future irrigation activities within the City and surrounding areas, which would be considered a beneficial socioeconomic effect. The City is pursuing several funding mechanisms that would include applying for state and federal grants and loans to help reduce the cost of the project. In addition, the City would repay any loans by charging a fee to users for the use of the recycled water. It is assumed that the project costs would result in an increase in costs. However, the additional project costs would not adversely affect any minority or low-income populations and/or adversely alter the socioeconomic conditions of populations that reside within the City. As a result, the Proposed Project/Action would not have any adverse socioeconomic effects.

(b) **No Impact.** Executive Order 12898 requires each federal agency to achieve environmental justice as part of its mission, by identifying and addressing disproportionately high and adverse human health or environmental effects, including social and economic effects of its programs, policies, and activities or minority populations and low-income populations of the United States. The Proposed Project/Action would involve the construction and operation of a recycled water system to deliver supplemental water to the region to help enhance the existing irrigation practices within the City and encourage the use of recycled water in industrial processes. The Proposed Project/Action would primarily occur in a highly urbanized area. The Proposed Project/Action does not propose any features that would result in disproportionate adverse human health or environmental effects, have any physical effects on minority or low-income populations, and/or alter socioeconomic conditions of populations that reside or work within the City and vicinity.

(c) **No Impact.** The Proposed Project/Action would not have any adverse effects on Indian Trust Assets (ITA). ITAs are legal interests in property or rights held by the United States for Indian Tribes or individuals. Trust status originates from rights imparted by treaties, statutes, or executive orders. Examples of ITAs are lands, including reservations and public domain allotments, minerals, water rights, hunting and fishing rights, or other natural resources, money or claims. Assets can be real property, physical assets, or intangible property rights. ITAs cannot be sold, leased, or otherwise alienated without federal approval. ITAs do not include things in which a tribe or individuals have no legal interest such as off-reservation sacred lands or archaeological sites in which a tribe has no legal property interest. No ITAs have been identified within the construction areas of the Proposed Project/Action. There has been some speculation that the use of the Lucky Chances' parking lot as a staging area could be considered as an effect to an ITA. However, the Lucky Chances Casino is not an Indian Casino and is not an ITA. As a result, the Proposed/Action would have no adverse effects on ITAs.

3.16 Traffic and Transportation

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Cause an increase in traffic, which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections)?	☐	☒	☐	☐
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☒	☐	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location which results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☒	☐	☐
f) Result in inadequate parking capacity?	☐	☐	☒	☐
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☒	☐

Discussion

(a) **Less-than-Significant Impact with Mitigation.** Construction would temporarily disrupt transportation and circulation patterns in the vicinity of the project thus disrupting local vehicle, bicycle, and pedestrian traffic along the haul routes and the planned pipeline alignment. Although construction-generated traffic would be temporary during peak excavation and earthwork activities, average daily truck trips would not likely exceed 40 round-trip truck trips per day. The primary impacts from the movement of trucks would include short-term and intermittent lessening of roadway capacities due to slower movements and larger turning radii of the trucks compared to passenger vehicles and temporary lane closures and possible detours during certain times. The following mitigation measures are proposed:

Mitigation Measure TRA-1: Prepare and Implement Traffic Control Plan. As is consistent with existing policy, the City shall require the contractor to prepare and implement effective traffic control plans to show specific methods for maintaining traffic flows. Examples of traffic control measures to be considered include: 1) use of flaggers to maintain alternating one-way traffic while working on one-half of the street; 2) use of advance construction signs and other public notices to alert drivers of activity in the area; 3) use of "positive guidance" detour signing on alternate access streets to minimize inconvenience to the driving public; 4) provisions for emergency access and passage; and 5) designated areas for construction worker parking.

Mitigation Measure TRA-2: Return Roads to Pre-construction Condition. Following construction, the City shall ensure that road surfaces that are damaged during construction are returned to their pre-construction condition or better.

With the incorporation of the above mitigation measures, potential temporary impacts are considered to be less-than-significant.

(b) **Less-than-Significant Impact with Mitigation.** As discussed above in (a), construction activities of the Proposed Project/Action may result in increased vehicle trips. This could temporarily exceed, either individually or cumulatively, existing level of service standards. However, the Proposed Project/Action would not result in any long-term degradation in operating conditions or level of service on any project roadways. With the implementation of **Mitigation Measure TRA-1** impacts associated with exceeding level of service standards would be reduced to a less-than-significant level.

(c) **No Impact.** The Proposed Project/Action does not involve use of air transit, nor is it expected to cause any change in air traffic patterns. No impact is expected and no mitigation is required.

(d) **No Impact.** The Proposed Project/Action does not propose to make changes to roadways that would create road hazards or alter design features developed to mitigate such hazards. No impacts are expected and no mitigation is required.

(e) **Less-than-Significant Impact with Mitigation.** The Proposed Project/Action would have temporary effects on traffic flow, due to added truck traffic during construction that could result in delays for emergency vehicle access in the vicinity of the project. Implementation of **Mitigation Measure TRA-1** would require the contractor to establish methods for maintaining traffic flow in the project vicinity and minimizing disruption to emergency vehicle access to land uses along the truck route and/or pipeline alignment. Implementation of **Mitigation Measure TRA-1** would also ensure potential impacts associated with temporary effects on emergency access would be mitigated to a less-than-significant level.

(f) **Less-than-Significant Impact.** Project-related construction activities would require additional parking for workers and equipment on a temporary basis. However, sufficient space exists within the construction easement and/or staging areas to accommodate parking needs for construction workers and equipment. As a result, no impacts are anticipated and no mitigation is required.

(g) **Less-than-Significant Impact.** The construction activities associated with the Proposed Project/Action would be short term and would not conflict with adopted policies, plans, or programs supporting alternative transportation. Also once constructed, the Proposed Project/Action would not conflict with adopted policies, plans, or programs supporting alternative transportation. Any short-term effects would be considered less-than-significant.

3.17 Utilities and Service Systems

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Exceed waste water treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or waste water treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the Project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☒	☐
e) Result in a determination by the wastewater treatment provider which serves or may serve the Project that it has adequate capacity to serve the Project's projected demand in addition to the provider's existing commitments?	☐	☐	☒	☐
f) Be served by a landfill with sufficient permitted capacity to accommodate the Project's solid waste disposal needs?	☐	☐	☐	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project/Action would not exceed wastewater treatment requirements of the San Francisco Regional Water Quality Control Board. Therefore, no impacts are anticipated and no mitigation is required.

(b) **Less-than-Significant Impact.** The Proposed Project/Action would involve the construction of a water recycling system to serve the City. This would also include construction of new tertiary treatment facilities at the City's existing WWTP. However, any impacts associated with the construction and/or operations are considered to be less-than-significant and no mitigation is required.

(c) **No Impact.** The Proposed Project/Action would not require or result in the construction of additional off-site storm water drainage facilities. Therefore, no impacts are expected and no mitigation is required.

(d) **Less-than-Significant Impact.** Under the Proposed Project/Action the City will be receiving tertiary treated water from the proposed project/Action. This would be a new water supply, but would not require the City purchasing this new water supply. Any impacts are considered to be less-than-significant and no mitigation is required.

(e) **No Impact.** Under the Proposed Project/Action the City will be expanding the existing WWTP to treat the existing effluent to tertiary treatment levels and used as a recycled water supply. This would be a new water supply, but would not require the City purchasing this new water supply. The Proposed Project/Action will not result in any additional wastewater to be treated. The Proposed Project/Action would treat approximately 1,400 afy of the waste streams currently received by the WWTP. Therefore, approximately 1.25 mgd of wastewater will be generated and treated at the WWTP as part of the Proposed Project/Action. This represents approximately 16 percent of the average daily water flow of 8 mgd that is currently discharged from the WWTP. Therefore, no impacts are anticipated and no mitigation is required.

(f) **No Impact.** Construction and operation of the Proposed Project/Action would not generate a significant amount of solid wastes. No impacts are expected to existing landfills and no mitigation is required.

(g) **No Impact.** The Proposed Project/Action will comply with all relevant federal, state, and local statutes and regulations related to solid waste. Therefore, there are no anticipated impacts and no mitigation is required.

3.18 Mandatory Findings of Significance

	Potentially Significant Impact	*Less Than Significant with Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐
b) Have impacts that would be individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☒	☐	☐
c) Have environmental effects that would cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐

Discussion

(a) **Less-than-Significant Impact with Mitigation.** With the incorporation of the previously identified mitigation measures, the Proposed Project/Action will not substantially degrade the quality of the environment, reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory. Any impacts from the Proposed Project/Action in these areas are considered here to be less-than-significant with the implementation and incorporation of the above mentioned mitigation measures.

(b) **Less-than-Significant Impact with Mitigation.** No direct project-specific significant effects were identified that could not be mitigated to a less-than-significant level. Mitigation Measures incorporated herein mitigate any potential contribution to cumulative (as well as direct) impacts associated with these environmental issues. Therefore, the Proposed Project/Action does not have impacts that are individually limited, but cumulatively considerable.

(c) **Less-than-Significant Impact with Mitigation**. As a result of mitigation included in this environmental document, the Proposed Project/Action would not result in substantial adverse effects to humans, either directly or indirectly.

Chapter 4 Determination

On the basis of this initial evaluation for the City of Daly City's Recycled Water Project:

☐ I find that the Proposed Project/Action COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the Proposed Project/Action could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the Project have been made by or agreed to by the City. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the Proposed Project/Action MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the Proposed Project/Action MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the Proposed Project/Action could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the Proposed Project/Action, nothing further is required.

Patrick Sweetland — 7/18/17

Signature — Date

Mr. Patrick Sweetland — Director of Water and Wastewater Resources

Printed Name — Title

Chapter 5 Bibliography

Detailed below are the primary sources consulted and reviewed during the preparation of this environmental document.

- Bay Area Air Quality Management District. *CEQA Guidelines*. December 1999.
- California Department of Forestry and Fire Protection. *Fire Severity Mapping*. January 2017
- California Natural Diversity Database. 2016. http://www.dfg.ca.gov/biogeodata/cnddb
- California Regional Water Quality Control Board, ORDER NO. R2-2006-0068; NPDES NO. CA0037737, October 11, 2006.
- California Department of Toxic Substances. *Envirostor database and GIS System*. August 2017
- City of Daly City. *Recycled Water Facility Plan, Recycled Water Project*. October 2016.
- City of Daly City. *General Plan EIR*. October 2012.
- Federal Emergency Management Agency 100-Year Flood Zone Maps. 2017
- U. S. Fish and Wildlife Service species list database and Wetland Tracker. 2017. http://www.fws.gov/

Appendix A

Air Quality Emissions Calculations

Road Construction Emissions Model, Version 6.3.2

Emission Estimates for -> City of Daly City Recycled Water Project Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	7.3	37.6	40.2	7.0	2.0	5.0	2.9	1.8	1.0	7,260.5
Grading/Excavation	7.5	43.5	39.8	7.1	2.1	5.0	2.9	1.9	1.0	7,809.2
Drainage/Utilities/Sub-Grade	6.5	38.4	36.0	6.9	1.9	5.0	2.7	1.7	1.0	7,030.7
Paving	5.6	34.2	29.1	1.8	1.8	-	1.6	1.6	-	5,247.7
Maximum (pounds/day)	7.5	43.5	40.2	7.1	2.1	5.0	2.9	1.9	1.0	7,809.2
Total (tons/construction project)	1.8	10.5	9.8	1.6	0.5	1.1	0.7	0.5	0.2	1,887.0

Notes: Project Start Year -> 2019
Project Length (months) -> 24
Total Project Area (acres) -> 38
Maximum Area Disturbed/Day (acres) -> 1
Total Soil Imported/Exported (yd^3/day)-> 20

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> City of Daly City Recycled Water Project Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	3.3	17.1	18.3	3.2	0.9	2.3	1.3	0.8	0.5	3,300.2
Grading/Excavation	3.4	19.8	18.1	3.2	1.0	2.3	1.3	0.9	0.5	3,549.6
Drainage/Utilities/Sub-Grade	3.0	17.4	16.4	3.1	0.9	2.3	1.2	0.8	0.5	3,195.8
Paving	2.5	15.6	13.2	0.8	0.8	-	0.7	0.7	-	2,385.3
Maximum (kilograms/day)	3.4	19.8	18.3	3.2	1.0	2.3	1.3	0.9	0.5	3,549.6
Total (megagrams/construction project)	1.6	9.5	8.9	1.5	0.5	1.0	0.6	0.4	0.2	1,711.6

Notes: Project Start Year -> 2019
Project Length (months) -> 24
Total Project Area (hectares) -> 15
Maximum Area Disturbed/Day (hectares) -> 0
Total Soil Imported/Exported ($meters^3$/day)-> 15

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in columns K and L.

Appendix B

Potential for Special Status Species to Occur Within the Project Area

Appendix B Potential for Special-Status Species to Occur in the Proposed Project/Action Study Area				
Species	**Status**	**Habitat**	**Potential for Occurrence**	**Recommendations**
Insects				
Bay checkerspot butterfly *(Euphydryas editha bayensis)*	FT	Native grasslands on outcrops of serpentine soil in the vicinity of the San Francisco Bay. *Plantago erecta* is the primary host plant.	None. No suitable habitat present.	No further actions are recommended for this species.
Callippe silverspot butterfly *(Speyeria callippe callippe)*	FE	Grasslands with host plant *Viola pedunculata.* Males congregate on hilltops insearch offemales.	None. No suitable habitat present.	No further actions are recommended for this species.
Mission blue butterfly *(Plebejus icarioides missionensis)*	FE	Grassland and coastal scrub with any of host plants *(Lupinus albifrons, L.voriicolor, L. formosus).*	None. No suitable habitat present.	No further actions are recommended for this species.
Myrtle's silverspot *(Speyeriazerene myrtleae)*	FE	Restricted to the foggy,coastal the Point Reyes dunes/hills of Peninsula; extirpated from coastal San Mateo County	None. No suitable habitat present.	No further actions are recommended for this species.
Opler's longhorn moth *(adela oplerella)*	None	The moth has usually been collected on creamcups (*Platystemon californicus*).	None. No suitable habitat present.	No further actions are recommended for this species.
San Bruno elfin butterfly *(Callophrys mossii bayensis)*	FE	Rocky outcrops within grassland and coastal scrub, with host plant *Sedum spathulifolium.*	None. No suitable habitat present.	No further actions are recommended for this species.
Fish				
Delta Smelt (Hypomesus transpacificus)	FT	Found in large, main channels and open areas of the bay. Occur from tidal freshwater reaches of the Delta west to eastern San Pablo Bay.	None. No suitable habitat occurs within the Study Area.	No further actions are recommended for this species.
Hardhead *(Mylopharodon conocepholus)*	SSC	Low to mid-elevation streams in the Sacramento-San Joaquin drainage. Also present inthe Russian River.	None. No suitable habitat present.	No further actions are recommended for this species.
Longfin smelt (Spirinchus thaleichthys)	ST, SSC	Found in several estuaries and lakes along the northern Pacific coast of North America.	None. No suitable habitat present.	No further actions are recommended for this species.
Steelhead - central California coast DPS *(Oncorhynchus*	FT	From Russian River, south to Soquel Creek and to, but not	None. No suitable habitat	No further actions are recommended for this species.

Appendix B Potential for Special-Status Species to Occur in the Proposed Project/Action Study Area				
Species	**Status**	**Habitat**	**Potential for Occurrence**	**Recommendations**
mykiss irideus)		including, Pajaro River. Also San Francisco and San Pablo Bay basins.	present.	
Tidewater goby *(Eucyclogobius newberryi)*	FE	Brackish water habitats along the CA coast. Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water & high oxygen levels.	None. No suitable habitat present.	No further actions are recommended for this species.
Amphibians				
California red-legged frog *(Rana draytonii)*	FT, SSC	Found within permanent and semipermanent aquatic habitats, such as creeks and cold-water ponds, with emergent and submergent vegetation; may aestivate in rodent burrows or cracks during dry periods.	None. No suitable habitat present.	No further actions are recommended for this species.
Reptiles				
San Francisco garter snake *(Thomnophis sirtalis tetrataenia)*	FE, SE, FPT	Vicinity of freshwater marshes, ponds and slow moving streams. Prefers dense cover & water depths of at least one foot. Upland areas near water are also very important.	None. No suitable habitat present.	No further actions are recommended for this species.
Western pond turtle *(Emys marmorata)*	SSC	An aquatic turtle found in ponds, marshes, rivers, streams, and irrigation ditches. Requires basking sites and suitable (sandy banks or grassy open fields) upland habitat.	None. No suitable habitat present.	No further actions are recommended for this species.
Birds				
Alameda song sparrow *(Melospiza melodia pusi/lula)*	SSC	Salt marshes of the south arm of San Francisco Bay. Nests low ingrindelia bushes (high enough to escape high tides) and in pickleweed.	None. No suitable habitat present.	No further actions are recommended for this species.
American peregrine falcon *(Falco peregrinus*	FPT	Near wetlands, lakes, rivers, or other water; on cliffs, banks, dunes, mounds; also,	None. No suitable habitat present.	

Appendix B Potential for Special-Status Species to Occur in the Proposed Project/Action Study Area				
Species	**Status**	**Habitat**	**Potential for Occurrence**	**Recommendations**
anatum)		human-made structures.		
Bank swallow *(Riparia riparia)*	ST	Colonial nester; nests primarily in riparian and other lowland habitats west of the desert. Requires vertical banks/cliffs with fine textured/sandy soils near streams, rivers, lakes, ocean to dig nesting hole.	None. No suitable habitat present.	No further actions are recommended for this species.
California black rail *(Lateral/us jamaicensis coturniculus)*	ST, FPT	Inhabits freshwater marshes, wet meadows & shallow margins of saltwater marshes bordering larger bays. Nests and forages in tidal emergent wetland with pickleweed and cordgrass.	None. No suitable habitat present.	No further actions are recommended for this species.
California clapper rail *(Rallus longirostris obsoletus)*	FE, SE, FPT	Salt-water & brackish marshes traversed by tidal sloughs in the vicinity of San Francisco Bay. Nests and forages in emergent wetland with pickleweed, bulrush,and cordgrass.	None. No suitable habitat present.	No further actions are recommended for this species.
California least tern *(Sternula antillarum)*	FE	The California Least Tern hunts primarily in shallow estuaries and lagoons, where smaller fishes are abundant.	None. No suitable habitat present.	No further actions are recommended for this species.
Saltmarsh common Yellowthroat *(Geothlypis trichas sinuosa)*	SSC	Resident of the San Francisco Bay region, in fresh and saltwater marshes. Uses tall grasses, tules, or willows for nesting	None. No suitable habitat present.	No further actions are recommended for this species.
Western Snowy Plover *(Charadrius alexandrines nivosus)*	FT, SSC, BCC, RP	(Nesting) Federal listing applies only to the Pacific coastal population. Found on sandy beaches, salt pond levees and shores of large alkali lakes. Requires sandy, gravelly or friable soils for nesting.	None. No suitable habitat present.	No further actions are recommended for this species.
Mammals				

Appendix B Potential for Special-Status Species to Occur in the Proposed Project/Action Study Area				
Species	**Status**	**Habitat**	**Potential for Occurrence**	**Recommendations**
Hory bat *(Lasiurus cinereus)*	SSC	Typically associated with riparian areas for foraging and roosting below 3,000 ft. They tend to roost in tree foliage, especially near water.	None. No suitable habitat present.	No further actions are recommended for this species.
Salt-marsh Harvest Mouse *(Reithrodontomys raviventris)*	FE, SE	Primary habitat in pickleweed dominated saline emergent marshes of San Francisco Bay. Require adjacent upland areas for escape from high tides.	None. No suitable habitat present.a.	No further actions are recommended for this species.
Southern Sea otter *(Enhydra lutris nereis)*	FT	Is a marine mammal native to the coasts of the northern and eastern North Pacific Ocean.	None. No suitable habitat present.	No further actions are recommended for this species.
Townsend's big-eared bat *(Corynorhinus townsendii)*	SSC	Requires large cavities for roosting; these may include abandoned buildings and mines, caves, and basal cavities of trees	None. No suitable habitat present.	No further actions are recommended for this species.
Plants				
Adobe sanicle (Sanicula maritime)	CNPS 1B.1	Meadows and seeps,valley and foothill grassland, chaparral, coastal prairie.	None. No suitable habitat present.	No further actions are recommended for this species.
Alkali milk-vetch *(Astragalus tener var. tener)*	CNPS 1B.2	Alkali flats, vernal pools in valley grassland.	None. No suitable habitat present.	No further actions are recommended for this species.
Arcuate bush-mallow *(Malacothamnus arcuatus)*	CNPS 1B.2	Chaparral, cismontane woodland.	None. No suitable habitat present.	No further actions are recommended for this species.
Beach layia *(Layia carnosa)*	FE, SE, CNPS 1B.1	Coastal dunes, on sparsely vegetated, semi-stabilized dunes, usually behind fore-dunes.	None. No suitable habitat present. Species extirpated from region.	No further actions are recommended for this species.
Bent-flowered fiddleneck *(Amsinckia lunaris)*	CNPS 1B.2	Open cismontane woodland, valley and foothillgrassland.	None. No suitable habitat present.	
Blue coast gilia *(Gilio capitata ssp. Chamissonis)*	CNPS 1B.1	Coastal dunes, coastal scrub.	None. No suitable habitat present.	No further actions are recommended for this species.
California seablite (Suaeda californica)	FE, CNPS 1B.1	Coastal saltwater marshes and swamps.	None. No Suitable habitat present	No further actions are recommended for this species.

Appendix B Potential for Special-Status Species to Occur in the Proposed Project/Action Study Area				
Species	**Status**	**Habitat**	**Potential for Occurrence**	**Recommendations**
Charis' popcorn-flower *(Plagiobothrys chorisianus var. chorisianus)*	CNPS 1B.2	Chaparral, coastal prairie, coastal scrub, in mesic sites.	None. No suitable habitat present.	No further actions are recommended for this species.
Coastal triquetrella (Triquetrella californica)	CNPS 1B.2	Grows within 30 meters from the coast in coastal scrub, grasslands and in open gravels on roadsides, hillsides, and rocky slopes.	None. No suitable habitat present.	No further actions are recommended for this species.
Compact cobwebby thistle *(Cirsium occidentale var. compactum)*	CNPS 1B.2	Chaparral, coastal dunes, coastal prairie, coastal scrub, on dunes and on clay in chaparral.	None. No suitable habitat present.	No further actions are recommended for this species.
Congested-headed hayfield tarplant *(Hemizonia congesta ssp. Congesta)*	CNPS 1B.2	Coastal scrub, valley and foothill grassland.	None. No suitable habitat present.	No further actions are recommended for this species.
Dark-eyed gilia *(Gilio mi/Jefoliata)*	CNPS 1B.2	Coastal dunes.	None. No suitable habitat present.	No further actions are recommended for this species.
Diablo helianthella *(Helianthella castanea*	CNPS 1B.2	Broadleaved upland forest, chaparral, cismontane woodland, coastal scrub, grassland. Usually in chaparral/oak woodland interface in rocky soils.	None. No suitable habitat present.	No further actions are recommended for this species.
Fragrant fritillary *(Fritillaria liliacea)*	CNPS 1B.2	Coastal scrub, valley and foothill grassland, coastal prairie on serpentine.	None. No suitable habitat present.	No further actions are recommended for this species.
Franciscan Manzanita *(Arctostaphylos franciscana)*	CNPS 1B.1	Chaparral, coastal scrub.	None. No suitable habitat present.	No further actions are recommended for this species.
Franciscan Onion (Allium peninsulare var. franciscanum)	CNPS 1B.2	Clay, volcanic, often serpentinite. Cismontane, woodland, Valley and foothill grassland	None. No suitable habitat present.	No further actions are recommended for this species.
Franciscan thistle *(Cirsium andrewsii)*	CNPS 1B.2	Coastal bluff scrub, broadleaved upland forest, coastal scrub.	None. No suitable habitat present,	No further actions are recommended for this species.
Kellogg's horkelia *(Horkelia cuneata var. sericea)*	CNPS 1B.l	Closed-cone coniferous forest, coastal scrub, chaparral, on old dunes and coastal sandhills.	None. No suitable habitat present.	No further actions are recommended for this species.
Montara Manzanita *(Arctostaphylos montaroensis)*	CNPS 1B.2	Chaparral, coastal scrub. Species occurrences are well documented and are	None. No suitable habitat present.	No further actions are recommended for this species.

Appendix B Potential for Special-Status Species to Occur in the Proposed Project/Action Study Area				
Species	**Status**	**Habitat**	**Potential for Occurrence**	**Recommendations**
		only known from San Bruno Mountain and Montara Mountain.		
Northern curly-leaved monardella *(Monardellasinuata ssp. Nigrescens)*	CNPS 1B.2	It is endemic to the coast of California from Sonoma to Santa Barbara Counties, where it is known from several coastal habitat types, including dunes, coastal sage scrub, chaparral, and forest.	None. No suitable habitat present.	No further actions are recommended for this species.
Pacific Manzanita *(Arctostaphylos pacifica)*	CNPS 1B.2	Coastal scrub. Species occurrences are well documented and are only known from San Bruno Mountain and Montara Mountain.	None. No suitable habitat present.	No further actions are recommended for this species.
Point Reyes horkelia *(Horkelia marinensis)*	CNPS 1B.2	Coastal dunes, coastal prairie, coastal scrub, in sandy flats and dunes near coast.	None. No suitable habitat present.	No further actions are recommended for this species.
Presidio Manzanita *(Arctostaphylos montona ssp. Ravenii)*	FE,CNPS 1B.2	Chaparral, coastal prairie, coastal scrub. Open rocky serpentine slopes.	None. No suitable habitat present.	No further actions are recommended for this species.
Robust spineflower *(Chorizanthe robusta var. robusta)*	FE, SE, CNPS 1B.1	Cismontane woodland, coastal dunes, coastal scrub. Sandy terraces and bluffs or in loose sand.	None. No suitable habitat present.	No further actions are recommended for this species.
Rose leptosiphon *(Leptosiphon rosaceus)*	FE, CNPS 18.1	Coastal bluff scrub.	None. No suitable habitat present.	No further actions are recommended for this species.
Round-headed Chinese-houses *(Collinsia corymbosa)*	CNPS 1B.1	Coastal dunes, coastal prairie.	None. No suitable habitat present.	No further actions are recommended for this species.
San Bruno Mountain manzanita *(Arctostaphy/os imbricate)*	CNPS 1B.1	Chaparral, coastal scrub.	None. No suitable habitat present.	No further actions are recommended for this species.
San Francisco Bay Spineflower *(Chorizanthe cuspidata var. cuspidate)*	CNPS 18.2	Cismontane woodland, coastal dunes, coastal scrub. Sandy terraces and bluffs or in loose sand.	None. No suitable habitat present.	No further actions are recommended for this species.
San Francisco campion (*silene verecunda ssp. Verecunda)*	CNPS 1B.2	Coastal scrub, valley and foothill grassland, coastal bluff scrub, chaparral. Often on rocky soils, mudstone, or shale	None. No suitable habitat present.	No further actions are recommended for this species.
San Francisco collinsia *(Collinsia multicolor)*	CNPS 1B.2	Moist shady woodland, associated with California buckeye,	None. No suitable habitat	No further actions are recommended for this species.

Appendix B Potential for Special-Status Species to Occur in the Proposed Project/Action Study Area				
Species	**Status**	**Habitat**	**Potential for Occurrence**	**Recommendations**
		honeysuckle, ferns, coast live oak, poison oak.	present.	
San Francisco gumplant *(Grindelia hirsutula var. maritime)*	CNPS 3.2	Coastal scrub, Coastal bluff scrub, valley and foothill grassland. Sandy or serpentine slopes.	None. No suitable habitat present.	No further actions are recommended for this species.
San Francisco lessingia *(Lessingia germanorum)*	FE, SE, CNPS 1B.1	Coastal scrub from remnant dunes. Open sandy soils relatively free of competing plants.	None. No suitable habitat present.	No further actions are recommended for this species.
San Francisco owl's-cover *(Triphysaria floribunda)*	CNPS 1B.2	Coastal prairie, valley and foothill grassland.	None. No suitable habitat present.	No further actions are recommended for this species.
Short-leaved evax *(Hesperevax sparsiflora var. brevifolia)*	CNPS 18.2	Coastal bluff scrub, coastal dunes.	None. No suitable habitat present.	No further actions are recommended for this species.
Short-Tailed albatross (Phoebastria (=diomedea) albatrus)	FE	Preferres to nest on large open areas near stands of the grass and near the ocean.	None. No suitable habitat present.	No further actions are recommended for this species.
Two-fork clover or Showy Indian Clover (*Trifolium amoenum)*	FE, CNPS 1B.1	Valley and foothill grassland, coastal bluff scrub. Sometimes on serpentine soil, open sunny sites, swales.	None. No suitable habitat present.	No further actions are recommended for this species.
Water star-grass *(Heteranthera dubia)*	CNPS 2B.2	It lives submersed in freshwater such as rivers and lakes.	None. No suitable habitat present.	No further actions are recommended for this species.
White-rayed pentachaeta *(Pentachaeta bellidiflora)*	FE, SE, CNPS 18.1	Valley and foothill grassland. Open dry rocky slopes and grassy areas, often on soils derived from serpentine bedrock.	None. No suitable habitat present.	No further actions are recommended for this species.

Key to status codes:
FE Federal Endangered
FT Federal Threatened
FX Federal Critical Habitat
FC Federal Candidate
FD Federal De-listed
FPD Federal Proposed for De-listing
FPT Federal Proposed Threatened
NMFS Species under the Jurisdiction of the National Marine Fisheries Service
BCC USFWS Birds of Conservation Concern
RP Sensitive species included in a USFWS Recovery Plan or Draft Recovery Plan
SE State Endangered
ST State Threatened
SR State Rare
CSC CDFG Species of Special Concern
Draft CSC 4 April 2000 Draft CDFG Species of Special Concern
CFP CDFG Fully Protected Animal

Appendix B Potential for Special-Status Species to Occur in the Proposed Project/Action Study Area				
Species	**Status**	**Habitat**	**Potential for Occurrence**	**Recommendations**
WBWG Western Bat Working Group High Priority species SLC Species of Local Concern List 1A CNPS List 1A: Plants presumed extinct in California List 1B CNPS List 1B: Plants rare, threatened or endangered in California and elsewhere List 2 CNPS List 2: Plants rare, threatened, or endangered in California, but more common elsewhere List 3 CNPS List 3: Plants about which CNPS needs more information (a review list) Threat Rank 0.1: Seriously threatened in California (high degree/immediacy of threat) 0.2: Fairly threatened in California (moderate degree/immediacy of threat) 0.3: Not very threatened in California (low degree/immediacy of threats or no current threats known)				

Attachment A

CDFW Species List

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (San Francisco South (3712264))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Adela oplerella Opler's longhorn moth	IILEE0G040	None	None	G2	S2	
Allium peninsulare var. franciscanum Franciscan onion	PMLIL021R1	None	None	G5T1	S1	1B.2
Amsinckia lunaris bent-flowered fiddleneck	PDBOR01070	None	None	G2G3	S2S3	1B.2
Arctostaphylos franciscana Franciscan manzanita	PDERI040J3	Endangered	None	G1	S1	1B.1
Arctostaphylos imbricata San Bruno Mountain manzanita	PDERI040L0	None	Endangered	G1	S1	1B.1
Arctostaphylos montana ssp. ravenii Presidio manzanita	PDERI040J2	Endangered	Endangered	G3T1	S1	1B.1
Arctostaphylos montaraensis Montara manzanita	PDERI042W0	None	None	G1	S1	1B.2
Arctostaphylos pacifica Pacific manzanita	PDERI040Z0	None	Endangered	G1	S1	1B.2
Astragalus tener var. tener alkali milk-vetch	PDFAB0F8R1	None	None	G2T2	S2	1B.2
Banksula incredula incredible harvestman	ILARA14100	None	None	G1	S1	
Bombus caliginosus obscure bumble bee	IIHYM24380	None	None	G4?	S1S2	
Bombus occidentalis western bumble bee	IIHYM24250	None	None	G2G3	S1	
Caecidotea tomalensis Tomales isopod	ICMAL01220	None	None	G2	S2S3	
Callophrys mossii bayensis San Bruno elfin butterfly	IILEPE2202	Endangered	None	G4T1	S1	
Carex comosa bristly sedge	PMCYP032Y0	None	None	G5	S2	2B.1
Chorizanthe cuspidata var. cuspidata San Francisco Bay spineflower	PDPGN04081	None	None	G2T1	S1	1B.2
Chorizanthe robusta var. robusta robust spineflower	PDPGN040Q2	Endangered	None	G2T1	S1	1B.1
Cicindela hirticollis gravida sandy beach tiger beetle	IICOL02101	None	None	G5T2	S2	
Cirsium andrewsii Franciscan thistle	PDAST2E050	None	None	G3	S3	1B.2
Cirsium occidentale var. compactum compact cobwebby thistle	PDAST2E1Z1	None	None	G3G4T1	S1	1B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Collinsia corymbosa round-headed Chinese-houses	PDSCR0H060	None	None	G1	S1	1B.2
Collinsia multicolor San Francisco collinsia	PDSCR0H0B0	None	None	G2	S2	1B.2
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	None	G3G4	S2	SSC
Dufourea stagei Stage's dufourine bee	IIHYM22010	None	None	G1G2	S1?	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Eucyclogobius newberryi tidewater goby	AFCQN04010	Endangered	None	G3	S3	SSC
Euphydryas editha bayensis Bay checkerspot butterfly	IILEPK4055	Threatened	None	G5T1	S1	
Falco peregrinus anatum American peregrine falcon	ABNKD06071	Delisted	Delisted	G4T4	S3S4	FP
Fritillaria liliacea fragrant fritillary	PMLIL0V0C0	None	None	G2	S2	1B.2
Geothlypis trichas sinuosa saltmarsh common yellowthroat	ABPBX1201A	None	None	G5T3	S3	SSC
Gilia capitata ssp. chamissonis blue coast gilia	PDPLM040B3	None	None	G5T2	S2	1B.1
Gilia millefoliata dark-eyed gilia	PDPLM04130	None	None	G2	S2	1B.2
Grindelia hirsutula var. maritima San Francisco gumplant	PDAST470D3	None	None	G5T1Q	S1	3.2
Helianthella castanea Diablo helianthella	PDAST4M020	None	None	G2	S2	1B.2
Hemizonia congesta ssp. congesta congested-headed hayfield tarplant	PDAST4R065	None	None	G5T1T2	S1S2	1B.2
Hesperevax sparsiflora var. brevifolia short-leaved evax	PDASTE5011	None	None	G4T3	S2	1B.2
Heteranthera dubia water star-grass	PMPON03010	None	None	G5	S2	2B.2
Horkelia cuneata var. sericea Kellogg's horkelia	PDROS0W043	None	None	G4T1?	S1?	1B.1
Horkelia marinensis Point Reyes horkelia	PDROS0W0B0	None	None	G2	S2	1B.2
Hydroporus leechi Leech's skyline diving beetle	IICOL55040	None	None	G1?	S1?	
Ischnura gemina San Francisco forktail damselfly	IIODO72010	None	None	G2	S2	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Lasiurus cinereus hoary bat	AMACC05030	None	None	G5	S4	
Laterallus jamaicensis coturniculus California black rail	ABNME03041	None	Threatened	G3G4T1	S1	FP
Layia carnosa beach layia	PDAST5N010	Endangered	Endangered	G2	S2	1B.1
Leptosiphon rosaceus rose leptosiphon	PDPLM09180	None	None	G1	S1	1B.1
Lessingia germanorum San Francisco lessingia	PDAST5S010	Endangered	Endangered	G1	S1	1B.1
Lichnanthe ursina bumblebee scarab beetle	IICOL67020	None	None	G2	S2	
Malacothamnus arcuatus arcuate bush-mallow	PDMAL0Q0E0	None	None	G2Q	S2	1B.2
Melospiza melodia pusillula Alameda song sparrow	ABPBXA301S	None	None	G5T2?	S2S3	SSC
Monardella sinuata ssp. nigrescens northern curly-leaved monardella	PDLAM18162	None	None	G3T2	S2	1B.2
Mylopharodon conocephalus hardhead	AFCJB25010	None	None	G3	S3	SSC
Pentachaeta bellidiflora white-rayed pentachaeta	PDAST6X030	Endangered	Endangered	G1	S1	1B.1
Phalacrocorax auritus double-crested cormorant	ABNFD01020	None	None	G5	S4	WL
Plagiobothrys chorisianus var. chorisianus Choris' popcornflower	PDBOR0V061	None	None	G3T2Q	S2	1B.2
Plebejus icarioides missionensis Mission blue butterfly	IILEPG801A	Endangered	None	G5T1	S1	
Rallus longirostris obsoletus California clapper rail	ABNME05016	Endangered	Endangered	G5T1	S1	FP
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Riparia riparia bank swallow	ABPAU08010	None	Threatened	G5	S2	
Sanicula maritima adobe sanicle	PDAPI1Z0D0	None	Rare	G2	S2	1B.1
Silene verecunda ssp. verecunda San Francisco campion	PDCAR0U213	None	None	G5T2	S2	1B.2
Speyeria callippe callippe callippe silverspot butterfly	IILEPJ6091	Endangered	None	G5T1	S1	
Spirinchus thaleichthys longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	SSC

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Suaeda californica California seablite	PDCHE0P020	Endangered	None	G1	S1	1B.1
Thamnophis sirtalis tetrataenia San Francisco gartersnake	ARADB3613B	Endangered	Endangered	G5T2Q	S2	FP
Trachusa gummifera San Francisco Bay Area leaf-cutter bee	IIHYM80010	None	None	G1	S1	
Trifolium amoenum two-fork clover	PDFAB40040	Endangered	None	G1	S1	1B.1
Triphysaria floribunda San Francisco owl's-clover	PDSCR2T010	None	None	G2?	S2?	1B.2
Triquetrella californica coastal triquetrella	NBMUS7S010	None	None	G2	S2	1B.2

Record Count: 68

Attachment B

USFWS Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
FEDERAL BUILDING, 2800 COTTAGE WAY, ROOM W-2605
SACRAMENTO, CA 95825
PHONE: (916)414-6600 FAX: (916)414-6713

Consultation Code: 08ESMF00-2017-SLI-0753 January 06, 2017
Event Code: 08ESMF00-2017-E-01619
Project Name: Daly City Recycled Water Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at:
http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm;
http://www.towerkill.com; and
http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

Official Species List

Provided by:

Sacramento Fish and Wildlife Office
FEDERAL BUILDING
2800 COTTAGE WAY, ROOM W-2605
SACRAMENTO, CA 95825
(916) 414-6600

Consultation Code: 08ESMF00-2017-SLI-0753
Event Code: 08ESMF00-2017-E-01619

Project Type: WASTEWATER PIPELINE

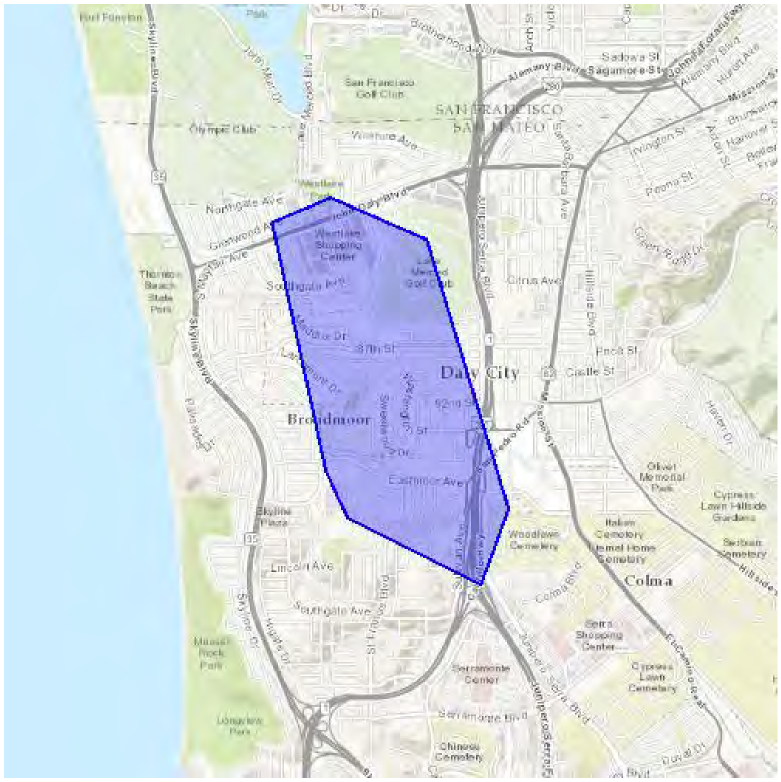
Project Name: Daly City Recycled Water Project
Project Description: Daly City Recycled Water Project

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

United States Department of Interior
Fish and Wildlife Service

Project name: Daly City Recycled Water Project

Project Location Map:



Project Coordinates: MULTIPOLYGON (((-122.4755859375 37.700392438407 93, -122.46871948242186 37.68273350145476, -122.47112274169922 37.67784259082313, -122.48210906982423 37.682190082863734, -122.48382568359374 37.68517883584943, -122.48828887939453 37.70147900486174, -122.48348236083984 37.70310882467999, -122.4755859375 37.70039243840793)))

Project Counties: San Mateo, CA

Endangered Species Act Species List

There are a total of 23 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Amphibians	**Status**	**Has Critical Habitat**	**Condition(s)**
California red-legged frog *(Rana draytonii)* Population: Wherever found	Threatened	Final designated	
Birds			
California Clapper rail *(Rallus longirostris obsoletus)* Population: Wherever found	Endangered		
California Least tern *(Sterna antillarum browni)* Population: Wherever found	Endangered		
Marbled murrelet *(Brachyramphus marmoratus)* Population: U.S.A. (CA, OR, WA)	Threatened	Final designated	
Short-Tailed albatross *(Phoebastria (=diomedea) albatrus)* Population: Wherever found	Endangered		
western snowy plover *(Charadrius nivosus ssp. nivosus)* Population: Pacific Coast population DPS-	Threatened	Final designated	

U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast)			
Fishes			
Delta smelt *(Hypomesus transpacificus)* Population: Wherever found	Threatened	Final designated	
steelhead *(Oncorhynchus (=salmo) mykiss)* Population: Northern California DPS	Threatened	Final designated	
Tidewater goby *(Eucyclogobius newberryi)* Population: Wherever found	Endangered	Final designated	
Flowering Plants			
Franciscan manzanita *(Arctostaphylos franciscana)* Population: Wherever found	Endangered	Final designated	
Presidio Manzanita *(Arctostaphylos hookeri var. ravenii)* Population: Wherever found	Endangered		
Robust spineflower *(Chorizanthe robusta var. robusta)* Population: Wherever found	Endangered	Final designated	
San Francisco lessingia *(Lessingia germanorum (=l.g. var. germanorum))* Population: Wherever found	Endangered		
Showy Indian clover *(Trifolium amoenum)* Population: Wherever found	Endangered		

White-Rayed pentachaeta *(Pentachaeta bellidiflora)* Population: Wherever found	Endangered		
Insects			
Bay Checkerspot butterfly *(Euphydryas editha bayensis)* Population: Wherever found	Threatened	Final designated	
Callippe Silverspot butterfly *(Speyeria callippe callippe)* Population: Wherever found	Endangered		
Mission Blue butterfly *(Icaricia icarioides missionensis)* Population: Wherever found	Endangered		
Myrtle's Silverspot butterfly *(Speyeria zerene myrtleae)* Population: Wherever found	Endangered		
San Bruno Elfin butterfly *(Callophrys mossii bayensis)* Population: Wherever found	Endangered		
Mammals			
Salt Marsh Harvest mouse *(Reithrodontomys raviventris)* Population: wherever found	Endangered		
Southern Sea otter *(Enhydra lutris nereis)* Population: Wherever found	Threatened		
Reptiles			
San Francisco Garter snake	Endangered		

(Thamnophis sirtalis tetrataenia) Population: Wherever found			

Critical habitats that lie within your project area

There are no critical habitats within your project area.

Appendix C

Federally-Listed Biological Resources Assessment Report

Federally-Listed Biological Resources Assessment Report

City of Daly City
Expanded Tertiary Recycled Water Project

Prepared by:

SMB Environmental, Inc.

July 2017

Table of Contents

Figures

Tables

Attachments

Section 1 - Introduction

This document describes the potential effects of the City of Daly City's (City) proposed Recycled Water Reservoir Improvements Project (Proposed Action or Project) on those federally-listed and proposed species that may occur in the Proposed Action Area. This section describes the purpose of this assessment and identifies potential federally-listed species and species of concern that could be affected by the implementation of the City's Proposed Action.

1.1 Purpose of this Assessment

The purpose of this document is to describe potential effects of the District's Proposed Action on those federally-listed and proposed species that may occur in the Proposed Action Area. This document conforms to and with the legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C 1536(c) and 50 CFR 402). The District is seeking funds from the Clean Water State Revolving Fund (CWSRF) Loan Program that is administered by the State Water Resources Control Board (State Board) on behalf of the U.S. Environmental Protection Agency. This document evaluates the potential direct, indirect, and cumulative effects the Proposed Action may have on federally-listed and proposed species, and outlines those potential effects as well as recommended mitigation to reduce potential adverse effects to a less than significant level.

1.2 Species of Concern

Pursuant to Section 7(c) (1) of the Endangered Species Act, SMB obtained a list of federally-listed species potentially found within the Proposed Action Area from the U.S. Fish and Wildlife Service (USFWS) – See Attachment A. This list was also updated using a list provided from the California Natural Diversity Database (CNDDB) (January 2017) – See Attachment B. This document analyzes the potential effects of the Proposed Action upon the following federally-listed and proposed species.

Plants

- Beach layia — *Layia carnosa*
- California seablite — *Suaeda californica*
- Franciscan Manzanita — *Arctostaphylos franciscana* (E)
- Presidio Manzanita — *Arctostaphylos montona ssp. Ravenii* (E)
- Robust spineflower — *Chorizanthe robusta var. robusta* (E)
- Rose leptosiphon — *Leptosiphon rosaceus* (E)
- San Francisco lessingia — *Lessingia germanorum* (E)
- Short-Tailed albatross — *Phoebastria (=diomedea) albatrus* (E)
- Two-fork clover or Showy Indian Clover — *Trifolium amoenum* (E)
- White-rayed pentachaeta — *Pentachaeta bellidiflora* (E)

Mammals

- Salt-marsh Harvest Mouse — *Reithrodontomys raviventris* (E)
- Southern Sea otter — *Enhydra lutris nereis* (T)

Birds

- American peregrine falcon — *Falco peregrinus anatum* (P)

- California black rail — *Lateral/usjamaicensis coturniculus* (P)
- California clapper rail — *Rallus longirostris obsoletus* (E)
- California least tern — *Sternula antillarum* (E)
- Western Snowy Plover — *Charadrius alexandrines nivosus* (T)

Amphibians

- California Red-legged frog — *Rana aurora draytonii* (T) (X)

Reptiless

- San Francisco garter snake — *Thomnophis sirtalis tetrataenia* (E) (P)

Fish

- Tidewater goby — *Eucyclogobius newberryi* (E)
- Delta smelt — *Hypomesus transpacificus* (T) (X)
- Steelhead, Central CA Coast /Valley — *Oncorhynchus mykiss* (T) (X)

Insects

- Bay checkerspot butterfly — *Euphydryas editha bayensis* (T)
- Callippe silverspot butterfly — *Speyeria callippe callippe* (E)
- Mission blue butterfly — *Plebejus icarioides missionensis* (E)
- Myrtle's silverspot — *Speyeria zerene myrtleae* (E)
- San Bruno elfin butterfly — *Callophrys mossii bayensis* (E)

E= Endangered
T=Threatened
P=Proposed
C=Candidate
X=Critical Habitat
PX-Proposed Critical Habitat

Section 2 - Description of Proposed Action

This section provides a description of the Proposed Action including the location and background, purpose and need, construction considerations, and operational considerations.

2.1 Project Location and Background

The City of Daly City (City) is a city of 108,383 people in northern San Mateo County, adjacent to the City and County of San Francisco, on the Pacific Ocean and just minutes away from San Francisco Bay. This enviable location inspired the nickname "Gateway to the Peninsula." Figure 1 illustrates the project location.

The San Francisco Public Utilities Commission (SFPUC) serves the San Francisco and Daly City area with surface water from the Hetch-Hetchy system. Daly City operates its own water system in which well water is blended with surface water supplied by the SFPUC. Beginning in 2017, groundwater wells within Daly City withdraw water from the Westside Groundwater Basin for potable water use in all years (San Francisco Groundwater Project). The Westside Basin is also being examined by the SFPUC as an emergency water supply during drought conditions. Due to common interest in reducing reliance on the Westside Basin, both the City and SFPUC have partnered to commission this Project.

The Project would expand the Daly City recycled water system to supply irrigation water to customers in Daly City, the Town of Colma, and South San Francisco. Recycled water would be used for landscape irrigation at cemeteries, parks, schools, and a golf course driving range. The customers currently use potable water from Cal Water, potable supply from Daly City, or groundwater from private wells. The Proposed Project would supply approximately 1,400 acre-feet per year (AFY) of recycled water.

2.2 Purpose and Need

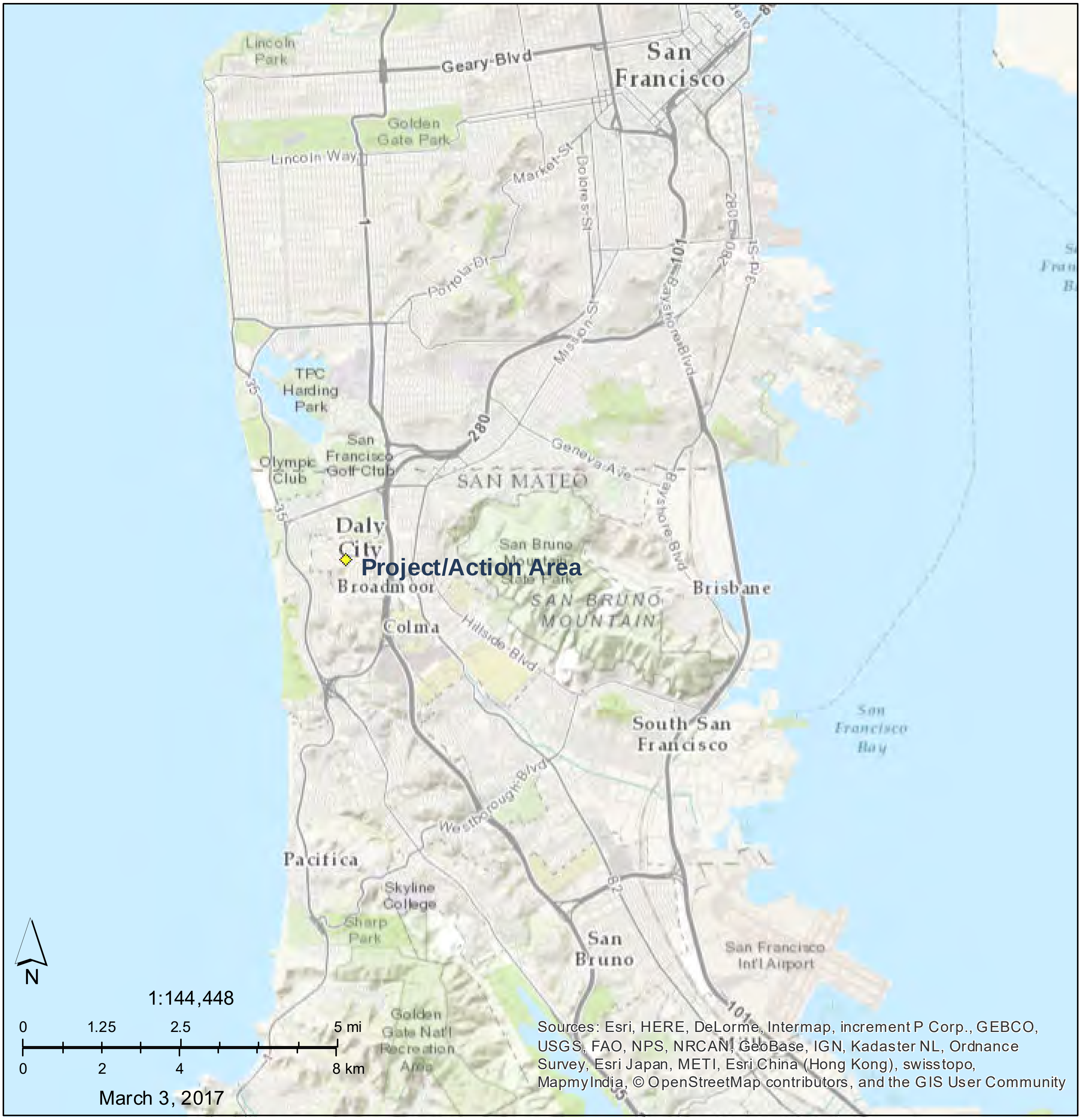
The City is conducting a preliminary design of the Expanded Tertiary Recycled Water Project. The City operates an existing tertiary treatment facility with a permitted capacity of 2.77 million gallons per day (mgd). This Proposed Project/Action would add a new tertiary treatment process to provide an additional 3.0 mgd of tertiary treatment capacity during the irrigation season. The average yearly capacity of the system is 1.25 mgd or 1,400 acre-feet per year (afy) because the system will only operate during the irrigation season. The new treatment processes would include pressure membrane filtration followed by ultraviolet (UV) disinfection due to the small site constraints. New pipelines, pump stations and offsite storage would be constructed to complete the recycled water distribution system, delivering water to new customers for irrigation purposes in lieu of groundwater pumping. The purpose of the Proposed Project/Action is to:

- Reduce irrigation reliance on the groundwater basin;
- Provide local, sustainable, and drought-proof water supply; and
- Preserve available groundwater supplies for drinking water.

2.3 Proposed Action Description

The Project includes the following major components, which are described in further detail in the

Figure 1
General Location Map



Author: cnddb_com
Printed from http://bios.dfg.ca.gov

following sections:

- Daly City Wastewater Treatment Plant (WWTP) Expansion
- Recycled Water Conveyance System

2.1 Daly City Wastewater Treatment Plant Expansion

The Daly City WWTP is located at 153 Lake Merced Boulevard, Daly City, California, 94015. The WWTP is owned and operated by the North San Mateo County Sanitation District, a subsidiary of the City of Daly City. The Proposed Project/Action components for the Daly City WWTP expansion are listed below and depicted on Figure 2.

- Construction of a two-story tertiary treatment building located at Daly City's WWTP site. The facility would be located near the plant entrance and is approximately 82-feet by 41-feet and approximately 40-feet high. The final building size would be confirmed in final design.

- Construction of new electrical building located on vacant land owned by Daly City near the existing WWTP entrance. The electrical building size is approximately 40-feet by 25-feet and approximately 15-feet high. The final building size would be confirmed during final design.

- Construction of a new chemical and neutralization area, which is located inside the Daly City Wastewater Treatment Plant would be approximately 20-feet by 70-feet.

- Relocation of an existing surge tank and other facilities.

2.2 Recycled Water Conveyance/Distribution System

The other major component of the Project is the recycled water conveyance system consisting of pipelines, pumps, and a 2.41 million gallon storage tank. The purpose of the conveyance system is to deliver water from the Daly City WWTP to the customers. The conveyance system includes a 14-inch diameter pipeline from the Daly City WWTP to a recycled water storage tank located in Colma. The pipeline would be installed in streets within Daly City, the Town of Colma, Broadmoor, South San Francisco, and pipeline easements owned by the SFPUC.

The distribution system, which delivers recycled water from the storage tank site to the customers in Colma and South San Francisco, is 4-inches to 18-inches in size. The customer service laterals, 1-inch to 4-inches in diameter size, would be installed along public roads and/or the private property of the recycled water customers.

There are three sites under consideration for the recycled water storage tank. This project description summarizes three different minor variations of the pipeline alignment because the tank location is not finalized. Figure 3 shows all of the pipeline alignments under consideration. It is important to note that although there are three different pipeline alignments, the roads affected by all three alignments would be fairly similar. The minor difference lies in the pipeline alignment for one of the customer service laterals. The facilities associated with each alignment are summarized in the following subsections. The three tank sites described below are referred to by their current ownership names.

