REVISED

Directors
Manny Fernandez
Tom Handley
Pat Kite
Anjali Lathi
Jennifer Toy

BOARD MEETING AGENDA
Monday, August 26, 2019
Regular Meeting - 7:00 P.M.

Union Sanitary District
Administration Building
5072 Benson Road
Union City, CA 94587

Officers
Paul R. Eldredge
General Manager/
District Engineer

Karen W. Murphy
Attorney

	1.	Call to Order.
	2.	Salute to the Flag.
	3.	Roll Call.
Motion	4.	Approve Minutes of the Board Workshop of July 9, 2019.
Motion	5.	Approve Minutes of the Board Workshop of July 15, 2019.
Motion	6.	Approve Minutes of the Board Meeting of August 12, 2019.
Information	7.	July 2019 Monthly Operations Report *(to be reviewed by the Budget & Finance and Legal/Community Affairs Committees).*
	8.	Written Communications.
	9.	Public Comment. Public Comment is limited to three minutes per individual, with a maximum of 30 minutes per subject. If the comment relates to an agenda item, the speaker should address the Board at the time the item is considered. Speaker cards will be available in the Boardroom and are requested to be completed prior to the start of the meeting.
Motion	10.	Consider Rescinding Policy No. 2040, Exceptions to Ordinance Fees.
Motion	11.	Authorize the General Manager to Execute an Agreement and Task Order No.1 with Carollo Engineers, Inc. for the Plant Network Architecture Study *(to be reviewed by the Engineering and Information Technology Committee).*
Motion	12.	Adopt a Resolution Approving ~~Accept~~ the Final Report for the Enhanced Treatment & Site Upgrade Program (CEQA Review: Exempt Under CEQA Guidelines Section 15061(b)(3) and 15262) *(to be reviewed by the Engineering and Information Technology Committee).*

REVISED

Motion	13.	Reject the Sole Bid Received for the Primary Digester No. 7 Project and Authorize Staff to Re-bid the Project *(to be reviewed by the Engineering and Information Technology Committee).*
Motion	14.	Designate and Appoint Two Board Representatives to an Ad Hoc Subcommittee on General Manager Contract Negotiations.
Information	15.	Check Register.
Information	16.	Committee Meeting Reports. *(No Board action is taken at Committee meetings):*

a. Engineering and Information Technology Committee – Wednesday, August 21, 2019, at 10:00 a.m.
   - Director Fernandez and Director Toy

b. Budget & Finance Committee – Wednesday, August 21, 2019, at 12:00 p.m.
   - Director Kite and Director Lathi

c. Legal/Community Affairs Committee – Thursday, August 22, 2019, at 12:00 p.m.
   - Director Fernandez and Director Kite

d. Audit Committee – will not meet.

e. Legislative Committee – will not meet.

f. Personnel Committee – will not meet.

Information	17.	General Manager's Report. *(Information on recent issues of interest to the Board).*
	18.	Other Business:

a. Comments and questions. *Directors can share information relating to District business and are welcome to request information from staff.*

b. Scheduling matters for future consideration.

19. Adjournment – The Board will adjourn to the next Regular Board Meeting in the Boardroom on Monday, September 9, 2019, at 7:00 p.m.

The facilities at the District Offices are wheelchair accessible. Any attendee requiring special accommodations at the meeting should contact the General Manager's office at (510) 477-7503 at least 24 hours in advance of the meeting.

Directors
Manny Fernandez
Tom Handley
Pat Kite
Anjali Lathi
Jennifer Toy

Officers
Paul R. Eldredge
General Manager/
District Engineer

Karen W. Murphy
Attorney

ENGINEERING AND INFORMATION TECHNOLOGY COMMITTEE MEETING

Committee Members: Director Fernandez and Director Toy

AGENDA
Wednesday, August 21, 2019
10:00 A.M.

Alvarado Conference Room
5072 Benson Road
Union City, CA 94587

1. Call to Order

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2. Roll Call

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3. Public Comment
   Public Comment is limited to three minutes per individual, with a maximum of 30 minutes per subject. If the comment relates to an agenda item, the speaker should address the Board at the time the item is considered. Speaker cards will be available and are requested to be completed prior to the start of the meeting.

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4. Items to be reviewed for the Regular Board meeting of August 26, 2019:
   - Authorize the General Manager to Execute an Agreement and Task Order No.1 with Carollo Engineers, Inc. for the Plant Network Architecture Study
   - Accept the Final Report for the Enhanced Treatment & Site Upgrade Program
   - Reject the Sole Bid Received for the Primary Digester No. 7 Project and Authorize Staff to Re-bid the Project

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5. Adjournment

Items reviewed at committee meetings will be included in the agenda packet for the upcoming Board meeting. No action will be taken at committee meetings.

The facilities at the District Offices are wheelchair accessible. Any attendee requiring special accommodations at the meeting should contact the General Manager's office at (510) 477-7503 at least 24 hours in advance of the meeting.

REVISED

BUDGET & FINANCE COMMITTEE MEETING
Committee Members: Director Kite and Director Lathi

AGENDA
Wednesday, August 21, 2019
12:00 P.M.

Alvarado Conference Room
5072 Benson Road
Union City, CA 94587

THIS MEETING WILL BE TELECONFERENCED WITH DIRECTOR LATHI FROM THE GUEST PARKING AREA ON OCASO CAMINO, WEST OF AND CLOSEST TO THE INTERSECTION OF PASEO PADRE PARKWAY IN FREMONT, CALIFORNIA

1. Call to Order

2. Roll Call

3. Public Comment
Public Comment is limited to three minutes per individual, with a maximum of 30 minutes per subject. If the comment relates to an agenda item, the speaker should address the Board at the time the item is considered. Speaker cards will be available and are requested to be completed prior to the start of the meeting.

4. Items to be reviewed for the Regular Board meeting of August 26, 2019:
   - July 2019 Monthly Operations Report – Financial Reports

5. Adjournment

Items reviewed at committee meetings will be included in the agenda packet for the upcoming Board meeting. No action will be taken at committee meetings.

The facilities at the District Offices are wheelchair accessible. Any attendee requiring special accommodations at the meeting should contact the General Manager's office at (510) 477-7503 at least 24 hours in advance of the meeting.

Directors
Manny Fernandez
Tom Handley
Pat Kite
Anjali Lathi
Jennifer Toy

LEGAL/COMMUNITY AFFAIRS COMMITTEE MEETING

Committee Members: Director Fernandez and Director Kite

Officers
Paul R. Eldredge
General Manager/
District Engineer

Karen W. Murphy
Attorney

AGENDA
Thursday, August 22, 2019
12:00 P.M.

Alvarado Conference Room
5072 Benson Road
Union City, CA 94587

1. Call to Order

2. Roll Call

3. Public Comment
   Public Comment is limited to three minutes per individual, with a maximum of 30 minutes per subject. If the comment relates to an agenda item, the speaker should address the Board at the time the item is considered. Speaker cards will be available and are requested to be completed prior to the start of the meeting.

4. Items to be reviewed for the Regular Board meeting of August 26, 2019:
   - July 2019 Monthly Operations Report – Odor and Work Group Reports

5. Adjournment

Items reviewed at committee meetings will be included in the agenda packet for the upcoming Board meeting.
No action will be taken at committee meetings.

The facilities at the District Offices are wheelchair accessible. Any attendee requiring special accommodations at the meeting should contact the General Manager's office at (510) 477-7503 at least 24 hours in advance of the meeting.

MINUTES OF THE SPECIAL MEETING OF THE
BOARD OF DIRECTORS OF
UNION SANITARY DISTRICT
July 9, 2019

CALL TO ORDER

President Lathi called the special meeting to order at 6:00 p.m.

ROLL CALL

PRESENT: Anjali Lathi, President
Manny Fernandez, Vice President
Jennifer Toy, Secretary
Tom Handley, Director
Pat Kite, Director

STAFF: Paul Eldredge, General Manager/District Engineer

PUBLIC COMMENT

There was no public comment.

BOARD WORKSHOP

General Manager Eldredge provided an update to the Board regarding the state of the District.

ADJOURNMENT:

The special meeting was adjourned at approximately 8:00 p.m. to the Newsletter and Rebranding Board Workshop in the Alvarado Conference Room on Monday, July 15, 2019, at 6:00 p.m.

SUBMITTED:

____
REGINA McEVOY
BOARD CLERK

ATTEST:

____
PAT KITE
SECRETARY

APPROVED:

____
JENNIFER TOY
PRESIDENT

Adopted this 26th day of August, 2019

MINUTES OF THE SPECIAL MEETING OF THE
BOARD OF DIRECTORS OF
UNION SANITARY DISTRICT
July 15, 2019

CALL TO ORDER

President Lathi called the special meeting to order at 6:00 p.m.

ROLL CALL

PRESENT: Anjali Lathi, President
Manny Fernandez, Vice President
Jennifer Toy, Secretary
Tom Handley, Director
Pat Kite, Director

STAFF: Paul Eldredge, General Manager/District Engineer
Michelle Powell, Communications and Intergovernmental Relations Coordinator
Regina McEvoy, Executive Assistant to the General Manager/Board Clerk

PUBLIC COMMENT

There was no public comment.

BOARD WORKSHOP

General Manager Eldredge and Communications and Intergovernmental Relations Coordinator Powell presented information regarding the District newsletter.

Communications and Intergovernmental Relations Coordinator Powell and Executive Assistant to the General Manager/Board Clerk McEvoy provided an update regarding the District rebranding initiative.

ADJOURNMENT:

The special meeting was adjourned at approximately 8:00 p.m. to the next Regular Meeting to be held in the Boardroom on Monday, July 22, 2019, at 7:00 p.m.

SUBMITTED: ATTEST:

REGINA McEVOY
BOARD CLERK

PAT KITE
SECRETARY

APPROVED:

JENNIFER TOY
PRESIDENT

Adopted this 26th day of August, 2019

MINUTES OF THE MEETING OF THE
BOARD OF DIRECTORS OF
UNION SANITARY DISTRICT
August 12, 2019

CALL TO ORDER

President Toy called the meeting to order at 7:00 p.m.

SALUTE TO THE FLAG

ROLL CALL

PRESENT: Jennifer Toy, President
Tom Handley, Vice President
Pat Kite, Secretary
Anjali Lathi, Director
Manny Fernandez, Director

STAFF: Paul Eldredge, General Manager/District Engineer
Karen Murphy, District Counsel
Armando Lopez, Treatment and Disposal Services Manager
Sami Ghossain, Technical Services Manager
Robert Simonich, Fabrication, Maintenance, and Construction Manager
James Schofield, Collection Services Manager
Gene Boucher, Human Resources Manager
Laurie Brenner, Business Services Coach
Michael Dunning, Environmental Compliance Coach
Regina McEvoy, Executive Assistant to the General Manager/Board Clerk

VISITORS: Roelle Balan, Tri-City Voice Newspaper

APPROVE MINUTES OF THE BOARD MEETING OF JULY 22, 2019

It was moved by Secretary Kite, seconded by Director Lathi, to Approve the Minutes of the Board Meeting of July 22, 2019.

WRITTEN COMMUNICATIONS

There were no written communications.

PUBLIC COMMENT

There was no public comment.

PUBLIC HEARING TO CONSIDER ADOPTING ORDINANCE 36.04, SEWER USE ORDINANCE, AND TO REPEAL ORDINANCE 36.03

This item was reviewed by the Legal/Community Affairs Committee. Environmental Compliance Coach Dunning stated Ordinance 36 provides the requirements for restrictions on discharges to the sanitary sewer; applies to industrial, commercial, and residential dischargers; and establishes the requirements for the District's pretreatment program. A Notice of Public Hearing was published in the Argus Newspaper on June 28 and July 5, 2019. The proposed revisions to Ordinance 36 include revised definitions, additional prohibitions of various discharges, additional requirements for Industrial Users regarding Immediate Notification of Slug Loadings, and updated language of Requirements for Dental Facilities pursuant to the Code of Federal Regulations. Following the public hearing, District staff will publish a summary of the ordinance in the Tri-City Voice Newspaper on August 20 and 27, 2019, and will also publish in The Argus Newspaper August 23 and 30, 2019. The proposed ordinance was scheduled to go into effect September 12, 2019. Staff recommended the Board conduct a public hearing and consider adopting Ordinance 36.04, Sewer Use Ordinance.

President Toy opened the public hearing. There were no speakers.

President Toy closed the public hearing.

It was moved by Vice President Handley, seconded by Director Fernandez, to Adopt Ordinance 36.04, Sewer Use Ordinance. Motion carried unanimously.

AUTHORIZE THE GENERAL MANAGER TO EXECUTE A COST-SHARING AGREEMENT WITH THE ALAMEDA COUNTY WATER DISTRICT AND THE SAN FRANCISCO PUBLIC UTILITIES COMMISSION FOR THE PURIFIED WATER FEASIBILITY EVALUATION

This item was reviewed by the Budget & Finance Committee. Technical Services Manager Ghossain stated the Bay Area's largest water agencies have been working to develop a regional solution to improve water supply reliability. The 2019 Joint Alameda County Water District (ACWD), San Francisco Public Utilities Commission (SFPUC), and Union Sanitary District (USD) Purified Water Feasibility Evaluation will build upon past studies by starting with previous recommendations for reuse of advanced treated purified water for recharge of the Niles Cone Groundwater Basin to augment potable supplies as the lower limit of potential alternatives. The study will evaluate a broader range of alternatives to use locally controlled purified water to augment water supply, including both direct and indirect potable reuse. The details of the cost-sharing agreement were outlined in the Board meeting packet. Staff recommended the Board authorize the General Manager to execute a cost-sharing agreement with ACWD and SFPUC for the Purified Water Feasibility Evaluation.

It was moved by Secretary Kite, seconded by Director Lathi, to Authorize the General Manager to Execute a Cost-Sharing Agreement with the Alameda County Water District and the San Francisco Public Utilities Commission. Motion carried unanimously.

REVIEW AND CONSIDER APPROVAL OF POLICY NO. 5334, EQUAL EMPLOYMENT OPPORTUNITY

This item was reviewed by the Personnel Committee. Human Resources Manager Boucher stated Policy No. 5334 provides guidelines to staff on State and Federal laws regarding protected categories and status when considering a person for employment. The Policy is scheduled for review every five years and was last approved by the Board at the January 14, 2013, Board meeting. Staff edited the Policy to reflect updates to State and Federal laws. Staff recommended the Board consider and approve revisions to District Policy No. 5334, Equal Employment Opportunity.

It was moved by Director Fernandez, seconded by Vice President Handley, to Approve Policy No. 5334, Equal Employment Opportunity. Motion carried unanimously.

INFORMATION ITEMS:

Board of Directors Internal Committee Assignments for Fiscal Year 2020

President Toy stated Board of Directors Internal Committee Assignments for Fiscal Year 2020 were included in the Board meeting packet.

Solar and Cogeneration Facilities Operational Update

This item was reviewed by the Budget & Finance Committee. Technical Services Manager Ghossain stated the total benefit to date for the Alvarado Wastewater Treatment Plant Solar Carport, constructed in 2011, was $604,461 for a 67.9% simple payback. The total benefit to date for the Irvington Pump Station Solar Facility, constructed in 2012, was $2,704,702 for a 94.6% simple payback. The total benefit to date for the Cogeneration Facility, constructed in 2014, was $7,758,769 for a 60.6% simple payback.

Boardmember Expenses, Fourth Quarter Fiscal Year 2019

This item was reviewed by the Budget & Finance Committee. Business Services Coach Brenner provided an overview of the Fourth Quarter Boardmember Expenses included in the Board meeting packet.

Report on the East Bay Dischargers Authority (EBDA) Meeting of July 18, 2019
Director Lathi provided an overview of the EBDA meeting minutes included in the Board meeting packet.

Check Register
Staff responded to Boardmember questions regarding the Check Register.

COMMITTEE MEETING REPORTS:

The Budget & Finance, Personnel, and Legal/Community Affairs Committees met.

GENERAL MANAGER'S REPORT:
General Manager Eldredge stated:

- General Manager Eldredge provided an update on the status of East Bay Regional Park District repair projects at the Hayward Marsh.
- General Manager Eldredge stated he will be attending the California Association of Sanitation Agencies Annual Conference August 21 – 23, 2019.

OTHER BUSINESS:
There was no other business.

ADJOURNMENT:

The meeting was adjourned at 7:26 p.m. to the next Regular Meeting in the Boardroom on Monday, August 26, 2019, at 7:00 p.m.

SUBMITTED:	ATTEST:
________________________	________________________
REGINA McEVOY BOARD CLERK	PAT KITE SECRETARY

APPROVED:

____
JENNIFER TOY
PRESIDENT

Adopted this 26th day of August 2019

AUGUST 26, 2019
BOARD OF DIRECTORS MEETING
AGENDA ITEM # 7

TITLE: **Monthly Operations Report for July 2019** ***(This is an Information Item)***

SUBMITTED: Paul R. Eldredge, General Manager/District Engineer

Recommendation

Information only.

Previous Board Action

None

Background

Attached are Monthly Operations Reports for July 2019. Staff is available to answer questions regarding information contained in the report.

Work Group Managers

General Manager/Administration	Paul Eldredge	GM
Collection Services	James Schofield	CS
Technical Support	Sami Ghossain	TS
Treatment and Disposal Services	Armando Lopez	T&D
Fabrication, Maintenance, and Construction	Robert Simonich	FMC

ODOR COMPLAINTS:
During the month of July 2019, there were two odor complaints received by the Collection System.

SAFETY

- There were no injuries during July.
- We acquired 2 radar speed signs that will be used by Collections for traffic control on the streets. They are also being used to help increase awareness of speed in the treatment plant.
- We completed the Injury Illness prevention training for all employees.

STAFFING & PERSONNEL:

Recruitments Opened:

- Administrative Specialist I – Research and Support Team (replacement for Janinne Ward – retirement effective 9/30/19)
- Accounting Technician I/II (replacement for Nina Narvaez – resignation effective 7/11/19)
- Environmental Health & Safety Program Manager (replacement for Mike Marzano – retirement effective 12/21/19)
- Enhanced Treatment & Site Upgrade Program Manager (New position. Limited Term – 7-10 years)
- Enhanced Treatment & Site Upgrade Assistant Program Manager (New position. Limited Term – 7-10 years)

G.M. ACTIVITIES: For the month of July, the General Manager was involved in the following:

- Attended the East Bay Dischargers Authority (EBDA) Managers Advisory Committee (MAC) meeting
- Attended the EBDA Meeting
- Participated in USD's EBDA JPA Ad Hoc Meetings
- Attended an EBDA MAC JPA Discussion Meeting
- Attended the General Manager's Check-in Board Workshop
- Attended the Newsletter and Rebranding Board Workshop
- Provided a presentation at the Newark Rotary meeting

Attachments: Odor Report and Map
Hours Worked and Leave Time by Work Group
Business Services
Technical Services
Collection Services
Fabrication, Maintenance, and Construction
Treatment and Disposal Services

ODOR REPORT
July 2019

During the recording period from July 01, 2019 through July 31, 2019, there were two odor related service requests received by the District.

City: Fremont

1. Complaint Details:

Date: 7/8/2019
Time: 12:00 am
Location: BALLANTINE PL
Reported By: Don Smith
Wind (from): South
Wind Speed: 10 mph
Temperature: 68 Degrees F
Weather: Sunny

Response and Follow-up:

We inspected manholes in the area. The resident reported they detected the odor in their house. We inspected the sinks, toilets and tubs in the residence. We used our gastech and detected no odors. We gave the resident our USD brochure and suggested they run water in their sinks if the odors return. We also suggested they call us back if the odor returns and running water in the sinks if that doesn't rectify the situation.

2. Complaint Details:

Date: 7/16/2019
Time: 9:00 am
Location: TRENOUTH ST
Reported By: Aiqing Cho
Wind (from): West
Wind Speed: 10 mph
Temperature: 68 Degrees F
Weather: Sunny

Response and Follow-up:

We inspected our sewer mains and the drain inlets in the area. We found garbage and debris on the street which was the source of the odor. We relayed our findings to the reporting party and suggested they call their refuse contractor.

Legend

Odor Complaints: July 2019

- Odor found, USD resolved (0)
- Odor found, not related to USD (1)
- No odor found (1)

Odor Complaints: Aug. 2018 to Jun. 2019

- Odor found, USD resolved (6)
- Odor found, not related to USD (4)
- No odor found (10)

0 0.5 1 2 3 4 5 Miles

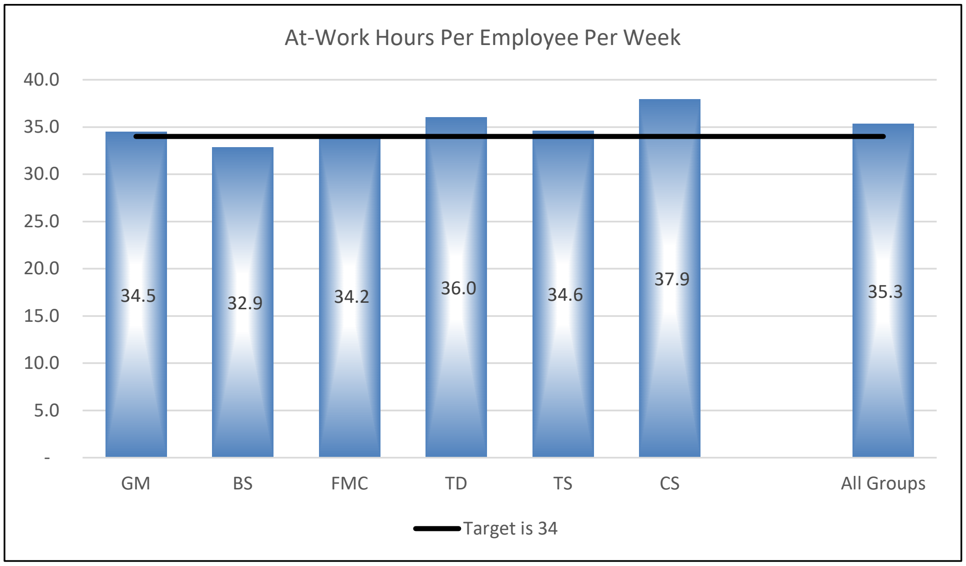
Location of Odor Reports
August 2018 to July 2019

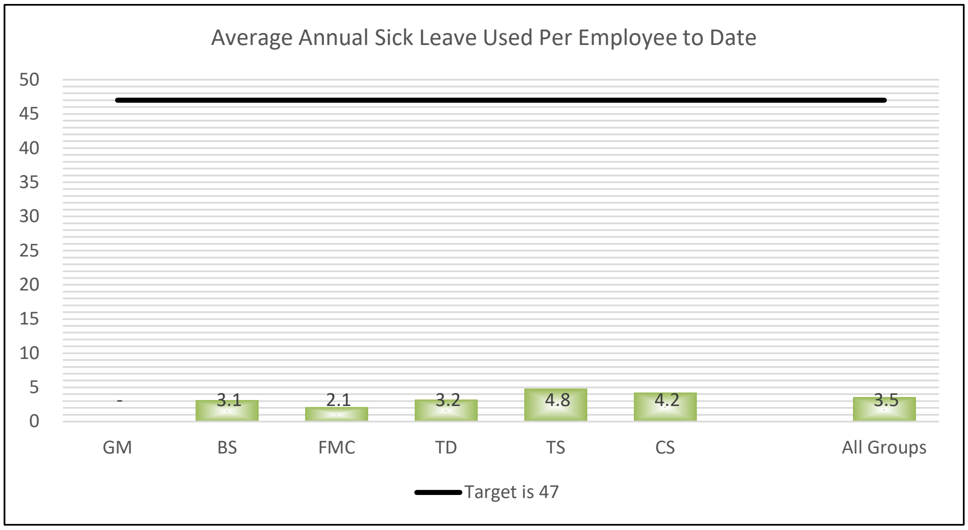
N W E S

HOURS WORKED AND LEAVE TIME BY WORK GROUP

June 27, 2019 through July 24, 2019

Weeks to Date: 4 out of 52 (7.69%)





NOTES

(1) Regular hours does not include hours worked by part-time or temporary employees.

(2) Overtime hours includes call outs.

(3) Discretionary Leave includes Vacation, HEC, Holiday, MAL, FLEX, Funeral, Jury Duty, Military, OT Banked Use, Paid Admin., SLIP, VRIP, Holiday Banked Use leaves.

(4) Sick Leave includes sick and catastrophic sick leaves as well as protected time off, of which the District has no discretion.

An employee using 15 vacation, 11 holiday, 2 HEC, and 5 sick days will work an average of **34.9** hours per week over the course of a year; with 20 vacation days, **34.2** hours per week.

HOURS WORKED AND LEAVE TIME BY WORK GROUP

June 27, 2019 through July 24, 2019

Weeks to Date: 4 out of 52 (7.69%)

Group	Average Number of Employees	**AT-WORK HOURS**		At-Work Hours Per Employee Per Week	**LEAVE HOURS**				Average Annual Sick Leave Used Per Employee To Date	**FY19**		
		Regular (1)	Overtime (2)		Discretionary (3)	Short Term Disability	Workers Comp	Sick (4)		Average Number of Employees	At-Work Hours Per Week Per Employee	Annual Sick Leave Used
GM	2	264.00	2.00	34.5	56.00	-	-	-	0.0	2	34.8	38.5
BS	17	2,116.50	38.50	32.9	391.00	-	-	52.50	3.1	16	35.5	41.1
FMC	28	3,659.65	33.58	34.2	762.35	-	-	58.00	2.1	28	34.5	39.3
TD	26	3,592.50	17.41	36.0	515.60	-	-	83.90	3.2	26	35.4	35.2
TS	33	4,386.68	18.25	34.6	682.31	-	-	158.01	4.8	32	34.6	46.2
CS	31	4,282.50	254.04	37.9	545.77	-	-	131.73	4.2	30	36.1	59.3
All Groups	**137**	**18,301.83**	**363.78**	**35.3**	**2,953.03**	**-**	**-**	**484.14**	**3.5**	**134**	**35.1**	**50.5**
SICK LEAVE INCENTIVE PROGRAM TARGETS				**≥34**					**≤47**			

The Sick Leave Incentive Program target goals are 47 or less hours of sick leave per employee annually, and 34 or more hours of at-work time per week per employee.

NOTES

(1) Regular hours does not include hours worked by part-time or temporary employees.

(2) Overtime hours includes call outs.

(3) Discretionary Leave includes Vacation, HEC, Holiday, MAL, FLEX, Funeral, Jury Duty, Military, OT Banked Use, Paid Admin., SLIP, VRIP, Holiday Banked Use leaves.

(4) Sick Leave includes sick and catastrophic sick leaves, as well as protected time off, of which the District has no discretion.

An employee using 15 vacation, 11 holiday, 2 HEC, and 5 sick days will work an average of **34.9** hours per week over the course of a year;

with 20 vacation days, **34.2** hours per week.

BUDGET AND FINANCE REPORT

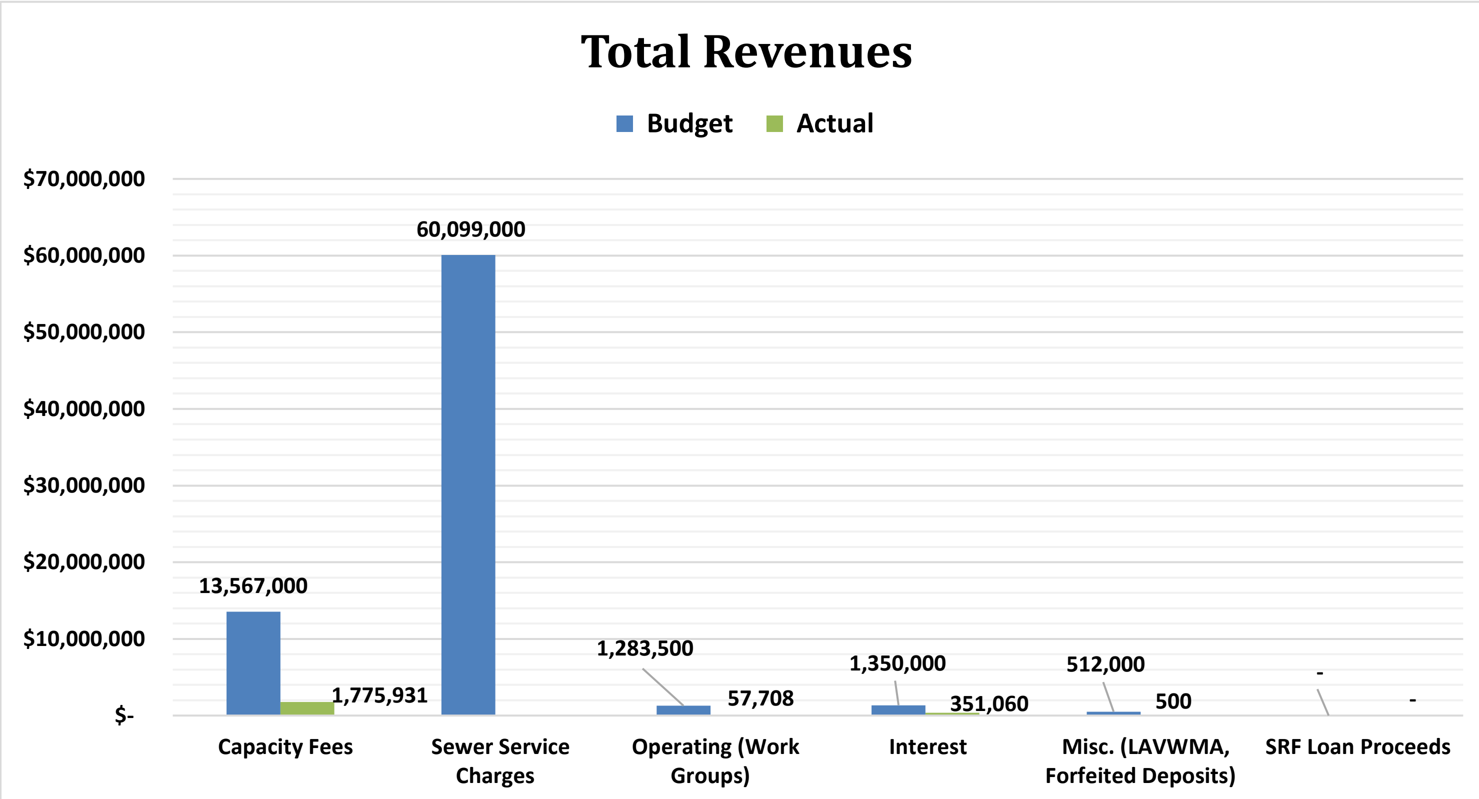
FY 2020	Year-to-date as of 7/31/2019		8.33% of year elapsed	
Revenues	**Budget**	**Actual**	**% of Budget Rec'd**	**Unaudited Last Year Actuals 6/30/19**
Capacity Fees	$ 13,567,000	$ 1,775,931	13%	$ 16,158,027
Sewer Service Charges	60,099,000		0%	54,522,310
Operating (Work Groups)	1,283,500	57,708	4%	1,221,357
Interest	1,350,000	351,060	26%	2,643,095
Misc. (LAVWMA, Forfeited Deposits)	512,000	500	0%	956,260
Subtotal Revenues	$ 76,811,500	$ 2,185,199	3%	$ 75,501,050
SRF Loan Proceeds	-	-		-
Total Revenues + SRF Proceeds	**$ 76,811,500**	**$ 2,185,199**	**3%**	**$ 75,501,050**

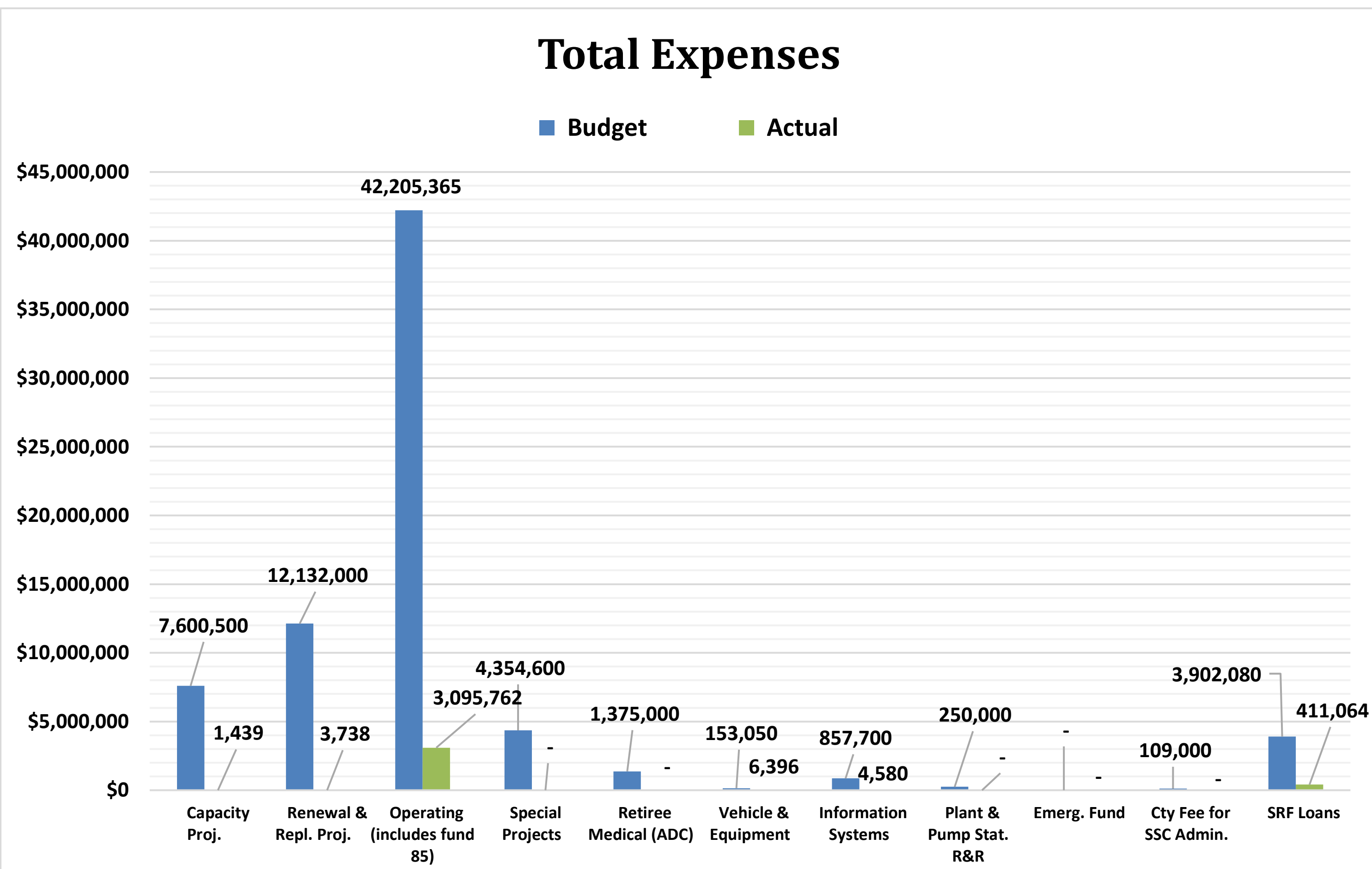
Expenses	**Budget**	**Actual**	**% of Budget Used**	**Last Year Actuals**
Capital Improvement Program:				
Capacity Proj.	$ 7,600,500	$ 1,439	0%	$ 1,736,483
Renewal & Repl. Proj.	12,132,000	3,738	0%	4,387,833
Operating (includes fund 85)	42,205,365	3,095,762	7%	36,053,824
Special Projects	4,354,600	-	0%	772,658
Retiree Medical (ADC)	1,375,000	-	0%	1,333,416
Vehicle & Equipment	153,050	6,396	4%	725,877
Information Systems	857,700	4,580	1%	629,584
Plant & Pump Stat. R&R	250,000	-	0%	302,969
Emerg. Fund	-	-	0%	-
Cty Fee for SSC Admin.	109,000	-	0%	108,344
Debt Servicing:				
SRF Loans	3,902,080	411,064	11%	3,902,110
Total Expenses	**$ 72,939,295**	**$ 3,522,977**	**5%**	**$ 49,953,099**
Total Revenue & Proceeds less Expenses	***$ 3,872,205***	***$ (1,337,778)***		***25,547,951***

Operating (Work Group) Expenses	**Budget**	**Actual**	**% of Budget Used**	**Unaudited Last Year Actuals**
Board of Directors	$ 179,176	$ 12,007	7%	$ 134,672
General Manager/Admin.	1,066,367	58,197	5%	765,753
Business Services	4,342,141	256,210	6%	3,257,883
Collection Services	7,316,485	539,683	7%	6,544,180
Technical Services	6,639,720	504,469	8%	6,031,713
Treatment & Disposal Services	12,913,507	1,063,344	8%	10,678,104
Fabrication, Maint. & Construction	8,837,463	522,514	6%	8,064,297
Non-Departmental	910,506	139,338	15%	577,223
Total	$ 42,205,365	$ 3,095,762	7%	**$ 36,053,824**

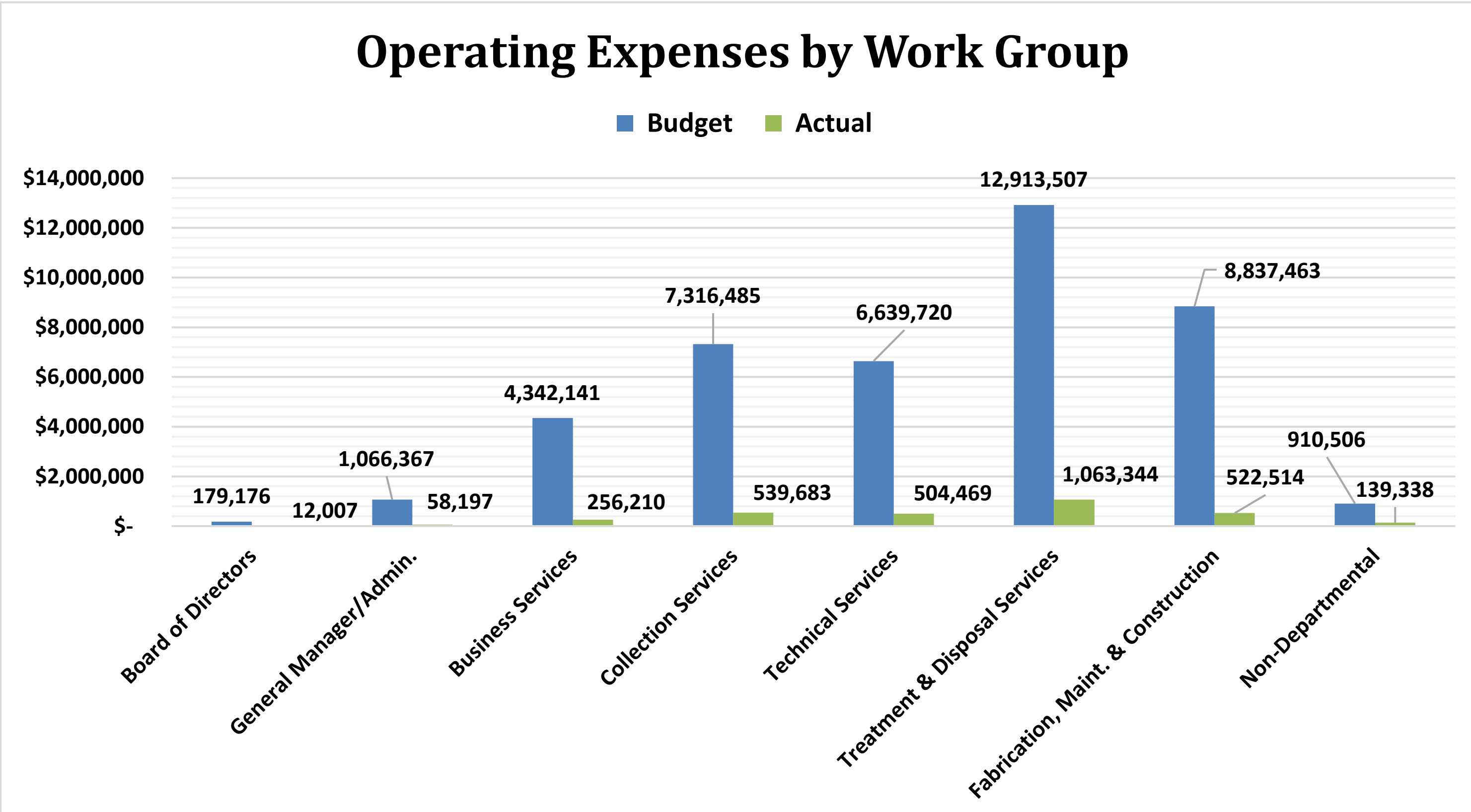
Operating (Work Group) Expenses by Type	**Budget**	**Actual**	**% of Budget Used**	**Last Year Actuals**
Personnel (incl D&E)	$ 28,878,209	$ 2,155,800	7%	$ 25,360,040
Repairs & Maintenance	2,256,400	51,246	2%	2,256,010
Supplies & Matls (chemicals, small tools)	3,351,150	73,641	2%	2,599,242
Outside Services (utilities, biosolids, legal)	7,489,606	815,075	11%	5,759,770
Fixed Assets	230,000	-	0%	78,762
Total	$ 42,205,365	$ 3,095,762	7%	**$ 36,053,824**

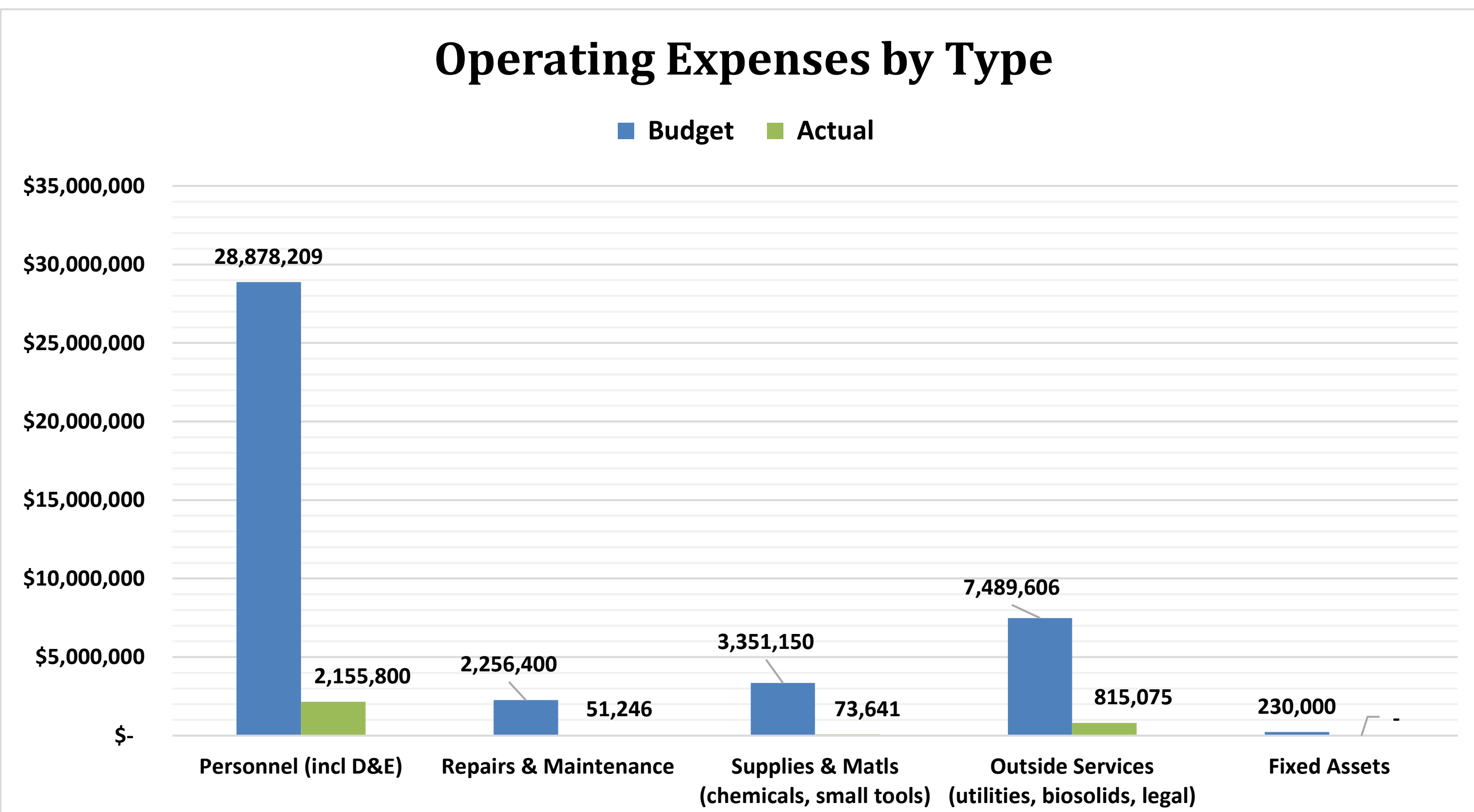
REVENUES AND EXPENSES REPORT
as of 7/31/19





REVENUES AND EXPENSES REPORT
as of 7/31/19

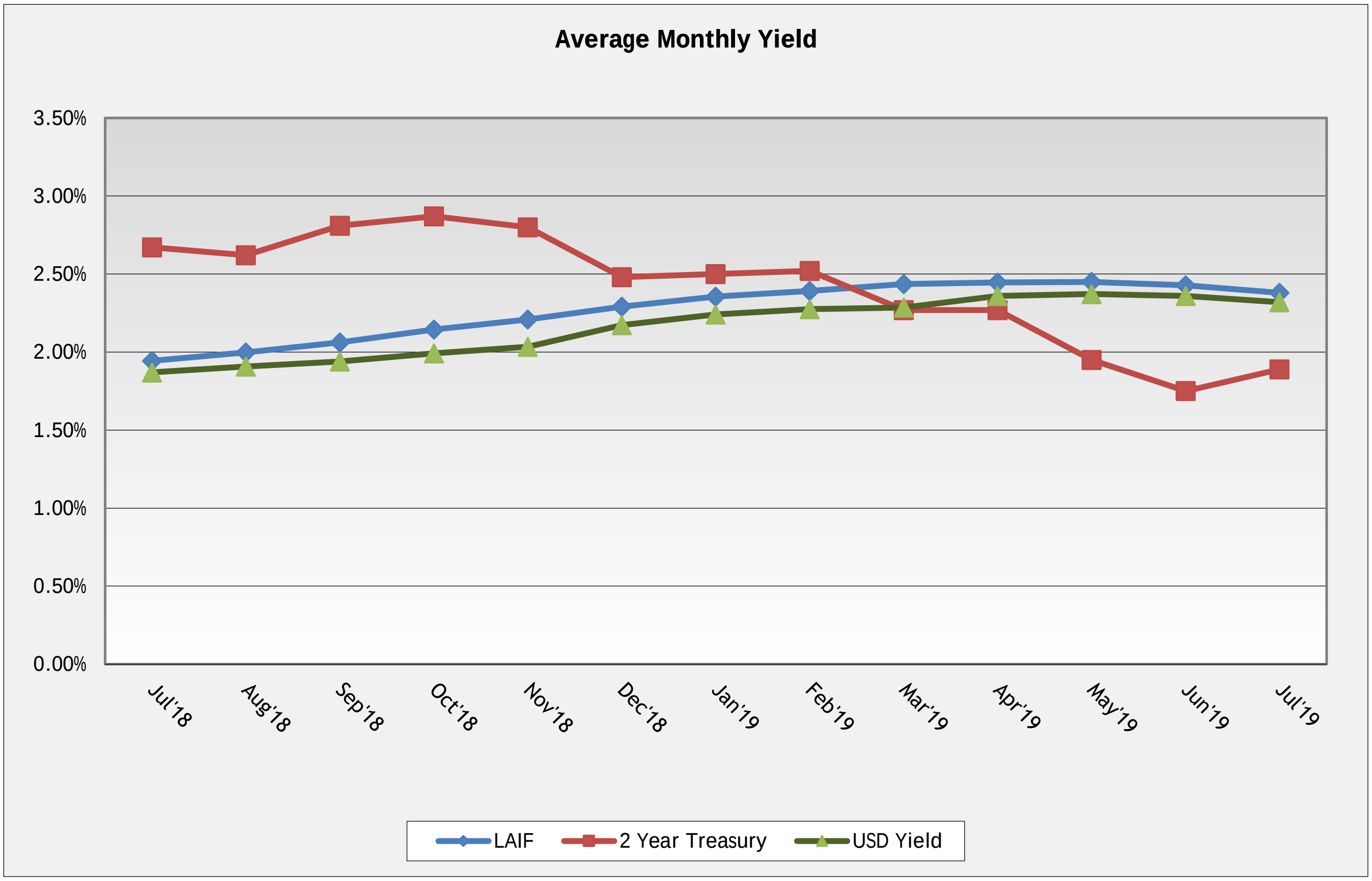


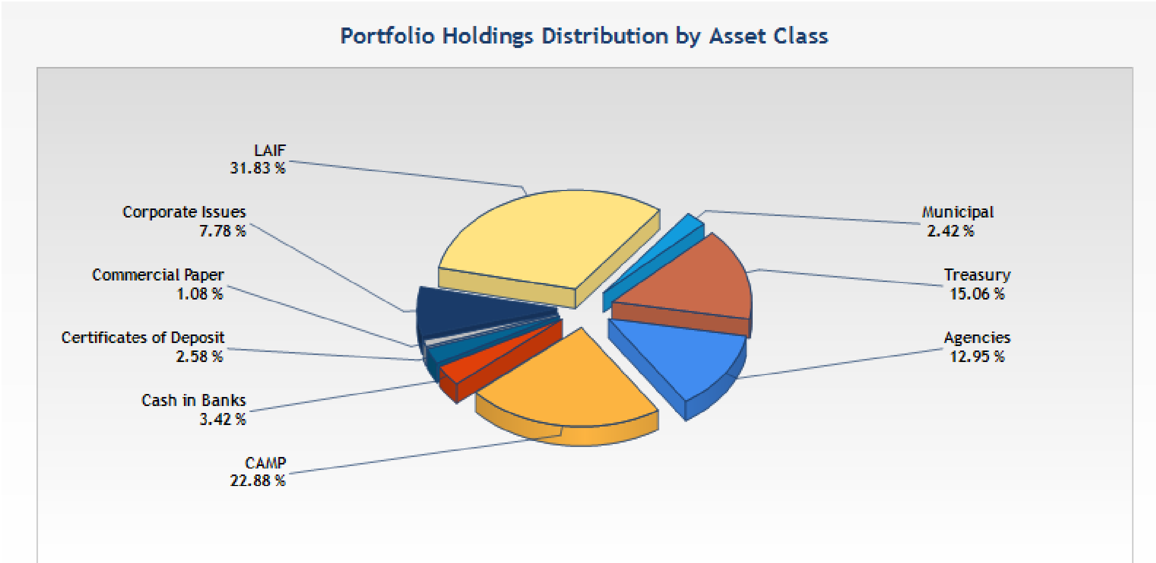


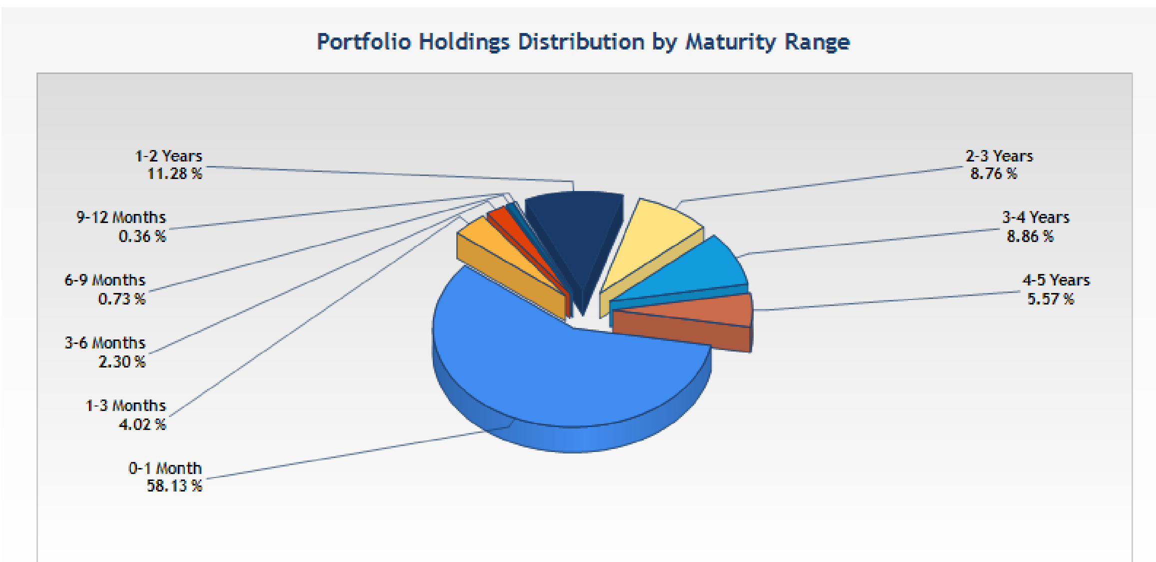
Business Services Group
July 2019

- Recruitment for CIP Administrative Specialist I was completed; May Bautista was hired on July 1, 2019.