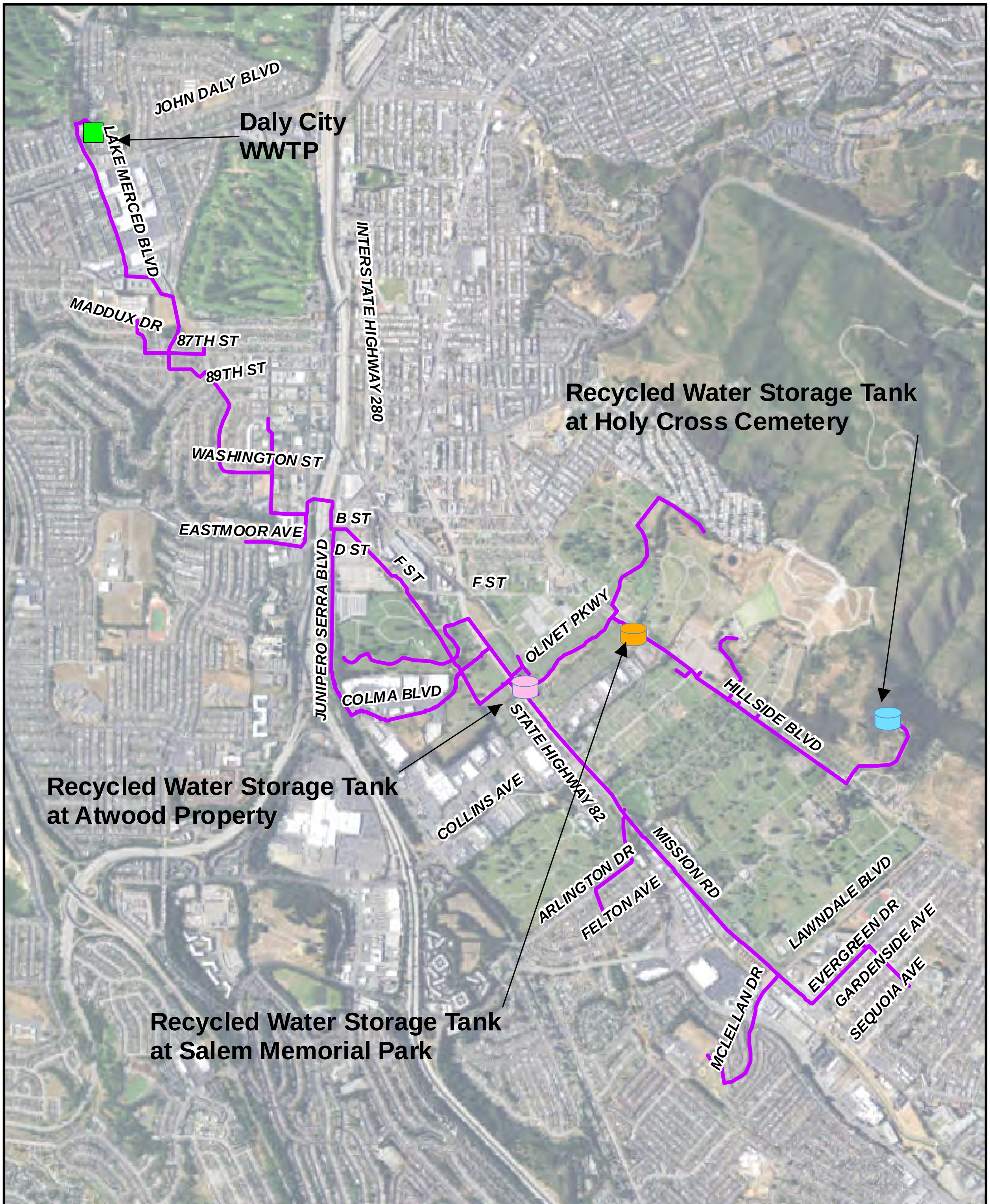
TREATMENT PLANT EXPANSION FACILITIES

FIGURE 2

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo



Daly City WWTP

Preferred Option - Holy Cross Cemetery Storage Tank

Alternative 1 - Atwood Property Storage Tank and PS

Alternative 2 - Salem Storage Tank and

Pipeline

Feet

0 1,250 2,500

PROJECT OVERVIEW

FIGURE 3

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

2.2.1 Storage Tank at the Atwood Property

This alternative storage tank site assumes the storage tank would be located at the intersection of State Highway 82 and Olivet Parkway and would be approximately 200-feet long by 55-feet wide by 30-feet high and installed underground. The depth of excavation would be approximately 40-feet deep. The Atwood Property is adjacent to a Bay Area Rapid Transit (BART) underground rail line.

Recycled water would be pumped from the Daly City WWTP to the storage tank at the Atwood Property and then pumped to customers located in Colma and South San Francisco. The pump station building at the Atwood Property would be approximately 40-feet by 50-feet and above grade and approximately 20-feet high. The facility sizing will be finalized during Final Design. Figure 4 presents an overview of the conveyance system to/from the Atwood Property. Figure 5 presents an overview of the storage tank at the Atwood Property.

Table 1 presents a summary of the pipeline lengths for the Atwood property tank site alternative. From the WWTP to I-280, the new 14-inch transmission main would be installed in public roads owned by Daly City or San Mateo County. There are also customer service laterals along this section of the transmission main. In order to cross I-280, an existing 16-inch pipe located on a utility bridge maintained by the California Department of Transportation (Caltrans) would be utilized. The 16-inch pipe is owned by Daly City and not in service. From I-280 to State Highway 82, the 14-inch transmission main would be installed in either SFPUC owned property or along Junipero Serra Boulevard and Colma Boulevard. The 14-inch transmission main would eventually need to cross State Highway 82, which is owned by Caltrans, and a BART underground rail line to reach the storage tank. From the storage tank, the distribution system would deliver pumped water to the customers in Colma and South San Francisco. The distribution system crosses three BART underground rail lines.

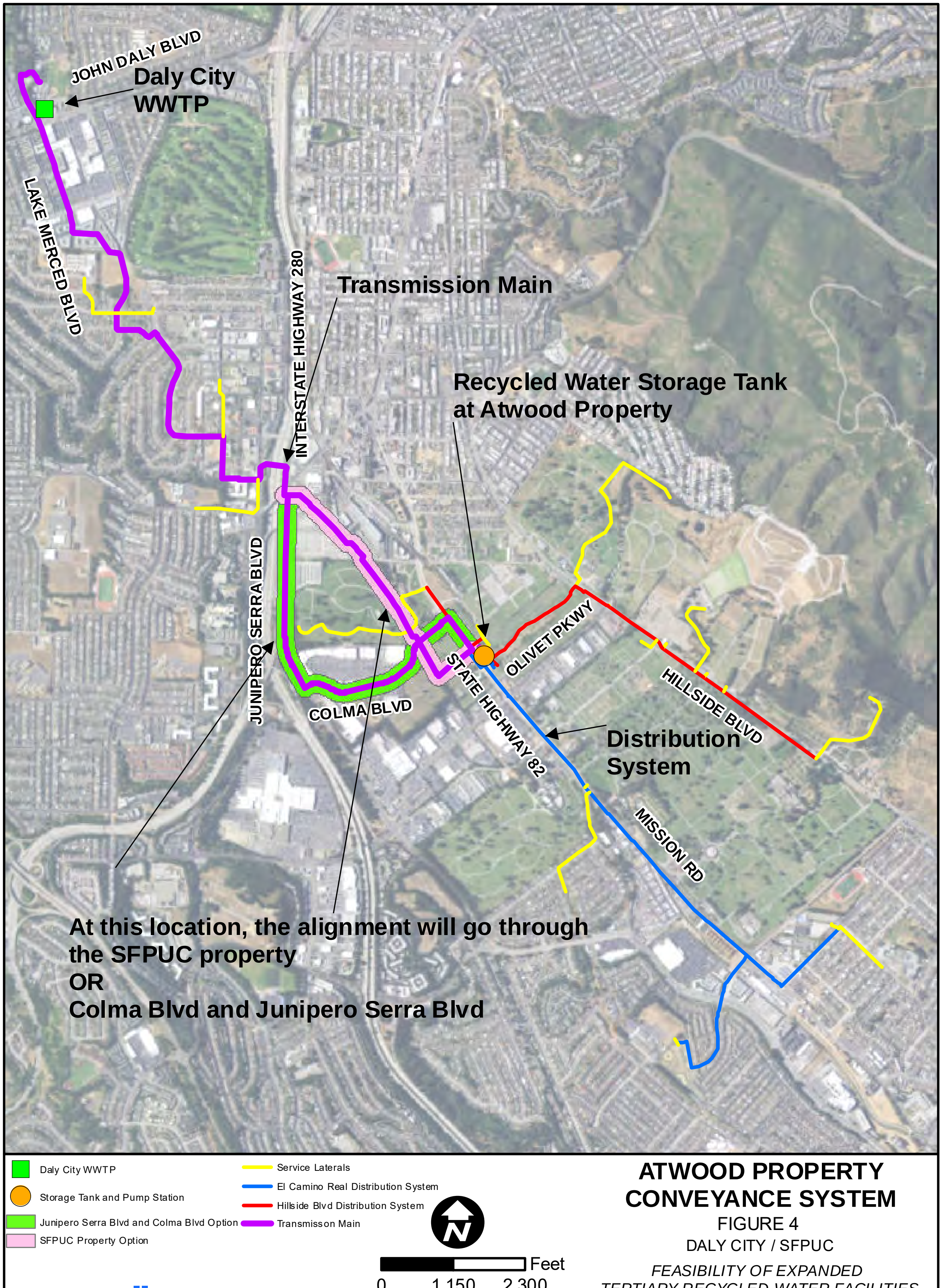
Table 1
Conveyance System Pipe Lengths for Tank at Atwood Property
Expanded Tertiary Recycled Water Project

Description	Pipe Sizes (Inches)[1]	Length (Feet)
Transmission Main from WWTP to Storage Tank	14	16,345[2]
Pipe Bridge	16	320
Customer Laterals Along Transmission Main	1.5 - 4	4,160
Distribution System	4 - 18	20,865
Customer Laterals Along Distribution System	1 - 14	15,280
Total		**56,970**

1) Pipe sizes will be finalized in the Final Design.
2) This assumes the transmission main is installed on SFPUC land. If the pipeline is installed through Junipero Serra Boulevard and Colma Boulevard, the length is 18,331 ft.

2.2.2 Storage Tank at the Salem Memorial Park Property

This alternative storage tank site assumes the storage tank would be located at vacant land at the intersection of Hillside Boulevard and Serramonte Boulevard, referred to herein as the Salem Memorial Park Property. Recycled water would be pumped from the WWTP to an underground storage tank, measuring approximately 115-feet long by 40-feet wide by 70-feet high; these dimensions assume the



ATWOOD PROPERTY CONVEYANCE SYSTEM

FIGURE 4

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo

Storage Tank
Pump Station
BART ROW and Tunnel
Atwood Parcel

N

0 50 100 Feet

carollo

ATWOOD PROPERTY STORAGE TANK SITE

FIGURE 5

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

Lucky Chances parking lot cannot be used as a construction staging area. If the parking lot can be used as a staging area, the tank can be made shallower (dimensions of 145-feet long by 70-feet long by 33-feet high. All facility sizing would be finalized during Final Design. Figure 6 presents an overview of the conveyance system to/from the Salem Memorial Park Property. Figure 7 presents an overview of the storage tank at the Salem Memorial Park Property.

Table 2 presents a summary of the pipeline lengths for the Salem Memorial Park property tank site alternative. From the WWTP to I-280, the new 14-inch transmission main would be installed in public streets owned by Daly City and/or San Mateo County; there are also customer service laterals along this section of the transmission main. In order to cross I-280, an existing 16-inch pipe located on a utility bridge maintained by the California Department of Transportation (Caltrans) would be utilized. The 16-inch pipe is owned by Daly City and not in service. From I-280 to State Highway 82, the 14-inch transmission main would be installed in either SFPUC owned property or along Junipero Serra Boulevard and Colma Boulevard. The 14-inch transmission main would eventually need to cross State Highway 82, which is owned by Caltrans, and a BART underground rail line to reach the storage tank. From the storage tank, the distribution system would deliver pumped water to the customers in Colma and South San Francisco. The distribution system crosses three BART underground rail lines.

Table 2
Conveyance System Pipe Lengths for Tank at Salem Memorial Park Property
Expanded Tertiary Recycled Water Project

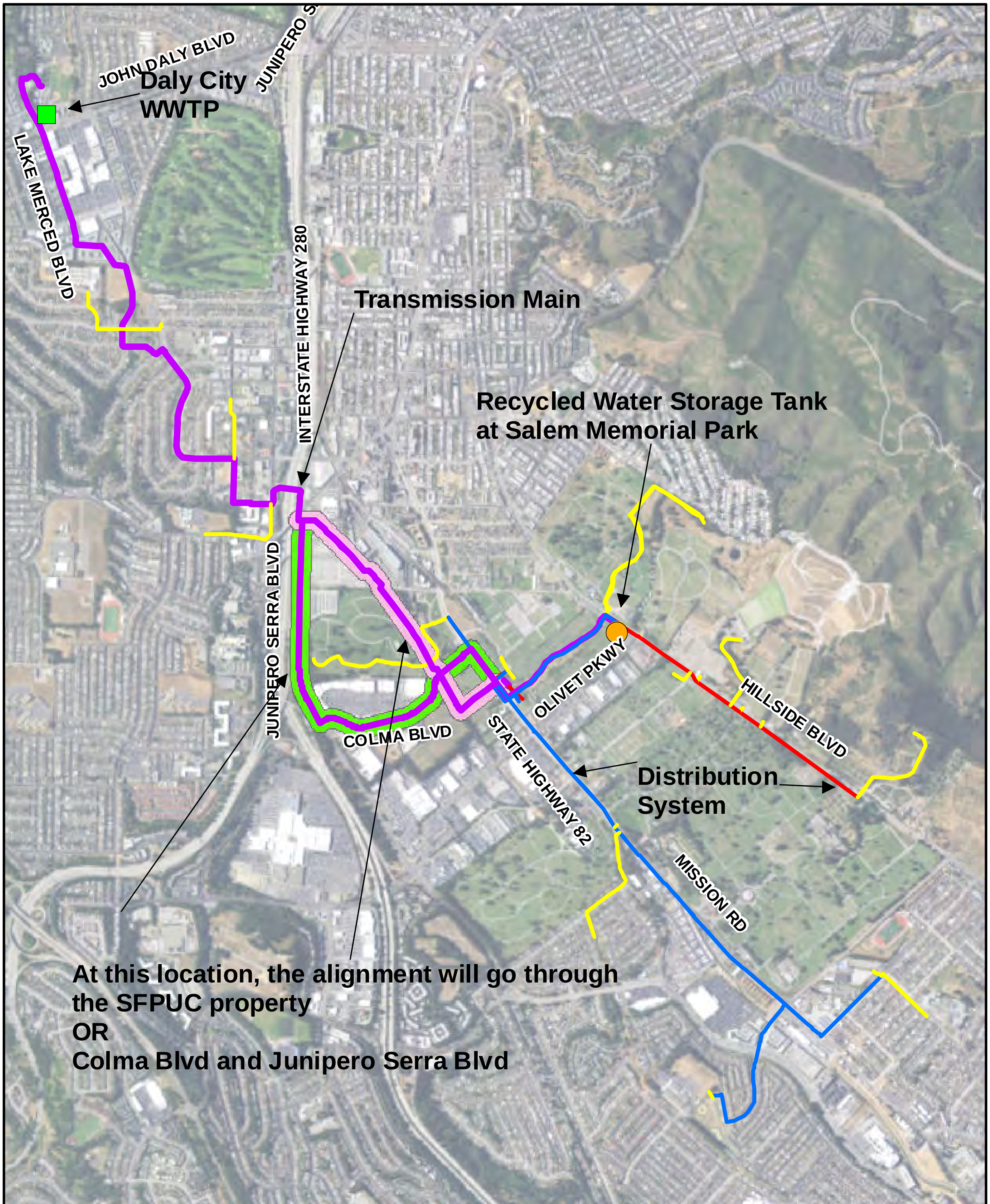
Description	Pipe Sizes (Inches)[1]	Length (Feet)
Transmission Main from WWTP to Storage Tank	14	16,070[2]
Pipe Bridge	16	320
Customer Laterals Along Transmission Main	1.5 - 4	4,160
Distribution System	4 - 16	22,950
Customer Laterals Along Distribution System	1 - 14	15,260
Total		**58,760**

1) Pipe sizes will be finalized in the Final Design.
2) This assumes the transmission main is installed on SFPUC land. If the pipeline is installed through Junipero Serra Boulevard and Colma Boulevard, the length is 18,056.

2.2.3 Storage Tank at the Holy Cross Cemetery Property

This preferred option assumes the storage tank is located at vacant land at the Holy Cross Cemetery property at Hillside Boulevard. Recycled Water would be pumped from the WWTP to an aboveground storage tank, measuring approximately 118.5-foot diameter and 30-feet high located on a hill on Hillside Boulevard. From the Holy Cross Cemetery property, the recycled water would gravity flow to customers located in Colma and South San Francisco. A pump station would not be required for this alternative. All facility sizing would be finalized during Final Design. Figure 8 presents an overview of the conveyance system to/from the Holy Cross Cemetery property. Figure 9 presents an overview of the storage tank at the Holy Cross Cemetery property.

Table 3 presents a summary of the pipeline lengths for the Holy Cross property tank site alternative. From the WWTP to I-280, the new 14-inch transmission main would be installed in public streets owned by Daly City and/or San Mateo County; there are also customer service laterals along this section of the



Daly City WWTP
Storage Tank and Pump Station
Junipero Serra Blvd and Colma Blvd Option
SFPUC Property Option
Service Laterals
El Camino Real Distribution System
Hillside Blvd Distribution System
Transmisson Main

N

0 1,150 2,300 Feet

SALEM MEMORIAL PARK CONVEYANCE SYSTEM

FIGURE 6

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo

Storage Tank
Pump Station
Salem Parcel
Vacant Land

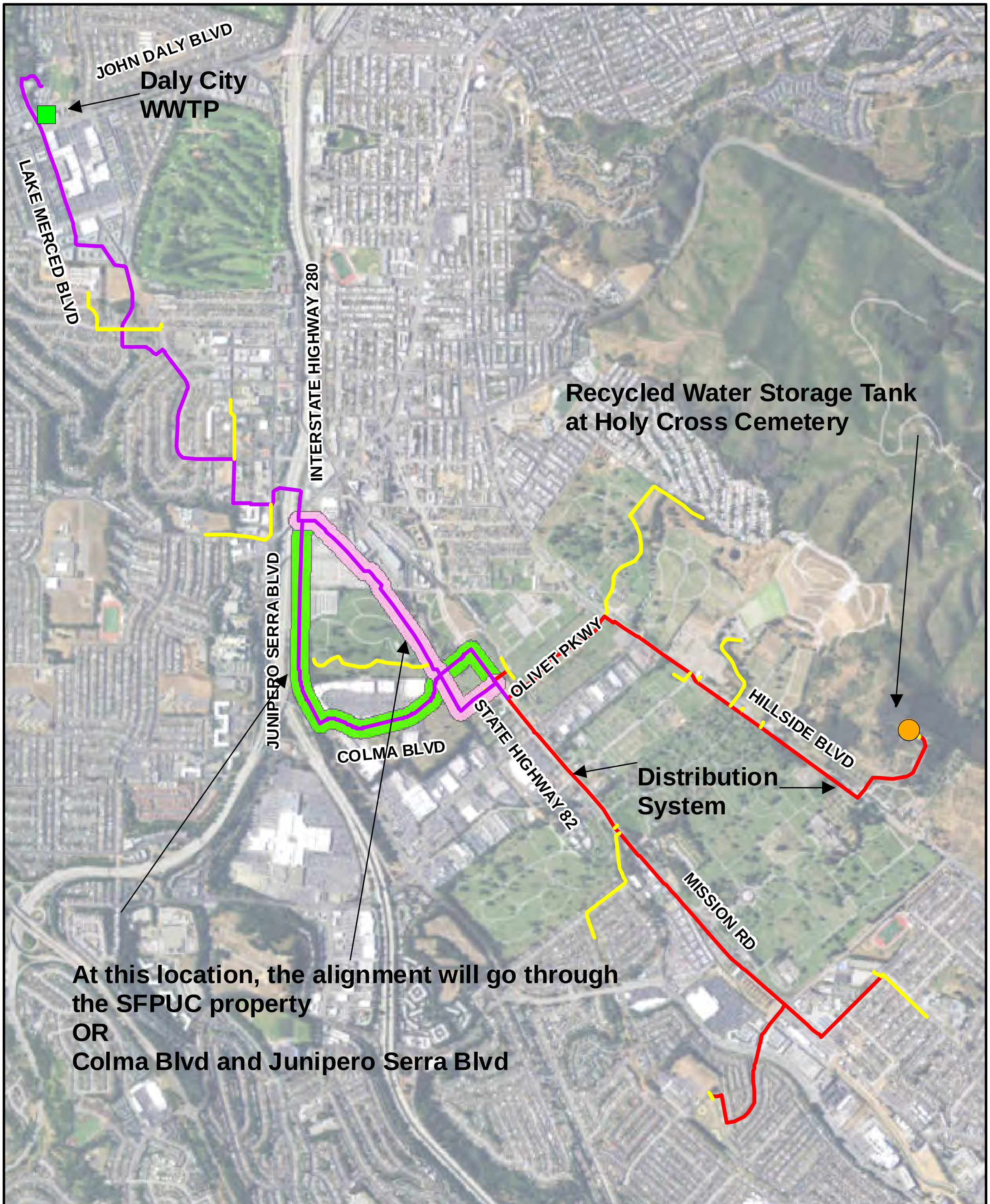
Feet
0 40 80

SALEM MEMORIAL PARK STORAGE TANK SITE

FIGURE 7

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES



Daly City WWTP
Storage Tank and Pump Station
Junipero Serra Blvd and Colma Blvd Option
SFPUC Property Option
Service Laterals
Gravity Distribution System
Transmission Main

N

0 1,150 2,300 Feet

HOLY CROSS CEMETERY CONVEYANCE SYSTEM

FIGURE 8

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo

HOLY CROSS CEMETERY STORAGE TANK SITE

FIGURE 9

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo

transmission main. In order to cross I-280, an existing 16-inch pipe located on a utility bridge maintained by the California Department of Transportation (Caltrans) would be utilized. The 16-inch pipe is owned by Daly City and not in service. From I-280 to State Highway 82, the 14-inch transmission main would be installed in either SFPUC owned property or along Junipero Serra Boulevard and Colma Boulevard. The 14-inch transmission main would eventually need to cross State Highway 82, which is owned by Caltrans, and a BART underground rail line to reach the storage tank. From the storage tank, the distribution system would deliver recycled water by gravity to the customers in Colma and South San Francisco. The distribution system crosses three BART underground rail lines.

Table 3
Conveyance System Pipe Lengths for Tank at Holy Cross Cemetery
Expanded Tertiary Recycled Water Project

Description	Pipe Sizes (Inches)[1]	Length (Feet)
Transmission Main from WWTP to Storage Tank	14	16,315[2]
Pipe Bridge	16	320
Customer Laterals Along Transmission Main	1.5 - 4	4,160
Distribution System	4 - 18	20,040
Customer Laterals Along Distribution System	1 - 14	12,360
Total		**53,195**

1) Pipe sizes will be finalized in the Final Design.
2) This assumes the transmission main is installed on SFPUC land. If the pipeline is installed through Junipero Serra Boulevard and Colma Boulevard, the length is 18,301.

2.2 Project Construction

This section describes the construction activities associated with the Proposed Project's major components.

2.2.1 Daly City WWTP Expansion

The Project components located at the Daly City WWTP include a tertiary treatment building, an electrical building, a surge tank, and a chemical and neutralization area. Typical construction activities include excavation, shoring, treatment process and electrical buildings construction, installation of treatment process equipment, testing, commissioning, and startup. Depending on the groundwater levels found during the geotechnical investigation and construction, excavations may require an excavation dewatering system. The dewatering system will be installed during construction to lower the groundwater below the excavated area. The groundwater will be disposed of according to local laws and regulations.

2.2.2 Conveyance Pipelines and Storage Tank

The majority of the new conveyance pipeline system would be installed using open trench methods in streets and public right-of-ways. Typical construction activities include pavement cutting, excavation, pipeline installation, backfill and pavement repair. The typical trench size is expected to be 4-feet wide and 8-feet deep and trench shoring designed according to Occupational Safety and Health Administration (OSHA) requirements would be used in excavations deeper than 5-feet.

The project may include trenchless installation of the pipeline to cross certain areas. A commonly used trenchless installation method involves jack-and bore construction. Jack-and-bore construction involves digging a jacking pit, typically 35-feet by 12-feet, and a receiving pit, typically 10-feet by 10-feet. The jack and bore pits would be approximately 30-feet deep. Then, a boring machine will be used to simultaneously cut through the soil with an auger, and push a casing pipe into the soil. The pipe carrying the recycled water will eventually be installed through the casing pipe. Staging areas will be at the WWTP and at the selected storage tank site.

2.2.3 Construction Duration

It is anticipated that construction would begin in 2019 and last for approximately 24 months. The project would be constructed during normal working hours 8 AM - 5 PM Monday through Friday. However, it may be necessary for the Contractor to work night and/or weekends if required to meet critical schedule deadlines, or accelerate the schedule. It is estimated that 3 crews of approximately 12 workers each (i.e. 36 construction workers) would be required.

2.3 Facility Operations and Maintenance

The recycled water treatment and conveyance system will be operated by Daly City operations and maintenance staff. The system will operate 24 hours per day and 7 days per week and produce an average of 1,400 afy. It is anticipated that the irrigation schedule for all the users will occur 8 hours a day, from 9 PM to 5 AM. Operation and maintenance of the proposed facilities are not anticipated to increase the number of permanent workers or employees.

2.4 Compliance with CCR Title 22 and State Board's Recycled Water Policy

The Proposed Project/Action will be designed and operated in accordance with the applicable requirements of CCR Title 22 and any other state or local legislation that is currently effective or may become effective as it pertains to recycled water. The State Board adopted a Recycled Water Policy (RW Policy) in 2009 to establish more uniform requirements for water recycling throughout the State and to streamline the permit application process in most instances. As part of that process, the State Board prepared an Initial Study and Mitigated Negative Declaration for the use of recycled water. The newly adopted RW Policy includes a mandate that the State increase the use of recycled water over 2002 levels by at least 1,000,000 AFY by 2020 and by at least 2,000,000 AFY by 2030. Also included are goals for storm water reuse, conservation and potable water offsets by recycled water. The onus for achieving these mandates and goals is placed both on recycled water purveyors and potential users. The State Board has designated the Regional Water Quality Control Boards as the regulating entities for the Recycled Water Policy. In this case, the San Francisco Bay Regional Water Quality Control Board (San Francisco RWQCB) is responsible for permitting recycled water projects throughout the San Francisco Bay Area, including the City of Daly City

The Proposed Project/Action will provide high quality unrestricted use tertiary treated recycled water and make it available to users within the City. All irrigation systems will be operated in accordance with the requirements of Title 22 of the CCR, the State Board Recycled Water Policy, and any other local legislation that is effective or may become effective as it pertains to recycled water and any reclamation permits issued by the San Francisco RWQCB. Reclamation permits typically require the following:

- Irrigation rates will match the agronomic rates of the plants being irrigated;
- Control of incidental runoff through the proper design of irrigation facilities;
- Implementation of a leak detection program to correct problems within 72 hours or prior to the release of 1,000 gallons whichever occurs first;
- Management of ponds containing recycled water to ensure no discharges; and
- Irrigation will not occur within 50 feet of any domestic supply wells, unless certain conditions have been met as defined in Title 22.

Section 3 –Regulatory and Environmental Setting

This section describes the regulatory and existing environment within and around the Proposed Project/Action Study Area as it pertains to state and federally-listed species.

3.1 Regulatory Environment

The following discussion identifies federal, state, and local regulations that serve to protect sensitive biological resources relevant to the environmental review process.

3.1.1 Federal Regulations

The following discussion identifies federal regulations that serve to protect sensitive biological resources relevant to the environmental review process.

3.1.1.1 Federal Endangered Species Act

The Secretary of the Interior (represented by the USFWS) and the Secretary of Commerce (represented by the National Marine Fisheries Service, NMFS) have joint authority to list a species as threatened or endangered under the Federal Endangered Species Act (FESA) (United States Code [USC], Title 16, Section 1533[c]). FESA prohibits the "take" of endangered or threatened fish, wildlife, or plants species in areas under federal jurisdiction or in violation of state law, in addition to adverse modifications to their critical habitat. Under FESA, the definition of "take" is to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The USFWS and NMFS also interpret the definition of "harm" to include significant habitat modification that could result in the take of a species.

If an activity would result in the take of a federally listed species, one of the following is required: an incidental take permit under Section 10(a) of FESA, or an incidental take statement issued pursuant to federal interagency consultation under Section 7 of FESA. Such authorization typically requires various measures to avoid and minimize species take, and to protect the species and avoid jeopardy to the species' continued existence.

Pursuant to the requirements of Section 7 of FESA, a federal agency reviewing a proposed project which it may authorize, fund, or carry out must determine whether any federally listed threatened or endangered species, or species proposed for federal listing, may be present in the project area and determine whether implementation of the proposed project is likely to affect the species. In addition, the federal agency is required to determine whether a proposed project is likely to jeopardize the continued existence of a listed species or any species proposed to be listed under FESA or result in the destruction or adverse modification of critical habitat proposed or designated for such species (16 USC 1536[3], [4]).

Generally, the USFWS implements FESA for terrestrial and freshwater fish species and the NMFS implements FESA for marine and anadromous fish species. USFWS and/or NMFS must authorize projects where a federally listed species is present and likely to be affected by an existing or proposed project.

Authorization may involve a letter of concurrence that the project will not result in the potential take of a listed species, or may result in the issuance of a Biological Opinion that describes measures that must be undertaken to minimize the likelihood of an incidental take of a listed species. A project that is determined by USFWS or NMFS to jeopardize the continued existence of a listed species cannot be approved under a Biological Opinion.

Where a federal agency is not authorizing, funding, or carrying out a project, take that is incidental to the lawful operation of a project may be permitted pursuant to Section 10(a) of FESA through approval of a habitat conservation plan (HCP).

FESA requires the federal government to designate “critical habitat” for any species it lists under the Endangered Species Act. “Critical habitat” is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to the species conservation, and those features that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the regulatory agency determines that the area itself is essential for conservation.

3.1.1.2 Federal Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (MBTA) (16 USC, Section 703, Supp. I, 1989), as amended by the Migratory Bird Treaty Reform Act, prohibits killing, possessing, or trading in migratory birds, except in accordance with regulations prescribed by the Secretary of the Interior. The act addresses whole birds, parts of birds, and bird nests and eggs. For projects that would not cause direct mortality of birds, the MBTA is generally interpreted in CEQA analyses as protecting active nests of all species of birds that are included in the “List of Migratory Birds” published in the Federal Register in 1995 and as amended in 2005. Though the MBTA allows permits to be issued for import and export, banding, scientific collecting, taxidermy, and rehabilitation, among other reasons, there is no provision in the MBTA that allows for species take related to creation or other development (Code of Federal Regulations, Title 50: Wildlife and fisheries Part 21; Migratory Bird Permits).

3.1.1.3 Federal Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 USC 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from “taking” bald eagles, including their parts, nests, or eggs. The act provides criminal penalties for persons who “take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle…[or any golden eagle], alive or dead, or any part, nest, or egg thereof.” The act defines “take” as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb.”

3.1.1.4 River and Harbor Act and Clean Water Act

The Secretary of the Army (represented by the Corps of Engineers [USACE]) has permitting authority over activities affecting waters of the United States under Section 10 of the River and Harbors Act (33 USC 403) and Section 404 of the Clean Water (33 USC 1344). Waters of the United States are defined in Title 33 CFR Part 328.3(a) and include a range of wet environments such as lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds. Section 10 of the River and Harbor Act requires a federal license or permit prior to accomplishing any work in, over, or under navigable waters of the United States, or which affects the course, location, condition or capacity of such waters. Section 404 of the Clean Water Act requires a federal license or permit prior to discharging dredged or fill material into waters of the United States, unless the activity is exempt (33 CFR 324.4) from Section 404 permit requirements (e.g., certain farming and forestry activities). To obtain a federal license or permit, project proponents must demonstrate that they have attempted to avoid the resource or minimize impacts on the resource; however, if it is not possible to avoid impacts or minimize impacts further, the project proponent is required to mitigate remaining project impacts on all federally-regulated waters of the United States.

Section 401 of the Act (33 USC 1341) requires any project proponents for a federal license or permit to conduct any activity including, but not limited to, the creation or operation of facilities, which may result in any discharge into navigable waters of the United States to obtain a certification from the state in which the discharge originates or would originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over the navigable waters at the point where the discharge originates or would originate, that the discharge will comply with the applicable effluent limitations and water quality standards. A certification obtained for the creation of any facility must also pertain to the subsequent operation of the facility. The responsibility for the protection of water quality in California rests with the State Water Resources Control Board (SWRCB) and its 9 Regional Water Quality Control Boards (RWQCBs).

3.2 Regional and Local Setting

The Proposed Action is located within Daly City is located on the San Francisco Bay Peninsula and, like the neighboring Town of Colma and South San Francisco, it has been heavily developed and is now over 90 percent urbanized. Portions of San Bruno Mountain within Daly City and certain areas in the Coastal Zone are the only large undeveloped areas in the city that support relatively large patches of suitable habitat for special status species. While San Bruno Mountain supports high quality habitat for several endangered species, most undeveloped areas along the coastline are highly disturbed and dominated by exotic plants leaving very little native habitat. The Proposed Action is not located within the San Bruno Mountain or the Coastal Zone.

3.2.2 Wetlands and Other Waters of the U.S.

Based upon a literature search (i.e. USFWS and CDFW 2017) and a reconnaissance field study on October 14, 2016, there are no known critical habitats, wetlands, and/or vernal pools that would be affected by the Proposed Project/Action. The Proposed Project/Action would not cross any local creeks/drainages that could be considered "Other Waters of the U.S".

3.3 Potentially Affected Federal Species and Habitats

A record search of USFWS' Species List and the CDFW's California Natural Diversity Database (CNDDB) was conducted for the area within a five-mile radius of the Project area to identify previously reported occurrences of state and federal special-status plants and animals (See Attachments A and B). In addition, a field visit of the Proposed Action was conducted on October 14, 2016 to determine the potential for special-status species to occur within the general vicinity of the Proposed Project/Action Study Area (i.e. Construction Area) as described in Chapter 2 – Description of Proposed Action. This field visit was not intended to be protocol-level surveys to determine the actual absence or presence of special-status species, but were conducted to determine the potential for special-status species to occur within the Proposed Project/Action Area. Figure 11 shows the location of known state and federal listed species within the Project/Action Area. The potential for each special status species to occur in the Study Area was then evaluated according to the following criteria:

- **No Potential.** Habitat on and adjacent to the site is clearly unsuitable for the species requirements (foraging, breeding, cover, substrate, elevation, hydrology, plant community, site history, disturbance regime).
- **Unlikely.** Few of the habitat components meeting the species requirements are present, and/or the majority of habitat on and adjacent to the site is unsuitable or of very poor quality. The species is not likely to be found on the site.
- **Moderate Potential.** Some of the habitat components meeting the species requirements are present, and/or only some of the habitat on or adjacent to the site is unsuitable. The species has a moderate probability of being found on the site.
- **High Potential.** All of the habitat components meeting the species requirements are present and/or most of the habitat on or adjacent to the site is highly suitable. The species has a high probability of being found on the site.
- **Present.** Species is observed on the site or has been recorded on the site recently.

Table 4 below lists the federally-listed species that have the potential to exist within the Proposed Project/Action Area, along with their preferred habitats, the potential to occur within the Action Study Area, and recommendations to avoid and minimize potential effects to these species.

Table 4
Potential for Federally-Listed Species to Occur in the Proposed Project/Action Study Area

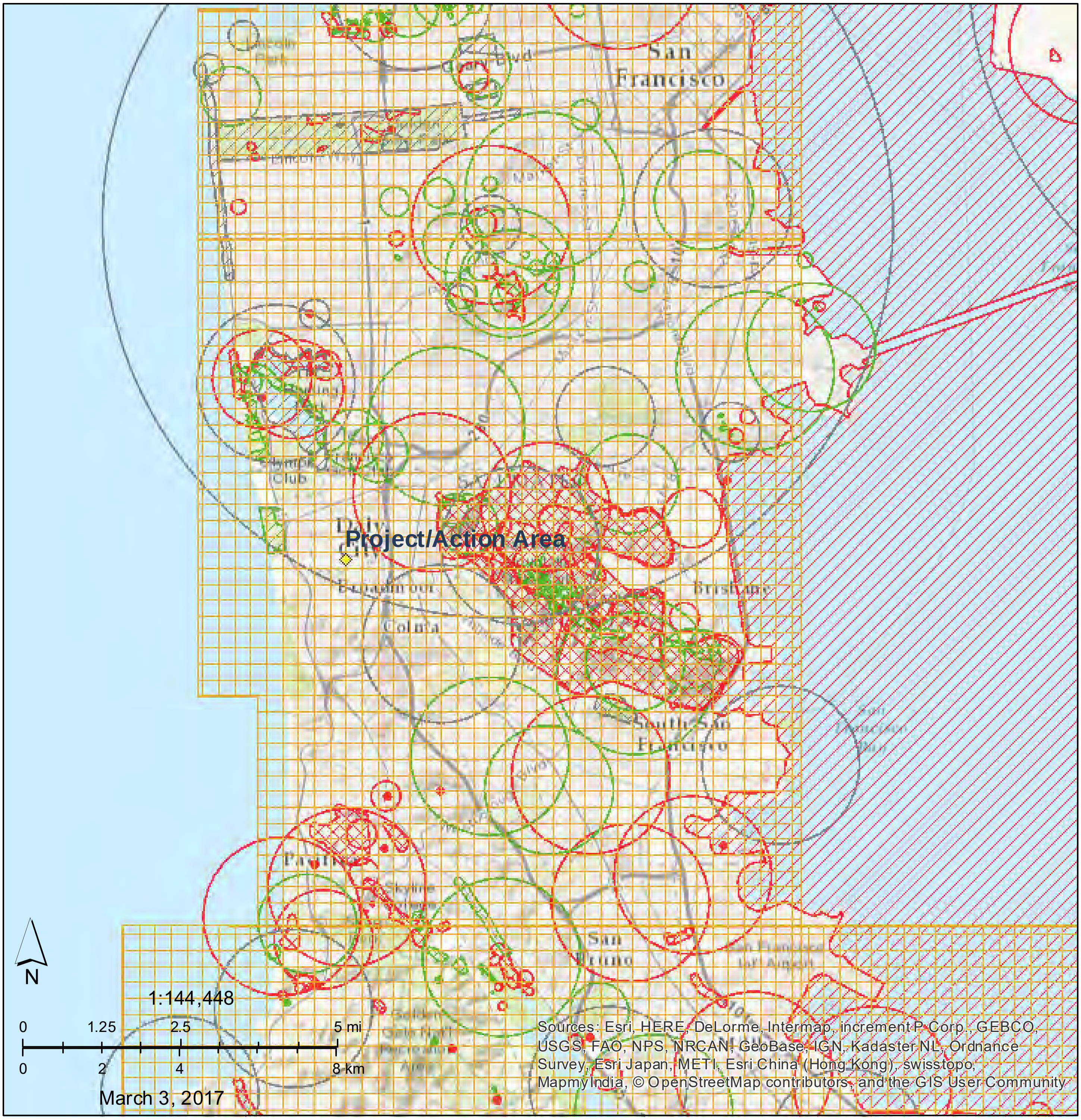
Species	Status	Habitat	Potential for Occurrence	Recommendations
Plants				
Beach layia (*Layia carnosa*)	FE, SE, CNPS 1B.1	Coastal dunes, on sparsely vegetated, semi-stabilized dunes, usually behind fore-dunes.	Unlikely. No suitable habitat present. Species extirpated from region.	No further actions are recommended for this species.

Table 4 Potential for Federally-Listed Species to Occur in the Proposed Project/Action Study Area				
Species	**Status**	**Habitat**	**Potential for Occurrence**	**Recommendations**
California seablite *(Suaeda californica)*	FE, CNPS 1B.1	Coastal saltwater marshes and swamps.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Franciscan Manzanita *(Arctostaphylos franciscana)*	FE CNPS 1B.1	Chaparral, coastal scrub.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Presidio Manzanita *(Arctostaphylos montona ssp. Ravenii)*	FE,CNPS 1B.2	Chaparral, coastal prairie, coastal scrub. Open rocky serpentine slopes.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Robust spineflower *(Chorizanthe robusta var. robusta)*	FE, SE, CNPS 1B.1	Cismontane woodland, coastal dunes, coastal scrub. Sandy terraces and bluffs or in loose sand.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Rose leptosiphon *(Leptosiphon rosaceus)*	FE, CNPS 18.1	Coastal bluff scrub.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
San Francisco lessingia *(Lessingia germanorum)*	FE, SE, CNPS 1B.1	Coastal scrub from remnant dunes. Open sandy soils relatively free of competing plants.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Short-Tailed albatross (Phoebastria (=diomedea) albatrus)	FE	Preferres to nest on large open areas near stands of the grass and near the ocean.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Two-fork clover or Showy Indian Clover (Trifolium amoenum)	FE, CNPS 1B.1	Valley and foothill grassland, coastal bluff scrub. Sometimes on serpentine soil, open sunny sites, swales.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
White-rayed pentachaeta *(Pentachaeta bellidiflora)*	FE, SE, CNPS 18.1	Valley and foothill grassland. Open dry rocky slopes and grassy areas, often on soils derived from serpentine bedrock.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Mammals				
Salt-marsh Harvest Mouse *(Reithrodontomys raviventris)*	FE, SE	Primary habitat in pickleweed dominated saline emergent marshes of San Francisco Bay. Require adjacent upland areas for escape from high tides.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Southern Sea otter *(Enhydra lutris nereis)*	FT	Is a marine mammal native to the coasts of the northern and eastern North Pacific Ocean.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Birds				
American peregrine falcon *(Falco peregrinus anatum)*	FP	Near wetlands, lakes, rivers, or other water; on cliffs, banks, dunes, mounds; also, human-made structures.	Unlikely. No Suitable habitat present.	
California black rail	ST,FP	Inhabits freshwater	Unlikely. No	No further actions are

Table 4 Potential for Federally-Listed Species to Occur in the Proposed Project/Action Study Area				
Species	**Status**	**Habitat**	**Potential for Occurrence**	**Recommendations**
(Lateral/us jamaicensis coturniculus)		marshes, wet meadows & shallow margins of saltwater marshes bordering larger bays. Nests and forages intidal emergent wetland with pickleweed and cordgrass.	Suitable habitat present.	recommended for this species.
California clapper rail *(Rallus longirostris obsoletus)*	FE, SE, FP	Salt-water & brackish marshes traversed by tidal sloughs in the vicinity of San Francisco Bay. Nests and forages in emergent wetland with pickleweed, bulrush,and cordgrass.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
California least tern *(Sternula antillarum)*	FE	The California Least Tern hunts primarily in shallow estuaries and lagoons, where smaller fishes are abundant.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Western Snowy Plover *(Charadrius alexandrines nivosus)*	FT, SSC, BCC, RP	(Nesting) Federal listing applies only to the Pacific coastal population. Found on sandy beaches, salt pond levees and shores of large alkali lakes. Requires sandy, gravelly or friable soils for nesting.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Amphibians				
California red-legged frog *(Rana draytonii)*	FT, SSC	Found within permanent and semipermanent aquatic habitats, such as creeks and cold-water ponds, with emergent and submergent vegetation; may aestivate in rodent burrows or cracks during dry periods.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Reptiles				
San Francisco garter snake *(Thomnophis sirtalis tetrataenia)*	FE, SE, FPT	Vicinity of freshwater marshes, ponds and slow moving streams. Prefers dense cover & water depths of at least one foot. Upland areas near water are also very important.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Fish				
Delta Smelt (Hypomesus transpacificus)	FT	Found in large, main channels and open areas of the bay. Occur	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.

Table 4 Potential for Federally-Listed Species to Occur in the Proposed Project/Action Study Area				
Species	**Status**	**Habitat**	**Potential for Occurrence**	**Recommendations**
		from tidal freshwater reaches of the Delta west to eastern San Pablo Bay.		
Steelhead - central California coast DPS *(Oncorhynchus mykiss irideus)*	FT	From Russian River, south to Soquel Creek and to, but not including, Pajaro River. Also San Francisco and San Pablo Bay basins.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Tidewater goby *(Eucyclogobius newberryi)*	FE	Brackish water habitats along the CA coast. Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water & high oxygen levels.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Insects				
Bay checkerspot butterfly *(Euphydryas editha bayensis)*	FT	Native grasslands on outcrops of serpentine soil in the vicinity of the San Francisco Bay. *Plantago erecta* is the primary host plant.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Callippe silverspot butterfly *(Speyeria callippe callippe)*	FE	Grasslands with host plant *Viola pedunculata.* Males congregate on hilltops in search of females.	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Mission blue butterfly *(Plebejus icarioides missionensis)*	FE	Grassland and coastal scrub with any of host plants *(Lupinus albifrons, L. voriicolor, L. formosus).*	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Myrtle's silverspot *(Speyeriazerene myrtleae)*	FE	Restricted to the foggy, coastal the Point Reyes dunes/hills of Peninsula; extirpated from coastal San Mateo County	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
San Bruno elfin butterfly *(Callophrys mossii bayensis)*	FE	Rocky outcrops within grassland and coastal scrub, with host plant *Sedum spathulifolium.*	Unlikely. No Suitable habitat present.	No further actions are recommended for this species.
Key to status codes: FE Federal Endangered FT Federal Threatened FX Federal Critical Habitat FC Federal Candidate FD Federal De-listed FPD Federal Proposed for De-listing FPT Federal Proposed Threatened NMFS Species under the Jurisdiction of the National Marine Fisheries Service BCC USFWS Birds of Conservation Concern RP Sensitive species included in a USFWS Recovery Plan or Draft Recovery Plan \				

Figure 10
Location of Federal and State Listed Species



Plant (80m)
Plant (specific)
Plant (non-specific)
Plant (circular)
Animal (80m)
Animal (specific)
Animal (non-specific)
Animal (circular)
Terrestrial Comm. (80m)
Terrestrial Comm. (specific)
Terrestrial Comm. (non-specific)
Terrestrial Comm. (circular)
Aquatic Comm. (80m)
Aquatic Comm. (specific)
Aquatic Comm. (non-specific)
Aquatic Comm. (circular)
Multiple (80m)
Multiple (specific)
Multiple (non-specific)
Multiple (circular)
Sensitive EO's (Commercial only)

Author: cnddb_com
Printed from http://bios.dfg.ca.gov

Section 4 – Effects on Species and Habitat

This section describes the potential effects on federally-listed species and habitat as a result of implementing the Proposed Action.

4.1 General Effects

Implementation of the Proposed Action has the potential to cause the following general effects on federally listed species and habitat in the Action Area.

- Increase in Human Activity. The Proposed Action will require construction crews to be working in the Action Area for several months. In addition, construction activities will cause an increase in noise in the Action Area, thereby potentially disturbing non-status species of wildlife causing them to avoid the area. This may indirectly cause reduced viability, as foraging opportunities may temporarily become more limited and/or chances for predation increase.

4.2 Effects to Federally Listed Species and Habitat

This section describes the potential direct, indirect, cumulative, interrelated, and/or interdependent effects the Proposed Project/Action may have to those species identified in Section 3.0 as having a medium or higher potential to occur within the Proposed Project/Action Area. Possible interrelated and interdependent actions to the Proposed Project/Action are also discussed. Potential effects are defined as follows.

- **Direct Effect.** Those effects generated directly from the Proposed Project/Action, such as an incidental take during construction and elimination of suitable habitat due to construction (50CFR 402.02)
- **Indirect Effect.** Those effects that are caused by the Proposed Project/Action and are later in time, such as the discharge of sediment or chemicals that may adversely affect water quality downstream of the Action Area (50 CFR 402.02).
- **Cumulative Effect.** Effects of future state or private activities that are reasonably certain to occur within the Proposed Action Area (50 CFR 402.02).
- **Interrelated Actions.** Those actions that are part of, and dependent upon, a larger action (50 CFR 402.02).
- **Interdependent Actions.** Actions that have no independent utility apart from the Proposed Action (50 CFR 402.02).

The Proposed Project/Action would not have any direct, indirect, cumulative, interrelated actions, and/or interdependent actions that would result in a "take"[1] of federally-listed species during construction and/or operation activities. Summarized below are the potential effects on each identified federally-listed categories of species of concern as identified by USFWS and CDFW.

[1] From Section 3(18) of the Federal Endangered Species Act: "The term '**take**' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

Plants

This section describes the potential direct, indirect, cumulative, interrelated and/or interdependent effects the Proposed Action may have on federally-listed plant species.

Direct and Indirect Effects

The Proposed Action would not have any direct or indirect effects that would result in a "take" of federally-listed plant species during construction and/or operation activities.

Cumulative Effects

The Proposed Project/Action will not have significant cumulative effects on federally-listed plant species. No other known development is currently planned in the Proposed Project/Action Area that would remove or further degrade habitat in the vicinity of Proposed Project/Action Area. In addition, the operations of the Proposed Project/Action would not have any long-term effects to plant species after construction is completed.

Interdependent and Interrelated Effects

The Proposed Project/Action is considered to be an action that has independent utility apart from other Projects in Daly City and/or in the County of San Mateo and would not have any additional adverse interrelated effects on plant species.

Mammals

This section describes the potential direct, indirect, cumulative, interrelated and/or interdependent effects the Proposed Project/Action may have on federally-listed mammal species.

Direct and Indirect Effects

The Proposed Project/Action would not have any direct or indirect effects that would result in a "take" of federally-listed mammal species during construction and/or operation activities.

Cumulative Effects

The Proposed Project/Action would not have significant cumulative effects on federally-listed mammal species. No other known development is currently planned in the Proposed Project/Action Area that would remove or further degrade habitat in the vicinity of Proposed Project/Action Area. In addition, the operations of the Proposed Project/Action would not have any long-term effects to federally-listed mammal species after construction is completed.

Interdependent and Interrelated Effects

The Proposed Project/Action is considered to be an action that has independent utility apart from other Projects in Daly City and/or in the County of San Mateo and would not have any additional adverse interrelated effects on federally-listed mammal species or its supporting habitat.

Birds

This section describes the potential direct, indirect, cumulative, interrelated and/or interdependent effects the Proposed Action may have on federally-listed bird species.

Direct and Indirect Effects

The Proposed Project/Action would be constructed entirely within the District's existing wastewater treatment plant. The Proposed Project/Action would occur in a highly disturbed area and would not have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW and USFWS.

A review of the CDFW's CNDDB and USFWS' Species List and indicates that there is not suitable habitat for special status plant species. However, there are numerous mature trees within and adjacent to the existing reservoirs. Mature trees can serve as perching or nesting sites for migratory birds, including raptors, and construction activities near them could adversely affect breading and/or nesting behavior. These species may occur within the area, which are protected under the U.S. Fish and Wildlife Service, the California Fish and Wildlife Code and/or the Federal Migratory Bird Treaty Act. The Proposed project is scheduled to occur in the spring/summer of 2017 and could extend into the fall of 2020 and into the breeding/nesting season (i.e. through February 1 and August 31). If construction does in fact occur within the breeding/nesting season, the construction activities could have a significant adverse impact on federally-listed special status bird species and/or migratory birds. With the incorporation of the following precautionary mitigation measures and procedures, any potential impacts to special status birds would be minimized and are not expected to have any significant adverse effects on special status bird species:

- **Conduct Breeding Surveys.** For any new construction activities that occur or begin between February 1 and August 31, preconstruction breeding bird surveys shall be conducted by a qualified biologist prior to and within 10 days of any initial construction activities. Surveys shall be conducted within all suitable nesting habitat within 250-feet of the activity. All active, non-status passerine nests identified at that time should be protected by a 50-foot radius minimum exclusion zone. Active raptor, swallow, or special-status species nests should be protected by a buffer with a minimum radius of 200-feet. CDFW and USFWS recommend that a minimum 500-foot exclusion buffer be established around active nests. The following considerations apply to this mitigation measure:

    - Survey results are valid for 14 days from the survey date. Should ground disturbance commence later than 14 days from the survey date, surveys should be repeated. If no breeding birds are encountered, then work may proceed as planned.

    - The non-breeding season is defined as September 1 to January 31. During this period, breeding is not occurring and surveys are not required. However, if nesting birds are encountered during work activities in the non-breeding season, disturbance activities within a minimum of 50-feet of the nest should be postponed until the nest is abandoned or young birds have fledged.

- **Conduct Nesting Surveys.** For any construction activities initiated between March 15 and September 1, surveys for nesting swallow and/or raptors are required within 250-feet of areas of disturbance. If an active nest is found, a qualified biologist shall monitor the nest during construction activities within 250-feet of the nest to determine whether project construction may result in abandonment. The monitor shall continue monitoring the nest until construction within 250-feet of the nest is completed, or until all chicks have completely fledged. If the monitor determines that construction may result in abandonment of the nest, all construction activities within 250-feet should be halted until the nest is abandoned or all young have fledged.

The implementation of the above precautionary measures would further reduce any potential impacts to any special-status bird species associated with the Proposed Action to a further level of less-than-significant.

Cumulative Effects

The Proposed Project/Action would not have significant cumulative effects on federally-listed bird species or its supporting habitat. No other known development is currently planned in the Proposed Project/Action Area that would remove or further degrade habitat in the vicinity of Proposed Project/Action Area. In addition, the operations of the Proposed Project/Action would not have any long-term effects to habitat quality in the region after construction is completed.

Interdependent and Interrelated Effects

The Proposed Project/Action is considered to be an action that has independent utility apart from other Projects in Daly City and/or in the County of San Mateo and would not have any additional adverse interrelated effects on this species or its supporting habitat.

Reptiles

This section describes the potential direct or indirect, indirect, cumulative, interrelated and/or interdependent effects the Proposed Project/Action may have on federally-listed reptile species.

Direct and Indirect Effects

The Proposed Project/Action would not have any direct or indirect actions that would result in a “take” of federally-listed reptile species during construction and/or operation activities.

Cumulative Effects

The Proposed Project/Action would not have significant cumulative effects on these federally-listed reptile species or supporting habitat. No other known development is currently planned in the Proposed Project/Action Area that would remove or further degrade habitat in the vicinity of Proposed Project/Action Area. In addition, the operations of the Proposed Project/Action would not have any long-term effects to federally-listed reptile species in the region after construction is completed.

Interdependent and Interrelated Effects

The Proposed Project/Action is considered to be an action that has independent utility apart from other Projects in Daly City and/or in the County of San Mateo and would not have any additional adverse interrelated effects on these species or supporting habitat.

Amphibians

This section describes the potential direct or indirect, indirect, cumulative, interrelated and/or interdependent effects the Proposed Project/Action may have on federally-listed amphibian species.

Direct and Indirect Effects

The Proposed Project/Action would not have any direct or indirect actions that would result in a "take" of federally-listed amphibian species during construction and/or operation activities.

Cumulative Effects

The Proposed Action would not have significant cumulative effects on these federally-listed amphibian species or supporting habitat. No other known development is currently planned in the Proposed Project/Action Area that would remove or further degrade habitat in the vicinity of Proposed Project/Action Area. In addition, the operations of the Proposed Project/Action would not have any long-term effects to federally-listed amphibian species in the region after construction is completed.

Interdependent and Interrelated Effects

The Proposed Project/Action is considered to be an action that has independent utility apart from other Projects in Daly City and/or in the County of San Mateo and would not have any additional adverse interrelated effects on these federally-listed amphibian species or supporting habitat.

Fish

This section describes the potential direct or indirect, indirect, cumulative, interrelated and/or interdependent effects the Proposed Project/Action may have on federally-listed fish species.

Direct and Indirect Effects

The Proposed Project/Action would not have any direct or indirect actions that would result in a "take" of federally-listed fish species during construction and/or operation activities.

Cumulative Effects

The Proposed Project/Action would not have significant cumulative effects on these federally-listed fish species or supporting habitat. No other known development is currently planned in the Proposed Project/Action Area that would remove or further degrade habitat in the vicinity of Proposed Project/Action Area. In addition, the operations of the Proposed Project/Action would not have any long-term effects to federally-listed fish species in the region after construction is completed.

Interdependent and Interrelated Effects

The Proposed Project/Action is considered to be an action that has independent utility apart from other Projects in Daly City and/or in the County of San Mateo and would not have any additional adverse interrelated effects on these federally-listed fish species or supporting habitat.

Insects

This section describes the potential direct or indirect, indirect, cumulative, interrelated and/or interdependent effects the Proposed Action may have on federally-listed invertebrate species.

Direct and Indirect Effects

The Proposed Project/Action would not have any direct or indirect actions that would result in a "take" of federally-listed invertebrate species during construction and/or operation activities.

Cumulative Effects

The Proposed Project/Action would not have significant cumulative effects on these species or supporting habitat. No other known development is currently planned in the Proposed Project/Action Area that would remove or further degrade habitat in the vicinity of Proposed Project/Action Area. In addition, the operations of the Proposed Project/Action would not have any long-term effects to federally-listed invertebrate species in the region after construction is completed.

Interdependent and Interrelated Effects

The Proposed Project/Action is considered to be an action that has independent utility apart from other Projects in Daly City and/or in the County of San Mateo and would not have any additional adverse interrelated effects on these federally-listed invertebrate species or supporting habitat.

4.3 Waters of the United States, Including Wetlands

The following is a summary of the potential to affect water of the United States, including wetlands.

Seasonal Wetland/Vernal Pools

There are no known seasonal wetlands and/or vernal pools in the Proposed Project/Action Area. As a result, there are no seasonal wetlands and/or vernal pools that would be affected by the Proposed Project/Action.

Other Waters of the U.S.

There are no known "Other Waters of the U.S." in the Proposed Project/Action Area. As a result, there are no "Other Waters of the U.S." that would be affected by the Proposed Project/Action.

Direct and Indirect Effects

The Proposed Project/Action would not have an adverse effect on local creek/drainage crossings that may meet the USACE criteria for Waters of the U.S. and any fill or degradation to these channels could significantly impact water quality or habitat for protected species. Specifically, any activity, which results in the deposit of dredge or fill material within the Ordinary High Water mark of Waters of the U.S. typically requires a permit from the USACE. In addition, the bed and banks of the creeks and drainage channels could also fall under the regulatory authority of the CDFW.

The Proposed Project/Action would not expose and disturb soils, resulting in potential increases in erosion and siltation in the Project area. Construction during the rainy season could result in increases in erosion, siltation, and water quality issues. Generally, excavation, grading, paving, and other construction activities could expose disturbed and loosened soils to erosion by wind and runoff. Construction activities could therefore result in increased erosion and siltation, including nutrient loading and increasing the total suspended solids concentration. Erosion and siltation from construction have the potential to impact the creeks and drainage crossings, therefore posing a potentially significant impact to wetlands and "Other Waters of the U.S." However, the Proposed Project/Action is not in an area where there are wetlands or "Other Water of the U.S.". Further, as described in Section 2 – Project Description, any creek or drainage crossings would be done with trenchless construction methods. As a result, the Proposed Project/Action would not have any direct or indirect effects on wetlands or "Other Waters of the U.S."

Cumulative Effects

The Proposed Project/Action will not have any cumulative effects on riparian habitat and/or jurisdictional wetlands. No other known development is currently planned in the Proposed Project/Action Area that would remove or further degrade riparian habitat and/or jurisdictional wetlands within the vicinity of Proposed Project/Action Area. In addition, the construction and/or operation of the Proposed Project/Action would not have any effects to riparian habitat and/or jurisdictional wetlands in the region.

Interdependent and Interrelated Effects

The Proposed Project/Action is considered to be an action that has independent utility apart from other Projects in Daly City and/or in the County of San Mateo and would not have any adverse interdependent and/or interrelated effects on riparian habitat and/or jurisdictional wetlands.

Section 5 Determination of Effects

This section provides a summary and makes a determination as to the potential for the Proposed Project/Action to affect the federally listed species identified in Section 1.

5.1 No Effect

Through the course of this study and analysis, it is our determination that the Proposed Project/Action will not affect the following species:

Plants

- Beach layia — *Layia carnosa*
- California seablite — *Suaeda californica*
- Franciscan Manzanita — *Arctostaphylos franciscana* (E)
- Presidio Manzanita — *Arctostaphylos montona ssp. Ravenii* (E)
- Robust spineflower — *Chorizanthe robusta var. robusta* (E)
- Rose leptosiphon — *Leptosiphon rosaceus* (E)
- San Francisco lessingia — *Lessingia germanorum* (E)
- Short-Tailed albatross — *Phoebastria (=diomedea) albatrus* (E)
- Two-fork clover or Showy Indian Clover — *Trifolium amoenum* (E)
- White-rayed pentachaeta — *Pentachaeta bellidiflora* (E)

Mammals

- Salt-marsh Harvest Mouse — *Reithrodontomys raviventris* (E)
- Southern Sea otter — *Enhydra lutris nereis* (T)

Birds

- American peregrine falcon — *Falco peregrinus anatum* (P)
- California black rail — *Lateral/usjamaicensis coturniculus* (P)
- California clapper rail — *Rallus longirostris obsoletus* (E)
- California least tern — *Sternula antillarum* (E)
- Western Snowy Plover — *Charadrius alexandrines nivosus* (T)

Amphibians

- California Red-legged frog — *Rana aurora draytonii* (T) (X)

Reptiless

- San Francisco garter snake — *Thomnophis sirtalis tetrataenia* (E) (P)

Fish

- Tidewater goby — *Eucyclogobius newberryi* (E)
- Delta smelt — *Hypomesus transpacificus* (T) (X)
- Steelhead, Central CA Coast /Valley — *Oncorhynchus mykiss* (T) (X)

Insects

- Bay checkerspot butterfly *Euphydryas editha bayensis* (T)
- Callippe silverspot butterfly *Speyeria callippe callippe* (E)
- Mission blue butterfly *Plebejus icarioides missionensis* (E)
- Myrtle's silverspot *Speyeria zerene myrtleae* (E)
- San Bruno elfin butterfly *Callophrys mossii bayensis* (E)

E= Endangered
T=Threatened
P=Proposed
C=Candidate
X=Critical Habitat
PX-Proposed Critical Habitat

Section 6 Bibliography

This section provides a listing of the references and resources used in this report.

- California Natural Diversity Database. 2017. http://www.dfg.ca.gov/biogeodata/cnddb.
- U. S. Fish and Wildlife Service species list database and Wetland Tracker. 2017. http://www.fws.gov/

Attachment A

USFWS Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
FEDERAL BUILDING, 2800 COTTAGE WAY, ROOM W-2605
SACRAMENTO, CA 95825
PHONE: (916)414-6600 FAX: (916)414-6713

Consultation Code: 08ESMF00-2017-SLI-0753 January 06, 2017
Event Code: 08ESMF00-2017-E-01619
Project Name: Daly City Recycled Water Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at:
http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm;
http://www.towerkill.com; and
http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

Official Species List

Provided by:

Sacramento Fish and Wildlife Office
FEDERAL BUILDING
2800 COTTAGE WAY, ROOM W-2605
SACRAMENTO, CA 95825
(916) 414-6600

Consultation Code: 08ESMF00-2017-SLI-0753
Event Code: 08ESMF00-2017-E-01619

Project Type: WASTEWATER PIPELINE

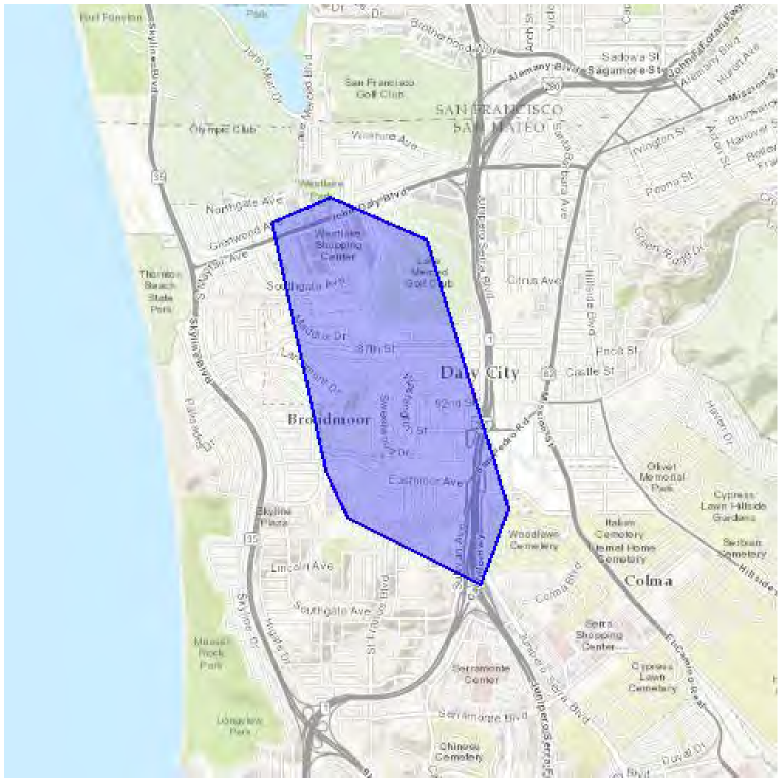
Project Name: Daly City Recycled Water Project
Project Description: Daly City Recycled Water Project

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

United States Department of Interior
Fish and Wildlife Service

Project name: Daly City Recycled Water Project

Project Location Map:



Project Coordinates: MULTIPOLYGON (((-122.4755859375 37.70039243840793, -122.46871948242186 37.68273350145476, -122.47112274169922 37.67784259082313, -122.48210906982423 37.682190082863734, -122.48382568359374 37.68517883584943, -122.48828887939453 37.70147900486174, -122.48348236083984 37.70310882467999, -122.4755859375 37.70039243840793)))

Project Counties: San Mateo, CA

Endangered Species Act Species List

There are a total of 23 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Amphibians	Status	Has Critical Habitat	Condition(s)
California red-legged frog *(Rana draytonii)* Population: Wherever found	Threatened	Final designated	
Birds			
California Clapper rail *(Rallus longirostris obsoletus)* Population: Wherever found	Endangered		
California Least tern *(Sterna antillarum browni)* Population: Wherever found	Endangered		
Marbled murrelet *(Brachyramphus marmoratus)* Population: U.S.A. (CA, OR, WA)	Threatened	Final designated	
Short-Tailed albatross *(Phoebastria (=diomedea) albatrus)* Population: Wherever found	Endangered		
western snowy plover *(Charadrius nivosus ssp. nivosus)* Population: Pacific Coast population DPS-	Threatened	Final designated	

U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast)			
Fishes			
Delta smelt *(Hypomesus transpacificus)* Population: Wherever found	Threatened	Final designated	
steelhead *(Oncorhynchus (=salmo) mykiss)* Population: Northern California DPS	Threatened	Final designated	
Tidewater goby *(Eucyclogobius newberryi)* Population: Wherever found	Endangered	Final designated	
Flowering Plants			
Franciscan manzanita *(Arctostaphylos franciscana)* Population: Wherever found	Endangered	Final designated	
Presidio Manzanita *(Arctostaphylos hookeri var. ravenii)* Population: Wherever found	Endangered		
Robust spineflower *(Chorizanthe robusta var. robusta)* Population: Wherever found	Endangered	Final designated	
San Francisco lessingia *(Lessingia germanorum (=l.g. var. germanorum))* Population: Wherever found	Endangered		
Showy Indian clover *(Trifolium amoenum)* Population: Wherever found	Endangered		

White-Rayed pentachaeta *(Pentachaeta bellidiflora)* Population: Wherever found	Endangered		
Insects			
Bay Checkerspot butterfly *(Euphydryas editha bayensis)* Population: Wherever found	Threatened	Final designated	
Callippe Silverspot butterfly *(Speyeria callippe callippe)* Population: Wherever found	Endangered		
Mission Blue butterfly *(Icaricia icarioides missionensis)* Population: Wherever found	Endangered		
Myrtle's Silverspot butterfly *(Speyeria zerene myrtleae)* Population: Wherever found	Endangered		
San Bruno Elfin butterfly *(Callophrys mossii bayensis)* Population: Wherever found	Endangered		
Mammals			
Salt Marsh Harvest mouse *(Reithrodontomys raviventris)* Population: wherever found	Endangered		
Southern Sea otter *(Enhydra lutris nereis)* Population: Wherever found	Threatened		
Reptiles			
San Francisco Garter snake	Endangered		

(Thamnophis sirtalis tetrataenia) Population: Wherever found			

Critical habitats that lie within your project area

There are no critical habitats within your project area.

Attachment B

CDFW Species List

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (San Francisco South (3712264))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Adela oplerella Opler's longhorn moth	IILEE0G040	None	None	G2	S2	
Allium peninsulare var. franciscanum Franciscan onion	PMLIL021R1	None	None	G5T1	S1	1B.2
Amsinckia lunaris bent-flowered fiddleneck	PDBOR01070	None	None	G2G3	S2S3	1B.2
Arctostaphylos franciscana Franciscan manzanita	PDERI040J3	Endangered	None	G1	S1	1B.1
Arctostaphylos imbricata San Bruno Mountain manzanita	PDERI040L0	None	Endangered	G1	S1	1B.1
Arctostaphylos montana ssp. ravenii Presidio manzanita	PDERI040J2	Endangered	Endangered	G3T1	S1	1B.1
Arctostaphylos montaraensis Montara manzanita	PDERI042W0	None	None	G1	S1	1B.2
Arctostaphylos pacifica Pacific manzanita	PDERI040Z0	None	Endangered	G1	S1	1B.2
Astragalus tener var. tener alkali milk-vetch	PDFAB0F8R1	None	None	G2T2	S2	1B.2
Banksula incredula incredible harvestman	ILARA14100	None	None	G1	S1	
Bombus caliginosus obscure bumble bee	IIHYM24380	None	None	G4?	S1S2	
Bombus occidentalis western bumble bee	IIHYM24250	None	None	G2G3	S1	
Caecidotea tomalensis Tomales isopod	ICMAL01220	None	None	G2	S2S3	
Callophrys mossii bayensis San Bruno elfin butterfly	IILEPE2202	Endangered	None	G4T1	S1	
Carex comosa bristly sedge	PMCYP032Y0	None	None	G5	S2	2B.1
Chorizanthe cuspidata var. cuspidata San Francisco Bay spineflower	PDPGN04081	None	None	G2T1	S1	1B.2
Chorizanthe robusta var. robusta robust spineflower	PDPGN040Q2	Endangered	None	G2T1	S1	1B.1
Cicindela hirticollis gravida sandy beach tiger beetle	IICOL02101	None	None	G5T2	S2	
Cirsium andrewsii Franciscan thistle	PDAST2E050	None	None	G3	S3	1B.2
Cirsium occidentale var. compactum compact cobwebby thistle	PDAST2E1Z1	None	None	G3G4T1	S1	1B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Collinsia corymbosa round-headed Chinese-houses	PDSCR0H060	None	None	G1	S1	1B.2
Collinsia multicolor San Francisco collinsia	PDSCR0H0B0	None	None	G2	S2	1B.2
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	None	G3G4	S2	SSC
Dufourea stagei Stage's dufourine bee	IIHYM22010	None	None	G1G2	S1?	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Eucyclogobius newberryi tidewater goby	AFCQN04010	Endangered	None	G3	S3	SSC
Euphydryas editha bayensis Bay checkerspot butterfly	IILEPK4055	Threatened	None	G5T1	S1	
Falco peregrinus anatum American peregrine falcon	ABNKD06071	Delisted	Delisted	G4T4	S3S4	FP
Fritillaria liliacea fragrant fritillary	PMLIL0V0C0	None	None	G2	S2	1B.2
Geothlypis trichas sinuosa saltmarsh common yellowthroat	ABPBX1201A	None	None	G5T3	S3	SSC
Gilia capitata ssp. chamissonis blue coast gilia	PDPLM040B3	None	None	G5T2	S2	1B.1
Gilia millefoliata dark-eyed gilia	PDPLM04130	None	None	G2	S2	1B.2
Grindelia hirsutula var. maritima San Francisco gumplant	PDAST470D3	None	None	G5T1Q	S1	3.2
Helianthella castanea Diablo helianthella	PDAST4M020	None	None	G2	S2	1B.2
Hemizonia congesta ssp. congesta congested-headed hayfield tarplant	PDAST4R065	None	None	G5T1T2	S1S2	1B.2
Hesperevax sparsiflora var. brevifolia short-leaved evax	PDASTE5011	None	None	G4T3	S2	1B.2
Heteranthera dubia water star-grass	PMPON03010	None	None	G5	S2	2B.2
Horkelia cuneata var. sericea Kellogg's horkelia	PDROS0W043	None	None	G4T1?	S1?	1B.1
Horkelia marinensis Point Reyes horkelia	PDROS0W0B0	None	None	G2	S2	1B.2
Hydroporus leechi Leech's skyline diving beetle	IICOL55040	None	None	G1?	S1?	
Ischnura gemina San Francisco forktail damselfly	IIODO72010	None	None	G2	S2	

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Lasiurus cinereus hoary bat	AMACC05030	None	None	G5	S4	
Laterallus jamaicensis coturniculus California black rail	ABNME03041	None	Threatened	G3G4T1	S1	FP
Layia carnosa beach layia	PDAST5N010	Endangered	Endangered	G2	S2	1B.1
Leptosiphon rosaceus rose leptosiphon	PDPLM09180	None	None	G1	S1	1B.1
Lessingia germanorum San Francisco lessingia	PDAST5S010	Endangered	Endangered	G1	S1	1B.1
Lichnanthe ursina bumblebee scarab beetle	IICOL67020	None	None	G2	S2	
Malacothamnus arcuatus arcuate bush-mallow	PDMAL0Q0E0	None	None	G2Q	S2	1B.2
Melospiza melodia pusillula Alameda song sparrow	ABPBXA301S	None	None	G5T2?	S2S3	SSC
Monardella sinuata ssp. nigrescens northern curly-leaved monardella	PDLAM18162	None	None	G3T2	S2	1B.2
Mylopharodon conocephalus hardhead	AFCJB25010	None	None	G3	S3	SSC
Pentachaeta bellidiflora white-rayed pentachaeta	PDAST6X030	Endangered	Endangered	G1	S1	1B.1
Phalacrocorax auritus double-crested cormorant	ABNFD01020	None	None	G5	S4	WL
Plagiobothrys chorisianus var. chorisianus Choris' popcornflower	PDBOR0V061	None	None	G3T2Q	S2	1B.2
Plebejus icarioides missionensis Mission blue butterfly	IILEPG801A	Endangered	None	G5T1	S1	
Rallus longirostris obsoletus California clapper rail	ABNME05016	Endangered	Endangered	G5T1	S1	FP
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Riparia riparia bank swallow	ABPAU08010	None	Threatened	G5	S2	
Sanicula maritima adobe sanicle	PDAPI1Z0D0	None	Rare	G2	S2	1B.1
Silene verecunda ssp. verecunda San Francisco campion	PDCAR0U213	None	None	G5T2	S2	1B.2
Speyeria callippe callippe callippe silverspot butterfly	IILEPJ6091	Endangered	None	G5T1	S1	
Spirinchus thaleichthys longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	SSC

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Suaeda californica California seablite	PDCHE0P020	Endangered	None	G1	S1	1B.1
Thamnophis sirtalis tetrataenia San Francisco gartersnake	ARADB3613B	Endangered	Endangered	G5T2Q	S2	FP
Trachusa gummifera San Francisco Bay Area leaf-cutter bee	IIHYM80010	None	None	G1	S1	
Trifolium amoenum two-fork clover	PDFAB40040	Endangered	None	G1	S1	1B.1
Triphysaria floribunda San Francisco owl's-clover	PDSCR2T010	None	None	G2?	S2?	1B.2
Triquetrella californica coastal triquetrella	NBMUS7S010	None	None	G2	S2	1B.2

Record Count: 68

Appendix D

Section 106 Cultural Resources Investigation Report

Section 106
Cultural Resources Investigation Report
Daly City Expanded Tertiary Recycled Water Project

Prepared by:

SMB Environmental, Inc.

July 2017

Table of Contents

List of Figures

List of Tables

Section 1 - Introduction

This document is a cultural resources inventory study on the City of Daly City's (City) proposed Expanded Tertiary Recycled Water Project (Proposed Project/Action) in San Mateo County, California. This report presents the project location and background, Proposed Description/Action, area of potential effect, environmental setting, regulatory framework, and the investigation methods and results of the cultural resources investigation for the Proposed Project/Action.

The term "cultural resources" encompasses historic, archaeological, and paleontological resources, and burial sites. Below is a brief summary of each component:

- **Historic Resources:** Historic resources are associated with the recent past. In California, historic resources are typically associated with the Spanish, Mexican, and American periods in the State's history and are generally less than 200 years old.

- **Archaeological Resources:** Archaeology is the study of prehistoric human activities and cultures. Archaeological resources are generally associated with indigenous cultures.

- **Burial Sites:** Burial sites are formal or informal locations where human remains, usually associated with indigenous cultures, are interred.

This study was conducted in order to identify cultural resources that include prehistoric and historic archeological resources, buildings, structures, and sites of religious or cultural significance for Native Americans within the proposed project area. Because the Proposed Project/Action may involve the use of State Revolving Loan Program and/or federal funds, this investigation was conducted in compliance with Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations (36 Code of Federal Register [CFR] Part 800).

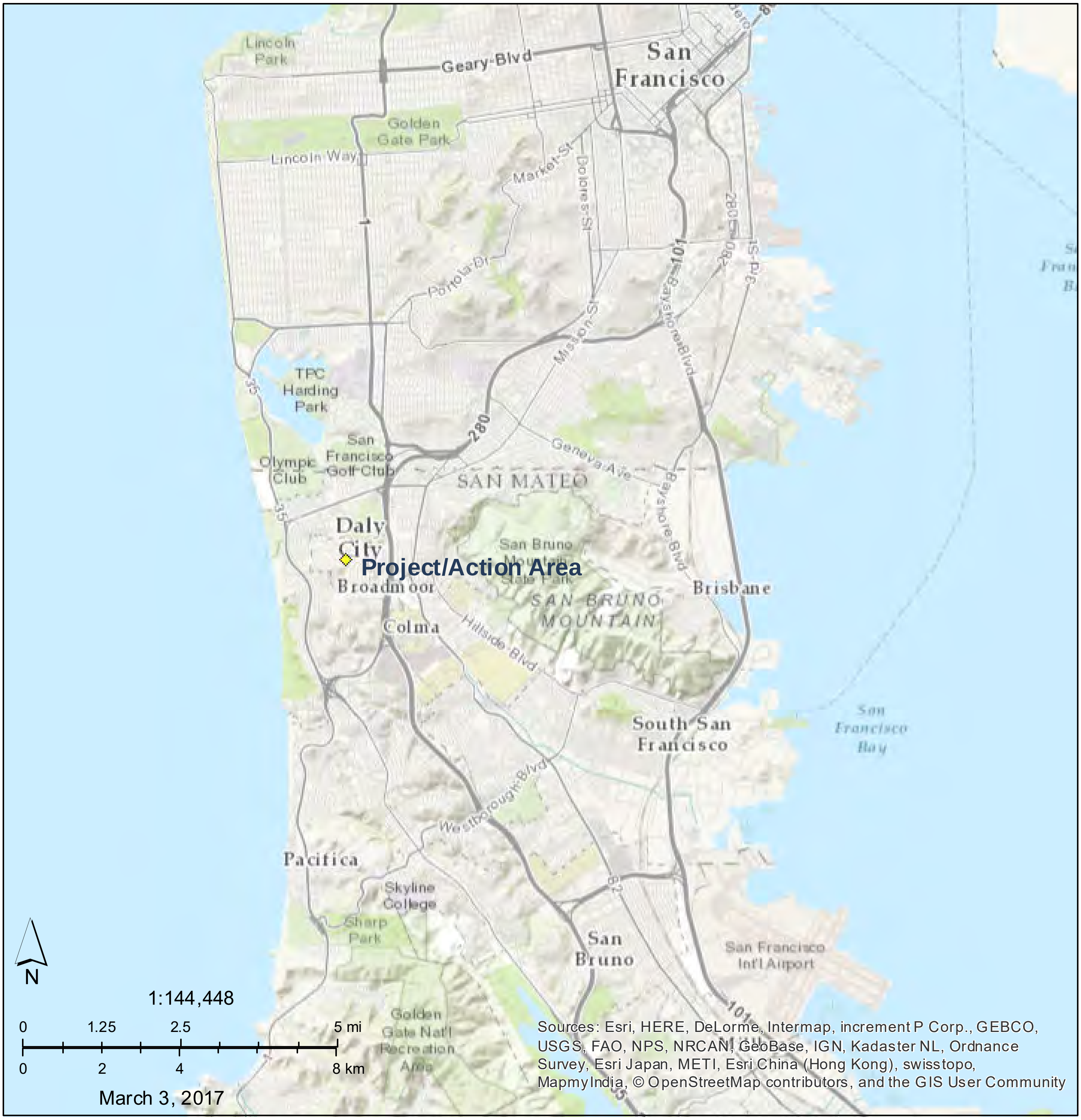
1.1 Project Location and Background

The City of Daly City (City) is a city of 108,383 people in northern San Mateo County, adjacent to the City and County of San Francisco, on the Pacific Ocean and just minutes away from San Francisco Bay. This enviable location inspired the nickname "Gateway to the Peninsula." Figure 1 illustrates the project location.

The San Francisco Public Utilities Commission (SFPUC) serves the San Francisco and Daly City area with surface water from the Hetch-Hetchy system. Daly City operates its own water system in which well water is blended with surface water supplied by the SFPUC. Beginning in 2017, groundwater wells within Daly City withdraw water from the Westside Groundwater Basin for potable water use in all years (San Francisco Groundwater Project). The Westside Basin is also being examined by the SFPUC as an emergency water supply during drought conditions. Due to common interest in reducing reliance on the Westside Basin, both the City and SFPUC have partnered to commission this Project.

The Project would expand the Daly City recycled water system to supply irrigation water to customers in Daly City, the Town of Colma, and South San Francisco. Recycled water would be used for landscape irrigation at cemeteries, parks, schools, and a golf course driving range. The customers currently use

Figure 1
General Location Map



Author: cnddb_com
Printed from http://bios.dfg.ca.gov

potable water from Cal Water, potable supply from Daly City, or groundwater from private wells. The Proposed Project would supply approximately 1,200 acre-feet per year (AFY) of recycled water.

1.2 Purpose and Need

The City is conducting a preliminary design of the Expanded Tertiary Recycled Water Project. The City operates an existing tertiary treatment facility with a permitted capacity of 2.77 million gallons per day (mgd). This Proposed Project/Action would add a new tertiary treatment process to provide an additional 3.0 mgd of tertiary treatment capacity during the irrigation season. The average yearly capacity of the system is 1.25 mgd or 1,400 acre-feet per year (afy) because the system will only operate during the irrigation season. The new treatment processes would include pressure membrane filtration followed by ultraviolet (UV) disinfection due to the small site constraints. New pipelines, pump stations and offsite storage would be constructed to complete the recycled water distribution system, delivering water to new customers for irrigation purposes in lieu of groundwater pumping. The purpose of the Proposed Project/Action is to:

- Reduce irrigation reliance on the groundwater basin;
- Provide local, sustainable, and drought-proof water supply; and
- Preserve available groundwater supplies for drinking water.

Section 2 - Proposed Action Description

The City is s conducting a preliminary design of the Expanded Tertiary Recycled Water Project. The goal of the project is to produce approximately 1,400 afy of recycled water to: reduce irrigation reliance on the groundwater basin; provide local, sustainable, and drought-proof water supply; and preserve available groundwater supplies for drinking water. The Proposed Project includes the following major components, which are described in further detail in the following sections:

- Daly City Wastewater Treatment Plant (WWTP) Expansion
- Recycled Water Conveyance System

2.1 Daly City Wastewater Treatment Plant Expansion

The Daly City WWTP is located at 153 Lake Merced Boulevard, Daly City, California, 94015. The WWTP is owned and operated by the North San Mateo County Sanitation District, a subsidiary of the City of Daly City. The Proposed Project/Action components for the Daly City WWTP expansion are listed below.

- Construction of a two-story tertiary treatment building located at Daly City's WWTP site. The facility would be located near the plant entrance and is approximately 82-feet by 41-feet and approximately 40-feet high. The final building size would be confirmed in final design.

- Construction of new electrical building located on vacant land owned by Daly City near the existing WWTP entrance. The electrical building size is approximately 40-feet by 25-feet and approximately 15-feet high. The final building size would be confirmed during final design.

- Construction of a new chemical and neutralization area, which is located inside the Daly City Wastewater Treatment Plant would be approximately 20-feet by 70-feet.

- Relocation of an existing surge tank and other facilities.

Figure 2 shows the location of the Project components described above.

2.2 Recycled Water Conveyance/Distribution System

The other major component of the Project is the recycled water conveyance system consisting of pipelines, pumps, and a 2.41 million gallon storage tank. The purpose of the conveyance system is to deliver water from the Daly City WWTP to the customers. The conveyance system includes a 14-inch diameter pipeline from the Daly City WWTP to a recycled water storage tank located in Colma. The pipeline would be installed in streets within Daly City, the Town of Colma, Broadmoor, South San Francisco, and pipeline easements owned by the SFPUC.

The distribution system, which delivers recycled water from the storage tank site to the customers in Colma and South San Francisco, is 4-inches to 18-inches in size. The customer service laterals, 1-inch to 4-inches in diameter size, would be installed along public roads and/or the private property of the recycled water customers.

There are three sites under consideration for the recycled water storage tank. This project description

Project Facilities

Feet
0 25 50

TREATMENT PLANT EXPANSION FACILITIES
FIGURE 2
DALY CITY / SFPUC
FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo

summarizes three different minor variations of the pipeline alignment because the tank location is not finalized. Figure 3 shows all of the pipeline alignments under consideration. It is important to note that although there are three different pipeline alignments, the roads affected by all three alignments would be fairly similar. The minor difference lies in the pipeline alignment for one of the customer service laterals. The facilities associated with each alignment are summarized in the following subsections. The three tank sites described below are referred to by their current ownership names.

2.2.1 Storage Tank at the Atwood Property

This alternative storage tank site assumes the storage tank would be located at the intersection of State Highway 82 and Olivet Parkway and would be approximately 200-feet long by 55-feet wide by 30-feet high and installed underground. The depth of excavation would be approximately 40-feet deep. The Atwood Property is adjacent to a Bay Area Rapid Transit (BART) underground rail line.

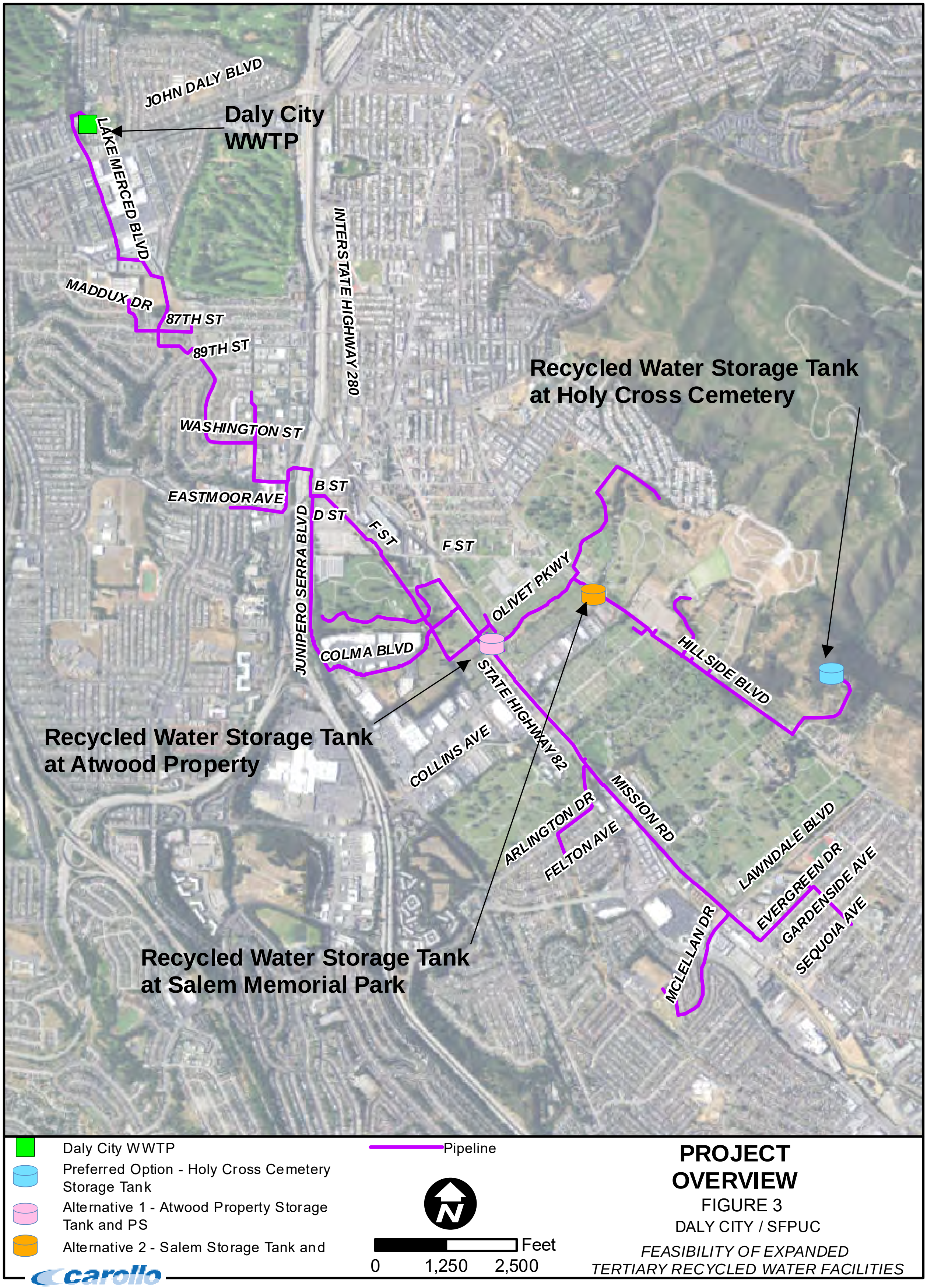
Recycled water would be pumped from the Daly City WWTP to the storage tank at the Atwood Property and then pumped to customers located in Colma and South San Francisco. The pump station building at the Atwood Property would be approximately 40-feet by 50-feet and above grade and approximately 20-feet high. The facility sizing will be finalized during Final Design. Figure 4 presents an overview of the conveyance system to/from the Atwood Property. Figure 5 presents an overview of the storage tank at the Atwood Property.

Table 1 presents a summary of the pipeline lengths for the Atwood property tank site alternative. From the WWTP to I-280, the new 14-inch transmission main would be installed in public streets owned by Daly City and/or San Mateo County. There are also customer service laterals along this section of the transmission main. In order to cross I-280, an existing 16-inch pipe located on a utility bridge maintained by the California Department of Transportation (Caltrans) would be utilized. The 16-inch pipe is owned by Daly City and not in service. From I-280 to State Highway 82, the 14-inch transmission main would be installed in either SFPUC owned property or along Junipero Serra Boulevard and Colma Boulevard. The 14-inch transmission main would eventually need to cross State Highway 82, which is owned by Caltrans, and a BART underground rail line to reach the storage tank. From the storage tank, the distribution system would deliver pumped water to the customers in Colma and South San Francisco. The distribution system crosses three BART underground rail lines.

Table 1
Conveyance System Pipe Lengths for Tank at Atwood Property
Expanded Tertiary Recycled Water Project

Description	Pipe Sizes (Inches)[1]	Length (Feet)
Transmission Main from WWTP to Storage Tank	14	16,345[2]
Pipe Bridge	16	320
Customer Laterals Along Transmission Main	1.5 - 4	4,160
Distribution System	4 - 18	20,865
Customer Laterals Along Distribution System	1 - 14	15,280
Total		**56,970**

1) Pipe sizes will be finalized in the Final Design.
2) This assumes the transmission main is installed on SFPUC land. If the pipeline is installed through Junipero Serra Boulevard and Colma Boulevard, the length is 18,331 ft.

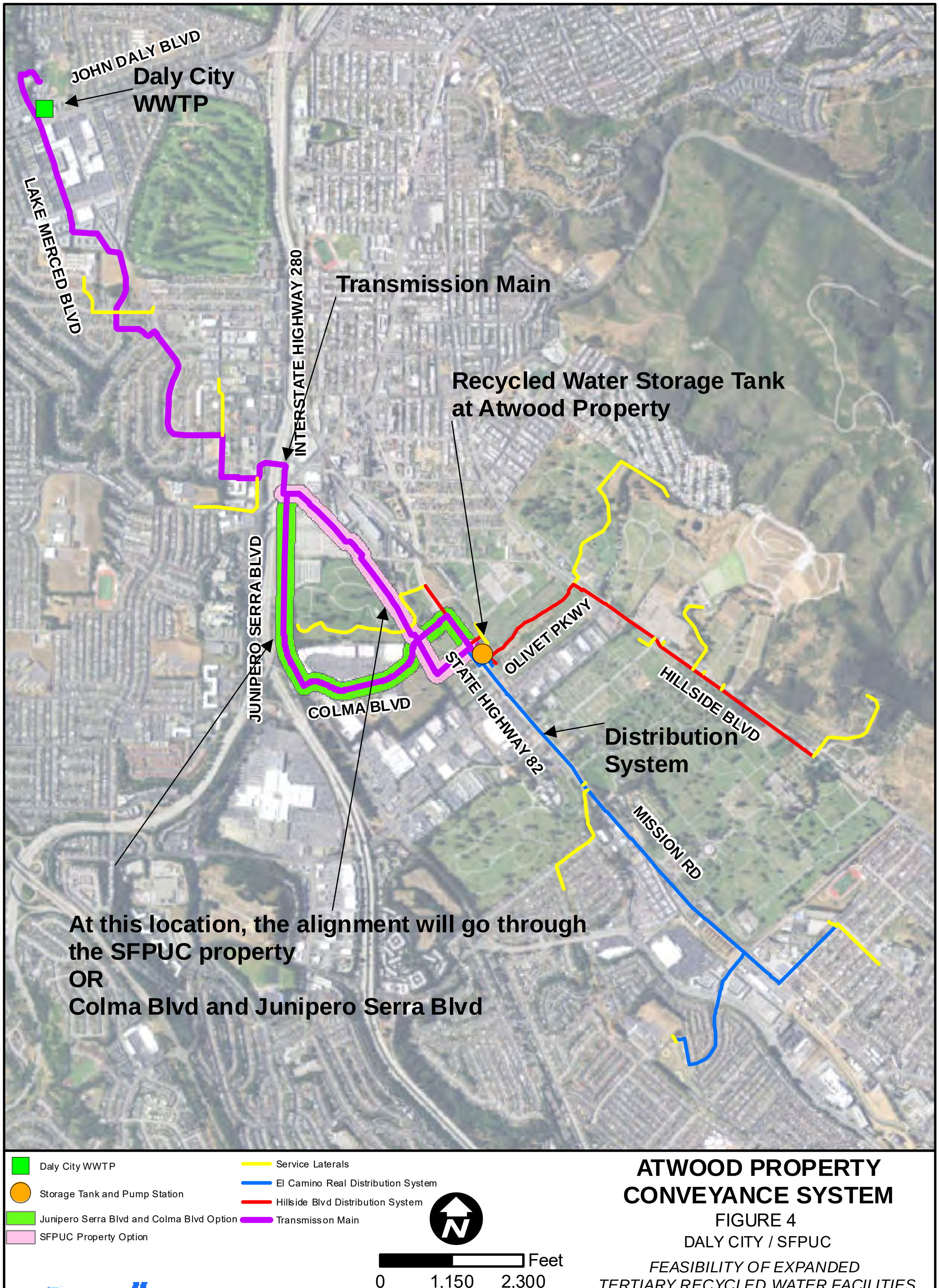


PROJECT OVERVIEW

FIGURE 3

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES



ATWOOD PROPERTY CONVEYANCE SYSTEM

FIGURE 4

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo

ATWOOD PROPERTY STORAGE TANK SITE

FIGURE 5

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

2.2.2 Storage Tank at the Salem Memorial Park Property

This alternative storage tank site assumes the storage tank would be located at vacant land at the intersection of Hillside Boulevard and Serramonte Boulevard, referred to herein as the Salem Memorial Park Property. Recycled water would be pumped from the WWTP to an underground storage tank, measuring approximately 115-feet long by 40-feet wide by 70-feet high; these dimensions assume the Lucky Chances parking lot cannot be used as a construction staging area. If the parking lot can be used as a staging area, the tank can be made shallower (dimensions of 145-feet long by 70-feet long by 33-feet high). The vacant land is adjacent to grave sites and a parking lot being used by the Lucky Chances Casino. From the Salem Memorial Park Property, the recycled water would be pumped to customers located in Colma and South San Francisco. The pump station building at the Salem Memorial Park Property would measure approximately 40-feet by 50-feet and would be aboveground, approximately 20-feet high. All facility sizing would be finalized during Final Design. Figure 6 presents an overview of the conveyance system to/from the Salem Memorial Park Property. Figure 7 presents an overview of the storage tank at the Salem Memorial Park Property.

Table 2 presents a summary of the pipeline lengths for the Salem Memorial Park property tank site alternative. From the WWTP to I-280, the new 14-inch transmission main would be installed in public streets owned by Daly City and/or San Mateo County; there are also customer service laterals along this section of the transmission main. In order to cross I-280, an existing 16-inch pipe located on a utility bridge maintained by the California Department of Transportation (Caltrans) would be utilized. The 16-inch pipe is owned by Daly City and not in service. From I-280 to State Highway 82, the 14-inch transmission main would be installed in either SFPUC owned property or along Junipero Serra Boulevard and Colma Boulevard. The 14-inch transmission main would eventually need to cross State Highway 82, which is owned by Caltrans, and a BART underground rail line to reach the storage tank. From the storage tank, the distribution system would deliver pumped water to the customers in Colma and South San Francisco. The distribution system crosses three BART underground rail lines.

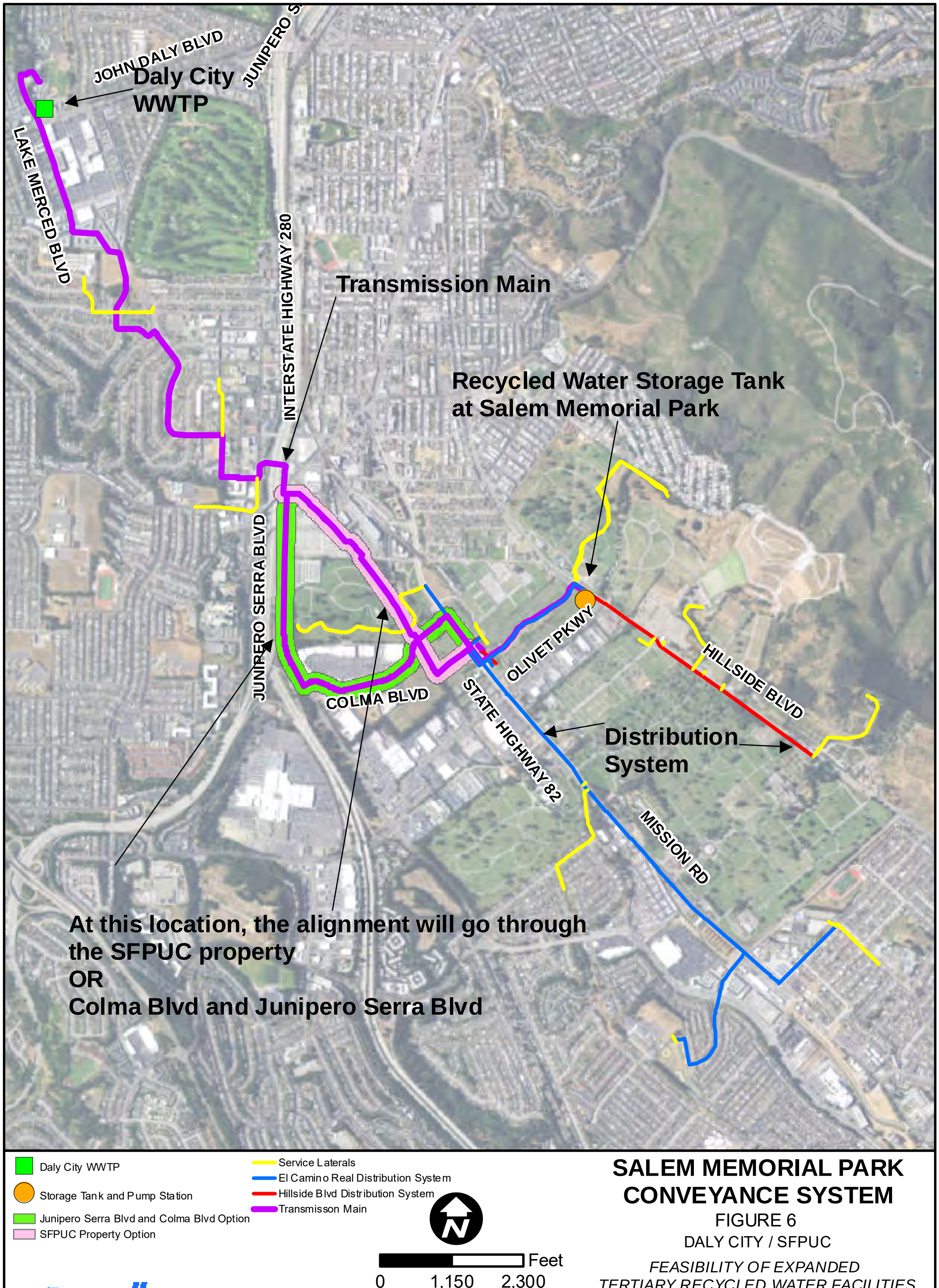
Table 2
Conveyance System Pipe Lengths for Tank at Salem Memorial Park Property
Expanded Tertiary Recycled Water Project

Description	Pipe Sizes (Inches)[1]	Length (Feet)
Transmission Main from WWTP to Storage Tank	14	16,070[2]
Pipe Bridge	16	320
Customer Laterals Along Transmission Main	1.5 - 4	4,160
Distribution System	4 - 16	22,950
Customer Laterals Along Distribution System	1 - 14	15,260
Total		**58,760**

1) Pipe sizes will be finalized in the Final Design
2) This assumes the transmission main is installed on SFPUC land. If the pipeline is installed through Junipero Serra Boulevard and Colma Boulevard, the length is 18,056.

2.2.3 Storage Tank at the Holy Cross Cemetery Property

This preferred option assumes the storage tank is located at vacant land at the Holy Cross Cemetery property at Hillside Boulevard. Recycled Water would be pumped from the WWTP to an aboveground storage tank, measuring approximately 118.5-foot diameter and 30-feet high located on a hill on Hillside Boulevard. From the Holy Cross Cemetery property, the recycled water would gravity flow to customers



SALEM MEMORIAL PARK CONVEYANCE SYSTEM

FIGURE 6

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo

Storage Tank
Pump Station
Salem Parcel
Vacant Land

Feet
0 40 80

SALEM MEMORIAL PARK STORAGE TANK SITE

FIGURE 7

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo

located in Colma and South San Francisco. A pump station would not be required for this alternative. All facility sizing would be finalized during Final Design. Figure 8 presents an overview of the conveyance system to/from the Holy Cross Cemetery property. Figure 9 presents an overview of the storage tank at the Holy Cross Cemetery property.

Table 3 presents a summary of the pipeline lengths for the Holy Cross property tank site alternative. From the WWTP to I-280, the new 14-inch transmission main would be installed in public streets owned by Daly City and/or San Mateo County; there are also customer service laterals along this section of the transmission main. In order to cross I-280, an existing 16-inch pipe located on a utility bridge maintained by the California Department of Transportation (Caltrans) would be utilized. The 16-inch pipe is owned by Daly City and not in service. From I-280 to State Highway 82, the 14-inch transmission main would be installed in either SFPUC owned property or along Junipero Serra Boulevard and Colma Boulevard. The 14-inch transmission main would eventually need to cross State Highway 82, which is owned by Caltrans, and a BART underground rail line to reach the storage tank. From the storage tank, the distribution system would deliver recycled water by gravity to the customers in Colma and South San Francisco. The distribution system crosses three BART underground rail lines.

Table 3
Conveyance System Pipe Lengths for Tank at Holy Cross Cemetery
Expanded Tertiary Recycled Water Project

Description	Pipe Sizes (Inches)[1]	Length (Feet)
Transmission Main from WWTP to Storage Tank	14	16,315[2]
Pipe Bridge	16	320
Customer Laterals Along Transmission Main	1.5 - 4	4,160
Distribution System	4 - 18	20,040
Customer Laterals Along Distribution System	1 - 14	12,360
Total		**53,195**

1) Pipe sizes will be finalized in the Final Design.
2) This assumes the transmission main is installed on SFPUC land. If the pipeline is installed through Junipero Serra Boulevard and Colma Boulevard, the length is 18,301.

2.2 Project Construction

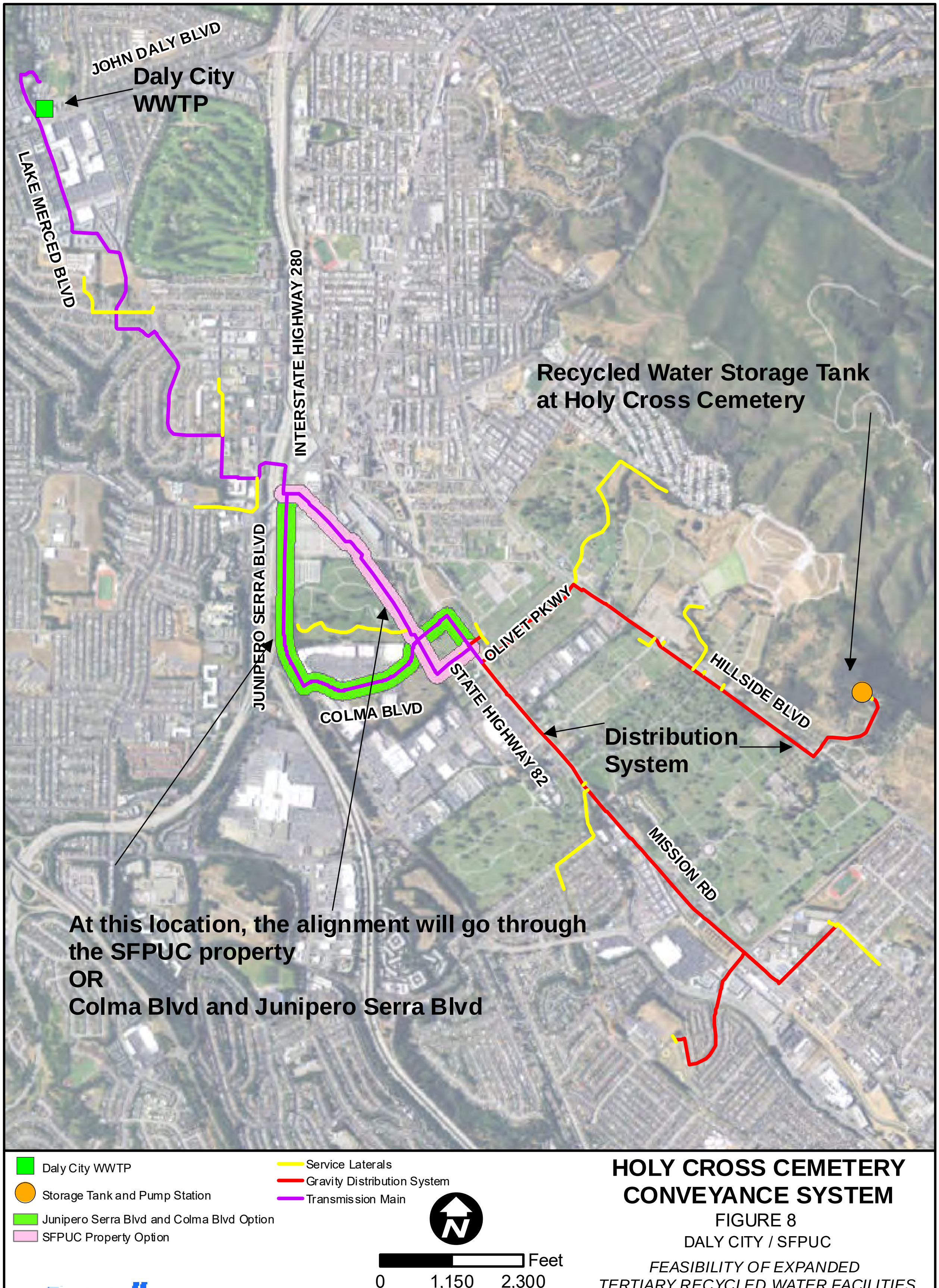
This section describes the construction activities associated with the Proposed Project's major components.

2.2.1 Daly City WWTP Expansion

The Project components located at the Daly City WWTP include a tertiary treatment building, an electrical building, a surge tank, and a chemical and neutralization area. Typical construction activities include excavation, shoring, treatment process and electrical buildings construction, installation of treatment process equipment, testing, commissioning, and startup. Depending on the groundwater levels found during the geotechnical investigation and construction, excavations may require an excavation dewatering system. The dewatering system will be installed during construction to lower the groundwater below the excavated area. The groundwater will be disposed of according to local laws and regulations.

2.2.2 Conveyance Pipelines and Storage Tank

The majority of the new conveyance pipeline system would be installed using open trench methods in



HOLY CROSS CEMETERY CONVEYANCE SYSTEM

FIGURE 8

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

HOLY CROSS CEMETERY STORAGE TANK SITE

FIGURE 9

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

carollo

streets and public right-of-ways. Typical construction activities include pavement-cutting, excavation, pipeline installation, backfill and pavement repair. The typical trench size is expected to be 4-feet wide and 8-feet deep and trench shoring designed according to Occupational Safety and Health Administration (OSHA) requirements would be used in excavations deeper than 5-feet.

The project may include trenchless installation of the pipeline to cross certain areas. A commonly used trenchless installation method involves jack-and bore construction. Jack-and-bore construction involves digging a jacking pit, typically 35-feet by 12-feet, and a receiving pit, typically 10-feet by 10-feet. The jack and bore pits would be approximately 30-feet deep. Then, a boring machine will be used to simultaneously cut through the soil with an auger, and push a casing pipe into the soil. The pipe carrying the recycled water will eventually be installed through the casing pipe. Staging areas will be at the WWTP and at the selected storage tank site.

2.2.3 Construction Duration

It is anticipated that construction would begin in 2019 and last for approximately 24 months. The project would be constructed during normal working hours 8 AM - 5 PM Monday through Friday. However, it may be necessary for the Contractor to work night and/or weekends if required to meet critical schedule deadlines, or accelerate the schedule. It is estimated that 3 crews of approximately 12 workers each (i.e. 36 construction workers) would be required.

2.3 Facility Operations and Maintenance

The recycled water treatment and conveyance system will be operated by Daly City operations and maintenance staff. The system will operate 24 hours per day and 7 days per week and produce an average of 1,400 afy. It is anticipated that the irrigation schedule for all the users will occur 8 hours a day, from 9 PM to 5 AM. Operation and maintenance of the proposed facilities are not anticipated to increase the number of permanent workers or employees.

2.4 Compliance with CCR Title 22 and State Board's Recycled Water Policy

The Proposed Project/Action will be designed and operated in accordance with the applicable requirements of CCR Title 22 and any other state or local legislation that is currently effective or may become effective as it pertains to recycled water. The State Board adopted a Recycled Water Policy (RW Policy) in 2009 to establish more uniform requirements for water recycling throughout the State and to streamline the permit application process in most instances. As part of that process, the State Board prepared an Initial Study and Mitigated Negative Declaration for the use of recycled water. The newly adopted RW Policy includes a mandate that the State increase the use of recycled water over 2002 levels by at least 1,000,000 AFY by 2020 and by at least 2,000,000 AFY by 2030. Also included are goals for storm water reuse, conservation and potable water offsets by recycled water. The onus for achieving these mandates and goals is placed both on recycled water purveyors and potential users. The State Board has designated the Regional Water Quality Control Boards as the regulating entities for the Recycled Water Policy. In this case, the San Francisco Bay Regional Water Quality Control Board (San Francisco RWQCB) is responsible for permitting recycled water projects throughout the San Francisco Bay Area, including the City of Daly City

The Proposed Project/Action will provide high quality unrestricted use tertiary treated recycled water and make it available to users within the City. All irrigation systems will be operated in accordance with the requirements of Title 22 of the CCR, the State Board Recycled Water Policy, and any other local legislation that is effective or may become effective as it pertains to recycled water and any reclamation permits issued by the San Francisco RWQCB. Reclamation permits typically require the following:

- Irrigation rates will match the agronomic rates of the plants being irrigated;
- Control of incidental runoff through the proper design of irrigation facilities;
- Implementation of a leak detection program to correct problems within 72 hours or prior to the release of 1,000 gallons whichever occurs first;
- Management of ponds containing recycled water to ensure no discharges; and
- Irrigation will not occur within 50 feet of any domestic supply wells, unless certain conditions have been met as defined in Title 22.

2.4 Area of Potential Effect

The Area of Potential Effect (APE) for the Proposed Project/Action is defined as “the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of cultural resources as defined above. Trenching for installing the recycled water pipelines would typically require a width of four feet and a vertical depth of approximately eight feet; therefore the vertical APE would be typically eight feet. For this Proposed Project/Action, a vertical APE of eight feet and a horizontal APE of 12-foot wide corridor (6-foot from centerline) would be assumed to accommodate for areas for staging and spoils along the pipeline alignment(s). If either the Atwood Property Storage Tank or the Salem Memorial Park Storage Tank is selected, the vertical APE for that area would be up to 50-feet below ground surface elevation due to the fact that they would be installed underground.

Section 3 – Environmental Setting

This section presents the environmental setting and impact assessment for cultural resources. Cultural resources are defined as prehistoric and historic sites, structures, and districts, or any other physical evidence associated with human activity considered important to a culture, a subculture, or a community or scientific, traditional, religious, or any other reason. For analysis purposes, cultural resources may be categorized into three groups: archaeological resources, historic resources, and contemporary Native American resources.

Archaeological resources are places where human activity has measurably altered the earth or left deposits of physical remains. Archaeological resources may be either prehistoric (before the introduction of writing in a particular area) or historic (after the introduction of writing). The majority of such places in this region are associated with either Native American or Euro American occupation of the area. The most frequently encountered prehistoric and early historic Native American archaeological sites are village settlements with residential areas and sometimes cemeteries; temporary camps where food and raw materials were collected; smaller, briefly occupied sites where tools were manufactured or repaired; and special-use areas like caves, rock shelters, and sites of rock art. Historic archaeological sites may include foundations or features such as privies, corrals, and trash dumps.

Historic resources are standing structures of historic or aesthetic significance that are generally 50 years of age or older (i.e., anything built in the year 1955 or before). In California, historic resources considered for protection tend to focus on architectural sites dating from the Spanish Period (1529-1822) through the early years of the Depression (1929-1930). Historic resources are often associated with archaeological deposits of the same age.

Contemporary Native American resources, also called ethnographic resources, can include archaeological resources, rock art, and the prominent topographical areas, features, habitats, plants, animals, and minerals that contemporary Native Americans value and consider essential for the preservation of their traditional values.

The following cultural, historical, and ethnographic baseline information is extracted from an overview document prepared by the Northwest Information Center at Sonoma State University, as well as information provided by the City of Daly City.

3.1 Regional Setting

This section summarizes the historical and archeological setting in the Project Area, and provides the essential background pertaining to these resources.

3.1.1 Physical Setting

The City of Daly City is located in the northwest corner of San Mateo County. It shares a border with the City and County of San Francisco to the north, Pacifica to the south, and South San Francisco, Colma, and Brisbane to the east. To the west of the city lies the Pacific Ocean. The city is urbanized with a variety of residential, commercial, and institutional land uses and has varying topography ranging from relatively flat in the northwest to steep hills in the south, northeast, and along the coast. A number of open space areas are also located in the city, with the majority located along the coast.

3.1.2 Prehistoric Context

The first survey of archeological sites in the San Francisco Bay region was led by N.C. Nelson for the University of California at Berkeley between 1906 and 1908, documenting 425 shell mounds throughout the region. These shell mounds typified Bay Area archeology and reflected its economic unity, which relied greatly on marine resources. Cultural materials discovered at the University Village Complex (SMA-277) in San Mateo County indicate that the San Francisco Peninsula Region was inhabited between circa 3,500 and 2,500 B.C. Excavation and analysis of that site showed that the complex is earlier than “middle Horizon,” yet unlike “Early Horizon” deposits, which led excavators to believe that a pre-Costanoan or Early Bay culture once existed.[1]

3.1.3 Native American Period

The Ohlone Indian Tribe inhabited a large area along the California Coast, running from the San Francisco Bay Area to Monterey Bay. The tribelet, which inhabited the Daly City area, lived primarily in two main inland villages located on the Colma and San Bruno Creeks and a seasonal village along the coast at Mussel Rock. The Ohlones were a small and very mobile tribe of hunters and gatherers that travelled to find food and other items that were available only in certain areas on the Peninsula. The Ohlone hunted deer, rabbits, fish, wild geese, and ducks in addition to gathering food such as nuts, roots, berries, and shellfish such as mussels and clams. Most of the fishing was done on the inland bay areas, while the coast provided sea otters and seals. Items, which could not be found locally, were usually obtained through trading with neighboring villages.