Performance Measures for the USD Investment Portfolio







Maturity Range	Face Amount/Shares	YTM @ Cost	Cost Value	Days To Maturity	% of Portfolio	Market Value	Book Value	Duration To Maturity
0-1 Month	80,037,386.03	2.368	80,037,386.03	1	58.13	80,037,386.03	80,037,386.03	0.00
1-3 Months	5,548,000.00	2.583	5,534,571.03	51	4.02	5,539,093.74	5,541,950.85	0.14
3-6 Months	3,160,000.00	1.642	3,165,756.57	124	2.30	3,153,519.20	3,160,427.57	0.34
6-9 Months	1,000,000.00	1.590	1,000,000.00	236	0.73	994,790.00	1,000,000.00	0.64
9-12 Months	498,000.00	1.700	498,000.00	303	0.36	496,250.97	498,000.00	0.83
1-2 Years	15,350,000.00	2.120	15,526,503.56	589	11.28	15,363,378.21	15,393,984.25	1.58
2-3 Years	12,058,000.00	2.231	12,054,951.18	953	8.76	12,115,290.86	12,047,055.30	2.54
3-4 Years	12,475,000.00	2.463	12,197,722.14	1,329	8.86	12,445,043.25	12,222,865.61	3.52
4-5 Years	7,790,000.00	2.344	7,663,156.25	1,637	5.57	7,817,244.80	7,673,658.93	4.29
TOTAL / AVERAGE	**137,916,386.03**	**2.319**	**137,678,046.76**	**367**	**100**	**137,961,997.06**	**137,575,328.54**	**0.97**

Union Sanitary District
Portfolio Holdings
Board Report - Holdings
Report Format: By Transaction
Group By: Asset Class
Average By: Cost Value
Portfolio / Report Group: All Portfolios
As of 7/31/2019

Description	CUSIP/Ticker	Credit Rating 1	Settlement Date	Face Amount/Shares	Cost Value	Coupon Rate	Market Value	YTM @ Cost	Next Call Date	Maturity Date	% of Portfolio
Agencies											
FFCB 1.3 11/25/2019-16	3133EGBK0	Moodys-Aaa	5/25/2016	1,000,000.00	997,950.00	1.300	996,560.00	1.360		11/25/2019	0.72
FFCB 1.59 3/23/2020-17	3133EFR25	Moodys-Aaa	3/23/2016	1,000,000.00	1,000,000.00	1.590	994,790.00	1.590		3/23/2020	0.73
FFCB 1.7 5/3/2021-17	3133EF5T0	Moodys-Aaa	5/3/2016	1,000,000.00	1,000,000.00	1.700	995,220.00	1.700		5/3/2021	0.73
FHLB 1.93 12/21/2020-17	3130AADQ8	None	12/21/2016	1,000,000.00	1,000,000.00	1.930	995,180.00	1.930		12/21/2020	0.73
FHLB 2 10/26/2021-19	3130AB3D6	None	4/26/2017	1,000,000.00	1,000,000.00	2.000	1,000,790.00	2.000		10/26/2021	0.73
FHLB 2.05 12/29/2021-17	3130AAET1	Moodys-Aaa	12/29/2016	1,000,000.00	1,000,000.00	2.050	1,000,030.00	2.050	9/29/2019	12/29/2021	0.73
FHLB 2.4 12/22/2021-17	3130AAHC5	None	12/22/2016	1,000,000.00	1,000,000.00	2.400	1,000,020.00	2.400		12/22/2021	0.73
FHLB 2.85 3/27/2024	3130AG5B7	Moodys-Aaa	4/26/2019	330,000.00	330,000.00	2.850	330,204.60	2.850		3/27/2024	0.24
FHLB Step 4/28/2021-16	3130A7PR0	Moodys-Aaa	4/28/2016	1,000,000.00	1,000,000.00	2.000	1,000,210.00	2.114	10/28/2019	4/28/2021	0.73
FHLB Step 4/28/2021-16	3130A7QX6	Moodys-Aaa	4/28/2016	1,000,000.00	1,000,000.00	1.750	999,020.00	2.021		4/28/2021	0.73
FHLMC 1.25 10/28/2019-17	3134G8XQ7	Moodys-Aaa	4/28/2016	1,000,000.00	1,000,000.00	1.250	997,880.00	1.250		10/28/2019	0.73
FHLMC 1.5 12/30/2019-17	3134GAYY4	S&P-AA+	12/30/2016	1,000,000.00	1,000,000.00	1.500	997,110.00	1.500	9/30/2019	12/30/2019	0.73
FHLMC 1.5 9/9/2019-18	3134GA7A6	Moodys-Aaa	5/10/2017	1,000,000.00	1,000,000.00	1.500	999,320.00	1.500		9/9/2019	0.73
FHLMC 2 12/30/2021-17	3134GAYV0	None	12/30/2016	1,000,000.00	1,000,000.00	2.000	998,860.00	2.000	9/30/2019	12/30/2021	0.73
FHLMC Step 4/28/2021-16	3134G8VZ9	Moodys-Aaa	4/28/2016	2,500,000.00	2,500,000.00	1.500	2,494,250.00	2.116		4/28/2021	1.82
FHLMC Step 4/28/2021-16	3134G8Z28	Moodys-Aaa	5/10/2016	1,000,000.00	999,500.00	1.500	998,890.00	2.044		4/28/2021	0.73

Description	CUSIP/Ticker	Credit Rating 1	Settlement Date	Face Amount/Shares	Cost Value	Coupon Rate	Market Value	YTM @ Cost	Next Call Date	Maturity Date	% of Portfolio
FNMA 1.5 6/16/2021-16	3136G3QX6	Moodys-Aaa	6/16/2016	1,000,000.00	995,000.00	1.500	986,870.00	1.604		6/16/2021	0.72
Sub Total / Average Agencies				**17,830,000.00**	**17,822,450.00**	**1.720**	**17,785,204.60**	**1.867**			**12.95**
CAMP											
CAMP LGIP	LGIP4000	None	5/31/2011	31,506,432.29	31,506,432.29	2.420	31,506,432.29	2.420	N/A	N/A	22.88
Sub Total / Average CAMP				**31,506,432.29**	**31,506,432.29**	**2.420**	**31,506,432.29**	**2.420**			**22.88**
Cash in Banks											
Union Bank Cash	LGIPUNIONBANK	None	12/31/2016	4,704,734.20	4,704,734.20	1.910	4,704,734.20	1.910	N/A	N/A	3.42
Sub Total / Average Cash in Banks				**4,704,734.20**	**4,704,734.20**	**1.910**	**4,704,734.20**	**1.910**			**3.42**
Certificates of Deposit											
Ally Bank 1.35 10/28/2019	02006LQ48	None	10/27/2016	248,000.00	248,000.00	1.350	247,452.64	1.350		10/28/2019	0.18
American Expr Centurion 2.45 4/5/2022	02587DN38	None	4/5/2017	247,000.00	247,000.00	2.450	250,983.17	2.450		4/5/2022	0.18
Belmont Savings Bank 2.15 3/22/2022	080515BV0	None	3/20/2017	248,000.00	248,000.00	2.150	249,970.88	2.150		3/22/2022	0.18
BMW Bank 2.15 3/10/2022	05580AGR9	None	3/10/2017	247,000.00	247,000.00	2.150	248,941.72	2.150		3/10/2022	0.18
Capital One Bank 1.5 10/26/2020	140420L99	None	10/26/2016	248,000.00	248,000.00	1.500	246,038.67	1.500		10/26/2020	0.18
Credit Agricole CIB NY 2.83 4/2/2021	22535CDU2	None	4/4/2019	575,000.00	575,000.00	2.830	583,001.30	2.830		4/2/2021	0.42
Discover Bank 2.25 12/29/2021	254672Y36	None	12/29/2016	247,000.00	247,000.00	2.250	249,295.67	2.250		12/29/2021	0.18
Lakeside Bank 1.75 5/29/2020	51210SMU8	None	5/30/2017	249,000.00	249,000.00	1.750	248,229.59	1.750		5/29/2020	0.18
Landmark Bank 2.1 3/29/2021-17	51506VCA9	None	3/29/2017	248,000.00	248,000.00	2.100	248,372.32	2.100	9/27/2019	3/29/2021	0.18
Ponce De Leon Federal Bank 1.85 5/28/2021	732333AJ8	None	5/31/2017	249,000.00	249,000.00	1.850	248,510.32	1.850		5/28/2021	0.18
State Bank of India 2.25 1/26/2022	8562846A7	None	1/26/2017	247,000.00	247,000.00	2.250	249,400.32	2.250		1/26/2022	0.18
Summit Community Bank 1.65 5/29/2020	86604XLT1	None	5/31/2017	249,000.00	249,000.00	1.650	248,021.38	1.650		5/29/2020	0.18
Synchrony Bank 2.3 2/24/2022	87165ELT2	None	2/28/2017	247,000.00	247,000.00	2.300	249,823.80	2.300		2/24/2022	0.18

Description	CUSIP/Ticker	Credit Rating 1	Settlement Date	Face Amount/Shares	Cost Value	Coupon Rate	Market Value	YTM @ Cost	Next Call Date	Maturity Date	% of Portfolio
Sub Total / Average Certificates of Deposit				**3,549,000.00**	**3,549,000.00**	**2.116**	**3,568,041.78**	**2.116**			**2.58**
Commercial Paper											
MUFG Bank LTD/NY 2.59 9/19/2019	62479MWK5	Moodys-P1	3/25/2019	1,500,000.00	1,480,790.83	2.590	1,495,395.90	5.276		9/19/2019	1.08
Sub Total / Average Commercial Paper				**1,500,000.00**	**1,480,790.83**	**2.590**	**1,495,395.90**	**5.276**			**1.08**
Corporate Issues											
Amazon.com Inc. 2.4 2/22/2023	023135AW6	Fitch-A+	4/15/2019	675,000.00	668,499.75	2.400	681,412.50	2.664		2/22/2023	0.49
American Express Credit 2.7 3/3/2022	0258M0EG0	Moodys-A2	5/15/2017	1,000,000.00	1,013,279.67	2.700	1,009,090.00	2.406		3/3/2022	0.74
Bank of America Corp 4.1 7/24/2023	06053FAA7	Fitch-A	3/22/2019	500,000.00	520,405.00	4.100	530,620.00	3.087		7/24/2023	0.38
BB&T Corporation 3.05 6/20/2022	05531FBG7	Fitch-A+	3/22/2019	525,000.00	525,714.00	3.050	534,502.50	3.006		6/20/2022	0.38
Chevron Corp 2.1 5/16/2021	166764BG4	Moodys-Aa2	5/10/2017	1,000,000.00	999,500.00	2.100	999,620.00	2.113		5/16/2021	0.73
Chevron Corp 2.193 11/15/2019	166764AN0	Moodys-Aa2	2/26/2016	1,160,000.00	1,167,806.57	2.193	1,159,849.20	2.004		11/15/2019	0.85
Exxon Mobil Corporation 2.726 3/1/2023	30231GAR3	Moodys-Aaa	6/14/2019	985,000.00	1,001,400.25	2.726	1,003,498.30	2.256		3/1/2023	0.73
GE Capital International 2.04 11/15/2020	36164QMS4	S&P-AA	3/10/2017	1,000,000.00	1,010,642.28	2.040	995,700.00	1.738		11/15/2020	0.73
HSBC 4.875 8/24/2020	4042Q1AE7	Moodys-A1	5/17/2016	2,000,000.00	2,191,145.28	4.875	2,048,200.00	2.500		8/24/2020	1.59
JPMorgan Chase & Co 2.7 5/18/2023	46625HRL6	Fitch-A+	3/22/2019	525,000.00	517,970.25	2.700	529,877.25	3.045		5/18/2023	0.38
Paccar Financial Corp 2.65 5/10/2022	69371RP83	None	5/10/2019	580,000.00	579,686.80	2.650	586,101.60	2.669		5/10/2022	0.42
State Street Corp 1.95 5/19/2021	857477AV5	Fitch-AA-	3/22/2019	530,000.00	520,566.00	1.950	527,360.60	2.805		5/19/2021	0.38
Sub Total / Average Corporate Issues				**10,480,000.00**	**10,716,615.85**	**3.001**	**10,605,831.95**	**2.420**			**7.78**
LAIF											
LAIF LGIP	LGIP1002	None	4/30/2011	43,826,219.54	43,826,219.54	2.379	43,826,219.54	2.379	N/A	N/A	31.83
Sub Total / Average LAIF				**43,826,219.54**	**43,826,219.54**	**2.379**	**43,826,219.54**	**2.379**			**31.83**
Municipal											

Description	CUSIP/Ticker	Credit Rating 1	Settlement Date	Face Amount/Shares	Cost Value	Coupon Rate	Market Value	YTM @ Cost	Next Call Date	Maturity Date	% of Portfolio
City of Riverside CA 2.125 6/1/2021	769036BA1	S&P-AA-	6/1/2017	500,000.00	500,000.00	2.125	498,530.00	2.125		6/1/2021	0.36
La Quinta Redev Agency 2.034 9/1/2019	50420BCH3	S&P-AA-	12/22/2016	1,330,000.00	1,336,650.00	2.034	1,329,933.50	1.843		9/1/2019	0.97
State of California 2.152 4/1/2022	13063DAD0	Moodys-Aa3	4/27/2017	1,000,000.00	1,010,000.00	2.152	1,009,330.00	1.938		4/1/2022	0.73
Victor Valley College General Obligation Bond 2.35	92603PER9	Moodys-Aa2	12/28/2016	500,000.00	490,150.00	2.350	498,405.00	2.811		8/1/2021	0.36
Sub Total / Average Municipal				**3,330,000.00**	**3,336,800.00**	**2.130**	**3,336,198.50**	**2.056**			**2.42**
Treasury											
T-Bill 0 9/3/2019	912796VT3	None	7/31/2019	470,000.00	469,130.20	0.000	469,111.70	1.990		9/3/2019	0.34
T-Note 1.25 7/31/2023	912828S92	Fitch-AAA	4/2/2019	1,790,000.00	1,712,806.25	1.250	1,748,615.20	2.302		7/31/2023	1.24
T-Note 1.375 6/30/2023	912828S35	Fitch-AAA	3/20/2019	2,000,000.00	1,914,609.38	1.375	1,964,060.00	2.431		6/30/2023	1.39
T-Note 1.375 9/30/2023	912828T26	Fitch-AAA	3/20/2019	2,000,000.00	1,909,531.25	1.375	1,961,480.00	2.436		9/30/2023	1.39
T-Note 1.5 3/31/2023	912828Q29	Fitch-AAA	3/20/2019	2,000,000.00	1,929,140.63	1.500	1,975,000.00	2.428		3/31/2023	1.40
T-Note 1.75 7/15/2022	9128287C8	Fitch-AAA	7/31/2019	1,000,000.00	998,789.06	1.750	997,190.00	1.792		7/15/2022	0.73
T-Note 1.75 9/30/2022	912828L57	Fitch-AAA	3/20/2019	2,000,000.00	1,954,531.25	1.750	1,993,600.00	2.426		9/30/2022	1.42
T-Note 1.875 2/28/2022	912828W55	Fitch-AAA	4/2/2019	1,050,000.00	1,037,572.27	1.875	1,050,084.00	2.298		2/28/2022	0.75
T-Note 2 4/30/2024	912828X70	Fitch-AAA	6/7/2019	960,000.00	964,875.00	2.000	966,115.20	1.891		4/30/2024	0.70
T-Note 2 6/30/2024	912828XX3	Fitch-AAA	7/3/2019	500,000.00	505,156.25	2.000	503,185.00	1.783		6/30/2024	0.37
T-Note 2.125 12/31/2022	912828N30	Fitch-AAA	3/20/2019	2,000,000.00	1,978,359.38	2.125	2,018,360.00	2.426		12/31/2022	1.44
T-Note 2.125 2/29/2024	912828W48	Fitch-AAA	3/20/2019	2,000,000.00	1,970,625.00	2.125	2,023,360.00	2.442		2/29/2024	1.43
T-Note 2.125 6/30/2022	912828XG0	Fitch-AAA	3/20/2019	1,420,000.00	1,406,909.38	2.125	1,430,877.20	2.418		6/30/2022	1.02
T-Note 2.25 12/31/2023	912828V23	Fitch-AAA	3/20/2019	2,000,000.00	1,982,968.75	2.250	2,032,900.00	2.439		12/31/2023	1.44
Sub Total / Average Treasury				**21,190,000.00**	**20,735,004.05**	**1.745**	**21,133,938.30**	**2.332**			**15.06**
Total / Average				**137,916,386.03**	**137,678,046.76**	**2.229**	**137,961,997.06**	**2.319**			**100**

All investment actions executed since the last report have been made in full compliance with the District's Investment Policy. The District will meet its expenditure obligations for the next six months. Market value sources are the LAIF, CAMP, and BNY Mellon monthly statements. Broker/Dealers utilized per USD Investment Policy and at the discretion of investment portfolio advisor.

Reviewer:

Approver:

Union Sanitary District
Transactions Summary
Board Report - Activity
Group By: Action
Portfolio / Report Group: All Portfolios
Begin Date: 06/30/2019, End Date: 07/31/2019

Description	CUSIP/Ticker	Face Amount/Shares	Principal	Interest/Dividends	Coupon Rate	YTM @ Cost	Settlement Date	Total
Buy								
T-Bill 0 9/3/2019	912796VT3	470,000.00	469,130.20	0.00	0.000	1.990	7/31/2019	469,130.20
T-Note 1.375 7/31/2019	9128282K5	247,000.00	246,971.05	1,613.69	1.375	1.835	7/22/2019	248,584.74
T-Note 1.375 7/31/2019	9128282K5	245,000.00	244,913.87	1,535.48	1.375	2.158	7/15/2019	246,449.35
T-Note 1.375 7/31/2019	9128282K5	490,000.00	489,674.61	2,847.62	1.375	2.222	7/3/2019	492,522.23
T-Note 1.75 7/15/2022	9128287C8	1,000,000.00	998,789.06	760.87	1.750	1.792	7/31/2019	999,549.93
T-Note 2 6/30/2024	912828XX3	500,000.00	505,156.25	81.52	2.000	1.783	7/3/2019	505,237.77
Sub Total / Average Buy		**2,952,000.00**	**2,954,635.04**	**6,839.18**				**2,961,474.22**
Deposit								
CAMP LGIP	LGIP4000	64,500.07	64,500.07	0.00	N/A	0.000	7/31/2019	64,500.07
LAIF LGIP	LGIP1002	338,196.59	338,196.59	0.00	N/A	0.000	7/12/2019	338,196.59
Union Bank Cash	LGIPUNIONBANK	4,704,734.20	4,704,734.20	0.00	N/A	0.000	7/31/2019	4,704,734.20
Sub Total / Average Deposit		**5,107,430.86**	**5,107,430.86**	**0.00**				**5,107,430.86**
Interest								
Bank of America Corp 4.1 7/24/2023	06053FAA7	0.00	0.00	10,250.00	4.100	0.000	7/24/2019	10,250.00
CAMP LGIP	LGIP4000	0.00	0.00	64,500.07	N/A	0.000	7/31/2019	64,500.07
Discover Bank 2.25 12/29/2021	254672Y36	0.00	0.00	2,771.14	2.250	0.000	7/1/2019	2,771.14
FHLB 2.05 12/29/2021-17	3130AAET1	0.00	0.00	10,250.00	2.050	0.000	7/1/2019	10,250.00
FHLMC 1.5 12/30/2019-17	3134GAYY4	0.00	0.00	7,500.00	1.500	0.000	7/1/2019	7,500.00
FHLMC 2 12/30/2021-17	3134GAYV0	0.00	0.00	10,000.00	2.000	0.000	7/1/2019	10,000.00
JP Morgan Chase Bank 1.1 7/15/2019	48125Y5L4	0.00	0.00	682.87	1.100	0.000	7/15/2019	682.87
LAIF LGIP	LGIP1002	0.00	0.00	338,196.59	N/A	0.000	7/12/2019	338,196.59
Lakeside Bank 1.75 5/29/2020	51210SMU8	0.00	0.00	358.15	1.750	0.000	7/31/2019	358.15
Lakeside Bank 1.75 5/29/2020	51210SMU8	0.00	0.00	370.09	1.750	0.000	7/1/2019	370.09
Landmark Bank 2.1 3/29/2021-17	51506VCA9	0.00	0.00	1,312.70	2.100	0.000	7/1/2019	1,312.70
Ponce De Leon Federal Bank 1.85 5/28/2021	732333AJ8	0.00	0.00	391.24	1.850	0.000	7/31/2019	391.24

Description	CUSIP/Ticker	Face Amount/Shares	Principal	Interest/Dividends	Coupon Rate	YTM @ Cost	Settlement Date	Total
Ponce De Leon Federal Bank 1.85 5/28/2021	732333AJ8	0.00	0.00	378.62	1.850	0.000	7/1/2019	378.62
State Bank of India 2.25 1/26/2022	8562846A7	0.00	0.00	2,755.91	2.250	0.000	7/26/2019	2,755.91
Summit Community Bank 1.65 5/29/2020	86604XLT1	0.00	0.00	348.94	1.650	0.000	7/31/2019	348.94
Summit Community Bank 1.65 5/29/2020	86604XLT1	0.00	0.00	337.68	1.650	0.000	7/1/2019	337.68
T-Note 0.875 7/31/2019	912828TH3	0.00	0.00	2,143.75	0.875	0.000	7/31/2019	2,143.75
T-Note 1.25 7/31/2023	912828S92	0.00	0.00	11,187.50	1.250	0.000	7/31/2019	11,187.50
T-Note 1.375 6/30/2023	912828S35	0.00	0.00	13,750.00	1.375	0.000	7/1/2019	13,750.00
T-Note 1.375 7/31/2019	9128282K5	0.00	0.00	6,751.25	1.375	0.000	7/31/2019	6,751.25
T-Note 2.125 12/31/2022	912828N30	0.00	0.00	21,250.00	2.125	0.000	7/1/2019	21,250.00
T-Note 2.125 6/30/2022	912828XG0	0.00	0.00	15,087.50	2.125	0.000	7/1/2019	15,087.50
T-Note 2.25 12/31/2023	912828V23	0.00	0.00	22,500.00	2.250	0.000	7/1/2019	22,500.00
Wells Fargo Bank 1.15 7/22/2019	9497486R3	0.00	0.00	251.05	1.150	0.000	7/22/2019	251.05
Sub Total / Average Interest		**0.00**	**0.00**	**543,325.05**				**543,325.05**
Matured								
FHLB 0 7/3/2019	313384HR3	1,000,000.00	1,000,000.00	0.00	0.000	0.000	7/3/2019	1,000,000.00
JP Morgan Chase Bank 1.1 7/15/2019	48125Y5L4	249,000.00	249,000.00	0.00	1.100	0.000	7/15/2019	249,000.00
T-Note 0.875 7/31/2019	912828TH3	490,000.00	490,000.00	0.00	0.875	0.000	7/31/2019	490,000.00
T-Note 1.375 7/31/2019	9128282K5	245,000.00	245,000.00	0.00	1.375	0.000	7/31/2019	245,000.00
T-Note 1.375 7/31/2019	9128282K5	247,000.00	247,000.00	0.00	1.375	0.000	7/31/2019	247,000.00
T-Note 1.375 7/31/2019	9128282K5	490,000.00	490,000.00	0.00	1.375	0.000	7/31/2019	490,000.00
Wells Fargo Bank 1.15 7/22/2019	9497486R3	249,000.00	249,000.00	0.00	1.150	0.000	7/22/2019	249,000.00
Sub Total / Average Matured		**2,970,000.00**	**2,970,000.00**	**0.00**				**2,970,000.00**
Withdraw								
LAIF LGIP	LGIP1002	3,000,000.00	3,000,000.00	0.00	N/A	0.000	7/25/2019	3,000,000.00
LAIF LGIP	LGIP1002	4,000,000.00	4,000,000.00	0.00	N/A	0.000	7/16/2019	4,000,000.00
Union Bank Cash	LGIPUNIONBANK	2,971,829.98	2,971,829.98	0.00	N/A	0.000	7/30/2019	2,971,829.98
Sub Total / Average Withdraw		**9,971,829.98**	**9,971,829.98**	**0.00**				**9,971,829.98**

Union Sanitary District's Internal Retiree Medical Fund
Quarterly Report

For Period Ended 6/30/19

Fund Balance 3/31/19:		**$75,998.15**
Revenues:		
Expenses:		
	Quarterly Net Medical Reimbursments	(116,442.51)
Transfers Out:		
6/14/19	CalPERS OPEB Trust Actuarially Determined Contrib. (ADC) (payment #4 of 4)	(220,133.25)
Ending Fund Balance 6/30/19:		**($260,577.61)**

Union Sanitary District
CERBT Strategy 2
Entity #: SKB7-6011550262
Quarter Ended June 30, 2019

Market Value Summary:

	QTD Current Period	Fiscal Year to Date
Beginning Balance	$6,674,901.63	$5,786,838.94
Contribution	220,133.25	880,533.00
Disbursement	0.00	0.00
Transfer In	0.00	0.00
Transfer Out	0.00	0.00
Investment Earnings	228,539.91	460,035.78
Administrative Expenses	(829.74)	(3,043.83)
Investment Expense	(606.65)	(2,225.49)
Other	0.00	0.00
Ending Balance	$7,122,138.40	$7,122,138.40
FY End Contrib per GASB 74 Para 22	0.00	0.00
FY End Disbursement Accrual	0.00	0.00
Grand Total	$7,122,138.40	$7,122,138.40

Unit Value Summary:

	QTD Current Period	Fiscal Year to Date
Beginning Units	401,227.421	360,093.033
Unit Purchases from Contributions	13,028.358	54,162.746
Unit Sales for Withdrawals	0.000	0.000
Unit Transfer In	0.000	0.000
Unit Transfer Out	0.000	0.000
Ending Units	414,255.779	414,255.779
Period Beginning Unit Value	16.636206	16.070400
Period Ending Unit Value	17.192611	17.192611

Please note the Grand Total is your actual fund account balance at the end of the period, including all contributions per GASB 74 paragraph 22 and accrued disbursements. Please review your statement promptly. All information contained in your statement will be considered true and accurate unless you contact us within 30 days of receipt of this statement. If you have questions about the validity of this information, please contact CERBT4U@calpers.ca.gov.

Statement of Transaction Detail for the Quarter Ending 06/30/2019

Union Sanitary District

Entity #: SKB7-6011550262

Date	Description	Amount	Unit Value	Units	Check/Wire	Notes
06/14/2019	Contribution	$220,133.25	$16.896469	13,028.358	WIRE 2019061400140 314	

Client Contact:
CERBT4U@CalPERS.ca.gov

If you have any questions or comments regarding the new statement format please contact CERBT4U@CalPERS.ca.gov

MONTHLY OPERATIONS REPORT FOR THE MONTH OF JULY 2019
TECHNICAL SUPPORT WORK GROUP SUMMARY

Capital Improvement Program

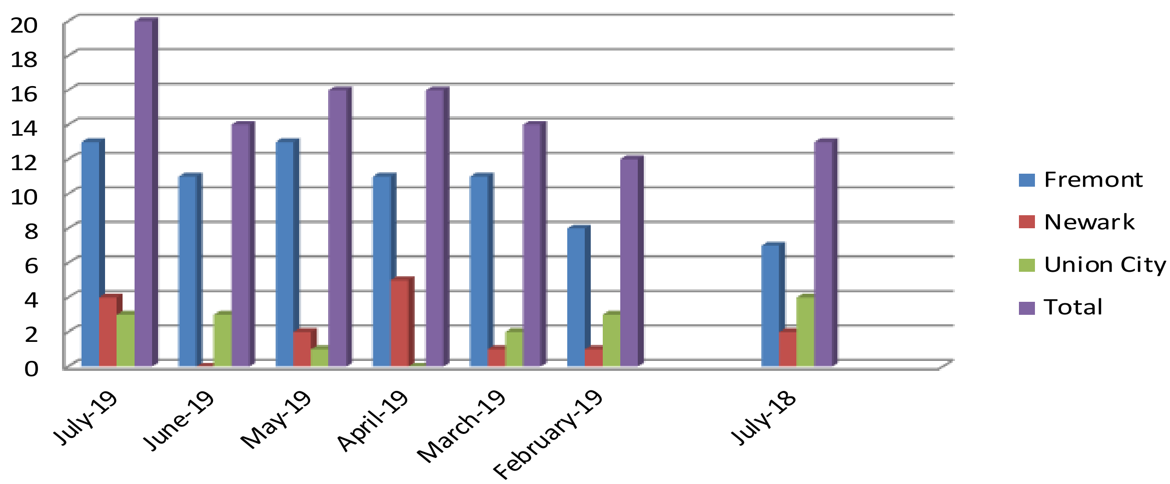
Primary Digester No. 3 Rehabilitation Project – Project closeout and punch list work in progress.

Sludge Degritter System Project – Performance testing and adjustment of the Degritter unit in progress.

Customer Service

Trouble Calls dispatched from the Front Desk during business hours:

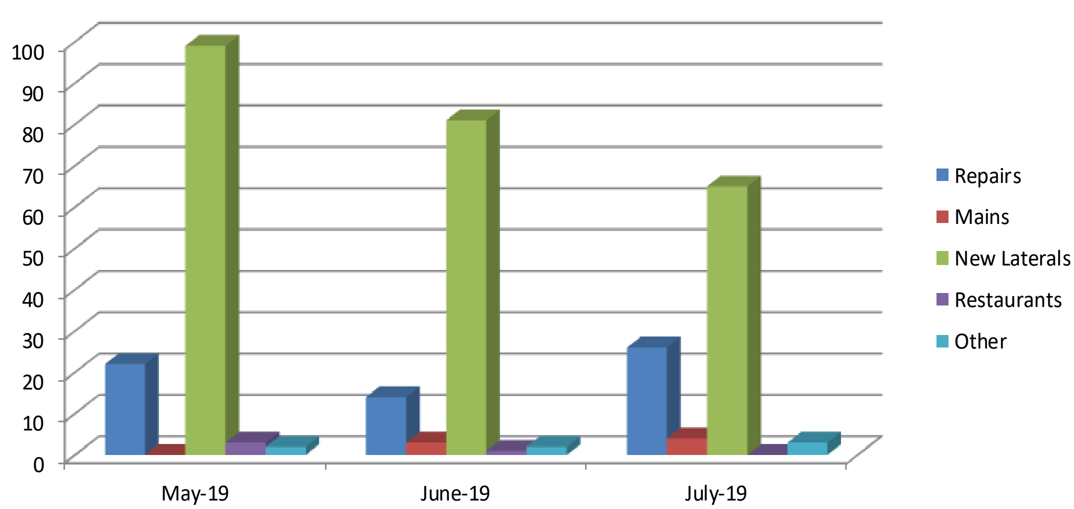
Month	Fremont	Newark	Union City	Total
July-19	13	4	3	**20**
June-19	11	0	3	**14**
May-19	13	2	1	**16**
April-19	11	5	0	**16**
March-19	11	1	2	**14**
February-19	8	1	3	**12**
July-18	*7*	*2*	*4*	*13*
			6-Month Total	**92**



Sewer Permits Issued

Month	Repairs	Mains	New Laterals	Restaurants	Other
July-19	26	4	65	0	3
June-19	14	3	81	1	2
May-19	22	0	99	3	2

New Laterals - New residential lateral connections
Other - Non-residential construction (except restaurants)



Communication

- Social Media posts:
  - July 4 holiday closure
  - Triclosan information
  - BACWA nutrient information
  - Certificate of Achievement from Government Finance Officers Association for CAFR
  - Accounting Tech II recruitment
  - Your toilet is not a trashcan
  - ETSU Program Manager and Assistant Program Manager recruitments
  - Don't flush pet waste
  - Environmental Health and Safety Program Manager recruitment
- Newark Rotary presentation July 16, 2019
- Content development/printing preparation for Fall 2019 newsletter
- Continued activities regarding District Branding initiative
- Uploads to District website:
  - Homeowner Lateral video
  - Ordinance 34.08
  - FY 2020 rate information on Customer Service pages
- Removed outdated documents from District website files
- Participated in Chamber of Commerce Board activities as Director and Past-President

Environmental Compliance

Pollution Prevention/Stormwater Programs

USD's Environmental Compliance (EC) team conducts pollution prevention inspections at restaurants, car wash businesses, and other commercial facilities. EC also conducts inspections and enforcement for the City of Fremont's Environmental Services group. Over 600 Stormwater compliance inspections are conducted every year to ensure that commercial facilities, including restaurants and auto shops, comply with City Ordinance requirements, and do not discharge pollutants to the creeks and bay.

During the past month, the EC team conducted 65 Stormwater (Urban Runoff), and 29 FOG (restaurant) inspections. During this reporting period, Inspectors identified 12 Stormwater and 9 FOG enforcement actions. Five (5) of the Stormwater enforcements resulted in administrative fines ranging from $100 to $500. All the administrative fines were for repeated violations.

Urban Runoff Inspections and Enforcements

July 2019	No. of UR Inspections	VW	WL	NOV	AF	LA	Total Enforcements	No. of Illicit Discharge/s	0
	65	2	0	5	5	0	12	% Enforcement	18%

FOG Inspections and Enforcements

July 2019	No. of FOG Inspections	VW	WL	NOV	AF	LA	Total Enforcements	% Enforcement	31%
	29	4	5	0	0	0	9		

Enforcements:

VW –Verbal Warning *WL – Warning Letter* *NOV – Notices of Violation*
AF – Administrative Fine *LA – Legal Action* *NOD – Notice of Deficiency*
AO – Administrative Order *C&D – Cease & Desist Order* *SNC – Significant Non-Compliance*

Dental Inspections, School Outreach, and Plant Tours

# of Dental Inspections	# of School Outreach Events	# of Plant Tours
6	None	3

Industrial Pretreatment

The Industrial Pretreatment program has pending permits as shown in the table below. USD inspectors are working with each of these companies to establish permitted industrial discharges.

Pending Permits

New Industrial/Groundwater Permits	Groundwater/Temporary
N7K Neuralink- Industrial	DPI Inc. (34760 & 34800 Campus Drive, Fremont)
Silicon Valley RO DI Services-Industrial	
Facebook Commissary- Industrial	

Permits Issued

Company Name	Date Permit Issued
None	

Industrial Permit Closures

Company Name	Date of Closure
None	

Reports (Annual & Semi-Annual Pretreatment Report, Union City Report, etc.)

Report Name	Date Report Completed and Submitted
Semi-Annual Pretreatment Report	July 30, 2019

Enforcement Action

IU Name & Nature of Business	Comments	City	Parameter Violated	Discharge concentration (mg/L)	USD/Fed Limit Violated(mg/L)	Enforce-ment *(1)*
None						

(1) WL – Warning Letter NOV – Notices of Violation AO – Administrative Order
C&D – Cease and Desist Order SNC – Significant Non-Compliance EM – Enforcement Meeting

Other - Training, Special Meetings, Conferences, IAC (topics)

Activity	Date of Event	Attendees
BACWA Executive Meeting	7/19/19	Doug Dattawalker
BAPPG Steering Committee	7/9/19	Doug Dattawalker
MEDS Coalition Meeting	7/10/19	Doug Dattawalker

Engineering/Construction

No. of projects under construction: 2

	Construction Projects	**Capital ($1000)**	**Scheduled Completion**	**Completed Scope**	**Completed Time**	**Comments for July 2019 Activities**
1.	Primary Digester No. 3 Rehabilitation – Derek	$2,410	03/19	100%	100%	Closeout and punch list work in progress.
2.	Sludge Degritter System Project – Kevin	$1,436	10/19	95%	100%	Performance testing and adjustment of the Degritter unit in progress

Design/Study

No. of projects in design/study phase: 18

	Design/Study Projects	Capital ($1000)	Scheduled Completion	Completed Scope	Completed Time	Comments for July 2019 Activities
1.	Alvarado Influent Pump Station Improvements Project – Thomas	$479	05/19	99%	100%	Project advertised on July 9th. Bid opening is scheduled on September 26.
2.	Centrifuge Building Improvements Project – Somporn	$184	06/19	100%	100%	Consultant completed predesign phase work. Staff will review the project scope to include in the final design phase.
3.	Control Box No. 1 Improvements Project – Kevin	$89	1/20	5%	5%	Final design kick-off meeting held on July 31st.
4.	Effluent Management Study – Curtis	$155	03/18	100%	100%	Study completed. Results will be incorporated into the ETSU report.
5.	Emergency Outfall Improvements Project – Andrew	$365	04/19	95%	100%	Consultant worked on 100% specifications. Board authorized GM to execute the lease agreement with the State Lands Commission.
6.	ETSU Plan – Raymond/Curtis	$510	04/19	95%	100%	Draft report submitted on July 29th. Final report to be submitted in August.
7.	Force Main Condition Assessment – Andrew	$121	10/20	60%	67%	Next round of inspection will be scheduled with the next phase of Force Main Corrosion Repairs project.
8.	Force Main Corrosion Repairs Project Phase 3 – Andrew	$60	02/19	75%	85%	Project construction is pending the completion of Force Main relocation project.
9.	Headworks Screens Replacement Project – Thomas	$215	03/19	100%	100%	Bid opening was on July 25th. Bid review is in progress.
10.	Irvington and Newark Odor Control Study - Kevin	$99	12/19	30%	30%	Second round of odor sampling completed.
11.	Newark Basin Masterplan – Andrew	$318	08/19	95%	95%	Consultant shared results of deficiency modeling. Staff to field verify structure elevation for rehabilitation recommendation.

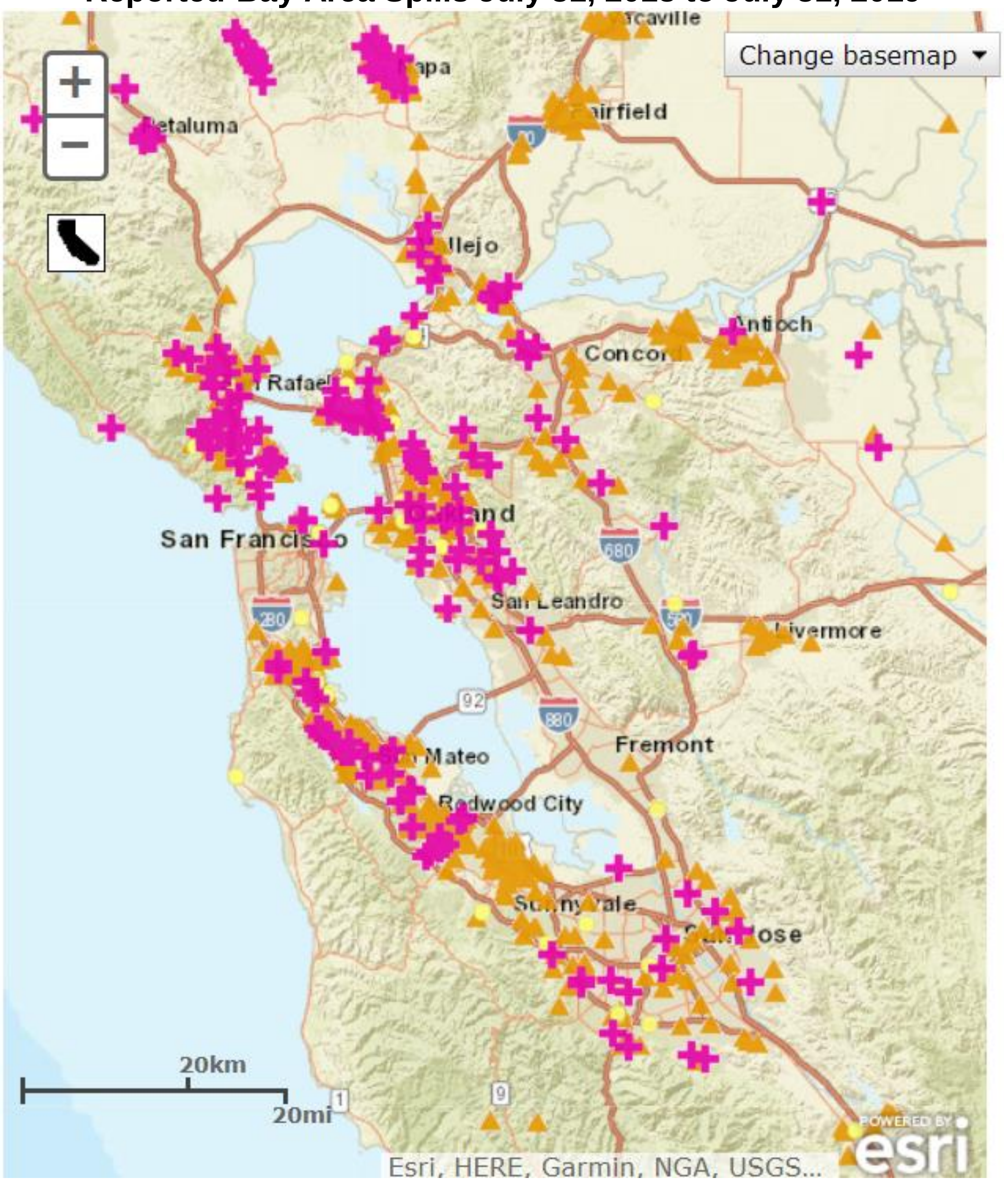
	Design/Study Projects	Capital ($1000)	Scheduled Completion	Completed Scope	Completed Time	Comments for July 2019 Activities
12.	Newark Equalization Storage Facilities Project – Somporn	$347	06/19	85%	100%	Consultant is preparing final Conceptual Design Report with District Comments.
13.	Odor Control Alternatives Study – Kevin	$465	07/19	97%	97%	Review of final odor study report and final Plant Assessment report in progress. BAAQMD emissions update letter being finalized.
14.	Primary Digester No. 2 Rehabilitation Project – Derek	$213	09/19	60%	75%	90% design submittal in progress.
15.	Primary Digester No. 7 Project – Curtis	$1,904	06/19	98%	100%	Project advertised on June 25th. Bid opening was on August 6th.
16.	Secondary Treatment Process Improvements – Curtis	$565	04/19	98%	100%	Revised report submitted on July 18th. Final report to be submitted in August. Results to be incorporated into the ETSU Plan.
17.	Standby Power Generation System Upgrade Project – Raymond/Kevin	$2,019	01/20	50%	60%	Temporary generator testing completed.
18.	WAS Thickener Replacement Project – Curtis	$284	05/19	40%	100%	Consultant and staff continued to work on thickening equipment selection process. Rotary drum thickener pilot test was completed in July.

COLLECTION SERVICES
ACTIVITIES REPORT
July 2019

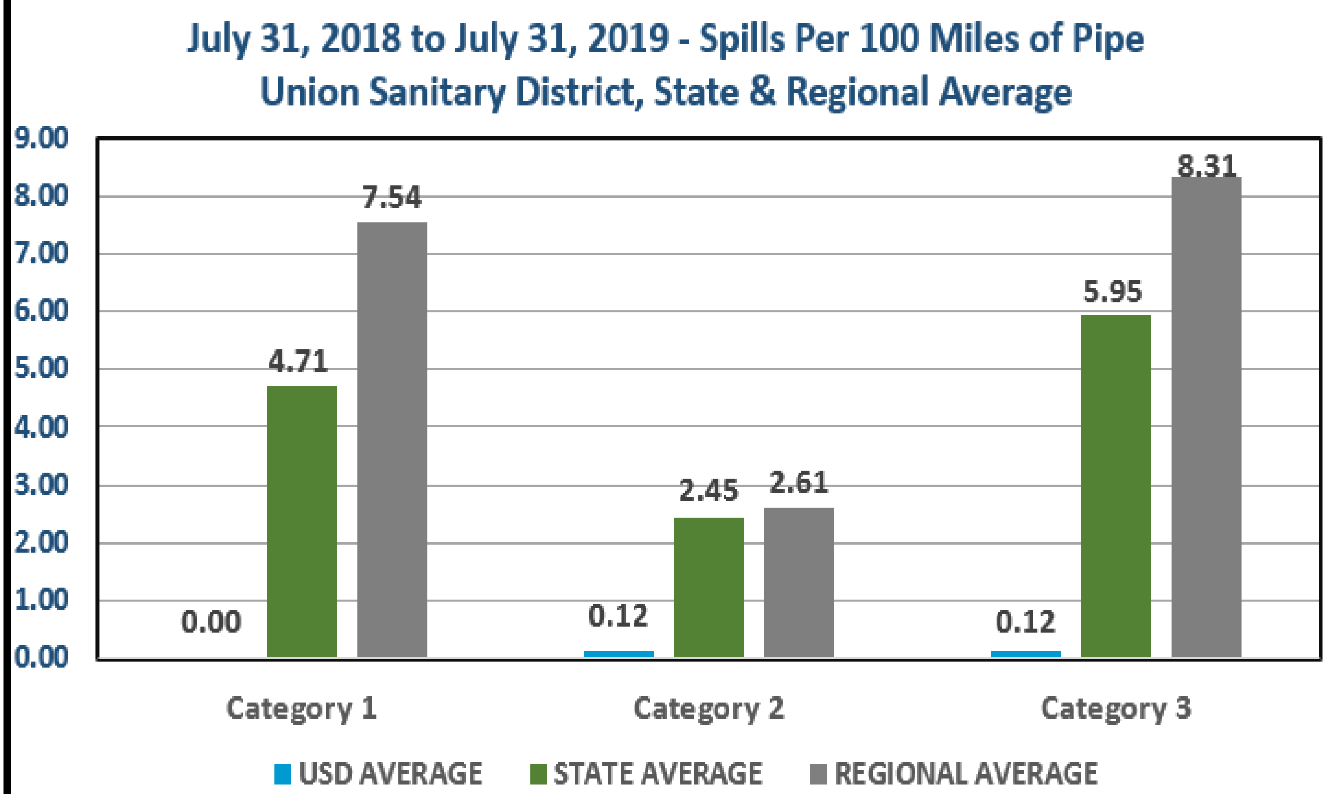
Progress/Accomplishments

- Zero Spills in July.
- Completed 18.8miles of sewer main cleaning in July.
- Completed 6.3 miles of sewer main inspection in July.
- Responded to 21 service request calls in July.
- Completed a total of 26 sewer main repairs in July.
- Safety Recognition Milestone Breakfast
- Trainings
  - Hydro Jet Operation JCR (1employee)
  - CCTV Operation JCR (1employee)

Reported Bay Area Spills July 31, 2018 to July 31, 2019



July 31, 2018 to July 31, 2019 Spills Per 100 Miles of Pipe
Union Sanitary District, State & Regional Average



Spill Rate Statistics - July 31, 2018 to July 31, 2019

Spills per 100 Miles of Pipe

	Category 1	Category 2	Category 3
USD AVERAGE	0.00	0.12	0.12
STATE AVERAGE	4.71	2.45	5.95
REGIONAL AVERAGE	7.54	2.61	8.31

Category 1 - 1,000 gallons or more. Discharges to surface water, not fully captured

Category 2 - 1,000 gallons or more. Does not reach surface waters, not fully captured

Category 3 - 1,000 gallons or less, does not reach surface waters, full captured

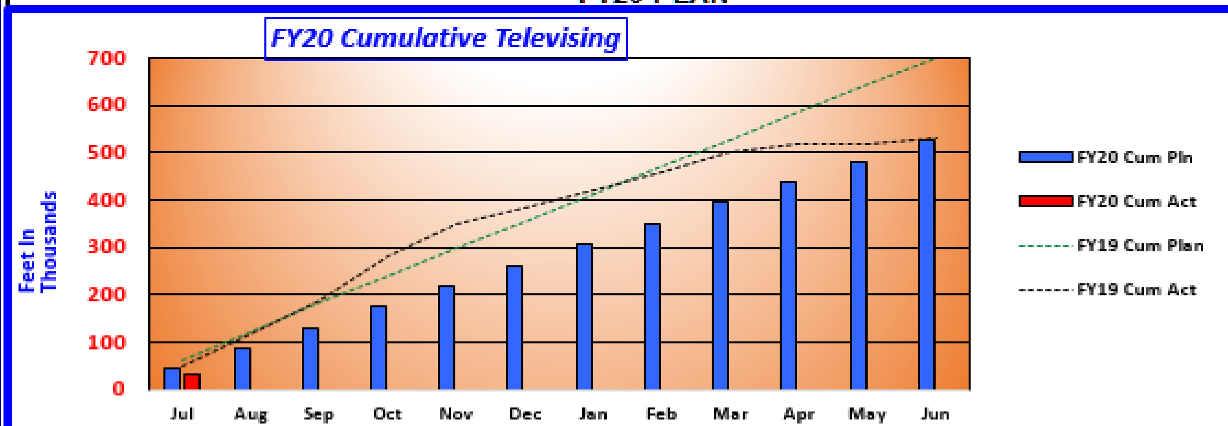
Performance Measures

FY20 PLAN

Cleaning Actual Footages/Costs — July-19 Clean Cost/Ft = $0.91

Description	Jul-19 Footage	FY20 Q1 Footage	FY20 YTD Footage	FY20 YE Goal	FY19 YTD Footage	% Cmpl to Plan
84 Month Hydro-jet Clean	72,508	72,508	72,508	605,190	388,628	12.0%
Selective Line Cleaning	8,315	8,315	8,315	114,574	177,381	7.3%
Special Condition Clean	0	0	0	31,599	31,514	0.0%
Root Control/Chemical Cln	18,573	18,573	18,573	298,028	294,349	6.2%
Cast Iron Proj/Other (not included in Cost Per Foot)	0	0	0	0	0	
Totals	99,396	99,396	99,396	1,049,391	891,872	9.5%

FY20 PLAN

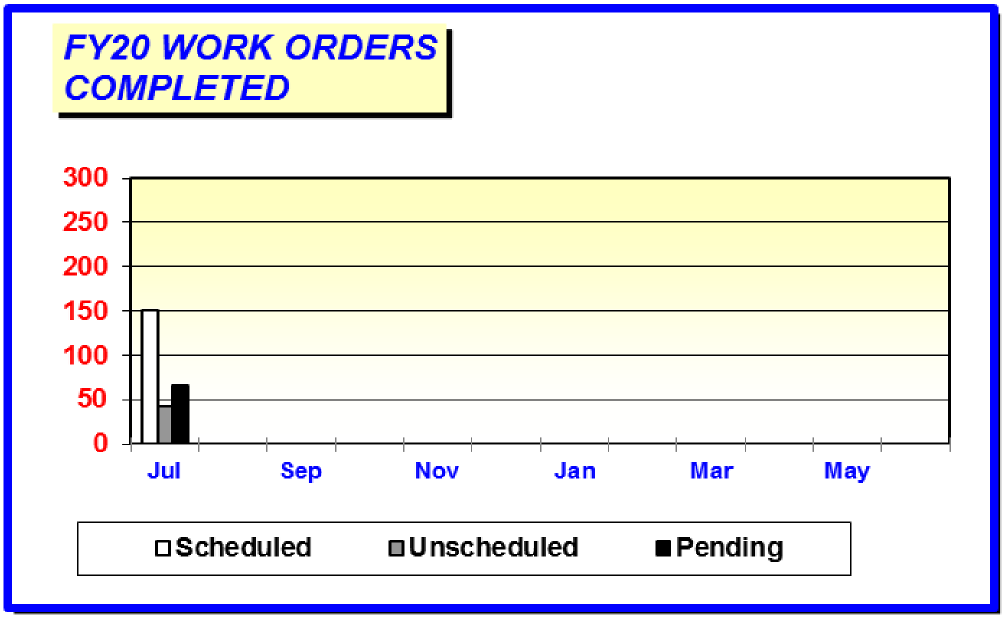


Televising Actual Footages/Costs — July-19 TV Cost/Ft = $0.83

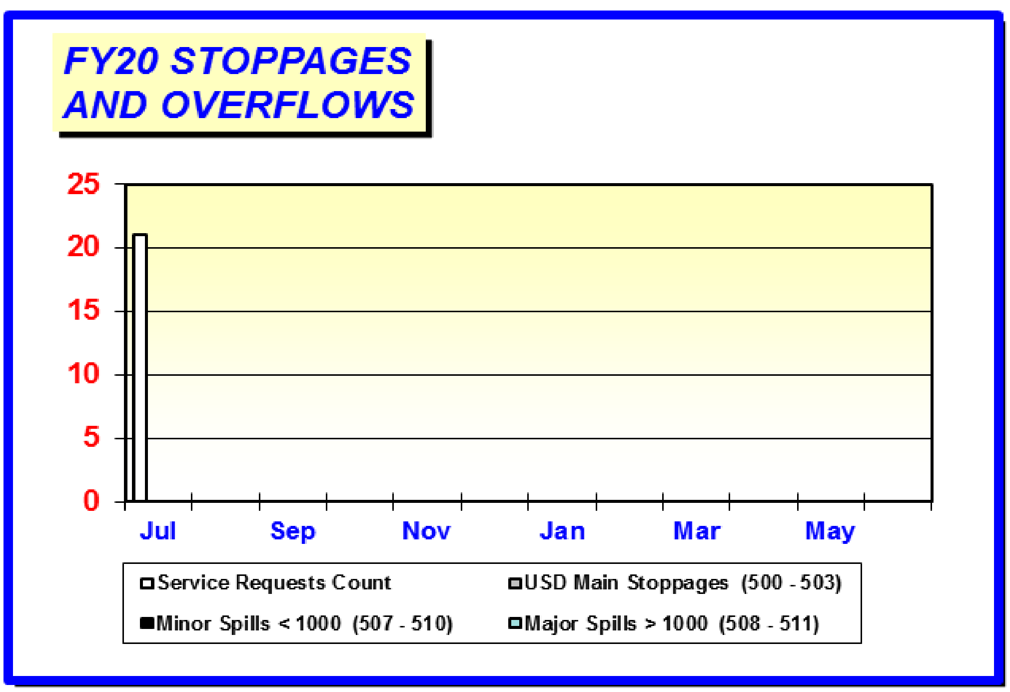
Description	Jul-19 Footage	FY20 Q1 Footage	FY20 YTD Footage	FY20 YE Goal	FY19 YTD Footage	% Cmpl to Plan
84 Month TV Inspection	32,117	32,117	32,117	416,533	432,269	7.7%
Visual/Condition,Pre/Post Cnst TV	917	917	917	23,481	28,651	3.9%
New Development, CIP, Misc.	0	0	0	44,852	46,736	0.0%
QA/QC Line Condition	0	0	0	17,186	7,044	0.0%
QA/QC Root Control	0	0	0	22,352	14,260	0.0%
Totals	33,034	33,034	33,034	524,404	528,960	6.3%

Other Collection Services Status Data:

Support Team Work Order Status:



C/S Maintenance Status:



Fabrication, Maintenance and Construction
Activities Report
July 2019

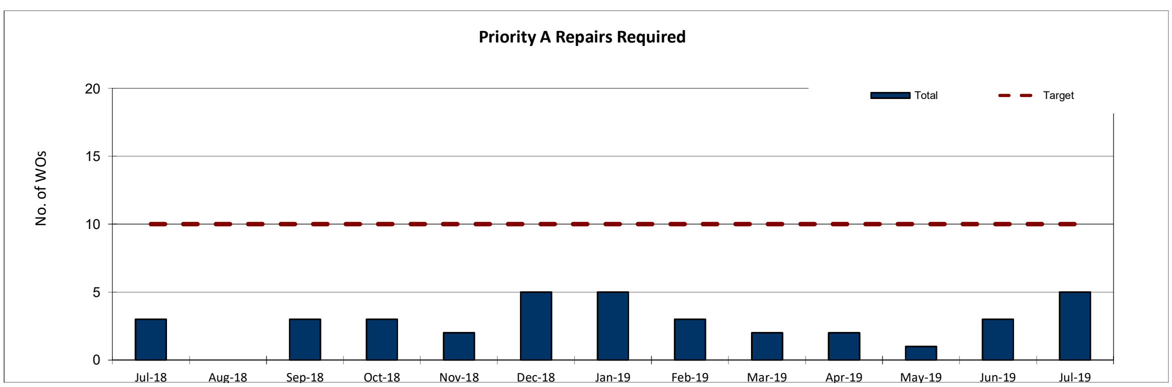
Progress/Accomplishments

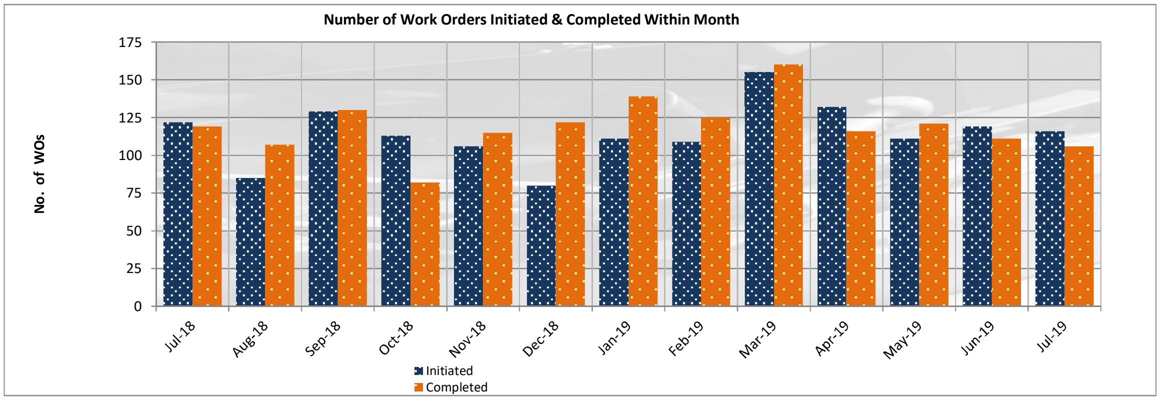
- Completed 98.52% of preventive maintenance activities for the month of July
- Completed 106 corrective maintenance work orders for the month of July
- Replace IPS eyewash piping
- Install new surge buster check valve for Reclaim Pumps 2 & 5
- buildings
- Overhaul of TWAS Pump #2
- Piian Pump upgrade

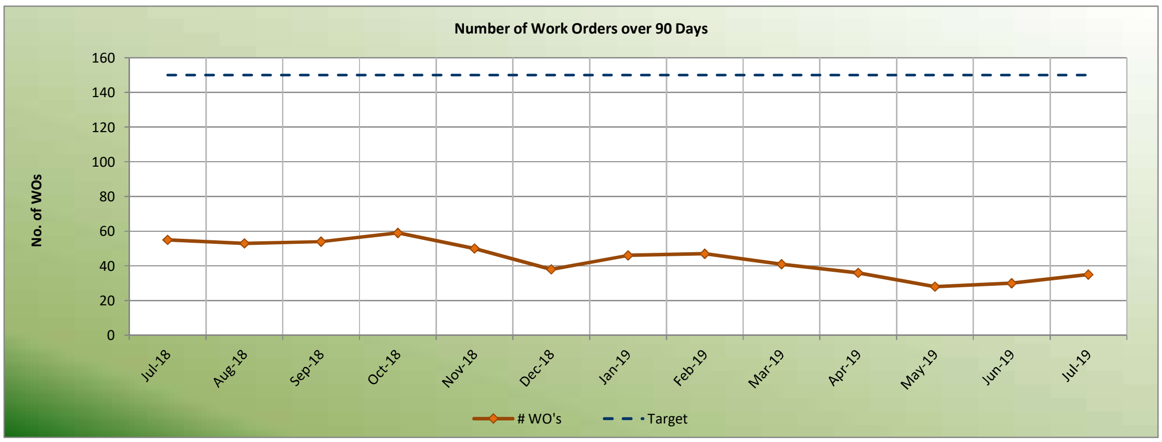
Future Planning

- Install new NPDES sampler
- Painting of IPS Pig launcher
- Design and fabricate new seal water manifold for Mixing Pump 1
- Design and fabricate HDPE fusion piping for hypo to GBT polymer tanks.
- Install ventilation on emergency supply container

Performance Measurements




Number of Work Orders Initiated & Completed Within Month
No. of WOs
175
150
125
100
75
50
25
0
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Initiated
Completed


Number of Work Orders over 90 Days
No. of WOs
160
140
120
100
80
60
40
20
0
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
WO's
Target

Treatment & Disposal
Activities Report
July 2019

Progress/Accomplishments

- Maintained 100% compliance with NPDES permits.
- Completed 99.7% preventive maintenance activities for the month of July.
- Performed site visits at the City of Lodi's Wastewater Treatment Plant, the City of Galt's Wastewater Treatment Plant, and Central Contra Costa Sanitary District to look at alternative dewatered centrifuge cake conveyance system options.
- Performed a Treatment Plant Power Shutdown to test the Treatment Plant's ability to run off of a temporary generator.
- Managed contractors to fully dewater Primary Digester No. 2 in preparation for it's rehabilitation project.
- Met with EBRPD and the Regional Board staff about a bypass for Hayward Marsh emergency maintenance.
- Reviewed Digester 7 and standby boiler draft permit conditions.
- Reviewed Jacobs memorandum to BAAQMD regarding emission factor changes.
- Began Rotary Drum Thickener(RDT) on-site pilot study and associated laboratory work.
- Continued LIMS implementation project. Installed analytical balance and ICP interfaces and
- Completed economic evaluation of the aeration basin acid cleaning project.
- Attended a kick off meeting for recruitment of the R&S Administrative Specialist.
- Attended Water Environment Federation sponsored Nutrient Symposium.
- Completed effluent sampling for PFAS/ PFOA for informational purposes.
- Scheduled sampling for the New Nutrient Watershed Permit that became effective in July 2019.

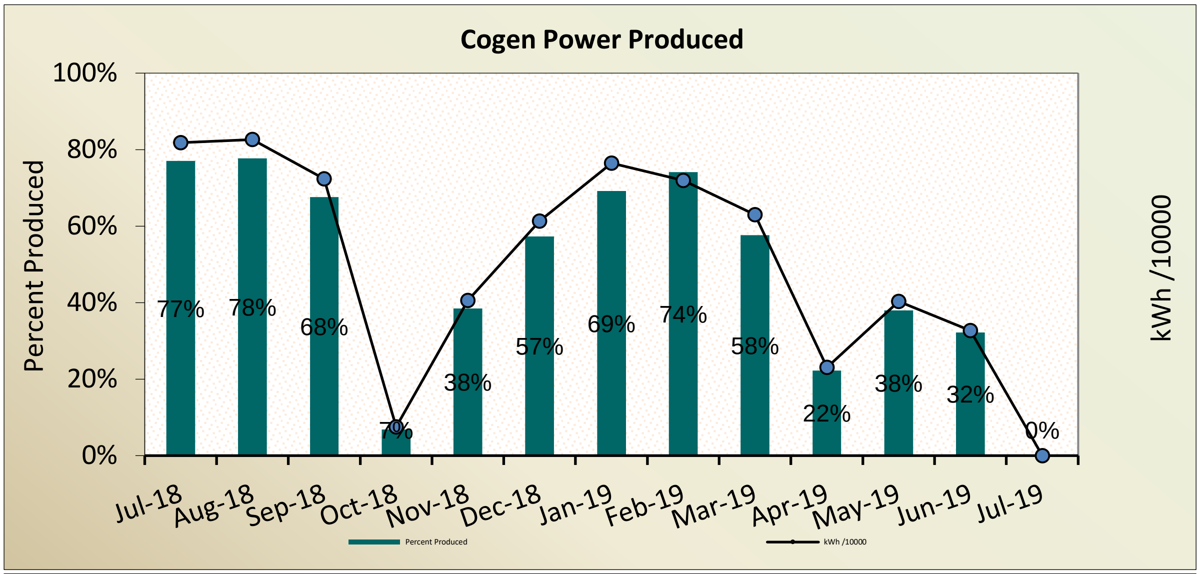
Future Planning

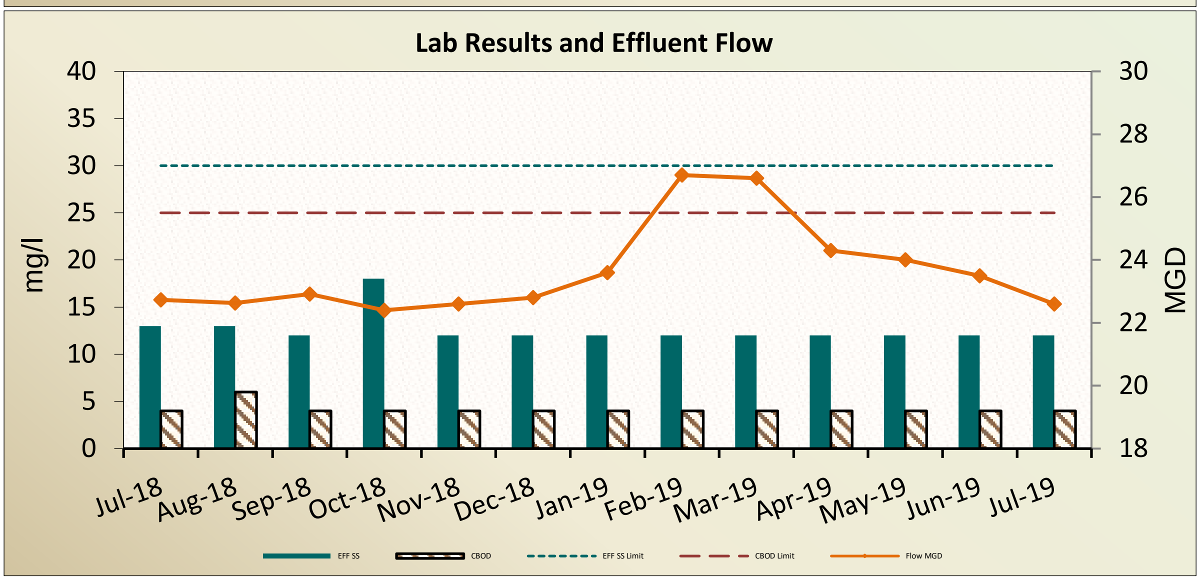
- Evaluate existing and new degritter performance.
- Stop flow to Hayward Marsh and begin operational contingency planning for wet weather.
- Schedule second round of aeration membrane Acid Cleaning project for September. Complete economic evaluation for the first round of cleaning.
- Schedule annual sampling for the Hayward Marsh before the shutdown for emergency maintenance.
- Compete RDT study and associated lab work
- Submit SFEI toxic loading information for the calculation of RMP fees.
- Evaluate a proposal for purchasing third party energy from the Cit of Hayward.
- Complete the recruitment for the R&S Administrative Specialist.
- Draft the Annual Union City Report.
- Meet with BAAQMD if necessary to revise Plant emission factors in advance of AB 617 requirements for the calculation of toxic emission inventory and BAAQMD requirements for HRA.

Other

- Cogen system produced 0% of power consumed for the month of July.

Performance Measurements





USD's Final Effluent Monthly Monitoring Results				
Parameter	**EBDA Limit**	**May-19**	**Jun-19**	**Jul-19**
Copper, µg/l	78	4.2	4.1	3.7
Mercury, µg/l	0.066	0.0022	0.0019	0.0019
Cyanide, µg/l	42	E 1.3	< 0.9	E 0.96
Ammonia- N, mg/L (Range)	130	37.5 - 44.6	39.5 - 43.3	35.4 - 44.0
Fecal Coliform, MPN/100ml (Range)				
• 5-Day Geometric Mean	500	21 - 39	25 - 46	18 - 28
• 11-Sample 90th Percentile	1100	46 - 72	72 - 75	40 - 77
Enterococci				
• Monthly Geometric Mean	240	11.9	16.8	12.5
E = Estimated value, concentration outside calibration range. For SIP, E = DNQ, estimated concentration.				

AUGUST 26, 2019
BOARD OF DIRECTORS MEETING
AGENDA ITEM # 10

TITLE: **Rescind Policy No. 2040, Exceptions to Ordinance Fees** ***(This is a Motion Item)***

SUBMITTED: Paul R. Eldredge, General Manager/District Engineer
Karen W. Murphy, General Counsel

Recommendation

Rescind Policy No. 2040, Exceptions to Ordinance Fees

Previous Board Action

03/09/2009 Board Meeting – Approval of revised Policy No. 2040 (originally approved in 1990 and again in 2001)

04/14/2014 Board Meeting – Approval of revised Policy No. 2040

04/22/19 Board Meeting – Direct staff to bring back an item rescinding Policy No. 2040 after revisions to Ordinance No. 34 are considered

07/22/19 Board meeting – Approval of Ordinance 34.08

Background

Policy No. 2040, Exceptions to Ordinance Fees, has been in place since 1990 and provides direction on how District staff should address protests and appeals related to the following four ordinances:

1. Ordinance No. 31 – Sewer Service Charge
2. Ordinance No. 34 – Plan Check, Processing, Inspection and Study Fees

3. Ordinance No. 35 – Capacity Fees
4. Ordinance No. 36 – Industrial Permit, Reporting and Monitoring Fees

Policy No. 2040 provides that protests or appeals are to be directed to the General Manager, who will review them with legal counsel and the Board of Directors and make a recommendation to the Board. The policy further provides that the final decision shall be made by the Board.

At the April 22, 2019, Board meeting, staff noted that three of the four ordinances already provided their own appeal process, which is different from, and would supersede, the language in Policy No. 2040. Ordinances No. 31, 35, and 36 all set forth an appeal process where appeals are first considered by the General Manager/District Engineer or District staff, and then may be further appealed to the Board of Directors. This appeal process is fairly standard as it provides a two-step process by which appeals are first addressed at the staff level, with the ability to appeal further to the Board if necessary. Ordinance No. 34 did not include an appeals provision at that time, but has since been amended to include a similar appeals provision.

In order to simplify and ensure consistent procedures, at the meeting on April 22, 2019, the Board directed staff to bring back an item rescinding Policy No. 2040 after revisions to Ordinance No. 34 are considered. Since Ordinance No. 34.08 has now been amended to include an appeals provision, staff is recommending rescission of Policy No. 2040.

Attachments: Policy 2040

Effective: 4/14/2014	**Exceptions to Ordinance Fees**	Policy Number 2040 Page 1 of 2

Policy

Union Sanitary District grants no exceptions to fees established in its ordinances. The Board of Directors will have the final decision on any variance.

Purpose

To set forth a uniform "no exceptions to fees" statement that provides direction to staff and is uniform for all rate payers.

Procedure

Fee ordinances are:

Ordinance	Title	Use of Revenues
31	Sewer Service Charge	Annual operating costs; renewal and replacement of District equipment; Construction of capital improvement projects
34	Plan Check and Processing Fee; Inspection Fee; Study Fee	Fully or partially fund cost of service
36	Industrial Permit, Reporting and Monitoring Fees	Fund portions of the Environmental Compliance Program cost of service
35	Capacity Fees	Construction of capacity related capital improvement projects and associated study and design services

Management Responsibility

District staff is to apply the fees as set forth in the ordinances. Any protests or appeals relating to fees identified in any ordinance are to be directed to the General Manager. The General Manager will review with legal counsel and the Board of Directors and make recommendations to the Board on any proposed variance. The Board will have the final decision on any variance.

This revision supersedes the versions listed below, which are no longer effective.

Title	Policy #	Effective Date
Exceptions to Ordinance Fees	**4540**	**11/90**
Exceptions to Ordinance Fees	**4540**	**12/00**
Exceptions to Ordinance Fees	**4540**	**3/10/09**

Approved by:	Board of Directors
Author/owner:	General Manager
Reviewers:	General Manager, Legal Counsel
Notify Person:	General Manager
Revision frequency:	Every 5 years
Next Review:	April 2019

AUGUST 26, 2019
BOARD OF DIRECTORS MEETING
AGENDA ITEM # 11

TITLE: **Authorize the General Manager to Execute an Agreement and Task Order No. 1 with Carollo Engineers, Inc. for the Plant Network Architecture Study *(This is a Motion Item)***

SUBMITTED: Paul R. Eldredge, General Manager/District Engineer
Sami E. Ghossain, Technical Services Work Group Manager
Raymond Chau, CIP Team Coach
Somporn Boonsalat, Associate Engineer

Recommendation

Staff recommends the Board authorize the General Manager to execute an Agreement and Task Order No. 1 with Carollo Engineers, Inc. (Carollo) in the amount of $99,955 for the Plant Network Architecture Study (Study).

Previous Board Action

None.

Background

The District's Alvarado Wastewater Treatment Plant (WWTP) has an existing information network system that was originally built in 1986 and has been expanded over the past 30 years to accommodate new construction. The plant network system allows information to be transferred from anywhere on the network to the supervisory control and data acquisition system (SCADA) located in the plant operations control room.

The plant network system's architecture consists of fiber cables that are installed in underground ductbanks and pull boxes and connected to network switches located at each WWTP process area. Control devices, such as programmable logic controllers (PLCs), receive information from equipment and field instruments and transmit it to other PLCs and SCADA through the network switches and fiber cables. Staff uses the plant network system to monitor and adjust various treatment processes to ensure the WWTP is operating without problems and stays in permit compliance. See Figure 1 for the site plan that shows the location of the PLCs and other control devices.

The plant network system was originally configured as a ring network. However, the expansion of the network over the past 30 years has significantly modified the network and reduced its resilience to provide uninterrupted communication.

A ring network is a network of control devices where each control device is connected to two other control devices and to the fiber network. The main advantage of a ring network is the ability to keep a control device connected to the fiber network if the connection to one of the other control devices or the fiber network is severed. The disadvantage of the current ring network is that parts of the existing underground infrastructure limit the fiber cables connecting the control devices and to the fiber network to be routed through one conduit. If the conduit and fiber cables are damaged, it would take one or more control devices offline and create a gap in the plant network system, thus reducing its resilience.

The 2015 SCADA Master Plan recommended a project to evaluate the plant network system to improve network resilience and performance to meet existing and future WWTP needs. The upcoming Enhanced Treatment & Site Upgrade (ETSU) Program will upgrade significant portions of the WWTP, so this is a good opportunity to conduct the Study and provide recommendations that will be incorporated into the projects of the ETSU Program.

<u>Task Order No. 1</u>

Through a Request for Proposal process, staff selected Carollo for the Study due to their knowledge of the District's infrastructure and their staff's experience with similar network system evaluations. Carollo's scope of services includes the following tasks:

1. Assess the existing plant network system's configuration and architecture.
2. Develop alternatives to improve the resilience and redundancy of the plant network system that will accommodate future WWTP upgrades.
3. Provide life cycle cost estimate for each alternative.
4. Assess potential underground electrical infrastructure expansion where expansion of the communication infrastructure will be considered.
5. Develop a plan of capital improvement projects to expand the underground infrastructure and a schedule of implementation.

Carollo's fee for Task Order No. 1 is summarized below:

Task No.	Task Description	Fee
1	Project Management and Meetings	$9,362
2	Existing Network Analysis	$40,171
3	Network Architecture Study	$50,422
Task Order Not-to-Exceed Fee		**$99,955**

Staff believes the proposed fee is reasonable for this level of effort.

Staff anticipates Carollo will complete the Study by spring 2020.

Staff recommends the Board authorize the General Manager to execute an Agreement and Task Order No. 1 with Carollo Engineers, Inc. in the amount of $99,955 for the Plant Network Architecture Study.

PRE/SEG/RC/SB:mb

Attachments: Figure 1 – WWTP Site Plan
Agreement
Task Order No. 1


FIGURE - 1
CONTROL DEVICE:
- PLC
- REMOTE BASE CONTROLLER (RBC)
- REMOTE INPUT/OUTPUT (RIO) MODULE
North
Primary Digester #6
H/M #4
PLC-20
Covered Vehicle Storage
CS Trailer
Solar Carport
Cogen
PLC-41 & 43
PLC-42
Pri Dig #5
Pri Dig #4
H/M 3
PLC-25
Generator Bldg #2
Centrifuge Bldg
PLC-31, 32, 33, 34, 35 & 36
PLC-16
Odor Control Bldg
Sub 2
Sec Dig #1
Thick 3
Thick 1
PLC-44
Paint Shop
Pri Dig #3
H/M 2
Generator Bldg #1
PLC-24
Thick Bldg
Sec Dig #2
Thick 4
Thick 2
PLC-45
H/M 1
Generator Bldg #3
Maintenance Shop
Field Operations Bldg
Veasy Street
RIO-15
Degritter Bldg
PLC-07 & 7A
WAS Thick Bldg
Sub 1
PLC-39
Pri Dig #2
Pri Dig #1
PLC-23
Surge Tower
Site Waste PS
PLC-22 &46
PLC-48
PLC-21
Headworks
PLC-03 & 03A
RBC-02
EBDA PS
Control Bldg
PLC-99
PLANT OPERATIONS CONTROL ROOM
Lift Station #2
RIO-09
Primary Clarifiers 1 - 4
PLC-8A
Aeration Basins 5 - 7
Secondary Clarifiers 1 - 4
RIO-05
CB3
CB 1
CB 2
Chlorine Contact Tank
PLC-98
Administration Bldg
RIO-12 & PLC-47
PLC-13
PLC-40
RIO-11
Primary Clarifiers 5 - 6
Aeration Basins 1 - 4
Lift Station #1
Secondary Clarifiers 5 - 6
CB4
Alvarado PS
PLC-10
Benson Road

PLANT NETWORK ARCHITECTURE STUDY

AGREEMENT

BETWEEN

UNION SANITARY DISTRICT

AND

CAROLLO ENGINEERS, INC.

FOR

PROFESSIONAL SERVICES

THIS IS AN AGREEMENT MADE AS OF ___________________, 2019, BETWEEN UNION SANITARY DISTRICT (hereinafter referred to as District), and CAROLLO ENGINEERS, INC. (hereinafter referred to as Engineer).

WITNESSETH:

WHEREAS, District intends to complete the Plant Network Architecture Study (hereinafter referred to as Project), and,

WHEREAS, District requires certain professional services in connection with the Project (hereinafter referred as Services); and

WHEREAS, Engineer is qualified and prepared to provide such Services;

NOW, THEREFORE, in consideration of the promises contained herein, the parties agree as follows:

ARTICLE 1 - SERVICES TO BE PERFORMED BY ENGINEER

1.1 Specific Services and the associated scope of services, payment, schedule, and personnel will be defined in specific Task Order as mutually agreed by District and Engineer.

1.2 All Task Orders will by reference incorporate the terms and conditions of this Agreement, and become formal amendments hereto.

ARTICLE 2 - COMPENSATION

2.1 Compensation for consulting services performed under this Agreement shall include:

(1) Direct labor costs, multiplied by an agreed upon fixed factor (the Multiplier), to compensate for fringe benefits, indirect costs, and profit.

(2) Non-labor direct project charge not included in the fixed factor and acceptable, without any markup.

(3) Subconsultant costs, with a maximum markup of 5%.

Definitions are as follows:

(a) Direct labor is salaries and wages paid to personnel for time directly chargeable to the project. Direct labor does not include the cost of Engineer’s statutory and customary benefits, such as sick leave, holidays, vacations, and medical and retirement benefits nor the cost of the time of executive and administrative personnel and others whose time is not identifiable to the project.

(b) Fringe benefits include Engineer’s statutory and customary benefits, such as sick leave, holidays, vacations, medical and retirement benefits, incentive pay, tuition, and other costs classified as employee benefits.

(c) Indirect costs are allocations of costs that are not directly chargeable to a specific engagement and are commonly referred to as Engineer’s overhead. Indirect costs include provisions for such things as clerical support, office space, light and heat, insurance, statutory and customary employee benefits, and the time of executive and administrative personnel and others whose time is not identifiable to the Project or to any other project. Under no circumstances can the same labor costs be charged as direct labor and also appear at the same time as indirect costs, and vice versa.

(d) The Multiplier is a multiplicative factor which is applied to direct labor costs, and compensates Engineer for fringe benefits and indirect costs (overhead) and profit.

(e) Other non-labor direct project charges shall be included in the overhead and these charges include typical expenses as cost of transportation and subsistence, printing and reproduction, computer time and programming costs, identifiable supplies, outside consultant’s charges, subcontracts, and charges by reviewing authorities.”

Alternatively, the District and the Engineer may agree to utilize the fully-encumbered hourly rates and fees for Services performed by the Engineer. These hourly rates and fees shall be based on the Engineer's rate schedule published at the time this Agreement or Task Order is executed and shall be attached to each applicable Task Order.

2.2 Reimbursement for mileage shall not exceed the prevailing Internal Revenue Service's standard mileage rate.

2.3 A *Cost Ceiling* will be established for each Task Order which is based upon estimated labor-hours and cost estimates. Costs as described above, comprising direct labor, overhead cost, and other direct costs, shall be payable up to a Cost Ceiling as specified in the Task Order. A *Maximum Fee Ceiling,* or *Task Order Firm Ceiling*, will also be established for each Task Order which includes the Cost Ceiling plus the Professional Fee.

2.4 Engineer shall invoice District monthly for the actual costs incurred, and a pro-rated portion of the Professional Fee for work performed during the previous month. If the Maximum Fee Ceiling is reached, the Engineer will complete the agreed-upon work for the Maximum Fee Ceiling. With District staff approval, labor hours may be reallocated within the tasks without renegotiation in such a manner so as not to exceed the Maximum Fee Ceiling.

2.5 The Engineer shall provide the District with a review of the budget amounts when 75 percent of the Cost Ceiling for any task has been expended. Engineer may request a revision in the Cost Ceiling for performance of this Agreement, and will relate the rationale for the revision to the specific basis of estimate as defined in the Scope of Services. Such notification will be submitted to the District at the earliest possible date. The authorized Cost Ceiling shall not be exceeded without written approval of the District.

2.6 The Professional Fee will not be changed except in the case of a written amendment to the Agreement which alters the Scope of Services. District and Engineer agree to negotiate an increase or decrease in Cost Ceiling and Professional Fee for any change in Scope of Services required at any time during the term of this Agreement. Engineer will not commence work on the altered Scope of Services until authorized by District.

2.7 Direct labor rates are subject to revision to coincide with Engineer's normal salary review schedule. Adjustments in direct labor rates shall not affect the firm ceiling without prior written authorization of the District.

2.8 District shall pay Engineer in accordance with each Task Order for Services.

2.9 Engineer shall submit monthly statements for Services rendered. District will make prompt monthly payments in response to Engineer's monthly statements.

ARTICLE 3 - PERIOD OF SERVICE

3.1 Engineer's services will be performed and the specified services rendered and deliverables submitted within the time period or by the date stipulated in each Task Order.

3.2 Engineer's services under this Agreement will be considered complete when the services are rendered and/or final deliverable is submitted and accepted by District.

3.3 If any time period within or date by which any of the Engineer's services are to be completed is exceeded through no fault of Engineer, all rates, measures and amounts of compensation and the time for completion of performance shall be subject to equitable adjustment.

ARTICLE 4 - DISTRICT'S RESPONSIBILITIES

District will do the following in a timely manner so as not to delay the services of Engineer.

4.1 Provide all criteria and full information as to District's requirements for the services assignment and designate in writing a person with authority to act on District's behalf on all matters concerning the Engineer's services.

4.2 Furnish to Engineer all existing studies, reports and other available data pertinent to the Engineer's services, obtain or authorize Engineer to obtain or provide additional reports and data as required, and furnish to Engineer services of others required for the performance of Engineer's services hereunder, and Engineer shall be entitled to use and rely upon all such information and services provided by District or others in performing Engineer's services under this Agreement.

4.3 Arrange for access to and make all provisions for Engineer to enter upon public and private property as required for Engineer to perform services hereunder.

4.4 Perform such other functions as are indicated in each Task Order related to duties of District.

4.5 Bear all costs incident to compliance with the requirements of this Section.

ARTICLE 5 - STANDARD OF CARE

5.1 Engineer shall exercise the same degree of care, skill, and diligence in the performance of the Services as is ordinarily provided by a professional Engineer under similar circumstance and Engineer shall, at no cost to District, re-perform services which fail to satisfy the foregoing standard of care.

ARTICLE 6 - OPINIONS OF COST AND SCHEDULE

6.1 Since Engineer has no control over the cost of labor, materials, equipment or services furnished by others, or over contractors', subcontractors' , or vendors' methods of determining prices, or over competitive bidding or market conditions or economic conditions, Engineer's cost estimate and economic analysis shall be made on the basis of qualification and experience as a professional engineer.

6.2 Since Engineer has no control over the resources provided by others to meet contract schedules, Engineer's forecast schedules shall be made on the basis of qualification and experience as a professional Engineer.

6.3 Engineer cannot and does not guarantee that proposals, bids or actual project costs will not vary from his cost estimates or that actual schedules will not vary from his forecast schedules.

ARTICLE 7 - SUBCONTRACTING

7.1 No subcontract shall be awarded by Engineer until prior written approval is obtained from the District.

ARTICLE 8 - ENGINEER-ASSIGNED PERSONNEL

8.1 Engineer shall designate in writing an individual to have immediate responsibility for the performance of the services and for all matters relating to performance under this Agreement. Key personnel to be assigned by Engineer will be stipulated in each Task Order. Substitution of any assigned person shall require the prior written approval of the District, which shall not be unreasonably withheld. If the District determines that a proposed substitution is not responsible or qualified to perform the services then, at the request of the District, Engineer shall substitute a qualified and responsible person.

ARTICLE 9 - OWNERSHIP OF DOCUMENTS

9.1 All work products, drawings, data, reports, files, estimate and other such information and materials (except proprietary computer programs, including source codes purchased or developed with Engineer monies) as may be accumulated by Engineer to complete services under this Agreement shall be owned by the District.

9.2 Engineer shall retain custody of all project data and documents other than deliverables specified in each Task Order, but shall make access thereto available to the District at all reasonable times the District may request. District may make and retain copies for information and reference.

9.3 All deliverables and other information prepared by Engineer pursuant to this Agreement are instruments of service in respect to this project. They are not intended or represented to be suitable for reuse by District or others on extensions of this Project or on any other project. Any reuse without written verification or adaptation by Engineer for the specific purpose intended will be at District's sole risk and without liability or legal exposure to Engineer; and District shall indemnify and hold harmless Engineer against all claims, damages, losses, and expenses including attorney's fees arising out of or resulting from such reuse. Any such verification or adaptation will entitle Engineer to further compensation at rates to be agreed upon by District and Engineer.

ARTICLE 10 - RECORDS OF LABOR AND COSTS

10.1 Engineer shall maintain for all Task Orders, records of all labor and costs used in claims for compensation under this Agreement. Records shall mean a contemporaneous record of time for personnel; a methodology and calculation of the Multiplier for fringe benefits and indirect costs; and invoices, time sheets, or other factors used as a basis for determining other non-labor Project charges. These records must be made available to the District upon reasonable notice of no more than 48 hours during the period of the performance of this Agreement.

10.2 After delivery of Services (completion of Task Orders) under this Agreement, the Engineer's records of all costs used in claims for compensation under this Agreement shall be available to District's accountants and auditors for inspection and verification. These records will be maintained by Engineer and made reasonably accessible to the District for a period of three (3) years after completion of Task Orders under this Agreement.

10.3 Engineer agrees to cooperate and provide any and all information concerning the Project costs which are a factor in determining compensation under this Agreement as requested by the District or any public agency which has any part in providing financing for, or authority over, the Services which are provided under the Agreement.

10.4 Failure to provide documentation or substantiation of all Project costs used as a factor in compensation paid under Article 2 hereof will be grounds for District to refuse payment of any statement submitted by the Engineer and for a back charge for any District funds, including interest from payment; or grant, matching, or other funds from agencies assisting District in financing the Services specified in this Agreement.

ARTICLE 11 - INSURANCE

Engineer shall provide and maintain at all times during the performance of the Agreement the following insurances:

11.1 Workers' Compensation and Employer's Liability Insurance for protection of Engineer's employees as required by law and as will protect Engineer from loss or damage because of personal injuries, including death to any of his employees.

11.2 Comprehensive Automobile Liability Insurance. Engineer agrees to carry a Comprehensive Automobile Liability Policy providing bodily injury liability. This policy shall protect Engineer against all liability arising out of the use of owned or leased automobiles both passenger and commercial. Automobiles, trucks, and other vehicles and equipment (owned, not owned, or hired, licensed or unlicensed for road use) shall be covered under this policy. Limits of liability for Comprehensive Automobile Liability Insurance shall not be less than $1,000,000 Combined Single Limit.

11.3 Comprehensive General Liability Insurance as will protect Engineer and District from any and all claims for damages or personal injuries, including death, which may be suffered by persons, or for damages to or destruction to the property of others, which may arise from the

Engineer's operations under this Agreement, which insurance shall name the District as additional insured. Said insurance shall provide a minimum of $1,000,000 Combined Single Limit coverage for personal injury, bodily injury, and property damage for each occurrence and aggregate. Such insurance will insure Engineer and District from any and all claims arising from the following:

1. Personal injury;
2. Bodily injury;
3. Property damage;
4. Broad form property damage;
5. Independent contractors;
6. Blanket contractual liability.

11.4 Engineer shall maintain a policy of professional liability insurance, protecting it against claims arising out of negligent acts, errors, or omissions of Engineer pursuant to this Agreement, in an amount of not less than $1,000,000. The said policy shall cover the indemnity provisions under this Agreement.

11.5 Engineer agrees to maintain such insurance at Engineer's expense in full force and effect in a company or companies satisfactory to the District. All coverage shall remain in effect until completion of the Project.

11.6 Engineer will furnish the District with certificates of insurance and endorsements issued by Engineer's insurance carrier and countersigned by an authorized agent or representative of the insurance company. The certificates shall show that the insurance will not be cancelled without at least thirty (30) days' prior written notice to the District. The certificates for liability insurance will show that liability assumed under this Agreement is included. The endorsements will show the District as an additional insured on Engineer’s insurance policies for the coverage required in Article 11 for services performed under this Agreement, except for workers’ compensation and professional liability insurance.

11.7 Waiver of Subrogation: Engineer hereby agrees to waive subrogation which any insurer of Engineer may acquire from Engineer by virtue of the payment of any loss. Engineer agrees to obtain any endorsement that may be necessary to effect this waiver of subrogation.

The Workers’ Compensation policy shall be endorsed with a waiver of subrogation in favor of the District for all work performed by the Engineer, its employees, agents and subconsultants.

ARTICLE 12 - LIABILITY AND INDEMNIFICATION

12.1 Having considered the risks and potential liabilities that may exist during the performance of the Services, and in consideration of the promises included herein, District and Engineer agree to allocate such liabilities in accordance with this Article 12. Words and phrases used in this Article shall be interpreted in accordance with customary insurance industry usage and practice.

12.2 Engineer shall indemnify and save harmless the District and all of their agents, officers, and employees from and against all claims, demands, or causes of action of every name or nature to the extent caused by the negligent error, omission, or act of Engineer, its agents, servants, or employees in the performance of its services under this Agreement. In no event shall Engineer's costs to defend the District exceed the Engineer's proportionate percentage of negligence or fault, based upon a final judicial determination, except that if one or more defendants in an action are unable to pay its share of defense costs due to bankruptcy or dissolution, Engineer shall meet and confer with the other defendant parties regarding defense costs.

12.3 In the event an action for damages is filed in which negligence is alleged on the part of District and Engineer, Engineer agrees to defend District. In the event District accepts Engineer's defense, District agrees to indemnify and reimburse Engineer on a pro rata basis for all expenses of defense and any judgment or amount paid by Engineer in resolution of such claim. Such pro rata share shall be based upon a final judicial determination of proportionate negligence or, in the absence of such determination, by mutual agreement.

12.4 Engineer shall indemnify District against legal liability for damages arising out of claims by Engineer's employees. District shall indemnify Engineer against legal liability for damages arising out of claims by District's employees.

12.5 Indemnity provisions will be incorporated into all Project contractual arrangements entered into by District and will protect District and Engineer to the same extent.

12.6 Upon completion of all services, obligations and duties provided for in the Agreement, or in the event of termination of this Agreement for any reason, the terms and conditions of this Article shall survive.

12.7 To the maximum extent permitted by law, Engineer's liability for District's damage will not exceed the aggregate compensation received by Engineer under this Agreement or the maximum amount of professional liability insurance available at the time of any settlement or judgment, which ever is greater.

ARTICLE 13 - INDEPENDENT CONTRACTOR

Engineer undertakes performance of the Services as an independent contractor and shall be wholly responsible for the methods of performance. District will have no right to supervise the methods used, but District will have the right to observe such performance. Engineer shall work closely with District in performing Services under this Agreement.

ARTICLE 14 - COMPLIANCE WITH LAWS

In performance of the Services, Engineer will comply with applicable regulatory requirements including federal, state, and local laws, rules, regulations, orders, codes, criteria and standards. Engineer shall procure the permits, certificates, and licenses necessary to allow Engineer to perform the Services. Engineer shall not be responsible for procuring permits, certificates, and licenses required for any construction unless such responsibilities are specifically assigned to Engineer in Task Order.

ARTICLE 15 - NONDISCLOSURE OF PROPRIETARY INFORMATION

Engineer shall consider all information provided by District and all drawings, reports, studies, design calculations, specifications, and other documents resulting from the Engineer's performance of the Services to be proprietary unless such information is available from public sources. Engineer shall not publish or disclose proprietary information for any purpose other than the performance of the Services without the prior written authorization of District or in response to legal process.

ARTICLE 16 - TERMINATION OF CONTRACT

16.1 The obligation to continue Services under this Agreement may be terminated by either party upon seven days written notice in the event of substantial failure by the other party to perform in accordance with the terms hereof through no fault of the terminating party.

16.2 District shall have the right to terminate this Agreement or suspend performance thereof for District's convenience upon written notice to Engineer, and Engineer shall terminate or suspend performance of Services on a schedule acceptable to District. In the event of termination or suspension for District's convenience, District will pay Engineer for all services performed and costs incurred including termination or suspension expenses. Upon restart of a suspended project, equitable adjustment shall be made to Engineer's compensation.

ARTICLE 17 - UNCONTROLLABLE FORCES

17.1 Neither District nor Engineer shall be considered to be in default of this Agreement if delays in or failure of performance shall be due to uncontrollable forces, the effect of which, by the exercise of reasonable diligence, the nonperforming party could not avoid. The term "uncontrollable forces" shall mean any event which results in the prevention or delay of performance by a party of its obligations under this Agreement and which is beyond the control of the nonperforming party. It includes, but is not limited to, fire, flood, earthquake, storms, lightening, epidemic, war, riot, civil disturbance, sabotage, inability to procure permits, licenses, or authorizations from any state, local, or federal agency or person for any of the supplies, materials, accesses, or services required to be provided by either District or Engineer under this Agreement, strikes, work slowdowns or other labor disturbances, and judicial restraint.

17.2 Neither party shall, however, be excused from performance if nonperformance is due to uncontrollable forces which are removable or remediable, and which the nonperforming party could have, with the exercise of reasonable diligence, removed or remedied with reasonable dispatch. The provisions of this Article shall not be interpreted or construed to require Engineer or District to prevent, settle, or otherwise avoid a strike, work slowdown, or other labor action. The nonperforming party shall, within a reasonable time of being prevented or delayed from performance by an uncontrollable force, give written notice to the other party describing the circumstances and uncontrollable forces preventing continued performance of the obligations of this Agreement. The Engineer will be allowed reasonable negotiated extension of time or adjustments for District initiated temporary stoppage of services.

ARTICLE 18 - MISCELLANEOUS

18.1 A waiver by either District or Engineer of any breach of this Agreement shall not be binding upon the waiving party unless such waiver is in writing. In the event of a written waiver, such a waiver shall not affect the waiving party's rights with respect to any other or further breach.

18.2 The invalidity, illegality, or unenforceability of any provision of this Agreement, or the occurrence of any event rendering any portion or provision of this Agreement void, shall in no way effect the validity or enforceability of any other portion or provision of the Agreement. Any void provision shall be deemed severed from the Agreement and the balance of the Agreement shall be construed and enforced as if the Agreement did not contain the particular portion or provision held to be void.

ARTICLE 19 - INTEGRATION AND MODIFICATION

19.1 This Agreement (consisting of pages 1 to 14), together with all Task Orders executed by the undersigned, is adopted by District and Engineer as a complete and exclusive statement of the terms of the Agreement between District and Engineer. This Agreement supersedes all prior agreements, contracts, proposals, representations, negotiations, letters, or other communications between the District and Engineer pertaining to the Services, whether written or oral.

19.2 The Agreement may not be modified unless such modifications are evidenced in writing signed by both District and Engineer.

ARTICLE 20 - SUCCESSORS AND ASSIGNS

20.1 District and Engineer each binds itself and its directors, officers, partners, successors, executors, administrators, assigns and legal representatives to the other party to this Agreement and to the partners, successors, executors, administrators, assigns, and legal representatives of such other party, in respect to all covenants, agreements, and obligations of this Agreement.

20.2 Neither District nor Engineer shall assign, sublet, or transfer any rights under or interest in (including, but without limitation, monies that may become due or monies that are due) this Agreement without the written consent of the other, except to the extent that the effect of this limitation may be restricted by law. Unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under this Agreement. Nothing contained in this paragraph shall prevent Engineer from employing such independent engineers, associates, and subcontractors as he may deem appropriate to assist him/her in the performance of the Services hereunder and in accordance with Article 7.

20.3 Nothing herein shall be construed to give any rights or benefits to anyone other than District and Engineer.

ARTICLE 21 – INFORMATION SYSTEM SECURITY

When the District determines this article is applicable, the Engineer shall obtain written approval from the District representative prior to accessing District internal systems through real-time computer connections. Upon approval, the Engineer will use only in-bound connections to accomplish a legitimate business need and a previously defined and approved task. As a condition of approval, the Engineer shall:

a) Be running a current operating system supported by the District with up-to-date security patches applied as defined in the District COE/Non-COE document.

b) Have anti-virus software installed on his/her personal computer with up-to-date virus signatures.

c) Have personal firewall software installed and enabled on their computer.

d) Understand and sign the District's Electronic Equipment Use Policy, number 2160.

The District reserves the right to audit the security measures in effect on Engineer's connected systems without prior notice. The District also reserves the right to terminate network connections immediately with all Engineer's systems not meeting the above requirements.

ARTICLE 22 – EMPLOYEE BACKGROUND CHECK

Engineer, at no additional expense to the District, shall conduct a background check for each of its employees, as well as for the employees of its subconsultants (collectively "Consultant Employees") who will have access to District's computer systems, either through on-site or remote access, or whose contract work requires an extended presence on the District's premises. The minimum background check process for any District consultant shall include, but not be limited to

1. California residents: Criminal Records (County and State Criminal Felony and Misdemeanor
2. Out of State residents: Federal criminal search of the National Criminal Database,

The background check shall be conducted and the results submitted to the District prior to initial access by Consultant Employees. If at any time, it is discovered that a Consultant Employee has a criminal record that includes a felony or misdemeanor, the Engineer is required to inform the District immediately and the District will assess the circumstances surrounding the conviction, time frame, nature, gravity, and relevancy of the conviction to the job duties, to determine whether the Consultant Employee will be placed or remain on a District assignment. The District may withhold consent at its sole discretion. The District may also conduct its own criminal background check of the Consultant Employees. Failure of the Engineer to comply with the terms of this paragraph may result in the termination of its contract with the District.

ARTICLE 23 - EXCEPTIONS

No exceptions.

IN WITNESS WHEREOF, the parties hereto have made and executed this Agreement as of the day and year first above written.

UNION SANITARY DISTRICT

By: ___________________________

Paul R. Eldredge, P.E.
General Manager/District Engineer

Date: ___________________________

CAROLLO ENGINEERS, INC.

By: ___________________________

Scott E. Parker, P.E.
Senior Vice President

Date: ___________________________

By: ___________________________

Christopher T. Cleveland, P.E.
Senior Vice President

Date: ___________________________

PLANT NETWORK ARCHITECTURE STUDY

TASK ORDER NO. 1

TO

AGREEMENT

BETWEEN

UNION SANITARY DISTRICT

AND

CAROLLO ENGINEERS, INC.

FOR

PROFESSIONAL SERVICES

Dated: ______________, 2019

1. PURPOSE

The purpose of Task Order No. 1 is for Carollo Engineers, Inc. (Engineer) to provide planning services for the Plant Network Architecture Study (PNAS).

2. PROJECT UNDERSTANDING

The District's Alvarado WWTP currently operates a 6-strand multimode fiber network, originally built in 1986, organized in a ring architecture. The ring architecture has been expanded over the past 30+ years and currently connects 28 on-site buildings to allow District staff to monitor and modify various treatment processes to ensure permit compliance. As wastewater treatment regulations continue to become more restrictive, new treatment technologies become commercially available, and redundant communications have become essential, the District's network has outgrown the current ring architecture. As such, the District wishes to evaluate different network design architecture, such as Dual Star topology, for increased system redundancy and reliability.

The project objectives include 1) an assessment the District's current information network architecture, 2) development of alternatives and recommendations for a more resilient and redundant network architecture that will accommodate future WWTP expansion, and 3) develop a capital improvements plan that provides clear objectives for reuse of existing pull box/conduit(s) and routing of new pull box/conduit(s), equipment, installation methods, and maintaining service while transitioning into the new network architecture and future expansions.

3. PROJECT COORDINATION

All work related to this task order shall be coordinated through the District's Project Manager, Somporn Boonsalat.

4. SCOPE OF SERVICES

The task numbers in this Scope of Services are associated with the cost data presented in Exhibit A.

Task 1 – Project Management and Meetings

Task 1.1 – Project Management

Engineer shall prepare a project management plan that covers key activities. The plan will define the personnel, project schedule, scope of services, quality assurance/quality control (QA/QC), communication protocol, and other procedures required to effectively conduct the project.

Engineer shall monitor and track the overall project scope, budget, and schedule, and update on a monthly basis. A log shall be maintained throughout the project to record the decisions made by the project team. The log will contain decisions made during workshops and project meetings as well as during telephone conversations or emails.

Engineer shall prepare and submit a written monthly invoice to the District which will show the percentage of work completed and the percentage of contract billed, summarize the work completed during the month, and to be completed during the following month. Engineer shall conduct brief weekly conference calls with District's Project Manager to review progress and any deviations from the schedule and budget. It is assumed that these conference calls will last approximately 15 minutes each. The Project Manager shall maintain decision and action logs as well as a critical issue log that will be updated during these monthly calls.

Deliverables List:

- Meeting Agendas and documentation
- Monthly progress reports
- Action Items Log
- Decision Log

Task 1.2 – Kickoff Meeting

Prior to the kickoff meeting Engineer shall attempt to obtain and review as much documentation about the existing facility network(s) as practical. Additionally, the Engineer shall review existing electrical planning documents for coordination with the PNAS. This will provide Engineer background information specific to the

District and should improve communication efficiency in the kickoff meeting and workshops.