3.1.4 Spanish Period

The first Europeans to reach the San Francisco area were Spanish explorers. An expedition led by Juan Bautista de Anza in 1776 resulted in the establishment of Mission San Francisco de Asis (Mission Dolores). The El Camino Real (now Mission Street, which runs through the city) became a heavily traveled route between Mission Dolores and other missions to the south and led to the establishment of inns and roadhouses to serve travelers along the way.[2]

3.1.5 Mexican Period

During the Mexican rule of California (1822 through 1848), large tracts of land were issued to private individuals, usually cattle ranchers and hide and tallow traders. The city was part of three separate land grants including the “Rancho Buri Buri,” one of the largest grants on the peninsula.

3.1.6 Early American Period

In the early 1850's a few settlers claimed lands on the old Mexican grants. By 1868 a dairy farmer named John Daly had purchased approximately 250 acres near what is today the Top of the Hill. As owner of the San Mateo Dairy, Daly became a prominent businessman and leader among the burgeoning population of the area.

The 1906 earthquake and fire in San Francisco caused population to surge in the areas in and around Daly’s ranch as he opened his farmlands for emergency use by refugees who fled the devastation. A small

[1] Carolyn Rice, Archeological Survey Report for BART-San Francisco Airport Extension Project, June 1994, Revised December 1994.

[2] Northwest Information Center, California Historical Resources Information System Record Search, File No.: 11-1115, May 1, 2012

community and railway station blossomed in the vicinity of the ranch and Daly subdivided his property in 1907, establishing the city's first residential subdivisions in the area known today as the Crocker neighborhood. In 1911 Daly City incorporated, named in honor of John Daly.

In the decades that followed, population gradually increased, but significant growth did not occur until after World War II, when a San Francisco builder, Henry Doelger, purchased 600 acres of sand dunes and cabbage patches that occupied much of the land between the city's original westerly edge and the ocean. Doelger's land was annexed to Daly City in 1948 and developed by him into the Westlake community. In the decade that followed, Doelger doubled his land purchases and continued building west and south, as he and other builders constructed thousands of homes and new satellite shopping centers in the St. Francis Height and Serramonte subdivisions. The 1963 annexation of the Bayshore neighborhood expanded the city's boundaries to the east.

3.1.7 Recorded Resources in and around Daly City

According to the Northwest Information Center (NWIC) of the California Historic Resources Information System at Sonoma State University in Rohnert Park, 58 cultural resource studies have been conducted in and around the city. These studies consist of a mixture of architectural and archaeological studies and generally are concentrated around the Highway 280 corridor, the coastal margin, and around the periphery of San Bruno Mountain.

Archeological Resources

The Mussel Rock archaeological site, P-41-000075 or San Mateo County Site 72 (CA-SMA-72), is a site in Daly City from which artifacts of the Ohlone tribe have been uncovered. During the excavation and grading of the area in 1977 for the construction of a waste transfer station, archaeologists uncovered the largest number of Ohlone artifacts of any of the registered sites in San Mateo County. Artifacts uncovered at the site included human remains, cooking and food preparation tools, hunting and fishing items, shell jewelry, and mammal remains. Archaeologists have determined that the artifacts date back to approximately 1500 A.D.

A records search conducted by the NWIC indicates the presence of six other recorded archaeological resources within the city including an unknown Native American site (P-41-000052 or CA-SMA-48), a Native American habitation site (P-41-000053 or CA-SMA-49), a Native American habitation site with known burials (P-41-000496 or CA-SMA-356), remains of an historic-era water conveyance system (P-41-002219 or CA-SMA-385H), an early 20th century artifact deposit (P-41-002278), and a site with both Native American and historic-era cultural material (P-41-002281).

According to the NWIC, Native American resources in the northern part of San Mateo County have been found in close proximity to sources of water (including perennial and intermittent streams and springs), near the bay margin and its associated wetlands, along the coastal terraces and sheltered valleys, and near ecotones and other productive environments. The coast contains many of these environments, spanning almost the entire width of the San Francisco Peninsula from coast to bay and containing the upper reaches of the Colma Creek drainage and the headwaters of Lake Merced. Additionally, the city contains a variety of landforms that range from pre-Quaternary deposits and bedrock, to Pleistocene and Holocene-age alluvial fans deposits, and from dune and beach sand to artificial fill. While locations that are characterized as bedrock or Pleistocene-age deposits may have only the potential to contain archaeological materials on or near the surface, those from later periods contain the increased potential for containing buried archaeological deposits that are capped in sterile material or fill. Overall, the correlation of these environmental factors coupled with the generalized ethnographic sensitivity of the region suggest that there is a high potential for the presence of unrecorded Native American resources (including buried deposits with no surface indications) within parts of the city.

Historical Resources

There are no sites in the city listed on the National Register of Historic Places. A records search conducted by the NWIC indicates the presence of two structures that are eligible for the National Register including the Cow Palace and the Crocker Masonic Lodge. The NWIC records search also indicates the presence of numerous structures with potential historic value at the local level. These include: 46 properties with a rating of 6Y, including Seton Medical Center, Westmoor High School, and Westlake Community Baptist Church; one property with a rating of 7N, the Broderick and Terry Duel Site; and two properties with a rating of 7R, including a residence and Bridge #35-77 on State Route 35. Additionally, NWIC base maps indicate the presence of one other recorded building, the Holy Child and Saint Martin Episcopal Church (P-41-002195).

Other properties throughout the city might be determined eligible for listing as historic resources upon further review and analysis. For example, the City of Daly City contains numerous buildings and structures that are at least 50 years old (constructed before 1967), and as such, may qualify as historic resources if other criteria apply and if they retain sufficient physical integrity to convey their historic associations. These buildings have not yet been comprehensively surveyed either individually or as a group. The following is a description of each resource:

- **Cow Palace.** This property is owned by the State of California and consists of a State-operated indoor arena on an approximately 70-acre site (partially located within the City of San Francisco). It was completed in 1941 as part of the federal Government's Workers Progress Administration (WPA), which employed millions of Americans during the Great Depression. The Cow Palace originally served as a livestock exhibition center, but has served many other purposes as well. During World War II, it was rented by the Federal Government to house soldiers on their way to the Pacific Theater. Today, it is best known as a music and performance venue.

- **Crocker Masonic Lodge.** The Crocker Masonic Lodge was built around 1936. It is currently used by the Freemason organization as Crocker Lodge No. 212. Located on the front façade of the building is a plaque marking the location of the San Mateo Dairy, which was owned by the city's namesake, John Daly, who subdivided the land in 1907 and built the first large-scale housing development in Daly City.

Paleontological Resources

Fossil remains are considered to be important as they provide indicators of the earth's chronology and history. The University of California Museum of Paleontology (UCMP) specimens list contains more than 300 localities where fossils have been found in San Mateo County. At least one locality is located in the City of Daly City at Mussel Rock, although the UCMP does not provide the precise coordinates for the fossils in order to protect paleontological resources[3]. The locality contains records for two fossilized plant species, Pseudotsuga taxifolia and Pinus masonii.

[3] University of California Museum of Paleontology, UCMP Specimen Database, available at http://ucmpdb.berkeley.edu, accessed May 21, 2012

Section 4 - Regulatory Framework

Summarized below are the relevant federal and state regulations as well as local goals and policies related to cultural resources that are applicable to the Proposed Project/Action.

4.1 Federal

Summarized below are the relevant federal regulations related to cultural resources that are applicable to the Proposed Project/Action.

4.1.1 National Historic Preservation Act

The National Historic Preservation Act of 1966 (NHPA), as amended, established the National Register of Historic Places (NRHP), which contains an inventory of the nation's significant prehistoric and historic properties. Under 36 Code of Federal Regulations 60, a property is recommended for possible inclusion on the NRHP if it is at least 50 years old, has integrity, and meets one of the following criteria: It is associated with significant events in history, or broad patterns of events.

- It is associated with significant people in the past.
- It embodies the distinctive characteristics of an architectural type, period, or method of construction; or it is the work of a master or possesses high artistic value; or it represents a significant and distinguishable entity whose components may lack individual distinction.
- It has yielded, or may yield, information important in history or prehistory.
- Certain types of properties are usually excluded from consideration for listing in the NRHP, but they can be considered if they meet special requirements in addition to meeting the criteria listed above. Such properties include religious sites, relocated properties, graves and cemeteries, reconstructed properties, commemorative properties, and properties that have achieved significance within the past 50 years.

4.1.2 National Environmental Policy Act

NEPA's concern is with the "human environment," defined as including the natural and physical (e.g. built) environment and the relationships of people to that environment. A thorough environmental analysis under NEPA should systematically address the "human" -- social and cultural -- aspects of the environment as well as those that are more "natural," and should address the relationships between natural and cultural. Culturally valued aspects of the environment generally include historic properties, other culturally valued pieces of real property, cultural use of the biophysical environment, and such "intangible" sociocultural attributes as social cohesion, social institutions, lifeways, religious practices, and other cultural institutions.

4.2 State

Summarized below are the relevant state regulations related to cultural resources that are applicable to the Proposed Project/Action.

4.2.1 California Register of Historical Resources

As defined by Section 15064.5(a)(3)(A-D) of the CEQA Guidelines, a resource shall be considered historically significant if the resource meets the criteria for listing on the California Register of Historical Resources (CR). The California Register of Historical Resources and many local preservation ordinances have employed the criteria for eligibility to the NRHP as a model, since the NHPA provides the highest standard for evaluating the significance of historic resources. A resource that meets the NRHP criteria is clearly significant. In addition, a resource that does not meet the NRHP standards may still be considered historically significant at a local or state level.

4.2.2 California Environmental Quality Act

The CEQA Guidelines state that a resource need not be listed on any register to be found historically significant. The CEQA guidelines direct lead agencies to evaluate archaeological sites to determine if they meet the criteria for listing in the California Register. If an archaeological site is a historical resource, in that it is listed or eligible for listing in the California Register, potential adverse impacts to it must be considered. If an archaeological site is considered not to be a historical resource, but meets the definition of a “unique archeological resource” as defined in Public Resources Code Section 21083.2, then it would be treated in accordance with the provisions of that section.

21083.2: Archaeological Resources

CEQA directs the lead agency on any project undertaken, assisted, or permitted by the State to include the following in its environmental impact report for the project: determines the project's effect on unique archeological resources; defines unique archeological resources; enables a lead agency to require an applicant to make reasonable effort to preserve or mitigate impacts to any affected unique archeological resource; sets requirements for the applicant to provide payment to cover costs of mitigation; and restricts excavation as a mitigation measure.

21084.1: Historical Resources

CEQA defines historic resources and establishes that an adverse effect on a historical resource qualifies as a significant effect on the environment.

4.2.3 CEQA Guidelines

Historic Resources

Section 15064.5 of CEQA guidelines define three ways that a property can qualify as a significant historical resource for the purposes of CEQA review:

- If the resource is listed in or determined eligible for listing in the California Register of Historical Resources (CRHR);
- If the resource is included in a local register of historical resources, as defined in section 5020.1(k) of the Public Resources Code, or is identified as significant in a historical resource survey meeting the requirements of section 5024.1(g) of the Public Resources Code unless a preponderance of evidence demonstrates that it is not historically or culturally significant; or,
- If the lead agency determines the resource to be significant as supported by substantial evidence (California Code of Regulations, Title 14, Division 6, Chapter 3, section 15064.5).

In addition to determining the significance and eligibility of any identified historical resource under CEQA and the California Register, historic properties must be evaluated under the criteria for the National Register should federal funding or permitting become involved in any undertaking subject to this document.

Archeological Resources

CEQA Guidelines Section 15126.4 states that "public agencies should, whenever feasible, seek to avoid damaging effects on any historical resources of an archeological nature." The Guidelines further state that preservation-in-place is the preferred approach to mitigate impacts on archaeological resources. However, according to Section 15126.4, if data recovery through excavation is "the only feasible mitigation," then a "data recovery plan, which makes provision for adequately recovering the scientifically consequential information from and about the historical resources, shall be prepared and adopted prior to any excavation being undertaken." Data recovery is *not* required for a resource of an archaeological nature if "the lead agency determines that testing or studies already completed have adequately recovered the scientifically consequential information from and about the archaeological or historical resource." The section further states that its provisions apply to those archaeological resources that also qualify as historic resources.

Paleontological Resources

Paleontological resources are afforded protection by CEQA. Appendix G (Part V) of the CEQA Guidelines provides guidance relative to significant impacts on paleontological resources, stating that a project will normally result in a significant impact on the environment if it will "…disrupt or adversely affect a paleontological resource or site or unique geologic feature, except as part of a scientific study." Section 5097.5 of the Public Resources Code specifies that any unauthorized removal of paleontological remains is a misdemeanor. Further, the California Penal Code Section 622.5 sets the penalties for the damage or removal of paleontological resources.

Native American Heritage Act

Also relevant to the evaluation and mitigation of impacts to cultural resources, the Native American Heritage Act (NAHA) of 1976 established the Native American Heritage Commission (NAHC) and protects Native American religious values on state property (see California Public Resources Code 5097.9). PRC 5097.98 defines the steps that need to be taken if human remains are identified on a site, including the notification of descendants and the disposition of remains and grave goods.

4.2.4 Office of Historical Places

Also relevant to the evaluation and mitigation of impacts to cultural resources, the Native American Heritage Act (NAHA) of 1976 established the Native American Heritage Commission (NAHC) and protects Native American religious values on state property (see California Public Resources Code 5097.9). PRC 5097.98 defines the steps that need to be taken if human remains are identified on a site, including the notification of descendants and the disposition of remains and grave goods.

4.2.5 Disposition of Human Remains

Health and Safety Code Section 7050.5 states that when an initial study identifies the existence, or the probable likelihood, of Native American human remains within the project, a lead agency shall work with the appropriate Native Americans as identified by the NAHC as provided in Public Resources Code 5097.98. The applicant may develop an agreement for treating or disposing of, with appropriate dignity, the human remains and any items associated with Native American burials. Furthermore, Section 7050.5 of the California Health and Safety Code requires that construction or excavation be stopped in the vicinity of discovered human remains until the county coroner can determine whether the remains are those of a Native American. If the remains are determined to be Native American, the coroner must contact the NAHC.

4.2.6 Native American Graves Protection and Repatriation Act

Health and Safety Code Section 8010-8011 establishes a state repatriation policy intent that is consistent with and facilitates implementation of the federal Native American Graves Protection and Repatriation Act. The Act strives to ensure that all California Indian human remains and cultural items are treated with dignity and respect. It encourages voluntary disclosure and return of remains and cultural items by publicly funded agencies and museums in California. It also states the intent for the state to provide mechanisms for aiding California Indian tribes, including non-federally recognized tribes, in filing repatriation claims and getting responses to those claims.

4.2.7 Tribal Consultation Guidelines

Passed in 2004, Senate Bill (SB) 18 now Government Code Section 65351 and 65352 establishes a procedure to help tribes and jurisdictions define tribal cultural resources and sacred areas more clearly and incorporate protection of these places earlier into the General Plan and Specific Plan processes. The SB 18 process mirrors the federal 106 Review process used by archaeologists as part of the environmental review conducted under NEPA (36 CFR Part 800.16) While not a component of CEQA review per se, the Lead Agency is required to request consultation with responsible and trustee agencies, such as NAHC and neighboring tribes, during the initial study and EIR process (PRC 21080.3, 21080.4).

4.2.8 California Historical resources Information System

The California Historical Resources Information System (CHRIS) is a statewide system for managing information on the full range of historical resources identified in California. CHRIS is a cooperative partnership between the citizens of California, historic preservation professionals, 12 Information Centers, and various agencies. This system bears the following responsibilities: integrate newly recorded sites and information on known resources into the California Historical Resources Inventory; furnish information on known resources and surveys to governments, institutions, and individuals who have a justifiable need to know; and supply a list of consultants who are qualified to do work within their area.

Typically, the initial step in addressing cultural resources in the project review process involves contacting the appropriate Information Center to conduct a record search. A record search should identify any previously recorded historical resources and previous archaeological studies within the project area, as well as provide recommendations for further work, if necessary. Depending on the nature and location of the project, the project proponent or lead agency may be required to contact appropriate Native American representatives to aid in the identification of traditional cultural properties.

If known cultural resources are present within the proposed project area, or if the area has not been previously investigated for the presence of such resources, the Information Center may recommend a survey for historical, archaeological and paleontological sites. Cultural resources that may be adversely affected by an undertaking could warrant further evaluation for test excavations. For historical sites or standing structures, historical research may be necessary and an architectural evaluation may be warranted. Data recovery excavations may be warranted in the case of unavoidable damage to archaeological sites. If human burials are present, contact the appropriate Coroner’s office. A professional archaeologist and appropriate Native American representatives should also be consulted (Sections 21083.2 and 21084.1 of the PRC).

When an initial study identifies the existence, or the probable likelihood, of Native American human remains within the project, a lead agency shall work with the appropriate Native Americans as identified by the Native American Heritage Commission as provided in Public Resources Code.

The applicant may develop an agreement for treating or disposing of, with appropriate dignity, the human remains and any items associated with Native American burials with the appropriate Native Americans as identified by the Native American Heritage Commission.

4.3 Local

Summarized below are the relevant established goals and polices related to cultural resources in the City that are applicable to the Proposed Project/Action.

Policy RME-19 Undertake measures to protect and preserve historic and archaeological resources.

- *Task RME-19.1* Comply with State statutes related to historical and archaeological resources.
- *Task RME-19.2* Serve as a leader in historic preservation by preserving, restoring, and reusing City-owned historic resources where feasible.
- *Task RME-19.3* Through the City's Facade Improvement Program, encourage the preservation of facades and exteriors that exhibit historical architectural characteristics, e.g., those identified by the City's Mission Street Urban Design Plan.
- *Task RME-19.4* Continue to support community projects that will add to the knowledge of Daly City's past, including the continuing work of the History Guild of Daly City/Colma and the Daly City History Museum.
- *Task RME-19.5* Cooperate with civic organizations in the placement of appropriate monuments or plaques to publicize or memorialize historic sites.

Policy RME-20 Recognize the physical differences between different parts of the City and regulate land uses within these areas accordingly (see also Policy LU-7).

- *Task RME-20.1* Retain elements in the Zoning Ordinance which effectively preserve the architectural character of Daly City's older neighborhoods (e.g., predominant setback and tandem parking allowances).
- *T*
  ask RME-20.2 Amend the Zoning Ordinance to provide development regulations that more closely reflect the predominant neighborhood character established when the neighborhood was constructed (e.g., provide for three-foot side yard setbacks in Westlake where there is currently no side setback required). Where necessary, establish either separate or overlay zoning districts for such neighborhoods (see also Task LU-7.1).
- *Task RME-20.3* Update the Residential Design Guidelines to provide bulk, mass, and architectural guidelines for exterior additions and reconstructed homes in neighborhoods which possess unique architectural characteristics.
- *Task RME-20.4* Incorporate design features in new development that reflects the character of the neighborhood, to ensure that new construction is compatible with existing development.

Policy LU-19 Archeological resources should be preserved where possible.

- *Task LU-19.1* Archeological resources are a valuable educational resource for the residents of the city. Every effort should be made to preserve them in their natural state when found or be excavated by professional archeologists for display in a museum.

Section 5 - Investigation Methodology and Results

This section summarizes the investigation methods used to determine the potential for cultural resources to be affected by the Proposed Project/Action.

5.1 Northwest Information Center (NWIC) Record Search

In February 2017 a record search for previously recorded cultural resources in the project area and within a ½-mile radius was conducted at the Northwest Information Center, California Historical Resources Information System (NWIC File #16-1004). Resources identified include:

- P-41-002278, Historic Archaeological Feature (privy)
- P-41-002219, Vista Grande Canal and Tunnel
- P-41-001718, Utilitarian Structure within Italian Cemetery
- P-41-000400, Italian Cemetery
- P-41-000401, Eternal Home Cemetery
- P-41-000402, Salem Memorial Park
- P-41-000403, Home of Peace Cemetery
- P-41-000404, Cypress Lawn Memorial Park
- P-41-000405, Holy Cross Cemetery

Attachment A provides the records and resources found. Figure 10 provides the location of known cultural resources near and within the APE. While the six Colma cemeteries are listed on the National Register of Historic Places, no archaeological resources are known within the project area.

5.2 Survey Methods

Daniel Shoup (RPA) conducted a pedestrian archaeological survey of the project area between February 14 and 19, 2016. Dr. Shoup meets the Secretary of the Interior's standards for archaeology. All open areas were inspected for cultural evidence such as historic structures, artifacts, and features; and indicators of prehistoric archaeological deposits like midden soil, flaked lithics, groundstone, and shell. The archaeological survey covered the Daly City WWTP expansion area, both sides of the roads in which the proposed pipeline will be placed, and the three proposed storage tank locations. All proposed facilities were surveyed in 10-meter transects. No cultural resources were located in the scope of the survey. However, some areas of the survey corridor were inaccessible due to fences, lack of safe pedestrian access, or vegetation. Areas not surveyed included:

- Pipeline Corridor along Sullivan Avenue from Pierce Street to Eastmoor Street, Colma. This area does not have a sidewalk or enough shoulder for safe pedestrian access field reconnaissance survey.
- Pipeline corridor between B Street and F Street in Colma (west of Colma BART station). The corridor in this area runs through a fenced car lot.
- Pipeline corridor along western side of Hillside Boulevard from Olivet Parkway south to Lawndale Road. This area does not have a sidewalk or enough shoulder for safe pedestrian access.
- Proposed storage tank site at Holy Cross Cemetery. The proposed tank location is located on the grounds of a working nursery. Portions of the proposed site of the storage tank itself was inaccessible due to steep slopes and vegetation.

This Figure is NOT Provided in this Public Document because the Locations of the Resources are NOT Available for Public Review

No archaeological materials were discovered during the survey. Because the project will not affect the built environment within the Colma cemeteries, the project does not appear to have the potential to affect historic structures or historic landscapes (Criteria 1-3). Therefore, the project area does not appear to have the potential to affect historical resources as defined in CEQA §15064.5.

5.3 Native American Heritage Commission Record Search and Outreach

On January 5, 2017, a letter was sent to the Native American Heritage Commission (NAHC) in Sacramento, California in an effort to determine whether any sacred sites listed on its Sacred Lands File are within the current project APE. A response from the NAHC was received on January 13, 2017, stating that a search of its Sacred Land File failed to indicate the presence of Native American cultural resources in the immediate project APE. Included with the response was a list of 5 Native American representatives who may have further knowledge of Native American resources within or near the project APE. To ensure that all Native American concerns are adequately addressed, letters to each of the listed tribal contacts were sent on January 17, 2017, requesting any information about the project that these individuals may have. A record of this is located in Attachment B. Follow-up contacts were made via e-mail on March 8, 2017. However, as of this date, no responses have been received.

5.4 Conclusions and Recommendations

This investigation was conducted in compliance with Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations (36 Code of Federal Register [CFR] Part 800). Because the project will not affect the built environment within the Colma cemeteries, the project does not have the potential to affect historic structures or historic landscapes (Criteria 1-3). No archaeological materials were discovered during the survey. The project area therefore does not appear to have the potential to affect historical resources as defined in NEPA, CEQA, NHRP and etc.

Based upon this investigation, the Proposed Project/Action would not have any significant impacts to cultural resources. Specifically, the proposed Project would have:

- ***No Effect On Any Known Historical Resources or Properties;***
- ***No Effect On Any Known Archeological Resources; and/or***
- ***No Effect On Any Known Burial Sites.***

However, the construction of the Proposed Project could uncover unidentified or known buried cultural resources (i.e. Historical, archeological, paleontological, and human remains). To further reduce the potential to affect any of these resources, the following recommendations and mitigation measures should be implemented to ensure that there are no significant impacts to cultural resources that may exist in the APE as direct and indirect result of the Proposed Project/Action.

- **Halt work if cultural resources are discovered.** In the event that any prehistoric or historic subsurface cultural resources are discovered during ground disturbing activities, all work within 100 feet of the resources shall be halted and after notification, the City shall consult with a qualified archaeologist to assess the significance of the find. If any find is determined to be significant (CEQA Guidelines 15064.5[a][3] or as unique archaeological resources per Section 21083.2 of the California Public Resources Code), representatives of the City and a qualified archaeologist shall meet to determine the appropriate course of action. In considering any suggested mitigation proposed by the consulting archaeologist in order to mitigate impacts to historical resources or unique archaeological resources, the lead agency shall determine whether avoidance is necessary and feasible in light of factors such as the nature of the find, project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) shall be instituted. Work may proceed on other parts of the project site while mitigation for historical resources or unique archaeological resources is carried out.

- **Halt work if paleontological remains are discovered.** If paleontological resources, such as fossilized bone, teeth, shell, tracks, trails, casts, molds, or impressions are discovered during ground-disturbing activities, work will stop in that area and within 100 feet of the find until a qualified paleontologist can assess the significance of the find and, if necessary, develop appropriate treatment measures in consultation with the City.

- **Halt work if human remains are found.** If human remains are encountered during excavation activities conducted for the Proposed Project/Action, all work in the adjacent area shall stop immediately and the San Mateo County Coroner's office shall be notified. If the Coroner determines that the remains are Native American in origin, the Native American Heritage Commission shall be notified and will identify the Most Likely Descendent, who will be consulted for recommendations for treatment of the discovered human remains and any associated burial goods.

Section 6 - Bibliography

In addition to the archaeological maps and site records on file at the Northwest Information Center of the Historical Resources Information System, the following literature was reviewed and/or referenced:

- City of Daly City. General Plan EIR 2012.
- University of California Museum of Paleontology, UCMP Specimen Database, available at http://ucmpdb.berkeley.edu, accessed May 21, 2012

Attachment A

NWIC File #16-1004 Records

CALIFORNIA HISTORICAL RESOURCES INFORMATION SYSTEM

ALAMEDA
COLUSA
CONTRA COSTA
DEL NORTE
HUMBOLDT
LAKE
MARIN
MENDOCINO
MONTEREY
NAPA
SAN BENITO
SAN FRANCISCO
SAN MATEO
SANTA CLATA
SANTA CRUZ
SOLANO
SONOMA
YOLO

Northwest Information Center
Sonoma State University
150 Professional Center Drive, Suite E
Rohnert Park, California 94928-3609
Tel: 707.588.8455
nwic@sonoma.edu
http://www.sonoma.edu/nwic

1/24/2017 NWIC File No.: 16-1004

Daniel Shoup
Archaeological/Historical Consultants
609 Aileen Street
Oakland, CA 94609

re: Daly City Wastewater Improvements

The Northwest Information Center received your record search request for the project area referenced above, located on the San Francisco South USGS 7.5' quad. The following reflects the results of the records search for the project area and a 0.5 mile radius:

Resources within project area:	P-41-400, 401, 402, 403, 404, 405, & 1718.
Archaeological Resources within 0.5 mile radius:	P-41-2278 & 2219.
Reports within project area:	See enclosed database printout.
Reports within 0.5 mile radius:	No additional reports within 0.5 mile.
Other Reports within records search radius:	**S-848, 3184, 5537, 6160, 9462, 9580, 9583, 9795, 15529, 18217, 25560, 30204, 31037, 32596, 33545, 33600, 33611, 35858, & 39770**. These reports are classified as Other Reports; reports with little or no field work or missing maps. The electronic maps do not depict study areas for these reports, however a list of these reports has been provided. In addition, you have not been charged any fees associated with these studies.

Resource Database Printout (list): ☐ enclosed ☒ not requested ☐ nothing listed

Resource Database Printout (details): ☒ enclosed ☐ not requested ☐ nothing listed

Resource Digital Database Records: ☐ enclosed ☒ not requested ☐ nothing listed

Report Database Printout (list): ☒ enclosed ☐ not requested ☐ nothing listed

Report Database Printout (details): ☒ enclosed ☐ not requested ☐ nothing listed

Report Digital Database Records: ☐ enclosed ☒ not requested ☐ nothing listed

Resource Record Copies: ☐ enclosed ☒ not requested ☐ nothing listed

Report Copies: ☐ enclosed ☒ not requested ☐ nothing listed

OHP Historic Properties Directory: ☒ enclosed ☐ not requested ☐ nothing listed

<u>Archaeological Determinations of Eligibility</u>:	☐ enclosed	☐ not requested	☒ nothing listed
<u>CA Inventory of Historic Resources (1976):</u>	☐ enclosed	☒ not requested	☐ nothing listed
<u>Caltrans Bridge Survey:</u>	☐ enclosed	☒ not requested	☐ nothing listed
<u>Ethnographic Information:</u>	☐ enclosed	☒ not requested	☐ nothing listed
<u>Historical Literature:</u>	☐ enclosed	☒ not requested	☐ nothing listed
<u>Historical Maps:</u>	☐ enclosed	☒ not requested	☐ nothing listed
<u>Local Inventories:</u>	☐ enclosed	☒ not requested	☐ nothing listed
<u>GLO and/or Rancho Plat Maps:</u>	☐ enclosed	☒ not requested	☐ nothing listed
<u>Shipwreck Inventory:</u>	☐ enclosed	☒ not requested	☐ nothing listed

*Notes:

Please forward a copy of any resulting reports from this project to the office as soon as possible. Due to the sensitive nature of archaeological site location data, we ask that you do not include resource location maps and resource location descriptions in your report if the report is for public distribution. If you have any questions regarding the results presented herein, please contact the office at the phone number listed above.

The provision of CHRIS Data via this records search response does not in any way constitute public disclosure of records otherwise exempt from disclosure under the California Public Records Act or any other law, including, but not limited to, records related to archeological site information maintained by or on behalf of, or in the possession of, the State of California, Department of Parks and Recreation, State Historic Preservation Officer, Office of Historic Preservation, or the State Historical Resources Commission.

Due to processing delays and other factors, not all of the historical resource reports and resource records that have been submitted to the Office of Historic Preservation are available via this records search. Additional information may be available through the federal, state, and local agencies that produced or paid for historical resource management work in the search area. Additionally, Native American tribes have historical resource information not in the CHRIS Inventory, and you should contact the California Native American Heritage Commission for information on local/regional tribal contacts.

Should you require any additional information for the above referenced project, reference the record search number listed above when making inquiries. Requests made after initial invoicing will result in the preparation of a separate invoice.

Thank you for using the California Historical Resources Information System (CHRIS).

Sincerely,
Lisa C. Hagel
Researcher

NWIC Records are NOT Provided in this Public Document because they are NOT Available for Public Review

Attachment B

Native American Correspondence

SMB ENVIRONMENTAL

January 5, 2017

Native American Heritage Commission
1550 Harbor Blvd, Suite 100
West Sacramento, CA 95691

Subject: **Sacred Land Files and Native American Contact List Request for the City of Daly City's Recycled Water Project**

To Whom It May Concern:

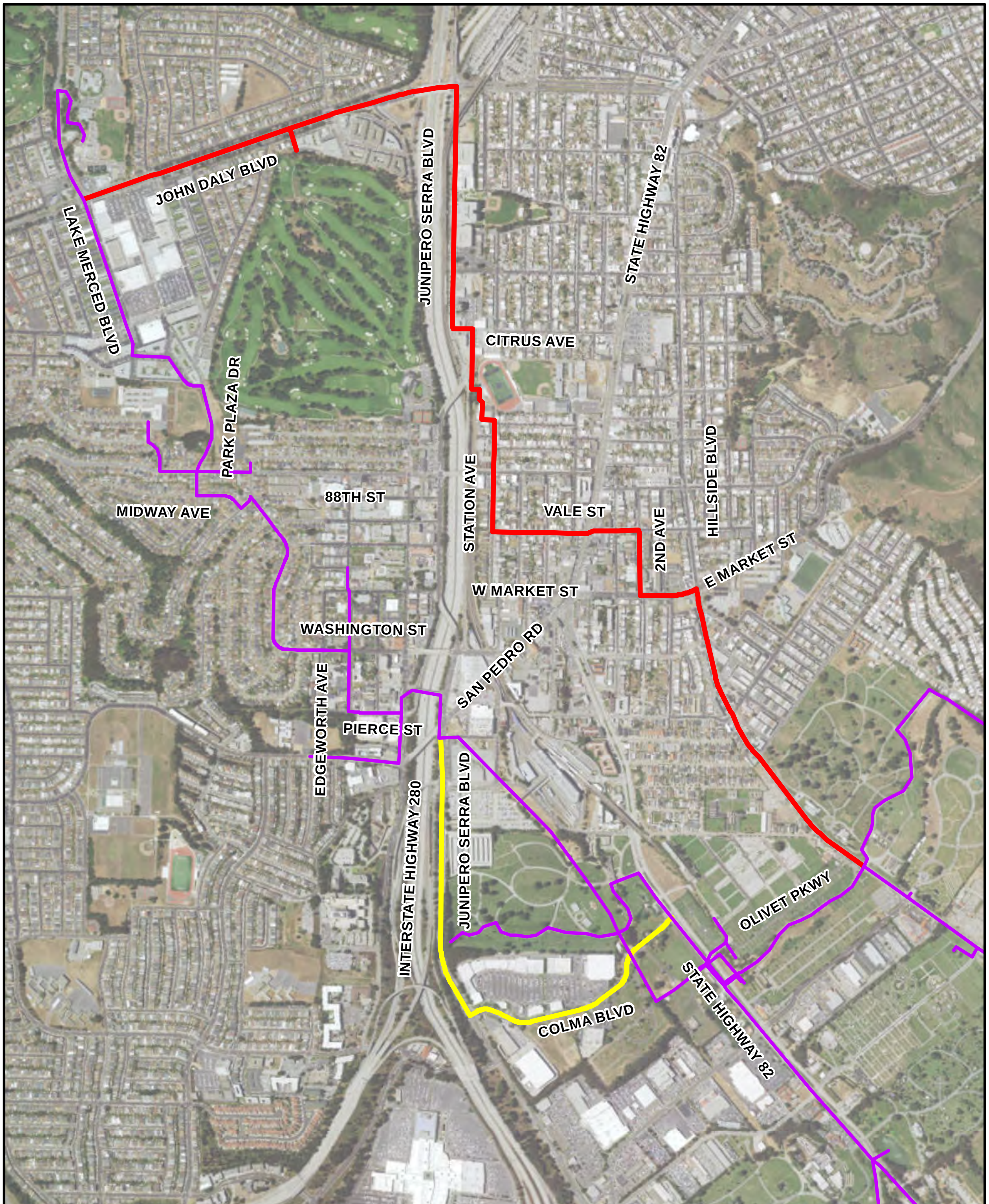
SMB Environmental is assisting the City of Daly City (City) prepare environmental documentation for its proposed Recycled Water Project (Proposed Project). The Project would expand the City's recycled water system to supply irrigation water to customers in Daly City (37°41′11″N 122°28′06″W), the Town of Colma (37°40′44″N 122°27′20″W), and South San Francisco (37°39′22″N 122°25′32″W). Recycled water would be used for landscape irrigation at cemeteries, parks, schools, and a golf course. The customers currently use potable water from Cal Water, potable supply from Daly City, or groundwater from private wells. The Proposed Project would supply approximately 1,200 acre-feet per year (AFY) of recycled water. Please see the attached map.

For purposes of Section 106 compliance, we would appreciate your checking of the Sacred Lands Files to see if there are any culturally sensitive areas within the immediate project vicinity. We would also like to receive a list of Native American organizations that may have knowledge or interest in the Proposed Project area and we will attempt to contact them to solicit their written input/concerns about the Proposed Project.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If any questions, please feel free to contact me at 916-517-2189 or at steve@smbenvironmental.com.

Sincerely,

Steve Brown
Principal



Legend

- Current Alignment
- Potential New North Alignment
- Potential New South Alignment
- STREETS

Feet
0 750 1,500

POTENTIAL ALIGNMENTS

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

Response from NAHC

NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
(916) 373-3710
(916) 373-5471 Fax

January 13, 2017

Steve Brown
SMB Environmental

Sent by: steve@smbenvironmental.com

RE: Daly City Recycled Water Project, San Mateo County

Dear Mr. Brown,

Attached is a list of tribes that have cultural and traditional affiliation to the area of potential project effect (APE) referenced above. I suggest you contact all of those listed, if they cannot supply information, they might recommend others with specific knowledge. The list should provide a starting place to locate areas of potential adverse impact within the APE. By contacting all those on the list, your organization will be better able to respond to claims of failure to consult, as may be required under particular state statutes. If a response has not been received within two weeks of notification, the Native American Heritage Commission (NAHC) requests that you follow-up with a telephone call to ensure that the project information has been received.

The NAHC also recommends that project proponents conduct a record search of the NAHC Sacred Lands File (SLF) at the appropriate regional archaeological Information Center of the California Historic Resources Information System (CHRIS) (http://ohp.parks.ca.gov/?page_id=1068) to determine if any tribal cultural resources are located within the area(s) affected by the proposed action. The SFL, established under Public Resources Code section 5094, are sites submitted for listing to the NAHC by California Native American tribes. The SFL, established under Public Resources Code section 5094, are sites submitted for listing to the NAHC by California Native American tribes. A record search of the SLF was completed for the APE referenced above with negative results. Please note records maintained by the NAHC and CHRIS is not exhaustive, and a negative response to these searches does not preclude the existence of tribal cultural resources. A tribe may be the only source of information regarding the existence of tribal cultural resources.

If you receive notification of change of addresses and phone numbers from any of these tribes, please notify me. With your assistance we are able to assure that our lists contain current information. If you have any questions or need additional information, please contact via email: frank.lienert@nahc.ca.gov

Sincerely,

Frank Lienert
Associate Governmental Program Analyst

Native American Contacts

January 13, 2017

Coastanoan Rumsen Carmel Tribe
Tony Cerda, Chairperson
244 E. 1st Street — Ohlone/Costanoan
Pomona, CA 91766
rumsen@aol.com
(909) 524-8041 Cell
(909) 629-6081

Amah MutsunTribal Band of Mission San Juan Bautista
Irenne Zwierlein, Chairperson
789 Canada Road — Ohlone/Costanoan
Woodside, CA 94062
amahmutsuntribal@gmail.com
(650) 400-4806 Cell

(650) 332-1526 Fax

Muwekma Ohlone Indian Tribe of the SF Bay Area
Rosemary Cambra, Chairperson
P.O. Box 360791 — Ohlone / Costanoan
Milpitas, CA 95036
muwekma@muwekma.org
(408) 314-1898
(510) 581-5194

The Ohlone Indian Tribe
Andrew Galvan
P.O. Box 3152 — Ohlone/Costanoan
Fremont, CA 94539 — Bay Miwok
chochenyo@AOL.com — Plains Miwok
(510) 882-0527 Cell — Patwin

(510) 687-9393 Fax

Indian Canyon Mutsun Band of Costanoan
Ann Marie Sayers, Chairperson
P.O. Box 28 — Ohlone/Costanoan
Hollister, CA 95024
ams@indiancanyon.org
(831) 637-4238

This list is current only as of the date of this document and is based on the information available to the Commission on the date it was produced.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code

This list is only applicable for contacting local Native Americans with regard to cultural resources assessments for Daly City Recycled Water Project, San Mateo County

Letters to Native Americans

January 17, 2017

Coastanoan Rumsen Carmel Tribe
Tony Cerda, Chairperson
240 E, 1st Street
Pomona, CA 91766

Subject: **Request for Cultural Resources Sites Information for the City of Daly City's Proposed Recycled Water Project**

Dear Tony Cerda:

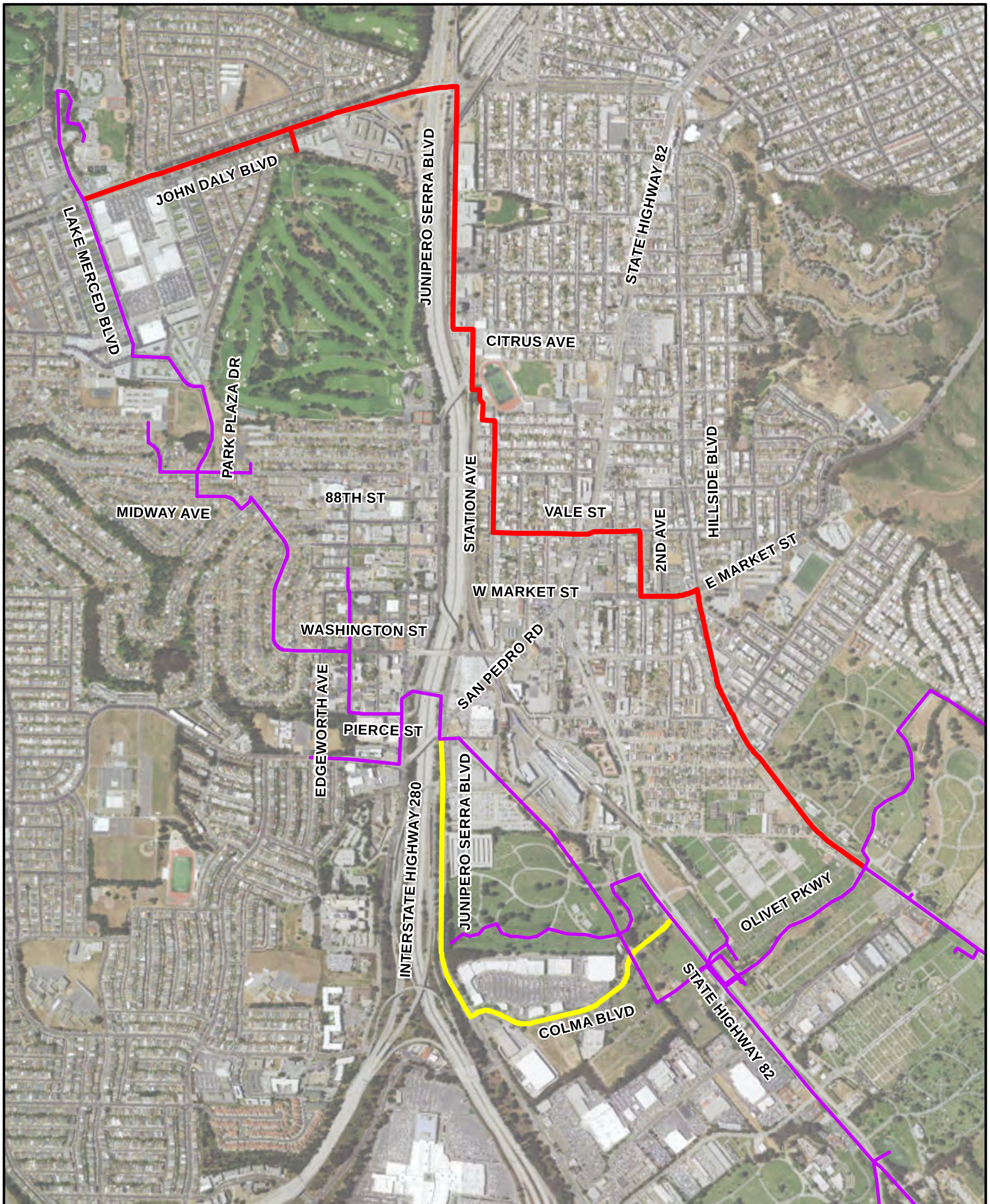
SMB Environmental is assisting the City of Daly (City) prepare environmental documentation for its proposed Recycled Water Project (Proposed Project). The Project would expand the City's recycled water system to supply irrigation water to customers in Daly City, the Town of Colma, and South San Francisco. Recycled water would be used for landscape irrigation at cemeteries, parks, schools, and a golf course. The customers currently use potable water from Cal Water, potable supply from Daly City, or groundwater from private wells. The Proposed Project would supply approximately 1,200 acre-feet per year (AFY) of recycled water. Please see the attached map.

The Native American Heritage Commission was contacted about the Proposed Project and provided us with a list of Native American individuals and organizations that may have knowledge of cultural resources in the project area. Please provide us with any information you may have about cultural resources or sites in the project area so that we can determine ways to protect those sites, including archeological sites and other locations of special value to Native Americans.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If any questions, please feel free to contact me at 916-517-2189 or at steve@smbenvironmental.com.

Sincerely,

Steve Brown
Principal



Legend

- Current Alignment
- Potential New North Alignment
- Potential New South Alignment
- STREETS

Feet
0 750 1,500

POTENTIAL ALIGNMENTS

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

SMB ENVIRONMENTAL

January 17, 2017

Amah Mutsun Tribal Band of Mission San Juan Bautista
Irene Zwierlein, Chairperson
789 Canada Road
Woodside, CA 94062

Subject: **Request for Cultural Resources Sites Information for the City of Daly City's Proposed Recycled Water Project**

Dear Irene Zwierlein:

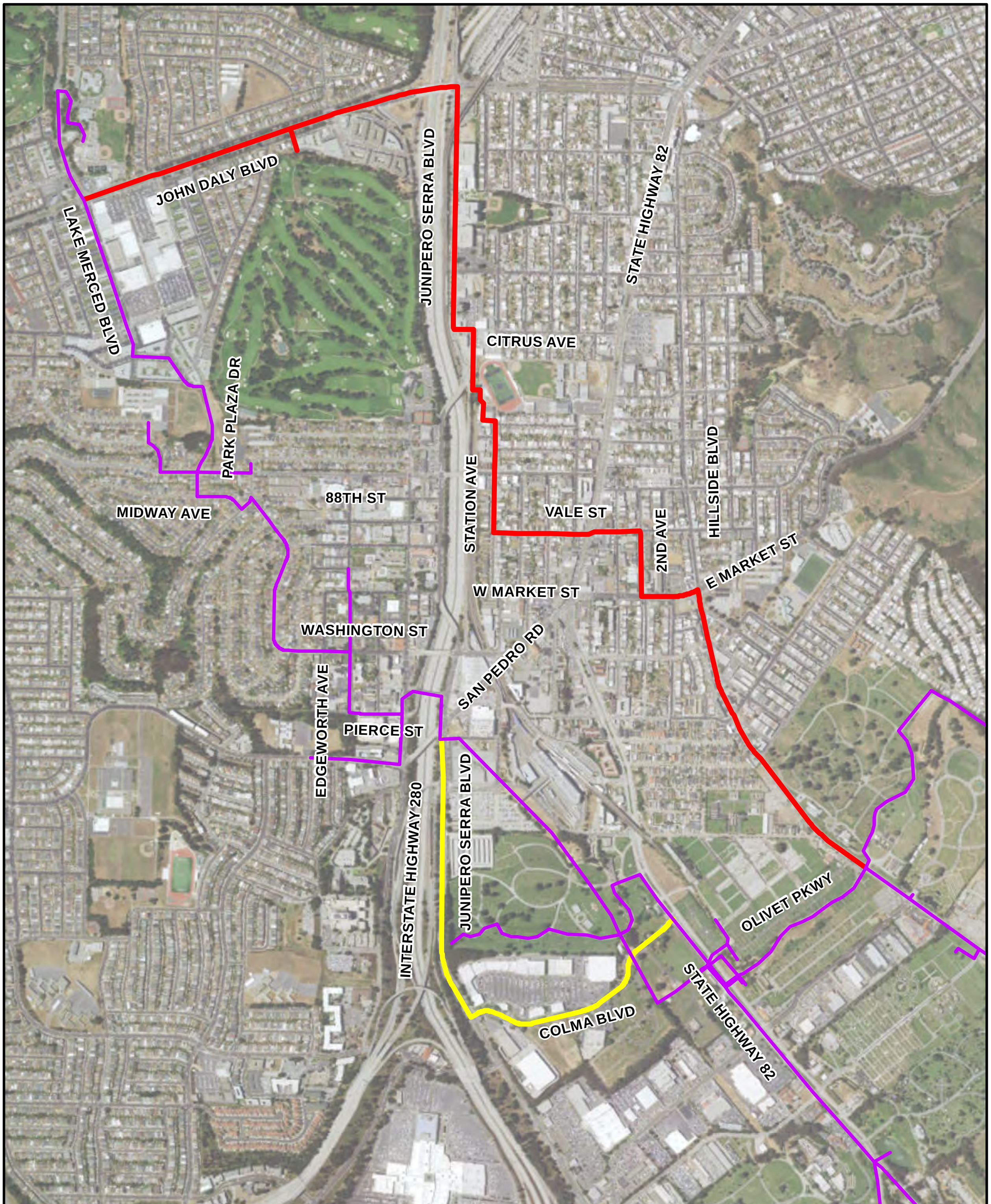
SMB Environmental is assisting the City of Daly (City) prepare environmental documentation for its proposed Recycled Water Project (Proposed Project). The Project would expand the City's recycled water system to supply irrigation water to customers in Daly City, the Town of Colma, and South San Francisco. Recycled water would be used for landscape irrigation at cemeteries, parks, schools, and a golf course. The customers currently use potable water from Cal Water, potable supply from Daly City, or groundwater from private wells. The Proposed Project would supply approximately 1,200 acre-feet per year (AFY) of recycled water. Please see the attached map.

The Native American Heritage Commission was contacted about the Proposed Project and provided us with a list of Native American individuals and organizations that may have knowledge of cultural resources in the project area. Please provide us with any information you may have about cultural resources or sites in the project area so that we can determine ways to protect those sites, including archeological sites and other locations of special value to Native Americans.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If any questions, please feel free to contact me at 916-517-2189 or at steve@smbenvironmental.com.

Sincerely,

Steve Brown
Principal



Legend

- Current Alignment
- Potential New North Alignment
- Potential New South Alignment
- STREETS

Feet
0 750 1,500

POTENTIAL ALIGNMENTS

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

January 17, 2017

Muwekma Ohlone Indian Tribe of the SF Bay Area
Rosemary Cambra, Chairperson
P.O. Box 360791
Milpitas, CA 95036

Subject: Request for Cultural Resources Sites Information for the City of Daly City's Proposed Recycled Water Project

Dear Rosemary Cambra:

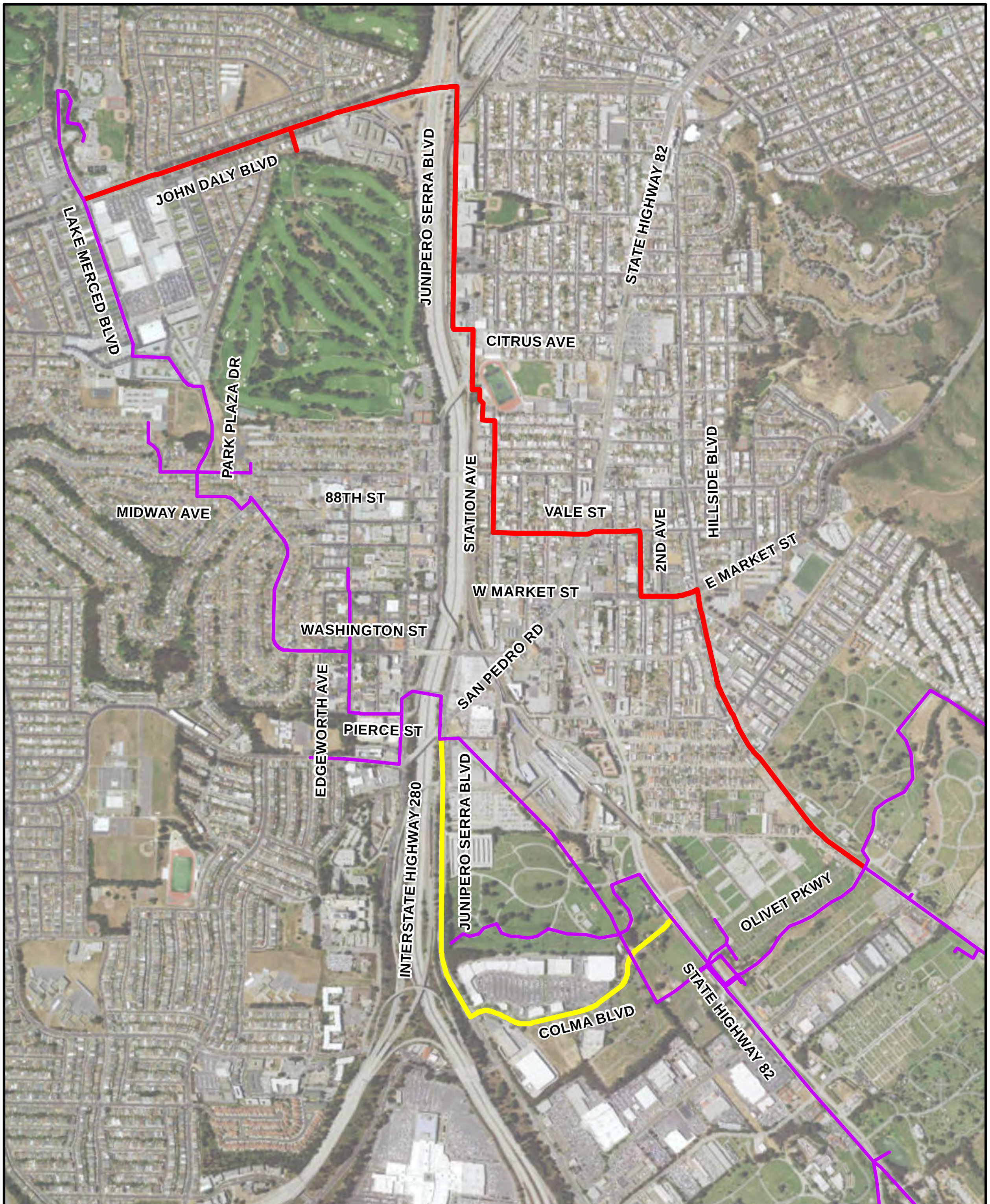
SMB Environmental is assisting the City of Daly City (City) prepare environmental documentation for its proposed Recycled Water Project (Proposed Project). The Project would expand the City's recycled water system to supply irrigation water to customers in Daly City, the Town of Colma, and South San Francisco. Recycled water would be used for landscape irrigation at cemeteries, parks, schools, and a golf course. The customers currently use potable water from Cal Water, potable supply from Daly City, or groundwater from private wells. The Proposed Project would supply approximately 1,200 acre-feet per year (AFY) of recycled water. Please see the attached map.

The Native American Heritage Commission was contacted about the Proposed Project and provided us with a list of Native American individuals and organizations that may have knowledge of cultural resources in the project area. Please provide us with any information you may have about cultural resources or sites in the project area so that we can determine ways to protect those sites, including archeological sites and other locations of special value to Native Americans.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If any questions, please feel free to contact me at 916-517-2189 or at steve@smbenvironmental.com.

Sincerely,

Steve Brown
Principal



Legend

- Current Alignment
- Potential New North Alignment
- Potential New South Alignment
- STREETS

Feet
0 750 1,500

POTENTIAL ALIGNMENTS

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

SMB ENVIRONMENTAL

January 17, 2017

The Ohlone Indian Tribe
Andrew Galvan
P.O. Box 3152
Fremont, CA 94539

Subject: **Request for Cultural Resources Sites Information for the City of Daly City's Proposed Recycled Water Project**

Dear Andrew Galvan:

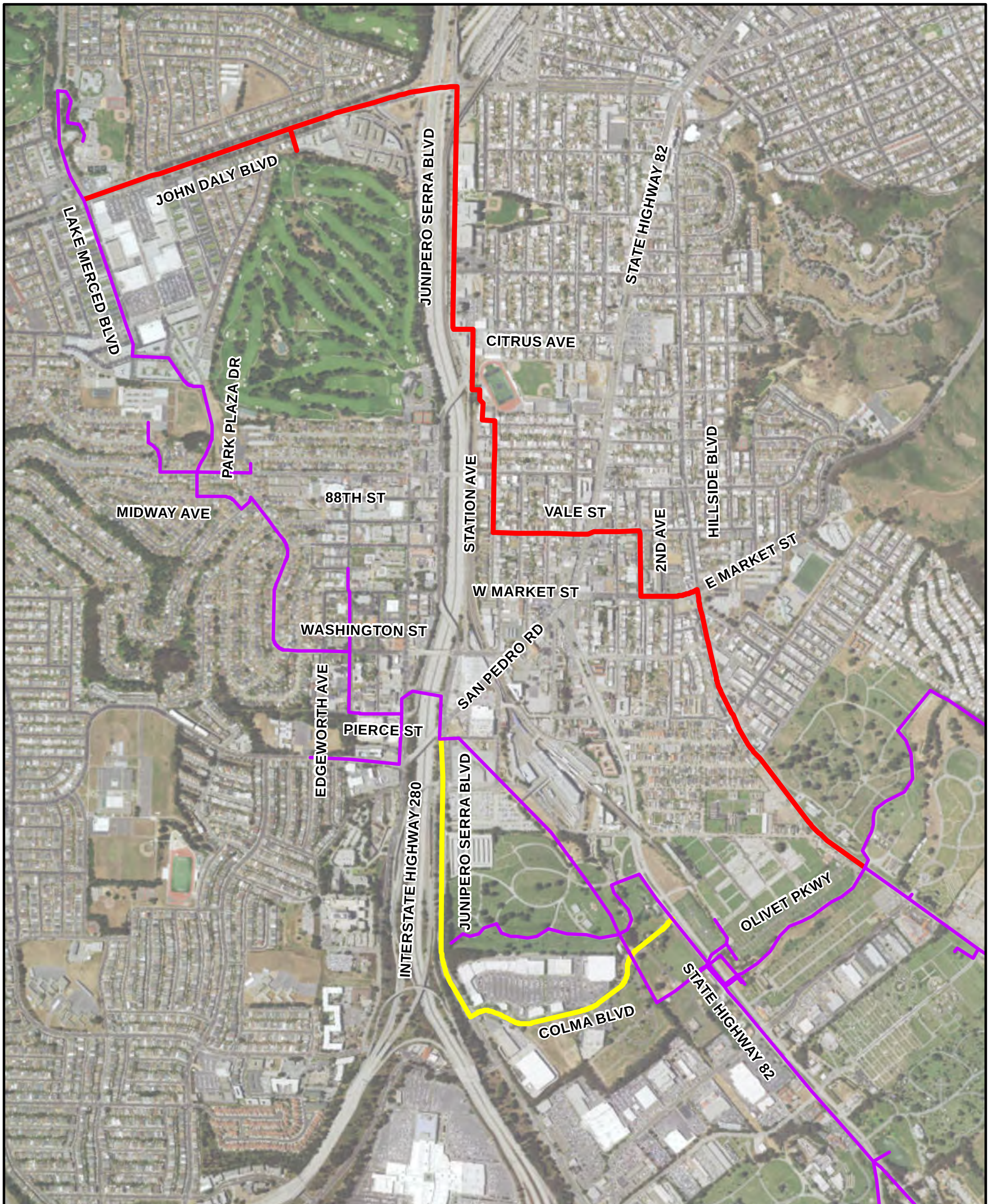
SMB Environmental is assisting the City of Daly City (City) prepare environmental documentation for its proposed Recycled Water Project (Proposed Project). The Project would expand the City's recycled water system to supply irrigation water to customers in Daly City, the Town of Colma, and South San Francisco. Recycled water would be used for landscape irrigation at cemeteries, parks, schools, and a golf course. The customers currently use potable water from Cal Water, potable supply from Daly City, or groundwater from private wells. The Proposed Project would supply approximately 1,200 acre-feet per year (AFY) of recycled water. Please see the attached map.