Engineer shall facilitate a project kickoff meeting with District staff to develop and define the District's goals and objectives for the PNAS. This will be a working meeting with participation from key District staff and stakeholders to discuss the District's strategic vision for network implementation and understand staff preferences. Additionally, Engineer shall review the overall scope, schedule, and budget for preparation of the PNAS and establish lines of communication between Engineer and District staff. The District shall provide feedback regarding the specific areas of focus for the plan at the kickoff meeting.

Deliverables List:

- Meeting Agendas and documentation
- Monthly progress reports
- Action Items Log
- Decision Log

Task 2 – Existing Network Analysis

This task includes an evaluation of needs, cost benefit, and life-cycle costs of the current and proposed future network alternatives. The following subtasks shall be performed as part of Task 2.

<u>Task 2.1 – Existing Network Documentation Review</u>

Engineer shall review any available network related documentation and aggregate that information into summary diagrams. Engineer expects to review design documents from previous projects, maintenance notes or diagrams, reports from asset management, and other relevant documentation related to the existing network infrastructure. The following includes other information that will be requested:

- Electrical plans drawings, duct banks, and other related information
- Capital Improvement Plan and Study documents for future duct bank routing
- Governance policies
- Network block diagrams (LAN)
- Network standards
- Network equipment lists
- Network Management System Report

Additional data/information may be requested as this task is completed, based on review of the information requested above.

Deliverables List:

- Summary of Existing Network Findings (Included in PNAS)

<u>Task 2.2 - Current Network Documentation</u>

Engineer shall combine the findings from Task 2.1 with the kickoff meeting site visit to document the existing communication infrastructure at planning level; detailed connection diagrams will not be provided. A high level network diagrams shall be created/updated showing all major components of the existing network, its architecture, and the general location of equipment relative to the site. While onsite informal interviews shall be conducted to determine known limitations and challenges with the existing network.

Deliverables List:

- Summary of Current Network including Diagrams (Included in PNAS)

<u>Task 2.3 – Stakeholder Workshop</u>

After the kickoff meeting and subsequent documentation of the existing network, Engineer shall prepare three proposed network architectures and conduct a visioning and philosophy workshop for all the stakeholders. The workshop will establish the analysis criteria that are most important to the District which shall be used in the analysis of the proposed criteria. These criteria shall be coordinated with the District's electrical staff and the Engineer's electrical engineering subconsultant. The workshop will probe into the District's needs, goals, and objectives which will serve as the foundation of good decision making process.

Deliverables List:

- Meeting Agendas and documentation
- Action Items Log
- Decision Log

Task 3 – Network Architecture Study

Task 3.1 – Organizational and Operational Assessment

This task shall focus on reviewing the organizational structure supporting the network system, network documentation, change management, maintenance, and integration with the utility enterprise information systems. The organizational structure shall be summarized and key stakeholders and decision makers for the network system will be verified.

Using the information from previous tasks, workshops, and calls with District's Project Manager and other stakeholders, Engineer shall summarize the District's organizational structure (from a network perspective) to establish chains of responsibility, authority, and communication. This information will be used in the future development of network governance to better establish system owners, stakeholders, and decision makers.

Deliverables List:

- Summary of staff's roles and responsibilities (Included in PNAS)

Task 3.2 – Draft Plant Network Architecture Study

Engineer shall provide the Draft Plant Network Architecture Study including the findings and recommendations from Task 1-3, equipment and cable specifications, conduit/communication pullbox optimization and requirements and implementation methodology and cost estimates.

The Draft Plant Network Architecture Study shall include a detailed alternatives analysis with drawings showing potential reuse of existing conduit(s) and routes of new conduits to support the different alternatives based on the topics discussed at the Stakeholder's workshop. Future conduit routing established for electrical power distribution shall also be considered. The analysis shall present three different alternatives based on the needs established and evaluate the cost benefits and life-cycle cost of each alternative. The analysis shall be published with the draft and final version of the Plant Network Architecture Study.

Deliverables List:

- Plant Network Architecture Study - DRAFT
    - Executive Summary (2 Page Max)
    - Project Background (2 Page Max)
    - Existing Network Summary (3-5 Pages and 3 Network Diagrams)

  - Future Network Recommendations including buildout conditions (3-5 Pages and 3 Network Diagrams). This shall include the review and coordination with the Enhanced Treatment & Site Upgrade Program.
  - Organizational and Operation Support Recommendations (2-3 Pages and Tables)
  - Appendices (Copies of all meeting documentation, decision logs, action items, presentations, and larger diagrams).

Task 3.3 – Plant Network Architecture Study Review Workshop

Engineer shall facilitate a workshop to review the Draft Plant Network Architecture Study.

Deliverables List:

- Meeting Agendas and documentation
- Action Items Log
- Decision Log

Task 3.4 – Final Plant Network Architecture Study

Engineer shall incorporate all comments and decisions into the final version of the Plant Network Architecture Study. This shall include a final draft to address any last ideas and comments that need to be incorporated into the plan.

Deliverables List:

- Plant Network Architecture Study – FINAL DRAFT
  - Same as draft with revisions noted.
- Plant Network Architecture Study – FINAL

KEY ASSUMPTIONS:

The following is a list of assumptions:

- Plant Network Architecture Study (PNAS) does not include an analysis of control system software or server hardware. Consideration for interfacing this equipment to the network shall be included.
- PNAS does not include an analysis of Programmable Logic Controller hardware or software. Consideration for interfacing this equipment to the network shall be included.
- PNAS does not include an analysis of field instrumentation.

- PNAS coordination with the Enhanced Treatment & Site Upgrade Program shall be conducted once with the latest version is available and shall focus on planned electrical duct bank routing. This scope does not include multiple reviews of the Enhanced Treatment & Site Upgrade Program.

5. PAYMENT TO THE ENGINEER

Payment to the Engineer shall be as called for in Article 2 of the Agreement. The billing rate schedule is equivalent to an overall labor multiplier of 3.21 for office staff, including profit. Subconsultants and outside services shall be billed at actual cost plus 5%; other direct costs shall be billed at actual cost; and mileage shall be billed at prevailing IRS standard rate.

The not-to-exceed amount for Task Order No. 1 shall be $99,955.00 for this scope of services. A summary of the anticipated distribution of cost and manpower between tasks is shown in Exhibit A.

The following table summarizes the previously executed and proposed task orders and amendments under the Agreement:

Task Order / Amendment	Not to Exceed Amount	Board Authorization Required?	District Staff Approval
Task Order No. 1 – Plant Network Architecture Study	$99,955	Yes	Paul Eldredge
Project Total	**$99,955**		

6. TIME OF COMPLETION

Anticipated schedule for completion of Engineer's scope of services is summarized as follows:

- Notice to Proceed (NTP): The Week of August 12, 2019
- Kickoff Meeting & Workshop: The Week of September 2, 2019
- Stakeholders Workshop: The Week of September 23, 2019
- NAMP - DRAFT: The Week of October 21, 2019
- NAMP - DRAFT Workshop: The Week of November 18, 2019
- NAMP - FINAL / DRAFT: The Week of December 16, 2019

7. KEY PERSONNEL

Engineering personnel assigned to this Task Order No. 1 are as follows:

Key Person to be Assigned	Role
Scott Parker	Principal in Charge
Jason Hise	Project Manager
Todd Beecher	Electrical Engineer

Key personnel shall not be changed except in accordance with Article 8 of the Agreement.

IN WITNESS WHEREOF, the parties hereto have made and executed this Task Order No. 1 as of ________________, 2019 and therewith incorporate it as part of the Agreement.

DISTRICT	ENGINEER
UNION SANITARY DISTRICT	CAROLLO ENGINEERS, INC.
By: ________________________ Paul R. Eldredge, P.E. General Manager/District Engineer	By: ________________________ Scott E. Parker, P.E. Senior Vice President
Date: ________________________	Date: ________________________
	By: ________________________ Christopher T. Cleveland, P.E. Senior Vice President
	Date: ________________________

Plant Network Architecture Study - Exhibit A

Union Sanitary District
Plant Network Architecture Study
Labor Hours & Cost

August 19, 2019

Task No.		Professional Hours	PIC	Project Manager	Sr. SCADA/I&C Engineer	Sr. Technical Reviewer	SCADA/I&C Engineers	Programmer	Administrative/CAD	Labor Cost	REIMBURSABLE COSTS: Subconsultant (1)	Travel, Subsistence, And Other Reimbursable Costs	Markup on Subs and Reimbursable Costs	Total Reimbursable Costs	Total Labor Cost & Reimbursable Costs
1	**PROJECT MANAGEMENT AND MEETINGS**														
	1.1 Project Management	20	8	12						$ 5,800		$ 420	$ 21	$ 441	$ 6,241
	1.2 Kickoff Meeting	12		8					4	$ 2,680		$ 420	$ 21	$ 441	$ 3,121
		0								$ -					
2	**EXISTING NETWORK ANALYSIS**														
	2.1. Existing Network Documentation Review	72		40		16	16			$ 18,480		$ -	$ -	$ -	$ 18,480
	2.2 Current Network Documentation	64		16	24	4	4		16	$ 14,800		$ -	$ -	$ -	$ 14,800
	2.3 Stakeholder Workshop	24		12		4	8			$ 6,000		$ 849	$ 42	$ 891	$ 6,891
		0								$ -		$ -	$ -	$ -	$ -
3	**NETWORK ARCHITECTURE STUDY**														
	3.1 Organizational and Operational Assessment	10		10						$ 2,700	$ 400	$ 1,225	$ 81	$ 1,706	$ 4,406
	3.2 Draft Plant Network Aarchitecture Study	106	2	48	24		8		24	$ 24,880	$ 400	$ -	$ 20	$ 420	$ 25,300
	3.3 Plant Network Architecture Study Review Workshop	12	4	8						$ 3,440	$ 800	$ 625	$ 71	$ 1,496	$ 4,936
	3.4 Final Plant Network Architecture Study	74	2	24	12		4		32	$ 15,360	$ 400	$ -	$ 20	$ 420	$ 15,780
Totals Row		**394**	**16**	**178**	**60**	**24**	**40**	**0**	**76**	**$ 94,140**	**$ 2,000**	**$ 3,539**	**$ 276**	**$ 5,815**	**$ 99,955**
	2019		320.00	270.00	270.00	270.00	210.00	185.00	130.00						
	(1) Beecher Engineering														

TOTAL CONTRACT AMOUNT $ 99,955

AUGUST 26, 2019
BOARD OF DIRECTORS MEETING
AGENDA ITEM # 12

TITLE: **Adopt a Resolution Approving the Final Report for the Enhanced Treatment & Site Upgrade Program (CEQA Review: Exempt Under CEQA Guidelines Section 15061(b)(3) and 15262)**
(This is a Motion Item)

SUBMITTED: Paul R. Eldredge, General Manager/District Engineer
Sami E. Ghossain, Technical Services Work Group Manager
Raymond Chau, CIP Team Coach
Curtis Bosick, Senior Engineer

Recommendation

Staff recommends the Board approve the Final Report, dated August 2019, for the Enhanced Treatment & Site Upgrade Program.

Previous Board Action

November 23, 2015, the Board authorized the General Manager to execute an agreement and Task Order No. 1 with Carollo Engineers in the amount of $238,117 for the Plant Solids System/Capacity Assessment – Phase 1.

December 12, 2016, the Board authorized the General Manager to execute an agreement and Task Order No. 1 with Woodard & Curran (formerly RMC Water and Environment) in the amount of $265,217 to study, review and assess the District's near- and long-term projects.

January 9, 2017, the Board authorized the General Manager to execute Task Order No. 2 with Carollo Engineers in the amount of $279,698 for the Plant Solids System/Capacity Assessment – Phase 2.

March 27, 2017, the Board authorized the General Manage to execute Task Order No. 2 with Woodard & Curran in the amount of $69,877 for the Effluent Management Study.

July 11, 2017, Woodard & Curran and staff conducted Workshop No. 1 with the Board to provide background and present analysis on the Administration and Control Buildings and cost comparison of the retrofit and new building alternatives.

January 22, 2018, the Board authorized the General Manager to execute Amendment No. 2 to Task Order No. 2 with Woodard & Curran in the amount of $74,518 to evaluate strategies for early adoption of nutrient removal process at the Plant and at the Hayward Marsh during the Effluent Management Study.

March 19, 2018, Woodard & Curran and staff conducted Workshop No. 2 with the Board to share the retrofit vs. new options for the Administration and Control Buildings, the options for secondary process improvements, and the need to vet the membrane bioreactor treatment technology.

July 23, 2018, the Board authorized the General Manager to execute an agreement and Task Order No. 1 with Hazen and Sawyer in the amount of $177,374 for the Secondary Treatment Process Improvements.

December 10, 2018, the Board authorized the General Manager to execute Amendment No. 1 to Task Order No. 1 with Hazen and Sawyer in the amount of $387,908 for the Secondary Treatment Process Improvements.

December 10, 2018, the Board authorized the General Manager to execute Amendment No. 4 to Task Order No. 1 with Woodard & Curran in the amount of $141,861 to further develop the two secondary treatment alternatives, conventional activated sludge and membrane bioreactor (MBR), by integrating findings from the Secondary Treatment Process Improvements.

May 8, 2019, Woodard & Curran, Hazen and Sawyer, and staff conducted Workshop No. 3 with the Board to share results from the secondary process evaluation, the alternatives and phasing of the secondary treatment process improvements, the new campus building alternative, and the capital and O&M cost updates.

Background

Carollo Engineers conducted an evaluation of the current solids capacity of the Alvarado Wastewater Treatment Plant. Phase I of the Solids System Capacity Assessment study focused on the solids side of the plant, while phase II focused on all liquids processes, including but not limited to: headworks, primary clarifiers, aeration basins, secondary clarifiers, and disinfection.

Among other things, the results of this assessment concluded that some of the plant's secondary treatment processes are at/near capacity at current average dry weather flow (ADWF) and over capacity during certain peak flow events.

Concurrently, staff worked with Woodard and Curran to study, review and assess the District's near- and long-term projects. Woodard and Curran evaluated the need to retrofit or replace existing facilities (e.g. Operations and Administration Buildings), recommended the sequence of design and construction implementation based on future regulatory changes. Their study also included determining priorities and schedules of improvements, evaluating existing and future space and capacity needs, optimizing process adjacencies, determining economic feasibility of options, and summarizing what is intended to be a road map for the District's Wastewater Treatment Plant for the next 20 to 40 years.

<u>Effluent Management Study</u>
Various alternatives were evaluated to determine the most viable options for managing effluent during peak wet weather flows, especially if the Hayward Marsh is no longer available in its current form. Some of these alternatives included: on-site options, such as equalization storage facilities, or shallow water discharge to Old Alameda Creek; off-site options, such as off-site equalization storage, restoration of the Hayward Marsh, and wet weather recycled water use; and influent flow reduction options, such as site drainage flow reduction, conveyance system storage, and satellite treatment/disposal. Results from this effort indicate that the only complete and feasible option for effluent management is shallow water discharge to Old Alameda Creek.

<u>Secondary Treatment Process Improvements</u>
Preliminary results from planning efforts identified two potential secondary improvement alternatives that could address both the plant's capacity needs and effluent management: conventional activated sludge and MBR. Both alternatives would include considerable retrofits and/or expansions to the existing aeration basins, as well as new infrastructure and some improvements to existing electrical, mechanical, communication, and conveyance systems. To help further develop and expedite the study of necessary improvements, staff proceeded with the consultant selection process for the preliminary design services for both alternatives.

During the consultant selection interview process, Hazen and Sawyer (Hazen) presented staff with an alternate approach that further optimizes current secondary treatment processes and leverages the use of existing infrastructure. This concept, if successful, would produce better settling sludge and would allow for some level of nutrient reduction. These proposed improvements would still require substantial upgrades to the existing plant infrastructure, but they could potentially minimize the overall project costs, and/or extend project costs over a longer period. Staff was intrigued by this concept; however, it meant momentarily redirecting efforts to focus on building alternatives while this concept is further evaluated. Although a delay in forward progress of planning efforts was not ideal, staff believed that it would be fiscally irresponsible not to fully evaluate this concept given the potential long-term benefits and cost considerations.

Hazen's evaluation of the plant's secondary treatment processes included the following: analysis of historical process data, special sampling, stress testing of existing processes, development/calibration of two secondary treatment process models, clarifier modeling, determination of near- and long-term capacity/infrastructure requirements, sequencing and phasing development, and life cycle cost comparisons. In summary, it was determined that an enhanced conventional activated sludge secondary process is the best value solution for the District. Refer to Appendix B of the attached report for the comprehensive evaluation performed for this effort.

Administration/Control/FMC Building Evaluation

Previous studies have identified multiple building vulnerabilities that would require repairs to the existing Administration and Control Buildings and significant upgrades to meet current building standards. Recommended improvements to the existing Administration and Control Buildings include seismic upgrades; mechanical, electrical, and plumbing upgrades; and building envelope repairs to prevent water intrusion. Additionally, the existing maintenance building and paint shop are nearing the end of their useful lives and were previously identified for replacement. Consequently, staff worked with Woodard and Curran to study and develop planning level layouts of approximate building footprints and related site areas, such as parking and materials storage for each of the following alternatives:

- Renovation of existing Administration and Control Buildings with a separate newly constructed FMC Building
- Construction of new combined Administration/Control Building with a separate newly constructed FMC Building
- Construction of new combined Campus Building

The costs of retrofitting the existing Administration and Control Buildings and constructing a new FMC Building were compared to the cost of constructing all new buildings. In summary, capital costs for constructing new buildings were estimated to be approximately 10 percent higher than retrofitting the existing buildings; however, the life cycle costs were estimated to be 20 percent less. Furthermore, new buildings would also provide:

- A longer life span;
- A facility built to the latest building codes;
- An opportunity for more efficient space planning;
- A construction sequence that significantly minimizes disruptions to staff, productivity, and customer service
- Consolidation of shared functions

- Most importantly, unlocking of valuable real estate that could be used to expand the existing secondary treatment process.

Of the two new building alternatives, the combined Campus Building provides a much smaller overall footprint. Additionally, the costs between the two new building alternatives is essentially the same when the total life cycle cost of the alternatives is taken into consideration. Accordingly, the new combined Campus Building is the recommended option to pursue.

Enhanced Treatment & Site Upgrade Program

The Enhanced Treatment & Site Upgrade (ETSU) Program is the study culminating the District's planning efforts and is based on the outcomes of the Administration/Control/FMC Building Evaluation, Effluent Management Study, and Secondary Treatment Process Improvements. The program includes projects recommended for implementation that will be phased to address both immediate drivers (current poor sludge settleability, treatment capacity, effluent disposal and aging infrastructure), while preparing for potential future nutrient regulations for discharge in the Bay that are being considered by the Regional Water Quality Control Board in consultation with BACWA (Bay Area Clean Water Association). The Phases I, II and III projects included in this program were presented to the Board during the workshop held on May 8, 2019. The improvements to be implemented in the near-term are in Phase I and are summarized in the following table.

Aeration Basin Modifications	Retrofitting the existing Aeration Basins 1 through 7 with the flexibility to operate initially with an anaerobic selector during implementation phase of the ETSU Program and transitioning to a biological nutrient removal (BNR) process following completion.
Campus Building (Admin, FMC, Ops)	Construction of a new combined Campus Building, including associated site and utility improvements and the demolition of existing buildings.
Secondary Clarifiers	Construction of four new 155-foot diameter secondary clarifiers, mixed liquor control box, and centralized RAS pump station and relocation of existing effluent force main.
Effluent Facilities	Construction of new chlorination/dechlorination contact basins and pump stations.
Plant Equalization Storage	Retrofitting existing Secondary Clarifiers 1 through 4 to operate as a primary effluent/treated effluent equalization basin.

This ETSU Program is not intended to approve any individual phases or project, but to study and identify the proposed projects the District intends to pursue, subject to further review during a formal decision-making process. As the Program is implemented and projects are designed and considered, environmental review required by the California Environmental Quality Act (CEQA) will be conducted and staff will pursue any required regulatory permits, including any required coordination with the City of Union City. Therefore, adoption of the ETSU Program is exempt under CEQA Guidelines section 15061(b)(3), as it can be seen with certainty that there is no possibility that adoption of the ETSU Program will have a significant effect on the environment, and section 15262, since the ETSU Program constitutes a planning and feasibility study with no legally binding effect on future activities. The ETSU Program studies possible future actions, which have not yet been approved, adopted or funded. The ETSU Program does, however, consider environmental factors, such as sea level rise and water quality.

Staff recommends the Board approve the Final Report, dated August 2019, for the Enhanced Treatment & Site Upgrade Program.

PRE/SEG/RC/CB;mb

Attachments:

- A summary of the Enhanced Treatment & Site Upgrade Program Final Report, dated August 2019, is attached (minus appendices).
- Resolution

The full report, including the following appendices, can be found at this link https://unionsanitary.ca.gov/ETSU:

- Historical Data Analysis
- Assumptions / Scenarios Document
- BioWin™ Sampling Results
- BioWin™ Model Calibration
- Clarifier Field Testing
- Clarifier Model Calibration Results
- Comprehend Phase Workshop Presentation and Minutes
- Explore Phase Workshop Presentation
- District Notes
- Converge Phase Workshop Presentation and Minutes
- Cost Estimate
- Follow-up Converge Phase Workshop Presentation

UNION SANITARY DISTRICT

Union Sanitary District's

Enhanced Treatment and Site Upgrade Program

WOODARD & CURRAN

woodardcurran.com

August 2019

ENHANCED TREATMENT & SITE UPGRADE PROGRAM

Union Sanitary District
August 2019

WOODARD & CURRAN

2175 N. California Blvd, Suite 315
Walnut Creek, CA 94596
925-627-4100

woodardcurran.com

COMMITMENT & INTEGRITY DRIVE RESULTS

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TABLES

FIGURES

APPENDICES

ACKNOWLEDGEMENTS

Union Sanitary District

Board of Directors

Manny Fernandez
Tom Handley
Pat Kite
Anjali Lathi
Jennifer Toy

General Manager/District Engineer

Paul R. Eldredge

Staff

Curtis Bosick, Senior Engineer
Raymond Chau, Capital Improvement Projects Coach
Mitchell Costello, Total Productive Operations Coach
Sami Ghossain, Technical Services Manager
Tim Grillo, Research and Support Coach
Connie Li, Senior Process Engineer
Armando Lopez, Treatment and Disposal Services Manager
Scott Martin, Mechanical Coach
Chris Pachmayer, Electrical/Support and Information Technology Coach
Ric Pipkin, Total Productive Operations Coach
James Schofield, Collection Services Manager
Robert Simonich, Fabrication, Maintenance, and Construction Manager

Woodard & Curran (RMC Water and Environment)

Mary Cousins, Regulatory Expert
Kraig Erickson, Staff Engineer
Jim Graydon, Technical Review
Susan Hsu, Project Engineer
Kate Marinchak, Graphics
Kevin Randeni Staff Engineer
Dave Richardson, Project Manager
Shalini Trivedi, Staff Engineer

Subconsultants

Burks Toma Architects
Overland, Pacific, and Cutler, LLC

Others

Mark Takemoto, CDM Smith
Hazen and Sawyer

Union Sanitary District's

Executive Summary

Union Sanitar y District's

Enhanced Treatment and Site Upgrade Program

EXECUTIVE SUMMARY

The goal of this Enhanced Treatment & Site Upgrade (ETSU) Program is to provide Union Sanitary District (USD) with a technically and fiscally sound, practical plan for the District's Wastewater Treatment Plant (WWTP) located in Union City, CA for the next 20 to 40 years. The ETSU Program is intended to be a roadmap, outlining key decisions to be considered in the future. The roadmap will allow USD to implement critical near-term projects over the next 5 to 10 years while maintaining compatibility and flexibility with the long-term vision for the WWTP, thereby avoiding stranded assets and undesirable space planning ramifications. This ETSU Program is not intended to approve any individual phase or project, but to identify the proposed plan and projects USD intends to pursue, subject to further review during a formal decision-making process.

Enhanced Treatment & Site Upgrades Program Drivers

The key drivers of the ETSU Program for the WWTP are:

1. Secondary treatment process performance requiring immediate upgrades and a plan for increasing solids treatment capacity and meeting anticipated nutrient regulations;
2. The need for new effluent management options with the anticipated shutdown of the Hayward Marsh;
3. Buildings/facilities in need of seismic upgrade and repair; and
4. Limited land available onsite for addressing these priorities.

The ETSU Program is designed to incorporate near-term capital improvements projects (CIP) with the secondary process upgrades as the WWTP transitions to a new era of managing nutrients, biosolids, effluent/recycled water, all while anticipating sea level rise. Factors that will drive when projects need to occur or need to be accelerated are:

- Nutrients requirements within the Regional Board's evolving Nutrients Watershed Permit
- Senate Bill 1383 organics diversion requirements that will modify current processing and reuse/disposal of organic wastes including biosolids. If implemented at USD's discretion, an onsite organics processing facility may drive the need for additional digestion and solids processing capacity.
- Increasing flows and especially loads associated with growth in the service area and the potential importation of additional organic waste
- Future demand for recycled water from Alameda County Water District (ACWD) and potential regional partners, which might drive siting of advanced water treatment facilities at or near the WWTP

Key Projects

The following key projects will be required to address USD's goals for the WWTP.

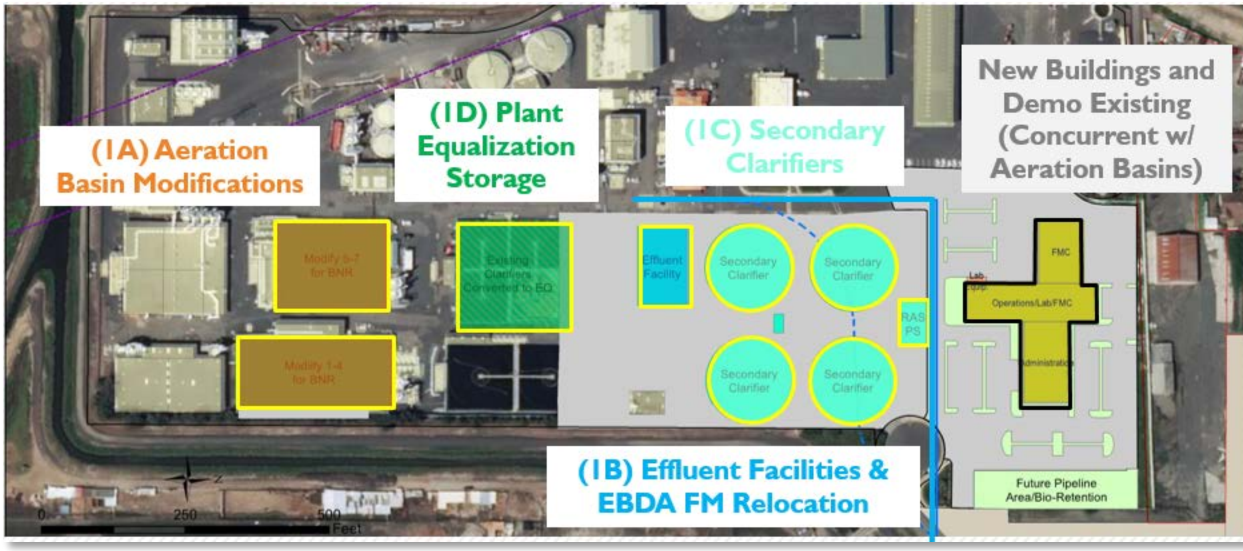
Secondary Treatment Process Improvements (including Early Action Nutrient Removal)

The most immediate priority for the WWTP is to implement the first phase of Secondary Treatment Process Improvements. The recommended project consists of the following:

- Upgrading aeration basins to incorporate:
  - Improved process control/settling
  - Nutrient removal
  - Wet weather step-feed mode
- Replacing existing secondary clarifiers with 4 new circular clarifiers to enable:
  - The secondary process to fully function in year-round ammonia/nutrient removal mode
  - More stable mixed liquor solids concentration to enhance biological treatment and nutrient removal
  - Improved effluent quality through greater total surface area and enhanced return activated sludge (RAS) control

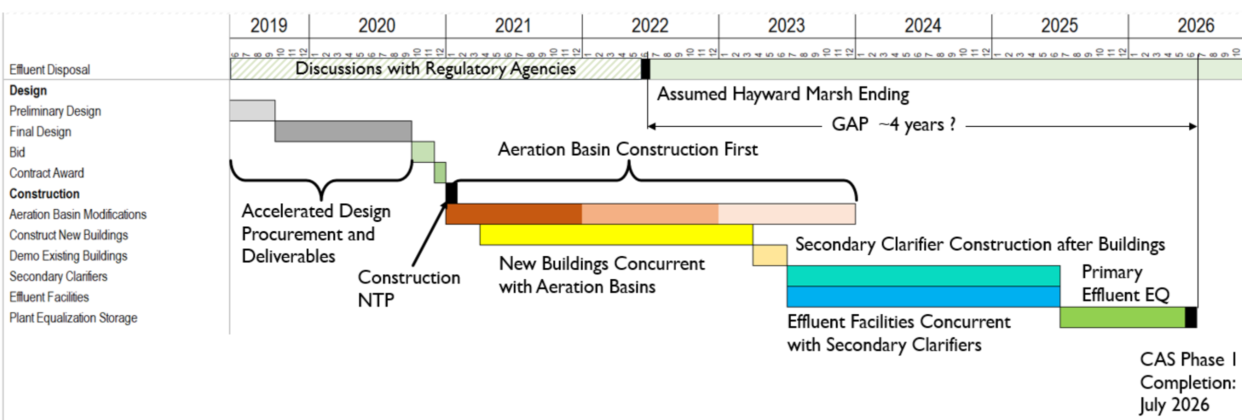
The construction of new secondary clarifiers would necessitate the removal of the existing Administration and Control Buildings (which had been slated for major rehabilitation or replacement and seismic upgrade) and replacement of those buildings in a new campus layout on the USD-owned property to the north of current active plant site (parking). Phase I would also include a new effluent/reclaim pump station (PS), new chlorine contact tank (CCT), new dechlorination facility, and conversion of existing square secondary clarifiers to primary effluent (PE) flow equalization. The proposed layout for Phase I is shown in **Figure ES-1**.

Figure ES-1: Layout of Phase I Facilities and Buildings



The implementation schedule for Phase I is presented in **Figure ES-2**, demonstrating how the improvements would be sequenced to bring the plant processes on line as soon as possible to minimize the time when effluent disposal capacity during wet weather will be limited by the combination of Hayward Marsh and Old Alameda Creek intermittent shallow water discharge. Implementation would consist of environmental review as required by the California Environmental Quality Act ("CEQA") and consideration of individual projects as they proceed to development.

Figure ES-2: Sequence of Phase I Activities



Phase II of the Secondary Treatment Process Improvements at the WWTP is intended to address potential future numerical nutrient limits and provide capacity for projected flows and loadings for 2040. They include maintaining existing permitted aeration basin treatment capacity, a new intermediate PS for primary effluent, new blower building, sidestream treatment, and additional ancillary facilities. These proposed improvements are shown in blue in **Figure ES-3**. Phase III of the Secondary Treatment Process Improvements, if necessary, would provide additional capacity to handle flows and loads beyond 2040 to buildout. It is currently estimated that buildout capacity at the WWTP will not exceed 38 million gallons per day (MGD). Phase III facilities are shown in purple in **Figure ES-3**.

The Secondary Treatment Process Improvements would be programmed in a phased approach in order to meet both near-term needs and future challenges posed by capacity limitations, future nutrient removal, and effluent discharge. The roadmap showing program drivers and triggers for implementation of theses phases is presented in **Figure ES-4**. Implementation would consist of environmental review as required by the California Environmental Quality Act ("CEQA") and consideration of projects during the timelines discussed in this Program.

Nutrient Removal

Through the Secondary Treatment Process Improvements, USD would achieve nutrient removal in phases to match the anticipated regulatory schedule, including "early action" removal of nutrients ahead of that required in the anticipated Nutrients Watershed Permit issued by the Regional Board every 5 years. The second Nutrients Watershed Permit, effective July 1, 2019, identified dry season average targets for nutrient loading established on a baseline loading from 2014, plus a 15% increase to account for growth since then. These targets are presently non-binding but signal potential nutrient loading caps in the next round of permitting in 2024. With the implementation of the Phase I Secondary Treatment Process Improvements, USD would be reducing ammonia and total inorganic nitrogen (TIN) levels. This would allow for increasing shallow water discharges during wet weather to be transitioned proportionately from the Hayward Marsh, where ammonia removal occurs within the Marsh, to Old Alameda Creek where there is no ammonia removal, but some dilution (see Effluent Management below). Phase I improvements would also meet anticipated load caps, potentially coming in 2024, and the "Level 2" nutrient benchmarks developed by the Bay Area Clean Water Agencies (BACWA) for much of the year. The "early action" element of Phase I would be used by USD to provide the basis for a request to the Regional Board for more time to meet future nutrient limits than the agencies within the same sub-embayment who do not implement "early action".

To fully meet concentrations reflective of BACWA Level 2 year-round, and to account for increasing flows and loads, Phase II would need to be implemented sometime between 2026 and 2040 (depending upon the timing of the regulatory trigger) as presented in the timeline on **Figure ES-4**.

The Phase III improvements (shown in purple in **Figure ES-3**) would be triggered if more stringent BACWA "Level 3" nutrient benchmarks are imposed by the Regional Board. As subsequent nutrients watershed permits roll out, USD will continue to update its road map to determine the timing and extent of the improvements to match the needs. If Level 3 benchmarks are never adopted as requirements, elements of Phase III would be implemented at the appropriate time to address the flows and loads experienced beyond 2040.

Effluent Management

USD has effectively used the Hayward Marsh as a wet weather discharge outlet for flows in excess of its capacity to discharge to the East Bay Dischargers Authority (EBDA) conveyance and outfall system. Flows in excess of the combination of EBDA and the Hayward Marsh discharges can be conveyed to the shallow water outfall to Old Alameda Creek adjacent to the WWTP. The capacity of the Hayward Marsh has been affected over the years by siltation and its berms have deteriorated due to wave action and differential settlement. The East Bay Regional Park District (EBRPD), the agency that owns and operates the Hayward Marsh, has indicated that it will not be repairing the Hayward Marsh in its current configuration and will not be accepting USD treated effluent in the near future. The timeframe for this conversion of marsh operations has not been finalized, but USD needs a wet weather effluent discharge alternative to the Hayward Marsh in the next several years.

Within the programming process, numerous alternatives for partial and complete management of wet weather discharges have been evaluated. The recommended alternative includes the increased shallow water discharge to Old Alameda Creek (it is currently permitted for limited frequency wet weather discharges), which will be facilitated by Early Action Nutrient Removal (Phase I of the Secondary Treatment Process Improvements).

The Secondary Treatment Process Improvements affords USD the opportunity to address aging infrastructure (aeration basins and clarifiers) while improving treatment performance and effluent management. By implementing Phase 1 of the Secondary Treatment Process Improvements, the water quality of USD effluent, especially with respect to ammonia concentrations will be improved to the extent that discharges can occur with greater frequency and greater quantities than currently permitted. Permitting is currently being developed for increased discharge to Old Alameda Creek during wet weather periods.

USD also continues to be open to collaborate with ACWD to ensure that secondary effluent may be made available if sufficient demand for recycled water is established. ACWD, in collaboration with SFPUC, is currently evaluating the feasibility and cost of a regional potable reuse project. This study commenced in July 2019; sizing and timing of this facility has yet to be determined.

Figure ES-3: USD Plant Layout at Builout (2058)

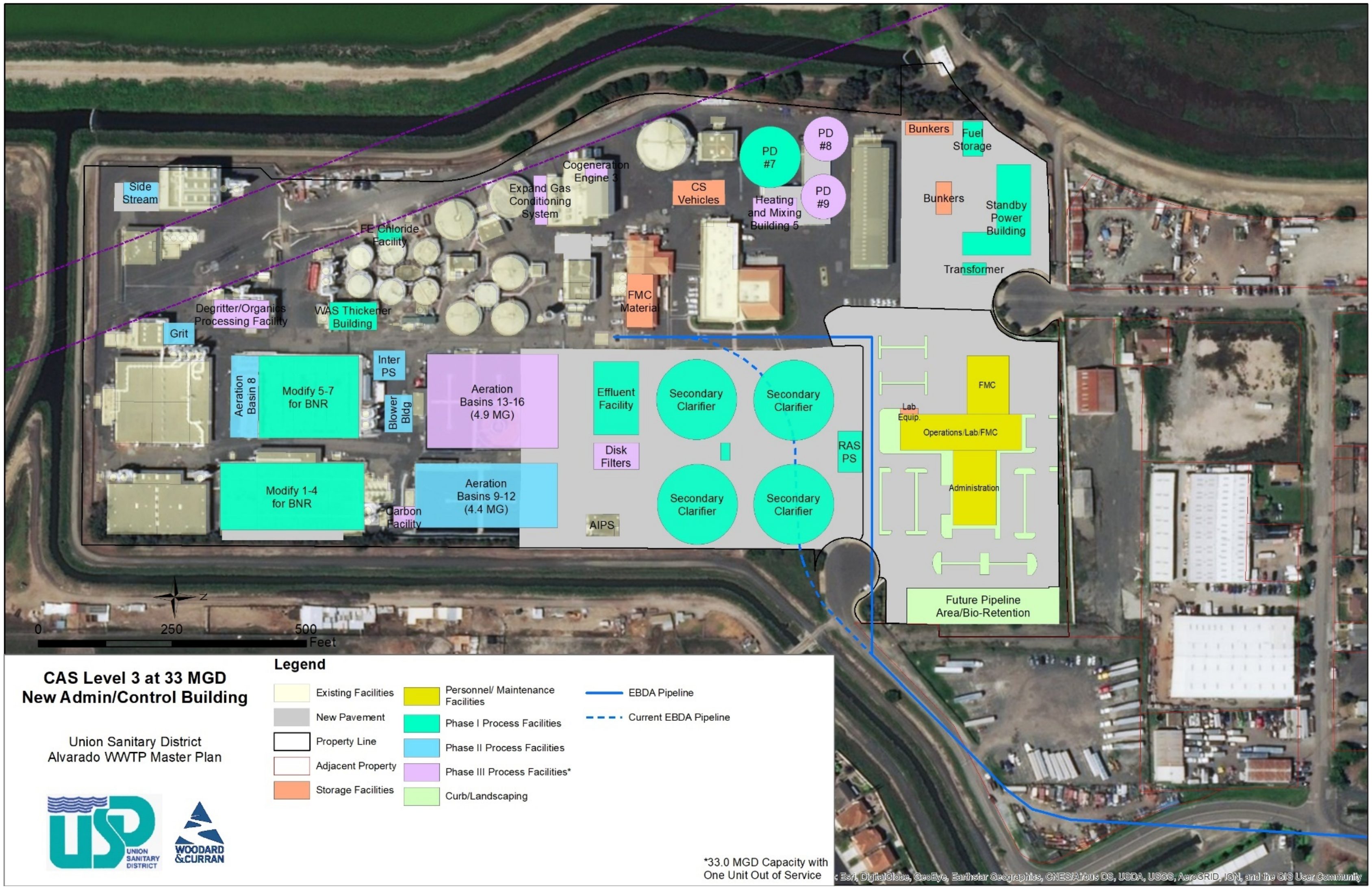
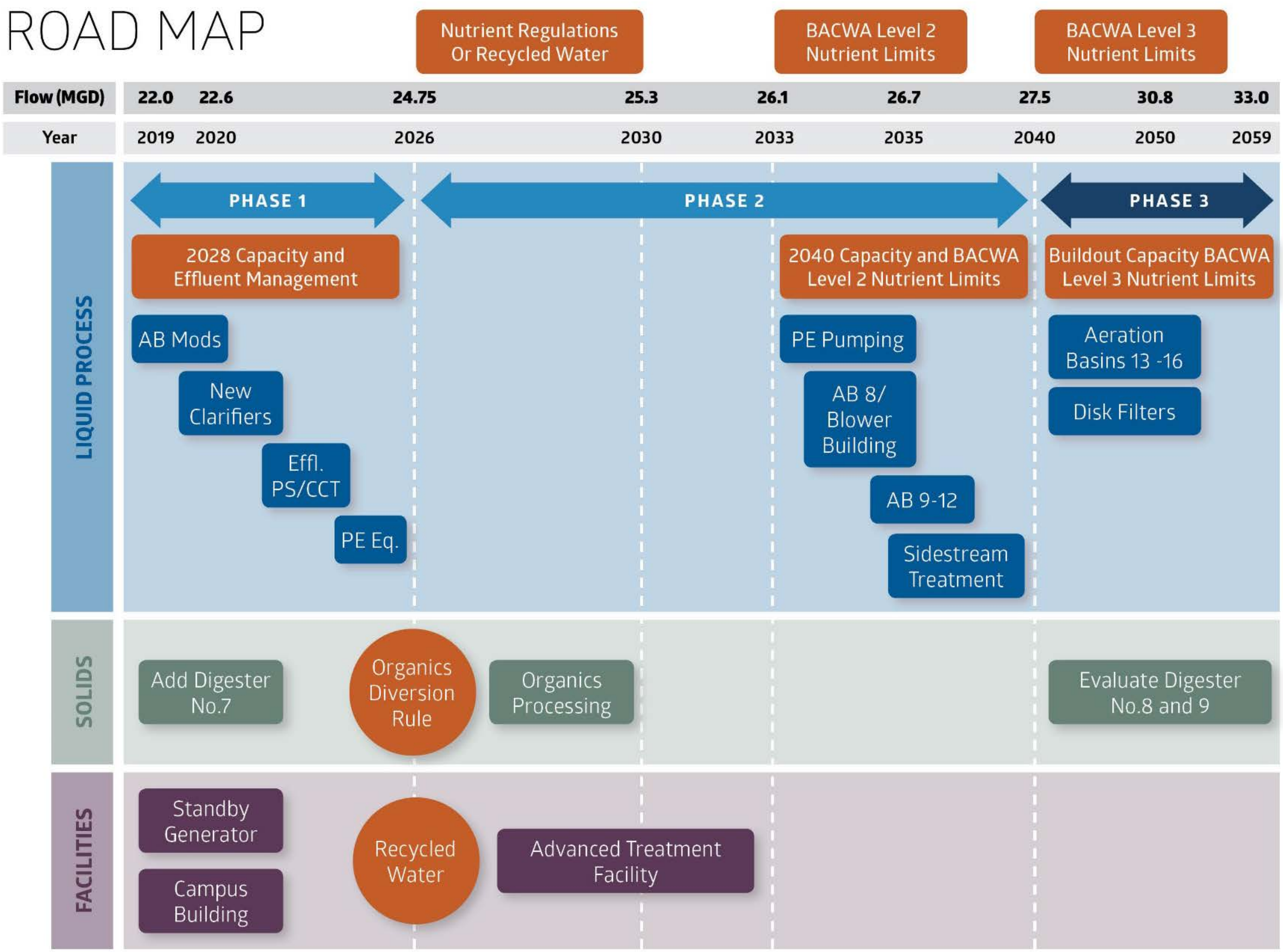


Figure ES-4: Road Map for ETSU Program Implementation



Vulnerable Buildings

Prior to the programming process, USD had identified the need for a new Facilities Maintenance (FMC) Building. More recently, the Administration Building and Control/Lab Building have been slated for repair and rehabilitation projects. The Administration and Control/Lab Buildings are currently located in the area suitable for secondary treatment process expansion. Rehabilitating these existing buildings was determined to entail higher life cycle costs than constructing new facilities, due to extensive renovations required for seismic retrofit, repair to address water intrusion, and the upgrades and expansion to address long-term needs and to meet the required California energy requirements. As part of the ETSU Program, the team of architects, engineers and staff evaluated how to best place future buildings to optimize space for the treatment process, minimize operational costs, and maximize the useful life of USD's buildings. Of the two new building alternatives, the single campus alternative (incorporating Administration, Control/Lab and FMC) provides the ideal building footprint at no additional expense compared to the separate building concept. Therefore, the campus alternative is recommended for implementation. Early implementation of this project in combination with Phase I of the Secondary Treatment Process Improvements would be necessary to accommodate the required WWTP improvements, eliminate the need for moving staff to temporary facilities while facilities are retrofitted, or new ones are built, and minimize impacts to USD's customers.

Organics Processing

SB-1383 establishes targets for reducing landfill disposal of organic materials, including biosolids, based on the 2014 levels of organic waste disposal in California, achieving 50% reduction by 2020[1] and 75% reduction by 2025. Driven by community needs to reduce diversion of organics to landfills, USD may consider an organics processing facility as a result of the organics diversion requirements. This project could have impacts on solids processing, gas conditioning, energy generation, tipping fees, and nutrient loadings if implemented.

Addressing Sea Level Rise and Future Land Requirements

To protect land, infrastructure, and facilities at the WWTP from erosion, inundation, and flooding in the future, the levees surrounding the plant need to be raised to an elevation of 13.00 ft plus freeboard to withstand a 100-year storm by year 2050. The western levee will need to be raised 1 ft and the southern and eastern levees will need to be raised 5 ft. As part of this ETSU Program, a capital plan has not yet been developed to address the levee issues. This program endeavored to ensure that real estate is set aside for proposed future projects without constraining a future levee footprint.

[1] SB 1383 states January 1, 2020 is the target date for a 50% reduction in organic waste disposal. Enforcement and penalties with the regard to this reduction are scheduled to begin on January 1, 2022.

Further, to ensure that USD has sufficient land in which to accommodate additional needs not yet identified, the programming team investigated real estate purchase options offsite and adjacent to the WWTP. Other than land to the east that was considered for possible effluent equalization, the only land suitable for plant footprint expansion was determined to be to the north and northeast. The price of land, based upon comparable prices for similar land in the area, was not determined to be an unreasonable constraint, but the landowner's lack of interest in selling the larger parcels of property compelled the team to propose all planned facilities within the current USD footprint.

Resources Needed

The costs of the key projects recommended in this ETSU Program are summarized in **Table ES-1**, including the Secondary Treatment Process Improvements.

Table ES-1: Estimated Costs for Secondary Treatment Process Improvements (Phase I and Phase II) and Campus Building

Project	Cost (1)
Campus Building	$ 72.4 M
Secondary Treatment Process Improvements Phase I	$ 231.8 M
Secondary Treatment Process Improvements Phase II (2)	$ 253.5 M
TOTAL PROJECT COST	**$ 557.7 M**

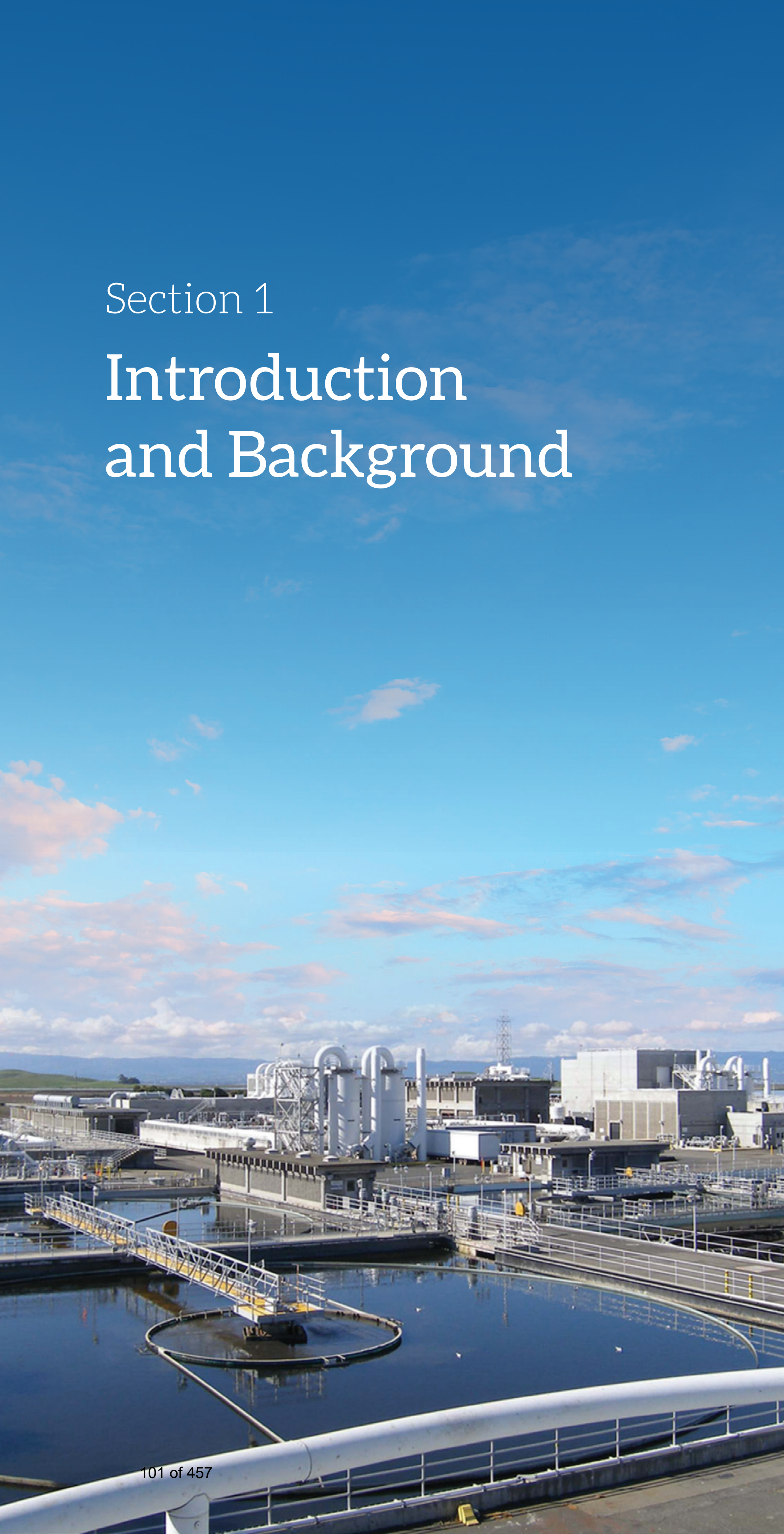
Notes:

1. Costs include inflation to midpoint of anticipated construction.
2. Assumes preliminary design for Phase II improvements to begin in July 2035.

The proposed Campus Building combines a new Administration Building, new Control/Lab Building, and a new Facilities Maintenance (FMC) building, with shared parking, elevators, lockers, common space, etc. to maximize efficiency and collaboration of staff. The Secondary Treatment Process Improvements, Phase I, include the upgrades to improve plant process performance immediately, improve effluent quality for increased shallow water discharge to Old Alameda Creek, and early action nutrient removal. Phase II includes improvements to meet nutrient requirements equivalent to BACWA Level 2 benchmarks and project flows and loads through 2040.

Section 1

Introduction and Background



1

Union Sanitary District's
Enhanced Treatment and Site Upgrade Program

1. INTRODUCTION AND BACKGROUND

1.1 Introduction

The goal of this Enhanced Treatment & Site Upgrade (ETSU) Program is to provide Union Sanitary District (USD) with a technically and fiscally sound practical plan for the District's Wastewater Treatment Plant (WWTP) located in Union City, CA for the next 20 to 40 years. The ETSU Program is intended to be a roadmap, outlining key decisions to be considered in the future. The roadmap will allow USD to implement critical near-term projects over the next 5 to 10 years while maintaining compatibility with the long-term vision for the WWTP, thereby avoiding stranded assets and undesirable space planning ramifications.

1.2 Goals and Approach

The following key tenets were considered as part of the ETSU Program:

1) The program must provide cost effective solutions
2) Impacts to ratepayers will reflect the values of the community and be fair and reasonable
3) USD will continue to be a good neighbor
    a) Odor control is critical
    b) Visual appearance to surrounding neighbors is considered

1.3 Challenges and Drivers

Over the planning period, USD is faced with a growing service area population, changing influent characteristics, increasingly stringent regulations, an unpredictable biosolids management environment, sea level rise, and aging infrastructure.

1.3.1 Secondary Treatment Process Capacity

The Solids System Capacity Assessment Report (*Carollo Engineers, August 2018*) documented that influent biochemical oxygen demand (BOD) and total suspended solids (TSS) concentrations have been increasing at the WWTP. In addition, population growth in the service area is projected to increase 1 percent per year during the planning period, with corresponding increases in flows and loads treated at the plant.

The WWTP average dry weather treatment capacity is limited due to poor settling of mixed liquor suspended solids, possibly resulting from the configuration of the existing aeration basin s and increased influent organic acid concentrations. This capacity limitation was corroborated in the Secondary Treatment Process Improvements Final Report (*Hazen and Sawyer, August 2019*). This report (included as **Appendix B**) evaluated a number of secondary improvements and recommendations have been incorporated into this ETSU Program. These improvements to the secondary system are required to more effectively treat the increased loading during both average and wet weather conditions as well as handling future service area population growth.

A major focus within the ETSU Program is to immediately upgrade the aeration basins and add new secondary clarification capacity.

1.3.2 Regulatory

Changes to the regulations governing both liquid and solids streams at the WWTP are expected. These include both nutrient removal requirements for treated effluent, and a shift towards beneficial reuse with regard to biosolids management.

1.3.2.1 Nutrients

Nutrients in the San Francisco Bay are becoming a major area of concern for the San Francisco Bay Area water quality community. A regional permit, *Waste Discharge Requirements for Nutrients from Municipal Wastewater Dischargers to San Francisco Bay*, was issued on April 9, 2014 by the San Francisco Regional Water Quality Control Board (RWQCB). This permit sets forth a regional framework to facilitate collaboration on studies that will inform future management decisions and regulatory strategies. The permit does not explicitly state nutrient removal goals, but future regulations will likely be more stringent than existing regulations. The second Watershed Permit became effective on July 1, 2019 and expires June 30, 2024. It has focused on an expanded science program, and the establishment of load targets which are set at 15% above 2014 base loads. It has also shifted focus from effluent Total Nitrogen (TN) to effluent Total Inorganic Nitrogen (TIN), which is defined as the sum of Total Ammonia (NH_3), Nitrate, and Nitrite as nitrogen. Timing of the RWQCB implementing specific nutrient limits is still unknown, although the next permit will likely include a dry season load cap.

As part of an ongoing nutrient management evaluation, the Bay Area Clean Water Agencies (BACWA) developed a work plan, including potential nutrient removal levels for treatment plants discharging to San Francisco Bay. The nutrient removal levels were established as reference points to develop treatment strategies and cost estimates and are not to be considered a basis for proposed permit limits. The evaluation plan, which was submitted to the RWQCB in November 2014, includes three potential levels of nutrient removal; one qualitative target based on optimizing nutrient removal and two quantitative total nitrogen and total phosphorus effluent limits. BACWA's reports were written prior to the July 1, 2019 Watershed Permit shifting focus from TN to TIN. Since the organic fraction of nitrogen found in wastewater is small compared to inorganic, these limits are still expected to be reasonable benchmarks for comparative analysis. For clarity, the rest of this document will refer to TN. These potential limits are summarized in **Table 1-1** below.

Table 1-1: Summary of BACWA Study Nutrient Removal Levels

Level	Units	Total Nitrogen (1)	Total Phosphorus
Existing Plant Optimization (2)	mg/L	---	---
Level 2	mg/L	15	1.0
Level 3	mg/L	6	0.3

Notes:

(1) Total nitrogen includes ammonia, nitrite, nitrate, particulate organic nitrogen, and soluble organic nitrogen.

(2) No specific discharge limits have been set for this phase. The focus here is to maximize existing treatment infrastructure to reduce nutrient loading in plant effluent.

The 15 mg-N/L limit is noted in the BACWA work plan as being achievable with conventional nutrient removal processes without adding an external carbon source or effluent filtration. The more stringent 6 mg-N/L limit would likely require an external carbon source for nitrogen removal and metal salt addition with filtration for most plant configurations[1]. The focus of this first phase on nutrient limits is nitrogen; regional permitting of phosphorus is possible in the future but does not appear likely at this time.

The average total nitrogen in USD's WWTP effluent from January 2016 to May 2019 was approximately 45.1 mg/L. To prepare for future nutrient removal requirements, USD is examining potential site impacts resulting from lower nutrient limits.

1.3.2.2 Restrictions on Biosolids Disposal

Senate Bill (SB) 1383 was passed in September 2016. It established methane emissions reduction targets aimed at reducing short-lived climate pollutants including methane. SB 1383 establishes a target of a 50% reduction in the statewide landfill disposal of organic waste by 2020[2] and a 75% reduction by 2025. These reduction percentages are based on the 2014 levels of organic waste disposal in California.

Decomposition of organic matter in landfills, including biosolids, is a significant source of methane emissions in the state. Therefore, landfill disposal of biosolids, including use as alternative daily cover, is a primary target of this bill. While this bill does not explicitly ban landfilling biosolids, it does heavily incentivize beneficial reuse as an alternate means of disposal, so it effectively serves as a landfill ban.

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[1] HDR, Brown and Caldwell. Potential Nutrient Reduction by Treatment Optimization and Treatment Upgrades, November 2014

[2] SB 1383 states January 1, 2020 is the target date for a 50% reduction in organic waste disposal. Enforcement and penalties with the regard to this reduction are scheduled to begin on January 1, 2022.

1.3.3 Wet Weather Effluent Discharge

The Hayward Marsh, owned and operated by the East Bay Regional Park District (EBRPD), receives and further polishes WWTP treated effluent that is not discharged to the EBDA outfall. Currently, during dry weather, approximately 2.6 MGD of WWTP effluent is pumped to Hayward Marsh as a fresh water source for the Marsh. During wet weather, WWTP effluent flows greater than 42.9 MGD are diverted to the Hayward Marsh. EBRPD has decided to convert the Hayward Marsh to a recreational facility and discontinue all treated effluent flows to the Hayward Marsh. Therefore, USD needs a wet weather effluent discharge alternative to the Hayward Marsh. USD is currently collaborating with EBRPD to transition the marsh management plan in a way that maximizes water quality protection at both Hayward Marsh and the Old Alameda Creek outfall where flows in excess to wet weather marsh flows are managed.

1.3.4 Sea Level Rise

According to a preliminary study on the effect of sea level rise on infrastructure at USD, the elevation of the 100-year storm still-water will be at an elevation of 13.00 ft in the year 2050, 14.08 ft in the year 2070, and 16.42 ft in the year 2100[1]. The elevations of the 100-year storm stillwater in 2050 and 2100 may be lower than the estimates from the ESA PWA Study, based on sea level rise estimates from the National Research Council.[2] To protect land, infrastructure, and facilities at the WWTP from erosion, inundation, and flooding in the future, the levees[3] surrounding the plant need to be raised to 13.00 ft plus freeboard. The western levee has a current levee crest elevation of approximately 12 ft NAVD88, and the southern and eastern levees have a levee crest elevation of approximately 7 ft NAVD88. Therefore, the western levee will need to be raised 1 ft and the southern and eastern levees will need to be raised 5 ft. In order to raise the height of the levee, the land would need to be cut horizontally towards the plant for sloping reasons. In **Figure 1-1** the blue cross-hatched area shows the additional area needed in order to raise the levees. The blue area is illustrative of where the future inside toe of the levee would need to be moved to in order to protect the plant against projected sea level rise. Conflicts with existing facilities will need to be worked out when these levees are implemented.

The Alameda County Flood Control & Water Conservation District (ACFWD) owns and operates a series of levees around USD, which falls into ACFWD's Zone 3A. ACFWD's levees along Old Alameda Creek vary in height from 10-14 ft NAVD88 to the north, south, and west of USD. If ACFWD raises its levees to protect against future sea level rise, then USD would be protected without needing to raise its own levees. USD should coordinate with ACFWD to plan for future sea level rise.

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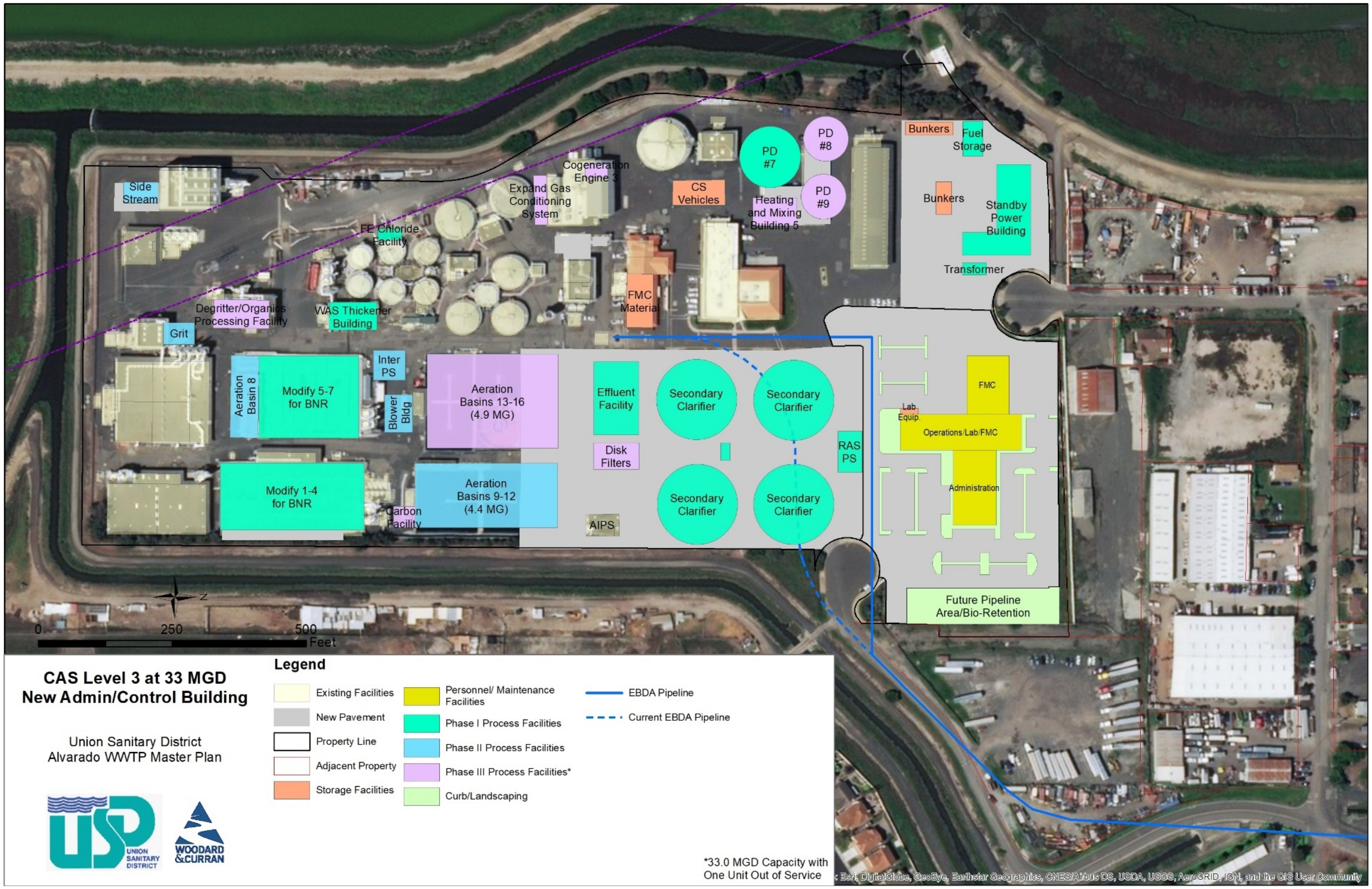
[1] ESA PWA. Union Sanitary District Preliminary Study of the Effect of Sea Level Rise on District Infrastructure, June 2013.

[2] National Research Council. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. Washington, DC: The National Academies Press, 2012.

[3] Levees were evaluated, but other alternatives such as vertical walls, horizontal levees, etc. are available.

Figure 1-1: Alvarado WWTP Site Use Study – Sea Level Rise Impacted Areas



1.3.5 Asset Management

In addition to the capacity, effluent, and nutrient removal drivers, the WWTP is also facing aging infrastructure drivers. While upgrades to the various systems have been completed, major infrastructure repairs are still required. A structural evaluation completed in 2013 noted that the east aeration basin covers need repair. Several of the buildings at the WWTP need significant seismic repairs including the Administration Building and the Control/Lab Building. Phase 1 of the Secondary Treatment Process Improvements, which is recommended for immediate implementation, affords USD the opportunity to address these aging infrastructure drivers while addressing the capacity and effluent disposal needs.

1.4 Additional Studies

The ETSU Program is built on numerous previous studies, combined with additional evaluation of select near-term issues, which require a more in-depth understanding in order to inform key near-term decisions. The additional evaluations performed as part of, or in conjunction with the ETSU Program, include:

- Effluent Management Study (see **Appendix A**)
- Secondary Treatment Process Improvements/Early Action Nutrient Removal – (see **Appendix B**)
- Administration, Control/Operations/Lab, and FMC Building Evaluation (see **Appendix C**)
- Real Estate Acquisition Investigation (See **Appendix D**)

Results of these evaluations are discussed in Section 2 through 5.

1.5 Projects Identified from Previous Studies

Other than the secondary process upgrades, related building demolitions and rebuilds, and effluent management facility improvements, the ETSU Program was largely developed based on previous projects and studies undertaken by USD. **Appendix E** contains table listing studies which describe these projects in more detail.

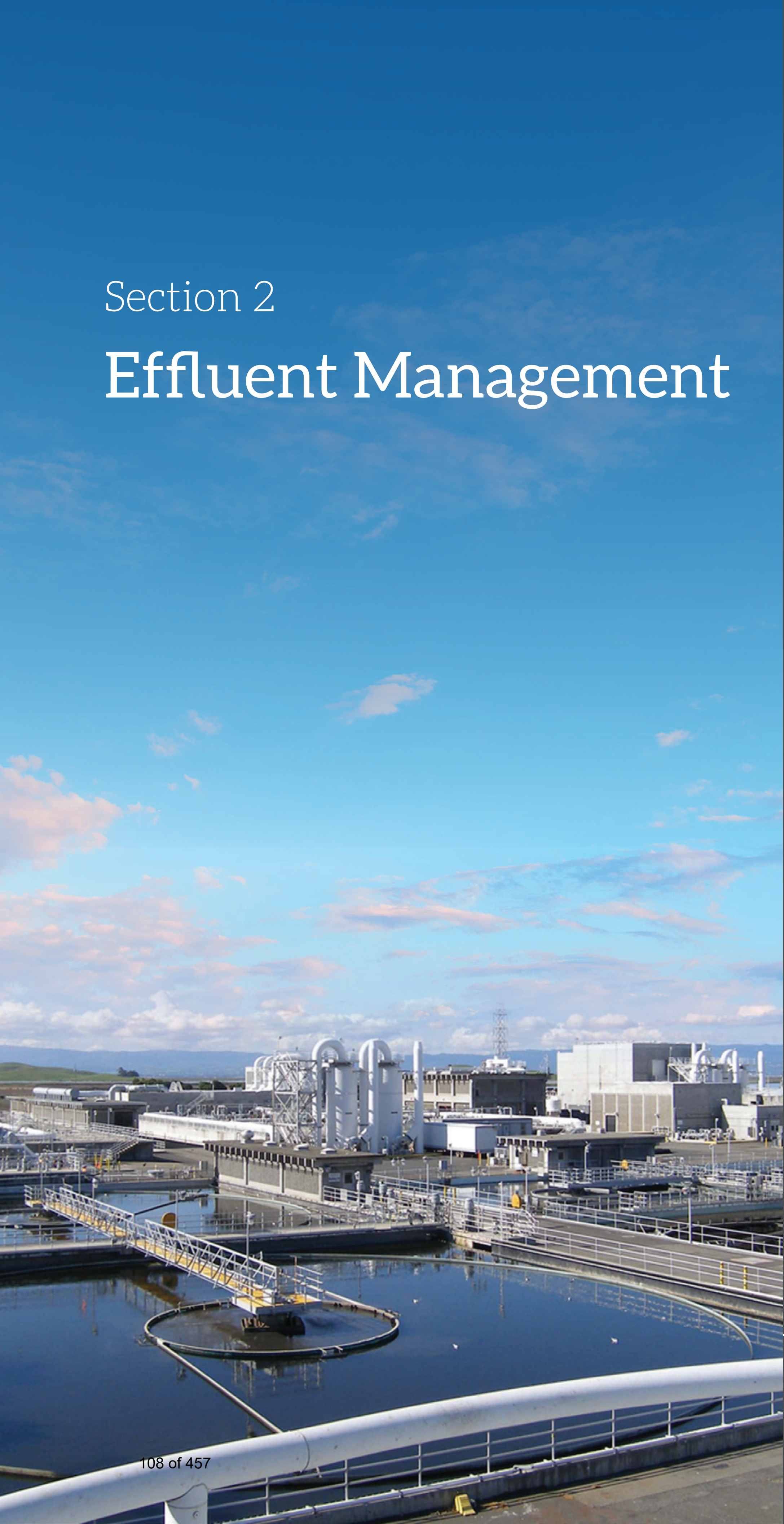
1.5.1 Fabrication, Maintenance and Construction Building / Paint Shop

USD's existing maintenance building and paint shop are nearing the end of their useful lives. The new Fabrication, Maintenance, and Construction (FMC) Building will include maintenance shop areas for the mechanics, electricians, and instrument technicians, and also a new paint shop. The proposed area for the building is approximately 15,300 SF. The space requirements will be further evaluated during the predesign phase for the new FMC Building. As part of the ETSU Program, the USD team has updated the FMC plan as part of the Campus Building (see Section 4.2).

Section 2

Effluent Management

2



Union Sanitary District's
Enhanced Treatment and Site Upgrade Program

2. EFFLUENT MANAGEMENT

This section summarizes the results of the Effluent Management Study (*Woodard & Curran, August 2019*) and discusses the impact of the conclusions on the ETSU Program. Please refer to **Appendix A** for the comprehensive evaluation.

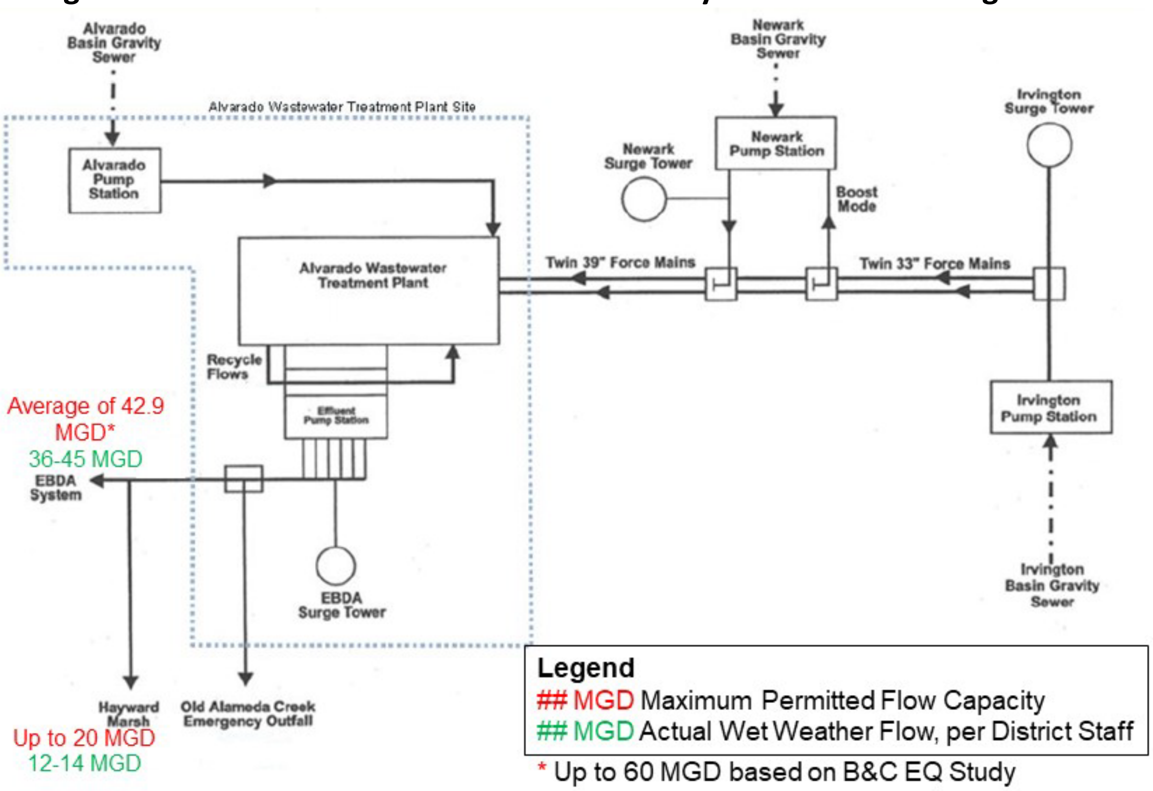
2.1 Existing Effluent Disposal System

The Union Sanitary District is evaluating strategies for disposing of treated wastewater from the WWTP. The WWTP currently provides secondary treatment of wastewater collected from Union City, Newark, and Fremont. Currently, USD is permitted to discharge secondary effluent at three discharge points:

- East Bay Dischargers Authority (EBDA) system
- Hayward Marsh
- Old Alameda Creek, during storm events only

Currently, USD is permitted to discharge up to 33 MGD average dry weather flow (ADWF). The WWTP effluent pump station is used to pump USD's treated effluent into the EBDA system. **Figure 2-1** shows a process flow schematic of the WWTP and the permitted flow capacities associated with its different discharge points.

Figure 2-1: Process Flow Schematic & Currently Permitted Discharge Points



Source: USD's Old Alameda Creek (Wet Weather Outfall) Permit. ORDER No. R2-2015-0045, NPDES No. CA0038733.

On average, approximately 3 MGD of effluent from USD is discharged from the EBDA pipeline to the Hayward Marsh. During peak weather events when total wastewater flow discharged by EBDA member agencies is beyond the capacity of the current system, up to 20 MGD of wastewater from USD's WWTP can be directed to Hayward Marsh. After the secondary-treated effluent flows through the freshwater treatment marsh, the reclaimed wastewater flows to San Francisco Bay.

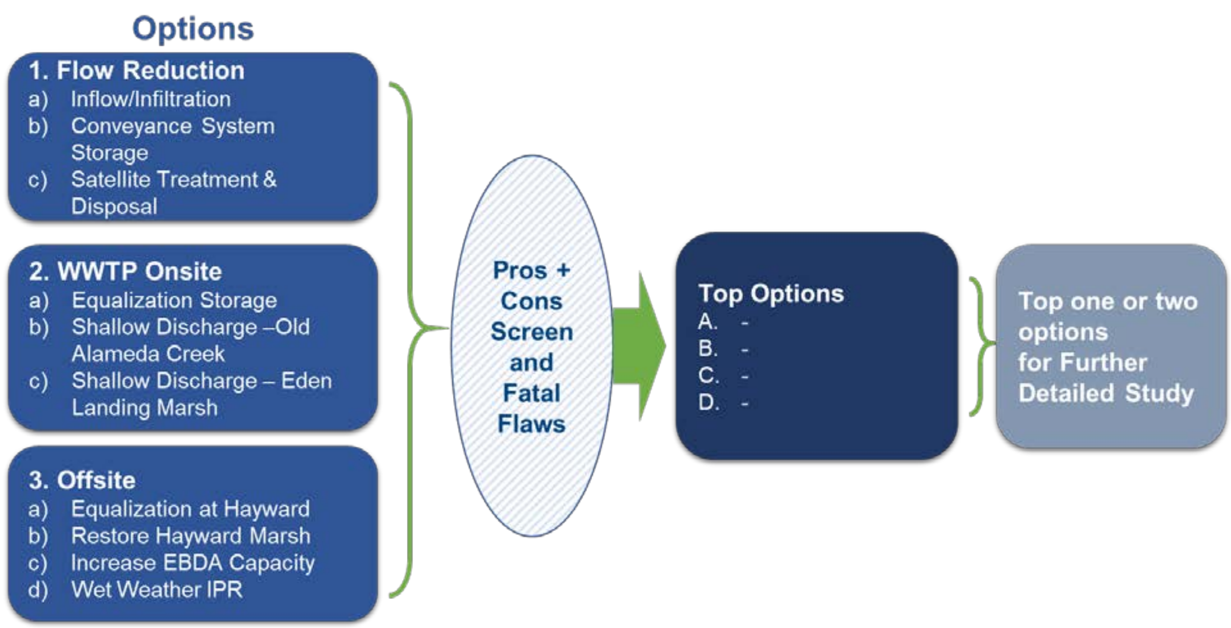
In addition to Hayward Marsh, during wet weather, USD can discharge to Old Alameda Creek. Although the previous maximum discharge flow limitation of 8.4 MG per discharge event is not retained in the current permit for Old Alameda Creek, calculations performed were based on this assumed limitation. USD has not been compelled to use this discharge point since 1998 but it typically has been exercised once per wet weather season since then.

Effluent options are required for USD in order to prepare for the elimination of Hayward Marsh as an option for wet weather discharges.

2.2 Alternatives Development

A range of effluent management and discharge options were identified and evaluated in this first phase of the Effluent Management Study. Management options are classified into three categories: 1) Flow Reductions, which are focused on reducing flows coming into the WWTP, 2) On-site at the WWTP, and 3) Off-site, which are focused on managing effluent downstream of the WWTP effluent pump station.

Figure 2-2: Effluent Management Study Approach



Each alternative was evaluated based on their viability, and the extent to which they can provide a solution to future effluent storage requirements. **Table 2-1** provides a summary of the effluent management options evaluation.

Table 2-1: Summary of Effluent Management Options

Alternative	Agency Coordination/ Complexity	Storage Volume/Flow Discharge Available	Complete solution?	Planning Level Costs	Implementation Timing	Viability
Influent Flow Reduction						
Conveyance System Storage	USD	Additional 1.8 MG @ Irvington, 2 MG @ Newark	Minor	~$10 M – $30 M, each basin [1]	3 – 5 years (based on current CIP)	Moderate
WWTP Onsite/Adjacent						
<u>Equalization Storage</u>						
EQ Basin East of WWTP	USD, ACFCD, ACWD, Army Corps, Water Board	Up to 20 MG	Partial to Full	$90 M [2]	5 years or more for permitting; potential partnership with ACFCD	Low
<u>Early Action Nutrient Removal + Old Alameda Creek Shallow Water Discharge</u>						
Alternative 1: Sidestream Nutrient Removal for Centrate	USD, Water Board	Dependent on negotiations RWQCB; permitting analysis underway	Partial to Full	$20.8 M [3]	4 – 5 years for design, construction, and permitting	Moderate

[1] Costs estimated from ongoing predesign effort for storage basin at Newark Pump Station.
[2] Cost from the Secondary Treatment Process Improvements (CAS Option 3) in Appendix B.
[3] Cost from the Secondary Treatment Process Improvements (CAS Option 2 – Phase II) in Appendix B.

Alternative	Agency Coordination/ Complexity	Storage Volume/Flow Discharge Available	Complete solution?	Planning Level Costs	Implementation Timing	Viability
Alternative 2: Full Flow Nutrient Removal	USD, Water Board	Dependent on negotiations RWQCB; permitting analysis underway	Full	$23.2 M [1]	7 years for design, construction, and permitting	High (recommended approach)
Offsite						
Baseline Restoration of Hayward Marsh	USD, Water Board, EBRPD	20 MGD	Partial	$20.1 M (April 2018 dollars)	More than 5 years to complete construction	Low
Wet Weather IPR	USD/ACWD/ Regional Agencies, Water Board	Up to 5 MGD without regional coordination	Partial	$80 M (2016 dollars; includes treatment and distribution)	Minimum 5 – 6 years for design, construction, and permitting	Low

[1] Only a fraction of the Secondary Treatment Process Improvements (CAS Option 2 – Phase I) in Appendix B is attributable to early action nutrient removal. That fraction is estimated at 10%, or $23.2 million, and is estimated to result in sufficient nutrient removal to permit increased shallow water discharges to Old Alameda Creek.

2.3 Recommended Alternatives

As shown in the table, the most viable options (with Moderate viability or better) are the following:

- Conveyance System Storage
- Shallow Water Discharge: Early Action Nutrient Removal + Old Alameda Creek

2.3.1 Conveyance System Storage

This option involves expanding the use of available storage within the existing conveyance system for peak flow attenuation. There is an existing wet weather equalization tank at the Irvington Pump Station, with a capacity of 1.8 MG. According to the Flow Equalization Update Report (*Brown and Caldwell, 2013*), this basin could be increased to 3.6 MG. However, there is currently not a reliable method in place for diverting influent flow into the existing storage at Irvington Pump Station without the capacity of the twin force mains being impacted. The Newark Pump Station site could allow for another 2 MG of similar influent storage.

In order to further vet this option, USD would need to identify the efforts and costs needed to avoid impacts to the force mains when diverting influent flow into the Irvington Pump Station basins, and/or to create a new influent storage basin at the Newark Pump Station. The identified influent storage available in the conveyance system is limited compared to the buildout storage needed (20 MG for secondary effluent storage up to 2038, and potentially beyond) so it would only provide a <u>minor</u> solution. Previous evaluation has determined that conveyance system storage is possible and is of <u>moderate</u> viability due to USD ownership of the facilities.

2.3.2 Shallow Water Discharge: Old Alameda Creek

Under this option, additional effluent capacity could be obtained by reducing the constraints on the use of the Old Alameda Creek (OAC) discharge location. Old Alameda Creek currently serves as an emergency outfall during peak wet weather flow conditions, but no maximum discharge rate is specified in the permit. The previous permit order dictated a maximum discharge volume limitation of 8.4 MG per discharge event, which was the expected flow from a storm with a 20-year return frequency (i.e., a 20-year storm). According to the permit, this number was determined from the USD's *1994 District Wide Master Plan* and *1999 Wastewater Equalization Storage Facilities Pre-Design*. The current order replaces the discharge flow limitation with a standard prohibition against the bypass of treatment systems. For more long-term, the increased frequency of use would be required. Some increase in treatment level at the WWTP would likely be required by the Regional Water Quality Control Board (RWQCB) to allow this increase because it is a shallow water discharge and could have more impacts on beneficial uses with increased frequency of use and increased volume of discharge. Consequently, it is anticipated that future nutrient removal improvements would be needed for the portion of flow discharged to Old Alameda Creek. Because the Secondary Treatment Process Improvements are recommended in this ETSU Program for implementation in Phase I to address immediate process improvement needs, it appears that some full flow (not sidestream) ammonia and overall TIN removal would be most cost effective and reduce the potential impacts of increased shallow water discharge volumes and frequencies relative to sidestream treatment.

2.4 Implementation

2.4.1 Shallow Water Discharge

The ETSU Program proposes implementing upgrades to improve secondary process performance as soon as possible. Additional nutrient removal capability as indicated through ongoing evaluation of future nutrient watershed permits would also be implemented concurrently. These upgrades are discussed in more detail in Chapter 3. Incorporating multiple benefits such as improved process performance, Title 22 recycled water production, and other benefits would need to be factored in to increase the viability of the early action nutrient removal options given their capital cost. USD has had favorable discussions with RWQCB staff regarding possibly permitting an increased wintertime discharge to Old Alameda Creek during high flow periods, along with early action nutrient removal; the next steps are underway and include developing technical studies and, if appropriate, a permit application.

USD, in conjunction with Woodard & Curran, is developing more defined technical documentation regarding discharge to Old Alameda Creek. This documentation will include analyses defining:

- Frequency of discharge to Old Alameda Creek after discharge to Hayward Marsh is no longer possible
- Projected water quality of the discharge based on the implementation timeline of process upgrades

If accepted, the RWQCB would be granting USD an exception to the current shallow water discharge prohibition on the basis that USD would be providing an "equivalent level of environmental protection"[1] to San Francisco Bay due to nutrient removal. This technical proposal is expected to be submitted to the RWQCB in September 2019.

In the meantime, USD will continue to work with EBRPD on the transition of Hayward Marsh from facility accepting secondary effluent from USD year-round to a facility used only during wet weather events for equalization and potential discharge in conjunction with Old Alameda Creek.

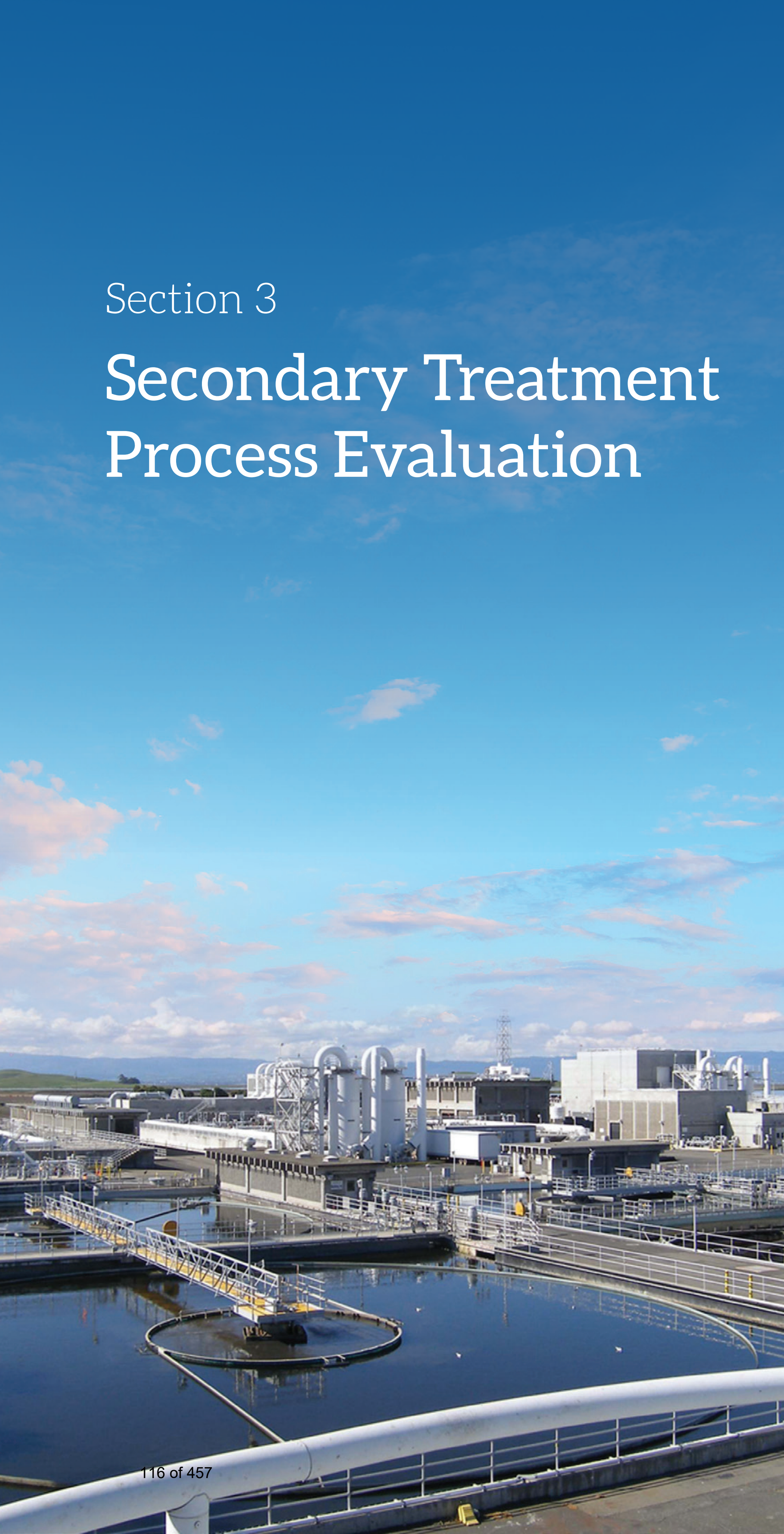
[1] San Francisco Bay Regional Water Quality Control Board. Order No. R2-2015-0045, NPDES No. CA0038733 Attachment F. November 18, 2015.

2.4.2 Recycled Water

USD continues to be open to collaborate with ACWD to ensure that secondary effluent may be made available if sufficient demand for recycled water is established. ACWD, in collaboration with SFPUC, is currently evaluating the feasibility and cost of a regional potable reuse project. This study commenced in July 2019; sizing and timing of this facility has yet to be determined.

Section 3

Secondary Treatment Process Evaluation



3

Union Sanitar y District's
Enhanced Treatment and Site Upgrade Program

3. SECONDARY TREATMENT PROCESS EVALUATION

The Solids System Capacity Assessment (*Carollo Engineers, August 2018*) provided capacity evaluation of the liquid treatment process and found that the following secondary improvements were required to provide additional capacity:

- Aeration Basins
  - Retrofit Aeration Basins 5-7 to create plug flow operation and anaerobic selectors
  - Add sludge reaeration capabilities and submersible mixers to the retrofitted selectors
  - Add foam and scum decant gates to all basins
  - Retrofit Aeration Basins 1-4 to create anaerobic selectors
- Secondary Clarifiers
  - Shorten Secondary Clarifier 5 baffle to match Secondary Clarifier 6
  - Operate all clarifiers with all 8 rotary valves in use
  - Replace sludge withdrawal mechanisms in Secondary Clarifiers 5 and 6 with suction header type mechanisms
  - Construct Secondary Clarifiers 7 and 8

These recommended improvements, however, were based on the continuation of current conventional activated sludge operation and did not address future nutrient removal requirements. Thus, initial evaluations incorporated these improvements into recommendations that would also address anticipated nutrient removal requirements. The secondary system upgrades initially proposed were all based on capacity evaluation assumptions of full nutrient removal treatment with the largest treatment unit out of service. This conservative basis led to a large footprint requirement at buildout, a which exceeded the space available at the plant.

Real estate acquisition to accommodate expansion of the plant was considered (discussed in further detail in Chapter 5). It became obvious that acquiring real estate near the plant would likely be a time-consuming and expensive process. USD chose to re-evaluate secondary treatment requirements to see if a less space-intensive solution could be formulated. Hazen and Sawyer was retained to conduct this evaluation. The remainder of this section summarizes the results of the Secondary Treatment Process Improvements Final Report (*Hazen and Sawyer, August 2019*) and discusses the impact of the conclusions on the ETSU Program. Please refer to **Appendix B** for the comprehensive evaluation.

3.1 Secondary Treatment Process Challenges and Drivers

The goal of the Secondary Treatment Process Improvements project was to evaluate alternatives to upgrade the secondary treatment system at the WWTP in response to the following challenges and drivers discussed in Section 1:

- Improve Process Reliability and Performance
- Wet Weather Treatment and Effluent Discharge
- Capacity Expansion
- Aging Infrastructure
- Synergy with Future Nutrient Removal
- Constrained Site with Limited Space for New Facilities

3.2 Alternatives Development

3.2.1 Phased Approach

A phased or programmatic approach to the Secondary Treatment Improvements Project is proposed to distribute cash flow and capital improvements over time. The benefit of implementing a phased approach is that later phases can be implemented when needed, preventing overbuilding or stranded assets. This is particularly useful for USD as the timing of near-term drivers are well-defined, but the impact and timing of long-term drivers are not. Therefore, developing a trigger-based approach will optimize capital expenditure and minimize risk.

Phase I of the Secondary Treatment Process Improvements is defined as the improvements needed to address the immediate and near-term needs at the WWTP to address process performance. The time frame for implementing Phase I is 2019 through 2026. Phase I is not tied to specific permit limits, beyond the current BOD and TSS limits in the existing WWTP NPDES permit. As a result, Phase I could include a wide spectrum of secondary treatment options, varying from no nutrient removal, seasonal removal, to year-round removal (however not to BACWA Level 2 standards).

Phase II of the Secondary Treatment Process Improvements covers the need for additional treatment capacity and potential BACWA Level 2 nutrient removal levels which are expected to take effect in 15-20 years. Phase III is the time period in which BACWA Level 3 nutrient removal levels at buildout conditions (33 MGD Annual Average [AA] Flow) may be required. Phase III is proposed to be implemented by approximately 2058.

3.2.2 Design Flows and Loads

The annual average (AA) and maximum month (M) influent flows and loads for the 2028 (Phase I) and 2040 (Phase II) design horizon are presented in **Table 3-1**.

Table 3-1: Design Flows and Loads

Parameter	Year	Current(1)		2028(1)		2040(1)		Buildout (2058)(2)	
	Units	AA	M	AA	M	AA	M	AA	M
Flow	mgd	23.4	26.9	25.8	29.7	29.1	33.5	33	37.9
Peak Hour Flow	mgd	64.7	64.7	67.1	67.1	70.4	70.4	74.4	74.4
Chemical Oxygen Demand (COD)	lbs/ day	146,000	167,900	161,300	185,500	181,700	209,000	206,100	237,000
Carbonaceous Biochemical Oxygen Demand (cBOD)	lbs/ day	52,600	60,500	58,100	66,800	65,500	75,300	74,300	85,400
Total Suspended Solids (TSS)	lbs/ day	70,500	81,100	77,900	89,600	87,800	100,900	99,600	114,500
Total Kjeldahl Nitrogen (TKN)	lbs/ day	10,650	12,240	11,800	13,500	13,250	15,240	15,100	17,400
Ammonia as Nitrogen (NH_3-N)	lbs/ day	7,200	8,300	8,000	9,200	9,010	10,360	10,300	11,800
Total Phosphorus (TP)	lbs/ day	1,350	1,560	1,490	1,720	1,680	1,940	2,000	2,300

(1) Source: Secondary Treatment Process Improvements Project Report, Hazen and Sawyer, August 2019.
(2) Extrapolated based on peaking factors for Current, 2028, and 2040 values.

3.2.3 Process Alternatives

A comprehensive analysis of options for early action nutrient removal was conducted as part of the Effluent Management Study (**Appendix A**) to enable the plant to initiate wet weather discharge to Old Alameda Creek. The results of that study narrowed the alternatives to Membrane Biological Reactor (MBR) and Conventional Activated Sludge (CAS). These two alternatives were further evaluated in the Secondary Treatment Process Improvements (**Appendix B**). Process alternatives evaluated in the Secondary Treatment Process Improvements were sized using a calibrated BioWin™ version 5.3 process model and computational fluid dynamics (CFD) modeling to meet anticipated Phase II permit limits, which are summarized in **Table 3-2**.

Table 3-2: Current and Projected Permit Limits by Phase

<table>
<tr><th rowspan="2">Parameter</th><th rowspan="2">Units</th><th rowspan="2">Basis</th><th colspan="3">Limit/Target</th></tr>
<tr><th>Phase I</th><th>Phase II</th><th>Phase III</th></tr>
<tr><th colspan="6">San Francisco Bay Discharge (EBDA)</th></tr>
<tr><td rowspan="2">cBOD</td><td rowspan="2">mg/L</td><td>Monthly</td><td colspan="3">25</td></tr>
<tr><td>Weekly</td><td colspan="3">40</td></tr>
<tr><td rowspan="2">TSS</td><td rowspan="2">mg/L</td><td>Monthly</td><td colspan="3">30</td></tr>
<tr><td>Weekly</td><td colspan="3">45</td></tr>
<tr><td>NH_3-N</td><td>mg/L</td><td>Monthly(1)</td><td rowspan="3">Optimize existing infrastructure(2)</td><td>2</td><td>2</td></tr>
<tr><td>Total Nitrogen (TN)</td><td>mg/L</td><td>Monthly(1)</td><td>15</td><td>6</td></tr>
<tr><td>TP</td><td>mg/L</td><td>Monthly(1)</td><td>1</td><td>0.3</td></tr>
<tr><th colspan="6">Old Alameda Creek Discharge(3)</th></tr>
<tr><td>Flow</td><td>mgd</td><td rowspan="5">Each discharge event</td><td colspan="3">0-22</td></tr>
<tr><td>cBOD</td><td>mg/L</td><td colspan="3">10</td></tr>
<tr><td>TSS</td><td>mg/L</td><td colspan="3">15</td></tr>
<tr><td>TN Removal</td><td>%</td><td colspan="3">20(4)</td></tr>
<tr><td>Ammonia</td><td>mg/L</td><td colspan="3">2</td></tr>
</table>

Notes:

1) At this time, the basis for nutrient removal limits is not known. For this analysis, the BACWA Level 2 and Level 3 concentrations were assumed to be monthly average targets.
2) No specific permit limits were defined for this phase. USD may optimize existing infrastructure to achieve some level of ammonia removal.
3) No standards for discharge to Old Alameda Creek have yet been defined. These values were used as an initial target for analysis.
4) On an annual mass loading basis, as measured at the EBDA Discharge.

Various combinations of flow and load scenarios were run to evaluate the process alternatives, and these are presented in **Table 3-3**. Redundancy was also incorporated into these scenarios, by taking one aeration basin (AB) or one secondary clarifier (SC) out of service (OOS) during dry weather operation. For more details on how these alternatives were developed, please refer to **Appendix B**.

Table 3-3: 2040 Model Influent Flow, Loads, and Concentrations

Scenario	AA		M		M Load-AA Flows		Redundancy – 1 AB OOS, AA		Redundancy – 1 SC OOS, AA	
Flow, mgd	29		33		29		29		29	
Temp, ºC	16		16		16		16		16	
Units	lbs/day	mg/L	lbs/day	mg/L	lbs/day	mg/L	lbs/day	mg/L	lbs/day	mg/L
cBOD	77,000	270	88,500	270	88,500	310	77,000	270	77,000	270
COD	182,000	749	209,000	749	209,000	861	182,000	749	182,000	749
TSS	85,500	362	98,000	362	98,000	416	85,500	362	85,500	362
TKN	13,300	55	15,300	55	15,300	63	13,300	55	13,300	55
NH_3-N	9,000	37	10,400	37	10,400	43	9,000	37	9,000	37
TP	1,690	6.9	1,940	6.9	1,940	8.0	1,690	6.9	1,690	6.9

In addition to secondary process upgrades, both alternatives require additional facilities for effluent management, sidestream treatment, and chemical phosphorus removal. These facilities are listed in **Section 3.2.3.3**. Development of these additional facilities is also discussed in Chapter 6 of **Appendix B**.

3.2.3.1 MBR Alternative

Figure 3-1 and **Figure 3-2** show the MBR process model flow diagram provided by Hazen and Sawyer. **Table 3-4** summarizes the MBR alternative sized to meet Phase II (BACWA Level 2 Nutrient Removal) permit limits.

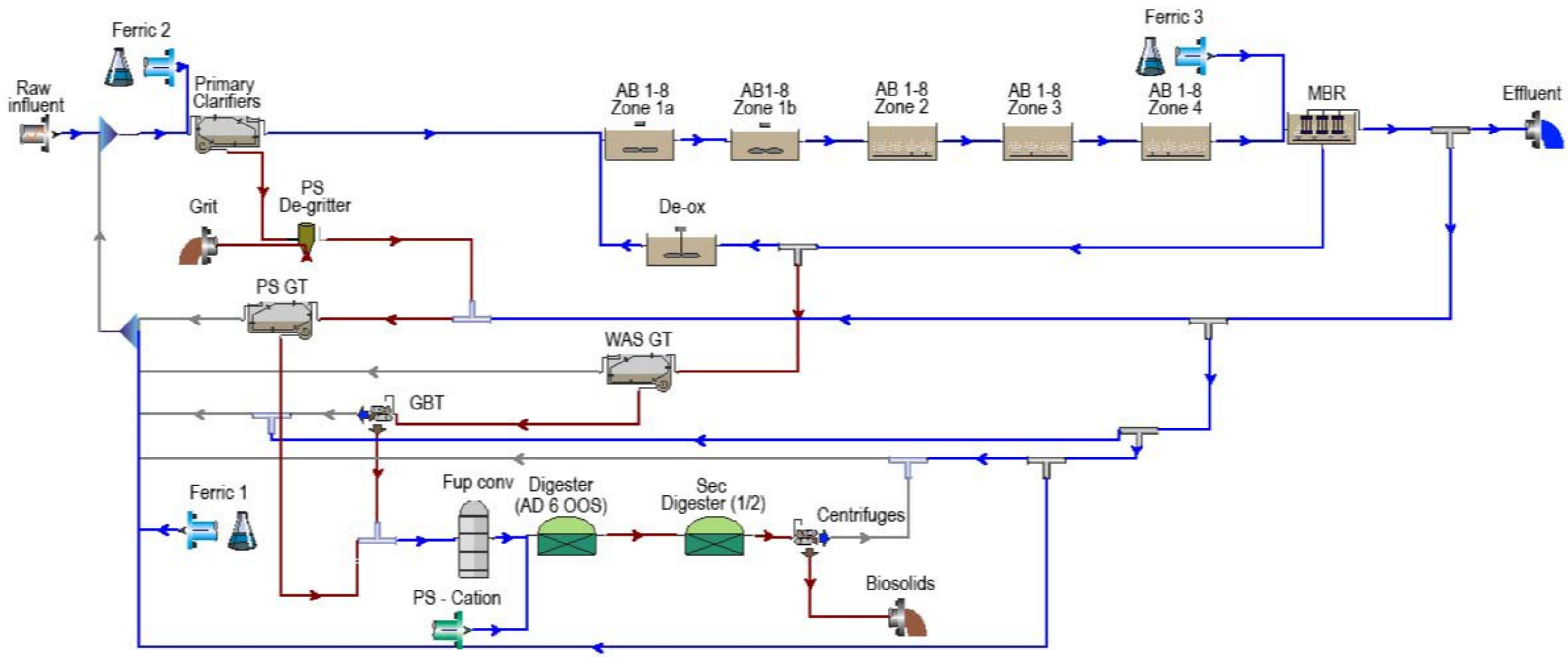
Table 3-4: MBR Alternative Summary and Model Results for Phase II Requirements

Unit Process	Parameter	Units	Scenario	
			All Units in Service(1)	1 Aeration Basin OOS
Aeration	Basins in Service	#	8	7
	Total Volume	MG	8.5	7.4
	MLSS	mg/L	7,300-7,700	8,000
	Solids Retention Time (SRT)	days	13	13
	Aerobic SRT	Days	8	8
MBR Tanks	Trains in Service	#	9	8
	Total Cassettes	#	162	144
	Total Reactor Volume	MG	8.5	---
	RAS Deoxygenation Volume		0.5	---
	Anoxic Volume		2.8	---
	Aerobic Volume		5.2	---
	Surface Area	Msf	3.1	2.7
	Design Flux	g/sf	12.5-14.5	12.5
	Actual Flux	g/sf	9.3-10.7	10.5
	RAS Ratio	%	400	400
WAS	WAS Flow	mgd	0.47-0.48	0.43
	WAS Concentration	mg/L	9,000-9,800	10,100
	WAS Load	lbs/day	36,000-39,300	36,200
Secondary Effluent	cBOD	mg/L	~1	~1
	TSS	mg/L	0	<1
	TN	mg N/L	~11-12	~11-12
	NH_3-N	mg N/L	<0.5	<0.5
	NO_3	mg N/L	~9-10	~9-10
	NO_2	mg N/L	~0	~0
	Total Inorganic Nitrogen (TIN)	mg N/L	~9-10	~9-10
	TP	mg N/L	<1	<1
	PO_4-P	mg P/L	<1	<1

Notes:

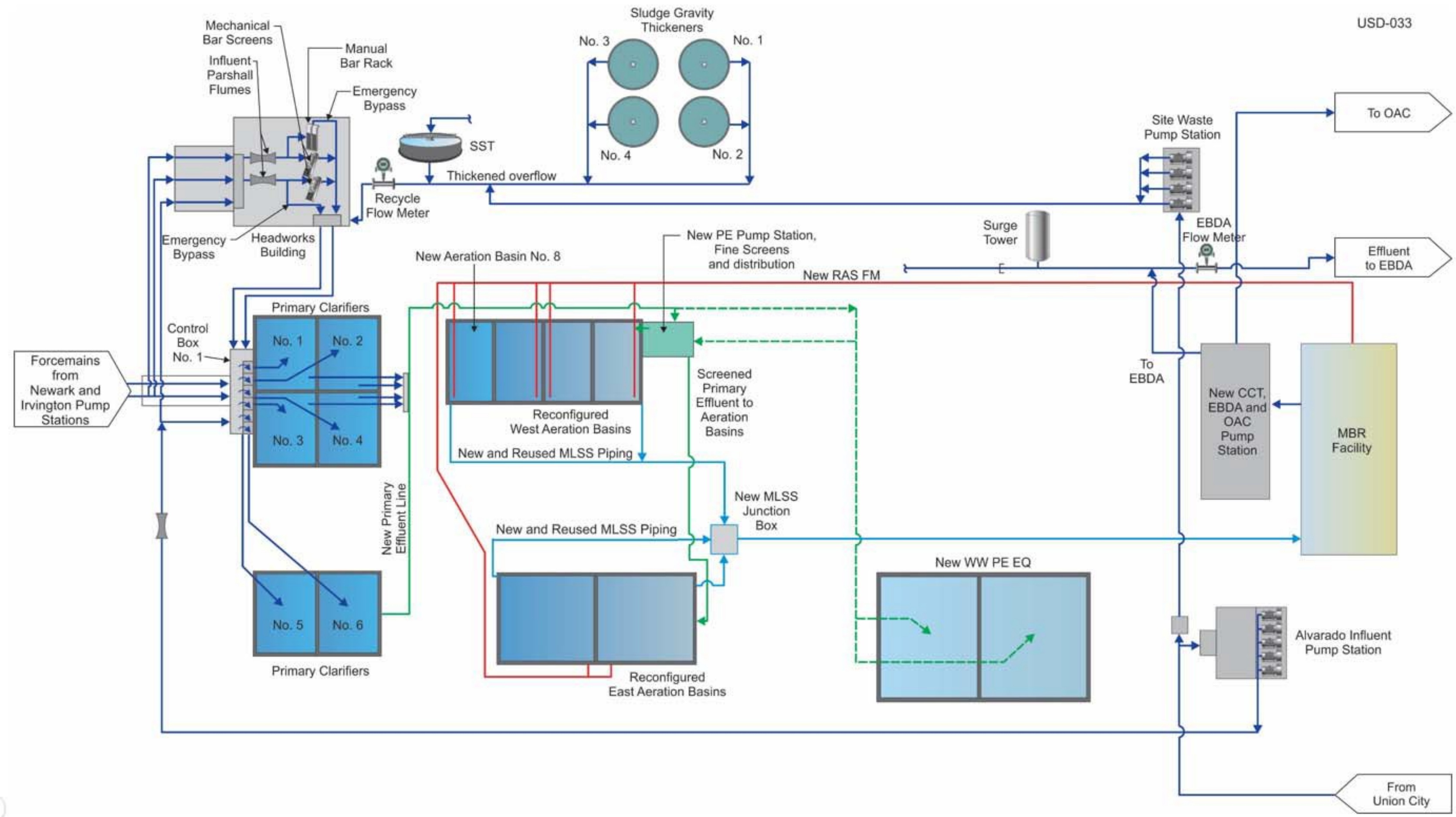
(1) This column reflects the range of scenarios through AA flow and load conditions, M flow and load conditions, and AA flow with M load conditions.