The Native American Heritage Commission was contacted about the Proposed Project and provided us with a list of Native American individuals and organizations that may have knowledge of cultural resources in the project area. Please provide us with any information you may have about cultural resources or sites in the project area so that we can determine ways to protect those sites, including archeological sites and other locations of special value to Native Americans.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If any questions, please feel free to contact me at 916-517-2189 or at steve@smbenvironmental.com.

Sincerely,

Steve Brown
Principal



Legend

- Current Alignment
- Potential New North Alignment
- Potential New South Alignment
- STREETS

Feet
0 750 1,500

POTENTIAL ALIGNMENTS

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

SMB ENVIRONMENTAL

January 17, 2017

Indian Canyon Mutsun Band of Costanoan
Ann Marie Sayers, Chairperson
P.0. Box 28
Hollister, CA 95024

Subject: **Request for Cultural Resources Sites Information for the City of Daly City's Proposed Recycled Water Project**

Dear Ann Marie Sayers:

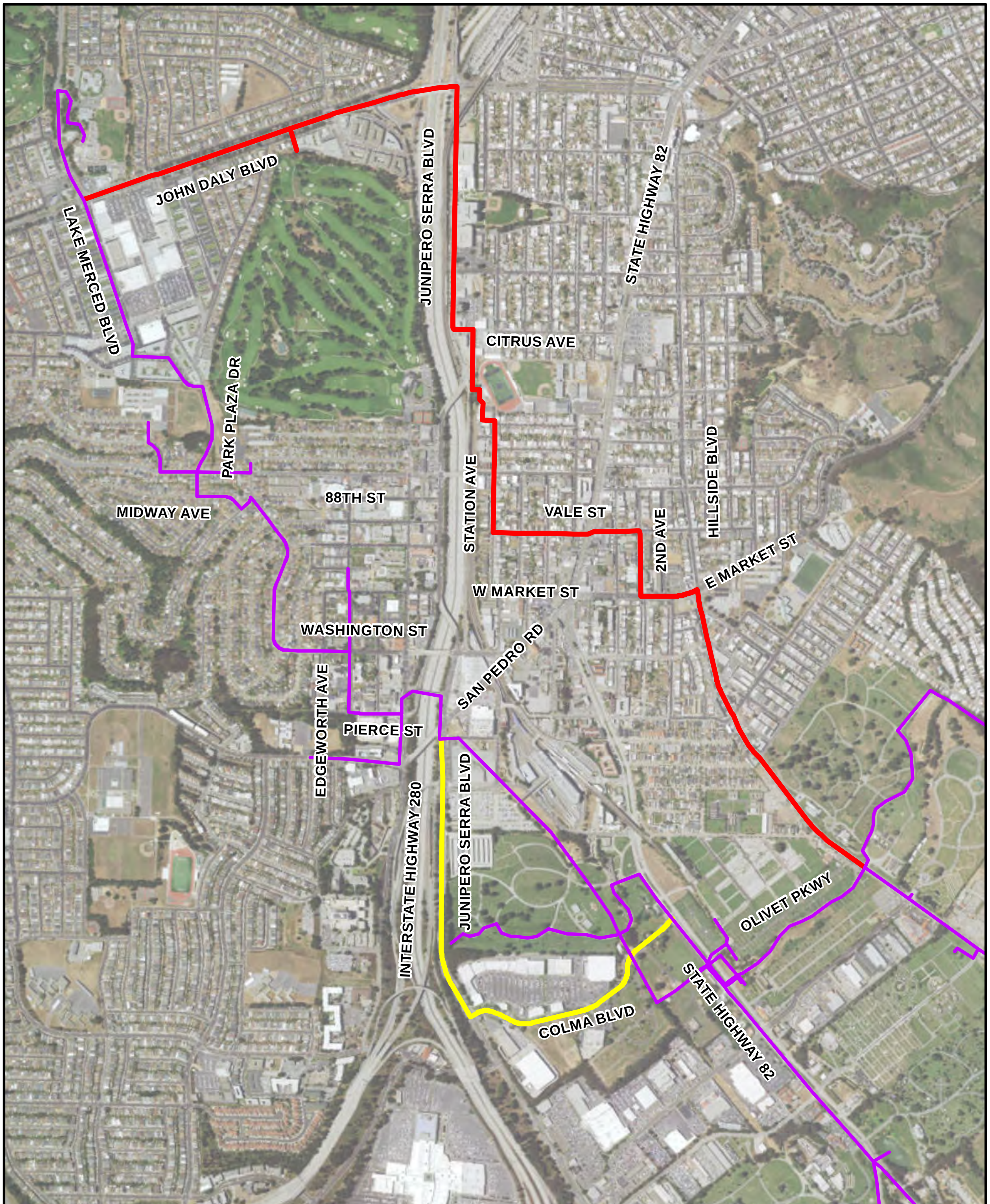
SMB Environmental is assisting the City of Daly City (City) prepare environmental documentation for its proposed Recycled Water Project (Proposed Project). The Project would expand the City's recycled water system to supply irrigation water to customers in Daly City, the Town of Colma, and South San Francisco. Recycled water would be used for landscape irrigation at cemeteries, parks, schools, and a golf course. The customers currently use potable water from Cal Water, potable supply from Daly City, or groundwater from private wells. The Proposed Project would supply approximately 1,200 acre-feet per year (AFY) of recycled water. Please see the attached map.

The Native American Heritage Commission was contacted about the Proposed Project and provided us with a list of Native American individuals and organizations that may have knowledge of cultural resources in the project area. Please provide us with any information you may have about cultural resources or sites in the project area so that we can determine ways to protect those sites, including archeological sites and other locations of special value to Native Americans.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If any questions, please feel free to contact me at 916-517-2189 or at steve@smbenvironmental.com.

Sincerely,

Steve Brown
Principal



Legend

- Current Alignment
- Potential New North Alignment
- Potential New South Alignment
- STREETS

N

Feet
0 750 1,500

POTENTIAL ALIGNMENTS

DALY CITY / SFPUC

FEASIBILITY OF EXPANDED TERTIARY RECYCLED WATER FACILITIES

No Responses from Native Americans have been Received

APPENDIX J – FINAL IS/MND

Daly City
Expanded Tertiary Recycled Water Project

Final Initial Study / Mitigated Negative Declaration
SCH # 2017072053

Prepared by:

SMB ENVIRONMENTAL

SMB Environmental, Inc.

September 2017

Table of Contents

Chapter 1 Introduction

Pursuant to the California Environmental Quality Act (CEQA; Public Resources Code Section 21000, et seq. and CEQA Guidelines), the City of Daly City (City) prepared a Public Draft Initial Study/Mitigated Negative Declaration (IS/MND) to evaluate potential environmental impacts associated with the City's proposed Expanded Tertiary Recycled Water Project (Proposed Project).

The City operates an existing tertiary treatment facility with a permitted capacity of 2.77 million gallons per day (mgd). This Proposed Project would add a new tertiary treatment process to provide an additional 3.0 mgd of tertiary treatment capacity during the irrigation season. The average yearly capacity of the system is 1.25 mgd or 1,400 acre-feet per year (afy) because the system will only operate during the irrigation season. The new treatment processes would include pressure membrane filtration followed by ultraviolet (UV) disinfection due to the small site constraints. New pipelines, pump stations and offsite storage would be constructed to complete the recycled water distribution system, delivering water to new customers for irrigation purposes in lieu of groundwater pumping. The purpose of the Proposed Project is to reduce irrigation reliance on the groundwater basin; provide local, sustainable, and drought-proof water supply; to preserve available groundwater supplies for drinking water.

On July 24, 2017, to initiate public review of the Draft IS/MND, the City filed a Notice of Completion (NOC) for the project with the Governor's Office of Planning and Research (State Clearinghouse or SCH) and a Notice of Availability (NOA) with the County of San Mateo and released the Draft IS/MND for a 30-day public review. The State Clearinghouse identified the project with SCH #2017072053. The 30-day public review period was established between July 24 and August 23, 2017, with copies of the Draft IS/MND available for review on the City's website at www.dalycity.org and at the addresses below:

City of Daly City
153 Lake Merced Boulevard
Daly City, CA 94015

Serramonte Main Library
40 Wembley Drive
Daly City, CA 94015

This Final IS/MND was prepared according to CEQA Guidelines and considers and incorporates all comments received by the State Clearinghouse and other agencies during the 30-day public review period. The purpose of this document is to clarify facts set forth in the Public Draft IS/MND, as necessary, to ensure accuracy. The City must consider the IS/MND, together with any comments received, before approving the Proposed Project (Public Resources Code Section 21091(f); and CEQA Guidelines Section 15074). The City has no affirmative duty to prepare formal responses to comments on the Public IS/MND, but should have adequate information on the record explaining why the comment(s) do/does not affect the conclusion that there are no potential significant environmental effects. The City is required to, however, notify, in writing, any commenting agencies of the date of the meeting on the Proposed Project for which an IS/MND is prepared and will be decided upon for approval (Public Resources Code Section 21092.5(b); and CEQA Guideline Section 15073).

This Final IS/MND is being distributed to agencies, stakeholder organizations, and individuals who commented on the Public Draft IS/MND to ensure that interested parties have an opportunity to express their views regarding the environmental impacts of the project, and to ensure that information pertinent to permits and approvals is provided to decision makers for the City and CEQA responsible agencies. Comments from the public have been incorporated into the Final IS/MND for the City to consider whether to approve the Proposed Project. **The City, through its subsidiary, the North San Mateo County Sanitation District, is scheduled to make a final decision on the Proposed Project at its regularly scheduled Sanitation District Board Meeting on September 25, 2017 at 6:45 pm in the City Council Chambers, 333-90th Street, City Hall – 2nd Floor, Daly City 94015.**

Chapter 2 Comments Received

During the 30-day public review period (July 24 through August 23, 2017), the City received a total of three (3) comment letters on the Proposed Project. The City has reviewed and considered all of the comments received as follows in Table 2-1 below. The letter(s) are attached.

TABLE 2-1

AGENCY COMMENT LETTERS RECEIVED

Date	Commenting Agency	Comment Letter
August 4, 2017	Gayle Totton, Associate Government Project Analyst Native American Heritage Commission 1550 Harbor Boulevard, Suite 100 West Sacramento, CA 95691	**A**
August 22, 2017	Sahil Pathak, Environmental Scientist State Water Resources Control Board 1001 I Street Sacramento, CA 95814	**B**
August 23, 2017	Michael P. Laughlin, AICP City Planner Town of Colma Planning Department 1190 El Camino Real, Colma, CA 94014	**C**

STATE OF CALIFORNIA Edmund G. Brown Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
Environmental and Cultural Department
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
Phone (916) 373-3710
Fax (916) 373-5471

August 4, 2017

Patrick Sweetland
City of Daly City
153 Lake Merced Boulevard
Daly City, CA 94015

Sent via e-mail: psweetland@dalycity.org

Re: SCH# 2017072053, Proposed Daly City Expanded Tertiary Recycled Water Project, City of Daly City; San Mateo County, California

Dear Mr. Sweetland:

The Native American Heritage Commission (NAHC) has reviewed the Mitigated Negative Declaration prepared for the project referenced above. The review included the Introduction and Project Description, the Environmental Review and Consequences, section 3.5, Cultural Resources, and Appendix D, Section 106 Cultural Resources Investigation Report prepared by SMB Environmental and RPA for the City of Daly City. We have the following concerns:

1. There is no Tribal Cultural Resources section or subsection in the Executive Summary or Environmental Checklist as per California Natural Resources Agency (2016) "Final Text for tribal cultural resources update to Appendix G: Environmental Checklist Form," http://resources.ca.gov/ceqa/docs/ab52/Clean-final-AB-52-App-G-text-Submitted.pdf A-1

2. There is no documentation of **government-to-government consultation by the lead agency** under AB-52 with Native American tribes traditionally and culturally affiliated to the project area as required by statute, or that mitigation measures were developed in consultation with the tribes. Discussions under AB-52 may include the type of document prepared; avoidance, minimization of damage to resources; and proposed mitigation. Contact by consultants during the Cultural Resources Assessments is not formal consultation. A-2

3. There are no mitigation measures specifically addressing Tribal Cultural Resources separately and distinctly from Archaeological Resources. Mitigation measures must take Tribal Cultural Resources into consideration as required under AB-52, **with or without consultation** occurring. **Mitigation language for archaeological resources is not always appropriate for or similar to measures specifically for handling Tribal Cultural Resources**. For sample mitigation measures, please refer to California Natural Resources Agency (2016) "Final Text for tribal cultural resources update to Appendix G: Environmental Checklist Form," http://resources.ca.gov/ceqa/docs/ab52/Clean-final-AB-52-App-G-text-Submitted.pdf A-3

The California Environmental Quality Act (CEQA)[1], specifically Public Resources Code section 21084.1, states that a project that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment.[2] If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an environmental impact report (EIR) shall be prepared.[3] In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources with the area of project effect (APE). A-4

CEQA was amended in 2014 by Assembly Bill 52. (AB 52).[4] **AB 52 applies to any project for which a notice of preparation or a notice of negative declaration or mitigated negative declaration is filed on or after July 1, 2015.** AB 52 created a separate category for "tribal cultural resources"[5], that now includes "a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment.[6] Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource.[7] Your project may also be subject to **Senate Bill 18 (SB 18)** (Burton, Chapter 905, Statutes of 2004), Government Code 65352.3, if it also involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space. **Both SB 18 and AB 52 have tribal consultation requirements**. Additionally, if your project is also subject to the federal National Environmental A-4 Cont'd

---

[1] Pub. Resources Code § 21000 et seq.
[2] Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, § 15064.5 (b); CEQA Guidelines Section 15064.5 (b)
[3] Pub. Resources Code § 21080 (d); Cal. Code Regs., tit. 14, § 15064 subd.(a)(1); CEQA Guidelines § 15064 (a)(1)
[4] Government Code 65352.3
[5] Pub. Resources Code § 21074
[6] Pub. Resources Code § 21084.2
[7] Pub. Resources Code § 21084.3 (a)

Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966[8] may also apply. A-4 Cont'd

Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.

Agencies should be aware that AB 52 does not preclude agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52. For that reason, we urge you to continue to request Native American Tribal Consultation Lists and Sacred Lands File searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/. Additional information regarding AB 52 can be found online at http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf, entitled "Tribal Consultation Under AB 52: Requirements and Best Practices". A-4 Cont'd

The NAHC recommends lead agencies consult with all California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. A-4 Cont'd

A brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments is also attached. A-4 Cont'd

Please contact me at gayle.totton@nahc.ca.gov or call (916) 373-3710 if you have any questions.

Sincerely,

Gayle Totton

Gayle Totton, B.S., M.A., Ph.D
Associate Governmental Project Analyst

Attachment

cc: State Clearinghouse

[8] 154 U.S.C. 300101, 36 C.F.R. § 800 et seq.

Pertinent Statutory Information:

Under AB 52:

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:
Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a **lead agency** shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice.
A **lead agency** shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project.[9] and **prior to the release of a negative declaration, mitigated negative declaration or environmental impact report**. For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code § 65352.4 (SB 18).[10]
The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:

a. Alternatives to the project.
b. Recommended mitigation measures.
c. Significant effects.[11]

1. The following topics are discretionary topics of consultation:
    a. Type of environmental review necessary.
    b. Significance of the tribal cultural resources.
    c. Significance of the project's impacts on tribal cultural resources.

If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. [12]
With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process **shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code sections 6254 (r) and 6254.10.** Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public.[13]
If a project may have a significant impact on a tribal cultural resource, **the lead agency's environmental document shall discuss** both of the following:

a. Whether the proposed project has a significant impact on an identified tribal cultural resource.
b. Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code section 21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource.[14]

Consultation with a tribe shall be considered concluded when either of the following occurs:

a. The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or
b. A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached.[15]

Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code section 21080.3.2 **shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program**, if determined to avoid or lessen the impact pursuant to Public Resources Code section 21082.3, subdivision (b), paragraph 2, and shall be fully enforceable.[16]
If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, **the lead agency shall consider feasible mitigation** pursuant to Public Resources Code section 21084.3 (b).[17]
An environmental impact report **may not be certified**, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:

a. The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code sections 21080.3.1 and 21080.3.2 and concluded pursuant to Public Resources Code section 21080.3.2.
b. The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.

---

[9] Pub. Resources Code § 21080.3.1, subds. (d) and (e)
[10] Pub. Resources Code § 21080.3.1 (b)
[11] Pub. Resources Code § 21080.3.2 (a)
[12] Pub. Resources Code § 21080.3.2 (a)
[13] Pub. Resources Code § 21082.3 (c)(1)
[14] Pub. Resources Code § 21082.3 (b)
[15] Pub. Resources Code § 21080.3.2 (b)
[16] Pub. Resources Code § 21082.3 (a)
[17] Pub. Resources Code § 21082.3 (e)

c. The lead agency provided notice of the project to the tribe in compliance with Public Resources Code section 21080.3.1 (d) and the tribe failed to request consultation within 30 days.[18]

This process should be documented in the Tribal Cultural Resources section of your environmental document.

Under SB 18:

Government Code § 65352.3 (a) (1) requires consultation with Native Americans on general plan proposals for the purposes of "preserving or mitigating impacts to places, features, and objects described § 5097.9 and § 5091.993 of the Public Resources Code that are located within the city or county's jurisdiction. Government Code § 65560 (a), (b), and (c) provides for consultation with Native American tribes on the open-space element of a county or city general plan for the purposes of protecting places, features, and objects described in Sections 5097.9 and 5097.993 of the Public Resources Code.

- SB 18 applies to **local governments** and requires them to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf
- Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.**[19]
- There is no Statutory Time Limit on Tribal Consultation under the law.
- Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research,[20] the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code sections 5097.9 and 5097.993 that are within the city's or county's jurisdiction.[21]
- Conclusion Tribal Consultation: Consultation should be concluded at the point in which:
  - The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
  - Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation.[22]

NAHC Recommendations for Cultural Resources Assessments:

- Contact the NAHC for:
  - A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.
  - A Native American Tribal Contact List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.
    - The request form can be found at http://nahc.ca.gov/resources/forms/.
- Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:
  - If part or the entire APE has been previously surveyed for cultural resources.
  - If any known cultural resources have been already been recorded on or adjacent to the APE.
  - If the probability is low, moderate, or high that cultural resources are located in the APE.
  - If a survey is required to determine whether previously unrecorded cultural resources are present.
- If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
  - The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
  - The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

[18] Pub. Resources Code § 21082.3 (d)
[19] (Gov. Code § 65352.3 (a)(2)).
[20] pursuant to Gov. Code section 65040.2,
[21] (Gov. Code § 65352.3 (b)).
[22] (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Examples of Mitigation Measures That May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:

- o Avoidance and preservation of the resources in place, including, but not limited to:
  - Planning and construction to avoid the resources and protect the cultural and natural context.
  - Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.
- o Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:
  - Protecting the cultural character and integrity of the resource.
  - Protecting the traditional use of the resource.
  - Protecting the confidentiality of the resource.
- o Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
- o Please note that a federally recognized California Native American tribe or a non-federally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed.[23]
- o Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated.[24]

The lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.

- o <u>Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources.</u>[25] In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.
- o <u>Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items</u> that are not burial associated in consultation with culturally affiliated Native Americans.
- o <u>Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains.</u> Health and Safety Code section 7050.5, Public Resources Code section 5097.98, and Cal. Code Regs., tit. 14, section 15064.5, subdivisions (d) and (e) (CEQA Guidelines section 15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

---

[23] (Civ. Code § 815.3 (c)).
[24] (Pub. Resources Code § 5097.991).
[25] per Cal. Code Regs., tit. 14, section 15064.5(f) (CEQA Guidelines section 15064.5(f)).

Comment Letter B

CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

AUG 22 2017

RECEIVED
AUG 25 2017
DWWR

Mr. Patrick Sweetland
153 Lake Merced Boulevard
Daly City, CA 94015

Dear Mr. Sweetland:

INITIAL STUDY/MITIGATED NEGATIVE DECLARATION (IS/MND) FOR DALY CITY (CITY); DALY CITY TERTIARY RECYCLED WATER PROJECT (PROJECT); SAN MATEO COUNTY; STATE CLEARINGHOUSE NO. 2017072053

We understand that the City is pursuing Clean Water State Revolving Fund (CWSRF) financing for this Project. As a funding agency and a state agency with jurisdiction by law to preserve, enhance, and restore the quality of California's water resources, the State Water Resources Control Board (State Water Board) is providing the following information on the IS/MND to be prepared for the Project. B-1

The State Water Board, Division of Financial Assistance, is responsible for administering the CWSRF Program. The primary purpose for the CWSRF Program is to implement the Clean Water Act and various state laws by providing financial assistance for wastewater treatment facilities necessary to prevent water pollution, recycle water, correct nonpoint source and storm drainage pollution problems, provide for estuary enhancement, and thereby protect and promote health, safety and welfare of the inhabitants of the state. The CWSRF Program provides low-interest funding equal to one-half of the most recent State General Obligation Bond Rates with a 30-year term. Applications are accepted and processed continuously. Please refer to the State Water Board's CWSRF website at:
www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/index.shtml. B-1 Cont'd

The CWSRF Program is partially funded by the United States Environmental Protection Agency and requires additional "California Environmental Quality Act (CEQA)-Plus" environmental documentation and review. Three enclosures are included that further explain the CWSRF Program environmental review process and the additional federal requirements. For the complete environmental application package please visit:
http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/srf_forms.shtml. B-1 Cont'd

The State Water Board is required to consult directly with agencies responsible for implementing federal environmental laws and regulations. Any environmental issues raised by federal agencies or their representatives will need to be resolved prior to The State Water Board approval of a CWSRF financing commitment for the proposed Project. For further information on the CWSRF Program, please contact Mr. Ahmad Kashkoli, at (916) 341-5855. B-1 Cont'd

It is important to note that prior to a CWSRF financing commitment, projects that are subject to provisions of the Federal Endangered Species Act (ESA), must obtain Section 7 clearance from the United States Department of the Interior, Fish and Wildlife Service (USFWS), and/or the United States Department of Commerce National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) for any potential effects to special-status species. B-1 Cont'd

Please be advised that the State Water Board will consult with the USFWS, and/or the NMFS regarding all federal special-status species that the Project has the potential to impact if the Project is to be financed by the CWSRF Program. The City will need to identify whether the Project will involve any direct effects from construction activities, or indirect effects such as growth inducement, that may affect federally listed threatened, endangered, or candidate species that are known, or have a potential to occur in the Project site, in the surrounding areas, or in the service area, and to identify applicable conservation measures to reduce such effects. B-1 Cont'd

In addition, CWSRF projects must comply with federal laws pertaining to cultural resources, specifically Section 106 of the National Historic Preservation Act (Section 106). The State Water Board has responsibility for ensuring compliance with Section 106, and must consult directly with the California State Historic Preservation Officer (SHPO). The SHPO consultation is initiated when sufficient information is provided by the CWSRF applicant. If the City decides to pursue CWSRF financing, please retain a consultant that meets the Secretary of the Interior's Professional Qualifications Standards (http://www.nps.gov/history/local-law/arch_stnds_9.htm) to prepare a Section 106 compliance report. B-1 Cont'd

Note that the City will need to identify the Area of Potential Effects (APE), including construction and staging areas, and the depth of any excavation. The APE is three-dimensional and includes all areas that may be affected by the Project. The APE includes the surface area and extends below ground to the depth of any Project excavations. The records search request should extend to a ½-mile beyond project APE. The appropriate area varies for different projects but should be drawn large enough to provide information on what types of sites may exist in the vicinity. B-1 Cont'd

Other federal environmental requirements pertinent to the Project under the CWSRF Program include the following (for a complete list of all federal requirements please visit: http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/docs/forms/application_environmental_package.pdf): B-1 Cont'd

A. An alternative analysis discussing environmental impacts of the project in either the CEQA document (Negative Declaration, MND or Environmental Impact Report) or in a separate report. B-1 Cont'd

B. A public hearing or meeting for adoption/certification of CEQA documents except for those with little or no environmental impacts. B-1 Cont'd

C. Compliance with the Federal Clean Air Act: (a) Provide air quality studies that may have been done for the Project; and (b) if the Project is in a nonattainment area or attainment area subject to a maintenance plan; (i) provide a summary of the estimated emissions (in tons per year) that are expected from both the construction and operation of the Project for each federal criteria pollutant in a nonattainment or maintenance area, and indicate if the nonattainment designation is moderate, serious, or severe (if applicable); (ii) if emissions are above the federal de minimis levels, but the Project is sized to meet only the needs of current population projections that are used in the approved State B-1 Cont'd

Implementation Plan for air quality, quantitatively indicate how the proposed capacity increase was calculated using population projections.

D. Compliance with the Coastal Zone Management Act: Identify whether the Project is within a coastal zone and the status of any coordination with the California Coastal Commission. B-1 Cont'd

E. Protection of Wetlands: Identify any portion of the proposed Project area that should be evaluated for wetlands or United States waters delineation by the United States Army Corps of Engineers (USACE), or requires a permit from the USACE, and identify the status of coordination with the USACE. B-1 Cont'd

F. Compliance with the Farmland Protection Policy Act: Identify whether the Project will result in the conversion of farmland. State the status of farmland (Prime, Unique, or Local and Statewide Importance) in the Project area and determine if this area is under a Williamson Act Contract. B-1 Cont'd

G. Compliance with the Migratory Bird Treaty Act: List any birds protected under this act that may be impacted by the Project and identify conservation measures to minimize impacts. B-1 Cont'd

H. Compliance with the Flood Plain Management Act: Identify whether or not the Project is in a Flood Management Zone and include a copy of the Federal Emergency Management Agency flood zone maps for the area. B-1 Cont'd

I. Compliance with the Wild and Scenic Rivers Act: Identify whether or not any Wild and Scenic Rivers would be potentially impacted by the Project and include conservation measures to minimize such impacts. B-1 Cont'd

Following are specific comments on the City draft IS/MND:

1. Does the San Mateo County have Native American Tribes on their AB 52 list? If yes, did the lead agency notify the Tribes on their list about the Project and invite them to consult under AB 52 prior to releasing the MND for public review? Prior to the release of the IS/MND, the lead agency shall begin consultation with a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed Project (Public Resources Code 21080.3.1). B-2

2. Pursuant to § 21083.09 (b) as of July 1, 2016 Tribal Cultural Resources (as defined in § 21074) must be considered under CEQA. Relevant sample questions have been added to *Appendix G: Environmental Checklist Form* under *Issue XVII. Tribal Cultural Resources.* Please include the Tribal Cultural Resources section in the environmental impact evaluation. B-3

3. The City conducted the field survey on January 25, 2017, but the biological resources section within the IS/MND does not discuss the habitat along the distribution pipelines. Please describe the habitat found along the distribution pipelines and the storage tanks in order to assess the special status species that may have the potential to use the habitat. B-4

Please provide us with the following documents applicable to the proposed Project following the City CEQA process: (1) one copy of the draft and final IS/MND, (2) the resolution adopting the IS/MND and making CEQA findings, (3) all comments received during the review period and the City's response to those comments, (4) the adopted Mitigation Monitoring and Reporting Program and (5) the Notice of Determination filed with the San Mateo County Clerk and the Governor's Office of Planning and Research, State Clearinghouse. In addition, we would appreciate notices of any hearings or meetings held regarding environmental review of any projects to be funded by the State Water Board. B-5

Thank you for the opportunity to review the City's draft IS/MND. If you have any questions or concerns, please feel free to contact me at (916) 319-0220, or by email at Sahil.Pathak@waterboards.ca.gov, or contact Ahmad Kashkoli at (916) 341-5855, or by email at Ahmad.Kashkoli@waterboards.ca.gov.

Sincerely,

Sahil Pathak
Environmental Scientist

Enclosures (3):

1. Clean Water State Revolving Fund Environmental Review Requirements
2. Quick Reference Guide to CEQA Requirements for State Revolving Fund Loans
3. Basic Criteria for Cultural Resources Reports

Cc: State Clearinghouse
(Re: SCH# 2017072053)
P.O. Box 3044
Sacramento, CA 95812-3044

CLEAN WATER STATE REVOLVING FUND

Basic Criteria for Cultural Resources Report Preparation

State Water Resources Control Board
Division of Financial Assistance

For Section 106 Consultation with the State Historic Preservation Officer (SHPO) under the National Historic Preservation Act

CULTURAL RESOURCES REPORT

The Cultural Resources Report must be prepared by a qualified researcher that meets the Secretary of the Interior's Professional Qualifications Standards. Please see the Professional Qualifications Standards at the following website at: ***http://www.cr.nps.gov/local-law/arch_stnds_9.htm***

The Cultural Resources Report should include one of the four "findings" listed in Section 106. These include:

"No historic properties affected"

(no properties are within the area of potential effect (APE; including below the ground).

"No effect to historic properties"

(properties may be near the APE, but the project will not have any adverse effects).

"No adverse effect to historic properties"

(the project may affect "historic properties", but the effects will not be adverse).

"Adverse effect to historic properties"

Note: Consultation with the SHPO will be required if a "no adverse effect to historic properties" or an "adverse effect to historic properties" determination is made, to develop and evaluate alternatives or modifications to the proposed project that could avoid, minimize or mitigate adverse effects on "historic properties."

RECORDS SEARCH

- A records search (less than one year old) extending to a half-mile beyond the project APE from a geographically appropriate Information Center is required. The records search should include maps that show all recorded sites and surveys in relation to the APE for the proposed project, and copies of the confidential site records included as an appendix to the Cultural Resources Report.
- The APE is three-dimensional (depth, length and width) and all areas (e.g., new construction, easements, staging areas, and access roads) directly affected by the proposed project.

We've got the **green**...
to keep California's **water clean**.
CLEAN WATER STATE REVOLVING FUND

NATIVE AMERICAN and INTERESTED PARTY CONSULTATION

- Native American and interested party consultation should be initiated at the planning phase of the proposed project to gather information to assist with the preparation of an adequate Cultural Resources Report.
- The Native American Heritage Commission (NAHC) must be contacted to obtain documentation of a search of the Sacred Lands Files for or near the project APE.
- All local Native American tribal organizations or individuals identified by the NAHC must be contacted by certified mail, and the letter should include a map and a description of the proposed project.
- Follow-up contact should be made by telephone and a phone log maintained to document the contacts and responses.
- Letters of inquiry seeking historical information on the project area and local vicinity should be sent to local historical societies, preservation organizations, or individual members of the public with a demonstrated interest in the proposed project.

Copies of all documents mentioned above (project description, map, phone log and letters sent to the NAHC and Native American tribal organizations or individuals and interested parties) must be included in the Cultural Resources Report.

Contact Information: For more information related to the CWSRF Program Cultural Resources and Requirments, please contact Mr. Ahmad Kashkoli at 916-341-5855 or Ahmad.Kashkoli@waterboards.ca.gov

PRECAUTIONS

A finding of ***"no known resources"*** without supporting evidence is unacceptable. The Cultural Resources Report must identify resources within the APE or demonstrate with sufficient evidence that none are present.

"The area is sensitive for buried archaeological resources," followed by a statement that ***"monitoring is recommended."*** Monitoring is not an acceptable option without good-faith effort to demonstrate that no known resource is present.

If ***"the area is already disturbed by previous construction"*** documentation is still required to demonstrate that the proposed project will not affect "historic properties." An existing road can be protecting a buried archaeological deposit or may itself be a "historic property." Additionally, previous construction may have impacted an archaeological site that has not been previously documented.

SHPO CONSULTATION LETTER

Submit a draft consultation letter prepared by the qualified researcher with the Cultural Resources Report to the State Water Resources Control Board. A draft consultation letter template is available for download on the State Water Board webpage at: *http://www.waterboards.ca.gov/water_issues/programs/grants_loans/cwsrf_requirements.shtml*

CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS
waterboards.ca.gov

CLEAN WATER STATE REVOLVING FUND

California Environmental Quality Act Requirements

State Water Resources Control Board
Division of Financial Assistance

The State Water Resources Control Board (State Water Board), Division of Financial Assistance, administers the Clean Water State Revolving Fund (CWSRF) Program. The CWSRF Program is partially funded by grants from the United States Environmental Protection Agency. All applicants seeking CWSRF financing must comply with the California Environmental Quality Act (CEQA), and provide sufficient information so that the State Water Board can document compliance with federal environmental laws. The "Environmental Package" provides the forms and instructions needed to complete the environmental review requirements for CWSRF Program financing. It is available at: *http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/srf_forms.shtml*

We've got the **green**... to keep California's **water clean**.
CLEAN WATER STATE REVOLVING FUND

LEAD AGENCY

The applicant is usually the "Lead Agency" and must prepare and circulate an environmental document before approving a project. Only a public agency, such as a local, regional or state government, may be the "Lead Agency" under CEQA. If a project will be completed by a non-governmental organization, "Lead Agency" responsibility goes to the first public agency providing discretionary approval for the project.

RESPONSIBLE AGENCY

The State Water Board is generally a "Responsible Agency" under CEQA. As a "Responsible Agency," the State Water Board must make findings based on information provided by the "Lead Agency" before financing a project.

ENVIRONMENTAL REVIEW

The State Water Board's environmental review of the project's compliance with both CEQA and federal cross-cutting regulations must be completed before a project can be financed by the CWSRF Program.

DOCUMENT REVIEW

Applicants are encouraged to consult with State Water Board staff early during preparation of CEQA document if considering CWSRF financing. Applicants shall also send their environmental documents to the State Water Board, Environmental Review Unit during the CEQA public review period. This way, any environmental concerns can be addressed early in the process.

REQUIRED DOCUMENTS

The Environmental Review Unit requires the documents listed below to make findings and complete its environmental review. Once the State Water Board receives all the required documents and makes its own findings, the environmental review for the project will be complete.

- ✓ Draft and Final Environmental Documents: Environmental Impact Report, Negative Declaration, and Mitigated Negative Declaration as appropriate to the project
- ✓ Resolution adopting/certifying the environmental document, making CEQA findings, and approving the project
- ✓ All comments received during the public review period and the "Lead Agency's" responses to those comments
- ✓ Adopted Mitigation Monitoring and Reporting Plan, if applicable
- ✓ Date-stamped copy of the Notice of Determination or Notice of Exemption filed with the County Clerk(s) and the Governor's Office of Planning and Research
- ✓ CWSRF Evaluation Form for Environmental Review and Federal Coordination with supporting documents

Contact Information: For more information related to the CWSRF Program environmental review process and requirements, please contact your State Water Board Project Manager or Mr. Ahmad Kashkoli at 916-341-5855 or Ahmad.Kashkoli@waterboards.ca.gov

CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS
waterboards.ca.gov

REVISED: FEB. 2014

TOWN OF COLMA
PLANNING DEPARTMENT

1198 El Camino Real • Colma, California 94014
Phone: (650) 757-8888 • FAX: (650) 757-8890

August 22, 2017

Mr. Patrick Sweetland
City of Daly City
153 Lake Merced Boulevard
Daly City, CA 94015

RE: Town of Colma Tertiary Recycled Water Project IS/MND Comments

Dear Mr. Sweetland:

Thank you for notifying the Town of Colma about the availability of the Tertiary Recycled Water Project IS/MND. The Town has reviewed the document and would like to offer the following comments. Since CEQA requires an analysis of project activities which may cause either a direct physical change to the environment, or a reasonably foreseeable indirect physical change in the environment, the Town is offering comments where necessary to include all project impacts, including those relating to the development of any of the alternative sites. Comments are primarily focused on Town of Colma General Plan and Zoning parameters that impact the design and placement of structures on each of the three alternative sites. The Town would like to have the improvements on the selected alternative site comply with General Plan and Zoning requirements, so we are recommending that these be incorporated as mitigation measures as described in the comments. In addition, the Town would like to assure that the final adopted IS/MND includes sufficient information to provide the necessary environmental clearance if one of the alternative sites is developed. C-1

Section 2.5, Table 4, pg. 2-14

Prior to obtaining building permits or an encroachment permit from the Town of Colma, the site selected for water storage and a pump building will require land use approvals from the Colma City Council. Since the zoning for the sites ("E" for Atwood site, "G" for Salem and Holy Cross) do not currently list public utilities as a permitted or conditional use, the site would require a rezoning action or zoning text amendment to allow the use. Depending on the zoning action taken by the City Council, the project will require Design Review approval and possibly a Conditional Use Permit. Table 4 should be updated to include Rezoning, Design Review and Conditional Use Permit as potential permits and approvals for the Town of Colma. C-2

Section 3.1 Aesthetics, pg. 3-2

For item a, the box checked should be: "*Less than significant with mitigation incorporation.*" The following text should be modified as follows: C-3

(a) **Treatment Plan Site, Daly City**

(Insert existing text, clarifying that it is the treatment plant site)

TOWN OF COLMA
PLANNING DEPARTMENT

1198 El Camino Real • Colma, California 94014
Phone: (650) 757-8888 • FAX: (650) 757-8890

Atwood Site, Colma

As described in the Colma General Plan, the Atwood Site in Colma is located on a locally designated scenic route. In addition, the site is adjacent to Salem Cemetery, which includes 5 structures which may be eligible for the National Register, including the office/chapel building located within 150' south of the potential well building. Since cemeteries extend all the way down to the El Camino Real, the Town of Colma has policies, guidelines and zoning provisions that are intended to maintain a greenbelt theme while still allowing limited development. Development of the site, particularly the well building, has the potential to create a significant visual impact to the El Camino Scenic Route. Compliance with the siting and design requirements in the Colma General Plan and Colma Municipal Code would reduce this impact to a less than significant level. C-3 Cont'd

Mitigation Measure:

Development of the Atwood site shall be in accordance with the following standards to maintain and enhance the El Camino Real Scenic Corridor:

- *Access to the sites shall occur from Olivet Parkway (GP Policy 5.03.726);*
- *Any above ground structures or parking areas shall maintain a 30' setback from the El Camino Real right-of-way (CMC 5.030.360);*
- *Within the 30' setback area, trees and landscaping shall be provided to enhance the greenbelt theme;* C-3 Cont'd
- *No fencing shall be maintained within the 30' setback area;*
- *Utilities shall be undergrounded from the nearest utility pole;*
- *Utility vaults shall be sited so as not to be visible from the El Camino Real right-of-way;*
- *Fencing shall either be a solid type or black vinyl clad cyclone fencing [CMC 5.03.350(e)];*
- *Siting of the well building shall be sensitive to existing views of the Salem office/chapel building; and*
- *The well building is required to be designed with Spanish Mediterranean architecture as required in the Colma General Plan and Design Review overlay district.*

Salem Site, Colma

As described in the Colma General Plan, the Salem Site in Colma is located on a locally designated scenic route. Hillside Boulevard provides views of San Bruno Mountain and scenic vistas to the west across the Colma valley. The site is part of the Salem Cemetery, which includes 5 structures which may be eligible for the National Register. The Town of Colma has policies, guidelines and zoning provisions that are intended to maintain a greenbelt theme while still allowing limited development. Development of the site, particularly the well building, has the potential to create a significant visual impact to the Hillside Scenic Route. Compliance with the siting and design requirements in the Colma General Plan and Colma Municipal Code would reduce this impact to a less than significant level. C-3 Cont'd

Mitigation Measure:

Development of the Salem site shall be in accordance with the following standards to maintain and enhance the Hillside Boulevard Scenic Corridor:

- *Any above ground structures or parking areas shall maintain a sufficient setback that will allow for generous landscape planting behind the sidewalk on Hillside Boulevard;*
- *fencing shall be set back from Hillside Boulevard and screened by landscaping;* C-3 Cont'd
- *Utilities shall be undergrounded from the nearest utility pole;*
- *Utility vaults shall be sited so as not to be visible from the Hillside Boulevard right-of-way;*
- *Fencing shall either be a solid type or black vinyl clad cyclone fencing [CMC 5.03.350(e)] and be set back to the extent feasible from Hillside Boulevard;*
- *Siting of the well building shall be sensitive to existing views from Hillside Boulevard; and*

TOWN OF COLMA
PLANNING DEPARTMENT
1198 El Camino Real • Colma, California 94014
Phone: (650) 757-8888 • FAX: (650) 757-8890

- *The well building is required to be designed with Spanish Mediterranean architecture as required in the Colma General Plan and Design Review overlay district.*

Holy Cross Site, Colma

As described in the Colma General Plan, the Holy Cross Site in Colma is located on a locally designated scenic route. Hillside Boulevard provides views of San Bruno Mountain and scenic vistas to the west across the Colma valley. In addition, the site is located in close proximity to the southeast gateway to the Town as described in the General Plan. The Town of Colma has policies, guidelines and zoning provisions that are intended to maintain a greenbelt theme while still allowing limited development. Development of the site, particularly the above ground storage tank, has the potential to create a significant visual impact to the Hillside Scenic Route and views looking toward San Bruno Mountain. Compliance with the siting and design requirements in the Colma General Plan and Colma Municipal Code would reduce this impact to a less than significant level. (Note: The Town disagrees with the statement on page 3-3 regarding the visual impact of an additional tank at the Holy Cross site. The existing tanks pre-date the 1998 General Plan policies, and any additional tanks would be required to be screened from view). C-3 Cont'd

Mitigation Measure:

Development of the Holy Cross site shall be in accordance with the following standards to maintain and enhance the Hillside Boulevard Scenic Corridor:

- *Utilities shall be undergrounded from the nearest utility pole;*
- *Utility vaults shall be sited so as not to be visible from the Hillside Boulevard right-of-way;*
- *Fencing shall black vinyl clad cyclone fencing [CMC 5.03.350(e)];*
- *Planting of a trees in front of the above ground tank will obscure views from Hillside Boulevard; and*
- *Painting of the storage tank and appropriate earth tone color will cause the tank to be less visually apparent.*

Section 3.3 Air Quality

General Comment: The discussion throughout this section is unclear about what constitutes "the project" and "the project site." The project consists of the improvements at the treatment plant and development of one of the three sites in Colma and pipe installation. Development of the Atwood Site or the Salem site could have significant construction air quality impacts due to the extensive grading required. Grading at the Atwood property is estimated at over 12,222 cubic yards and grading at the Salem property is estimated at over 11,925 cubic yards. It is unclear from the narrative what aspects of the project are included in the air quality analysis in Table 5. The analysis should include a worse-case development scenario that includes the impact of grading operations and which includes mitigation measures that address these impacts. C-4

Section 3.6 Geology and Soils

The Atwood site is located in a liquefaction area. Checklist item c) should be marked Less Than Significant with Mitigation Incorporation. Discussion item a) iii) should be modified to note that the Atwood site is in a liquefaction area. Mitigation would simply be Mitigation Measure GEO-1. C-5

Section 3.7 Hazards and Hazardous Materials.

General Comment: Reference to distance from San Francisco airport from center of project area is incorrect. Airport is at most 8 miles from the boundary of the airport property and about 4 miles to the Holy Cross site (reference: Comprehensive Airport land use plan for San Francisco International Airport). Airport land use policies will apply to the project. Suggested additional discussion in this section: C-6

TOWN OF COLMA
PLANNING DEPARTMENT

1198 El Camino Real • Colma, California 94014
Phone: (650) 757-8888 • FAX: (650) 757-8890

The project site is included in illustrations in the Comprehensive Airport Land Use Compatibility Plan for the Environs of the San Francisco International Airport, and is within the "Boundary for Airport Influence Area B" and within the "Outer Boundary of TERPS Approach and OEI Departure Surfaces" as shown in Exhibits IV-2, IV-10, IV-17 of the plan. (Source: Comprehensive Airport Land Use Compatibility Plan for the Environs of the San Francisco International Airport.)[1] However, all sites which constitute the Project are below the 400 foot elevation of the official aeronautical surface and more than 150 feet above ground level above the sites that constitute the project (Exhibit IV-17) so none of the sites will not be impacted by airport operations. In addition, the sites are outside the 65 dB noise contour; therefore, noise impacts from the airport would not result in a safety hazard for people in the vicinity of any of the potential project sites and a *less-than-significant* impact would occur. C-6 Cont'd

Wildland Fire, discussion item h). The Holy Cross site is an area of historic and potential wildfires due to its location at the base of San Bruno Mountain, and the Town of Colma is considered to be in an urban wildfire interface area per ABAG Hazard Maps (http://gis.abag.ca.gov/website/Hazards/?hlyr=wildfireThreat). Because if its rural location, this site is not in proximity to a fire hydrant or any fire suppression resources. This should be noted in the discussion. In addition, it should be noted that fire services for the Town of Colma (for all three alternative sites) are provided by the Colma Fire Protection District, which is a separate agency than the Town. Mitigation Measure HAZ-5 addresses this fire hazard during construction only. An additional mitigation measure should be added to address the prevention of ongoing, operational fire hazards. For the Holy Cross site, this would include annual weed abatement around the storage tank and making proper improvements as required by the Colma Fire Protection District. C-7

3.8 Hydrology and Water Quality

General Comment: Discussion throughout the section is unclear about what constitutes the project and the project site.

Runoff and impervious surfaces, discussion item (e). The determination should be changed from "no impact" to "less than significant impact" if one of the project sites will have more than 10,000 square feet of new impervious surfaces. The discussion should state the amount of impervious surfaces at each site. It is likely that no given project site would result in more than 10,000 square feet of impervious surfaces. It the development of any of the sites would create 10,000 square feet or more of impervious surfaces, development of that aspect of the project would be required to incorporate water quality improvements into the site design, as per the SMCWPPP requirements. Mitigation Measure HWQ-1 only addresses construction best management practices and not operational requirements. The operational phase of the Project (treatment site and chosen storage site) would include source control, LID site design, and stormwater treatment features to comply with the C.3 provisions of the MRP, which would improve water quality and thus reduce stormwater pollution. Implementation of these SWPPP measures would minimize post-development impacts to water quality; therefore, impacts would be *less than significant.* It should be noted in the discussion if any voluntary measures are being contemplated for any aspect of the project if under 10,000 square feet of impervious surfaces are added. C-8

3.9 Land Use and Planning

Conflict with any applicable land use plan, discussion item (b). The determination should be changed to "Less than Significant with Mitigation Incorporation" The discussion should be updated to address the conflicts and requirements with the Colma General Plan and Zoning as stated above. Mitigation measures can refer back to the Mitigation Measures in the Aesthetics section of vice versa, if the bulk of the discussion on land use is inserted here. C-9

---

[1] Prepared for City/County Association of Governments of San Mateo County Prepared by Ricondo and Associates, November 2012 http://ccag.ca.gov/wpcontent/uploads/2014/10/Consolidated_CCAG_ALUCP_November-20121.pdf)

TOWN OF COLMA
PLANNING DEPARTMENT

1198 El Camino Real • Colma, California 94014
Phone: (650) 757-8888 • FAX: (650) 757-8890

3.10 Mineral Resources

General Comment: Discussion appears to only be considering the treatment site in Daly City as the project site. Discussion should be expanded to include all sites in Colma and note that the City of Daly City General Plan and the Town of Colma General Plan do not identify any important mineral resources. C-10

3.11 Noise

Mitigation Measure NOI-1. The wording of this mitigation measure should be expanded to include not only Daly City's construction hours but also Colma's more restrictive Saturday construction end time of 5:00 p.m. (only in areas within 500 feet of a residential unit). It would be worth stating that noise generating activities would not occur on any federal holidays. C-11

3.12 Population and Housing

Discussion should be expanded to not only discuss "City (Daly City)" but also the Town of Colma, since a part of the project and distribution lines are in Colma. C-12

3.13 Public Services

Discussion should be expanded to note that the Colma Fire Protection District will serve the chosen storage site. As previously mentioned, the Holy Cross site is remote and does not have any fire fighting resources available. In the event of a fire, improvements could be damaged or lost. The discussion should note that should the Holy Cross site be chosen as the storage site, that development of the site will need to comply with the requirements of the Colma Fire Protection District. C-13

Tribal Cultural Resources

Consultant is using an outdated Initial Study Checklist, and document should be updated to discuss tribal cultural resources:

<u>XVII. TRIBAL CULTURAL RESOURCES</u>

a) Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

i) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or C-14

ii) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

3.16 Traffic and Transportation

Cause an increase in Traffic (discussion item a). The discussion should note that a construction and staging plan, in addition to an encroachment permit is required to be approved prior to work in the Town of Colma. It should also be noted that work in any Caltrans Right-of-Way will also require approval of a Caltrans encroachment permit. C-15

TOWN OF COLMA
PLANNING DEPARTMENT

1198 El Camino Real • Colma, California 94014
Phone: (650) 757-8888 • FAX: (650) 757-8890

Emergency access (discussion item e). This section should be revised to include a discussion about the Holy Cross site which is not easily accessible or may not be accessible at all to the Colma Fire Protection District. Mitigation would be required to prepare and receive approval of an emergency response and access plan from the Colma Fire Protection District prior to development to the site. C-15 Cont'd

Thank you in advance for your consideration of these items. Given the extent of the comments and need to amend most sections of the document, we would recommend that a revised Initial Study be prepared before being considered by a decision making body. Please feel free to contact me with any questions. C-16

Sincerely,

Michael P. Laughlin AICP
City Planner

Attachment: Town of Colma General Plan and Zoning Sections

Cc: Brad Donohue, Colma Public Works

Colma's green belt theme is reinforced through the impression one gets while driving through the Town.

5.02.140 CEMETERY, AGRICULTURE AND OPEN SPACE LAND USES

Holy Cross
Salem

5.02.141 Planning Context

Cemetery, agriculture and open space uses make up 76% of the land area in Town. Cemetery uses are concentrated in the Cemetery Planning Area and are also found in each of the other planning areas. In addition to memorial parks, uses found in this designation include flower growing plots, florists, greenhouses, monument shops and the Cypress Hills Golf Course. Other uses appropriate for this designation are private schools and churches. This land use designation is essential in maintaining Colma's greenbelt theme and it contributes to the economic base of the Town. The facilities on these lands draw people from around the Bay Area.

As the current trend toward cremation rather than ground burial continues, some cemetery owners may find that they have undeveloped land that could be leased or sold for other uses. As this occurs more intensive land uses may take the place of certain cemetery designations. These changes would, most likely, require a General Plan Amendment and zone change. Maintaining Colma's greenbelt theme throughout such changes can be accomplished in the way specific development proposals are implemented.

Colma's green belt theme is reinforced through the impression one gets while driving through the Town. Open space features such as large tree masses throughout the cemeteries, median strip landscaping and street trees on principal routes and the open, naturalized channel along open sections of Colma Creek, are all necessary in maintaining the open space character of the Town. The City Council will take action to improve civic beauty including tree planting, road median landscaping and enforcement of conditions related to private development projects. Further discussion of open space is found in the Open Space/Conservation Element.

Salem
Holy Cross

5.02.142 Cemetery, Agriculture and Open Space Land Use Development Guidelines

Cemeteries are generally required to have Building Permits for most structures. However, Use Permits are not required for crypts, mausoleums and chapels. Use Permits are required for cemetery business offices, maintenance buildings, corporation yards, mortuaries and other uses which could detract from the green belt theme if they are not designed and sited properly. Cemetery structures should be set back from property lines to ensure land stability and to provide space for building maintenance and buffer landscaping. It is intended that new buildings seen from public streets will incorporate a Spanish Mediterranean architectural theme unless this approach conflicts with existing improvements having recognized architectural or historic merit. Exterior walls should be well articulated and landscaped to be attractive to neighboring land uses particularly where cemetery grounds abut a residential area.

Holy Cross
Salem

Holy Cross
Salem

5.02.150 EXECUTIVE/ADMINISTRATIVE LAND USE (Coverage: 50%; FAR 1.0)

Atwood

5.02.151 Planning Context

The Executive/Administrative land use category was established to expand the range of possible land uses and economic opportunities along El

An example of an Executive/Administrative building incorporating a Spanish Mediterranean architectural theme.

Camino Real while continuing to protect the green belt theme of cemeteries. The Executive/Administrative designation is applied to land where the previous land use designation was Cemetery/Agriculture/Open Space. It may also be used to replace a commercial land use designation when access constraints and aesthetic objectives warrant such a conversion. In this land use category cemetery or memorial parks and floricultural or agricultural uses are allowed with no Use Permit. Those uses allowed upon issuance of a Use Permit are nurseries, flower shops, monument shops, medical service offices and professional business offices. These uses are typically compatible with cemetery uses because traffic generation is minimal, large signs are not needed and buildings can be screened with landscaping. Restaurants, in general, are not intended for this land use category however to encourage expansion of suitable places for business and community gatherings the City Council will consider proposals for restaurants which include banquet facilities capable of accommodating 50 or more people separated from the main dining rooms. No fast food facilities will be permitted.

At this time just over one percent of the Town's land area is designated for Executive/Administrative land use. Designations occur along both sides of El Camino Real. As conversions from the Cemetery/Agriculture/Open Space land use designation are made on other lands fronting El Camino Real, the Executive/Administrative designation will be applied.

5.02.152 Executive/Administrative Land Use Development Guidelines

Preservation of Colma's greenbelt theme is an important objective of the Executive/Administrative land use category. It is intended that new buildings on land designated for Executive/Administrative use will incorporate a Spanish Mediterranean architectural theme with a pitched roofline and that each development will include convenient off-street parking and high quality landscaping that perpetuates the greenbelt theme. Parking should be placed behind buildings or in fenced or walled enclosures well screened by landscaping. Roll up doors and loading areas should be located so they do not face the front of the lot. Signing should be restricted to small, building face signs whenever possible and no pole signs should be approved.

Atwood

5.02.160 PUBLIC AND QUASI-PUBLIC UTILITIES, FACILITIES AND SERVICES (Coverage: 50%; FAR 1.0)

5.02.161 Planning Context

Because of Colma's small residential population, many basic utilities, public facilities, and services are provided by contract with special districts or through agreements with adjacent cities. Colma residents are provided with utilities such as water, sewer, and power, public facilities such as local government and schools, and services such as police and fire protection. This land use category typically includes the types of activities and facilities which are generally recognized to be more efficiently provided by a public or quasi-public agency than by individuals. Public facilities and Town-owned facilities other than streets, include the City Hall, an office building and senior housing complex next to Town Hall, two small parks, a neighborhood community center site on F Street, an office building on Hillside Boulevard at F Street and a sewer pump station. Publicly-owned properties are so designated on the General Plan Land Use Map (Exhibit LU-2).

When opportunities arise, Colma should acquire additional vacant or underutilized land for community recreation purposes, a new public safety facility, playing fields, a library, and a corporation yard. Certain minimum levels of

5.02.171 <u>Access to In-Holding Lots</u>
The Cypress Hills District has a number of historic "in-holding" lots. These are lots typically purchased many years ago for speculative purposes and remain even though the bulk of the land has been acquired by Holy Cross Cemetery and Cypress Abbey Company. Roads were never physically constructed to provide access to these lots, although public easements, known as "paper streets," have been maintained to provide theoretical access. The paper streets remain on the maps presented in the General Plan as well as on the County Assessor's maps. Wherever possible, the Town should abandon paper streets that do not provide access to an in-holding lot, are not needed for utility purposes, or are redundant with other paper streets.

5.02.180 PLANNED DEVELOPMENT LAND USE

Colma's Zoning Ordinance contains a Planned Development (PD) Zone to allow flexibility of design to deal with special situations such as might be encountered with mixed uses. Developments under PD zoning are expected to be similar in intensity to projects that would be allowed under a standard zone and must be compatible with the surrounding neighborhood. PD zoning is expected to result in an exemplary project that provides an amenity value that might not otherwise be afforded by normal standards. PD zoning is not intended to accommodate density increases.

5.02.190 VACANT AND REDEVELOPABLE SITES

Colma has a limited number of vacant and redevelopable sites (See Exhibit LU-5). Not all vacant sites are available for urban development, however -- the large tract of vacant land in the Cypress Hills area east of Hillside Boulevard, for example, is designated open space. Refer to Exhibit LU-2 for the Land Use designations of specific vacant sites.

Colma does not have a redevelopment district as described by California planning law. Rather, the term "redevelopable sites" in the Colma General Plan refers to underdeveloped sites, underutilized sites, and those with non-conforming uses. Generally, the current uses of these sites are not considered the "highest and best" uses. These sites represent private redevelopment opportunities.

New development projects should be reviewed for their impacts on the transportation infrastructure. The impact of a specific project can vary depending on its relationship to roadways and public transportation facilities, as well as its compatibility with surrounding land uses. Large size projects are subject to City/County Association of Governments (C/CAG) Congestion Management Program review (see Section 5.03.516 in the Circulation Element).

5.02.200 GATEWAY SITES

Colma's image is dependent on what is seen from the road as people approach and move into the Town. Colma's separate identity and sense of containment can be strengthened by the experience of entering the Town through park-like gateways. The Plan identifies six distinct gateways:

- Mission Street at the intersection of B Street
- El Camino Real and Mission Road
- Serramonte Boulevard and Collins Avenue where they intersect Junipero Serra Boulevard
- Hillside Boulevard at the intersection of Hoffman Street
- Hillside Boulevard at the Hickey Boulevard extension (Lawndale) Holy Cross
- Mission Road at the Hickey Boulevard extension

Improvements to these gateways are described in the Circulation Element.