Figure 3-1: MBR Process Model(Biowin) Flow Diagram



Source: Secondary Treatment Process Improvements Final Report, Hazen and Sawyer, August 2019

Figure 3-2: MBR Process Flow Diagram



Source: Secondary Treatment Process Improvements Final Report, Hazen and Sawyer, August 2019

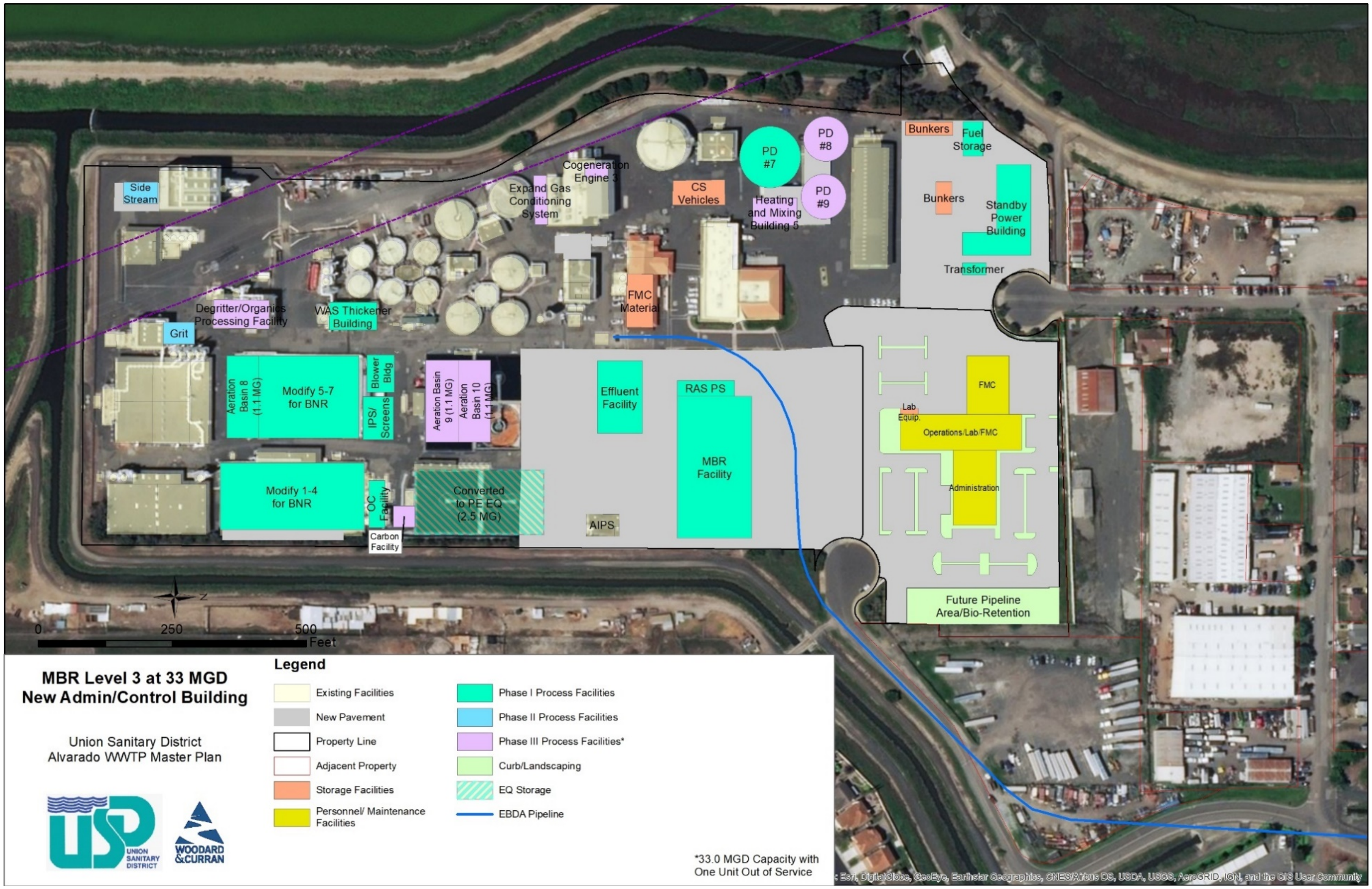
This alternative requires a total of 8.5 MG of reactor volume to meet Phase II permit limits. Existing reactor (aeration basin) volume totals 7.4 MG, therefore 1.1 MG of new reactor volume would be required. The existing reactors would be reconfigured to accommodate anoxic, anaerobic, and RAS deoxygenation zones.

This alternative is comprised of the following key modifications:

- Modified Aeration Basins 1-4 (East)
- Modified Aeration Basins 5-7 (West)
- New Aeration Basin 8 south of existing Aeration Basin 5-7
- New 60-inch PE line to centrally located Intermediate Pump Station routed to the west of existing Aeration Basin 5-7
- New intermediate pump station and fine screen facility
- New blower facility north of existing Aeration Basin 5-7
- PE distribution piping to the east and west aeration basins
- New 2.5 MG equalization basin (converted existing square secondary clarifiers)
- New MLSS junction box and reuse of the existing 60-inch line to the MBR tanks
- New MBR facility that includes:
    - 9 Membrane tanks (cassettes installed in 8 tanks)
    - Clean in place chemical storage and fee system
    - Scour blowers
    - Permeate pumps
- New effluent facility (see **Section 3.2.3.3** for further detail)

To meet Phase III permit limits, an additional 2.2 MG of reactor volume (Aeration Basins 9 and 10) is required, along with carbon addition facilities and additional membrane cassettes to meet increased flows. **Figure 3-3** shows a conceptual layout of these facilities, and phasing.

Figure 3-3: MBR Alternative - Phase III Conceptual Layout



3.2.3.2 CAS Alternative

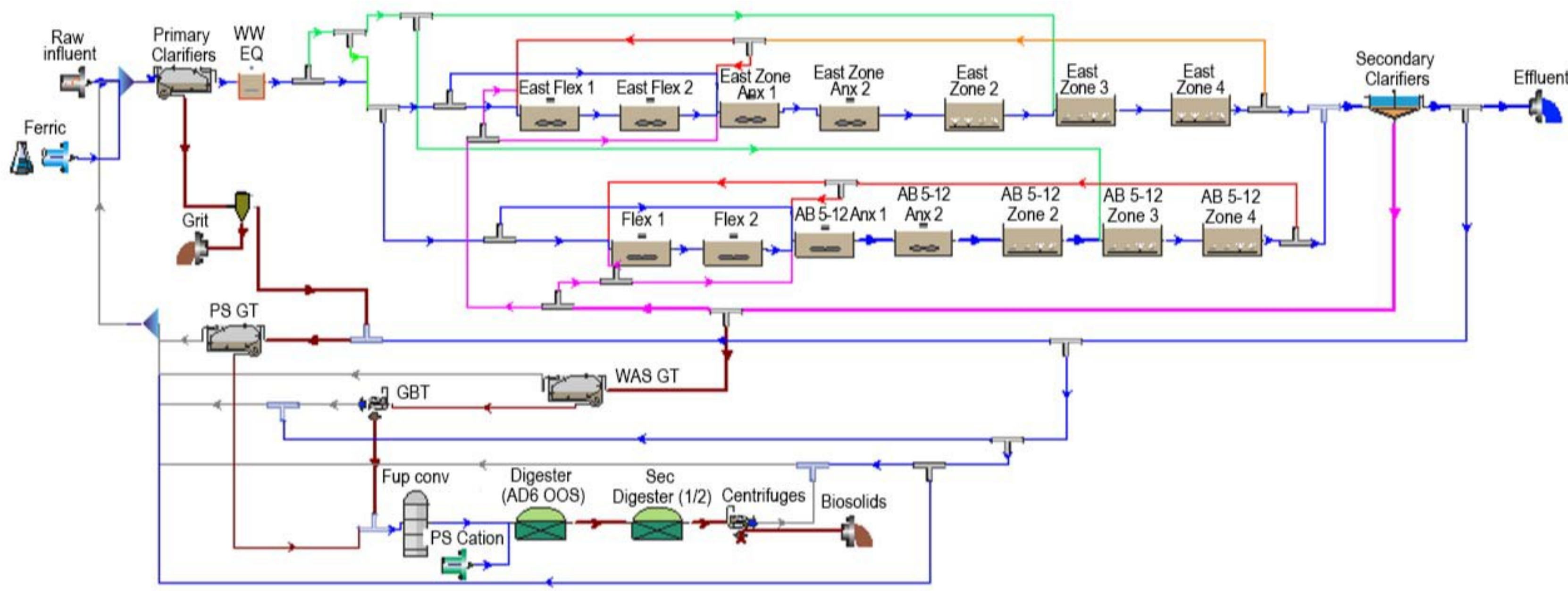
The CAS alternative evaluated in the Secondary Treatment Process Improvements differs from USD's current configuration. Instead of operating in a simple plug flow configuration with no mixed liquor recycle and aeration diffusers in every segment of the basins, the new configuration incorporates a step-feed operation mode for wet weather treatment, anoxic zones with mixers in lieu of diffusers for denitrification, and mixed liquor recycle pumps to enable nutrient removal. The CAS alternative evaluated by Hazen and Sawyer is summarized in **Table 3-5. Figure 3-4** and **Figure 3-5** shows the CAS process model flow diagram provided by Hazen and Sawyer.

Table 3-5: CAS Alternative Summary and Model Results for Phase II Requirements

Unit Process	Parameter	Units	Scenarios		
			All Units in Service[1]	1 Aeration Basin OOS	1 Secondary Clarifier OOS
Aeration	Basins in Service	#	10	9	10
	Total Volume	MG	12.9	11.6	12.9
	Swing Zone Volume	MG	0.5	---	---
	Anoxic Volume	MG	3.1	---	---
	Aerobic Volume	MG	9.3	---	---
	MLSS zone 2	mg/L	3,100-5,000	3,600	3,100
	MLSS zone 4	mg/L	2,700-3,600	3,600	3,100
	SRT	days	~10-13	~8	~10
	Aerobic SRT	Days	~6.5-8	~5.6	~6.5
Secondary Clarification	Number	#	4	4	3
	Diameter	ft	155	155	155
	Surface Area	sf	75,500	75,500	56,600
	Volume	MG	10	10	7.5
	Surface Overflow Rate (SOR)	gpd/sf	415-810	415	550
	Solids Loading Rate (SLR)	lbs/d/sf	18-23	20	24
	Sludge Volume Index (SVI)	mL/g	110	110	110
	RAS Ratio	%	64	64	64
Waste Activated Sludge	WAS Flow	mgd	0.55	0.55	0.55
	WAS Concentration	mg/L	8,000-9,100	9,100	8,000
	WAS Load	lbs/day	38,000-43,000	35,000	34,000
Secondary Effluent	cBOD	mg/L	<10	<10	<10
	TSS	mg/L	<15	<15	<15
	TN	mg N/L	~12-14	~13	~12
	NH_3-N	mg N/L	~1-2	~2	~1
	NO_3	mg N/L	~7-10	~9	~9
	NO_2	mg N/L	<0.5-1	<1.0	<1.0
	Total Inorganic Nitrogen (TIN)	mg N/L	~7-10	~9	~9
	TP	mg N/L	<1.0	<1.0	<1.0
	PO_4-P	mg P/L	<0.5	<0.5	<0.5

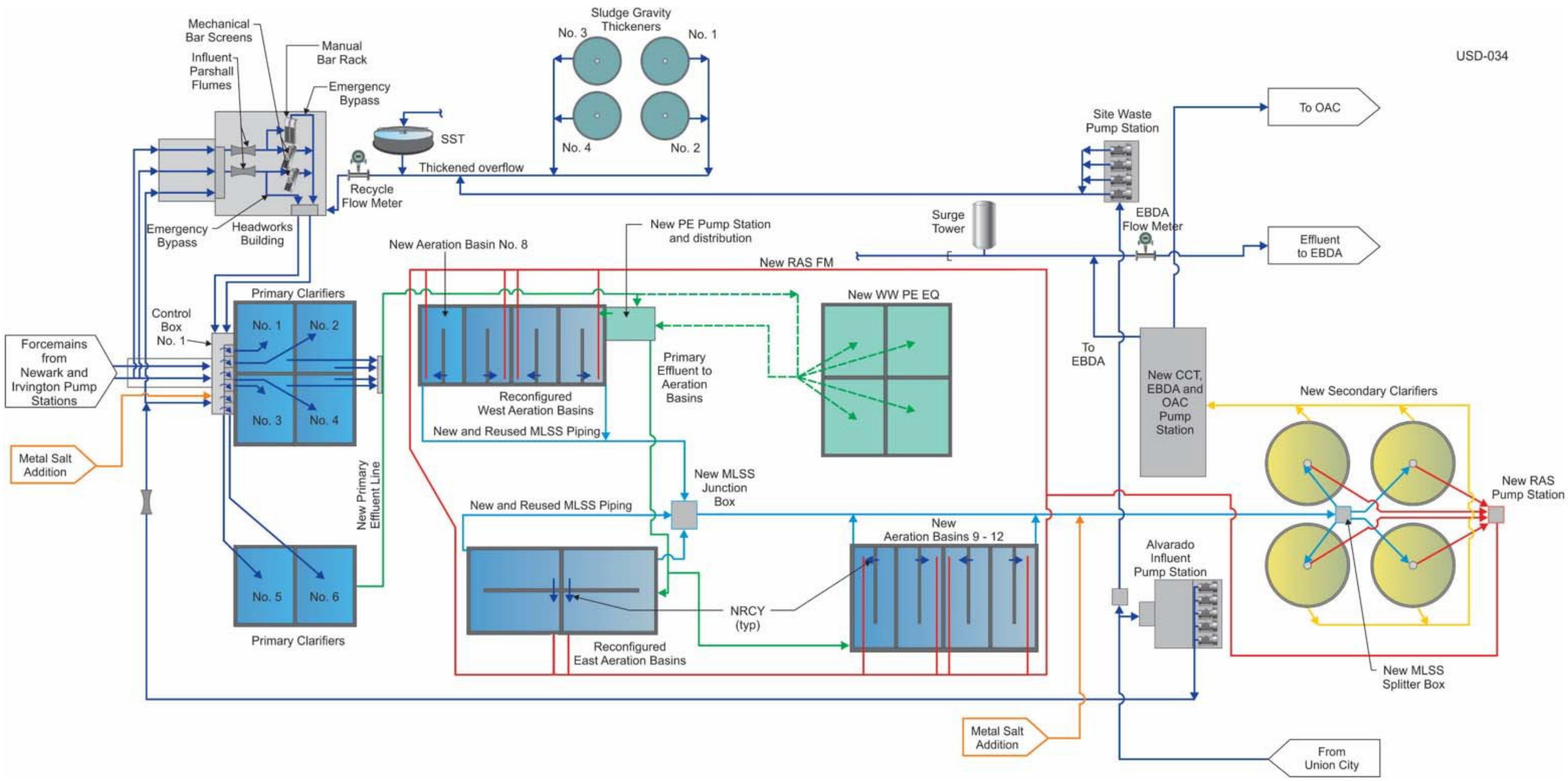
Notes:
1) This column reflects the range of scenarios through AA flow and load conditions, M flow and load conditions, AA flow with M load conditions, and wet weather flows with M loads. Wet Weather MLSS values reflect step-feed operation.

Figure 3-4: CAS Process Model (Biowin) Flow Diagram



Source: Secondary Treatment Process Improvements Final Report, Hazen and Sawyer, August 2019

Figure 3-5: CAS Process Flow Diagram



Source: Secondary Treatment Process Improvements Final Report, Hazen and Sawyer, August 2019

This alternative requires a total of 12.9 MG of aeration basin volume. The existing aeration basin volume totals 7.4 MG, therefore 5.5 MG of new volume would be required. The existing aeration basins would be reconfigured to accommodate anoxic, anaerobic, and RAS deoxygenation zones. Four new circular secondary clarifiers would also be constructed in place of the existing secondary clarifiers. Key modifications/improvements to the existing plant for this alternative include:

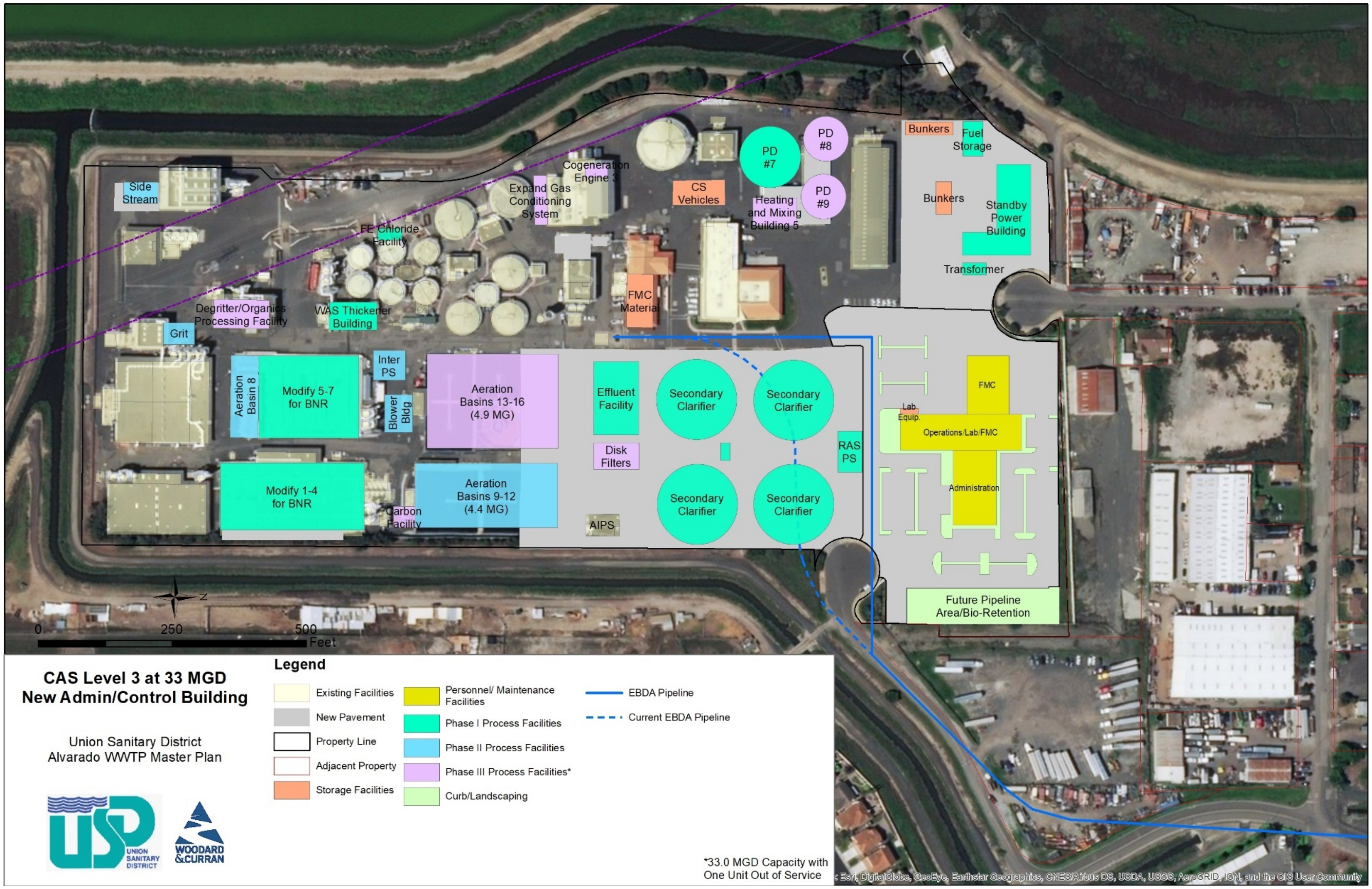
- Modified Aeration Basin 1-4 (East)
- Modified Aeration Basin 5-7 (West)
- New Aeration Basin 8 south of existing Aeration Basin 5-7
- New Aeration Basins 9-12 north of existing East Aeration Basins
- New 60-inch PE line to centrally located intermediate pump station routed to the west of existing Aeration Basin 5-7
- New intermediate pump station
- New blower facility north of existing Aeration Basin 5-7
- PE distribution piping to the existing and new aeration basins
- New 2.5 MG PE equalization basin (converted existing secondary clarifiers)
- New MLSS junction box and reuse of the existing 60-inch line to the new MLSS distribution box
- New MLSS distribution box
- Four new circular secondary clarifiers with sludge suction header
- Centralized RAS pump station
- New RAS force main
- New individual RAS lines (with flow meters and control valves) from force main to each aeration basin
- New 72-inch effluent line to new effluent facility
- New effluent facility (see **Section 3.2.3.3** for further detail)
- Relocation of EBDA force main to facilitate construction of new secondary clarifiers

To Meet Phase III Permit Limits The following additional improvements are required:

- Demolition of PE equalization installed in Phase II
- New Aeration Basin 13-16, 4.9 MG (at location of Phase II PE equalization)
- Carbon addition facilities for further denitrification
- Disk filters to meet low TP requirements

A conceptual layout of the CAS alternative including phasing is depicted in **Figure 3-6**.

Figure 3-6: CAS Option Phase III Conceptual Layout



3.2.3.3 Additional Facilities

The following additional facilities are common to both MBR and CAS alternatives, and are required for secondary treatment:

- Effluent Facilities, including:
  - New flash mixing for chlorination
  - New Chlorine Contact Tack (CCT)
  - New flash mixing for dechlorination
  - New dechlorination contact basin (sized for either thiosulfate or sodium bisulfite)
  - New effluent/reclaim pump station
  - New Old Alameda Creek pump station
  - New elevated discharge box to limit tidal impacts to pumping
  - New sample location for Total Residual Chlorine (TRC) confirmation
- Sidestream Deammonification Facilities for dewatering centrate, including:
  - Centrate equalization
  - 0.37 MG reactor volume
  - Electrical room
  - Chemical room
- Metal Salt Addition Facility for chemical phosphorus removal.

Effluent facilities were included in capital cost estimates for both CAS and MBR due to the following reasons. The existing chlorination and dechlorination facilities are in poor condition, unreliable, and cause hydraulic issues during peak flows. The existing effluent pump station is at the end of its useful life. A new pump station with elevated discharge box will be utilized for the Old Alameda Creek discharge to mitigate tidal influences on the discharge.

Sidestream deammonification is required to meet BACWA Level 2 standards for the for 2040 loads. USD recently piloted an ANITA™mox system. The system was considered in sizing the facility. USD requested that chemical phosphorus removal be assumed, therefore metal salt dosing stations were included.

All of these facilities are discussed in further detail in **Appendix B**.

3.2.4 Alternative Evaluation

To determine the best alternative for USD's secondary treatment process, the MBR and CAS alternatives were evaluated based on the following factors:

- Value
  - Which alternative offers the best benefit relative to lifecycle cost?
- Efficiency
  - Are existing assets leveraged to maximum advantage?
  - Can implementation be phased to "right-size" construction infrastructure and minimize footprint and spread capital investment over time?

The estimated costs, pros and cons of the two alternatives are summarized in **Table 3-6**.

Table 3-6: Alternatives Analysis Summary

Alternative	Cost to Meet Phase II Permit Limits(1)	Pros	Cons
MBR	$508M Capital $8.5M Annual O&M	• Excellent, consistent water quality • Compact footprint • Better effluent for recycled water production in future	• Significantly higher capital costs • Higher energy costs • Limited opportunity for phasing
CAS	$337-376M(2) Capital $4.6M Annual O&M	• Familiar technology • Cost less than other option • Greater opportunity for phasing	• Larger footprint than MBRs • Extended construction period due to phasing

Notes:

(1) Excluded campus building costs.
(2) The range of capital costs reflect 3 different implementation timelines, which are discussed in Section 3.2.5.

The MBR Alternative's capital and operating costs are higher compared to CAS, making it the more expensive alternative. MBR offers excellent effluent quality. While the aeration process in both alternatives is comparable, membranes provide a physical barrier for solids removal, improving solids removal reliability. Therefore, MBR offers a superior starting point for any recycled water and/or advanced treatment process. While the existing aeration basins would be retrofitted for MBR, secondary clarifiers are not required. This means MBR's footprint is more compact. The plant's existing rectangular clarifiers would be repurposed to provide primary effluent equalization.

Implementing MBR would also sacrifice some ability to phase implementation. The newly constructed MBR would have volume sufficient to meet Phase II Permit limits. This means the plant would immediately be implementing nutrient removal, prior to permit limits being implemented by the RWQCB. The Phase I plant optimization process would be omitted.

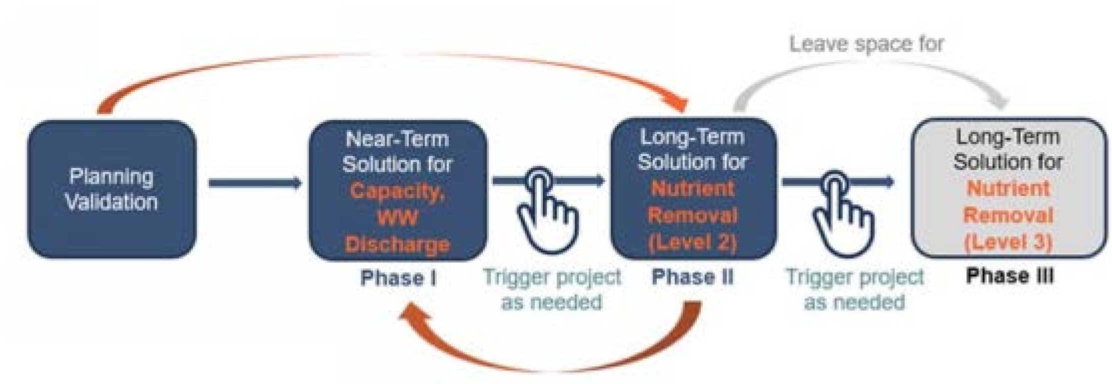
The CAS alternative offers both lower capital and operating costs. Water quality produced through a CAS process is good and would consistently meet permit limits. The use of existing infrastructure will be maximized through reconfiguring the existing aeration basins and utilization of the existing secondary clarifiers for primary effluent flow equalization. However, this flow equalization would eventually be demolished to make room for additional aeration tanks to meet Phase III permit limits. Therefore, some ability to leverage existing assets will be lost.

Another advantage of the CAS alternative is increased modularity, which allows adaptation to future flows, loads, and regulations. While requiring more total reactor volume may be a disadvantage from a footprint standpoint, the larger volume also affords USD the ability to build capacity incrementally as flows and loads dictate. This stands in contrast to MBR, where the conversion of the existing aeration basins results in excess capacity in the initial portion of the planning period. Based on this fact and the lower costs, CAS was chosen as the preferred alternative for the Secondary Treatment Process Improvements.

3.2.5 CAS Implementation Timeline Options

The Secondary Treatment Process Improvements also explored how the CAS alternative might be implemented to minimize footprint and spread capital investment over time while still providing expanded plant capacity and flexible effluent management. Triggers were identified to indicate when subsequent phases should be implemented. This process is illustrated in **Figure 3-7.**

Figure 3-7: Trigger Based Phasing of Near-Term and Long-Term Solutions



Credit: Secondary Treatment Process Improvements Project Draft Report, Hazen and Sawyer, May 2019

As presented in **Section 3.2.1**, it is recommended that the secondary improvements be implemented in three phases tied to BACWA nutrient removal levels. Hazen and Sawyer looked at three different options for CAS Implementation timelines, which they termed CAS Phasing Options. These options vary the timing of intermediate projects to achieve the near-term objectives of increasing plant capacity and improving effluent management during peak flow events. These implementation timeline options are presented along with benefits, considerations, and costs in **Table 3-7**. For a more detailed description and evaluation of the CAS Implementation Options, please refer to **Appendix B**.

Table 3-7: Summary of CAS Implementation Options, Benefits, and Considerations

Option	CAS Option 1 Clarifier Modifications and Limited Seasonal Biological Nitrogen Removal (BNR)	CAS Option 2 New Clarifiers Early and Year-round BNR	CAS Option 3 No Old Alameda Creek Discharge
Near-term Objectives	• Increase capacity • Earliest opportunity for creek discharge with limited BNR	• Increase capacity • Increased potential for discharge to Old Alameda Creek through year-round nutrient removal	• Increase capacity • Avoid creek discharge
Unit Processes Required in Addition to CAS Improvements	• Near-term Clarifier Modifications • Disk Filters	• None	• Secondary Effluent Equalization Basin
Benefits	• Achieves seasonal BNR (3 months) quickly to get to Old Alameda Creek with a gap of only 2 years • Achieves improved clarification performance (over current)	• Year round BNR • No sidestream treatment required in Phase I • Greatest TN removal • No stranded disk filters • No clarifier modifications • Better clarifier performance • New RAS control in Phase I • 2.5 MG available for PE EQ	• Simplified operation during wet weather • Storage provides flexibility for off-spec water during dry weather • Can shave daily peak flow in dry weather to reduce effluent pumping costs • EQ provides flexibility for future construction
Considerations	• Only achieves seasonal BNR • Stranded assets in disk filters and clarifier modifications • Less reliable clarifier performance until Phase II • Need sidestream treatment • O&M complexities due to two effluent qualities	• Need to move buildings delays getting to Old Alameda Creek by two additional years over CAS Option 1	• Permitting and environmental process poses additional risk • Land acquisition and restoration requirement pose additional risk • Option does not provide synergy with future nutrient removal
Total Project Costs(1)(2)(3)	**$356M**	**$337M**	**$376M**

Notes:

(1) Costs are in 2019 dollars; includes 30% non-construction costs but excludes inflation.

(2) Includes costs in Phase I for replacement of existing aeration blowers, odor control, electrical gear, and associated appurtenances.

(3) Excluded Campus Building costs.

CAS Option 1 resulted in stranded assets including disk filters and improvements to the existing secondary clarifiers, so it was eliminated. CAS Option 3 was eliminated due to having the highest total project cost and a probable lengthy permitting and environmental review process. CAS Option 2 maximizes use of existing assets and equipment, in additional to affording better effluent quality and more reliable technology at a lower cost.

Project Costs for the preferred option, CAS Option 2, are provided in **Table 3-8**. Sequencing of implementation is further discussed in Chapter 7 – Implementation.

Table 3-8: CAS Option 2 - New Clarifiers Early and Year-round BNR Estimated Costs

Scope Item	Cost (1)
Phase I (2)	**$ 232 M**
Aeration Basin Modifications	
Effluent Facilities & EBDA Relocation	
New Secondary Clarifiers	
Plant Equalization Storage	
Phase II (3)	**$ 254 M**
New Intermediate Pump Station and Flow Splitting	
New Aeration Basin Volume (5.5 MG)	
New Blowers and Blower Building	
Sidestream Treatment	
Chemical P Removal	
Total Project Costs (4)	**$ 486 M**

Notes:

(1) Costs include inflation to midpoint of anticipated construction.
(2) Includes costs for replacement of existing aeration blowers, odor control, electrical gear, and associated appurtenances.
(3) Assumes preliminary design for Phase II improvements to begin in July 2035.
(4) Excluded Campus Building costs.

3.2.6 2040 versus Buildout

Secondary Treatment Process Improvements concentrated on the year 2040 for implementation, which equates to influent flows of 29.1 MGD AA and 33.5 M. However, buildout flows for the WWTP equates to 33 MGD AA and 37.9 MGD M, which is predicted to occur in approximately 2058.These buildout flows require additional work to accommodate these flows and loads:

- Demolition of primary effluent equalization
- Construction of Aeration Basins 13-16
- Construction of disk filters
- Carbon addition for nutrient removal

Figure 3-8: shows the plant layout at 2040, while **Figure 3-9**: show the plant layout at buildout.

Figure 3-8: CAS Layout at 2040

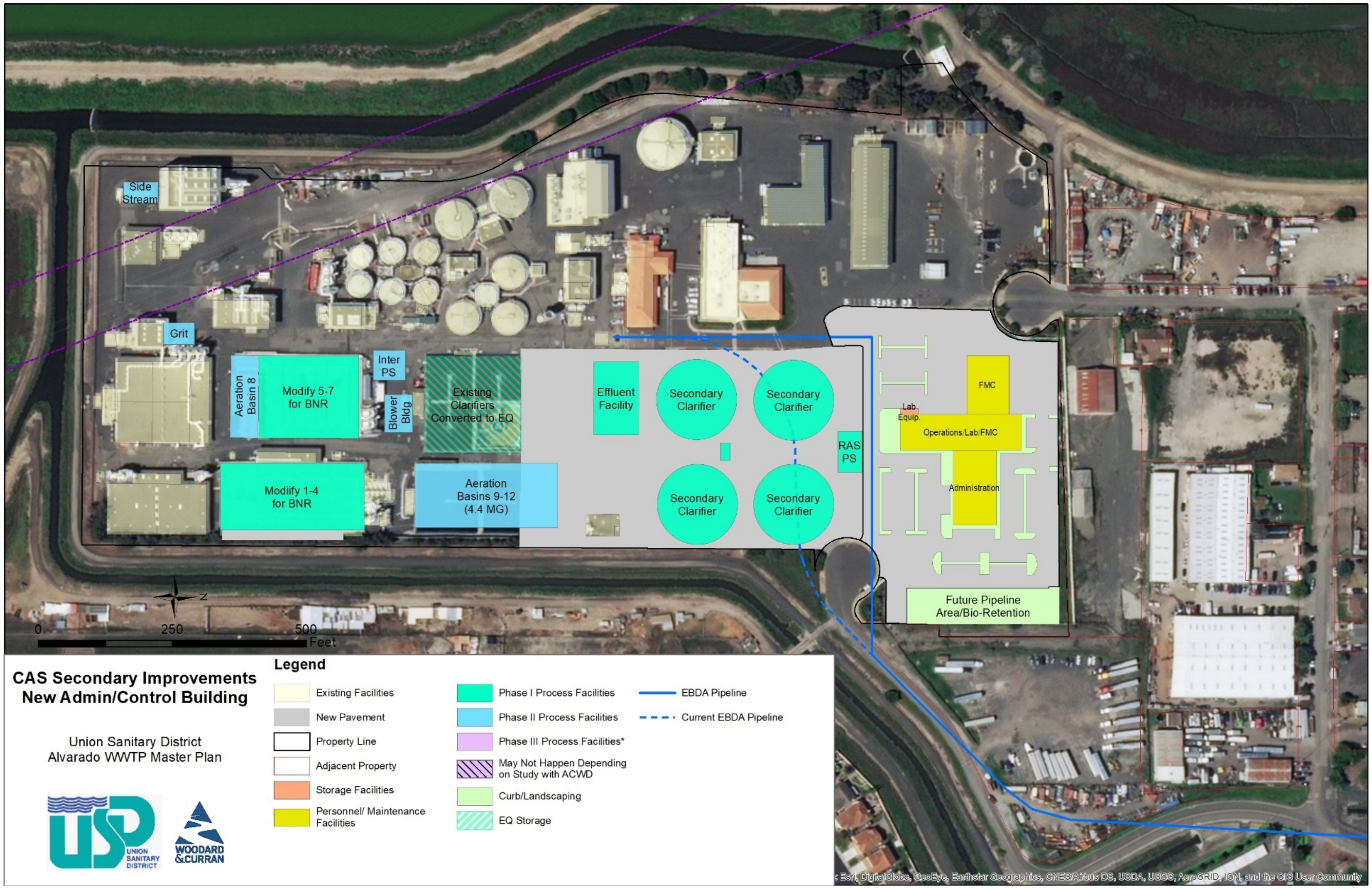
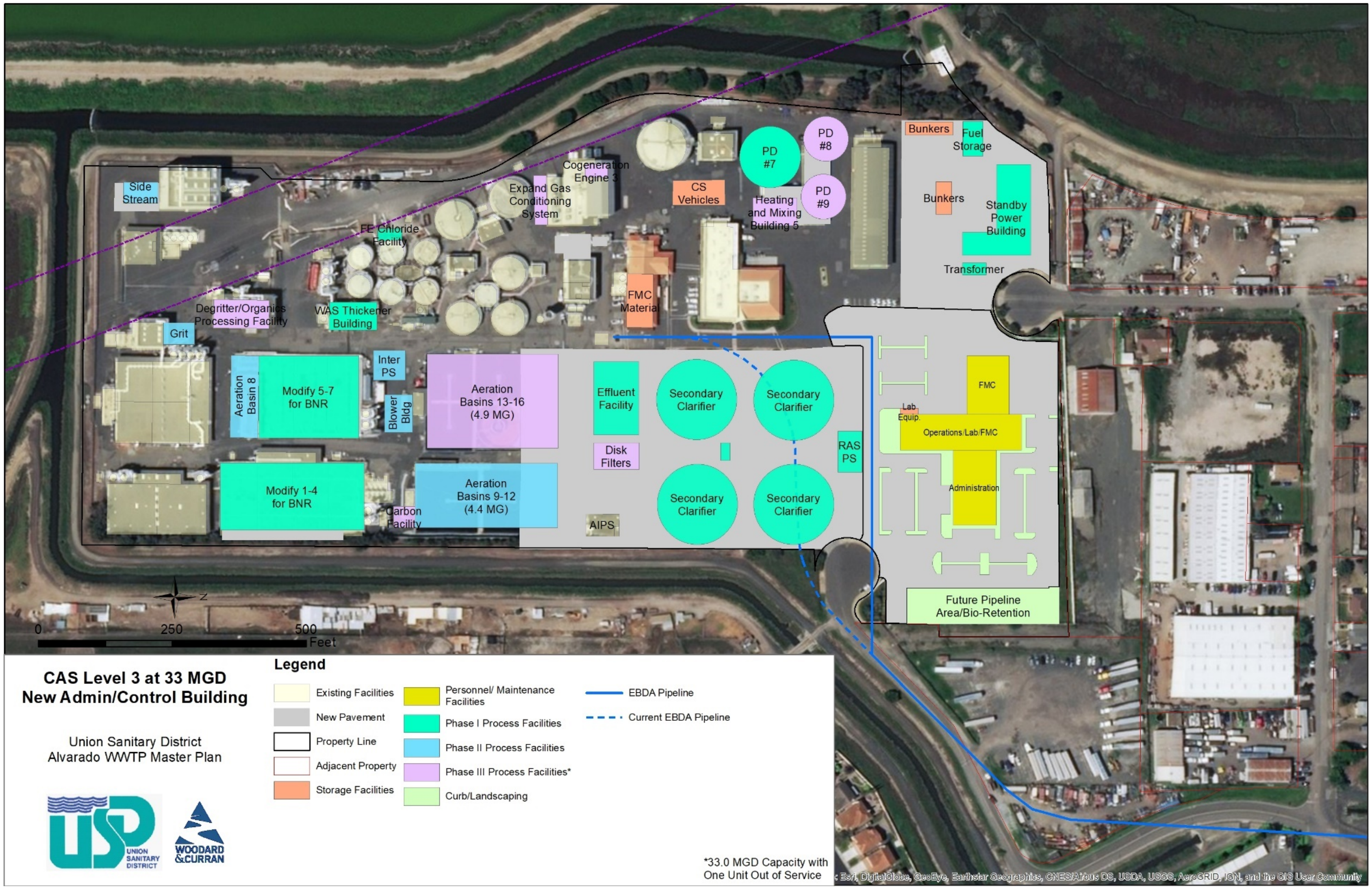
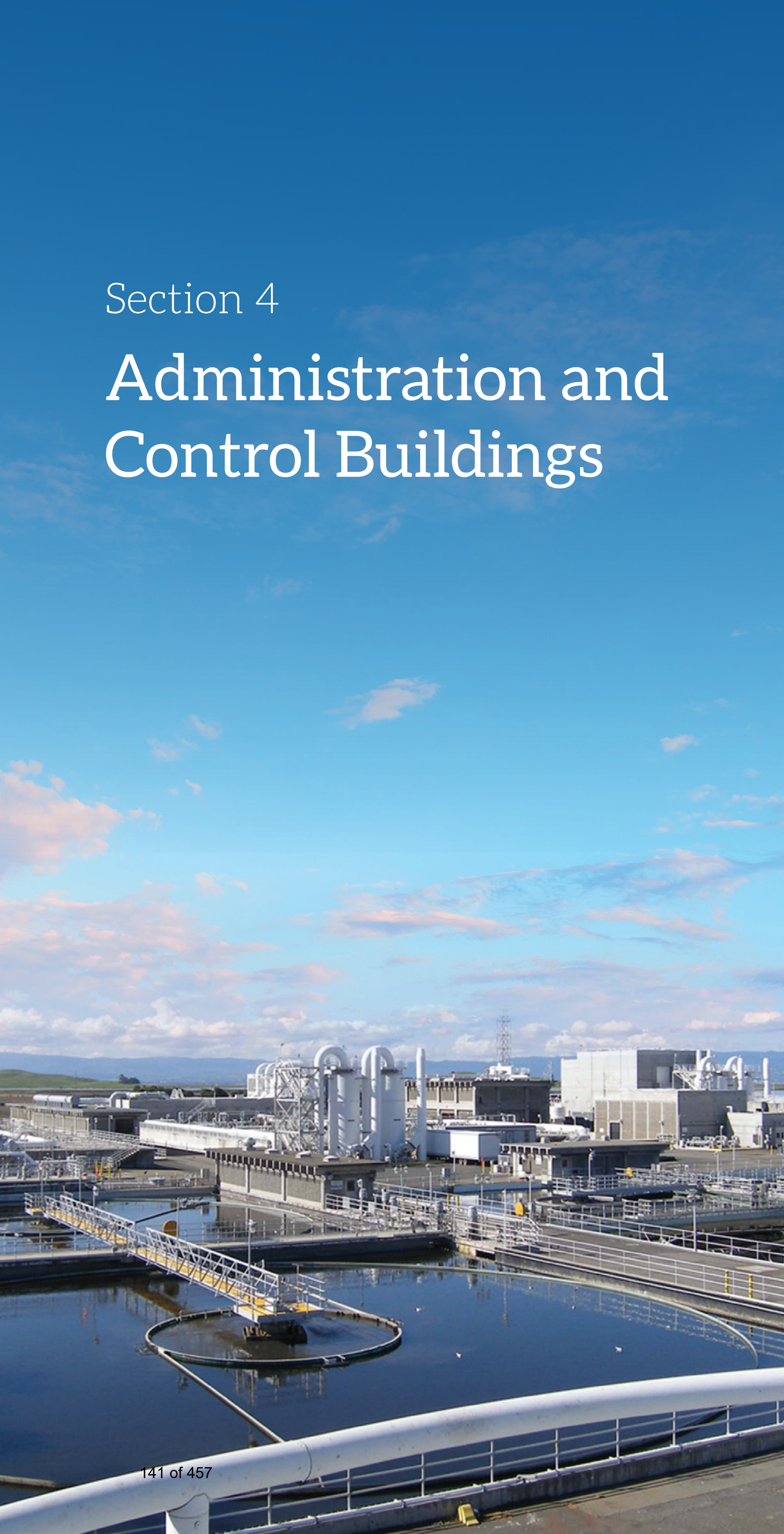


Figure 3-9: CAS layout at Buildout (2058)



Section 4

Administration and Control Buildings



4

Union Sanitary District's
Enhanced Treatment and Site Upgrade Program

4. ADMINISTRATION AND CONTROL BUILDINGS

The existing Administration Building is an obstacle to expanding the secondary treatment process. This combined with maintenance issues with the building led USD to explore options for relocation. This chapter discusses the development of the following options for upgrading or replacing the Administration and Control Buildings to determine the most viable option to pursue:

- Renovation of Existing Facilities
- Construction of New Administration and Control Building with Standalone Fabrication, Maintenance, and Construction (FMC) Building
- Construction of a New Combined Campus Building

4.1 Existing Administration and Control Buildings Renovation

Previous studies identified multiple building vulnerabilities that would require repairs at the existing Administration and Control Buildings and upgrades to the buildings necessary to address anticipated future needs of USD. These recommended repairs to the existing Administration and Control Buildings identified in these studies include seismic upgrades, mechanical, electrical, and plumbing (MEP) upgrades and building envelope repairs for water intrusion preventions. In addition to these repairs, several other improvements such to the Administration and Control Buildings are recommended to improve and optimize building space usage.

An evaluation was performed to weigh the advantages and disadvantages of retrofitting the existing Administration and Control Buildings compared to demolishing the existing Administration and Control buildings and constructing a new consolidated building. The decision to renovate the existing buildings or construct a new building will impact which treatment plant upgrade alternative will be recommended.

4.1.1 Seismic Assessment

Degenkolb Engineers performed seismic assessments of various buildings and structures for USD[1]. The findings recommended retrofitting the existing Administration Building and Control Building to mitigate seismic deficiencies. For the Administration Building, Degenkolb recommends strengthening or replacing existing braces with new buckling restrained braces, bracing existing precast concrete panels, and localized retrofits. At the Control Building, Degenkolb recommends strengthening the existing shear walls, the diaphragms and the connections at the discontinuous walls and diaphragms.

[1] Degenkolb Engineers Detailed Seismic Assessments & Conceptual Strengthening Schemes, (April 22, 2016)

4.1.2 Administration Building Envelope Repair

The Administration Building has experienced ongoing water intrusion during rain events. It was assumed that the building envelope would be repaired by removing and replacing the cladding components as part of Administration Building retrofit evaluation. The storefront windows at sill locations should also be replaced to direct water away from the structure.

Figure 4-1: Water Intrusion at Existing Administration Building

4.1.3 Mechanical and Electrical Upgrades

An evaluation of the mechanical, electrical, plumbing and fire protection (MEP/FP) systems at the Administration Building and Control Building was performed by PAE[1]. In the Administration Building, most existing MEP/FP equipment were installed in 1999 when the Administration Building was constructed. Based on visual inspection, the equipment appears to be in fair condition, but needing immediate upgrade. Certain equipment does not meet current building standards and HVAC thermal comfort issues were reported in the building due to poor balancing of air flow. The following upgrades for the MEP/FP systems are recommended in the Administration Building:

- New HVAC system including new AC units, control system, boilers and ductwork
- New LED lighting and controls
- New plumbing fixtures, some new plumbing distribution
- New electrical distribution equipment
- New fire alarm lateral pipe, sprinkler and front-end devices

Figure 4-2: Existing HVAC Unit at Administration Building

[1] USD Admin Building MEP/FP Due Diligence Report, PAE February 16, 2017 and USD Control/Operations Building MEP/FP Due Diligence Report, PAE March 16, 2017

The evaluation of the Control Building showed that laboratory plumbing equipment requires replacement and that the HVAC equipment is not code-compliant to the latest laboratory exhaust design and energy efficiency standards. The following upgrades for the MEP/FP systems are recommended in the Control Building:

- New HVAC system including new AC units, control system, boilers and ductwork
- New LED lighting and controls
- New plumbing fixtures, plumbing distribution and water heater
- New electrical distribution equipment to affected spaces and new mechanical
- New fire alarm lateral pipe, sprinkler and front-end devices to affected areas

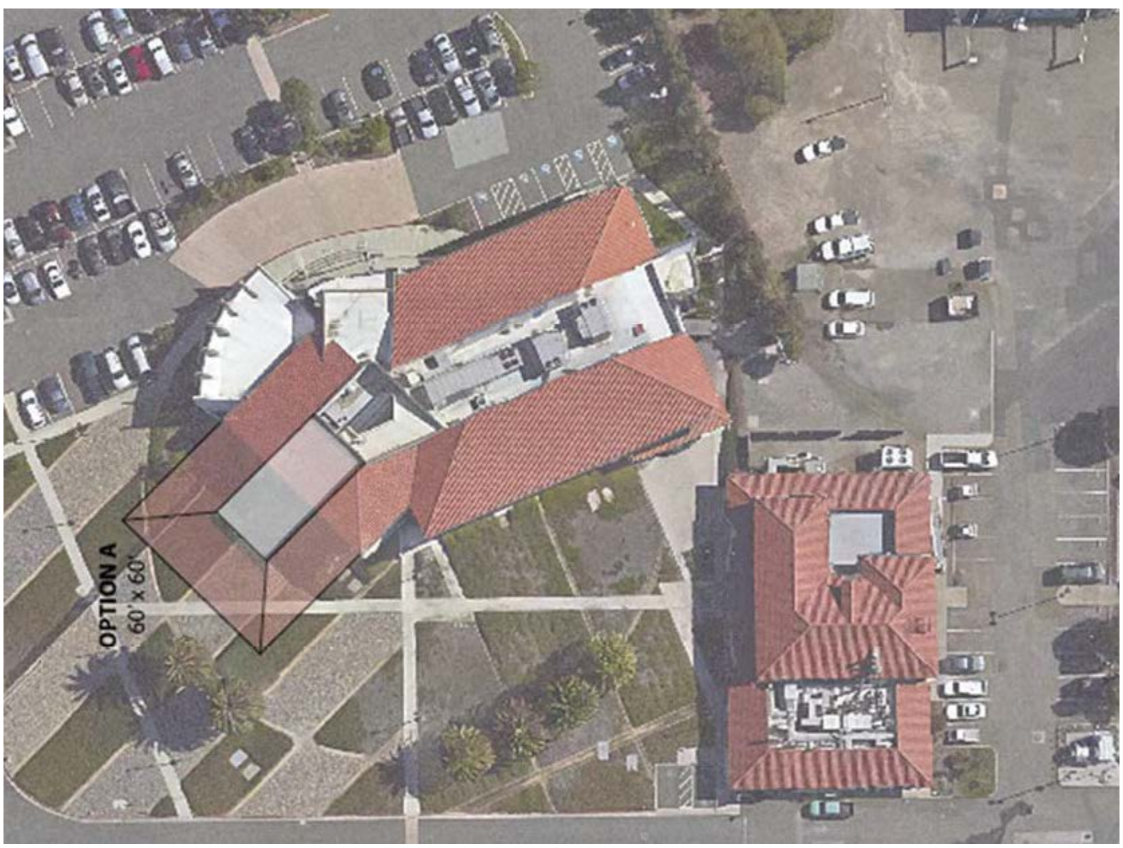
Figure 4-3: Existing HVAC equipment at Control Building

4.1.4 Administration Building Space Needs

The existing Administration Building does not have adequate space for staff or new functions. Siegel & Strain Architects[1] performed a spatial program study for the existing Administration Building and provided three options for a building addition to address the future space needs. If the Administration Building is retrofitted, a two-story addition at the north side of the building is recommended to provide USD with adequate space for anticipated future needs. The conceptual addition would total 7,000 SF (3,500 SF per floor) and would provide additional conference rooms, future staff space and additional staff support space.