5.02.210 COLLINS AVENUE CORRIDOR DEVELOPMENT GUIDELINES

A number of vacant underutilized or non-conforming uses exist in the Collins Avenue Corridor. The purpose of this section is to establish guidelines to be followed in the future development of properties fronting Collins Avenue.

5.02.300 LAND USE POLICIES & IMPLEMENTATION MEASURES

The following policies are set forth to help guide decision making with regard to land use in Colma:

5.02.310 LANDSCAPING, DESIGN AND COMPATIBILITY			
POLICY NUMBER	**POLICY**	**IMPLEMENTATION MEASURE**	**CROSS REFERENCES WITH OTHER GENERAL PLAN ELEMENTS**
5.02.311	In any proposed development the Town shall balance and use judgement in reviewing the visual effects and the potential impacts of the proposed development, facilitating the tranquil atmosphere required for the Town's memorial parks.	The City Planner will make recommendations consistent with this policy to the Town Council for new development projects.	Open Space/ Conservation 5.04.351
5.02.312	The Town should take action to improve civic beauty including tree planting, road median landscaping, and enforcement of conditions related to private development projects.	The Town of Colma will commit financial resources for beautification projects including tree planting and road median landscaping in future budgets. Existing budget resources are committed to landscape maintenance. The City Planner currently tracks and enforces conditions related to private development projects.	
5.02.313	Particular encouragement should be given to those new developments that incorporate passive and/or active solar energy systems for preheating water and for space heating and cooling.	The City Planner will make recommendations consistent with this policy to the Town Council for new development projects.	
5.02.314	The Town should prohibit land uses generating excessive amounts of traffic or requiring large signs from locating on El Camino Real.	The City Planner will make recommendations consistent with this policy to the Town Council for new development projects, and an Environmental Review will be conducted pursuant to the California Environmental Quality Act to consider traffic impacts. The Sign Ordinance allows only small signs for businesses facing the El Camino Real.	
5.02.315	The Town should encourage the private redevelopment of properties along Collins Avenue to strengthen the commercial retail core.	The City Planner will make property owners aware of the Town's desire to have properties redevelop.	

continued

The tranquil atmosphere required for the memorial parks should be maintained.

5.02.310 LANDSCAPING, DESIGN AND COMPATIBILITY (continued)			
POLICY NUMBER	**POLICY**	**IMPLEMENTATION MEASURE**	**CROSS REFERENCES WITH OTHER GENERAL PLAN ELEMENTS**
5.02.316	Culverting or covering of the remaining open sections of Colma Creek through Colma should not be permitted, except for a short segment near the junction of El Camino Real and Mission Road required for installation of a flood control diversion structure. The Town will seek to enhance the remaining open sections of Colma Creek with creekside landscaping and lighting where appropriate, and will seek to establish a pathway following all open sections of the creek as a condition of approval for improvement projects on properties abutting the following open sections of Colma Creek: a) Parallel to El Camino Real from near F Street to near Colma Boulevard b) El Camino Real to Serramonte Boulevard c) Collins Avenue to El Camino Real d) Parallel to Mission Road from near El Camino Real to the south Colma boundary. Culverting or covering of the remaining open sections of Colma Creek may be allowed by the City Council pursuant to a Use Permit and Design Review provided that the creek section is not visible from a public right-of-way and that a substantial community amenity is provided as mitigation.	The City Planner will make recommendations consistent with this policy to the Town Council for new development projects. Flood control projects will be constructed by the County Department of Public Works.  *Pathway along Colma Creek.*	Open Space/ Conservation 5.04.321 and 5.04.322
5.02.317	No new metal clad buildings should be permitted in the Town of Colma, other than agriculturally-related.	The City Planner will make recommendations consistent with this policy to the Town Council for new development projects.	
5.02.318	The Town should condition the approval of permits for all site and building improvement projects where such projects involve the public street frontage to require the installation of street trees along the public street frontage of the affected property. Spacing of trees should be in accordance with an adopted tree planting plan or, If no plan exists, trees should be installed at a minimum spacing of one tree each 25 feet parallel to the public roadway. Exceptions should be made if this approach would clash with an established landscape scheme of merit.	The City Planner will make recommendations consistent with this policy to the City Council for new development projects.	Circulation 5.03.732
5.02.319	In the case of properties located at gateway sites, the Town should require gateway elements to be included as part of the design of any new development where applicable.	The City Planner will recommend design alternatives and a preferred design will be adopted by the City Council. Gateways will be implemented as part of the Town's Capital Improvement Plan or alternatively, as part of the permitting for private site development.	Circulation 5.03.731
5.02.3110	It is intended that new buildings in design review districts where such buildings are visible from public roads, with the exception of established shopping centers and private cemetery family crypts and markers, should incorporate a Spanish/Mediterranean architectural theme. Exceptions should be allowed if this approach would clash with existing improvements having recognized historical or architectural merit.	Design requirements consistent with this policy have been added to the Design Review section of the Zoning Ordinance. The City Planner will make recommendations consistent with this policy to the City Council for new development projects, or at an administrative level if the project does not require City Council review	

5.02.320 RESIDENTIAL			
POLICY NUMBER	POLICY	IMPLEMENTATION MEASURE	CROSS REFERENCES WITH OTHER GENERAL PLAN ELEMENTS
5.02.320	The Town should allow only the construction of single family detached housing units as infill in the Sterling Park neighborhood.	In 1998, the City Council adopted a new Neighborhood Residential (R-S) Zoning for the Sterling Park Sub-area. This ordinance clearly defines density and design guidelines to maintain the single family detached character of the neighborhood.	
5.02.321	Residential developments having ten or more units should be required to provide park and recreation facilities or contribute to the improvement of community-wide facilities.	The City Planner will make recommendations consistent with this policy to the Town Council for new development projects.	
5.02.322	The Town should restrict to 50 the maximum annual number of new residential units that become available for rent or purchase and should monitor population growth so that the total population is only approximately 1500 by the year 2005.	Regulation of population growth is necessary so that City Services are not overburdened and can be expanded in an orderly manner.	
5.02.323 ✓	The existing commercial use on Hoffman Street should be phased out and replaced with a residential use.	The City Planner will make recommendations consistent with this policy to the Town Council. The City Planner will work with the property owner to design a Planned Development that is compatible with the surrounding residential development.	

5.02.330 COMMERCIAL			
POLICY NUMBER	POLICY	IMPLEMENTATION MEASURE	CROSS REFERENCES WITH OTHER GENERAL PLAN ELEMENTS
5.02.331	Shopping facilities, auto dealerships, and other general commercial land uses should be located in the commercial core area centered on Serramonte Boulevard and extending northward along Junipero Serra Boulevard to the 280 Metro Center.	The existing commercial zoning pattern, lot sizes and existing development follow this policy. Developments of this type in other commercial areas are not appropriate due to lot size constraints.	
5.02.332 ✓	The City Council should encourage expansion of the Auto Sales District onto vacant and redevelopable properties located at the westerly end of Collins Avenue. All development in the Collins Avenue Corridor should be required to follow specific development guidelines set forth in the General Plan. Heavier service commercial uses such as auto body shops, roofing companies, light manufacturing and similar uses should be located in the Mission Road District.	The City Planner has and will continue to make recommendations for the implementation of the Collins Avenue Corridor development guidelines in the General Plan at a staff level or in proposals presented to the City Council.	

✓ Special site specific policy. See Exhibit LU-2 for locations.

continued

5.02.330 COMMERCIAL (continued)			
POLICY NUMBER	**POLICY**	**IMPLEMENTATION MEASURE**	**CROSS REFERENCES WITH OTHER GENERAL PLAN ELEMENTS**
5.02.333	As properties on Collins Avenue are redeveloped, new uses which reinforce the Auto Sales District should be encouraged.	The City Planner has and will continue to make recommendations for the implementation of the Collins Avenue Corridor development guidelines in the General Plan at a staff level or in proposals presented to the City Council.	
5.02.334	Commercial land uses requiring frequent truck deliveries should not be located adjacent to residential or cemetery land uses without a sufficient buffer incorporated into their site plans.	The City Planner will make recommendations consistent with this policy to the Town Council for new development projects. Colma's primary residential area is physically removed from the commercial areas of Town.	
5.02.335 ✓	Mixed commercial and residential uses should be encouraged in the southerly portion of the Mission Road District and in the commercial frontage along Mission Street in the Sterling Park Planning Area.	The City Planner will make recommendations consistent with this policy to the Town Council for new development projects. Planned Development zoning should be encouraged.	

✓ Special site specific policy. See on Exhibit LU-2 for locations

Examples of mixed-use development with commercial and residential uses.

5.02.340 EXECUTIVE/ADMINISTRATIVE			
POLICY NUMBER	**POLICY**	**IMPLEMENTATION MEASURE**	**CROSS REFERENCES WITH OTHER GENERAL PLAN ELEMENTS**
5.02.341	Development proposals for parcels located on El Camino Real between F Street and Mission Road should be consistent with the Cemetery (G) or Executive/Administrative (E) land use categories. Zoning changes on El Camino Real from the Commercial (C) or Cemetery (G) category should only be made to the Executive/ Administrative (E) category.	The City Planner will make recommendations consistent with this policy to the Town Council for new development projects or rezoning requests.	
5.02.342	The Town should encourage medical service offices and professional business offices to locate their facilities in the Executive/Administrative land use area along El Camino Real.	The Exexutive/ Administrative land use designation along El Camino Real permits and encourages these uses. Other zoning designations do not encourage these uses.	

5.07.350 CIRCULATION AND TRANSIT			
POLICY NUMBER	**POLICY**	**IMPLEMENTATION MEASURE**	**CROSS REFERENCES WITH OTHER GENERAL PLAN ELEMENTS**
5.02.351	The Town should cooperate with SamTrans and BART to facilitate the extension of BART service through Colma in a manner that does not detract from Colma's greenbelt theme. All tailtrack and line extensions shall be located underground following the abandoned S.P. Railroad right-of-way through Colma. Replacement landscaping including the use of tree species that will attain significant height and mass should be required.	The Town of Colma was involved in the BART Environmental Impact Report review process and in the review of specific development plans. Verbal and written comments were submitted back to BART consistent with this policy. The Town will continue to review detailed development plans and to monitor construction operations.	
5.02.352	Sufficient off-street parking should be required for all new construction, in amounts varying with the type of use.	The Zoning Code specifies the amount of off-street parking required for all new construction.	
5.02.353	The City Council should condition the approval of permits for all site and building improvement projects where such projects involve the public street frontage to require the installation of a public sidewalk, if one does not already exist, within the public right-of-way fronting the affected property.	The City Planner will make recommendations consistent with this policy to the City Council for new development projects.	Circulation 5.03.722 Open Space/ Conservation 5.04.392
5.02.354 ✓	The Town should abandon "paper streets" in the Cypress Hills district that do not provide access to in-holding lots, or are redundant with other paper streets. Paper streets which provide direct access to in-holding lots should be maintained as public easements.	The City Planner will make recommendations consistent with this policy to the City Council. If a paper street is made redundant by an in-holding lot being acquired by an adjoining landowner, the City Planner will recommend to the City Council that the street be abandoned.	Circulation 5.03.718
5.02.355 ✓	Access to parcels fronting El Camino Real south of Mission Road should be restricted to right-turn in/right-turn out only. Access to parcels with frontage on both El Camino Real and Mission Road should be restricted to Mission Road.	The City Planner will make recommendations consistent with this policy to the City Council for new development projects.	Circulation 5.03.725

✓ Special site specific policy. See Exhibit LU-2 for locations.

5.02.360 UTILITIES			
POLICY NUMBER	**POLICY**	**IMPLEMENTATION MEASURE**	**CROSS REFERENCES WITH OTHER GENERAL PLAN ELEMENTS**
5.02.361	The Town should require all new construction projects to place power, telephone and cable TV lines underground. Utility boxes and transformers should also be undergrounded if possible. If there is no reasonable alternative than above ground placement then these facilities should be screened by fencing and/or landscaping.	The Town of Colma Municipal Code includes a section on utility undergrounding consistent with this policy.	
5.02.362	The Town should require all new construction projects to hook up to public water and sewer systems.	The City Planner will make recommendations consistent with this policy. Cemeteries will be allowed to continue using groundwater for irrigation purposes.	

5.02.370 PUBLIC SERVICES AND FACILITIES			
POLICY NUMBER	**POLICY**	**IMPLEMENTATION MEASURE**	**CROSS REFERENCES WITH OTHER GENERAL PLAN ELEMENTS**
5.02.371	The Town should acquire additional vacant or underutilized land for civic purposes such as community recreation facilities, playing fields, a library, a public safety facility, and a corporation yard.	The Town continues to investigate opportunities for acquiring additional sites for civic purposes. The City Council will be asked to rate acquisition priorities.	Open Space/ Conservation 5.04.391 Safety 5.07.438
5.02.372	The Town should insure that the community is served by a self-sufficient fire protection system which may include support for the existing District, establishment of a joint powers agreement, acquisition of the existing District and facilities or development of a new free-standing fire station.	A preliminary facility study has been prepared to assess current and future needs of the District. This study will be periodically be evaluated and used in decisions to purchase property or expand existing facilities.	Safety 5.07.437
5.02.373	If the police department maintains its facility at Town Hall, the City Council should consider ways to expand office space and facilities on-site or at a new, off-site location. An off-site location should be sought for a Town corporation yard.	A preliminary space needs assessment has been conducted which indicates that there is an urgent need to expand the Police Department facility to meet current and near-term growth. Maintaining the facility at Town Hall would retain the central location that the current facility enjoys.	
5.02.374	In the case that a private school is proposed to be constructed in Colma, it is appropriate to find a site located near established residential areas and public transit routes. If a church is proposed to be built in Colma, a site should first be sought within a cemetery/agriculture land use area; second, in an executive/administrative land use area; third, in a commercial area.	The City Planner will advise prospective applicants accordingly and make recommendations consistent with this policy to the Town Council for new development projects.	
5.02.375	Child care facilities should be encouraged in both residential and non-residential areas in ways that are compatible with existing uses, in order to promote availability and accessibility of services. Facilities will be encouraged to register with the Child Care Coordinating Council of San Mateo County.	The City Planner will advise prospective applicants accordingly and make recommendations consistent with this policy to the Town Council for new development projects.	

Colma Police Station at Town Hall

The "Y" at El Camino Real and Mission Road

because of the small number of business frontages and available off-street parking. Sidewalks have been installed on the entire east side of the roadway, but the west side lacks sidewalks north of the Greek Cemetery Driveway and south of Cypress Lawn (which transitions into the jurisdiction of South San Francisco). Ultimately, sidewalks should be constructed on both sides of the street along the entire length of El Camino Real. Although El Camino Real is a designated bicycle route, there are no marked bicycle lanes and no sidewalk or bicycle facilities have been provided north from South San Francisco into Colma. Because Highway 82 is a State Highway, state approval must be obtained for driveway and utility encroachments.

Left turns from Collins Avenue and from various cemetery entrance driveways onto El Camino Real can be dangerous at times due to the width of El Camino Real (three lanes in each direction) and at times the high speeds of traffic. The wide median is important for the protection it provides. Median landscaping improvements must not obscure lines of sight. Controls on left-turn movements should be considered. Likewise, access to parcels fronting El Camino Real south of Mission Road is potentially hazardous due to poor visibility caused by the curvature of the road, and the relatively high speed of traffic. Left turns to and from these parcels should be restricted. Access to parcels with frontage on both El Camino Real and Mission Road should be restricted to Mission Road. In general, additional driveway encroachments to El Camino Real should be discouraged to protect the greenbelt appearance and to promote traffic safety. Where possible, access should be from other streets.

Future projects included in the Colma Capital Improvement Program for the El Camino Real include upgrading and signalizing the merging of El Camino Real and Mission Road, commonly known as the "Y."

5.03.113 <u>Scenic Corridors - Major Highways</u>

The State of California has identified I-280 as a State Scenic Highway from the Santa Clara County line to the San Bruno City limit. The section from the San Bruno City limit north through Colma is an Eligible State Scenic Highway – not officially designated. Although the State has no jurisdiction over development in Colma, local consideration should be given to what is visible from the highway. For the most part there is a sense of open space that prevails except in the vicinity of Serramonte Boulevard where Colma's commercial core is concentrated.

While traveling on I-280, San Bruno Mountain is a major focal point to views east of the freeway. The existing backdrop of trees along most cemetery boundaries provides an important buffer at the edge of urban development. As long as the Town's open space character is maintained by retaining large tree buffers and adding

El Camino Real

new landscaping with future development, the view of Colma from the freeway will remain nearly the same.

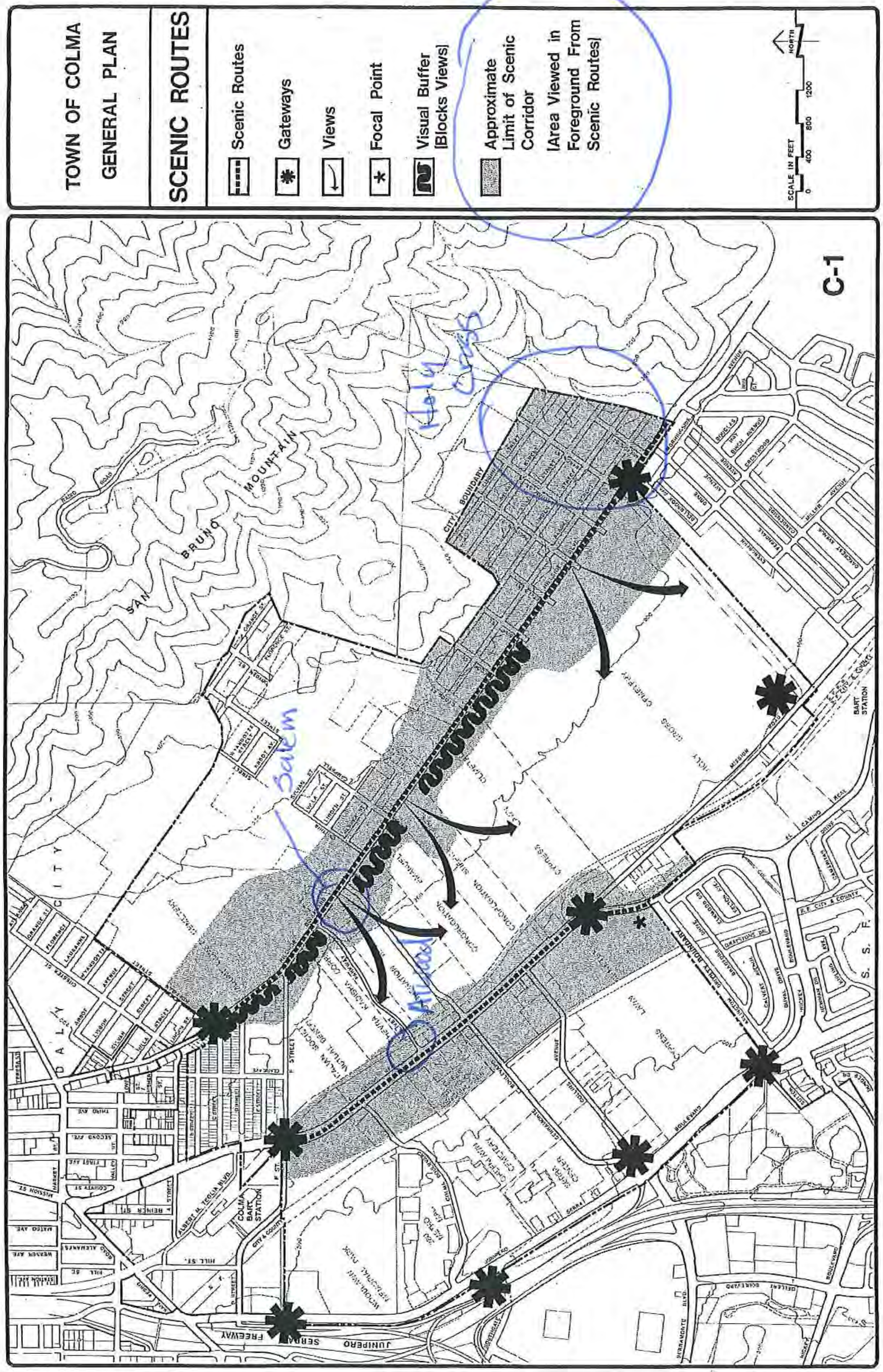
Atwood

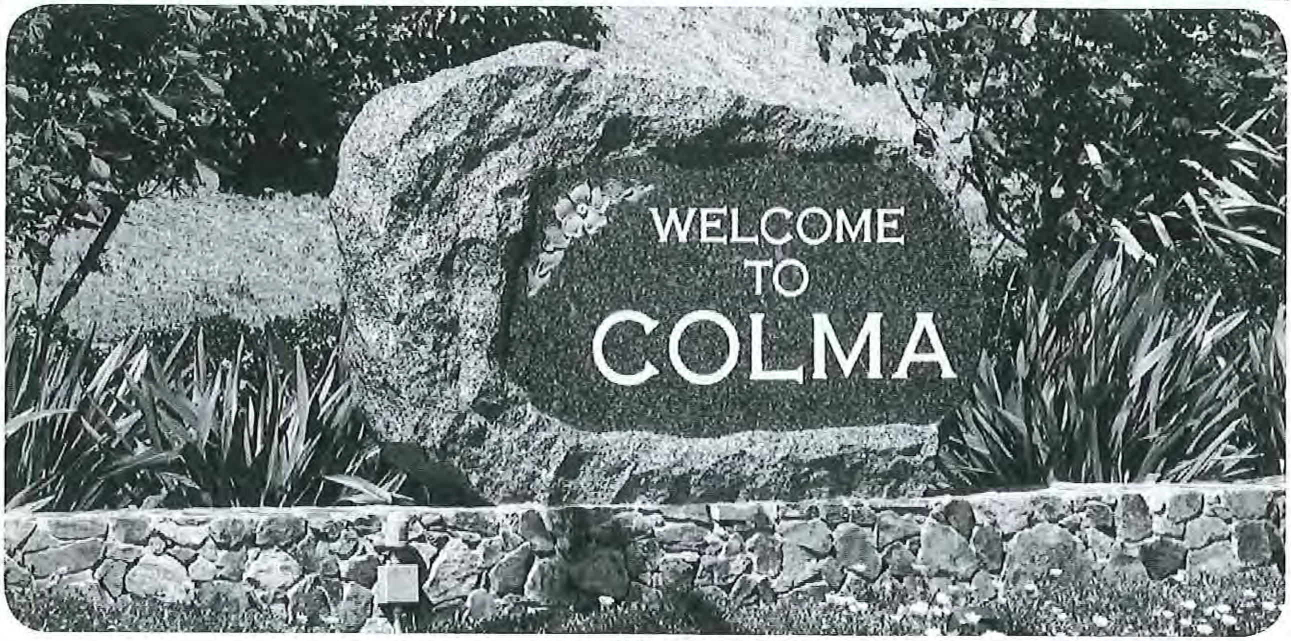
Landscaping along El Camino Real adds to the road's scenic quality and successfully reinforces Colma's open space character. The median is landscaped with lawn, which contributes a greenbelt theme. This should be enhanced with other landscape elements to create a distinctive appearance through Colma. Tree planting along the roadway and undergrounding of the overhead utility lines is recommended to better define the corridor and further contribute to the road's scenic quality. Site planning criteria for development along the El Camino Real scenic corridor should be adopted in order to maximize the visual effects of landscaping.

5.03.114 Entry Gateways

Colma's image is dependent on what is seen from the road as people approach and move into the Town. A key feature of Colma's General Plan is the recognition of natural gateways to the community along specified routes. Colma's separate identity and sense of containment is strengthened by nine gateway locations:

- El Camino Real - North: In median near intersection of B Street
- El Camino Real - South: At Mission Road, in landscaped area forming "T" intersection
- Serramonte Boulevard: At northeast corner of Junipero Serra Boulevard
- Junipero Serra Boulevard – North: In median near northern Town boundary
- Junipero Serra Boulevard – South: In median at southern Town boundary
- Junipero Serra Boulevard: At southwest corner of Southgate Avenue
- Hillside Boulevard – North: In median near Hoffman Street
- Hillside Boulevard – South: In median north of Lawndale Boulevard
- Old Mission Road – South: At northeast corner of Lawndale Boulevard


TOWN OF COLMA
GENERAL PLAN
SCENIC ROUTES
Scenic Routes
Gateways
Views
Focal Point
Visual Buffer [Blocks Views]
Approximate Limit of Scenic Corridor
[Area Viewed in Foreground From Scenic Routes]
SCALE IN FEET
0 400 800 1200
NORTH
C-1
Holy Cross
Salem
CITY BOUNDARY
SAN BRUNO MOUNTAIN
BART STATION
COLMA BART STATION
SERRAMONTE
JUNIPERO SERRA FREEWAY



Colma Entry Gateway

Most of Colma's natural gateway locations are formally identified with landscaping and a stone sign which reads, "Welcome to Colma," but there are some locations which haven't yet been formally identified due to anticipated capital improvement projects or intersection reconfigurations. Appropriate landscaping and a stone sign reading, "Welcome to Colma," should be installed at the following remaining locations:

- El Camino Real - South: At Mission Road, in landscaped area forming "Y" intersection
- Hillside Boulevard – North: In median near Hoffman Street (scheduled for installation in 2014-2015)
- Hillside Boulevard – South: In median north of Lawndale Boulevard

The nine gateway locations are shown on Exhibit C-1.

5.03.150 ARTERIAL STREETS

Arterial streets connect Colma's residential, commercial and cemetery districts and provide a link to surrounding communities. Arterials also act as alternative north-south routes should the major highway system be blocked. Arterial streets should ideally contain two lanes in each direction with no on-street parking, sidewalks at least five feet wide on both sides of the street and a minimal number of access points. A planting strip should be created adjacent to the sidewalk to enhance the appearance of the road. Existing arterial streets in Colma may not be built to this standard but any future arterials should have a minimum 70 foot right-of-way with a minimum roadway width of 56 feet curb to curb including medians. Some flexibility will be

Road is used as an alternate to El Camino from many sections of South San Francisco. Access to Mission Road from El Camino Real is controlled by a stop sign. Left turns from Mission Road into the south bound lane of El Camino Real are prohibited because of poor sight lines and fast-moving traffic; instead, motorists must make a u-turn at one of several median breaks on El Camino Real. On-street parking is allowed on both sides of Mission Road, although there are time restricted zones in some areas. Most of this route has sidewalks along both sides of the street. Auto repair uses in this area result in heavy demand for parking both on-and off-street. A program of restriping to add bicycle lanes coupled with sidewalk and landscape improvements is recommended to improve bicycle, pedestrian and traffic safety and visual appearance. Street tree planting, special sidewalk and pavement treatments, street furniture, and decorative street lights could be done as part of a utility undergrounding/street beautification program.

Mission Road

5.03.154 Hillside Boulevard

Hillside Boulevard is a north-south arterial roadway connecting Daly City near the San Francisco city limits, through Colma, to Highway 101 in South San Francisco. Hillside Boulevard has been striped for two lanes through Colma. Traffic signals are located at Olivet Parkway, Serramonte Boulevard, and Lawndale Boulevard. The intersections at F Street and at Hoffman Street are controlled by stop signs. Sidewalks are going to be installed on both sides of Hillside Boulevard between Serramonte Boulevard and Hoffman Street (these Phase 1 improvements from Hoffman Street to Serramonte Boulevard are scheduled for construction in the latter half of 2014, see Exhibit C-3). Future capital improvement plans will incorporate a continuous sidewalk from Serramonte Boulevard on the west side of the roadway to Lawndale Boulevard. Hillside Boulevard is a designated bicycle route with marked bicycle lanes.

Hillside Boulevard

5.03.155 Lawndale Boulevard

Lawndale is a east/west connector between Hillside Boulevard and Mission Road. Pacific Gas and Electric Company have installed gas and electric transmission lines the entire length of Lawndale Boulevard.

Lawndale Boulevard

Holy Cross
Salem

5.03.156 Scenic Corridor - Arterial Streets

Hillside Boulevard is designated a scenic corridor in Colma. It is located at a higher elevation than the rest of the Town. Therefore, the drive along Hillside provides unique foreground views of San Bruno Mountain and panoramic views of Colma, South San Francisco, and Daly City.

The view to the east along the Hillside Boulevard corridor is mostly of San Bruno Mountain and open space, including flower growing plots, cemeteries, and a few houses. The view to the west overlooks Colma and its surrounding communities (refer to the Scenic Route Map). Part of this view is blocked by roadside fencing and vegetation, which emphasizes the view to the east. Consequently this adds variety and interest to Hillside Boulevard.


Collins Avenue

As one travels along Hillside Boulevard there is a rural character to the corridor. There is a sense of separation from the urban development that surrounds Colma. This atmosphere should be protected if any development occurs along the Hillside Boulevard scenic corridor. Special care should be given to the landscape treatment associated with future uses along this route.

5.03.200 COLLECTOR STREETS


Colma Boulevard

Collector streets serve the important function of transferring traffic from local traffic generators such as shopping and employment areas to the arterials. Collector streets do not form a continuous system -- otherwise there would be a tendency to use them as arterials. The Plan for Colma includes collectors serving the Sterling Park residential area and the Core Commercial area.

The recommended standard for two-lane collectors is a 50-foot right-of-way with a minimum 36-foot wide roadway, curb to curb. Collector streets should have a five foot wide sidewalk on both sides of the street. Four-lane collectors should have at least a 60 foot right-of-way with a minimum 46-foot wide roadway curb-to-curb. A planting strip should be created adjacent to the sidewalks to enhance the appearance of the road. Existing collector roadways serving Colma have not been built to these standards, but any future collectors should be. Some flexibility will be needed to match new work to old work in the field.

5.03.210 Collins Avenue

Collins Avenue is a two-lane road which connects El Camino Real at its east end with Serramonte Boulevard at its west end. There is an existing sidewalk along Collins Avenue on the south side of the street near Junipero Serra Boulevard. In the western portion of Collins Avenue, parking is allowed only along the south side of the street. The eastern portion has a wider roadway, sidewalks and parking lanes on both sides of the street in accordance with the Collins Avenue Plan Line specifications (refer to Exhibit C-5). Collins Avenue descends from west to east and is bordered by a steep downslope along most of its north side.

The Town requires improvements to Collins Avenue as a condition of approval of new development projects. Improvements have occurred incrementally and some segments of the street still need to be improved.

the added peak hour trips will have no measurable impact on the Congestion Management Program roadway network.

3. Contribute an amount per peak hour trip to a special fund for improvements to the Congestion Management Program roadway network. This amount will be set annually by C/CAG based on a nexus test.

4. Require the developer and all subsequent tenants to implement Transportation Demand Management programs that mitigate the new peak hour trips. A list of acceptable programs and the equivalent number of trips that are mitigated will be provided by C/CAG annually. Programs can be mixed and matched so long as the total mitigated trips is equal to or greater than the new peak hour trips generated by the project. These programs, once implemented, must be on-going for the occupied life of the development. Programs may be substituted with prior approval of C/CAG, so long as the number of mitigated trips is not reduced. Additional measures may be proposed to C/CAG for consideration. Also there may be special circumstances that warrant a different amount of credit for certain measures. These situations can also be submitted to C/CAG in advance for consideration.

5.03.600 SCENIC ROUTES MAP

5.03.610 SCENIC ROUTES

El Camino Real, Hillside Boulevard, and Junipero Serra Boulevard have been defined as scenic routes through Colma. Key visual features of each have been described on the Scenic Routes Map. A generalized view corridor is shown along each of the routes. A more detailed analysis of each route, for the purpose of establishing precise boundaries for these corridors, is beyond the scope of the General Plan, butut an analysis with specific corridor plans should be prepared in the future. The width of the corridor should be maximized when scenic quality is high, and minimized where existing development forms the visual boundary (see Exhibit C-1).

3.611 Protection of the Scenic Corridors

Every effort should be made to protect the overall visual experience along each of the identified scenic corridors, primarily through enforcement of sensitive site planning. Distant, panoramic views of Colma and its environs can be appreciated in a number of locations. In these locations (see Exhibit C-1), first priority should be in keeping buildings out of the corridor so that views are not blocked. In some cases, noise compatibility planning will support this approach. Where development is permitted in the corridor, landscaping should be required to screen views of buildings, and to quickly cover any scars

left from grading. The open quality of views should be retained by concentrating landscape materials near the objects to be screened rather than by creating a wall of vegetation adjacent to the road.

5.03.620 CRITERIA FOR SITE PLANNING IN SCENIC CORRIDORS - All sites

Each development project within scenic corridors should be located, sited and designed to carefully fit within its environment. The scenic character of the site should be maintained as much as possible. The following criteria can be applied to development proposals in meeting the above stated goals.

5.03.621 <u>Site Planning</u>

5.03.621.1 All roads, buildings and other structural improvements or land coverage should be located, sited and designed to fit the natural topography.

5.03.621.2 All development should be sited and designed to minimize the impacts of noise, light, glare and odors on adjacent properties and the community-at-large.

5.03.621.3 No use, development or alteration should create uniform, geometrically-terraced building sites which are contrary to the natural land form or which substantially detract from the scenic and visual quality of the Town.

5.03.621.4 Development should not contribute to the instability of the parcel or adjoining lands, and all structural proposals including excavation, proposed roads and other pavement should adequately compensate for adverse subsurface conditions. Roads and structures should not be located where downward lateral forces can adversely effect a slope or creek bank.

5.03.622 <u>Paved Areas</u>

5.03.622.1 The number of access roads to a Scenic Corridor shall be minimized wherever possible. Development access roads shall be combined, with the intent of minimizing intersections with scenic roads.

5.03.622.2 Small, separate parking areas are preferred to single large parking lots.

5.03.622.3 Paved areas should be integrated into the site, related to their structure, and should be landscaped to reduce their visual impact from scenic corridors. Textured paving should be considered.

5.03.623 Landscaping and Views

5.03.623.1 Public views within and from Scenic Corridors should be protected and enhanced, and development should not be allowed to significantly obscure, detract from, or negatively affect the quality of these views. Vegetative screening may be used to mitigate such impacts.

5.03.623.2 Selective clearing of vegetation, which allows the display of important public views may be permitted.

5.03.623.3 Wherever possible, vegetation removed during construction should be replaced. Vegetation for the stabilization of graded areas or for replacement of existing vegetation shall be selected and located to be compatible with surrounding vegetation, and should recognize climatic, soil and ecological characteristics of Colma.

5.03.623.4 A smooth transition should be maintained between development and adjacent open areas through the use of natural landscaping and plant materials which are native or appropriate to the area.

5.03.623.5 Screening, as required under these design criteria, should not consist of solid fencing, rather it should be of natural materials of the area, preferably vegetation appropriate to the area in conjunction with low earth berms.

5.03.624 Architecture

5.03.624.1 The design of the structure should be appropriate to the use of the property and in harmony with the shape, size and scale of adjacent buildings in the community.

5.03.624.2 The architectural style of new buildings should incorporate a Spanish Mediterranean design theme with pitched roofs and varied horizontal planes to create shadows. Exceptions may be approved where this approach would clash with existing structures having historical or architectural merit.

5.03.624.3 Highly reflective surfaces and colors are discouraged.

5.03.625 Signs

5.03.625.1 No signs should be permitted within the front setback, or on rooftops. Billboard sings and pole signs should not be permitted within scenic corridors.

5.03.625.2 Signs appropriate for use in a scenic corridor are small identification signs, small building face signs and monument signs. Night lighting should be limited to direct spot lighting.

5.03.626 Utilities

5.03.626.1 Overhead utility lines should be placed underground to reduce the visual impact along scenic corridors.

5.03.626.2 Underground utility lines will be required for all new public and private developments.

5.03.626.3 Public utility structures shall be designed and sited so as to have an uncluttered appearance, subordinate to the setting.

5.03.700 ADOPTION DRAFT CIRCULATION ELEMENT POLICES

The following policies are set forth to help guide decision making with regard to circulation, transportation, and scenic routes in Colma. Programs necessary for the implementation of those polices are described following the policies section.

5.03.710 CIRCULATION SYSTEM		
POLICY NUMBER	**POLICY**	**IMPLEMENTATION MEASURE**
5.03.711	Commercial and industrial truck traffic, except for trucks serving local business, should be limited to highways or arterial streets for movement through the Town.	The City Engineer will require appropriate routes consistent with this policy.
5.03.712	Improvements to Collins Avenue consistent with the Plan Line for Collins Avenue should continue to be implemented as a condition of approval of new development projects.	The City Planner will make recommendations consistent with policy to the City Council for new development projects.
5.03.713	On-street parking should typically be prohibited except on local streets. On-street parking, where necessary to support commercial businesses, should be oriented primarily to short-term use for the convenience of patrons.	Areas with prohibited or restricted on-street parking are designated with painted curbs and/or signs. The Public Works Department will maintain these designations. The City Engineer will recommend changes when applicable.
5.03.714	A loop road allowing access for emergency vehicles should be included in any future development of the Cypress Hills area. The road should connect the Serramonte Boulevard extension through the Cypress Lawn Hillside Campus to the current golf course access road.	The City Planner will make recommendations consistent with this policy to developers during the design review process. If the property is developed for open space use the road may be private and restricted as to general public access. The road may be installed in increments as land adjoining the right-of-way is improved.
5.03.715	The Town shall favorably consider street abandonment applications for paper streets that do not provide access to in-holding lots, are not needed for utility purposes, or are redundant with other paper streets, and will not in the foreseeable future serve a public purpose.	The City Planner and City Engineer will identify streets that meet the policy's criteria and make recommendations for abandonment to the City Council based on the merits of the abandonment application.

5.03.720 COMPLETE STREETS POLICIES		
POLICY NUMBER	**POLICY**	**IMPLEMENTATION MEASURE**
5.03.721	Private off-street parking should be developed in all of Colma's commercial areas to minimize traffic congestion. Private off-street parking should be developed in conjunction with residential development projects.	The City Planner will make recommendations consistent with policy to the City Council for new development projects.

5.03.722	Pedestrian sidewalks or walkways should be constructed typically along all streets. These should be done as a requirement of private development, where possible.	The City Planner will make recommendations consistent with policy to the City Council for new development projects.
5.03.723	Sidewalks should be constructed where they do not presently exist, where feasible, on: • the west side of El Camino Real north of the entrance to the Greek Cemetery to the Colma BART station • one side of Hillside Boulevard • the north side of Serramonte Boulevard from El Camino Real to Hillside Boulevard • the south side of Collins Avenue	Projects will be considered as part of on-going CIP projects. For improvements on El Camino Real, Caltrans coordination will be required.
5.03.724	All loading and unloading of trucks associated with commercial uses should take place out of the road right-of-way in order to avoid potential conflicts with through traffic.	The City Planner will make recommendations consistent with this policy to the City Council for new development projects.
5.03.725	Facilities for disabled persons should be constructed in Colma including specified parking spaces, curb ramps at street crossings, sidewalk clearance around obstacles and sidewalk transitions at driveway crossings.	The City Planner will make recommendations consistent with this policy to the City Council for new development projects.
5.03.726 Atwood	Additional driveway access points to El Camino Real and to arterial and collector streets should be discouraged in order to promote traffic safety and retain landscape corridors. Where possible, access should be developed from other streets.	The City Planner will make recommendations consistent with policy to the City Council for new development projects.
5.03.727	The long term improvement of Hillside Boulevard should include sidewalks and landscaping.	Sidewalks and landscaping are proposed in improvements between Serramonte Boulevard and Hoffman Street . Sidewalks are proposed between Serramonte Boulevard and Lawndale Boulevard on the west side of the street. Existing sidewalk sections exist on the east side of Hillside Boulevard between Serramonte Boulevard and Sand Hill Road. Sidewalk on the east side of Hillside Boulevard between Sand Hill Road and Lawndale Boulevard would be required at the time of property development by the property owner.
5.03.728	The intersection of Mission Road and El Camino Real should be reconfigured to improve safety and to permit left turns from Mission Road onto El Camino Real.	The City Engineer will coordinate with Caltrans on an appropriate configuration. Any necessary funding will be considered in a future CIP.
5.03.729	The Town should strive to maintain a Level of Service D or better for all intersections. Levels of E or F should be tolerated during peak periods.	The City Planner and City Engineer will consider and require mitigation, where feasible, to the traffic impacts of new development projects in Colma and proposed in adjoining jurisdictions.

5.03.730 TOWN IMAGE

POLICY NUMBER	POLICY	IMPLEMENTATION MEASURE
5.03.731	Colma recognizes six major gateways to the Town: • El Camino Real at the intersection of F Street • El Camino Real and Mission Road • Serramonte Boulevard and Collins Avenue where they intersect Junipero Serra Boulevard • Hillside Boulevard at the intersection of F Street • Hillside Boulevard at Lawndale Boulevard • Mission Road at Lawndale Boulevard The Town's gateways should be enhanced and maintained with appropriate landscaping and to strengthen Colma's identity. Gateway elements (such as a sculpture or distinctive architecture) should be included at each gateway. The gateway elements should have a consistent theme. Improvements should be included as an element of private development, where appropriate.	The City Planner will make recommendations for the installation of new gateway signs and landscaping consistent with this policy to the City Council whenever a new development project or a CIP project is proposed that will allow for implementation. Remaining gateways to implement include: • El Camino Real and Mission Road (which can be implemented when the intersection is reconfigured or improved, or property at 1988 Mission Road is developed) • Hillside Boulevard at the intersection of F Street (to be implemented in Summer 2014) • Hillside Boulevard at Lawndale Boulevard (to be implemented when the southern section of Hillside Boulevard is improved)
5.03.732 Salem Atwood	Street trees should be planted along Colma's street system. Trees should be selected from a plant list approved by the City Council in order to create a unifying theme. Street trees should be planted as a requirement of private development, where such developments involve the public street frontage.	The City Planner will designate preferred trees for each street and make recommendations to the City Council for new development projects.
5.03.733	A utility undergrounding/street beautification program should be carried out for Mission Road in conjunction with the provision of additional off-street parking to improve visual appearance and traffic safety.	Undergrounding and beautification of Mission Road will be considered in as a future Capital Improvement Program project when funds become available.
5.03.734	Overhead transmission lines should be placed underground in order to improve the visual quality of all roadways.	Utility undergrounding will be considered in a future Capital Improvement Program.

5.03.740 BICYCLE AND RECREATION IMPROVEMENTS

POLICY NUMBER	POLICY	IMPLEMENTATION MEASURE
5.03.741	Bicycle lanes should be clearly marked on all designated bicycle routes.	The Town will implement, where feasible, San Mateo County's Comprehensive Bicycle and Pedestrian Master Plan (2011) when projects are being considered under the CIP. In addition, the Town will add Class II and class II bicycle markings and improvements to Mission Road, where feasible.
5.03.742	The Town should seek ways to implement bikeways along El Camino Real, and Hillside Boulevard.	Consistent with the San Mateo County Comprehensive Bicycle and Pedestrian Master Plan (2011), the Town will consult with Caltrans when improvements are being considered for El Camino Real in order to add bicycle lanes where feasible. Future phases of improvements to Hillside Boulevard will consider, where feasible, the addition of bikeways.

5.03.743	The Town should work with the San Francisco Water Company to see what landscaping improvements are possible on the Water Company right-of-way between Serramonte Boulevard and Collins Avenue.	Securing of an access easement and landscaping of portions of the Water Company right-of-way on the Collins Avenue side shall be considered in the future. The Serramonte half of the right-of-way is proposed to be developed with a wellhouse structure that will be fenced for security.

5.03.750 SCENIC ROUTES

POLICY NUMBER	POLICY	IMPLEMENTATION MEASURE
5.03.751	The Town recognizes El Camino Real, Hillside Boulevard, and the Junipero Serra Freeway as scenic routes. Detailed studies and mapping of the scenic routes should be undertaken as necessary to define precise corridor boundaries. Standards for site planning within scenic corridors should be adopted.	The City Planner will make recommendations consistent with this policy to the City Council for new development projects.

5.03.800 PROGRAMS FOR CIRCULATION ELEMENT IMPLEMENTATION

Circulation Element policies are intended to be implemented using both existing and proposed action programs. Reference is made as to whether the program is existing or proposed and the responsibility for program operation.

5.03.810 COMPLETE STREETS POLICY

5.03.811 **Complete Streets Principles**

(1) *Complete Streets Serving All Users.* The Town of Colma is commitmented to creating and maintaining Complete Streets that provide safe, comfortable, and convenient travel along and across streets (including streets, roads, highways, bridges, and other portions of the transportation system) through a comprehensive, integrated transportation network that serves all categories of users, including pedestrians, bicyclists, persons with disabilities, motorists, movers of commercial goods, users and operators of public transportation, seniors, children, youth, and families.

(2) *Context Sensitivity.* In planning and implementing street projects, departments and agencies of the Town of Colma shall consider local conditions in both residential and business districts as well as urban, suburban, and rural areas, and shall work with residents, merchants, and other stakeholders to ensure that a strong sense of place ensues. Improvements to be considered include sidewalks, shared use paths, bicycle lanes, bicycle routes, paved shoulders, street trees and landscaping, planting strips, accessible curb ramps, crosswalks,

5.03.090 "C" Zone.

The following uses may be permitted in the "C" Zone upon issuance of a use permit in accordance with the procedures set forth:

(a) A commercial establishment;

(b) A single family dwelling or a multiple dwelling up to six units, provided the proposed residential density does not exceed that specified in the Colma General Plan;

(c) Residential Planned Development on land identified in the Colma General Plan as suitable for residential uses, provided the proposed residential density does not exceed that specified in the Colma General Plan;

(d) A light industrial establishment;

(e) Communications structures;

(f) Commercial center;

(g) Retail Merchandising Unit; [Ord. 506, 3/12/97]

(h) Such other uses which, upon a finding of the City Council, are of a similar nature as the above described uses.

[History: formerly § 5.314; ORD. 234, 3/14/79; ORD. 309, 2/13/85; ORD. 425, 7/10/91; ORD. 638, 12/14/05]

5.03.100 "DR" Combining Zone.

The "DR" Design Review zone may be combined with all base zones to achieve a consistent site, landscape and building design theme in those areas where it is applied.

[History: formerly § 5.315; ORD. 500, 10/9/96; ORD. 638, 12/14/05]

5.03.110 "P" Zone.

The following uses are permitted in the "P" Zone:

(a) Public buildings and parks, and any uses incident thereto.

(b) Municipal supported senior housing.

[History: formerly § 5.316; ORD. 234, 3/14/79; ORD. 459, 10/13/93; ORD. 638, 12/14/05]

5.03.120 "E" Zone. At wood

(a) The following uses are generally permitted on land located within the "E" Zone:

(1) A cemetery or memorial park;

(2) Floriculture or agriculture.

(b) The following uses may be permitted by the City Council on land located in the "E" Zone upon issuance of a use permit in accordance with the procedures hereinafter set forth:

(1) Nurseries;

(2) Flower Shops;

(3) Monument Shops;

(4) Medical Service Offices where medical, dental or veterinarian consultation, treatment and/or advice is dispensed on an outpatient basis;

(5) Professional Business Offices where professional or technical business services are offered and/or where the administrative management function of a business is performed and where no external signing is required;

(6) Restaurants; provided that banquet facilities are included capable of accommodating 50 or more persons separated from the principal dining facilities.

7

(7) Such other uses as the Council finds are of a similar nature to the specified uses.

[History: formerly § 5.317; Ord. 234, 3/14/79; Ord. 321, 7/10/85; Ord. 372, 7/13/88; Ord. 638, 12/14/05]

5.03.130 "PD" Zone.

The following uses are permitted within the "PD" Zone upon issuance of a use permit in accordance with the procedures hereinafter set forth:

(a) Single family residential developments;

(b) Multiple housing developments;

(c) Neighborhood and community commercial centers;

(d) Professional and administrative offices; or

(e) A combination of such uses.

This zone may be established to allow flexibility of design, which is in accordance with the objectives and spirit of the General Plan.

[History: formerly § 5.319; Ord. 234, 3/14/79; Ord. 264, 9/17/81; Ord. 638, 12/14/05]

5.03.140 Establishment of PD Districts.

PD Districts may be established in any R or C Zone upon application of a property owner or owners, or upon the initiative of the City Council.

(4) Only construction methods and practices that will minimize flood damage may be used;

(5) Each building or structure must be designed or anchored to prevent the flotation, collapse or lateral movement of the structure or portions of the structure due to flooding;

(6) In regard to mobile homes:

(i) Over-the-top ties must be provided at each of the four corners of the mobile home with two (2) additional ties per side at the intermediate locations, and mobile homes less than fifty (50) feet long requiring one (1) additional tie per side;

(ii) Frame ties must be provided at each corner of the home with five (5) additional ties per side at intermediate points, and mobile homes less than fifty (50) feet long requiring four (4) additional ties per side;

(iii) All components of the anchoring system must be capable of carrying a force of 4,800 pounds;

(iv) Any additions to mobile homes must be similarly anchored.

(b) The term "100-year flood elevation" means the elevation which is determined by the City Engineer to have a one per cent chance of flooding in any given year.

[History: formerly § 5.335; ORD. 290, 08/10/83; ORD. 638, 12/14/05]

5.03.330 Restrictions Applicable to "E" Zone.

(a) All uses in the "E" Zone shall be subject to the following requirements:

(1) Area: Each lot shall have a minimum average width of 33-1/3 feet and a depth not less than 100 feet.

(2) Setbacks: The front yard shall have a depth of not less than five (5) feet from property line to the front line of any building except that any yard facing El Camino Real shall be thirty (30) feet; the side yards shall not be less than five (5) feet wide; the rear year shall not be less than five (5) feet deep.

(3) Site Coverage: Not more than fifty (50%) per cent of any building site shall be covered by buildings.

(4) Parking: There shall be maintained on each building site facilities for parking, loading, and unloading; provided, however, that off-street parking shall in no event be less than the following standards:

(i) Retail Stores: one (1) parking space for each one hundred (100) square feet of sales floor area, but in no case less than one (1) space for each two hundred (200) square feet of gross floor area;

(ii) Professional Business and Medical Service Offices: one (1) parking space for each three hundred (300) square feet of gross floor area;

(iii) Restaurants: One (1) parking space for each four (4) seats for seating other than private banquet facilities; and with respect to private banquet facilities such additional parking as may be appropriate considering the size of the facility, the reasonably anticipated utilization of the banquet facility, and the availability of adjacent parking; provided, however, that the amount of parking required for banquet facilities shall be no greater than one (1) parking space for each four (4) seats.

(iv) All other uses: minimum of one (1) space for each five (5) regular employees but, in any case, not less than one (1) space for each two thousand (2,000) square feet of gross floor area, or fraction thereof.

(5) Height: The maximum height of any building shall be thirty-six (36) feet.

(6) Design: The design of any building shall be subject to approval by the City Council who shall consider the height, design and use of such building in relation to the height, design and use of buildings in the surrounding area.

(7) Landscaping: Within the required setback area from El Camino Real there shall be maintained only paved walks, paved walks, paved driveways, lawns and landscaping. The landscaping shall be consistent with landscaping in the surrounding area, and shall screen parking areas from passerby on the adjacent street. The City Council may require, as a condition of any Use Permit, that all or a portion of the setback area be maintained as lawns or landscaping.

(8) Parking shall be placed behind buildings or well screened by landscaping.

(9) Any roll-up doors and loading areas shall be located so as not to face public roads.

[History: formerly § 5.335.1; ORD. 321, 7/10/85; ORD. 372, 7/13/88; ORD. 638, 12/14/05]

5.03.340 Restrictions Applicable to "T" Zone.

(a) No person may erect, construct, enlarge or improve any public or private transit building or transit structure in the "T" Zone, or permit the same to be done, unless such building or structure is underground and covered with soil so as to make its location indistinguishable from adjacent terrain.

(b) Notwithstanding the foregoing, nothing herein contained shall limit the establishment and maintenance of landscaping, fences, roads, surface parking facilities, or similar improvements in said zone.

(c) Notwithstanding the foregoing, the portion of a parcel containing a "T" zone shall be included in determining land to building ratios, set-backs, minimum lot size, and similar zoning requirements.

(d) Buildings and structures may be developed in the "T" Zone, subject to a Use Permit, provided the building or structure is supported on a foundation system that will not prevent the development of covered, underground public or private transit facilities at that location.

[History: formerly § 5.335.2; ORD. 374, 09/14/88; ORD. 460, 11/10/93; ORD. 638, 12/14/05]

5.03.350 Restrictions Applicable to All Zones.

(a) There shall not be permitted any use which may be determined by the City Council to be obnoxious or offensive because of the presence or emission of odor, fumes, dust, gas, smoke, noise, bright lights, vibrations, pollution, detrimental sewer wastes, or have a detrimental effect on permissible adjacent uses, or will be hazardous by reason of danger of fire or explosion.

(b) In each zone there shall be provided at the time of the erection of any main building or at the time any main building is enlarged or increased in capacity, sufficient off-street parking accommodations with adequate provisions for ingress and egress by standard size automobiles. Parking access-ways, parking spaces and fire lanes shall all meet the minimum standards provided in Section 5.01.080 (Definitions) above.

(c) The following uses are prohibited in all districts: amusement parks or centers, circuses, carnivals, outdoor theaters, race tracks, commercial recreation centers, stockyards, the slaughtering of animals, and medical marijuana dispensaries.

(d) Definition of "self-storage mini-warehouse": a structure containing more than five (5) individually locked rooms or compartments, each of which rooms or compartments are available for rent to the general public on a daily, weekly, monthly or other periodic basis for the purpose of storing chattel or personal property, where the property stored in the rooms or compartments is loaded and removed by the renter of the compartment, rather than by the owner of the self-storage mini-warehouse or his agent. "Self-storage mini-warehouse" does not include storage space made available on a rental basis to renters of apartments or owners of condominiums on the premises which contains the condominium or apartment building.

(e) No person shall install, construct or maintain a fence or hedge on any property in the Town of Colma except in compliance with the following:

(1) General fence and hedge limitations:

(i) If cyclone fencing is used, it must be black vinyl clad with black painted posts and supports.

(ii) Fences shall be maintained in good repair and condition.

(iii) Hedge height limits in this section do not apply to taller landscaping planted immediately adjacent to building walls. Free standing trees are encouraged in all yard areas.

(iv) Fences with razor wire are not permitted in the Town of Colma.

(v) For corner lots, a vision triangle of 35' shall be maintained to insure safe visibility for motorists. The vision triangle shall be created by measuring along the curb line 35' in each direction from the street corner, with the endpoints connected across the lot. Within the vision triangle, no fencing or vegetation shall exceed three (3) feet in height and all tree canopies must be kept seven (7) or more feet above grade.

(vi) Any unimproved right-of-way (the area between the back of sidewalk and the front property line of any property) may contain landscape planting, irrigation and fencing.

(vii) The height of a fence shall be measured as the higher of the two sides of the fence.

(2) Fence and hedge limitations in all Residential Zones:

(i) No fence or hedge in excess of four (4) feet in height is allowed between the back of the sidewalk and front wall of any residence. An exception is permitted for a single, freestanding trellis structure not exceeding eight (8) feet in height, five (5) feet in width, and five (5) feet in depth. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(ii) No fence or hedge in excess of six (6) feet in height is allowed from the front face of the residence to the rear property line. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(iii) No barbed wire shall be permitted in a residential zone.

(3) Fence and hedge limitations for Non-Residential Zones:

(i) No fence or hedge in excess of four (4) feet in height is allowed between the back of the sidewalk and a parallel line set back thirty (30) feet from the front property line. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(ii) No fence or hedge in excess of eight (8) feet in height is allowed from the thirty (30) foot setback line to the rear of the property. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(iii) No barbed wire shall be permitted in front of the thirty (30) foot setback line. An exception may be granted by the City Planner through the Design Review Process if required for security.

(4) Prior constructing or installing a fence in excess of six feet in height, retaining wall exceeding two (2) feet in height, masonry wall, or any improvement located in the public right-of-way, owners and occupants should consult with the Building Official or City Engineer to determine if a building permit and/or encroachment permit is needed.

[History: formerly § 5.336, ORD. 234, 03/14/79; ORD. 313, 02/13/85; ORD. 550, 4/14/1999; ORD. 638, 12/14/05, ORD 662, 9/12/07]

5.03.360 Restrictions and Landscaping Along El Camino Real.

(a) No building shall be located less than thirty (30) feet from any portion of El Camino Real to any portion of the building.

(b) Within the required setback from El Camino Real there shall be maintained only paved walks, paved driveways, lawns and landscaping. The landscaping shall be consistent with landscaping in the surrounding areas, and shall screen parking areas from passersby on El Camino Real. The City Council may, as a condition of any Use Permit, require a landscaping plan for the area within the required setback.

(c) The restrictions apply to property adjacent to El Camino Real the entire length of said street from the northern boundary of Colma to the Mission Road junction.

[N.B. Section 2 of Ordinance No. 270 (effective 7/9/82) provided as follows: "The requirements of this section shall not be construed to require the removal or other changes or alteration of any structure not conforming thereto as of the effective date hereof or otherwise interfere with the continuance of any non-conforming use; but shall apply to any replacement, addition, or substantial alteration of any such non-conforming structure."]

[History: formerly § 5.336.1; ORD. 270, 6/09/82; ORD. 638, 12/14/05]

5.03.370 Restrictions Applicable to Mobile Homes, Recreational Vehicles and Commercial Coaches.

Mobile homes, recreational vehicles and commercial coaches as defined in the Health and Safety Code of the State of California shall not be occupied in the Town of Colma except as follows:

(a) For temporary use as a field office or a business office during construction, alteration or repair of a project in the Town of Colma, provided that such use shall cease when the Certificate of Occupancy for such project is issued;

(b) For use as an office in connection with a commercial use, and pursuant to a conditional use permit issued by the City Council under section 18300.1 of the Health and Safety Code of the State of California; or

Such zone shall be in addition to and lay over the land use zones as set forth in subsection (a) above. All real property in the Town of Colma lying within 50 feet of either edge of the Colma Creek, and all other real property determined by the City Engineer to be subject to a one per cent chance of flooding in any given year, shall be in the F zone.

(c) The following transit zone shall be established in the City: T.

Such zone shall be in addition to and lay over the land use zones as set forth in subparagraph (a) above. All real property in the Town of Colma lying within the 60-foot right-of-way owned, or formerly owned, by Southern Pacific Company shall be in the T zone.