Additional work including bathroom expansion/relocation, internal partition relocation and rehabilitation of Boardroom and front counter are also recommended to improve space usage in the Administration Building.

Figure 4-4: Recommended addition to Administration Building



[1] Three Building Program, Siegel & Strain, April 5, 2016.

4.1.5 Control/OPS Building Space Needs

The existing Control/Operations Building currently contains laboratory space, office space, locker rooms and showers on the first floor; and Control room, Operations hub, office space, break room that doubles as a conference room and open-air terrace on the second floor. The existing laboratory space is insufficient. The following renovations are recommended to optimize space use in the Control Building[1]:

- Reconfigure lab office to lab space
- Create new lab office space at first floor
- Enclose existing deck space to become usable interior area
- Reconfigure crew break room to accommodate smaller break room and additional office space.
- Relocate office and meeting space to expanded second floor
- Add elevator and elevator machine room

4.1.6 Interior Finishes

Updates to the interior finishes are also recommended to be performed with the above recommended upgrades to the Administration and the Control/Operations Buildings. In both buildings, new paint, flooring, and ceiling grids are recommended. At the Control Building, new laboratory casework at lab expansion spaces, new partitions, doors, windows, and finishes at second floor expansion. The second-floor restrooms would also require updates to meet accessibility requirements including all new fixtures and finishes.

4.1.7 Surge Space

While the existing buildings undergo renovations, surge space will be required to temporarily house employees and equipment. An allowance is added to the total renovations costs to account for required surge space and moving costs.

[1] Existing Building Evaluation and Master Plan, Burks Toma, March 16, 2017.

4.2 New Building Construction

Due to the extensive repairs and upgrades that will be required to bring the existing buildings up to code and meet USD's long-term space needs, the feasibility of demolishing the existing Administration and Control Buildings and constructing new buildings in a new location north of the existing buildings was evaluated. Constructing new Administration and Control Buildings would allow USD more flexibility for future treatment process expansion by creating space for a continuous process layout. Two new building alternatives were evaluated, the first with a combined Administration and Control Building with a Standalone FMC building and the second alternative with a new building campus.

4.2.1 New Combined Administration and Control Building with Standalone FMC Building

The first new buildings alternative assumed a new combined Administration/Control building and a separate FMC building. The footprint of the new three-story Administration and Control Building was estimated to be 41,900 SF which is the combined square footage of the existing Administration (23,600 SF) and Control (11,300 SF) Buildings and the 7,000 SF addition for the Administration Building extension. Each story of the Admin/Control Building is approximately 15,000 SF. The new FMC building is estimated at 15,300 SF which is based on the Siegel Strain FMC programming work. New landscaping and site improvements would be required to accommodate this alternative.

4.2.2 New Campus Building

The new Campus Building alternative evaluated the option to locate the Administration, Control, and FMC building functions in a group of adjacent buildings. This option would allow employees in each of the buildings to share facilities such as parking, elevators, stairs, restrooms, locker rooms, and staff entries. This alternative would also allow internal access to different functional spaces.

As part of the evaluation of the campus alternative, an illustrative refined space programming was developed. The overall footprint of the building is 50,463 SF of office space and 8,940 SF of high-bay FMC shop space. The breakdown in space is summarized in **Table 4-1**.

Table 4-1: Campus Alternative Footprint Summary

<table>
<tr><th></th><th>Space</th><th colspan="2">Gross Area
(SF)</th></tr>
<tr><td rowspan="3">First Floor</td><td>High-Bay Shop Space</td><td colspan="2">8,940</td></tr>
<tr><td>Administration</td><td>10,169</td><td rowspan="2">25,574</td></tr>
<tr><td>FMC/OPS/Shared</td><td>15,405</td></tr>
<tr><td rowspan="2">Second Floor</td><td>Administration</td><td>11,882</td><td rowspan="2">24,993</td></tr>
<tr><td>FMC/OPS/Shared</td><td>13,111</td></tr>
</table>

The preliminary campus layout is comprised of a high-bay shop space for FMC, a combined Operations/Lab/FMC office Building and an Administration Building and is shown in **Figure 4-5** through **Figure 4-7**. The site layout is configured to provide separate public and employee entrances and parking areas and also to provide adequate turn radius for FMC vehicles.

Figure 4-5: Recommended Campus Site Layout

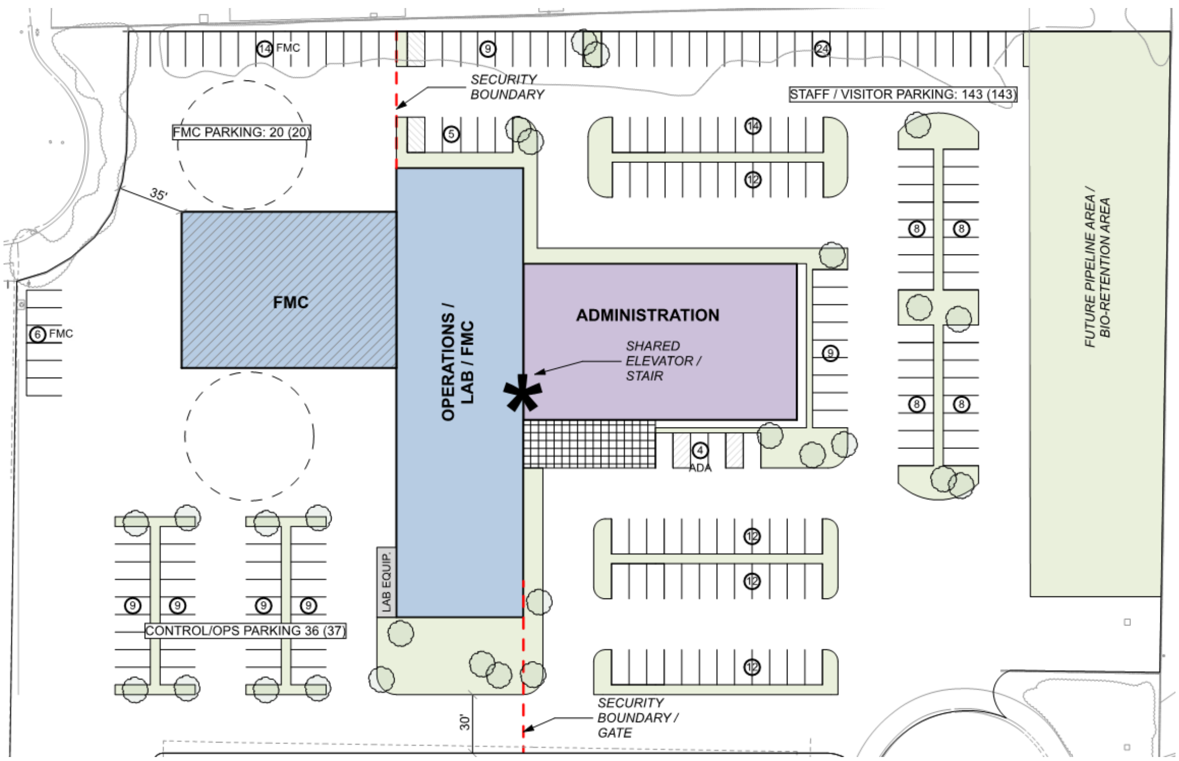


Figure 4-6: Campus Site Program First Floor

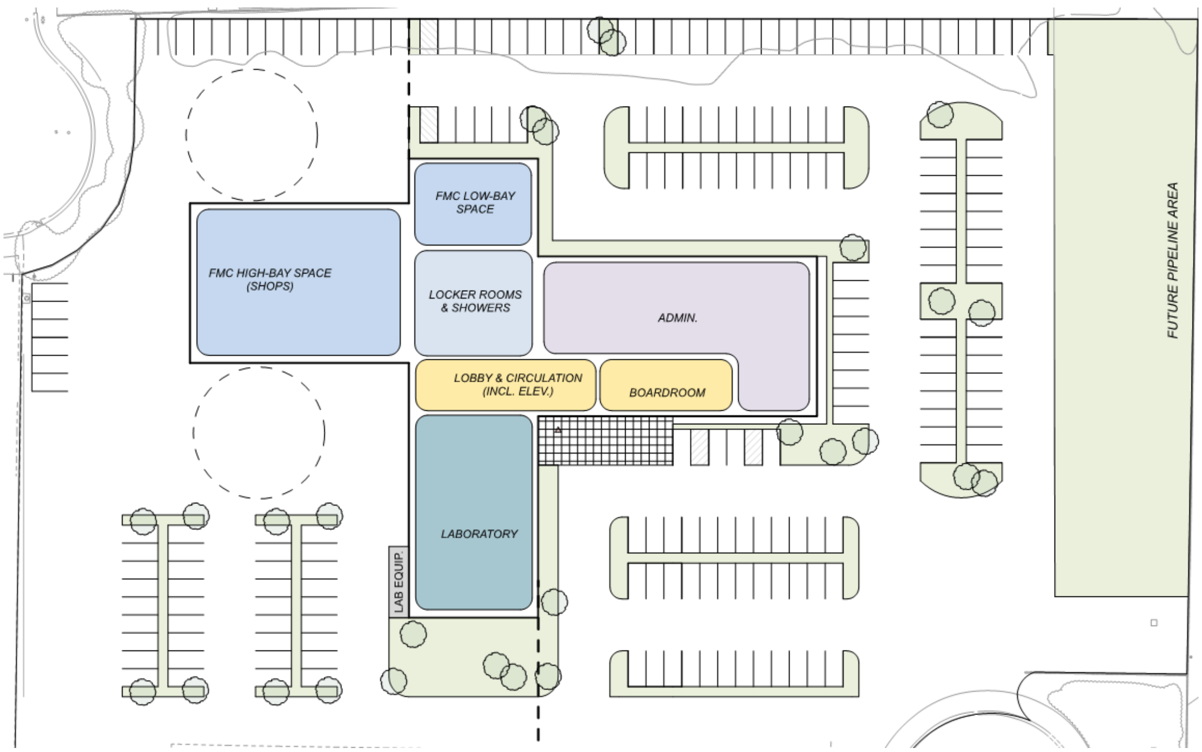
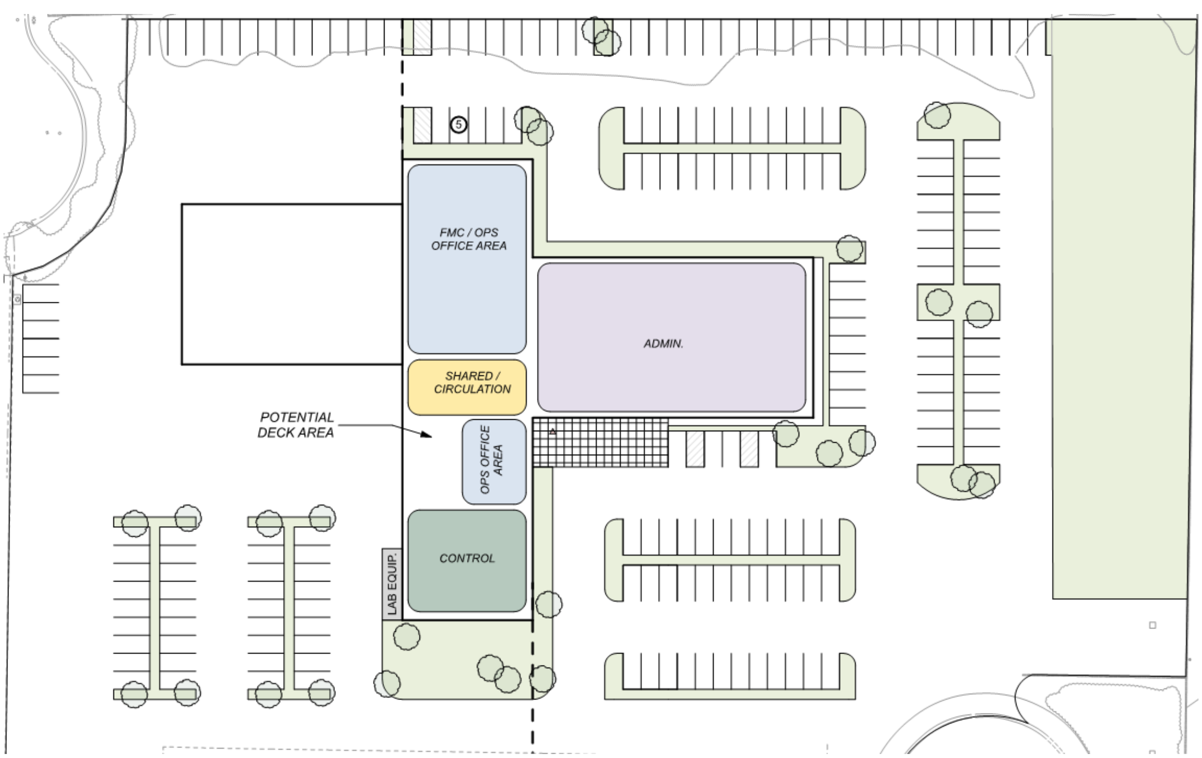


Figure 4-7: Campus Site Program Second Floor



4.3 Summary of Alternatives

The scope of existing building renovation and new building construction is summarized in **Table 4-2**.

Table 4-2: Summary of Scope for Building Renovation and New Construction

Alternative	Scope	Recommended
Retrofit Existing Administration and Control Building	Administration Building Renovation	• Seismic retrofit • MEP upgrades • Building envelope repair • 7,000 SF addition • Update interior finishes
	Control Building Renovation	• Seismic retrofit • MEP upgrades • Additional lab space • Enclose patio • Break area renovation • ADA accessibility • Update interior finishes
	New FMC	15,300 SF (High-Bay Space 8,300 SF, Low Bay Space 7,000 SF)
New Combined Admin and Control Building and Standalone FMC	New Administration and Control Building	Total footprint 41,900 SF
	New FMC	15,300 SF (High-Bay Space 8,300 SF, Low Bay Space 7,000 SF)
New Campus Building	New Administration, Control and FMC Combine Campus	Admin/Control/FMC 50,463 SF High-Bay Shop Space 8,940 SF

4.4 Estimated Cost Comparison of Building Alternatives

Construction costs were estimated for renovating the existing Administration and Control Buildings and for constructing a new combined Campus Building by TBD Consultants[1]. All costs were escalated to March 2019 dollars. The salvage value after 20 years of each option was incorporated to determine the present value of the buildings.

The estimated costs for three alternatives: 1) renovating existing buildings; 2) construction of a combined Administration and Control Building; and 3) Campus Building alternative, are summarized in **Table 4-3** and **Table 4-4**, respectively.

Table 4-3: Estimated Construction and Life Cycle Cost Summary of Existing Building Renovation

Existing Administration and Control Building Remodel & Retrofit	Costs (1)
Admin Building Renovation	$10.2M
Admin Exterior Skin Upgrade	$1.2M
Admin Building Extension (7,000 SF)	$5.8M
Control Building Renovation	$10.0M
New FMC Building w/ Site Improvements	$12.2M
Surge Costs	$3.2M
Total Construction Cost (2)	**$42.6M**
Salvage Value after 20 yrs. (FMC only)	-$2.8M
20 yrs. O&M PV @ 3%	$4.3M
REHABILITATION TOTAL PRESENT VALUE	**$44.1M**

Notes:
1. March 2019 costs; except new FMC Building estimated by escalating 17.5% from May 2017.
2. Includes seismic, MEP, interior refinishing, and all other building improvements.

[1] New Administration, Ops/Lab and FMC Facility, Burks Toma/TBD Consultants, March 2019

Table 4-4: Estimated Capital and Life Cycle Cost Summary of Separate Administration, Control and FMC Buildings and Campus Building Alternative

New Buildings vs. Campus Building Alternative	Separate Admin, Control and FMC Buildings (1,3)	Campus Building Alternative (3)
New Building Construction Cost	41.6M	$44.1M
Site Improvements (2)	$5.0M	$5.0M
Total Construction Cost	**$46.6M**	**$49.1M**
Salvage Value after 20 yrs. (PV @ 3%)	-$11.5M	-$12.2M
NEW BUILDINGS TOTAL PRESENT VALUE	**$35.1M**	**$36.9M**

Notes:
1. Does not include 10% bidding contingency.
2. Includes demo of existing Admin, Control buildings, site improvements, utilities work.
3. March 2019 costs; except new FMC Building estimated by escalating 17.5% from May 2017.

4.5 Recommended Building Alternative and Construction Cost

Rehabilitating existing facilities would require significantly more capital cost than building new facilities, due to extensive renovations required for seismic retrofit, repair of existing buildings, and expansion. Of the two new building alternatives, the Campus Building alternative provides the smallest building footprint at small additional expense compared to the separate building concept. Therefore, the campus alternative is recommended for construction. Total project costs for this alternative are estimated at $72.4M as listed in **Table 4-5**.

Table 4-5: Estimated Project Cost of Campus Alternative

New Buildings/Campus Alternative	Costs
Total Construction Cost (1)	$49.1 M
Solar Panels (optional)	$2.0 M
Implementation Cost (Design, Permitting, ESDC, CM) (30%)	$15.3 M
Inflation (midpoint of construction)	$6.0 M
TOTAL PROJECT COST	**$72.4 M**

Notes:
1. March 2019 costs; except new FMC Building estimated by escalating 17.5% from May 2017.

Section 5

Real Estate Acquisition Analysis

5

Union Sanitar y District’s
Enhanced Treatment and Site Upgrade Program

5. REAL ESTATE ACQUISITION ANALYSIS

To address the District's real estate needs to accommodate future facility needs, analysis of nearby parcels was performed and a plan to appraise, acquire and relocate the properties was considered. The details of this work are presented in **Appendix D**, but the highlights are presented in this report.

As part of the Site Use Study, a preliminary Land Evaluation was performed by PPC Land Consultants (PPC)[1] to examine zoning, redevelopment plans, environmental and title reports, and fence line evaluations of immediate parcels surrounding the WWTP.

A Real Estate Acquisition analysis of parcels surrounding the WWTP was subsequently performed by Overland, Pacific and Cutler, Inc. (OPC) to expand upon the work completed by PPC. Analysis by OPC included market data research, property owner outreach, acquisition cost estimates, identifying all applicable regulatory compliance issues, staffing functions, approval procedures, document controls, and schedule and cost controls. A preliminary Real Estate Acquisition Management Plan (RAMP)[2] was prepared by OPC that documents the real estate needs, practices and procedures for the Program.

Subsequent to the initial analysis of the 17 parcels immediately north and northeast of the WWTP, USD identified nine additional parcels of interest tracts further north of the WWTP. OPC performed a title report search of these nine parcels.

5.1 Owner Outreach on Parcels of Interest

OPC conducted owner outreach to discuss owners' interest in selling 17 tracts of interest directly north of the WWTP. The 17 tracts are currently owned by 13 different parties. OPC attempted to contact each of the property owners through letters, phone calls, and in-person site visits throughout April to October 2017. As of October 8, 2017, contact was made with 10 owners and 3 owners were not responsive. The responses from owners have been sorted into 5 categories- Responsive, Non-Responsive, Unwilling to Sell, Willing to Sell and Willing to Consider Property Exchanges. Responsive owners have responded to attempts to contact them and have indicated a willingness for future meetings but have not provided an answer on whether they are willing to sell. Non-Responsive owners have not responded after multiple attempts to contact them. A summary of owner and property information and results from owner outreach activities is presented in **Table 5-1**. A map of the tracts is shown on **Figure 5-1**. The five Technical Memos documenting the results of the owner outreach activities are provided in **Appendix E**.

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1 Union Sanitary District Alvarado Wastewater Treatment Plant Expansion Land Analysis, PPC Land Consultants, October 15, 2014.

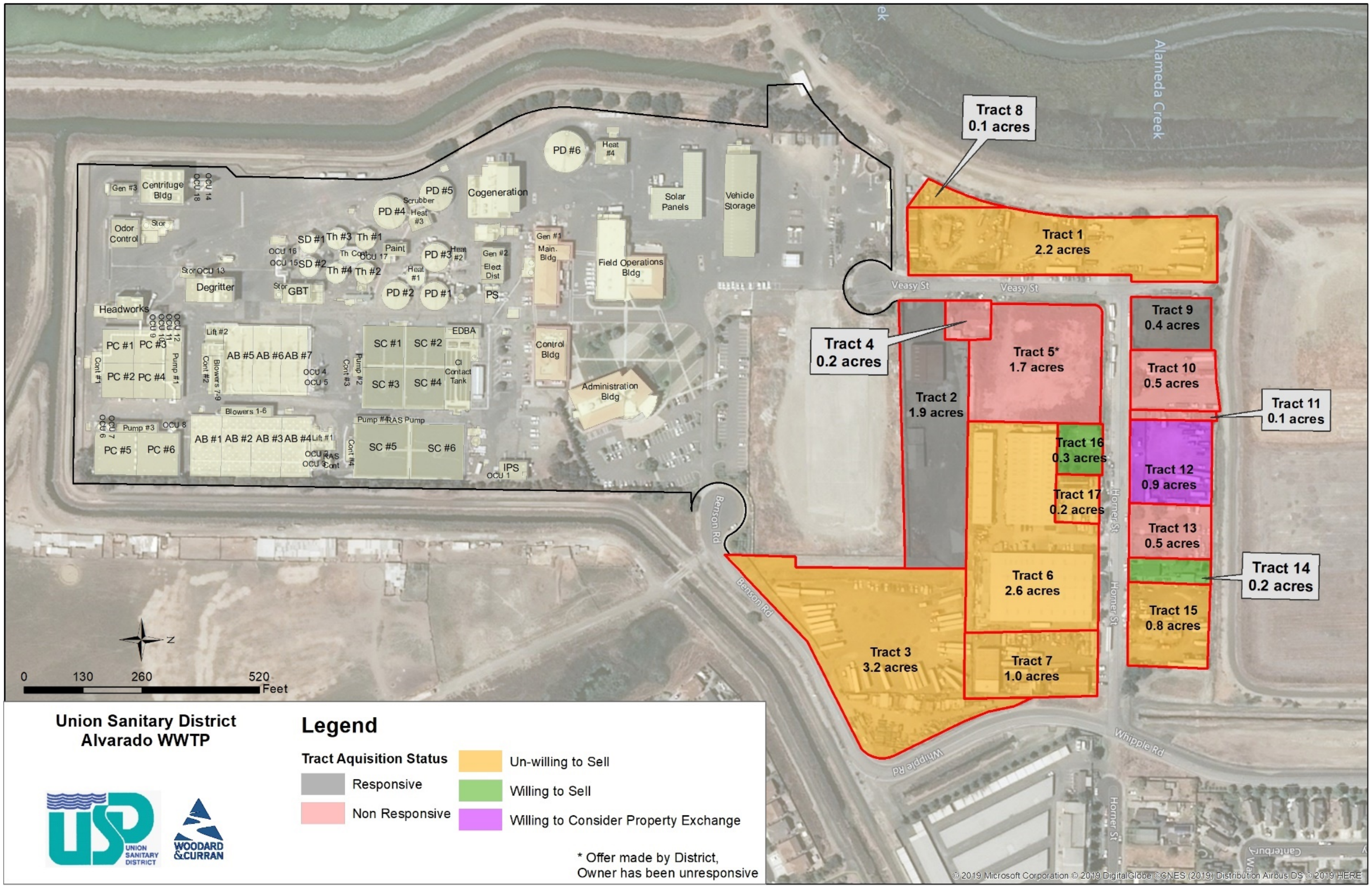
2 Real Estate Acquisition Management Plan, Overland, Pacific and Cutler, Inc., October 2017.

As described indicated on in the WWTP Site Use Study, Tracts 2 and 3 are the primary parcels of interest for site expansion. The owner of Tract 3 made himself available for a phone conversation and indicated that they are not interested the selling the property and declined further meetings and discussions.

Table 5-1: Tract Owner Outreach Summary

Tract	APN	Ownership	Outreach Result
1	482-22-1-2/482-22-7/ 482-22-9-1	Ken Bertelson	Unwilling to Sell
2	482-27-4-3	Shri Guru Ravidas Sabha Bay Area	Responsive
3	482-27-7-19	Tony Goncalves	Unwilling to Sell
4	482-27-6-1	Miguel Ramirez	Non-Responsive
5	482-27-13	Promax Investment 385 LLC	Non-Responsive
6	482-27-3-3	UMO Steel	Unwilling to Sell
7	482-27-1-10/ 482-20-18	Maninder Pattar	Unwilling to Sell
8		Ken Bertelson	Unwilling to Sell
9	482-20-9	Union City Redevelopment Agency	Responsive
10	482-20-8-2	Donald and Barbara Kirby	Non-Responsive
11	482-20-2-3	Donald and Barbara Kirby	Non-Responsive
12	482-20-7	Allan Williams	Willing to consider exchange
13	482-20-6	Patrick Barrera	Non-Responsive
14	482-20-5	Roland Marcelo	Willing to Sell
15	482-20-18	Maninder Pattar	Unwilling to Sell
16	487-27-2	Frank Perez	Willing to Sell
17	482-27-14	UMO Steel	Unwilling to Sell

Figure 5-1: Property Map



5.2 Title Search on Parcels of Interest to North of WWTP

Subsequent to the initial analysis of the 17 parcels immediately north and northeast of the WWTP, USD identified nine additional parcels of interest tracts further north of the WWTP. OPC performed a title report search of these nine parcels from November to December of 2018 to determine the feasibility of acquiring these parcels. These parcels are shown on **Figure 5-2**. The results of the title search are summarized in **Table 5-2**.

From the title search, Tracts 2, 3, 4 and 5 are zoned and permitted for agricultural use and are protected under wetlands designation. Tracts 3, 4 and 6 are also owned by the Alameda County Flood Control District (ACFCD). Lands controlled by ACFCD would likely require federal and state regulatory permits from multiple agencies prior to construction. These agencies potentially include the U.S. Army Corps of Engineers (USACE, San Francisco District), the Federal Emergency Management Agency (FEMA), the Natural Resources Conservation Service, the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration (NOAA), and the U. S. Geological Survey (USGS). Due to restrictions on land development for designated wetlands and additional permits required further research and evaluation of these parcels was not conducted.

5.3 Real Estate Recommendations

A real estate acquisition management plan was not developed further.

Table 5-2: Title Search Result Summary for Parcels North of WWTP

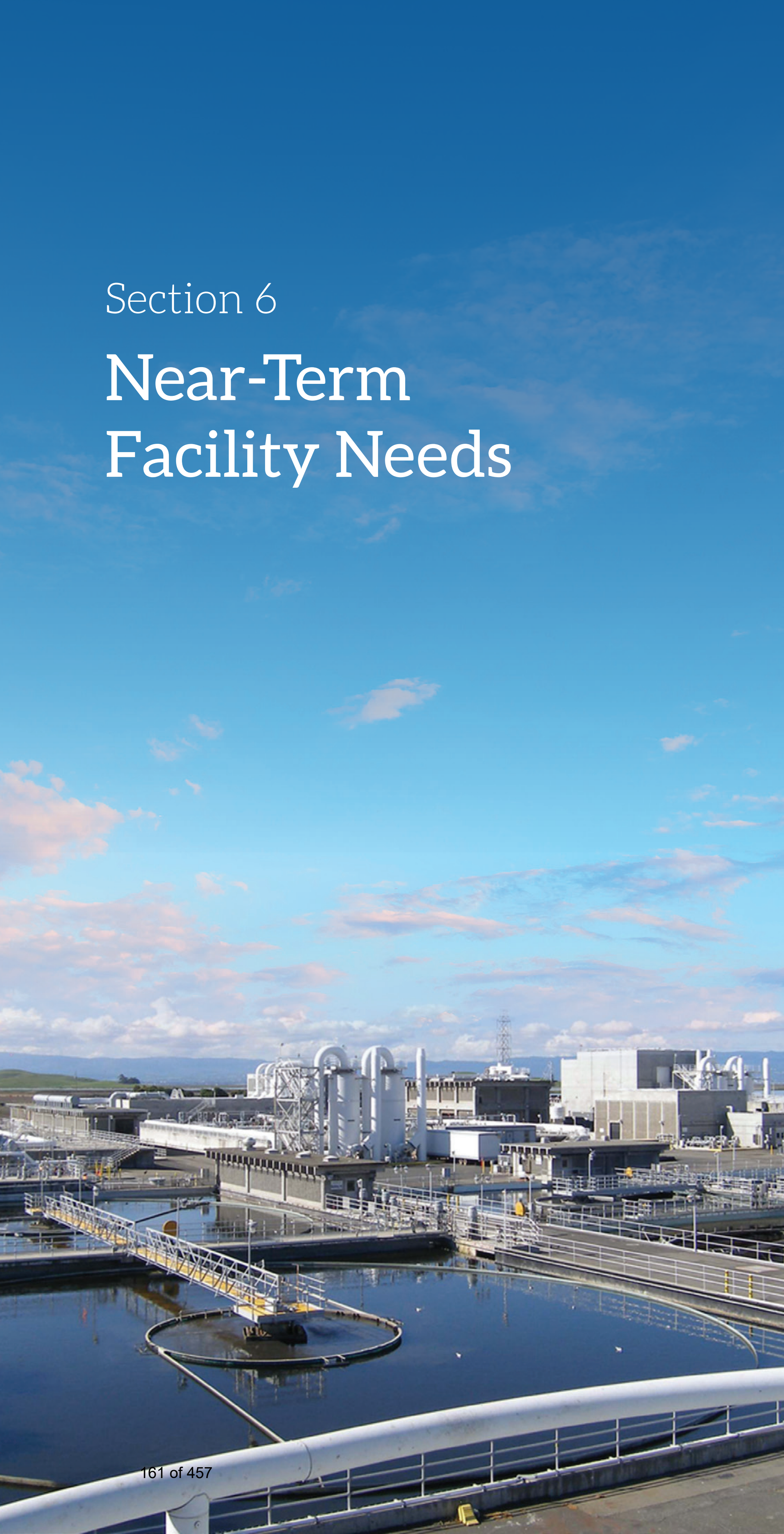
Tract	APN	Owner Name(s)	Zoning and Permitted Use
1	482-0096-007 482-0096-008	RREFF America REIT II, Columbia, MD	Light Industrial
2	482-0096-018 482-0096-019	RREFF America REIT II, Columbia, MD	Agriculture, Wetland Designation
3	482-0005-011-03 482-0020-019-05	Alameda County Flood Control District	Agriculture, Wetland Designation
4	482-0020-019-05	Alameda County Flood Control District	Agriculture, Wetland Designation
5	482-0080-003 482-0090-003 492-0095-003	State of California	Agriculture, Wetland Designation
6	482-0022-006-05	Alameda County Flood Control District	Light Industrial
7	482-0022-009-01 482-0022-001-02 482-0022-009-007	Bertelson Pre Cast Steps, Inc.	Light Industrial

In conclusion, the programming team determined that the unavailability of adjacent parcels in the immediate term has incentivized the development of facilities that can fit within USD's current footprint for the WWTP within the 2040 timeframe, and potentially to buildout, using the approach to treatment process technology presented in this ETSU Program.

Figure 5-2: Property Map of Parcels North of WWTP

Section 6

Near-Term Facility Needs



6

Union Sanitar y District's
Enhanced Treatment and Site Upgrade Program

6. NEAR-TERM FACILITY NEEDS

USD is pursuing a phased approach to secondary treatment improvements as identified in the Secondary Treatment Process Improvements Report (*Hazen and Sawyer, August 2019,* ***Appendix B***). Phase I of the recommended improvements would address capacity limitations and imminent effluent management restrictions (specifically the closing of Hayward Marsh) and are intended to be completed by the end of fiscal year 2026. Therefore, improvements to be implemented in the near-term, within the next 5-10 years, include these Phase I improvements as well as additional projects that have been identified in other studies to be completed within this time period.

6.1 Secondary Treatment Process Improvements

Phase I of the secondary treatment improvements achieves the near-term facility needs of increasing plant capacity and potential discharge to Old Alameda Creek through year-round nutrient removal. The scope of these improvements is listed in **Table 6-1**. The total project cost of these improvements is estimated at $155M.

Table 6-1: Phase I Secondary Treatment Process Improvements

Project	Description	Costs [1,2,3]
Aeration Basin Modifications	Retrofit existing Aeration Basins 1 through 7 to operate as a biological nutrient removal (BNR) process. Project includes constructing deoxygenation and anoxic zones, internal recycle pumps, and modifications to facilitate step feed operation and surface wasting.	$44M
Effluent Facilities	Construction of chlorination/dechlorination basins, effluent pump station, Old Alameda Creek pump station, relocate EBDA force main	$32M
Secondary Clarifiers	Construction of four new 155-foot diameter secondary clarifiers, mixed liquor control box, centralized RAS pump station	$67M
Plant Equalization Storage	Retrofit existing Secondary Clarifiers 1 through 4 to operate as a 2.5 MG primary effluent equalization basin	$12M
TOTAL PROJECT COST		**$155M**

Notes:

1. Costs are in 2019 dollars.
2. Includes costs for replacement of existing aeration blowers, odor control, electrical gear, and associated appurtenances.
3. USD CIP costs are higher and include inflation to midpoint of anticipated construction.

6.2 New Campus Building

This project consists of construction of a new Campus Building the combines the Administration, Operations/Lab, and FMC buildings, as well as the demolition of existing structures in this area. Total project cost is estimated at $66.4M. This project will have to be completed before the construction of new secondary clarifiers to make the space of existing administration buildings available.

Table 6-2: New Campus Building – Estimated Costs

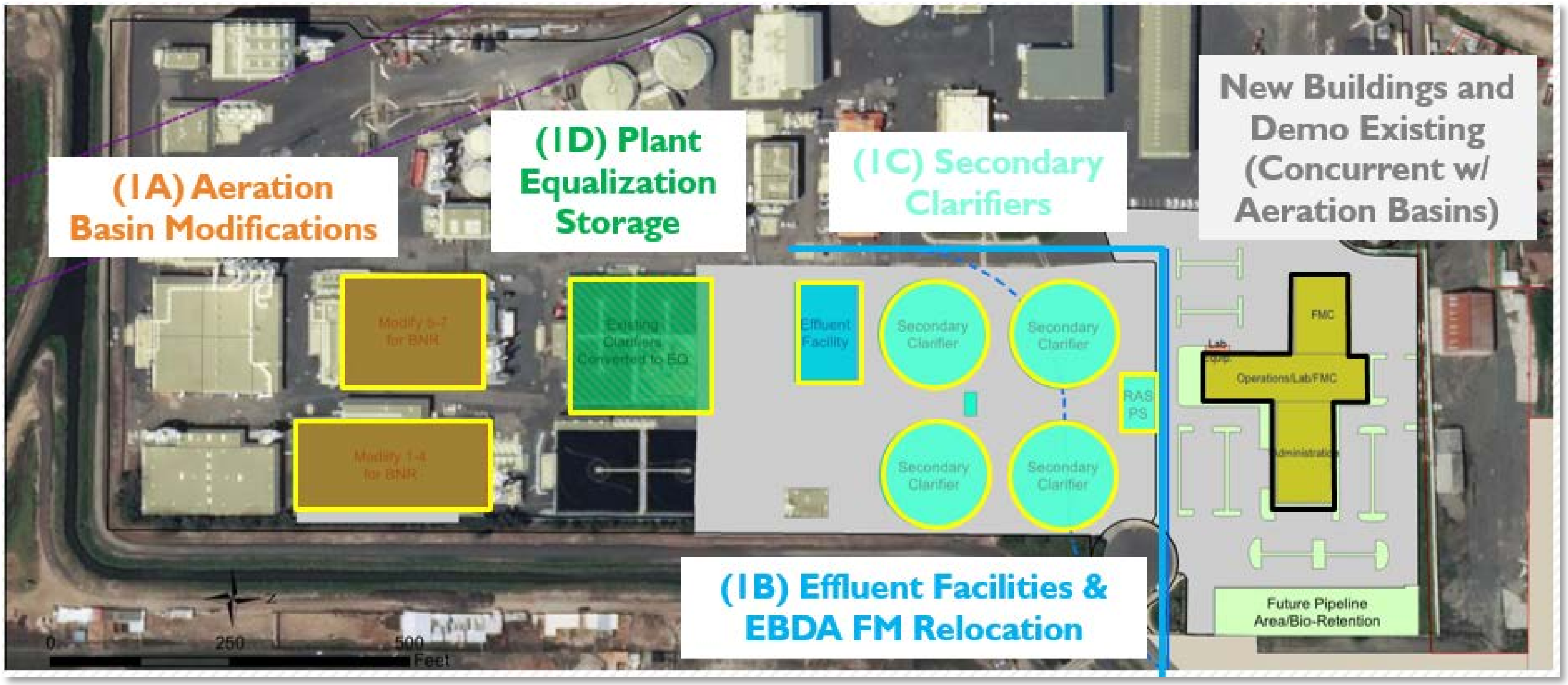
Project	Description	Costs (1,2)
New Campus Building	Consolidated Administration, Operations/Lab, and FMC Building. Demolition of Existing Structures.	$49.0M
Solar Panels (optional)	Construction and Implementation	$2.0M
Implementation Cost	Design, Permitting, ESDC, and CM at 30%	$15.3M
TOTAL PROJECT COST		**$66.4M**

Notes:

1) Costs are in 2019 dollars.
2) USD CIP cost includes inflation to midpoint of construction, and is presented as $72.4 M.

Figure 6-1 shows the scope of the Near-Term Secondary Treatment Process and Campus Building Improvements.

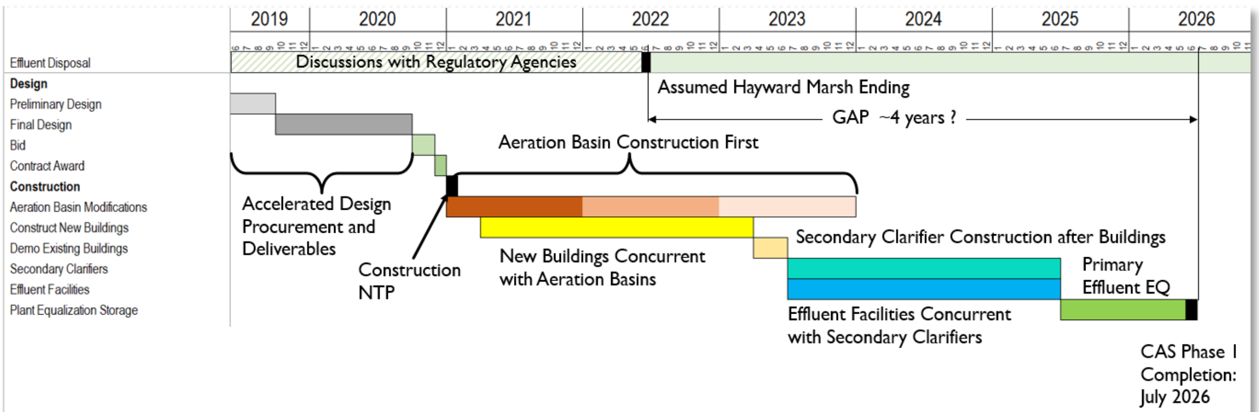
Figure 6-1: Layout of Phase I Facilities and Buildings



6.3 Sequence of Construction

Sequence of construction for near term projects associated with Secondary Treatment Process Improvements and Campus Building are shown in **Figure 6-2**.

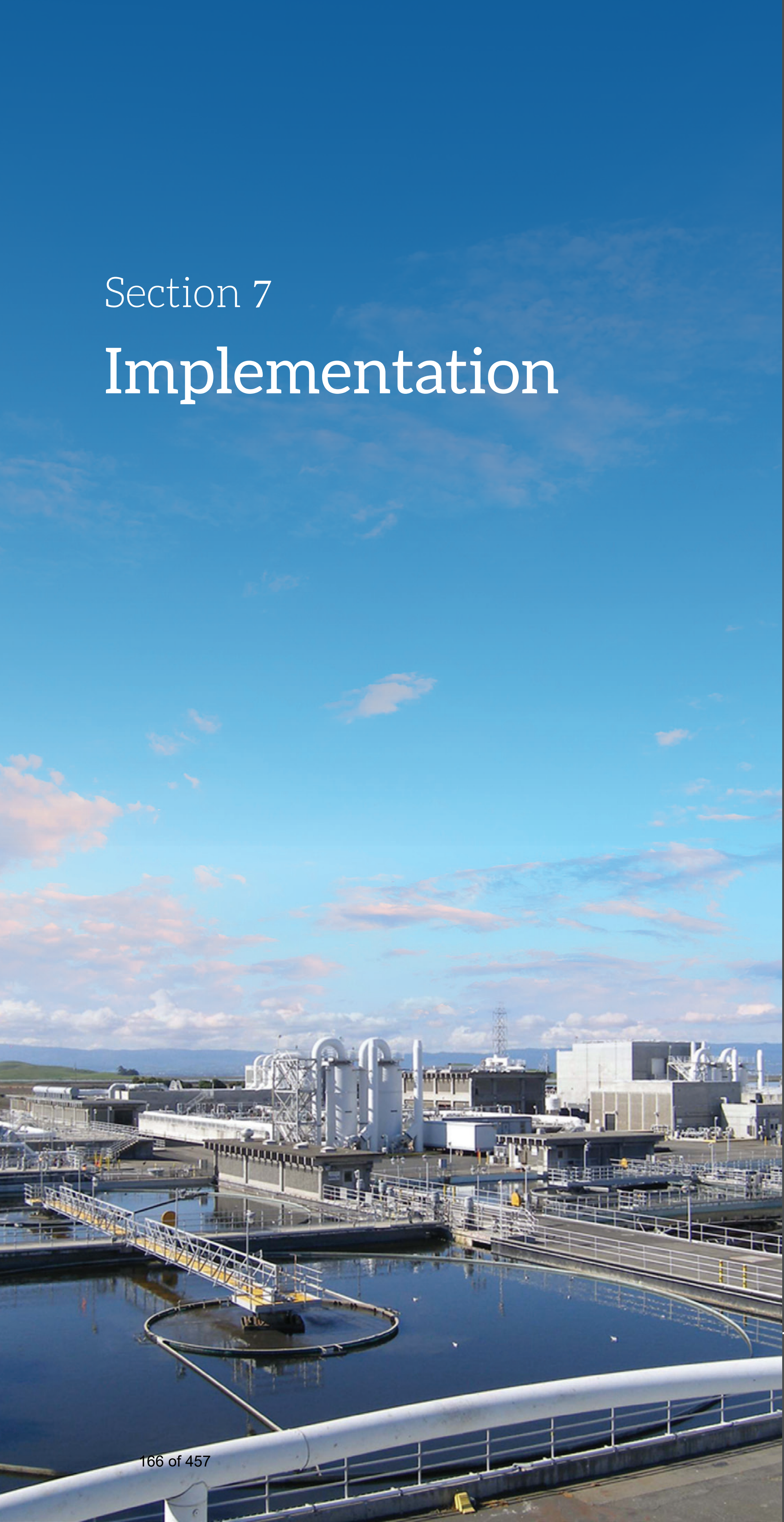
Figure 6-2: Phase 1 Secondary Treatment Process Improvements and New Campus Building Schedule



These projects are to address immediate needs to address secondary process performance and wet weather effluent management. Therefore, it is recommended to initiate the design process in the 3rd quarter of 2019, with the first components to be addressed being concurrent construction of aeration basin improvements (the 3 colors denote the phases of retrofit of the east basins, the west basins, and the common facilities because each bank of basins needs remain in operation while the other is retrofitted) and construction of the new campus of buildings to house administration, laboratory, and FMC facilities. The campus requires construction to relocate these facilities prior to demolition of existing buildings for secondary clarifiers. Effluent facilities can be built concurrently with secondary clarifiers, with the last component (primary effluent equalization) completed in July 2026.

This leaves a gap of approximately 4 years from the assumed closure of the Hayward Marsh effluent disposal option to the ability for USD to discharge to Old Alameda Creek during wet weather. Three options have been discussed as stop-gap measures, although at this time the preferred stop-gap measure has not been identified. These measures include:

1. Continuing a to use portion of the Hayward Marsh pond system for temporary secondary effluent storage until hydraulic capacity in the EBDA line becomes available.
2. Installing treatment facilities on the Old Alameda Creek Discharge to chemically remove ammonia.
3. Entering into an agreement with the RWQCB that would grant a temporary exception to water quality standards on the Old Alameda Creek discharge that would solidify the timing of the secondary treatment improvements.



Section 7

Implementation

7

Union Sanitar y District's
Enhanced Treatment and Site Upgrade Program

7. IMPLEMENTATION

The Secondary Treatment Process Improvements were proposed to provide a phased approach in order to meet both near-term and future challenges posed by capacity limitations, future nutrient removal, and effluent discharge. This phased approach maximizes the value of existing assets by rehabilitating those that can readily accommodate reuse and allows for initiation of improvements based on trigger points as discussed in this section.

7.1 Implementation Plan

Figure 7-1 provides the roadmap for implementation of USD's ETSU Program. The key trigger points that will drive when projects need to occur or need to be accelerated are:

- Phase out of Hayward Marsh as shallow water discharge during wet weather; this trigger is imminent
- SB1383 restriction on organics/biosolids disposal that will drive organics processing
- ACWD and potential regional (SFPUC and others) needs for advanced water treatment of Recycled Water
- BACWA Level 2 and Level 3 Benchmarks, and potential future Nutrient Limits
- Additional power needs driven by plant expansion
- Sea-level rise; this is currently not captured as a trigger, but expansions are planned leaving room for expanded levees.

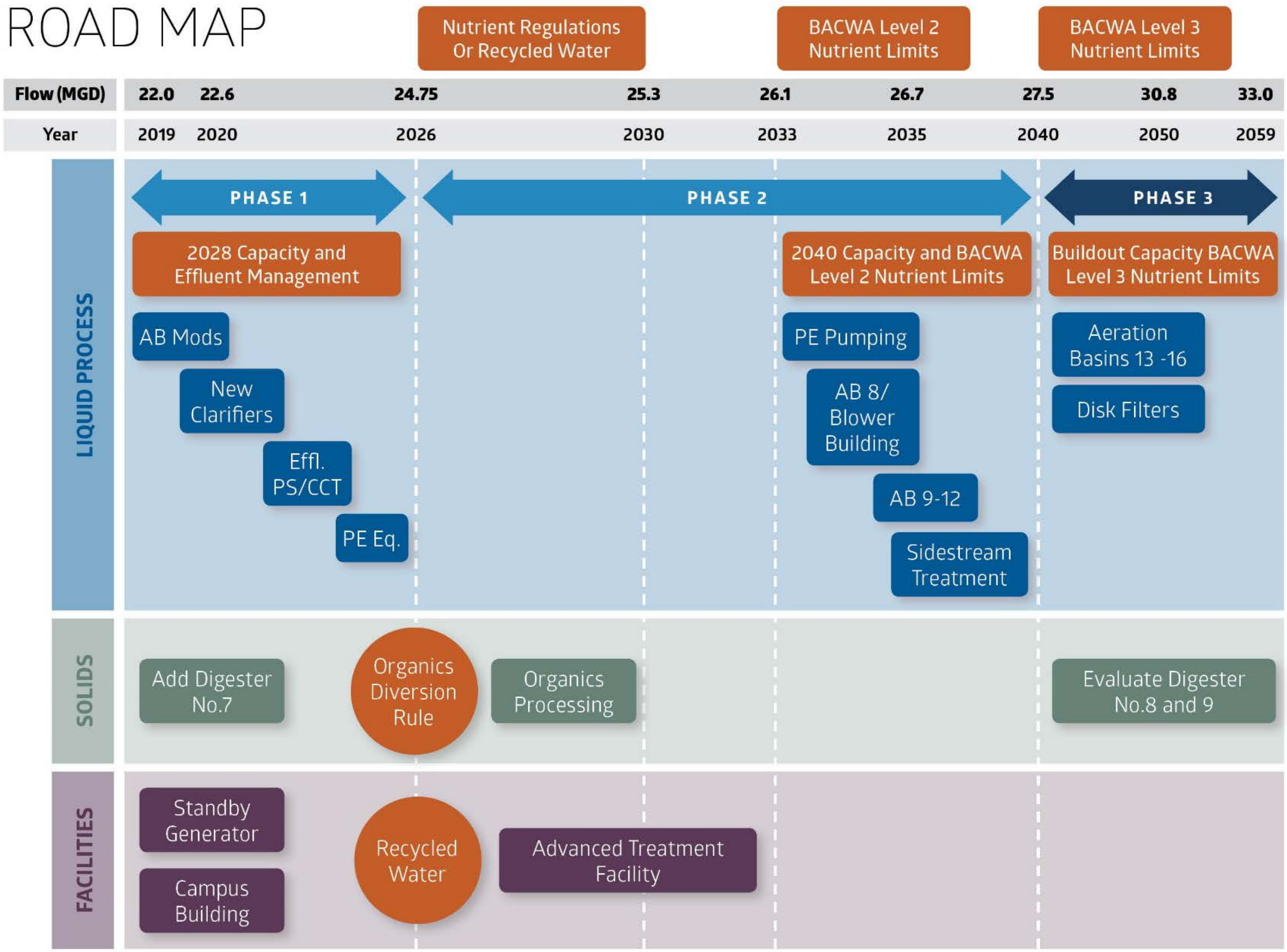
This ETSU Program is not intended to approve any individual phase or project, but to identify the proposed projects USD intends to pursue, subject to further review during a formal decision-making process. As the program is implemented and projects are designed and considered, environmental review required by CEQA will be conducted and USD will pursue any required regulatory permits. The program and the projects described propose no change in treatment capacity and are consistent with the uses approved by the City of Union City in Use Permit AP-4-95.

7.2 Key Factors

7.2.1 Effluent Management

Effluent Management is key concern for USD as wastewater discharge to Hayward Marsh phased out. Peak Flow attenuation in the form of conveyance system storage will serve as a partial solution for effluent management. Expanded and more frequent shallow water discharge to Old Alameda Creek, in conjunction with early action nutrient removal is anticipated to provide the remaining effluent management capacity. Modifications required for shallow water discharge are detailed in Section 7.2.2.1 below.

Figure 7-1: Road Map for USD's Enhanced Treatment and Site Upgrade Program Implementation



7.2.2 Secondary Treatment Capacity

CAS Option 2 is the preferred option for Secondary Treatment Process Improvements and BNR. For a more detailed description of these components, please see **Appendix B.** This phased approach maximizes use of existing infrastructure and does not result in stranded or redundant assets.

Operation of nutrient removal CAS system will be significantly different from that of USD's existing CAS system. BNR is typically a two-step process. In the first step, ammonia is oxidized to nitrate, which is referred to as nitrification. In an activated sludge system, this occurs in the aerobic zone of the aeration tanks. The SRT in the aerobic zone of the activated sludge system needs to be longer for nitrifying systems than for BOD-only removal and the required SRT can vary based on seasonal temperature differences in the wastewater. The Alvarado WWTP currently operates at a very short SRT of approximately one day, which is prone to filamentous bulking and too short to support nitrification. To achieve consistent year-round nitrification and target effluent ammonia concentrations of less than 1 mg/L, the SRT will need to be increased to a range of 8-13 days as shown in **Table 3-5**, depending on various operational factors.