(d) The following design review zone shall be established in the City: DR.

Such zone shall be in addition to and lay over the land use zones set forth in subparagraph (a), above. All real property from the junction of Mission Road and El Camino Real on the south to the junction of F Street and El Camino Real on the north, and from Junipero Serra Boulevard on the west to the City limits on the east, plus all property fronting on Mission Road, shall be in the DR zone.

(e) The zones aforesaid and the boundaries of such zones are shown upon a map filed with the City Clerk and designated "General Plan Land Use, Town of Colma, April 2008 Zoning Map". Said map and all notations, references and other information shown thereon shall be and hereby is incorporated by reference in this ordinance as if fully set forth herein.

> [History: formerly § 5.310, ORD. 234, 3/14/79; ORD. 290, 8/10/83; ORD. 321, 7/10/85; ORD. 374, 9/14/88; ORD. 409, 3/14/90; ORD. 536, 7/8/1998; ORD. 557, 8/18/1999; ORD. 573, 4/12/00, ORD. 588, 8/15/2001; ORD 609, 12/10/03; ORD. 610, 1/14/04; ORD. 627, 4/13/05; ORD. 638, 12/14/05; ORD. 668, 5/14/08]

5.03.050 Zone Boundaries.

Where uncertainty exists as to the boundaries of any zone shown on said "Zone Map", the following rules shall apply:

(a) Where such boundary is indicated as approximately following a street or alley line, such street or alley line shall be deemed to be such boundary.

(b) Where such boundary is indicated as approximately following a lot line, such lot shall be deemed to be such boundary.

(c) Where uncertainty exists, the City Council shall, by written declaration, determine the location of the zone boundary.

> [History: formerly § 5.311; ORD. 234, 3/14/79; ORD. 638, 12/14/05]

5.03.060 "G" Zone. Salem & Holy Cross

(a) The following uses are generally permitted on land located within the "G" Zone:

(1) A cemetery or memorial park;

(2) Agriculture, which is primarily open field;

(3) A golf course.

(b) The following uses may be permitted by the City Council on land located in the "G" Zone upon issuance of a use permit in accordance with the procedures hereinafter set forth:

(1) Any use which now or hereafter may be customarily incident to a cemetery or memorial park use, including flower shops, monument shops, crematoriums, and cemetery corporation yards;

(2) Any use which now or hereafter may be customarily incident to agriculture use, including nurseries, agriculture or flower growing utilizing greenhouses or shade structures, firewood yard, or landscape contractors yard;

?

(3) Any use which now or hereafter may be customarily incident to a golf course, including clubhouse, sale of golf balls, golf shoes and clothing or golf clubs and equipment, lunch counter, conduct of "pro shop", practice range, practice green, and driving range.

(4) Communications structures.

[History: formerly § 5.312; ORD. 234, 3/14/79; ORD. 325, 11/13/85; ORD. 480, 5/10/95; ORD. 520, 12/10/97; ORD. 638, 12/14/05]

5.03.070 "R" Zone.

(a) The following uses are permitted on land located within the "R" Zone:

(1) A single family dwelling;

(2) A "small family day care home", as defined in the Health and Safety Code providing family day care to six or fewer children; and

(3) Second dwelling units.

(b) The following uses may be permitted in the "R" Zone upon issuance of a use permit in accordance with the procedures hereinafter set forth:

(1) A multiple dwelling up to six units, provided that the proposed residential density does not exceed that specified in the Colma General Plan;

(2) Residential Planned Development on land identified in the Colma General Plan as suitable for residential uses, provided the proposed residential density does not exceed that specified in the Colma General Plan;

(3) Home office use;

(4) A "large family day care home," as defined, and pursuant to the procedures and standards set forth, in Section 5.03.085 below.

(4) The property and principal building thereon is not in violation of any applicable zoning or building codes;

(5) Provision has been made, to the satisfaction of the City Planner, to discontinue the use, to clean the area, and to return the area to its previous state upon termination of the period authorized in the use permit for a short-term or temporary use;

(6) The granting of the Permit will not be detrimental to the public health, safety or public welfare, or materially injurious to properties or improvements in the vicinity;

(7) Existing property uses, large or small, will not be detrimentally affected by the proposed use;

(8) The granting of the Permit will not constitute a grant of special privilege inconsistent with the limitations imposed by this subchapter on the existing use of properties, large or small, within the Town of Colma; and

(9) The proposed use will not constitute a nuisance as to neighboring persons or properties.

(c) The City Planner may impose such conditions on the issuance of the Administrative Use Permit as may be reasonably necessary to implement the purposes and intent of the Town's General Plan and Zoning Ordinance, including a condition that the permit holder post a bond or other security to guarantee compliance with this ordinance and the permit.

[History: formerly § 5.329, ORD. 563, 10/18/99; ORD. 638, 12/14/05]

5.03.240 Restrictions Applicable to "G" Zone.

(a) No commercial or business use of any kind shall be conducted in the "G" Zone, except such uses which are normally considered incidental to or accessory to a cemetery or memorial park, agriculture, or a golf course.

(b) As to any golf course use, the following restrictions shall apply:

(1) Enclosed sanitary facilities shall be provided, with not less than three toilets for men and three toilets for women at each golf course;

(2) Paved parking area shall be provided for 200 automobiles or more, which area shall be located within 100 feet of the clubhouse. A paved two-lane access road is to connect the parking area and public street or road;

(3) No more than one sign advertising a golf course may be maintained or erected.

(c) No building, other than a building used for cemetery purposes, shall exceed a height of thirty-six (36) feet in the "G" District.

(d) Communications structures, including relay towers, antennas and reception dishes, shall be located so as not to be highly visible from any public street and shall be located no closer than 1,000 feet from any Residential District. Such structures shall be no higher than 36 feet from the ground if freestanding and no higher than 15 feet above the roof top if placed on a building.

(e) Buffering Regulations. A crematorium shall be located such that the retort vents are no closer that 650 feet to the nearest residence and shall be sited, using topography and landscaping, so that the retort vents and delivery entrance cannot be seen from any public right-of-way. If the building can be seen from any public right-of-way, crematoriums shall be incorporated into the design of buildings such as chapels and mausoleums so that the cremation aspect is not apparent. Any crematorium existing prior to the effective date of this ordinance may be maintained and its equipment upgraded provided no retorts are added and the proposed work does not result in greater visibility, from any public right-of-way, of the existing retort vent(s) and delivery entrance.

[History: formerly § 5.330, ORD. 234, 3/14/79; ORD. 5/10/95; ORD. 325, 11/13/85; ORD. 520, 12/10/97; ORD. 638, 12/14/05]

5.03.250 Restrictions Applicable to "R" Zone.

(a) All land within the "R" Zone, except as provided in subparagraph (5) below, shall be subject to the following area requirements:

(1) The front yard shall have a depth of not less than fifteen (15) feet from property line to front line of the building;

(2) The side yard shall be not less than 10 per cent of the width of the lot or 10 feet, whichever is the lesser;

(3) The rear yard shall be not less than 25 per cent of the total area of the lot, but such rear yard need not exceed 25 feet; save and except any "R" Zone located in that portion of Colma bounded by F Street, Hillside Boulevard, El Camino Real, and the northern boundary of the Town of Colma, in which area the rear yard shall have a depth of not less than 15 feet from property line to rear line of the building with respect to the first story of the building, and a depth of not less than 25 feet from property line to the rear line of any portion of the building above the first story. The one-story portion of a building which extends less than 25 feet from the rear property line shall have a pitched roof, and the space above the roof shall not be used for a roof deck, balcony or other similar purpose.

(4) Every lot shall have a minimum average width of 33-1/3 feet and a depth of not less than 100 feet.

(5) Notwithstanding the setback requirements of subparagraphs (1), (2), and (3) above, the distance between the vehicle entry of any covered parking structure to the property line shall be not less than 19 feet.

(d) Buildings and structures may be developed in the "T" Zone, subject to a Use Permit, provided the building or structure is supported on a foundation system that will not prevent the development of covered, underground public or private transit facilities at that location.

[History: formerly § 5.335.2; ORD. 374, 09/14/88; ORD. 460, 11/10/93; ORD. 638, 12/14/05]

5.03.350 Restrictions Applicable to All Zones.

(a) There shall not be permitted any use which may be determined by the City Council to be obnoxious or offensive because of the presence or emission of odor, fumes, dust, gas, smoke, noise, bright lights, vibrations, pollution, detrimental sewer wastes, or have a detrimental effect on permissible adjacent uses, or will be hazardous by reason of danger of fire or explosion.

(b) In each zone there shall be provided at the time of the erection of any main building or at the time any main building is enlarged or increased in capacity, sufficient off-street parking accommodations with adequate provisions for ingress and egress by standard size automobiles. Parking access-ways, parking spaces and fire lanes shall all meet the minimum standards provided in Section 5.01.080 (Definitions) above.

(c) The following uses are prohibited in all districts: amusement parks or centers, circuses, carnivals, outdoor theaters, race tracks, commercial recreation centers, stockyards, the slaughtering of animals, and medical marijuana dispensaries.

(d) Definition of "self-storage mini-warehouse": a structure containing more than five (5) individually locked rooms or compartments, each of which rooms or compartments are available for rent to the general public on a daily, weekly, monthly or other periodic basis for the purpose of storing chattel or personal property, where the property stored in the rooms or compartments is loaded and removed by the renter of the compartment, rather than by the owner of the self-storage mini-warehouse or his agent. "Self-storage mini-warehouse" does not include storage space made available on a rental basis to renters of apartments or owners of condominiums on the premises which contains the condominium or apartment building.

(e) No person shall install, construct or maintain a fence or hedge on any property in the Town of Colma except in compliance with the following:

(1) General fence and hedge limitations:

(i) If cyclone fencing is used, it must be black vinyl clad with black painted posts and supports.

(ii) Fences shall be maintained in good repair and condition.

(iii) Hedge height limits in this section do not apply to taller landscaping planted immediately adjacent to building walls. Free standing trees are encouraged in all yard areas.

(iv) Fences with razor wire are not permitted in the Town of Colma.

(v) For corner lots, a vision triangle of 35' shall be maintained to insure safe visibility for motorists. The vision triangle shall be created by measuring along the curb line 35' in each direction from the street corner, with the endpoints connected across the lot. Within the vision triangle, no fencing or vegetation shall exceed three (3) feet in height and all tree canopies must be kept seven (7) or more feet above grade.

(vi) Any unimproved right-of-way (the area between the back of sidewalk and the front property line of any property) may contain landscape planting, irrigation and fencing.

(vii) The height of a fence shall be measured as the higher of the two sides of the fence.

(2) Fence and hedge limitations in all Residential Zones:

(i) No fence or hedge in excess of four (4) feet in height is allowed between the back of the sidewalk and front wall of any residence. An exception is permitted for a single, freestanding trellis structure not exceeding eight (8) feet in height, five (5) feet in width, and five (5) feet in depth. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(ii) No fence or hedge in excess of six (6) feet in height is allowed from the front face of the residence to the rear property line. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(iii) No barbed wire shall be permitted in a residential zone.

(3) Fence and hedge limitations for Non-Residential Zones:

(i) No fence or hedge in excess of four (4) feet in height is allowed between the back of the sidewalk and a parallel line set back thirty (30) feet from the front property line. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(ii) No fence or hedge in excess of eight (8) feet in height is allowed from the thirty (30) foot setback line to the rear of the property. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(iii) No barbed wire shall be permitted in front of the thirty (30) foot setback line. An exception may be granted by the City Planner through the Design Review Process if required for security.

(4) Prior constructing or installing a fence in excess of six feet in height, retaining wall exceeding two (2) feet in height, masonry wall, or any improvement located in the public right-of-way, owners and occupants should consult with the Building Official or City Engineer to determine if a building permit and/or encroachment permit is needed.

[History: formerly § 5.336, ORD. 234, 03/14/79; ORD. 313, 02/13/85; ORD. 550, 4/14/1999; ORD. 638, 12/14/05, ORD 662, 9/12/07]

5.03.360 Restrictions and Landscaping Along El Camino Real.

(a) No building shall be located less than thirty (30) feet from any portion of El Camino Real to any portion of the building.

(b) Within the required setback from El Camino Real there shall be maintained only paved walks, paved driveways, lawns and landscaping. The landscaping shall be consistent with landscaping in the surrounding areas, and shall screen parking areas from passersby on El Camino Real. The City Council may, as a condition of any Use Permit, require a landscaping plan for the area within the required setback.

(c) The restrictions apply to property adjacent to El Camino Real the entire length of said street from the northern boundary of Colma to the Mission Road junction.

[N.B. Section 2 of Ordinance No. 270 (effective 7/9/82) provided as follows: "The requirements of this section shall not be construed to require the removal or other changes or alteration of any structure not conforming thereto as of the effective date hereof or otherwise interfere with the continuance of any non-conforming use; but shall apply to any replacement, addition, or substantial alteration of any such non-conforming structure."]

[History: formerly § 5.336.1; ORD. 270, 6/09/82; ORD. 638, 12/14/05]

5.03.370 Restrictions Applicable to Mobile Homes, Recreational Vehicles and Commercial Coaches.

Mobile homes, recreational vehicles and commercial coaches as defined in the Health and Safety Code of the State of California shall not be occupied in the Town of Colma except as follows:

(a) For temporary use as a field office or a business office during construction, alteration or repair of a project in the Town of Colma, provided that such use shall cease when the Certificate of Occupancy for such project is issued;

(b) For use as an office in connection with a commercial use, and pursuant to a conditional use permit issued by the City Council under section 18300.1 of the Health and Safety Code of the State of California; or

5.03.090 "C" Zone.

The following uses may be permitted in the "C" Zone upon issuance of a use permit in accordance with the procedures set forth:

(a) A commercial establishment;

(b) A single family dwelling or a multiple dwelling up to six units, provided the proposed residential density does not exceed that specified in the Colma General Plan;

(c) Residential Planned Development on land identified in the Colma General Plan as suitable for residential uses, provided the proposed residential density does not exceed that specified in the Colma General Plan;

(d) A light industrial establishment;

(e) Communications structures;

(f) Commercial center;

(g) Retail Merchandising Unit; [Ord. 506, 3/12/97]

(h) Such other uses which, upon a finding of the City Council, are of a similar nature as the above described uses.

[History: formerly § 5.314; ORD. 234, 3/14/79; ORD. 309, 2/13/85; ORD. 425, 7/10/91; ORD. 638, 12/14/05]

5.03.100 "DR" Combining Zone.

The "DR" Design Review zone may be combined with all base zones to achieve a consistent site, landscape and building design theme in those areas where it is applied.

[History: formerly § 5.315; ORD. 500, 10/9/96; ORD. 638, 12/14/05]

5.03.110 "P" Zone. Possible rezoning designation?

The following uses are permitted in the "P" Zone:

(a) Public buildings and parks, and any uses incident thereto.

(b) Municipal supported senior housing.

[History: formerly § 5.316; ORD. 234, 3/14/79; ORD. 459, 10/13/93; ORD. 638, 12/14/05]

5.03.120 "E" Zone.

(a) The following uses are generally permitted on land located within the "E" Zone:

(1) A cemetery or memorial park;

(d) Buildings and structures may be developed in the "T" Zone, subject to a Use Permit, provided the building or structure is supported on a foundation system that will not prevent the development of covered, underground public or private transit facilities at that location.

[History: formerly § 5.335.2; ORD. 374, 09/14/88; ORD. 460, 11/10/93; ORD. 638, 12/14/05]

5.03.350 Restrictions Applicable to All Zones.

(a) There shall not be permitted any use which may be determined by the City Council to be obnoxious or offensive because of the presence or emission of odor, fumes, dust, gas, smoke, noise, bright lights, vibrations, pollution, detrimental sewer wastes, or have a detrimental effect on permissible adjacent uses, or will be hazardous by reason of danger of fire or explosion.

(b) In each zone there shall be provided at the time of the erection of any main building or at the time any main building is enlarged or increased in capacity, sufficient off-street parking accommodations with adequate provisions for ingress and egress by standard size automobiles. Parking access-ways, parking spaces and fire lanes shall all meet the minimum standards provided in Section 5.01.080 (Definitions) above.

(c) The following uses are prohibited in all districts: amusement parks or centers, circuses, carnivals, outdoor theaters, race tracks, commercial recreation centers, stockyards, the slaughtering of animals, and medical marijuana dispensaries.

(d) Definition of "self-storage mini-warehouse": a structure containing more than five (5) individually locked rooms or compartments, each of which rooms or compartments are available for rent to the general public on a daily, weekly, monthly or other periodic basis for the purpose of storing chattel or personal property, where the property stored in the rooms or compartments is loaded and removed by the renter of the compartment, rather than by the owner of the self-storage mini-warehouse or his agent. "Self-storage mini-warehouse" does not include storage space made available on a rental basis to renters of apartments or owners of condominiums on the premises which contains the condominium or apartment building.

(e) No person shall install, construct or maintain a fence or hedge on any property in the Town of Colma except in compliance with the following:

(1) General fence and hedge limitations:

(i) If cyclone fencing is used, it must be black vinyl clad with black painted posts and supports.

(ii) Fences shall be maintained in good repair and condition.

(iii) Hedge height limits in this section do not apply to taller landscaping planted immediately adjacent to building walls. Free standing trees are encouraged in all yard areas.

(iv) Fences with razor wire are not permitted in the Town of Colma.

(v) For corner lots, a vision triangle of 35' shall be maintained to insure safe visibility for motorists. The vision triangle shall be created by measuring along the curb line 35' in each direction from the street corner, with the endpoints connected across the lot. Within the vision triangle, no fencing or vegetation shall exceed three (3) feet in height and all tree canopies must be kept seven (7) or more feet above grade.

(vi) Any unimproved right-of-way (the area between the back of sidewalk and the front property line of any property) may contain landscape planting, irrigation and fencing.

(vii) The height of a fence shall be measured as the higher of the two sides of the fence.

(2) Fence and hedge limitations in all Residential Zones:

(i) No fence or hedge in excess of four (4) feet in height is allowed between the back of the sidewalk and front wall of any residence. An exception is permitted for a single, freestanding trellis structure not exceeding eight (8) feet in height, five (5) feet in width, and five (5) feet in depth. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(ii) No fence or hedge in excess of six (6) feet in height is allowed from the front face of the residence to the rear property line. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(iii) No barbed wire shall be permitted in a residential zone.

(3) Fence and hedge limitations for Non-Residential Zones:

(i) No fence or hedge in excess of four (4) feet in height is allowed between the back of the sidewalk and a parallel line set back thirty (30) feet from the front property line. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(ii) No fence or hedge in excess of eight (8) feet in height is allowed from the thirty (30) foot setback line to the rear of the property. An exception may be granted by the City Planner through the Design Review Process if required for security, pedestrian safety, to screen out undesirable views, or for other aesthetic reasons.

(iii) No barbed wire shall be permitted in front of the thirty (30) foot setback line. An exception may be granted by the City Planner through the Design Review Process if required for security.

(4) Prior constructing or installing a fence in excess of six feet in height, retaining wall exceeding two (2) feet in height, masonry wall, or any improvement located in the public right-of-way, owners and occupants should consult with the Building Official or City Engineer to determine if a building permit and/or encroachment permit is needed.

[History: formerly § 5.336, ORD. 234, 03/14/79; ORD. 313, 02/13/85; ORD. 550, 4/14/1999; ORD. 638, 12/14/05, ORD 662, 9/12/07]

5.03.360 Restrictions and Landscaping Along El Camino Real.

(a) No building shall be located less than thirty (30) feet from any portion of El Camino Real to any portion of the building.

(b) Within the required setback from El Camino Real there shall be maintained only paved walks, paved driveways, lawns and landscaping. The landscaping shall be consistent with landscaping in the surrounding areas, and shall screen parking areas from passersby on El Camino Real. The City Council may, as a condition of any Use Permit, require a landscaping plan for the area within the required setback.

(c) The restrictions apply to property adjacent to El Camino Real the entire length of said street from the northern boundary of Colma to the Mission Road junction.

[N.B. Section 2 of Ordinance No. 270 (effective 7/9/82) provided as follows: "The requirements of this section shall not be construed to require the removal or other changes or alteration of any structure not conforming thereto as of the effective date hereof or otherwise interfere with the continuance of any non-conforming use; but shall apply to any replacement, addition, or substantial alteration of any such non-conforming structure."]

[History: formerly § 5.336.1; ORD. 270, 6/09/82; ORD. 638, 12/14/05]

5.03.370 Restrictions Applicable to Mobile Homes, Recreational Vehicles and Commercial Coaches.

Mobile homes, recreational vehicles and commercial coaches as defined in the Health and Safety Code of the State of California shall not be occupied in the Town of Colma except as follows:

(a) For temporary use as a field office or a business office during construction, alteration or repair of a project in the Town of Colma, provided that such use shall cease when the Certificate of Occupancy for such project is issued;

(b) For use as an office in connection with a commercial use, and pursuant to a conditional use permit issued by the City Council under section 18300.1 of the Health and Safety Code of the State of California; or

Town of Colma Construction Noise Ordinance Notice

Please be advised that the Town of Colma only permits noise generating construction activity within 500 feet of any residential unit within the Town during specified time periods. Please check project approvals to see if special construction hours apply.

"noise generating construction activity" means the use of any noise generating equipment or tool, including but not limited to excavators, backhoes, post diggers, pile drivers, saws, electric screw drivers, grinders, nail guns, compressors, generators, hammers, jack hammers, power washers, paint guns, scaffolding erection, or similar power equipment. This definition includes construction material delivery, demolition activities and the servicing of any tool or equipment.

Noise generating construction activities *do not* include activities such as drywall finishing, painting, tile laying, carpet installation or the use of small hand tools in a fully enclosed structure with windows and doors closed.

If construction workers arrive prior to the start time, no noise generating activity may occur. All noise generating activities must cease by the end time. Violations of these time periods are subject to enforcement by a citation issued by the Town of Colma Police Department. Please abide by the following time periods:

- Weekday Start Time is 8:00 AM.
- Weekday End Time is 7:00 PM.
- Saturday Start Time is 9:00 AM.
- Saturday End Time is 5:00 PM.
- Sunday Start Time is 12:00 PM.
- Sunday End Time is 5:00 PM.
- Noise generating construction is prohibited on all Federal Holidays: New Year's Day, Martin Luther King Jr. Day, Presidents Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day and Christmas Day.

Any necessary deviations to these hours requires prior written approval from the Town.

The Town appreciates your cooperation in abiding by these hours for your project!

Chapter 3 Responses to Comments

This chapter evaluates the comments received during the 30-day public review period (July 24 through August 23, 2017). The City received three (3) comment letters. The City has reviewed and considered all of the comments received and provides a response to each of those comments as provided for below.

COMMENT LETTER A – NATIVE AMERICAN HERITAGE COMMISSION

Comment A-1. Comment Noted. Thank you for your letter and interest in the Proposed Project. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND. Specifically, we separated out the tribal cultural evaluation and made it its own separate section, 3.17 Tribal Cultural Resources of Chapter 3 – Environmental Review and Consequences as suggested. The City has provided outreach to the local Native American Tribes in the Region and no impacts to tribal cultural resources were discovered throughout this IS/MND effort.

Comment A-2. Comment Noted. We were unaware of any provisions in Assembly Bill 52 that does not allow consultants, acting on behalf of the City, to represent us in consultation with the Native American Tribes. As described in the Public Draft IS/MND, our consultant, Steve Brown of SMB Environmental, Inc. (SMB) obtained a list of the appropriate Native American tribes from your organization and sent them a request by formal letter on January 17, 2017 to provide us with any specific information as to known tribal cultural resources that may be affected by the Proposed Project. SMB also followed up with them on March 8, 2017. In addition, they all have access to our Public Draft IS/MND and have been invited to comment. As per your suggestion and to ensure that we are totally in compliance with AB 52, the City has sent each of the tribes a formal letter on August 10, 2017 requesting government-to-government consultation with each of them and invited them again to participate in our process. These letters are located in Appendix A of this Final IS/MND. We understand that according to AB 52 regulations, they have 30-days to respond. That 30-day period ended on September 11, 2017. To date, the City has not heard back from them. Further and more importantly, no impacts to tribal cultural resources were discovered throughout this IS/MND effort. Therefore, the City has completed its obligation under AB 52 and considers this matter closed. The City, through its subsidiary, the North San Mateo County Sanitation District, is scheduled to make a final decision on the Proposed Project at its regularly scheduled Sanitation District Board Meeting on September 25, 2017 at 6:45 pm in the City Council Chambers, 333-90th Street, City Hall – 2nd Floor, Daly City 94015.

Comment A-3. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND. Specifically, we separated out the tribal cultural evaluation and made it its own separate section, 3.17 Tribal Cultural Resources of Chapter 3 – Environmental Review and Consequences as suggested. While the Proposed Project would not affect any known tribal cultural resources, the City has added a precautionary mitigation measure (**TCR-1: Halt Work if Tribal Cultural Resources are Discovered During Construction Activities)** to ensure that tribal cultural resources are protected if they are discovered inadvertently during construction. This measure is similar to and would be implemented in conjunction with Mitigation Measures CR-1, CR-2, and CR-3.

Comment A-4. Thank you for your comments and the background information on AB 52.

COMMENT LETTER B – STATEWATER RESOURCES CONTROL BOARD (STATE BOARD)

Comment B-1. Comment Noted. Thank you for your letter and interest in the Proposed Project. Yes, the City is contemplating formally applying for funding under the Clean Water State Revolving Fund

(CWSRF). The City appreciates the State Water Board's role in administering the CWRSF program and fully understands that the program is partially funded by the United States Environmental Protection Agency (USEPA) and requires the additional CEQA-Plus environmental documentation and review. We appreciate the detailed information provided which will be required for formally applying for these funds. We have prepared the Public Draft IS/MND in such a way that the State Water Board can use this document as a basis for complying with the necessary CEQA-Plus requirements. If and when we formally apply for CWSRF, we will gladly work with the State Water Board to work through any remaining issues. However, at this time, the City is moving forward with its CEQA process and responsibilities as the CEQA Lead Agency. As requested, the City will provide the State Water Board with any and all necessary documents when it formally applies for funding under the CWSRF Program.

Comment B-2. As described in the Public Draft IS/MND, our consultant, Steve Brown of SMB Environmental, Inc. (SMB) obtained a list of the appropriate Native American tribes in or near the Proposed Project Area from the Native American Heritage Commission (HAHC) and sent them a request by formal letter on January 17, 2017 to provide the City with any specific information as to known tribal cultural resources that may be affected by the Proposed Project. SMB also followed up with them on March 8, 2017. In addition, they all have access to our Public Draft IS/MND and have been invited to comment. As per your suggestion and to ensure that we are totally in compliance with AB 52, the City has sent each of the tribes a formal letter on August 10, 2017 requesting government-to-government consultation with each of them and invited them again to participate in our process. These letters are located in Appendix A of this Final IS/MND. We understand that according to AB 52 regulations, they have 30-days to respond. That 30-day period ended on September 11, 2017. To date, the City has not heard back from them. Further and more importantly, no impacts to tribal cultural resources were discovered throughout this IS/MND effort. Therefore, the City, through its subsidiary, the North San Mateo County Sanitation District, is scheduled to make a final decision on the Proposed Project at its regularly scheduled Sanitation District Board Meeting on September 25, 2017 at 6:45 pm in the City Council Chambers, 333-90th Street, City Hall – 2nd Floor, Daly City 94015.

Comment B-3. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND. Specifically, we separated out the tribal cultural evaluation and made it its own separate section, 3.17 Tribal Cultural Resources of Chapter 3 – Environmental Review and Consequences as suggested and to be in full compliance with AB 52. While the Proposed Project would not affect any known tribal cultural resources, the City has added a precautionary mitigation measure (**TCR-1: Halt Work if Tribal Cultural Resources are Discovered During Construction Activities)** to ensure that tribal cultural resources are protected if they are discovered inadvertently during construction. This measure is similar to and would be implemented in conjunction with Mitigation Measures CR-1, CR-2, and CR-3.

Comment B-4. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND. Specifically, the Proposed Project is located on the San Francisco Bay Peninsula that has been heavily developed and is now over 90 percent urbanized. The Proposed Action is not located within the San Bruno Mountain or the Coastal Zone, which are the only areas on the San Francisco Bay Peninsula that supports suitable habitat for special status species. As discussed in Chapter 2, Project Description, the proposed expansion to the WWTP would be located in the parking lot of the existing WWTP located at 153 Lake Merced Boulevard, Daly City California, 94015. The pipeline alignments would be constructed or installed in existing paved streets within Daly City, the Town of Colma, Broadmoor, and South San Francisco as well as pipeline easements owned by the SFPUC. Further, the portion of the proposed pipeline alignment that might be located in the streets do not support special status species. The portion of the pipeline alignment through property owned by SFPUC consists of non-native grasses and vegetation that is routinely mowed and maintained and does not support special status species. Similarly, the potential location of a storage tank and pump station at either the Atwood

Property or at the Salem Memorial site would be located on a parcel of non–native grasses and vegetation that is routinely mowed and maintained and does not support any special status species. The potential storage tank/pump station site at the Holy Cross Cemetery would be located on a small agricultural field that the Cemetery has contracted out on a year-by-year basis to a small local nursery and which does not support special status species. With that said, there numerous large trees with and adjacent to the proposed construction activities, which could affect special status bird species. Mature trees can serve as perching or nesting sites for migratory birds, including raptors. No trees are being removed as part of the Proposed Project, but construction activities could affect breeding behavior of bird species.

Comment B-5. Comment Noted. As requested, the City will provide the State Water Board with any and all necessary documents when it formally applies for funding under the CWSRF Program.

COMMENT LETTER C – TOWN OF COLMA

Comment C-1. Thank you for your comments and the information you provided on the Town's General Plan, Zoning, and Construction Noise Ordinance parameters that would impact the design and placement of structures on each of the three alternative sites for locating a storage tank and pump station. In retrospect, it would have been very beneficial for the Town, as a responsible agency, to review our Administrative Draft IS/MND prior to the Public Draft release. Nevertheless, the City remains fully committed to work through these design issues and with the Town to develop a successful Project. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND. What follows are specific responses to your specific comments.

Comment C-2. Comment Noted. Table 4 has been updated to include Rezoning, Design Review and Conditional Use Permit as potential permits and approvals by the Town of Colma. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-3. Comment Noted. We have revised Section 3.1 Aesthetics to incorporate the Town's concerns about potential impacts associated with the location of a storage tank and pump station at either the Atwood, Salem or the Holy Cross site and have added the specific mitigation measure(s) requested for each site. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-4. Comment Noted. We understand the Town's concerns about potential air quality impacts associated with the potential excavation and grading activities at either the Atwood or the Salem site. The air quality analysis in the Public Draft IS/MND does in fact provide an estimate of emissions from the construction of the entire Proposed Project, including the improvements at the WWTP, the installation of the recycled water pipeline, and the construction of a storage tank and pump station at one of the three alternative sites in Colma. We believe that this analysis provides a realistic worse-case development scenario and the results suggest that the potential air quality impacts would be well below the thresholds of significance established by the San Francisco Bay Area Air Quality Management District (BAAQMD). In addition, BAAQMD's approach to analyses of construction impacts as noted in their BAAQMD CEQA Guidelines is to emphasize implementation of effective and comprehensive basic construction control measures rather than detailed quantification of emissions. As a result, we included their basic construction control measures as Mitigation Measures AIR-1 and AIR-2, which would have been the same measures employed even if the analysis determined that the Proposed Project's construction activities would exceed the thresholds of significance and cause a significant impact. In short, implementation of Mitigation Measures AIR-1 and AIR-2 is considered by the BAAQMD to reduce any air quality impacts from construction activities to less than significant levels, regardless of what the actual emission calculation is.

Comment C-5. Comment Noted. We assume the comment meant that Checklist Item a) should be marked Less-than-Significant instead of Checklist Item c) as Checklist item c) is already marked Less-than-Significant. Therefore, we have revised Checklist Item a) as requested by the Town. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-6. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-7. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-8. Comment Noted. The Proposed Project would not result in more than 10,000 square feet of new impervious surfaces. Further, the improvements at the WWTP and the potential storage tank at the Holy Cross Site would be designed and constructed to be in compliance with any and all stormwater rules and regulations.

Comment C-9. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-10. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-11. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-12. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-13. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-14. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-15. Comment Noted. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND.

Comment C-16. Comment Noted. Thank you again for your comments and the information you provided on the Town's General Plan, Zoning, and Construction Noise Ordinance parameters that would impact the design and placement of structures on each of the three alternative sites for locating a storage tank and pump station. Please see Chapter 4 of this Final IS/MND to find the revisions to the Public Draft IS/MND. Based on the Final IS/MND, the Proposed Project would not result in new significant impacts, substantially increase the severity of previously disclosed impacts, or involve any of the other conditions related to changed circumstances or new information that can require a subsequent or supplemental EIR under Public Resources Code section 21166 and CEQA Guidelines section 15162 beyond those impacts and conditions already identified in the City's Public Draft IS/MND. The City, through its subsidiary, the North San Mateo County Sanitation District, will use this Final IS/MND, in combination with the Public Draft IS/MND, to make a final decision on the Proposed Project at its regularly scheduled Sanitation District Board Meeting on September 25, 2017 at 6:45 pm in the City Council Chambers, 333-90th Street, City Hall – 2nd Floor, Daly City 94015. Further, the Mitigation Monitoring and Reporting Program (MMRP), located as Appendix B of this Final IS/MND, will be the governing document to ensure that all of the environmental issues are mitigated to less than significant levels.

Chapter 4 Revisions to the Public Draft IS/MND

This chapter shows revisions to the July 2017 Public Draft IS/MND, subsequent to the document's publication and public review. The revisions are presented in the order in which they appear in the Public Draft IS/MND and are identified by section and page number in respective chapters. These revisions are shown as excerpts from the Public Draft IS/MND, with strikethrough (~~strikethrough~~) text in indicate deletions and underlined (underlined) text to indicate additions.

The City has the following revisions to the Public Draft IS/MND.

Major Revision

A major revision to the IS/MND is the addition of a new and separate section in Section 3 – Environmental Review and Consequences Chapter in order to be more compliant with Assembly Bill 52 requiring assessing Tribal Cultural Resources separately and distinctly from Archeological, Paleontological, and Historical Resources as described in Section 3.5 Cultural Resources. Specifically, we are adding a new section in between 3.16 Traffic and Transportation and 3.17 Utilities and Service Systems. As a result, Section ~~3.17 Utilities and Service Systems~~ will become 3.18 Utilities and Service Systems and ~~3.18 Mandatory Findings of Significance~~ will become 3.19 Mandatory Findings of Significance. The City has provided outreach to the local Native American Tribes in the Region and no impacts to tribal cultural resources were discovered throughout this IS/MND effort.

Chapter 2 – Proposed Project Description and Alternatives

On Page 2-14 in Section 2.5, Table 4 has been revised as follows:

Table 4
Potential Permits and Approvals
Expanded Tertiary Recycled Water Facilities City of Daly City

Agency/Entity	Type of Approval
Bay Area Rapid Transit (BART)	• Construction Permit for Facilities Adjacent to BART Structures
California Department of Transportation (Caltrans)	• Encroachment Permit - El Camino Real / Hwy 82
California Division of Occupational Safety and Health (CAL/OSHA)	• Construction activities in compliance with CAL/OSHA safety requirements
City of South San Francisco	• Encroachment Permit - South San Francisco Roads
Colma Fire Protection District	• Approval of Fire Suppression System
Daly City	• Encroachment Permit - Daly City Roads
San Francisco Bay Regional Water Quality Control Board	• National Pollutant Discharge Elimination System General Permit for Stormwater Discharge • Associated with Construction Activities Updated Recycled Water Use Permit
San Francisco Public Utilities Commission (SFPUC)	• Encroachment Permit - SFPUC Right-of-Way
San Mateo County	• Encroachment Permit - Broadmoor and County Roads

Table 4 Potential Permits and Approvals Expanded Tertiary Recycled Water Facilities City of Daly City	
Town of Colma	• Encroachment Permit - Colma Roads • Rezoning Approval • Design Review and Approval • Conditional Use Permit

Chapter 3 Environmental Review and Consequences

On Page 3-1, the list of environmental resources evaluated has been revised as follows.

Environmental Resources Evaluated

The following are the key environmental resources that were evaluated in this document.

- ☒ Aesthetics
- ☒ Agriculture Resources
- ☒ Air Quality
- ☒ Biological Resources
- ☒ Cultural Resources
- ☒ Geology / Soils
- ☒ Hazards/Hazardous Materials
- ☒ Hydrology / Water Quality
- ☒ Land Use / Planning
- ☒ Mineral Resources
- ☒ Noise
- ☒ Public Services
- ☒ Population and Housing
- ☒ Recreation
- ☒ Socioeconomics
- ☒ Transportation/Traffic
- ☒ Tribal Cultural Resources
- ☒ Utilities and Service Systems
- ☒ Mandatory Findings of Significance

3.1 Aesthetics

Section 3.1 – Aesthetics on pages 3-2 through 3-3 of the Public Draft IS/MND has been revised as follows.

Would the Proposed Project/Action:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
a) Have a substantial adverse effect on a scenic vista?	☐	☒	☐	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☒	☐	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☒	☐	☐

d) Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area?

☐	☐	☐	☒

Discussion

(a) **Less-than-Significant Impact with Mitigation.** ~~**No Impact.**~~ ~~The Proposed Project/Action is not located in or near any designated scenic vistas and therefore would not have a substantial impact on a scenic vista.~~ Important scenic resources in ~~Daly City~~ Project Area include views of the ocean and coastline as well as the San Bruno Mountain. However, ~~T~~the construction activities of the Proposed Project/Action would be temporary and would not substantially interfere with views of these resources from surrounding publicly accessible areas. Further, once constructed, the expansion of the WWTP in the parking lot of the existing WWTP and the underground pipeline facilities would not have any effect on a scenic vista. However, the Town of Colma is concerned that the location of the storage tank and pump station at either the Atwood Property, the Salem Memorial site, or at the Holy Cross site (only one site would be selected) could affect local scenic routes as designated by their General Plan (i.e. El Camino Scenic Route and Hillsdale Scenic Route). As a result, they have requested that compliance with the siting and design requirements in the Colma General Plan and Colma Municipal Code are to be included as specific mitigation measures in order to reduce these potential impacts to less than significant levels. As a result, the following mitigation measure would be implemented, depending on which site is eventually selected.

Mitigation Measure AES-1: Compliance with the Colma General Plan and Colma Municipal Code. Depending on which site is ultimately selected, the following specific measures shall apply to each location.

Atwood Site, Colma. Development of the Atwood site shall be in accordance with the following standards to maintain and enhance the El Camino Real Scenic Corridor:

- Access to the sites shall occur from Olivet Parkway (GP Policy 5.03.726);
- Any above ground structures or parking areas shall maintain a 30' setback from the El Camino Real right-of-way (CMG 5.030.360);
- Within the 30' setback area, trees and landscaping shall be provided to enhance the greenbelt theme;
- No fencing shall be maintained within the 30' setback area;
- Utilities shall be undergrounded from the nearest utility pole;
- Utility vaults shall be sited so as not to be visible from the El Camino Real right-of-way;
- Fencing shall either be a solid type or black vinyl clad cyclone fencing [CMG 5.03.350(e)];
- Siting of the pump station building shall be sensitive to existing views of the Salem office/chapel building; and
- The pump station building is required to be designed with Spanish Mediterranean architecture as required in the Colma General Plan and Design Review overlay district.

Salem Site, Colma. Development of the Salem site shall be in accordance with the following standards to maintain and enhance the Hillside Boulevard Scenic Corridor:

- Any above ground structures or parking areas shall maintain a sufficient setback that will allow for generous landscape planting behind the sidewalk on Hillside Boulevard;
- Fencing shall be set back from Hillside Boulevard and screened by landscaping;
- Utilities shall be undergrounded from the nearest utility pole;
- Utility vaults shall be sited so as not to be visible from the Hillside Boulevard right-of-way;
- Fencing shall either be a solid type or black vinyl clad cyclone fencing [CMG 5.03.350(e)] and be set back to the extent feasible from Hillside Boulevard;
- Siting of the well building shall be sensitive to existing views from Hillside Boulevard; and
- The pump station building is required to be designed with Spanish Mediterranean architecture as required in the Colma General Plan and Design Review overlay district.

Holy Cross Site, Colma. Development of the Holy Cross site shall be in accordance with the following standards to maintain and enhance the Hillside Boulevard Scenic Corridor:

- Utilities shall be undergrounded from the nearest utility pole;
- Utility vaults shall be sited so as not to be visible from the Hillside Boulevard right-of-way;
- Fencing shall black vinyl clad cyclone fencing [CMG 5.03.350(e)};
- Planting of a trees in front of the above ground tank will obscure views from Hillside Boulevard; and
- Painting of the storage tank and appropriate earth tone color will cause the tank to be less visually apparent.

With the incorporation of the above mitigation, ~~N~~no impacts are anticipated and no other specific mitigation measures are required.

(b) **Less-than-Significant Impact with Mitigation.** ~~**No Impact.**~~ The Proposed Project/Action is not located near or within a designated state scenic highway and therefore would not damage scenic resources, including but not limited to trees, outcroppings, and historic buildings within a state scenic highway. Designated scenic highways and routes are intended to protect and enhance the scenic beauty of the highways, routes and adjacent corridors. Designation ensures that new development projects along recognized scenic corridors are designed to maintain the route's scenic potential. Skyline Boulevard (Route 35), Cabrillo Highway (Route 1), and Junipero Serra Freeway (I-280) are eligible to be State-designated Scenic Highways under the State Scenic Highways program, but are not officially designated. Some of the scenic potential along these corridors are related to the views of the coast and San Bruno Mountain. The County of San Mateo's Visual Quality General Plan Element identifies these three highways as roadways that provide scenic views along with portions of John Daly Boulevard and Guadalupe Canyon Parkway. ~~The Proposed Project/Action's construction activities would not be located within any area that has been designated as a scenic vista or scenic resource. Therefore, no impacts are anticipated and no specific mitigation measures are required.~~ However, the Town of Colma is concerned that the location of the storage tank and pump station at either the Atwood Property, the Salem Memorial site, or at the Holy Cross site (only one site would be selected) could affect local scenic routes as designated by their General Plan (i.e. El Camino Scenic Route and Hillsdale Scenic Route). As a result, they have requested that compliance with the siting and design requirements in the Colma General Plan and Colma Municipal Code are to be included as specific mitigation measures in order to reduce these potential impacts to less than significant levels. As a result, with the implementation of **Mitigation Measure AES-1** above, and impacts would be reduced to less than significant levels.

(c) **Less-than-Significant Impact with Mitigation.** ~~**No Impact.**~~ Construction of the Proposed Project/Action's facilities would be visible and would involve temporary negative aesthetic effects, including open trenches as well as the presence of construction equipment and materials. Construction of the new tertiary treatment facility, the electrical building, and a new chemical and neutralization areas, would be temporary and located inside the Daly City Wastewater Treatment Plant and is not considered to be a significant impact. ~~Once constructed, the new facilities would not have any significant visual impacts.~~ Construction impacts of the pipeline facilities would be temporary and are considered to be less-than-significant. Once built, the pipeline facilities would be buried underground and not visible. ~~The storage tanks at the Atwood Property or at the Salem Memorial Park Property would be underground and thus would not have any significant visual impacts once constructed. Any construction visual impacts of either tank would be considered less than significant. The proposed storage tank at the Holy Cross Cemetery is the preferred alternative for a storage tank and would be an above ground facility located on a hillside next to an existing storage tank and thus would not have any additional new or significant visual impacts. Operation of the Proposed Project/Action would not affect any visual resources. Therefore, no significant impacts are anticipated and no specific mitigation measures are required. .~~ However, the Town of Colma is concerned that the location of the storage tank and pump station at either the Atwood Property, the Salem Memorial site, or at the Holy Cross site (only one site would be selected) could affect local scenic routes as designated by their General Plan (i.e. El Camino Scenic Route and Hillsdale Scenic Route). As a result, they have requested that compliance with the siting and design requirements in the Colma General Plan and Colma Municipal Code are to be included as specific mitigation measures in order to reduce these potential impacts to less than significant levels. As a result, with the implementation of **Mitigation Measure AES-1** above, and impacts would be reduced to less than significant levels.

(d) **No Impact.** The Proposed Project/Action would not create a new source of substantial light or glare that would adversely affect day or nighttime views in the area. The Proposed Project/Action would not be constructed during nighttime hours and once constructed, there would be no lights or other sources of significant light or glare. Therefore no impacts would occur and no mitigation is required.

3.4 Biological Resources

On pages 3-12 and 3-13, the "Discussion" portion of the text in Section 3.4 Biological Resources as been revised as follows.

Discussion

The Proposed Project is located on the San Francisco Bay Peninsula that has been heavily developed and is now over 90 percent urbanized. The Proposed Action is not located within the San Bruno Mountain or the Coastal

Zone, which are the only areas on the San Francisco Bay Peninsula that supports suitable habitat for special status species.

A record search of CDFW's California Natural Diversity Database (CNDDB) and USFWS' Species List was conducted for the area within a five-mile radius of the Project area to identify previously reported occurrences of state and federal special-status plants and animals. In addition, a field visit of the pipeline alignment was conducted on January 25, 2017 to determine the potential for special-status species to occur within the general vicinity of the Proposed Project/Action Study Area (i.e. Construction Area) as described in Chapter 2 – Project Description. This field visit was not intended to be protocol-level surveys to determine the actual absence or presence of special-status species, but were conducted to determine the potential for special-status species to occur within the Proposed Project/Action Area. As discussed in Chapter 2, Project Description, the proposed expansion to the WWTP would be located in the parking lot of the existing WWTP located at 153 Lake Merced Boulevard, Daly City California, 94015. The pipeline alignments would be constructed or installed in existing paved streets within Daly City, the Town of Colma, Broadmoor, and South San Francisco as well as pipeline easements owned by the SFPUC. Further, the proposed pipeline alignment that would be located in the streets does not support special status species. The portion of the pipeline alignment through property owned by SFPUC consists of non-native grasses and vegetation that is routinely mowed and maintained and does not support special status species. Similarly, the potential location of a storage tank and pump station at either the Atwood Property or at the Salem Memorial site would be located on a parcel of non–native grasses and vegetation that is routinely mowed and maintained and does not support any special status species. The potential tank/pump station site at the Holy Cross Cemetery would be located on a small agricultural field that the Cemetery has contracted out on a year-by-year basis to a small local nursery and which does not support special status species. With that said, there are numerous large trees with and adjacent to the proposed construction activities, which could affect special status bird species. Mature trees can serve as perching or nesting sites for migratory birds, including raptors. No trees are being removed as part of the Proposed Project, but construction activities could affect breeding behavior of bird species. No special-status species were observed during the field visits. Figure 10 shows the location of known state and federal listed species within the Project/Action Area. Appendix B provides a summary of the potential for state and federal special status species to occur within the Proposed Project/Action Study Area. Appendix C provides an analysis of the potential for the Proposed Project/Action to adversely effect federal special status species in order to satisfy the requirements for CEQA-Plus and NEPA and the federal resource agencies.

3.6 Geology and Soils

Section 3.6 – Geology and Soils on pages 3-20 through 3-22 of the Public Draft IS/MND has been revised as follows.

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☒	☐	☐
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the				

State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☒	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☒	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐
c) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☒	☐	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☒	☐	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☒

Discussion

a) **Less-than-Significant Impact with Mitigation.** In June 2016, the City prepared a geotechnical investigation to determine if the Proposed Project could ~~The Proposed Project/Action does not~~ expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

i) Rupture of a known earthquake fault. The Proposed Project/Action is located in an area of known faults in the region. The Peninsula portion of the San Andreas Fault passes through the center of San Mateo County. The Northern San Gregorio fault also passes through the western edge of the county. The San Andreas Fault has a 21% chance of creating a magnitude 6.7 or greater earthquake in the next 30 years. The Proposed Project/Action area is susceptible to strong ground shaking during an earthquake that could occur along known faults in the region. However, the Proposed Project/Action does not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death due to a seismic event over existing conditions.

ii) Strong seismic ground shaking. The Proposed Project/Action area is susceptible to strong ground shaking during an earthquake that could occur along known faults in the region, including the San Andreas and the Northern San Gregorio Faults. However, the Proposed Project/Action does not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death due to a seismic event over existing conditions.

iii) Seismic-related ground failure, including liquefaction. Liquefaction is defined as the transformation of a granular material from a solid state into a liquefied state as a consequence of increased pore pressure and decreased effective stress. Liquefaction typically is caused by strong ground shaking during an earthquake. The potential for liquefaction to occur depends on both the susceptibility of near-surface deposits to liquefaction, and the likelihood that ground motions will exceed a specified threshold level. Areas most susceptible to liquefaction are underlain by granular sediments within younger alluvium and include low-lying lands adjacent to creeks and estuaries. ~~However, the Proposed Project/Action does not expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death due to an event causing liquefaction over existing conditions.~~ The Atwood Property is located in an area designated as a liquefaction area and the location of a storage tank and pump station on this site could expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death due to an event causing liquefaction over existing conditions.

iv) Landslides. Landslides and slope instability can also occur as a result of wet weather, weak soils, improper grading, improper drainage, steep slopes, adverse geologic structure, or a combination of any of these factors. Landslides are most likely to occur in areas where they have occurred previously. Landslides and debris flows can result in damage to property and cause buildings to become unsafe either due to distress or collapse during sudden or gradual slope movement. Construction on slopes steeper than about 15 percent typically require special grading, special foundation design, or site modification to mitigate slope ground conditions and reduce the potential for slope instability. Slope instabilities produced by seismically induced strong ground motions are likely to occur, given the occurrence of a moderate or large earthquake on ~~the Hayward Fault or~~ a nearby seismic source. If the storage tank and pump station is located at the Atwood Property, then the ~~The~~ Proposed Project/Action could ~~does not~~ expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death due to an event causing landslides.

The following mitigation measure shall be implemented to reduce any impacts to less than significant levels.

> **Mitigation Measure GEO-1: Design to Liquefaction and Landslide Design Standards.** The City shall design all facilities to the recommended design standards established in the June 2016 Geotechnical Report which determined the proper design and construction methods for the Proposed Project, including, but not limited to the design of any soil remediation measures as required to reduce hazards caused by landslides, liquefaction, and/or lateral spreading.

~~In summary, the Proposed Project/Action would not expose people or structures to potential adverse effects, including the risk of loss, injury, or death. Any impacts are less than significant and no mitigation is required.~~

(b) **Less-than-Significant Impact.** The operation of the Proposed Project/Action would not result in any excavation and earthmoving that could cause erosion or loss of topsoil. Construction activities associated with the Proposed Project/Action would involve excavation and earthmoving that could cause erosion or loss of topsoil. Construction activities would involve excavation, moving, filling, and the temporary stockpiling of soil. Earthwork associated with development construction could expose soils to erosion. However, the Proposed Project/Action would be constructed in existing roadways and utility corridors and would be covered and/or paved immediately after the pipeline and storage facilities have been installed. In addition, all areas not paved would be re-vegetated immediately after construction. As a result, any soil erosion or loss of topsoil would be considered less-than-significant.

(c) **Less-than-Significant Impact with Mitigation.** The Proposed Project/Action may be located in areas that consist of medium dense to dense fine granular soils. In addition, perched groundwater could be present. As such, the soil in some areas of the alignment may have a high susceptibility to liquefaction during seismic shaking. Other portions of the Proposed Project/Action may be less susceptible to liquefaction and related damage. Lateral spreading, often associated with liquefaction, is less likely because there are no steep banks or hard ground bordering the Proposed Project/Action area, but could still potentially be a hazard. ~~As a result, the following mitigation is proposed:~~

> ~~**Mitigation Measure GEO-1: Perform Geotechnical Investigation.** The City shall require a design-level geotechnical study to be prepared prior to project implementation to determine proper design and construction methods, including design of any soil remediation measures as required to reduce hazards caused by landslides, liquefaction, and/or lateral spreading.~~

With the incorporation of ~~this~~ **M~~m~~itigation M~~m~~easure GEO-1** above, any resulting impacts would be considered to be less-than-significant.

(d) **Less-than-Significant Impact with Mitigation.** The Proposed Project/Action could be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994). However, with the incorporation of **Mitigation Measures GEO-1** above, any impacts would be less-than-significant.

(e) **Less-than-Significant Impact.** The Proposed Project/Action would not include the use of septic tanks or alternative wastewater disposal systems. Therefore, no adverse effects to soil resources are expected. No mitigation is required.

3.7 Hazards and Hazardous Materials

On Page 3-25, Checklist Item (e) has been revised as follows.

(e) **No Impact.** The Proposed Project/Action is not located within two miles of an airport. The closest airport is the San Francisco International Airport, which is approximately 11 miles from the center of the Project Study Area. Portions of the Proposed Project may be located within the boundaries of the Comprehensive Airport Land Use Compatibility Plan for the San Francisco International Airport. However, all sites, which constitute the Proposed Project, would be below the 400-foot elevation of the official aeronautical surface elevation boundary and will not impact airport operations. Similarly, the Airport operations would not impact the Proposed Project. In addition, the sites are outside the Airport's 65 dB noise contour; therefore, noise impacts from the airport would not result in a safety hazard for people in the vicinity of any of the potential project sites and no impacts would occur. Further, ~~As a result,~~ construction and/or operation of the Proposed Project/Action would not adversely affect an airport or airport operations, including, noise, take-offs, landings, flight patterns, safety, light, navigation, or communications between aircraft and the control tower within the Project area. No impacts are anticipated. No specific mitigation is required.

On Pages 3-25 and 3-26, Checklist Item (h) has been revised as follows.

(h) **Less-than-Significant Impact with Mitigation.** Construction of the Proposed Project/Action would be located within an urban setting and is not generally located in an area where there is the risk of wildland fire. Specifically, a records search of the California Department of Forestry and Fire Protection Fire Severity mapping system does not regard the Proposed Project/Action Area to be in an area of moderate or high risk to wildfires. However, the location of the storage tank and pump station would be located in Colma, which is considered to be in an urban wildfire interface area per ABAG Hazard Maps. In addition, the Holy Cross site is not in proximity to a fire hydrant or any fire suppression resources and fire service is provided by the Colma Fire Protection District and not the Town. As a result, there is ~~little~~ potential to expose people or structures to a significant risk of loss, injury or death involving wildland fires. However, the potential exists that construction and/or operation activities could cause a fire, especially in a drought situation or in the dry season. With the incorporation of the following mitigation measure, any potential impacts are considered to be less than significant.

Mitigation Measure HAZ-5 Fire Prevention and Control: The City shall comply with all federal, state, county and local fire regulations pertaining to burning permits and the prevention of uncontrolled fires. The following measures shall be implemented to prevent fire hazards and control of fires:

- A list of relevant fire authorities and their designated representative to contact shall be maintained on site by construction personnel.
- Adequate firefighting equipment shall be available on site in accordance with the applicable regulatory requirements.
- The level of fire hazard shall be posted at the construction office (where visible for workers) and workers shall be made aware of the hazard level and related implications.
- The City or its contractor shall provide equipment to handle any possible fire emergency. This shall include, although not be limited to, water trucks; portable water pumps; chemical fire extinguishers; hand tools such as shovels, axes, and chain saws; and heavy equipment adequate for the construction of fire breaks when needed. Specifically, the City or its contractor shall supply and maintain in working order an adequate supply of fire extinguishers for each crew engaged in potentially combustible work such as welding, cutting, and grinding.
- All equipment shall be equipped with spark arrestors.
- In the event of a fire, the City or its contractor shall immediately use resources necessary to contain the fire. The City or contractor shall then notify local emergency response personnel.
- Any and all tree-clearing activities (if any) are to be carried out in accordance with local rules and regulations for the prevention of forest fires.
- Burning shall be prohibited.
- Flammable wastes shall be removed from the construction site on a regular basis.
- Flammable materials kept on the construction site must be stored in approved containers

away from ignition sources.

- Once constructed, the selected storage tank site in Colma shall be regularly maintained to include weed abatement and making proper improvements as required by the Colma Fire Protection District.

3.9 Land Use and Planning

On Page 3-33, the Land Use and Planning Section has been revised as follows.

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☒	☐	☐
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

Discussion

(a) **No Impact.** The Proposed Project/Action would not physically divide an established community. The Proposed Project/Action would not result in a disruption, physical division, or isolation of existing residential or open space areas. As a result, no impact is expected and no mitigation is required or necessary.

(b) **Less-than-Significant Impact with Mitigation.** ~~**No Impact.**~~ The Proposed Project/Action would not generally conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the Project area. In fact, the City has developed strategic plans and policies to encourage the use of recycled water. However, the location of the storage tank and pump station in Colma would require a rezoning action or zoning text amendment to allow the use. ~~Therefore, no impacts are anticipated and no mitigation is required~~. With the incorporation of **Mitigation Measure AES-1**, any impacts are reduced to less than significant levels.

(c) **No Impact.** The Proposed Project/Action would not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan. As stated above, the Proposed Project/Action would be constructed within the existing WWTP, existing roadways within the City, and on a small parcel in Colma, which is not located in a habitat conservation area. For this reason, no impacts are expected and no mitigation is required or necessary.

3.10 Mineral Resources

On page 3-34 Checklist Item (b) has been revised as follows.

(b) **No Impact.** The City's General Plan and the Town of Colma's General Plan do~~es~~ not identify any locally important mineral resources or recovery sites in the Proposed Project/Action's area. Further, as discussed in (a), the Proposed Project/Action would be unlikely to result in the loss of availability of a mineral resource deposit that has been identified as a mineral resource of value. Therefore, no adverse impacts are anticipated and no mitigation is required.

3.11 Noise

On Page 3-36 in Section 3.11 Noise, Mitigation Measure NOI-1 has been revised as follows.

Mitigation Measure NOI-1: **Limit Construction Hours.** Construction activities will be limited to the least noise-sensitive times and will comply with the City's and the Town of Colma's noise ordinances. Construction, alteration, and other related activities shall be allowed on weekdays between the hours of 8 a.m. and 5 p.m., and on Saturdays between the hours of 10 a.m. and 5 ~~6~~ p.m. Construction activities shall not exceed the outdoor ambient sound level (dBA) of 86 dBA. No noise generating activities shall occur on any federal holidays.

3.12 Population and Housing

On Pages 3-38 and 3-39, Checklist Items (b) and (c) have been revised as follows.

(b) **No Impact.** The Proposed Project/Action would not result in displacing substantial numbers of existing housing or necessitating the construction of replacement housing elsewhere. The Proposed Project/Action would be constructed within existing roadways and/or utility corridors within commercial, industrial, and residential zonings within the City and the Town of Colma. Construction of the Proposed Project/Action would avoid the need to demolish any existing houses and would not affect any other housing structures. As a result, the Proposed Project/Action would not displace existing housing, and therefore, no impacts are anticipated.

(c) **No Impact.** The Proposed Project/Action would not displace substantial numbers of people necessitating the construction of replacement housing elsewhere. The Proposed Project/Action would be constructed within existing roadways within the City and the Town of Colma. Construction of the Proposed Project/Action would not result in the demolition of existing housing and other housing structures. As a result, the Proposed Project/Action is not expected to displace people from their homes. Therefore, no impacts are anticipated and no mitigation is required.

3.13 Public Services

On Page 3-40, the Public Serves Section has been revised as follows.

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*

a) Would the Project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:

Fire protection?	☐	☐	☒	☐
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒

Discussion

(a) **Less-than-Significant ~~No~~ Impact with Mitigation.** The Proposed Project/Action will not generate population growth and the operation and maintenance of the Proposed Project/Action would not be labor intensive, requiring significant numbers of temporary workers to relocate to the area. In addition, the Proposed Project/Action would not increase the demand for the kinds of public services that would support new residents, such as schools, parks, police, or other public facilities. However, if the Holy Cross site is chosen for the location for the storage tank and pump station, then the City will be required to comply with the requirements of the Colma Fire Protection District, as the Holy Cross site is not located near an existing fire hydrant and does not have any fire fighting or suppression resources. ~~As a result, no impacts are anticipated and no mitigation is required.~~ Implementation of Mitigation Measure HAZ-5 would reduce any impacts to less than significant levels.

3.16 Traffic and Transportation

On Pages 3-44 and 3-45 in Section 3.16 Traffic and Transportation, Checklist Items (a) and (e) have been revised as follows.

(a) **Less-than-Significant Impact with Mitigation.** Construction would temporarily increase traffic and disrupt transportation and circulation patterns in the vicinity of the project thus disrupting local vehicle, bicycle, and pedestrian traffic along the haul routes and the planned pipeline alignment. Although construction-generated traffic would be temporary during peak excavation and earthwork activities, average daily truck trips would not likely exceed 40 round-trip truck trips per day. The primary impacts from the movement of trucks would include short-term and intermittent lessening of roadway capacities due to slower movements and larger turning radii of the trucks compared to passenger vehicles and temporary lane closures and possible detours during certain times. The following mitigation measures are proposed:

Mitigation Measure TRA-1: Prepare and Implement Traffic Control Plan. As is consistent with existing policy, the City shall require the contractor to prepare and implement effective traffic control plans to show specific methods for maintaining traffic flows. Examples of traffic control measures to be considered include: 1) use of flaggers to maintain alternating one-way traffic while working on one-half of the street; 2) use of advance construction signs and other public notices to alert drivers of activity in the area; 3) use of "positive guidance" detour signing on alternate access streets to minimize inconvenience to the driving public; 4) provisions for emergency access and passage; and 5) designated areas for construction worker parking.

Mitigation Measure TRA-2: Return Roads to Pre-construction Condition. Following construction, the City shall ensure that road surfaces that are damaged during construction are returned to their pre-construction condition or better.

Mitigation Measure TRA-3: Encroachment Permit. Prior to any work outside of the City's limits, the City shall obtain approval of a construction and staging plan and an encroachment permit from the responsible agency(s) (i.e. Town of Colma, Caltrans, South San Francisco, SFPUC, etc.).

With the incorporation of the above mitigation measures, potential temporary impacts are considered to be less-than-significant.

(e) **Less-than-Significant Impact with Mitigation.** The Proposed Project/Action would have temporary effects on traffic flow, due to added truck traffic during construction that could result in delays for emergency vehicle access in the vicinity of the project. Implementation of **Mitigation Measure TRA-1** and **Mitigation Measure HAZ-5** would require the contractor to establish methods for maintaining traffic flow in the project vicinity and minimizing disruption to emergency vehicle access to land uses along the truck route and/or pipeline alignment. Implementation of **Mitigation Measure TRA-1** and **Mitigation Measure HAZ-5** would also ensure potential impacts associated with temporary effects on emergency access would be mitigated to a less-than-significant level.

3.17 Tribal Cultural Resources

A new section has been added in order to be more compliant with Assembly Bill 52 requiring assessing Tribal Cultural Resources separately and distinctly from Archeological, Paleontological, and Historical Resources as described in Section 3.5 Cultural Resources. Specifically, we are adding a new section in between 3.16 Traffic and Transportation and 3.17 Utilities and Service Systems. As a result, Section ~~3.17 Utilities and Service Systems~~ will become 3.18 Utilities and Service Systems and ~~3.18 Mandatory Findings of Significance~~ will become 3.19 Mandatory Findings of Significance. The City has provided outreach to the local Native American Tribes in the Region and no impacts to tribal cultural resources were discovered throughout this IS/MND effort.

	Potentially Significant Impact	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
Would the Proposed Project/Action:				
a) Cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object				

with cultural value to a California Native American tribe, and that is:

i. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or

ii. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

☐	☐	☐	☒

Discussion

On January 5, 2017, a letter was sent to the Native American Heritage Commission (NAHC) in Sacramento, California in an effort to determine whether any sacred sites listed on its Sacred Lands File are within the current project APE. A response from the NAHC was received on January 13, 2017, stating that a search of its Sacred Land File failed to indicate the presence of Native American cultural resources in the immediate project APE. Included with the response was a list of 5 Native American representatives who may have further knowledge of Native American resources within or near the project APE. To ensure that all Native American concerns are adequately addressed, letters to each of the listed tribal contacts were sent on January 17, 2017, requesting any information about the project that these individuals may have. A record of this is located in Attachment B of Appendix D - Section 106 Cultural Resources investigation Report. Follow-up contacts were made via e-mail on March 8, 2017. In addition, to ensure that we are totally in compliance with AB 52, the City has sent each of the tribes a formal letter on August 10, 2017 requesting government-to-government consultation with each of tribes and invited them again to participate in the process. These letters are located in Appendix A of the Final IS/MND. We understand that according to AB 52 regulations, they have 30-days to respond. That 30-day period ended on September 11, 2017. To date, the City has not heard back from them. Therefore, the City completed the requirements under AB 52 and considers this matter closed. Further and more importantly, no impacts to tribal cultural resources were discovered throughout this IS/MND effort.

In February 2017 a record search for previously recorded cultural resources in the project area and within a ½-mile radius was conducted at the Northwest Information Center, California Historical Resources Information System (NWIC File #16-1004). Resources identified include:

- P-41-002278, Historic Archaeological Feature (privy)
- P-41-002219, Vista Grande Canal and Tunnel

- P-41-001718, Utilitarian Structure within Italian Cemetery
- P-41-000400, Italian Cemetery
- P-41-000401, Eternal Home Cemetery
- P-41-000402, Salem Memorial Park
- P-41-000403, Home of Peace Cemetery
- P-41-000404, Cypress Lawn Memorial Park
- P-41-000405, Holy Cross Cemetery

While the six Colma cemeteries are listed on the National Register of Historic Places, no archaeological of tribal cultural resources are known within the project area.

a) No Impact. The Proposed Project would not cause a substantial adverse change in the significance of a known tribal cultural resource, as defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is either; (1) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k); and/or (2) is a resource determined by the City or its archeological consultant, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1.

There are no tribal cultural resources that are known to exist within the Project area. Therefore, the Proposed Project/Action is not likely to cause a substantial adverse change in the significance of known or unique tribal cultural resources. Nevertheless, there is a slight chance that construction activities of the Proposed Project/Action could result in accidentally discovering unique tribal cultural resources. However, to further reduce this less-than-significant impact, the following mitigation measures shall be implemented along with and in combination with the mitigation measures identified as CR-1, CR-2, and CR-3 in Section 3.5 Cultural Resources:

Mitigation Measure TCR-1: Halt Work if Tribal Cultural Resources are Discovered. In the event that any tribal cultural resources are discovered during ground disturbing activities, all work within 100-feet of the resources shall be halted and after notification, the City shall consult with a qualified archaeologist and local tribes to assess the significance of the find. If any find is determined to be significant as a unique tribal cultural resource, the City shall treat the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including to, but not limited to, the following:

- Protecting the cultural character and integrity of the resource;
- Protecting the traditional use of the resource; and
- Protecting the confidentiality of the resource.

In considering any suggested mitigation proposed by the consulting archaeologist and/or the appropriate tribe in order to mitigate impacts to any tribal cultural resources find, the City shall determine whether avoidance is feasible in light of factors such as the nature of the find, project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) shall be instituted and coordinated with the appropriate tribe(s). Work may proceed on other parts of the project site while mitigation measures for tribal cultural resources or other unique archaeological resources are carried out.

With the implementation of the above mitigation measure, the Proposed Project/Action would not result in impacts to tribal cultural resources.

Chapter 5 CEQA Findings and Determination:

On the basis of this Final IS/MND for the City of Daly City's Expanded Tertiary Recycled Water Project:

☐ I find that the Proposed Project WOULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the Proposed Project COULD have a significant effect on the environment, there will NOT be a significant effect in this case because revisions in the Project and/or mitigation measures have been made by or agreed to by the City. As a result, a MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the Proposed Project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the Proposed Project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the Proposed Project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the Proposed Project, nothing further is required.

Patrick Sweetland

Signature

September 14, 2017

Date

Patrick Sweetland

Printed Name

Director of Water and Wastewater Resources

Title

Appendix A

Government-to-Government Consultation Request Pursuant to Assembly Bill 52

NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
(916) 373-3710
(916) 373-5471 Fax

January 13, 2017

Steve Brown
SMB Environmental

Sent by: steve@smbenvironmental.com

RE: Daly City Recycled Water Project, San Mateo County

Dear Mr. Brown,

Attached is a list of tribes that have cultural and traditional affiliation to the area of potential project effect (APE) referenced above. I suggest you contact all of those listed, if they cannot supply information, they might recommend others with specific knowledge. The list should provide a starting place to locate areas of potential adverse impact within the APE. By contacting all those on the list, your organization will be better able to respond to claims of failure to consult, as may be required under particular state statutes. If a response has not been received within two weeks of notification, the Native American Heritage Commission (NAHC) requests that you follow-up with a telephone call to ensure that the project information has been received.

The NAHC also recommends that project proponents conduct a record search of the NAHC Sacred Lands File (SLF) at the appropriate regional archaeological Information Center of the California Historic Resources Information System (CHRIS) (http://ohp.parks.ca.gov/?page_id=1068) to determine if any tribal cultural resources are located within the area(s) affected by the proposed action. The SFL, established under Public Resources Code section 5094, are sites submitted for listing to the NAHC by California Native American tribes. The SFL, established under Public Resources Code section 5094, are sites submitted for listing to the NAHC by California Native American tribes. A record search of the SLF was completed for the APE referenced above with negative results. Please note records maintained by the NAHC and CHRIS is not exhaustive, and a negative response to these searches does not preclude the existence of tribal cultural resources. A tribe may be the only source of information regarding the existence of tribal cultural resources.

If you receive notification of change of addresses and phone numbers from any of these tribes, please notify me. With your assistance we are able to assure that our lists contain current information. If you have any questions or need additional information, please contact via email: frank.lienert@nahc.ca.gov

Sincerely,

Frank Lienert
Associate Governmental Program Analyst

Native American Contacts

January 13, 2017

Coastanoan Rumsen Carmel Tribe
Tony Cerda, Chairperson
244 E. 1st Street — Ohlone/Costanoan
Pomona, CA 91766
rumsen@aol.com
(909) 524-8041 Cell
(909) 629-6081

Amah MutsunTribal Band of Mission San Juan Bautista
Irenne Zwierlein, Chairperson
789 Canada Road — Ohlone/Costanoan
Woodside, CA 94062
amahmutsuntribal@gmail.com
(650) 400-4806 Cell

(650) 332-1526 Fax

Muwekma Ohlone Indian Tribe of the SF Bay Area
Rosemary Cambra, Chairperson
P.O. Box 360791 — Ohlone / Costanoan
Milpitas, CA 95036
muwekma@muwekma.org
(408) 314-1898
(510) 581-5194

The Ohlone Indian Tribe
Andrew Galvan
P.O. Box 3152 — Ohlone/Costanoan
Fremont, CA 94539 — Bay Miwok
chochenyo@AOL.com — Plains Miwok
(510) 882-0527 Cell — Patwin

(510) 687-9393 Fax

Indian Canyon Mutsun Band of Costanoan
Ann Marie Sayers, Chairperson
P.O. Box 28 — Ohlone/Costanoan
Hollister, CA 95024
ams@indiancanyon.org
(831) 637-4238

This list is current only as of the date of this document and is based on the information available to the Commission on the date it was produced.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code

This list is only applicable for contacting local Native Americans with regard to cultural resources assessments for Daly City Recycled Water Project, San Mateo County

CITY OF DALY CITY

Department of Water and Wastewater Resources
153 Lake Merced Boulevard
Daly City, CA 94015
(650) 991-8200
Fax (650) 991-8220

Patrick Sweetland, Director

August 10, 2017

Costanoan Rumsen Carmel Tribe
Tony Cerda, Chairperson
244 E. 1st Street
Pomona, CA 91766

email to: rumsen@aol.com

Subject: Request for Government-to-Government Consultation under Assembly Bill 52 (AB-52) for the City of Daly City's Proposed Recycled Water Project

Dear Tony Cerda:

The City of Daly City (City) is requesting a formal government-to-government consultation with your organization to discuss the City's proposed Expanded Tertiary Recycled Water Project (Proposed Project) and the potential that the Proposed Project could have on Tribal Cultural Resources. This request is in addition to, and as a follow-up, to contacts made to you by our consultant, Steve Brown of SMB Environmental, Inc. (SMB), in a formal letter dated January 17, 2017 and then a follow-up e-mail on March 8, 2017 to obtain information from your organization as to the potential to affect Tribal Resources. To date, we have not received any response.

In summary, the Proposed Project would add a new tertiary treatment process to provide an additional 3.0 mgd of tertiary treatment capacity during the irrigation season. The average yearly capacity of the system is 1.25 mgd or 1,400 acre-feet per year (afy) because the system will only operate during the irrigation season. The new treatment processes would include pressure membrane filtration followed by ultraviolet (UV) disinfection due to the small site constraints. New pipelines, pump stations and offsite storage would be constructed to complete the recycled water distribution system, delivering water to new customers for irrigation purposes in lieu of groundwater pumping. The purpose of the Proposed Project is to reduce irrigation reliance on the groundwater basin; provide local, sustainable, and drought-proof water supply; to preserve available groundwater supplies for drinking water.

On July 21, 2017, the City released a Public Draft Initial Study/Mitigated Negative Declaration (IS/MND) on the Proposed Project for a 30-day public review period ending on **August 24, 2017.** An electronic copy of the IS/MND is located on the City's website www.dalycity.org. In addition hard copies are available for review at the City's public works department located at 153 Lake Merced Boulevard, Daly City, CA 94015 and at the Serramonte Main Library located at 40 Wembley Drive, Daly City, CA 94015.

As you will see in the IS/MND, our studies indicate that there would be no impacts to Tribal Cultural Resources. We request that you review the document and provide any comments that you may have and request formal consultation with us to discuss any and all matters related to the project including, but not limited to: alternatives to the Project; recommended mitigation measures; and potential significant effect to Tribal Cultural Resources.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If we do not receive a request from you (or your organization) within 30 days, we will assume that you do not want to have a formal consultation and agree with our assessment that the Proposed Project would not have any impacts to Tribal Cultural Resources that you are aware of. If you have any questions, please feel free to contact me at (650) 991-8201 or at Psweetland@dalycity.org.

Sincerely,

Patrick Sweetland
Director of Water and Wastewater Resources

L17-058A

CITY OF DALY CITY
Department of Water and Wastewater Resources
153 Lake Merced Boulevard
Daly City, CA 94015
(650) 991-8200
Fax (650) 991-8220

Patrick Sweetland, Director

August 10, 2017

Amah Mutsun Tribal Band of Mission San Juan Bautista
Irenne Zwierlein, Chairperson
789 Canada Road
Woodside, CA 94062

email to: amahmutsuntribal@gmail.com

Subject: Request for Government-to-Government Consultation under Assembly Bill 52 (AB-52) for the City of Daly City's Proposed Recycled Water Project

Dear Irenne Zwierlein:

The City of Daly City (City) is requesting a formal government-to-government consultation with your organization to discuss the City's proposed Expanded Tertiary Recycled Water Project (Proposed Project) and the potential that the Proposed Project could have on Tribal Cultural Resources. This request is in addition to, and as a follow-up, to contacts made to you by our consultant, Steve Brown of SMB Environmental, Inc. (SMB), in a formal letter dated January 17, 2017 and then a follow-up e-mail on March 8, 2017 to obtain information from your organization as to the potential to affect Tribal Resources. To date, we have not received any response.

In summary, the Proposed Project would add a new tertiary treatment process to provide an additional 3.0 mgd of tertiary treatment capacity during the irrigation season. The average yearly capacity of the system is 1.25 mgd or 1,400 acre-feet per year (afy) because the system will only operate during the irrigation season. The new treatment processes would include pressure membrane filtration followed by ultraviolet (UV) disinfection due to the small site constraints. New pipelines, pump stations and offsite storage would be constructed to complete the recycled water distribution system, delivering water to new customers for irrigation purposes in lieu of groundwater pumping. The purpose of the Proposed Project is to reduce irrigation reliance on the groundwater basin; provide local, sustainable, and drought-proof water supply; to preserve available groundwater supplies for drinking water.

On July 21, 2017, the City released a Public Draft Initial Study/Mitigated Negative Declaration (IS/MND) on the Proposed Project for a 30-day public review period ending on **August 24, 2017.** An electronic copy of the IS/MND is located on the City's website www.dalycity.org. In addition hard copies are available for review at the City's public works department located at 153 Lake Merced Boulevard, Daly City, CA 94015 and at the Serramonte Main Library located at 40 Wembley Drive, Daly City, CA 94015.

As you will see in the IS/MND, our studies indicate that there would be no impacts to Tribal Cultural Resources. We request that you review the document and provide any comments that you may have and request formal consultation with us to discuss any and all matters related to the project including, but not limited to: alternatives to the Project; recommended mitigation measures; and potential significant effect to Tribal Cultural Resources.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If we do not receive a request from you (or your organization) within 30 days, we will assume that you do not want to have a formal consultation and agree with our assessment that the Proposed Project would not have any impacts to Tribal Cultural Resources that you are aware of. If you have any questions, please feel free to contact me at (650) 991-8201 or at Psweetland@dalycity.org.

Sincerely,

Patrick Sweetland
Director of Water and Wastewater Resources

L17-058B

CITY OF DALY CITY

Department of Water and Wastewater Resources
153 Lake Merced Boulevard
Daly City, CA 94015
(650) 991-8200
Fax (650) 991-8220

Patrick Sweetland, Director

August 10, 2017

Muwekma Ohlone Indian Tribe of the SF Bay Area
Rosemary Cambra, Chairperson
P.O. Box 360791
Milpitas, CA 95036

email to: muwekma@muwekma.org

Subject: Request for Government-to-Government Consultation under Assembly Bill 52 (AB-52) for the City of Daly City's Proposed Recycled Water Project

Dear Rosemary Cambra:

The City of Daly City (City) is requesting a formal government-to-government consultation with your organization to discuss the City's proposed Expanded Tertiary Recycled Water Project (Proposed Project) and the potential that the Proposed Project could have on Tribal Cultural Resources. This request is in addition to, and as a follow-up, to contacts made to you by our consultant, Steve Brown of SMB Environmental, Inc. (SMB), in a formal letter dated January 17, 2017 and then a follow-up e-mail on March 8, 2017 to obtain information from your organization as to the potential to affect Tribal Resources. To date, we have not received any response.

In summary, the Proposed Project would add a new tertiary treatment process to provide an additional 3.0 mgd of tertiary treatment capacity during the irrigation season. The average yearly capacity of the system is 1.25 mgd or 1,400 acre-feet per year (afy) because the system will only operate during the irrigation season. The new treatment processes would include pressure membrane filtration followed by ultraviolet (UV) disinfection due to the small site constraints. New pipelines, pump stations and offsite storage would be constructed to complete the recycled water distribution system, delivering water to new customers for irrigation purposes in lieu of groundwater pumping. The purpose of the Proposed Project is to reduce irrigation reliance on the groundwater basin; provide local, sustainable, and drought-proof water supply; to preserve available groundwater supplies for drinking water.

On July 21, 2017, the City released a Public Draft Initial Study/Mitigated Negative Declaration (IS/MND) on the Proposed Project for a 30-day public review period ending on **August 24, 2017.** An electronic copy of the IS/MND is located on the City's website www.dalycity.org. In addition hard copies are available for review at the City's public works department located at 153 Lake Merced Boulevard, Daly City, CA 94015 and at the Serramonte Main Library located at 40 Wembley Drive, Daly City, CA 94015.

As you will see in the IS/MND, our studies indicate that there would be no impacts to Tribal Cultural Resources. We request that you review the document and provide any comments that you may have and request formal consultation with us to discuss any and all matters related to the project including, but not limited to: alternatives to the Project; recommended mitigation measures; and potential significant effect to Tribal Cultural Resources.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If we do not receive a request from you (or your organization) within 30 days, we will assume that you do not want to have a formal consultation and agree with our assessment that the Proposed Project would not have any impacts to Tribal Cultural Resources that you are aware of. If you have any questions, please feel free to contact me at (650) 991-8201 or at Psweetland@dalycity.org.

Sincerely,

Patrick Sweetland
Director of Water and Wastewater Resources

L17-058C

CITY OF DALY CITY

Department of Water and Wastewater Resources
153 Lake Merced Boulevard
Daly City, CA 94015
(650) 991-8200
Fax (650) 991-8220

Patrick Sweetland, Director

August 10, 2017

The Ohlone Indian Tribe
Andrew Galvan
P.O. Box 3152
Fremont, CA 94539

email to: chochenyo@aol.com

Subject: Request for Government-to-Government Consultation under Assembly Bill 52 (AB-52) for the City of Daly City's Proposed Recycled Water Project

Dear Andrew Galvan:

The City of Daly City (City) is requesting a formal government-to-government consultation with your organization to discuss the City's proposed Expanded Tertiary Recycled Water Project (Proposed Project) and the potential that the Proposed Project could have on Tribal Cultural Resources. This request is in addition to, and as a follow-up, to contacts made to you by our consultant, Steve Brown of SMB Environmental, Inc. (SMB), in a formal letter dated January 17, 2017 and then a follow-up e-mail on March 8, 2017 to obtain information from your organization as to the potential to affect Tribal Resources. To date, we have not received any response.

In summary, the Proposed Project would add a new tertiary treatment process to provide an additional 3.0 mgd of tertiary treatment capacity during the irrigation season. The average yearly capacity of the system is 1.25 mgd or 1,400 acre-feet per year (afy) because the system will only operate during the irrigation season. The new treatment processes would include pressure membrane filtration followed by ultraviolet (UV) disinfection due to the small site constraints. New pipelines, pump stations and offsite storage would be constructed to complete the recycled water distribution system, delivering water to new customers for irrigation purposes in lieu of groundwater pumping. The purpose of the Proposed Project is to reduce irrigation reliance on the groundwater basin; provide local, sustainable, and drought-proof water supply; to preserve available groundwater supplies for drinking water.

On July 21, 2017, the City released a Public Draft Initial Study/Mitigated Negative Declaration (IS/MND) on the Proposed Project for a 30-day public review period ending on **August 24, 2017.** An electronic copy of the IS/MND is located on the City's website www.dalycity.org. In addition hard copies are available for review at the City's public works department located at 153 Lake Merced Boulevard, Daly City, CA 94015 and at the Serramonte Main Library located at 40 Wembley Drive, Daly City, CA 94015.

As you will see in the IS/MND, our studies indicate that there would be no impacts to Tribal Cultural Resources. We request that you review the document and provide any comments that you may have and request formal consultation with us to discuss any and all matters related to the project including, but not limited to: alternatives to the Project; recommended mitigation measures; and potential significant effect to Tribal Cultural Resources.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If we do not receive a request from you (or your organization) within 30 days, we will assume that you do not want to have a formal consultation and agree with our assessment that the Proposed Project would not have any impacts to Tribal Cultural Resources that you are aware of. If you have any questions, please feel free to contact me at (650) 991-8201 or at Psweetland@dalycity.org.

Sincerely,

Patrick Sweetland
Director of Water and Wastewater Resources

L17-058

CITY OF DALY CITY
Department of Water and Wastewater Resources
153 Lake Merced Boulevard
Daly City, CA 94015
(650) 991-8200
Fax (650) 991-8220
Patrick Sweetland, Director

August 10, 2017

Indian Canyon Mutsun Band of Costanoan
Ann Marie Sayers, Chairperson
P.O. Box 28
Hollister, CA 95024

email to: ams@indiancanyon.org

Subject: Request for Government-to-Government Consultation under Assembly Bill 52 (AB-52) for the City of Daly City's Proposed Recycled Water Project

Dear Ann Marie Sayers:

The City of Daly City (City) is requesting a formal government-to-government consultation with your organization to discuss the City's proposed Expanded Tertiary Recycled Water Project (Proposed Project) and the potential that the Proposed Project could have on Tribal Cultural Resources. This request is in addition to, and as a follow-up, to contacts made to you by our consultant, Steve Brown of SMB Environmental, Inc. (SMB), in a formal letter dated January 17, 2017 and then a follow-up e-mail on March 8, 2017 to obtain information from your organization as to the potential to affect Tribal Resources. To date, we have not received any response.

In summary, the Proposed Project would add a new tertiary treatment process to provide an additional 3.0 mgd of tertiary treatment capacity during the irrigation season. The average yearly capacity of the system is 1.25 mgd or 1,400 acre-feet per year (afy) because the system will only operate during the irrigation season. The new treatment processes would include pressure membrane filtration followed by ultraviolet (UV) disinfection due to the small site constraints. New pipelines, pump stations and offsite storage would be constructed to complete the recycled water distribution system, delivering water to new customers for irrigation purposes in lieu of groundwater pumping. The purpose of the Proposed Project is to reduce irrigation reliance on the groundwater basin; provide local, sustainable, and drought-proof water supply; to preserve available groundwater supplies for drinking water.

On July 21, 2017, the City released a Public Draft Initial Study/Mitigated Negative Declaration (IS/MND) on the Proposed Project for a 30-day public review period ending on **August 24, 2017.** An electronic copy of the IS/MND is located on the City's website www.dalycity.org. In addition hard copies are available for review at the City's public works department located at 153 Lake Merced Boulevard, Daly City, CA 94015 and at the Serramonte Main Library located at 40 Wembley Drive, Daly City, CA 94015.

As you will see in the IS/MND, our studies indicate that there would be no impacts to Tribal Cultural Resources. We request that you review the document and provide any comments that you may have and request formal consultation with us to discuss any and all matters related to the project including, but not limited to: alternatives to the Project; recommended mitigation measures; and potential significant effect to Tribal Cultural Resources.

Thank you for your cooperation and assistance. I look forward to your earliest possible reply. If we do not receive a request from you (or your organization) within 30 days, we will assume that you do not want to have a formal consultation and agree with our assessment that the Proposed Project would not have any impacts to Tribal Cultural Resources that you are aware of. If you have any questions, please feel free to contact me at (650) 991-8201 or at Psweetland@dalycity.org.

Sincerely,

Patrick Sweetland
Director of Water and Wastewater Resources

L17-058D

Appendix B

Mitigation Monitoring and Reporting Program

MITIGATION MONITORING AND REPORTING PROGRAM

Daly City
Expanded Tertiary Recycled Water Project
Final Initial Study / Mitigated Negative Declaration

SCH # 2017072053

Prepared for:

City of Daly City
153 Lake Merced Boulevard
Daly City, CA 94015

Prepared by:

SMB ENVIRONMENTAL

SMB Environmental, Inc.

September 2017

INTRODUCTION

Pursuant to the California Environmental Quality Act (CEQA; Public Resources Code Section 21000, et seq. and CEQA Guidelines), the City of Daly City (City) prepared a Public Draft Initial Study/Mitigated Negative Declaration (IS/MND) to evaluate potential environmental impacts associated with the City's proposed Expanded Tertiary Recycled Water Project (Proposed Project).

The City operates an existing tertiary treatment facility with a permitted capacity of 2.77 million gallons per day (mgd). The Proposed Project would add a new tertiary treatment process to provide an additional 3.0 mgd of tertiary treatment capacity during the irrigation season. The average yearly capacity of the system is 1.25 mgd or 1,400 acre-feet per year (afy) because the system will only operate during the irrigation season. The new treatment processes would include pressure membrane filtration followed by ultraviolet (UV) disinfection due to the small site constraints. New pipelines, pump stations and offsite storage would be constructed to complete the recycled water distribution system, delivering water to new customers for irrigation purposes in lieu of groundwater pumping. The purpose of the Proposed Project is to reduce irrigation reliance on the groundwater basin; provide local, sustainable, and drought-proof water supply; to preserve available groundwater supplies for drinking water.

CEQA Guidelines require public agencies to adopt a Mitigation Monitoring and Reporting Program (MMRP) for changes to the project, which it has adopted or made a condition of project approval in order to mitigate or avoid significant effects on the environment. A MMRP is required for the Proposed Project because the IS/MND identifies potentially significant adverse impacts related to project implementation, and mitigation measures have been identified to reduce those impacts.

On July 24, 2017, to initiate public review of the Draft IS/MND, the City filed a Notice of Completion (NOC) for the project with the Governor's Office of Planning and Research (State Clearinghouse or SCH) and a Notice of Availability (NOA) with the County of San Mateo and released the Draft IS/MND for a 30-day public review. The State Clearinghouse identified the project with SCH #2017072053. The 30-day public review period was established between July 24 and August 23, 2017, with copies of the Draft IS/MND available for review on the City's website at www.dalycity.org; the City's front desk at 153 Lake Merced Boulevard, Daly City, CA 94015; and the Serramonte Main Library, 40 Wembley Drive, Daly City 94015.

In September 2017, the City prepared a Final IS/MND according to CEQA Guidelines and incorporated all comments received by the State Clearinghouse and the City during the 30-day public review period. As a result, some of the mitigation measures identified in the Public Draft IS/MND have been revised to reflect those comments. Based on the Final IS/MND, the Proposed Project would not result in new significant impacts, substantially increase the severity of previously disclosed impacts, or involve any of the other conditions related to changed circumstances or new information that can require a subsequent or supplemental EIR under Public Resources Code section 21166 and CEQA Guidelines section 15162 beyond those impacts and conditions already identified in the City's Public Draft IS/MND.

PURPOSE OF MITIGATION MONITORING AND REPORTING PROGRAM

This MMRP has been prepared to ensure that all required mitigation measures are implemented and completed in a satisfactory manner before and during project construction and operation. The MMRP may be modified by the City during project implementation, as necessary, in response to changing conditions or other refinements. Table A (included at the end of this document) has been prepared to assist the responsible parties in implementing the mitigation measures. The table identifies individual mitigation measures, monitoring/mitigation timing, responsible person/agency for implementing the measure, monitoring and reporting procedure, and space to confirm implementation of the mitigation measures. The numbering of mitigation measures follows the numbering sequence found in the Public Draft IS/MND.

ROLES AND RESPONSIBILITIES

Unless otherwise specified herein, the City is responsible for taking all actions necessary to implement the mitigation measures under its jurisdiction according to the specifications provided for each measure and for demonstrating that the action has been successfully completed. The City, at its discretion, may delegate implementation responsibility or portions thereof to a licensed contractor or other designated agent. The City would be responsible for overall administration of the MMRP and for verifying that City staff members and/or the construction contractor has completed the necessary actions for each measure.

The City would designate a project manager to oversee implementation of the MMRP. The City is primarily responsible for implementing the mitigation measures for the Proposed Project as described in this MMRP. Duties of the project manager include the following:

- Ensure that routine inspections of the construction site are conducted by appropriate City staff; check plans, reports, and other documents required by the MMRP; and conduct report activities.
- Serve as a liaison between the City and the contractor or project applicant regarding mitigation monitoring issues.
- Complete forms and maintain reports and other records and documents generated by the MMRP.
- Coordinate and ensure that corrective actions or enforcement measures are taken, if necessary.

The responsible party for implementation of each item shall identify the staff members responsible for coordinating with the City on the MMRP.

REPORTING

The City's Director of Water and Wastewater Resources shall prepare a monitoring report, upon completion of the project, on the compliance of the activity with the required mitigation measures. Information regarding inspections and other requirements shall be compiled and explained in the report. The report shall be designed to simply and clearly identify whether mitigation measures have been adequately implemented. At a minimum, each report shall identify the mitigation measures or conditions to be monitored for implementation, whether compliance with the mitigation measures or conditions has occurred, the procedures used to assess compliance, and whether further action is required. The report shall be presented to the City and the North San Mateo County Sanitation District.

MITIGATION MONITORING AND REPORTING PLAN TABLE

The categories identified in Table A are described below.

- **Mitigation Measure –** This column provides the text of the mitigation measures identified in the IS/MND.
- **Timing –** This column identifies the time frame in which the mitigation will take place.
- **Implementation** – This column identifies the party responsible for implementing compliance with the requirements of the mitigation measure
- **Enforcement –** This column identifies the party responsible for enforcing compliance with the requirements of the mitigation measure.
- **Dated Signature for Verification of Compliance –** This column is to be dated and signed by the person (either project manager or his/her designee) responsible for verifying compliance with the requirements of the mitigation measure.

Table A
Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project

Mitigation Measure	Timing	Implementation[1]	Enforcement	Dated Signature for Verification of Compliance
3.1 Aesthetics				
Mitigation Measure AES-1: Compliance with the Colma General Plan and Colma Municipal Code. Depending on which site is ultimately selected, **t**he following specific measures shall apply to each location. ***Atwood Site, Colma.*** Development of the Atwood site shall be in accordance with the following standards to maintain and enhance the El Camino Real Scenic Corridor: • Access to the sites shall occur from Olivet Parkway (GP Policy 5.03.726); • Any above ground structures or parking areas shall maintain a 30' setback from the El Camino Real right-of-way (CMG 5.030.360); • Within the 30' setback area, trees and landscaping shall be provided to enhance the greenbelt theme; • No fencing shall be maintained within the 30' setback area; • Utilities shall be undergrounded from the nearest utility pole; • Utility vaults shall be sited so as not to be visible from the El Camino Real right-of-way; • Fencing shall either be a solid type or black vinyl clad cyclone fencing [CMG 5.03.350(e)]; • Siting of the pump station building shall be sensitive to existing views of the Salem office/chapel building; and • The pump station building is required to be designed with Spanish Mediterranean architecture as required in the Colma General Plan and Design Review overlay district. ***Salem Site, Colma.*** Development of the Salem site shall be in accordance with the following standards to maintain and enhance the Hillside Boulevard Scenic Corridor: • Any above ground structures or parking areas shall maintain a sufficient setback that will allow for generous landscape planting	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District The Town of Colma	The City of Daly City and the North San Mateo County Sanitation District The Town of Colma	

[1] The City's Director of Water and Wastewater Resources is the Project Manager and is primarily responsible for implementing and ensuring compliance with the mitigation measures for the Proposed Project/Action as described MMRP.

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
behind the sidewalk on Hillside Boulevard; • Fencing shall be set back from Hillside Boulevard and screened by landscaping; • Utilities shall be undergrounded from the nearest utility pole; • Utility vaults shall be sited so as not to be visible from the Hillside Boulevard right-of-way; • Fencing shall either be a solid type or black vinyl clad cyclone fencing [CMG 5.03.350(e)] and be set back to the ex tent feasible from Hillside Boulevard; • Siting of the well building shall be sensitive to existing views from Hillside Boulevard; and • The pump station building is required to be designed with Spanish Mediterranean architecture as required in the Colma General Plan and Design Review overlay district. ***Holy Cross Site, Colma.*** Development of the Holy Cross site shall be in accordance with the following standards to maintain and enhance the Hillside Boulevard Scenic Corridor: • Utilities shall be undergrounded from the nearest utility pole; • Utility vaults shall be sited so as not to be visible from the Hillside Boulevard right-of-way; • Fencing shall black vinyl clad cyclone fencing [CMG 5.03.350(e)}; • Planting of a trees in front of the above ground tank will obscure views from Hillside Boulevard; and • Painting of the storage tank and appropriate earth tone color will cause the tank to be less visually apparent.				
3.3. Air Quality				
Mitigation Measure AIR-1: Basic Construction Mitigation Measures Recommended for ALL Proposed Projects. During all phases of construction, the following procedures shall be implemented: • All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District Bay Area Air	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
• All haul trucks transporting soil, sand, or other loose material off-site shall be covered. • All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited. • All vehicle speeds on unpaved roads shall be limited to 15 mph. • All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. • Idling times shall be minimized either by shutting equipment off when not in useor reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points. • All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator. • Post a publicly visible sign with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.			Quality Management District	
Mitigation Measure AIR-2: Additional Construction Mitigation Measures for Projects with Emissions over the Thresholds. During all phases of construction, the following procedures shall be implemented as appropriate: • All exposed surfaces shall be watered at a frequency adequate to maintain minimum soil moisture of 12 percent. Moisture content can be verified by lab samples or moisture probe.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District Bay Area Air	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
• All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 mph. • Windbreaks (e.g., trees, fences) shall be installed on the windward side(s) of actively disturbed areas of construction. Windbreaks should have at maximum 50 percent air porosity. • Vegetative ground cover (e.g., fast-germinating native grass seed) shall be planted in disturbed areas as soon as possible and watered appropriately until vegetation is established. • The simultaneous occurrence of excavation, grading, and ground-disturbing construction activities on the same area at any one time shall be limited. Activities shall be phased to reduce the amount of disturbed surfaces at any one time. • All trucks and equipment, including their tires, shall be washed off prior to leaving the site. • Site accesses to a distance of 100 feet from the paved road shall be treated with a 6 to 12 inch compacted layer of wood chips, mulch, or gravel. • Sandbags or other erosion control measures shall be installed to prevent silt runoff to public roadways from sites with a slope greater than one percent. • Minimizing the idling time of diesel powered construction equipment to five (5) minutes. • The project shall develop a plan demonstrating that the off-road equipment (more than 50 horsepower) to be used in the construction project (i.e., owned, leased, and subcontractor vehicles) would achieve a project wide fleet-average 20 percent NOx reduction and 45 percent PM reduction compared to the most			Quality Management District	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation**[1]	**Enforcement**	**Dated Signature for Verification of Compliance**
recent Air Resources Board (ARB) fleet average. Acceptable options for reducing emissions include the use of late model engines, low-emission,diesel products, alternative fuels, engine retro technology, after-treatment products, add-on devices such as particula filters, and/or other options as such become available. • Use low volatile organic compounds (VOC) (i.e., ROG) coatings beyond the local requirements (i.e., Regulation 8, Rule 3: Architectural Coatings). • Requiring that all construction equipment, diesel trucks, and generators be equipped with Best Available Control Technology for emission reductions of NOx and PM. • Requiring all contractors use equipment that meets the California Air Resources Board's (CARB) most recent certification standard for off-road heavy-duty diesel engines.				
3.4 Biological Resources				
Mitigation Measure BIO-1: Conduct Breeding Surveys. For construction activities that occur between February 1 and August 31, preconstruction breeding bird surveys shall be conducted by a qualified biologist prior to and within 10 days of any initial ground-disturbance activities. Surveys shall be conducted within all suitable nesting habitat within 250 feet of the activity. All active, non-status passerine nests identified at that time shall be protected by a 50-foot radius minimum exclusion zone. Active raptor or special-status species nests shall be protected by a buffer with a minimum radius of 200 feet. CDFW and USFWS recommend that a minimum 500-foot exclusion buffer be established around active white-tailed kite and golden eagle nests. The following considerations apply to this mitigation measure: • Survey results are valid for 14 days from the survey date. Should ground disturbance commence later than 14 days from the survey date, surveys should be repeated. If no breeding birds are encountered, then work may proceed as planned.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District California Department of Fish and Wildlife U.S. Fish and Wildlife Service	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation**[1]	**Enforcement**	**Dated Signature for Verification of Compliance**
• Exclusion zone sizes may vary, depending on habitat characteristics and species, and are generally larger for raptors and colonial nesting birds. Each exclusion zone would remain in place until the nest is abandoned or all young have fledged. • The non-breeding season is defined as September 1 to January 31. During this period, breeding is not occurring and surveys are not required. However, if nesting birds are encountered during work activities in the non-breeding season, disturbance activities within a minimum of 50 feet of the nest should be postponed until the nest is abandoned or young birds have fledged.				
Mitigation Measure BIO-2: Conduct Nesting Surveys. For any construction activities initiated between March 15 and September 1, surveys for nesting special status species are required within 250 feet of areas of disturbance. If an active nest is found, a qualified biologist shall monitor the nest during construction activities within 250 feet of the nest to determine whether project construction may result in abandonment. The biologist shall continue monitoring the nest until construction within 250 feet of the nest is completed, or until all chicks have completely fledged. If the monitor determines that construction may result in abandonment of the nest, all construction activities within 250 feet shall be halted until the nest is abandoned or all young have fledged.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District California Department of Fish and Wildlife U.S. Fish and Wildlife Service	
3.5 Cultural Resources				
Mitigation Measure CR-1: Halt work if cultural resources are discovered. In the event that any prehistoric or historic subsurface cultural resources are discovered during ground disturbing activities, all work within 100 feet of the resources shall be halted and after notification, the City shall consult with a qualified archaeologist to assess the significance of the find. If any find is determined to be significant (CEQA Guidelines 15064.5[a][3] or as unique archaeological resources per Section 21083.2 of the California Public Resources Code), representatives of the City and a qualified archaeologist shall meet to determine the appropriate course of action. In considering any suggested	Prior to construction of the Proposed Project t	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District For actions taken to satisfy the	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
mitigation proposed by the consulting archaeologist in order to mitigate impacts to historical resources or unique archaeological resources, the lead agency shall determine whether avoidance is necessary and feasible in light of factors such as the nature of the find, project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) shall be instituted. Work may proceed on other parts of the project site while mitigation for historical resources or unique archaeological resources is carried out.			requirements of Section106: The State Historic Preservation Office (SHPO)	
Mitigation Measure CR-2: Stop work if paleontological remains are discovered. If paleontological resources, such as fossilized bone, teeth, shell, tracks, trails, casts, molds, or impressions are discovered during ground-disturbing activities, work will stop in that area and within 100 feet of the find until a qualified paleontologist can assess the significance of the find and, if necessary, develop appropriate treatment measures in consultation with the City.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	
Mitigation Measure CR-3: Halt work if human remains are found. If human remains are encountered during excavation activities conducted for the Proposed Project/Action, all work in the adjacent area shall stop immediately and the San Mateo County Coroner's office shall be notified. If the Coroner determines that the remains are Native American in origin, the Native American Heritage Commission shall be notified and will identify the Most Likely Descendent, who will be consulted for recommendations for treatment of the discovered human remains and any associated burial goods.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District For actions taken to satisfy the requirements of Section106: The State Historic Preservation Office (SHPO)	
3.6 Geology and Soils				
Mitigation Measure GEO-1: Design to Liquefaction and Landslide Design Standards. The City shall design all facilities to the recommended design standards established in the June 2016 Geotechnical Report which determined the proper design and construction methods for the Proposed Project, including,	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
but not limited to the design of any soil remediation measures as required to reduce hazards caused by landslides, liquefaction, and/or lateral spreading.			Sanitation District	
3.7 Hazards and Hazardous Materials				
Mitigation Measure HAZ-1: Store, Handle, Use Hazardous Materials in Accordance with Applicable Laws. The City shall ensure that all construction-related and operational hazardous materials and hazardous wastes shall be stored, handled, and used in a manner consistent with relevant and applicable federal, state, and local laws. In addition, construction-related and operational hazardous materials and hazardous wastes shall be staged and stored away from stream channels and steep banks to keep these materials a safe distance from near-by residents and prevent them from entering surface waters in the event of an accidental release.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	
Mitigation Measure HAZ-2: Properly Dispose of Contaminated Soil and/or Groundwater. If contaminated soil and/or groundwater is encountered or if suspected contamination is encountered during project construction, work shall be halted in the area, and the type and extent of the contamination shall be identified. A contingency plan to dispose of any contaminated soil or groundwater will be developed through consultation with appropriate regulatory agencies.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	
Mitigation Measure HAZ-3: Properly Dispose of Hydrostatic Test Water. Dewatering of the pipeline during hydrostatic testing during construction, as well as any dewatering as a result of operations and maintenance activities, shall be discharged to land or the sanitary sewer system and not into any creeks, drainages, or waterways and shall require prior approval from the San Francisco Bay Regional Water Quality Control Board.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	
Mitigation Measure HAZ-4: Develop and Maintain Emergency Access Strategies. In conjunction with Mitigation Measure Traffic-1: Develop a Traffic Control Plan identified below in the Traffic and Transportation section, comprehensive strategies for maintaining emergency access shall be developed. Strategies shall include, but not limited to, maintaining steel trench plates at the construction sites to restore access across open trenches and identification of alternate routing around construction zones. Also, police, fire, and other emergency service providers shall be notified of the timing, location, and duration of the construction activities and the location of detours and lane	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
closures.				
Mitigation Measure HAZ-5 Fire Prevention and Control: The City shall comply with all federal, state, county and local fire regulations pertaining to burning permits and the prevention of uncontrolled fires. The following measures shall be implemented to prevent fire hazards and control of fires: • A list of relevant fire authorities and their designated representative to contact shall be maintained on site by construction personnel. • Adequate firefighting equipment shall be available on site in accordance with the applicable regulatory requirements. • The level of fire hazard shall be posted at the construction office (where visible for workers) and workers shall be made aware of the hazard level and related implications. • The City or its contractor shall provide equipment to handle any possible fire emergency. This shall include, although not be limited to, water trucks; portable water pumps; chemical fire extinguishers; hand tools such as shovels, axes, and chain saws; and heavy equipment adequate for the construction of fire breaks when needed. Specifically, the City or its contractor shall supply and maintain in working order an adequate supply of fire extinguishers for each crew engaged in potentially combustible work such as welding, cutting, and grinding. • All equipment shall be equipped with spark arrestors. • In the event of a fire, the City or its contractor shall immediately use resources necessary to contain the fire. The City or contractor shall then notify local emergency response personnel. • Any and all tree-clearing activities (if any) are to be carried out in accordance with local rules and regulations for the prevention of forest fires.	Prior to construction of the Proposed Project	The City of Daly City The City of Daly City and the North San Mateo County Sanitation District The Colma Fire Protection District	The City of Daly City and the North San Mateo County Sanitation District	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
• Burning shall be prohibited. • Flammable wastes shall be removed from the construction site on a regular basis. • Flammable materials kept on the construction site must be stored in approved containers away from ignition sources. • Once constructed, the selected storage tank site in Colma shall be regularly maintained to include weed abatement and making proper improvements as required by the Colma Fire Protection District.				
3.8 Hydrology and Water Quality				
Mitigation Measure HWQ-1: Implement Construction Best Management Practices. To reduce potentially significant erosion and siltation, the City and/or its selected contractor(s) shall obtain a Stormwater Pollution Prevention Permit (SWPPP) and implement Best Management Practices and erosion control measures as required by the San Francisco RWQCB. Best Management Practices to reduce erosion and siltation shall include the following measures: Avoidance of construction activities during inclement weather; limitation of construction access routes and stabilization of access points; stabilization of cleared, excavated areas by providing vegetative buffer strips, providing plastic coverings, and applying ground base on areas to be paved; protection of adjacent properties by installing sediment barriers or filters, or vegetative buffer strips; stabilization and prevention of sediments from surface runoff from discharging into storm drain outlets; use of sediment controls and filtration to remove sediment from water generated by dewatering; and returning all drainage patterns to pre-existing conditions.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	
Mitigation Measure HWQ-2: Avoid Cutting Through Creeks/Drainages. As described in the Proposed Project/Action description, all creek and drainage crossings will be crossed by using trenchless technologies such as micro tunneling, directional drilling, or suspending the pipeline on the downstream side of a bridge. Construction crews shall avoid entering the stream channels during installation. With these mitigation measures in place, the Proposed Project/Action is unlikely to have a direct and/or indirect adverse effect on water	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation**[1]	**Enforcement**	**Dated Signature for Verification of Compliance**
quality standards and/or waste discharge requirements. Once constructed, the operation and maintenance of the Proposed Project/Action will not adversely affect water quality standards and/or waste discharge requirements.				
Mitigation Measure HWQ-3: Implement Recycled Water Best Management Practices. In order to help reduce the potential effects of increased salt loading potential as a result of using recycled water, the City[2] shall: • Apply water consistent with Title 22 requirements and in amounts (frequency and intensity) which meet the demands of the plant (agronomic rates), but not in excessive amounts such that salts buildup in the soil beyond the root zone and/or otherwise are leached to groundwater; • Ensure that adequate soil drainage is maintained; • Ensure that salt-sensitive plants (e.g. Colonial bentgrass) are not to be spray wet; • Replace salt-sensitive plants with salt-tolerant plants (e.g, Bermudagrass); • Addressing sodium and alkalinity concerns through addition of water and soil amendments, including addition of gypsum; and • Comply with the State Board's General Waste Discharge Requirements of Recycled Water Use (Water Quality Order 2014-0090).	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	
3.9 Land Use and Planning				
Mitigation Measure AES-1: Compliance with the Colma General Plan and Colma Municipal Code. Depending on which site is ultimately selected, **t**he following specific measures shall apply to each location. ***Atwood Site, Colma.*** Development of the Atwood site shall be in accordance with the following standards to maintain and enhance the El Camino Real	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District The Town of Colma	The City of Daly City and the North San Mateo County Sanitation District	

[2] Many of these measures may be implemented by the customer through a Customer Services Agreement and verified and enforced by the City.

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
Scenic Corridor: • Access to the sites shall occur from Olivet Parkway (GP Policy 5.03.726); • Any above ground structures or parking areas shall maintain a 30' setback from the El Camino Real right-of-way (CMG 5.030.360); • Within the 30' setback area, trees and landscaping shall be provided to enhance the greenbelt theme; • No fencing shall be maintained within the 30' setback area; • Utilities shall be undergrounded from the nearest utility pole; • Utility vaults shall be sited so as not to be visible from the El Camino Real right-of-way; • Fencing shall either be a solid type or black vinyl clad cyclone fencing [CMG 5.03.350(e)]; • Siting of the pump station building shall be sensitive to existing views of the Salem office/chapel building; and • The pump station building is required to be designed with Spanish Mediterranean architecture as required in the Colma General Plan and Design Review overlay district. ***Salem Site, Colma.*** Development of the Salem site shall be in accordance with the following standards to maintain and enhance the Hillside Boulevard Scenic Corridor: • Any above ground structures or parking areas shall maintain a sufficient setback that will allow for generous landscape planting behind the sidewalk on Hillside Boulevard; • Fencing shall be set back from Hillside Boulevard and screened by landscaping; • Utilities shall be undergrounded from the nearest utility pole; • Utility vaults shall be sited so as not to be visible from the Hillside Boulevard right-of-way; • Fencing shall either be a solid type or black vinyl clad cyclone fencing [CMG 5.03.350(e)] and be set back to the extent feasible from Hillside Boulevard; • Siting of the well building shall be sensitive to existing views from Hillside Boulevard; and			The Town of Colma	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation**[1]	**Enforcement**	**Dated Signature for Verification of Compliance**
• The pump station building is required to be designed with Spanish Mediterranean architecture as required in the Colma General Plan and Design Review overlay district. ***Holy Cross Site, Colma.*** Development of the Holy Cross site shall be in accordance with the following standards to maintain and enhance the Hillside Boulevard Scenic Corridor: • Utilities shall be undergrounded from the nearest utility pole; • Utility vaults shall be sited so as not to be visible from the Hillside Boulevard right-of-way; • Fencing shall black vinyl clad cyclone fencing [CMG 5.03.350(e)}; • Planting of a trees in front of the above ground tank will obscure views from Hillside Boulevard; and • Painting of the storage tank and appropriate earth tone color will cause the tank to be less visually apparent.				
3.11 Noise				
Mitigation Measure NOI-1: **Limit Construction Hours.** Construction activities will be limited to the least noise-sensitive times and will comply with the City's noise ordinances. Construction, alteration, and other related activities shall be allowed on weekdays between the hours of 8 a.m. and 5 p.m., and on Saturdays between the hours of 10 a.m. and 5 p.m. Construction activities shall not exceed the outdoor ambient sound level (dBA) of 86 dBA. No noise generating activities shall occur on any federal holidays.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	
Mitigation Measure NOI-2: Locate Staging Areas away from Sensitive Receptors. The City's construction specification shall require that the contractor select staging areas as far as feasibly possible from sensitive receptors. Currently, planned staging areas are at the City's WWTP.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	
Mitigation Measure NOI-3: Maintain Mufflers on Equipment. The City's construction specifications shall require the contractor to maintain all construction equipment with manufacturer's specified noise-muffling devices.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
			District	
Mitigation Measure NOI-4: Idling Prohibition and Enforcement. The City shall prohibit and enforce unnecessary idling of internal combustion engines. In practice, this would mean turning off equipment if it will not be used for five or more minutes.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	
Mitigation Measure NOI-5: Equipment Location and Shielding. Locate all stationary noise-generating construction equipment such as air compressors and standby power generators as far as possible from homes and businesses.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	
3.13 Public Services				
Mitigation Measure HAZ-5 Fire Prevention and Control: The City shall comply with all federal, state, county and local fire regulations pertaining to burning permits and the prevention of uncontrolled fires. The following measures shall be implemented to prevent fire hazards and control of fires: • A list of relevant fire authorities and their designated representative to contact shall be maintained on site by construction personnel. • Adequate firefighting equipment shall be available on site in accordance with the applicable regulatory requirements. • The level of fire hazard shall be posted at the construction office (where visible for workers) and workers shall be made aware of the hazard level and related implications. • The City or its contractor shall provide equipment to handle any possible fire emergency. This shall include, although not be limited to, water trucks; portable water pumps; chemical fire extinguishers; hand tools such as shovels, axes, and chain saws; and heavy equipment adequate for the construction of fire breaks when needed. Specifically, the City or its contractor shall supply and maintain in working order an adequate supply of fire extinguishers for each crew engaged in	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District The Colma Fire Protection System	The City of Daly City and the North San Mateo County Sanitation District The Colma Fire Protection District	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
potentially combustible work such as welding, cutting, and grinding. • All equipment shall be equipped with spark arrestors. • In the event of a fire, the City or its contractor shall immediately use resources necessary to contain the fire. The City or contractor shall then notify local emergency response personnel. • Any and all tree-clearing activities (if any) are to be carried out in accordance with local rules and regulations for the prevention of forest fires. • Burning shall be prohibited. • Flammable wastes shall be removed from the construction site on a regular basis. • Flammable materials kept on the construction site must be stored in approved containers away from ignition sources. Once constructed, the selected storage tank site in Colma shall be regularly maintained to include weed abatement and making proper improvements as required by the Colma Fire Protection District.				
3.16 Traffic and Transportation				
Mitigation Measure TRA-1: Prepare and Implement Traffic Control Plan. As is consistent with existing policy, the City shall require the contractor to prepare and implement effective traffic control plans to show specific methods for maintaining traffic flows. Examples of traffic control measures to be considered include: 1) use of flaggers to maintain alternating one-way traffic while working on one-half of the street; 2) use of advance construction signs and other public notices to alert drivers of activity in the area; 3) use of "positive guidance" detour signing on alternate access streets to minimize inconvenience to the driving public; 4) provisions for emergency access and passage; and 5) designated areas for construction worker parking.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
Mitigation Measure TRA-2: Return Roads to Pre-construction Condition. Following construction, the City shall ensure that road surfaces that are damaged during construction are returned to their pre-construction condition or better.	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District	
Mitigation Measure TRA-3: Encroachment Permit. Prior to any work outside of the City's it limits, the City shall obtain approval of a construction and staging plan and an encroachment permit from the responsible agency(s) (i.e. Town of Colma, Caltrans, South San Francisco, SFPUC, etc).	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District	The City of Daly City and the North San Mateo County Sanitation District The Town of Colma San Francisco Public Utilities Commission	
3.17 Tribal Cultural Resources				
Mitigation Measure TCR-1: Halt Work if Tribal Cultural Resources are Discovered. In the event that any tribal cultural resources are discovered during ground disturbing activities, all work within 100-feet of the resources shall be halted and after notification, the City shall consult with a qualified archaeologist and local tribes to assess the significance of the find. If any find is determined to be significant as a unique tribal cultural resource, the City shall treat the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including to, but not limited to, the following: • Protecting the cultural character and integrity of the resource; • Protecting the traditional use of the resource; and • Protecting the confidentiality of the resource. In considering any suggested mitigation proposed by the consulting archaeologist and/or the appropriate tribe in order to mitigate impacts to any tribal cultural resources find, the City shall determine whether avoidance is	Prior to construction of the Proposed Project	The City of Daly City and the North San Mateo County Sanitation District y	The City of Daly City and the North San Mateo County Sanitation District	

Table A Mitigation Monitoring and Reporting Plan for the Daly City Expanded Tertiary Recycled Water Project				
Mitigation Measure	**Timing**	**Implementation[1]**	**Enforcement**	**Dated Signature for Verification of Compliance**
feasible in light of factors such as the nature of the find, project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) shall be instituted and coordinated with the appropriate tribe(s). Work may proceed on other parts of the project site while mitigation measures for tribal cultural resources or other unique archaeological resources are carried out.				