The second step in biological nitrogen removal is denitrification, in which nitrate is reduced to nitrogen gas and released to the atmosphere. In an activated sludge system, this reaction occurs in an anoxic environment where dissolved oxygen is not present. The heterotrophic organisms in the mixed liquor of the anoxic zone will utilize the oxygen in the nitrate for the biodegradation of organic matter, resulting in the release of nitrogen gas. Swing zones, which can fluctuate between aerobic or anoxic, may be used to change the size of the aerobic zone to accommodate seasonal solids retention time (SRT) changes and maximize volume for denitrification.

Step feed, which is suggested for wet-weather BNR operation, is when all or a portion of the primary effluent to be fed to an intermediate location of the aeration basin to lower the solids loading to the secondary clarifiers and preserve the nitrifier population in the upfront zones.

7.2.2.1 Secondary Treatment Process Improvements

Phase I modifications have the dual intent of providing increasing treatment capacity of the WWTP as well as providing effluent management facilities. Specifically, plant modifications would include:

- Increasing Plant Capacity
  - Modify existing aeration basins: forming 2 aeration basins from existing Aeration Basins 1-4, creation of RAS deoxygenation zone, and creation of anoxic zones
  - Replace existing secondary clarifiers with circular clarifiers: four new circular clarifiers will be constructed where the administration building is currently located
- Improving Effluent Management (Old Alameda Creek Discharge)
  - Modify existing secondary clarifiers to provide 2.5 MG primary effluent equalization
  - Construct chlorination and dechlorination facilities
  - Construct new EBDA Pump Station
  - Re-route EBDA forcemain

Phase I accomplishes improved effluent quality through year-round BNR. The aeration basin modifications described in Section 6.2.1.1 coupled with the new modern clarifiers will provide USD with the capability to operate in BNR mode year-round because:

- The RAS system associated with the new modern clarifiers allows for step feed operation during wet weather.
- The PE equalization shaves peaks during wet weather.
- The new clarifiers can handle wet weather at the higher solids loading required for BNR
- Year-round BNR operation can achieve approximately 50% effluent TN load reduction for the year. It also achieves significant ammonia removal in wet weather.

To meet the stringent TSS standards (TSS<15 mg/L) for creek discharge during wet weather while maintaining solids inventory for BNR, USD would use several features in CAS Option 2 Phase I:

- PE equalization to shave off peak flow during storm events
- Step feed operation to off load solids loading to the secondary clarifiers
- Modern clarifiers with more total surface area and improved RAS control.

7.2.2.2 Nutrient Removal

Phase II nutrient removal permit limits will require the following additional modifications:

- Construct intermediate pump station: To accommodate the 5.5 mg of new aeration basin volume additional primary effluent distribution lines and a new lift station will be needed.
- Construct 5.5 MG of new aeration basin volume: This new volume will accommodate aerobic and anoxic zone to achieve TN removal.
- Construct new blower building: New blowers will be centrally located in a new facility north of the existing Aeration Basins 5-7 to accommodate this phase and future aeration tanks through buildout.
- Implement chemical P removal
- Construct sidestream treatment

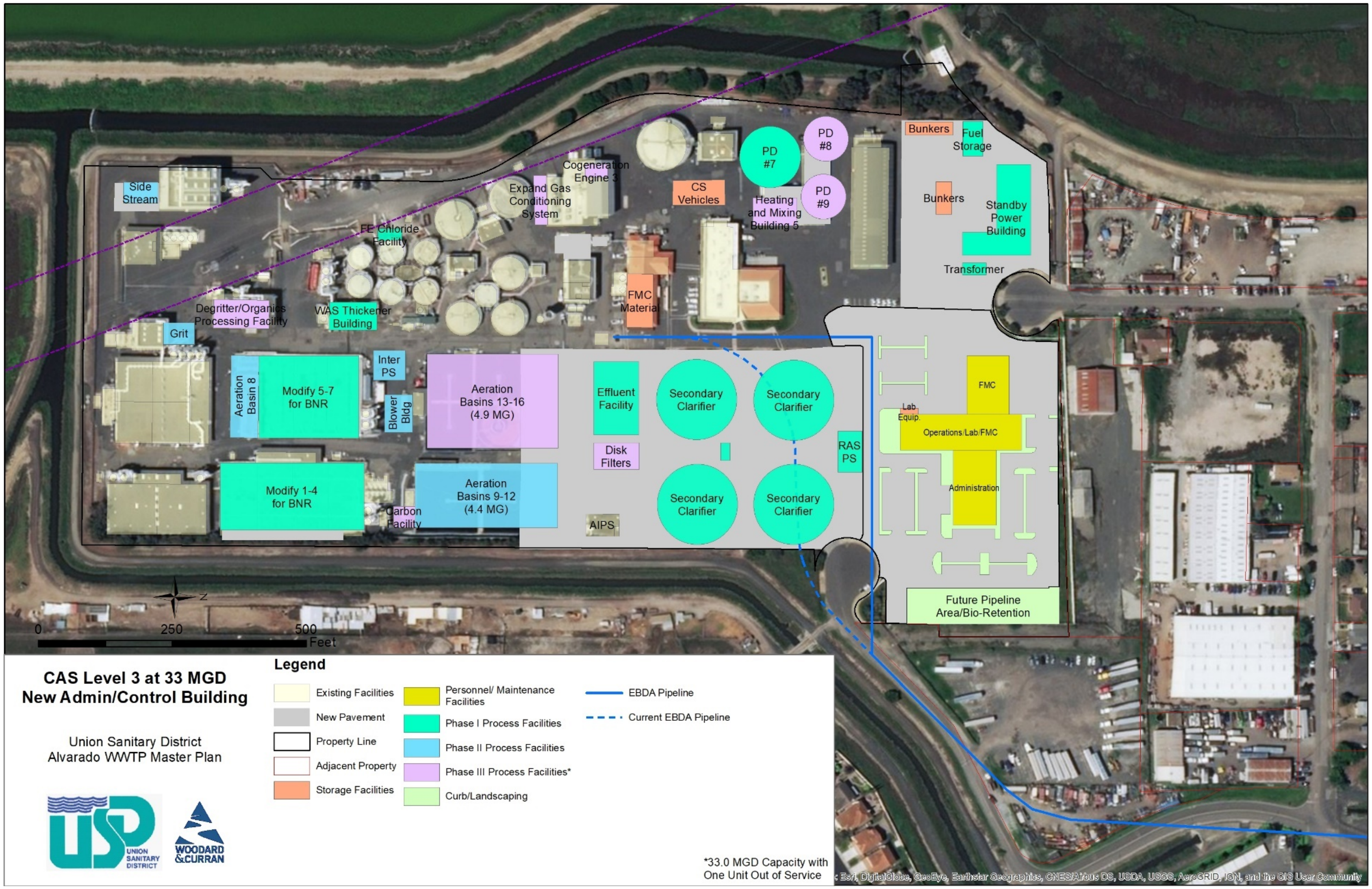
7.2.3 Restrictions on Biosolids Disposal

SB 1383 establishes the following targets for reducing landfill disposal of organic materials, including biosolids, based on the 2014 levels of organic waste disposal in California:

- 50% reduction by 2020
- 75% reduction by 2025

Depending upon the needs of the Union City, Newark, and Fremont Tri-Cities area for broad scale organics diversion, including food waste processing, and potential regional markets for organics diversion, an organics processing facility may be implemented by USD at its discretion. The viability of processing additional organics will need to be evaluated with regard to nutrient impacts of associated solids processing sidestreams as USD moves forward to implement the secondary treatment process improvements project, which will consider nutrient removal now and into the future. Space for such a facility is not currently accounted for within the site layouts included herein.

Figure 7-2: Phase III Plant Layout



7.3 Resources Needed

The costs of the key projects recommended in the ETSU Program are summarized in **Table 7-1**, including Secondary Treatment Process Improvements.

Table 7-1: Estimated Costs for Secondary Treatment Process Improvements (Phase I and Phase II) and Campus Building

Project	Costs
Campus Building	$ 72.4 M
Secondary Treatment Process Improvements Phase I	$ 231.8 M
Secondary Treatment Process Improvements Phase II	$ 253.5 M
GRAND TOTAL	**$557.7 M**

Notes:

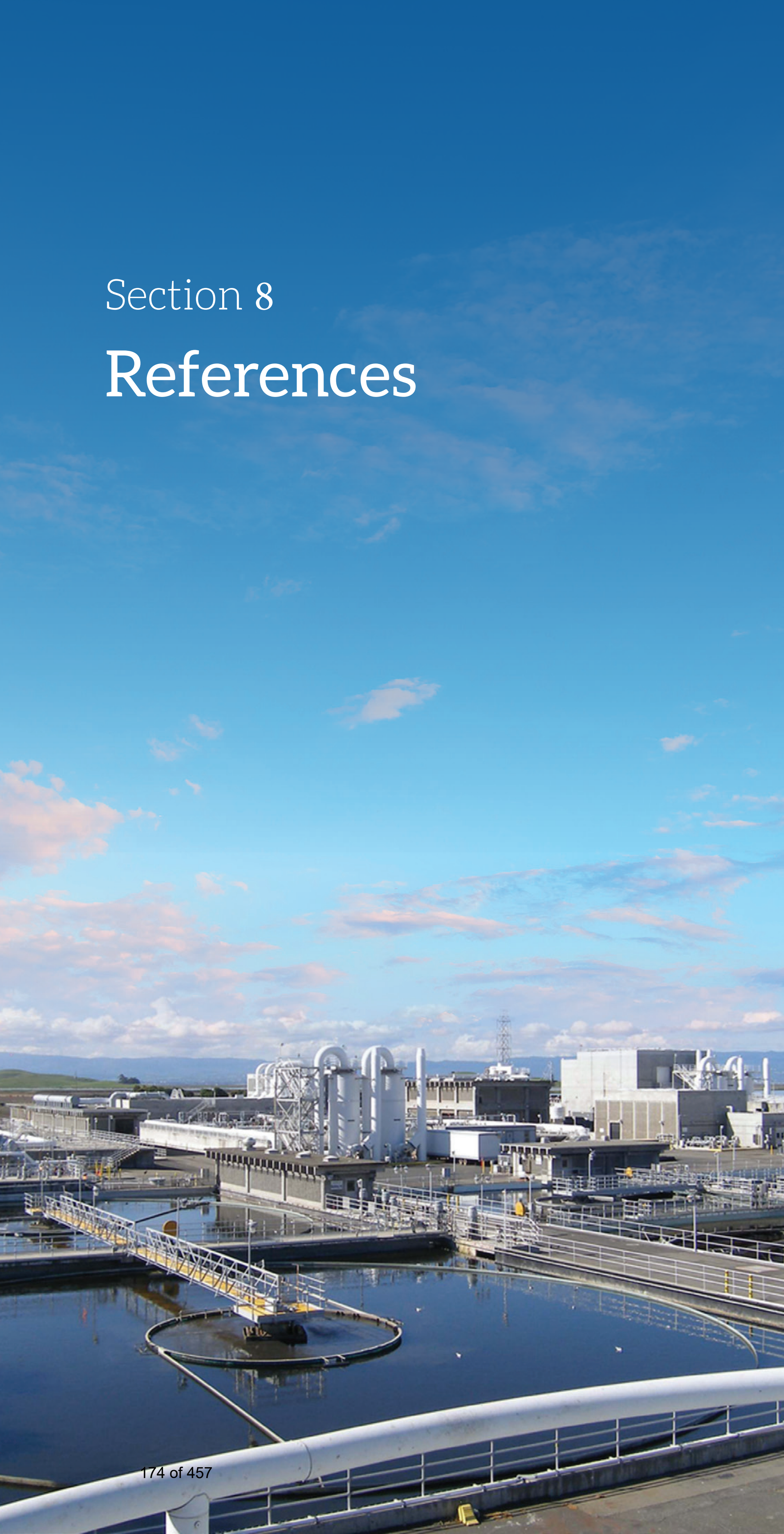
1. Costs include inflation to midpoint of anticipated construction.
2. Assumes preliminary design for Phase II improvements to begin in July 2035.

The proposed Campus Building combines a new administration building, new control building and laboratory, and a new Facilities Maintenance (FMC) building, with shared parking, elevators, lockers etc. to maximize efficiency and collaboration of staff. The Secondary Treatment Process Improvements, Phase I, include the upgrades to improve plant process performance immediately, improve effluent quality for increased shallow water discharge to Old Alameda Creek, and early action nutrient removal. Phase II includes improvements to meet Level 2 nutrient requirements and project flows and loads through 2040.

Section 8

References

8



Union Sanitar y District's
Enhanced Treatment and Site Upgrade Program

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Appendix A

Effluent Management Study

A

Union Sanitary District's
Enhanced Treatment and Site Upgrade Program

EFFLUENT MANAGEMENT STUDY

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COMMITMENT & INTEGRITY DRIVE RESULTS

Union Sanitary District
August 2019

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EXECUTIVE SUMMARY

The purpose of the Effluent Management Study (Study) is to develop and evaluate alternatives to manage effluent from the Union Sanitary District (District or USD) Alvarado Wastewater Treatment Plant (WWTP). More specifically, this study is focused on alternatives to address discharge of peak wet weather effluent flow from the WWTP.

USD's primary method of effluent discharge is through the East Bay Dischargers Association (EBDA) joint conveyance and outfall system. However, USD's ability to send effluent to the EBDA system is dependent on several factors, including discharge flow from the City of Hayward and the ability to discharge to the Hayward Marsh (via the EBDA system). USD can also discharge to Old Alameda Creek during unusually high flow events, however, discharge to Old Alameda Creek is not currently permitted on a routine basis. USD has an immediate effluent discharge issue given the current state of the Hayward Marsh and the limited capability of Old Alameda Creek to take additional peak flow discharge.

USD has investigated a broad variety of influent management, storage, and effluent management options to address the imminent phasing out of the Hayward Marsh as a reliable wet weather discharge location. Unless or until the East Bay Regional Parks District embraces its management role of the Marsh as an effluent reuse and disposal facility, along with providing habitat benefits, the best solution for long term effluent management at this stage appears to be upgrading effluent water quality at the WWTP, including early adoption of nutrient removal improvements, either for sidestream treatment as a partial nutrient removal, and/or full flow nutrient removal upgrade as a complete solution. Early adoption will address nutrient removal in the final effluent, which is anticipated to be needed after 2024 at some yet to be determined level. Early investment and adoption carry some level of risk to USD given that final standards are not determined. Given that these proposed improvements will benefit effluent water quality in the near term and can be repurposed to provide long term secondary treatment capacity, this risk can be mitigated. Implementing a nutrient process with a longer solids retention time will also provide benefits to operation and performance at the WWTP.

It is therefore recommended that early adoption of side-stream or full flow nutrient removal at the Alvarado WWTP and increased seasonal discharge to Old Alameda Creek be further developed as the primary effluent management project. This alternative will require extensive collaboration with the Regional Water Quality Control Board because an expansion of the use of the Old Alameda Creek outfall as a shallow water discharge requires site-specific permit conditions which have not yet been developed.

1. INTRODUCTION

The purpose of this Effluent Management Study is to present and evaluate peak wet weather effluent management strategies for Union Sanitary District (District or USD). The East Bay Dischargers Authority (EBDA) outfall provides the primary effluent disposal capability for USD, with Hayward Marsh (Marsh) and Old Alameda Creek providing essential wet weather capacity as well. The Hayward Marsh continues to function effectively as a discharge component for USD, but for the Marsh to continue to be effective for USD's effluent reuse and disposal purposes, it needs to be able to be permitted by the Regional Board, and needs to be maintained and supported (including dredging and levees reconstructed) by the East Bay Regional Parks District. East Bay Regional Parks has communicated to USD that is not in a position to invest the substantial capital (at least $20 Million) and O&M resources in the Marsh in order for USD to rely upon the Marsh for reliable disposal capacity.

Due to the potential loss of the Hayward Marsh as an effluent disposal option and the need to handle Peak Wet Weather Flows (PWWF), in excess of USD's effluent disposal capacity in EBDA, additional effluent management options need to be developed. This Study documents the effluent management options and identifies their viability at a preliminary level to help form a comprehensive and long-lasting solution. The Effluent Management Study is being developed in parallel with the interrelated Enhanced Treatment & Site Upgrade Program, which is intended to provide the long-term vision for the Alvarado Wastewater Treatment Plant (WWTP), including effluent water quality improvements.

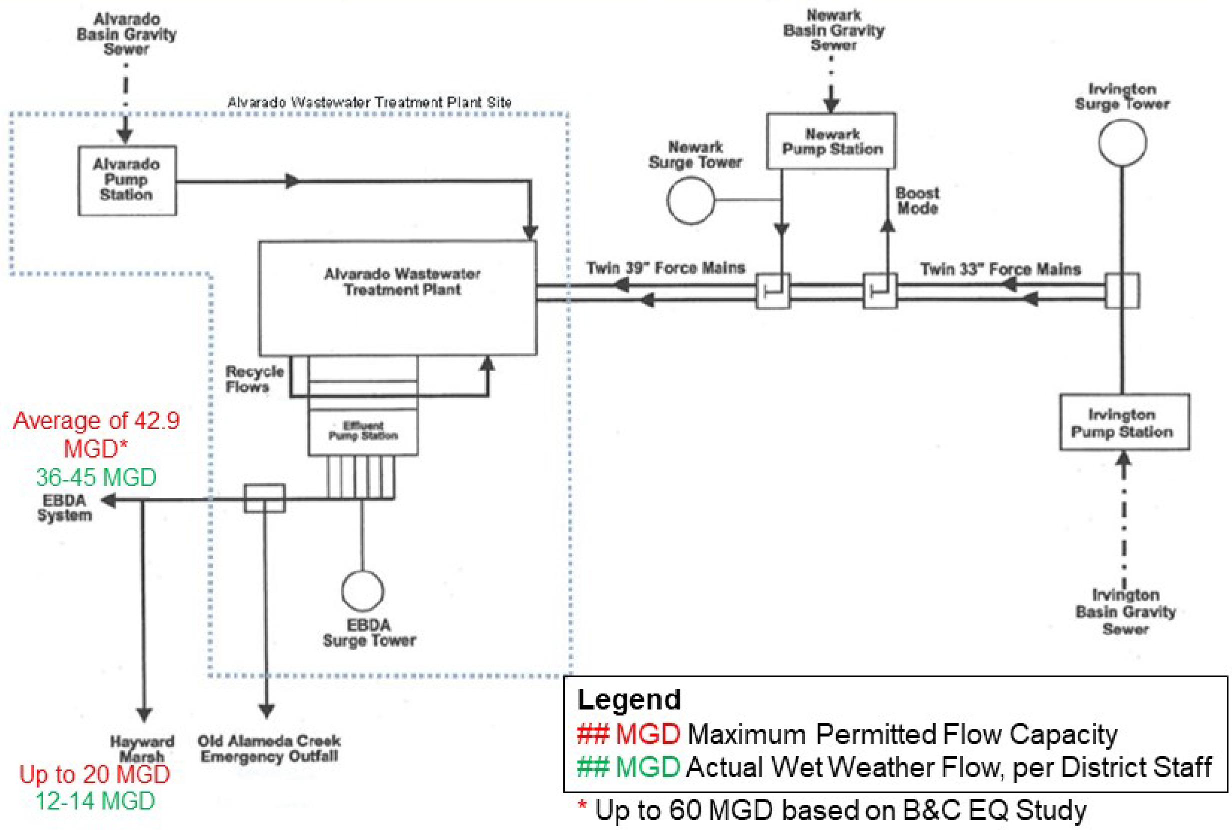
1.1 Existing Effluent Disposal System

The Union Sanitary District is evaluating strategies for disposing of treated wastewater from the WWTP. The WWTP currently provides secondary treatment of wastewater collected from Union City, Newark, and Fremont. Currently, USD is permitted to discharge secondary effluent at three discharge points:

- East Bay Dischargers Authority (EBDA) system
- Hayward Marsh
- Old Alameda Creek, during storm events only

Currently, USD is permitted to discharge up to 33 million gallons per day (MGD) average dry weather flow (ADWF) and 42.9 MGD peak daily flow of its wastewater to the EBDA outfall per its joint powers agreement (JPA) with EBDA (Order No. R2-2017-0016, NPDES No. CA 0037869). The Alvarado Effluent Pump Station (AEPS) is used to pump USD's treated effluent into the EBDA system. **Figure 1-1** shows a process flow schematic of the WWTP and the permitted flow capacities associated with its different discharge points.

Figure 1-1: Process Flow Schematic & Currently Permitted Discharge Points



Source: USD's Old Alameda Creek (Wet Weather Outfall) Permit. ORDER No. R2-2015-0045, NPDES No. CA0038733.

On average, approximately 3 MGD of effluent from USD is discharged from the EBDA pipeline to the Hayward Marsh. During peak weather events when total wastewater flow discharged by EBDA member agencies is beyond the capacity of the current system, up to 20 MGD of wastewater from USD's WWTP can be directed to Hayward Marsh. After the secondary-treated effluent flows through the freshwater treatment marsh, the reclaimed wastewater flows to San Francisco Bay.

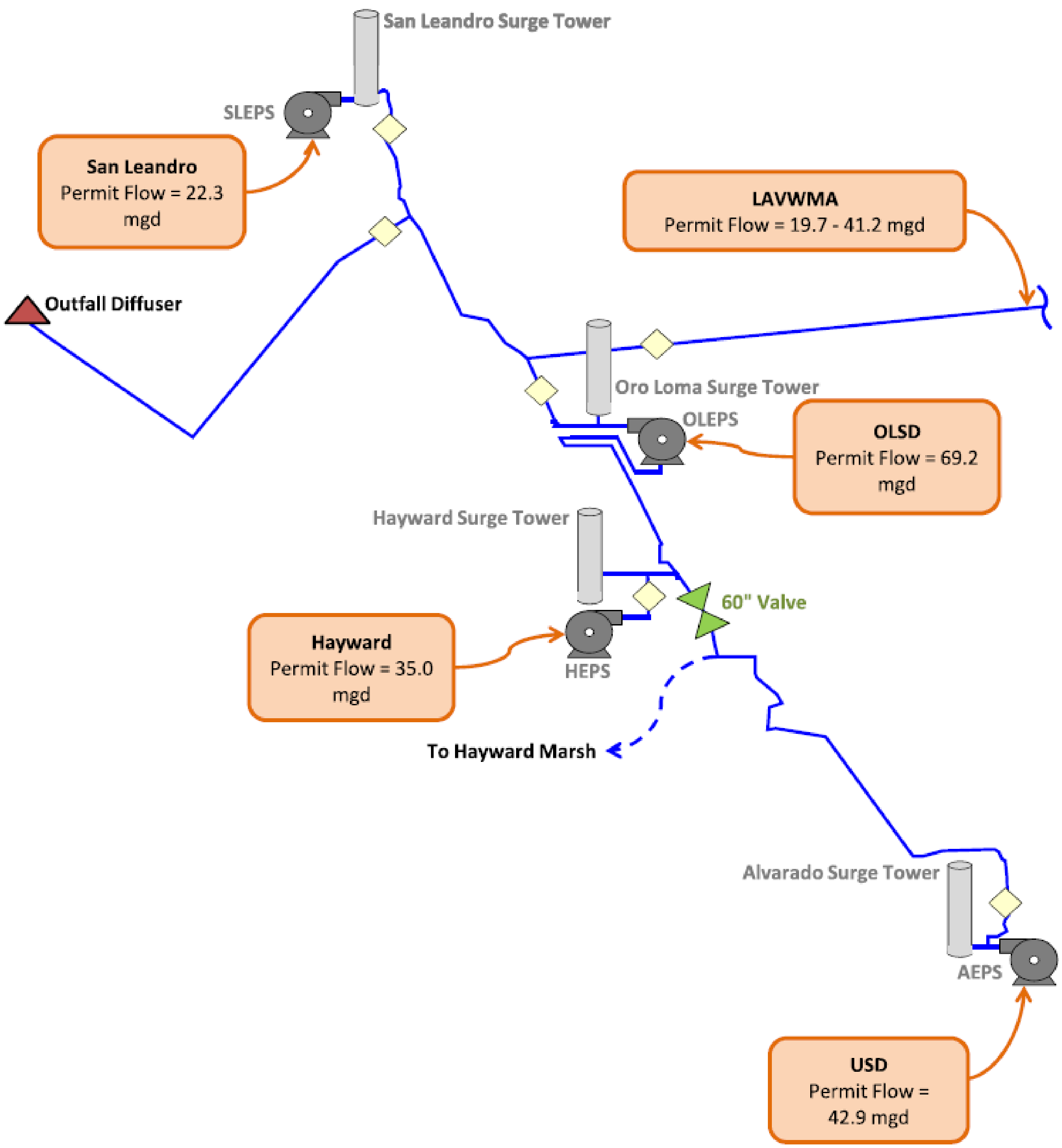
In addition to Hayward Marsh, during wet weather, USD can discharge to Old Alameda Creek. Although the previous maximum discharge flow limitation of 8.4 MG per discharge event is not retained in the current permit for Old Alameda Creek, calculations performed were based on this assumed limitation. The District has not been compelled to use this discharge point since 1998 but it typically has been exercised once per wet weather season since then.

Effluent options are required for USD in order to prepare for the elimination of Hayward Marsh as an option for wet weather discharges.

1.2 EBDA Capacity

USD's current average dry weather flow (ADWF) is 22.4 MGD and is estimated to increase to an ADWF of 33 MGD by 2058. Although there is sufficient effluent disposal capacity in the EBDA system to handle current and buildout average flows, flows through the plant increase significantly during wet weather events due to inflow and infiltration (I/I) into the collection system. A schematic of the EBDA system and permitted peak wet weather design flows is shown in **Figure 1-2**. Including flows from Livermore-Amador Valley Water Management Agency (LAVWMA), the total permitted discharge for the system is 189.1 MGD (San Francisco Bay Regional Water Quality Control Board, 2017).

Figure 1-2: EBDA System Schematic



Source: EBDA System Flow Master Plan (Carollo 2011)

Actual EBDA hydraulic capacity may not match the permitted discharge flow rate. Per District staff, USD can pump more than the permitted capacity amount, however, there are hydraulic limitations that vary depending on various conditions in the EBDA system. The District's hydraulic capacity was previously evaluated as part of the *Wastewater Equalization Storage Facilities Pre-Design* (Brown & Caldwell 1999) and more recently as part of the *Flow Equalization Report Update* (Brown & Caldwell, 2013), *Draft EBDA System Flow Master Plan* (Carollo 2011) and the *Draft EBDA Hydraulic Model Recalibration and Capacity Analysis* (Carollo 2017). The Final Version of the Hydraulic Model Recalibration and Capacity Analysis is not anticipated to have any significant new or different findings than the Draft.

The amount of available discharge capacity through the AEPS into the EBDA system is dynamic and dependent on the following primary factors:

1. Flow from Hayward Effluent Pump Station (HEPS), which is combined with the AEPS flow to the Oro Loma Effluent Pump Station (OLEPS). Increasing flows from HEPS decreases AEPS capacity.

2. Flow to the Hayward Marsh, which is diverted from the EBDA system upstream of the HEPS. Increasing flow to Hayward Marsh increases AEPS capacity.

3. The operating wet well level at OLEPS, which receives combined flow from AEPS, HEPS, and Oro Loma Sanitary District (OLSD). Increasing OLEPS wet well water levels decreases AEPS capacity.

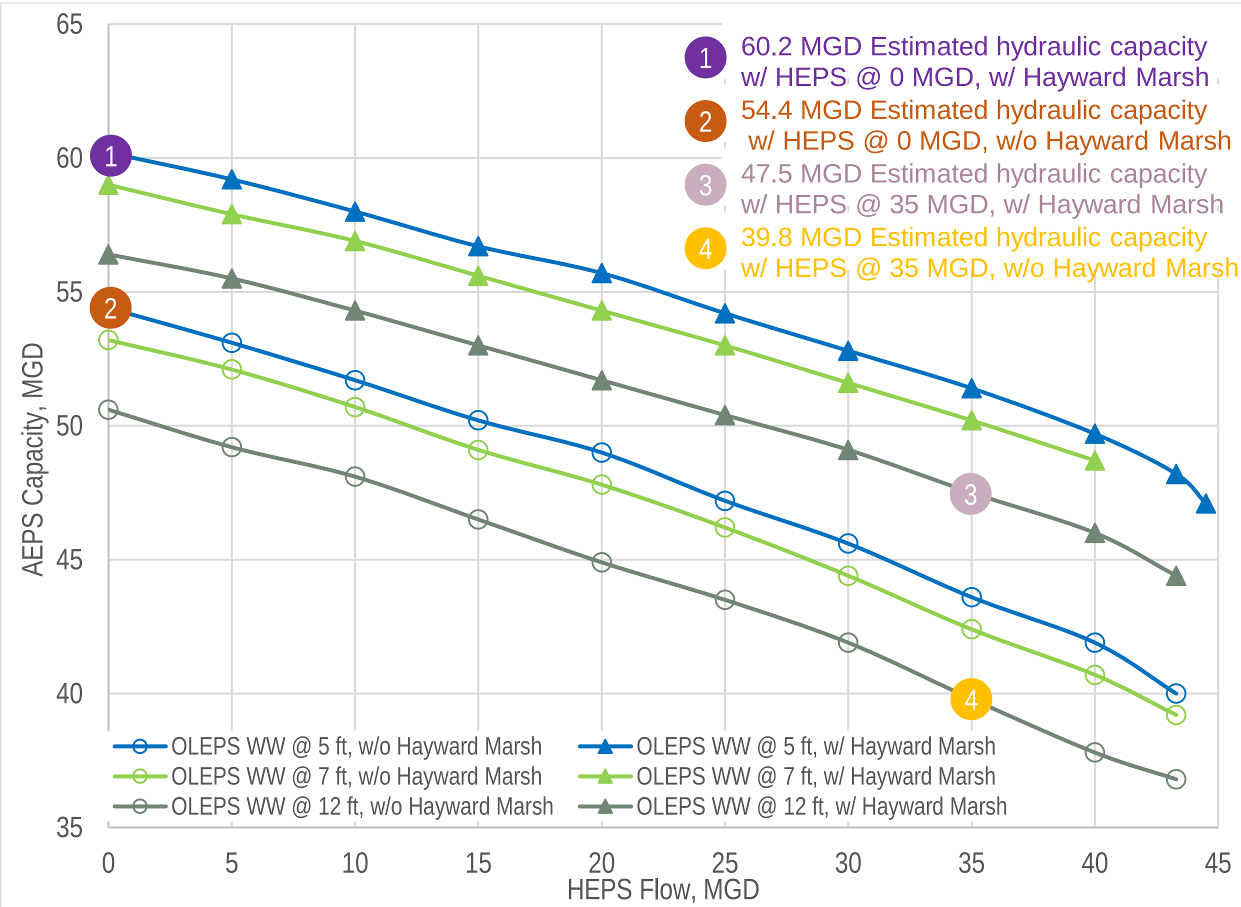
USD's discharge capacities under various conditions with and without flow to Hayward Marsh based on the 2017 study are shown in **Table 1-1**.

Table 1-1: Maximum Discharge from AEPS (USD) to EBDA

Flow from HEPS, MGD	OLEPS Wet Well Elevation, FT	Maximum Discharge to EBDA w/o Hayward Marsh, MGD	Maximum Discharge to EBDA w/ Hayward Marsh, MGD
0	5	54.4	60.2
	7	53.2	59
	12	50.6	56.4
20	5	49	55.7
	7	47.8	54.3
	12	44.9	51.7
35	5	43.6	51.4
	7	42.4	50.2
	12	39.8	47.5

As illustrated in **Table 1-1**, flow from HEPS has the largest impact on AEPS capacity, followed by flow to the Hayward Marsh and OLEPS Wet Well Elevation. Based on the *Draft EBDA Hydraulic Model Recalibration and Capacity Analysis* and illustrated in **Figure 1-3,** the capacity of AEPS without discharge to the Hayward Marsh varies from 36.8 MGD to 54.4 MGD, depending on HEPS discharge and OLEPS wet well level. With discharge to the Hayward Marsh, the AEPS capacity ranges from 44.0 MGD to 60.2 MGD.

Figure 1-3: Estimated AEPS Discharge Limitations



Source: Draft EBDA Hydraulic Model Recalibration and Capacity Analysis (Carollo 2017)

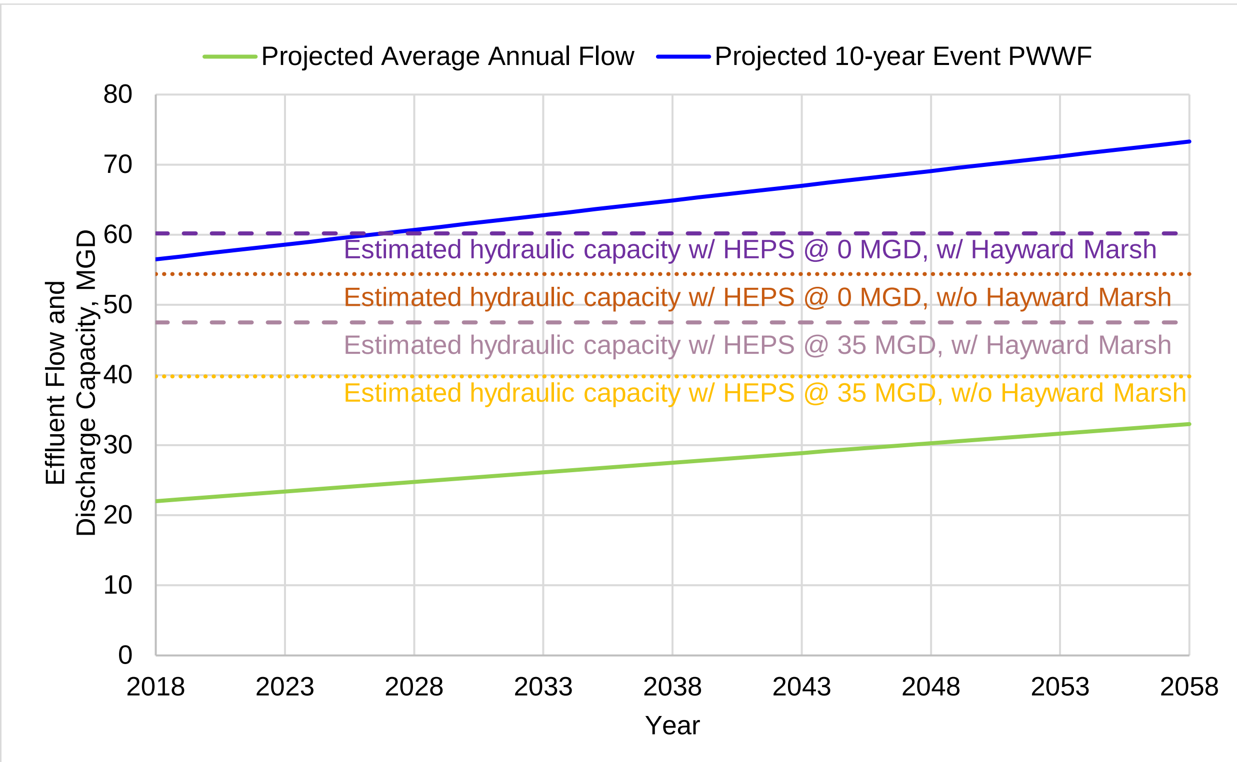
Although the allocated capacity for HEPS is 35 MGD, during peak wet weather events, some flow from the City of Hayward would be diverted to the City of Hayward storage ponds. Actual peak flow from HEPS may be less than 35 MGD due to the use of storage. As part of the Draft EBDA Hydraulic Model Recalibration and Capacity Analysis, EBDA requested that HEPS be evaluated using flows of 20 MGD and 15 MGD.

EBDA has developed as a standard operating procedure, which is used to manage capacity in the EBDA system during wet weather events. Based on the standard operating procedure, if the OLEPS wet well level continues to rise at ~ 110 MGD of flow through OLEPS, EBDA will direct the City of Hayward to begin diverting flow to the City of Hayward storage ponds. If the wet well level at OLEPS continues to rise, and USD cannot dispose of all of its flow through EBDA and the Hayward Marsh, USD may then need to discharge to Old Alameda Creek (that direction is not given by EBDA). A copy of the 2017-2018 EBDA Standard Operating Procedure is included as Appendix A.

1.3 Excess Effluent Storage (or Discharge) Requirements

A summary of USD's effluent discharge (current and future for both average and peak wet weather) and estimated EBDA hydraulic capacity is presented in **Figure 1-4.**

Figure 1-4: USD's Estimated Effluent Flow and Discharge Capacity



Notes: Maximum capacities shown are based on an OLEPS wet well level of 5 feet; minimum capacities are based on an OLEPS wet well level of 12 feet. Additional flow can be discharged to Old Alameda Creek (nominally up to 8.4 MG) during peak wet weather events. There is no longer a volumetric limit in the NPDES permit for Old Alameda Creek, but the frequency of use allowed in the Permit is tied to an excess flow event of approximately 8.4 MG.

Excess flows above USD's discharge capacity through the EBDA system will need to be managed (i.e. stored or discharged to an alternative location). USD's equalization storage (EQ) requirements (i.e. managed volume) for a 10-year storm event were also previously evaluated in the *Flow Equalization Report Update*. Due to water conservation measures, the current dry weather influent wastewater flow is similar to influent flow rates presented in the *Flow Equalization Report Update*, which was prepared in 2013*.* Although the current peak flow of 56.9 MGD would typically exceed the available capacity that can be accommodated in the EBDA pipeline, Brown and Caldwell concluded that the excess flow could currently be discharged to

Old Alameda Creek without the need for additional storage. The estimated current storage requirements from the *Flow Equalization Report* are presented in **Table 1-2** below.

Table 1-2: Effluent Storage Analysis at Current Peak Flows (56.9 MGD)

Assumed Available EBDA System Capacity, MGD	Hayward Marsh Flow, MGD	Excess Effluent Volume, MG	Old Alameda Creek Discharge Limit, MG	Effluent Storage Required, MG
42.9	0	2.3	8.4	0
51	0	0.4	8.4	0
60	20	0	8.4	0

Source: Flow Equalization Update Report (Brown and Caldwell, 2013)

However, flows are anticipated to increase at a rate of 1% per year and within two to three years the Hayward Marsh may not be available to USD for effluent discharge. For the full buildout condition of USD's service area (2058), the 10-year storm event would result in a projected flow of 73.3 MGD. Under this condition (with the worst case EBDA capacity of 42.9 MGD), 53.6 MG of equalization storage would be required with 8.4 MG of discharge capacity through Old Alameda Creek and no discharge to Hayward Marsh. However, with better than worst-case hydraulic conditions, the District could pump 51 MGD to the EBDA system, which would significantly reduce the amount of effluent storage required to 2.3 MG (with 8.4 MG discharged to Old Alameda Creek). Approximately, 60 MGD is the estimated maximum flow that USD can discharge into the EBDA system (including 20 MGD to Hayward Marsh) when downstream conditions are optimal. In the last case, no effluent storage is needed (with 2.2 MG discharged to Old Alameda Creek). **Figure 1-3** above shows the estimated AEPS discharge limitations; **Table 1-3** below summarizes the findings of the effluent storage analysis at buildout flows.

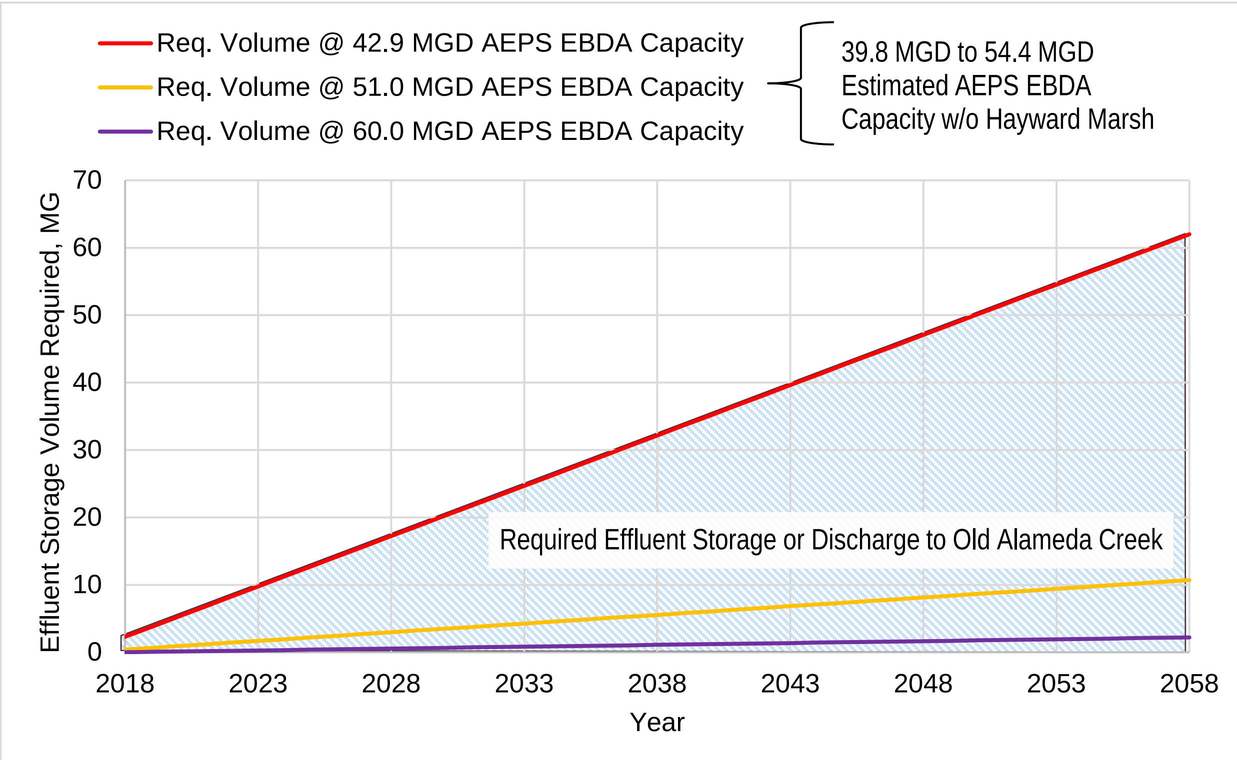
Table 1-3: Effluent Storage Analysis at Future Peak Flows (73.3 MGD)

Assumed Available EBDA System Capacity, MGD	Hayward Marsh Flow, MGD	Excess Effluent Volume, MG	Old Alameda Creek Discharge Limit, MG	Effluent Storage Required, MG
42.9	0	62.0	8.4	53.6
51	0	10.7	8.4	2.3
60	20	2.2	8.4	0

Source: Flow Equalization Update Report (Brown and Caldwell 2013)

Therefore, USD is identifying and evaluating alternatives for management and/or disposal of peak wet weather flows. A timeline showing the effluent storage requirement under the three EBDA system capacities, from current flows to build out, is presented in **Figure 1-5**.

Figure 1-5: Estimated Effluent Storage Requirements



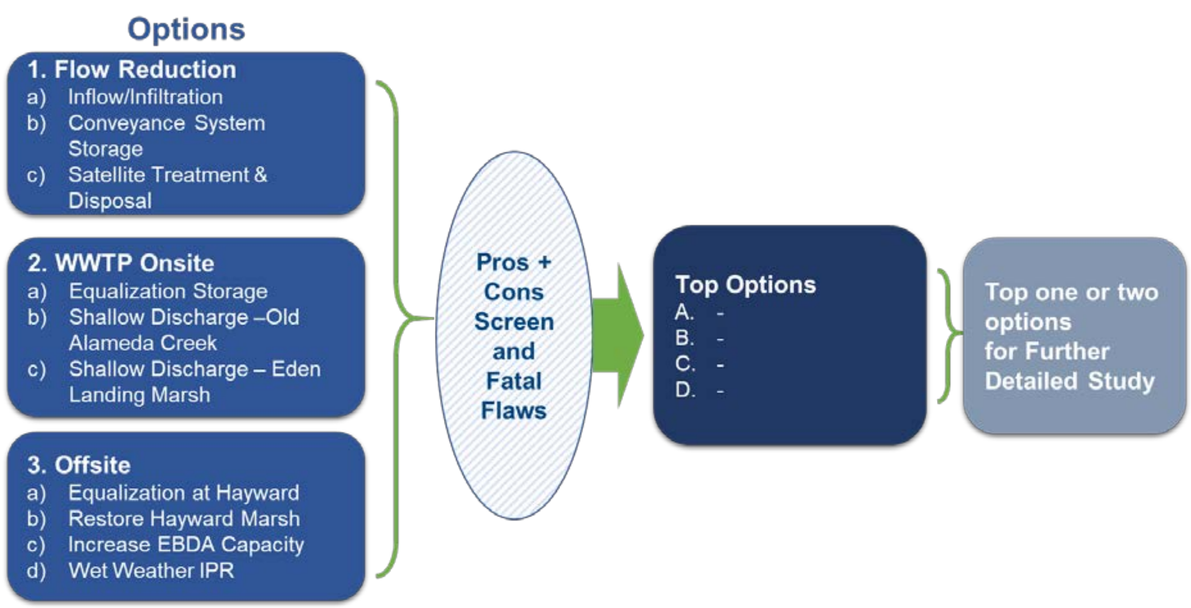
Note: Required volumes do not account for potential discharge to Old Alameda Creek (nominally up to 8.4 MG) during peak wet weather events.

2. EFFLUENT MANAGEMENT OPTIONS

A range of effluent management and discharge options were identified and evaluated in this first phase of the Effluent Management Study. The feasibility of the effluent management options were evaluated based on their viability and the extent to which they provide a solution to the amount of effluent storage required. Parameters considered for option viability included but were not limited to the following: permit compliance, operational complexity, capital cost, and life cycle cost. Based on the initial screening process, some options were eliminated from further consideration, leaving a narrower set of four top options. In Phase II, the costs, benefits and implementation plan for the preferred effluent management option(s) will be identified.

This chapter describes each of the identified options that will be subjected to the initial feasibility comparison. **Figure 2-1** below shows the initial set of options to be considered and the anticipated approach for the Effluent Management Study. Management options are classified into three categories: 1) Flow Reductions, which are focused on reducing flows coming into the WWTP, 2) On-site at the WWTP, and 3) Off-site, which are focused on managing effluent downstream of the AEPS.

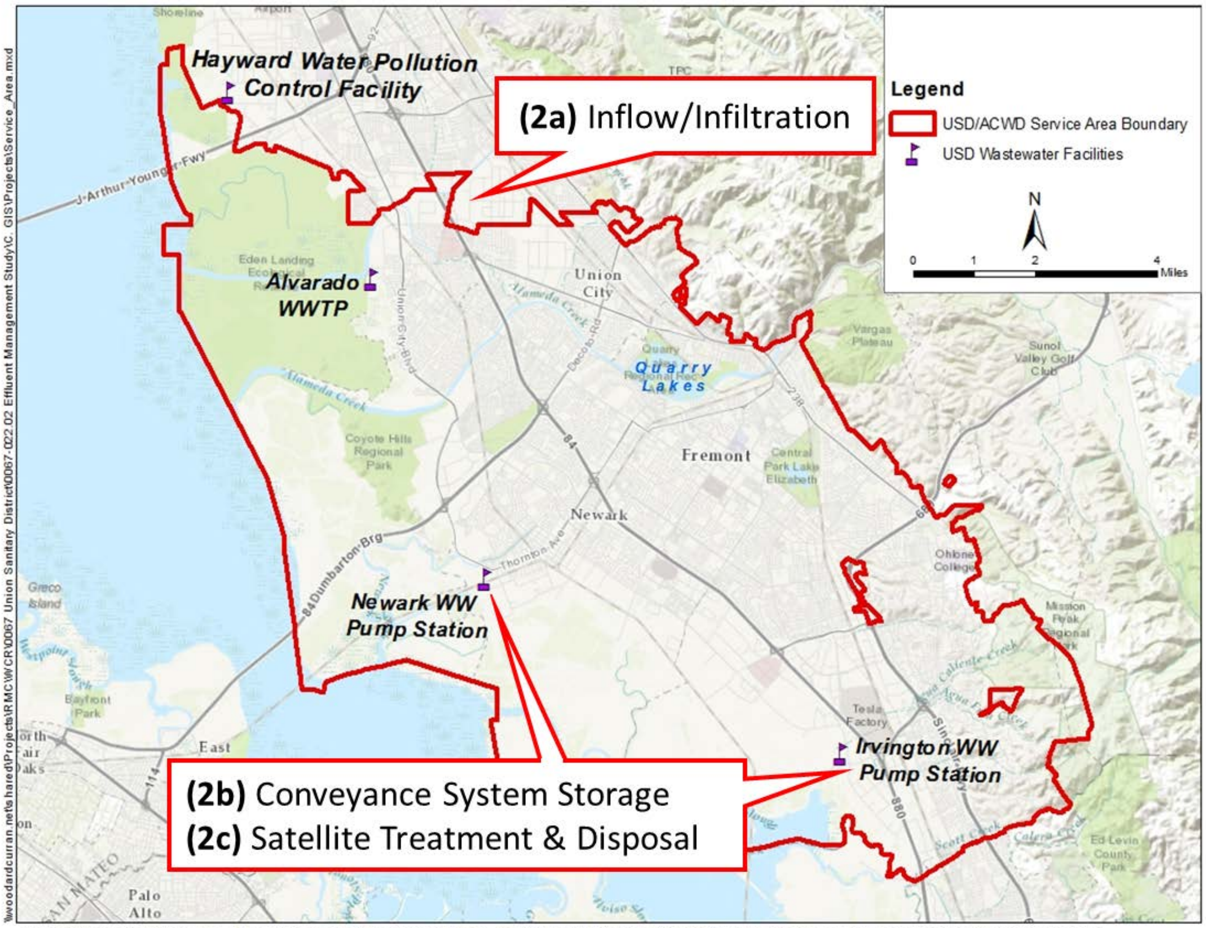
Figure 2-1: Effluent Management Study Approach



2.1 Influent Flow Reduction Options

This section describes three options that would address effluent management via influent flow reduction. This strategy reduces effluent by reducing flows in the collection system or delaying peaks from reaching the plant. **Figure 2-2** shows the location of these options relative to USD's pump station facilities, as well as the service area for USD/ACWD.

Figure 2-2: Locational Map of Influent Flow Reduction Options



Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

2.1.1 Inflow/Infiltration (I/I)

Stormwater I/I into the wastewater infrastructure system during wet weather increases the volume of wastewater conveyed through the collection system to the treatment plant. This option would involve the implementation of strategies that would reduce the level of I/I into the wastewater system. However, District staff has confirmed that current I/I in the collection system is minimal (the USD peaking factor of just over 2 is contrasted with systems throughout the East Bay and greater Bay Area of between 4 and 5) and that additional I/I reduction available would need to be addressed through upper laterals. Given the limited flow reduction possible with this option and the costs and time that would be associated with trying to reduce these minimal flows, it is ranked as a minor solution with low viability.

2.1.2 Conveyance System Storage

This option involves expanding the use of available storage within the existing conveyance system for peak flow attenuation. There is an existing wet weather equalization tank at the Irvington pump station, with a capacity of 1.8 MG. According to the Flow Equalization Update Project, this basin could be increased to 3.6 MG. However, per the *2013 Brown and Caldwell Flow Equalization Update Report*, the Irvington force main's capacity is currently reduced whenever influent flow is diverted into the Irvington pump station storage. The hydraulic impacts of additional storage at Irvington Pump Station would need to be confirmed. The Newark Pump Station site could allow for another 2 MG of similar influent storage. The old treatment plant at the Newark site on USD's property would be demolished to create space for influent storage. The District currently has plans to both expand the Irvington basin as well as to construct a new basin at Newark Pump Station in coming years.

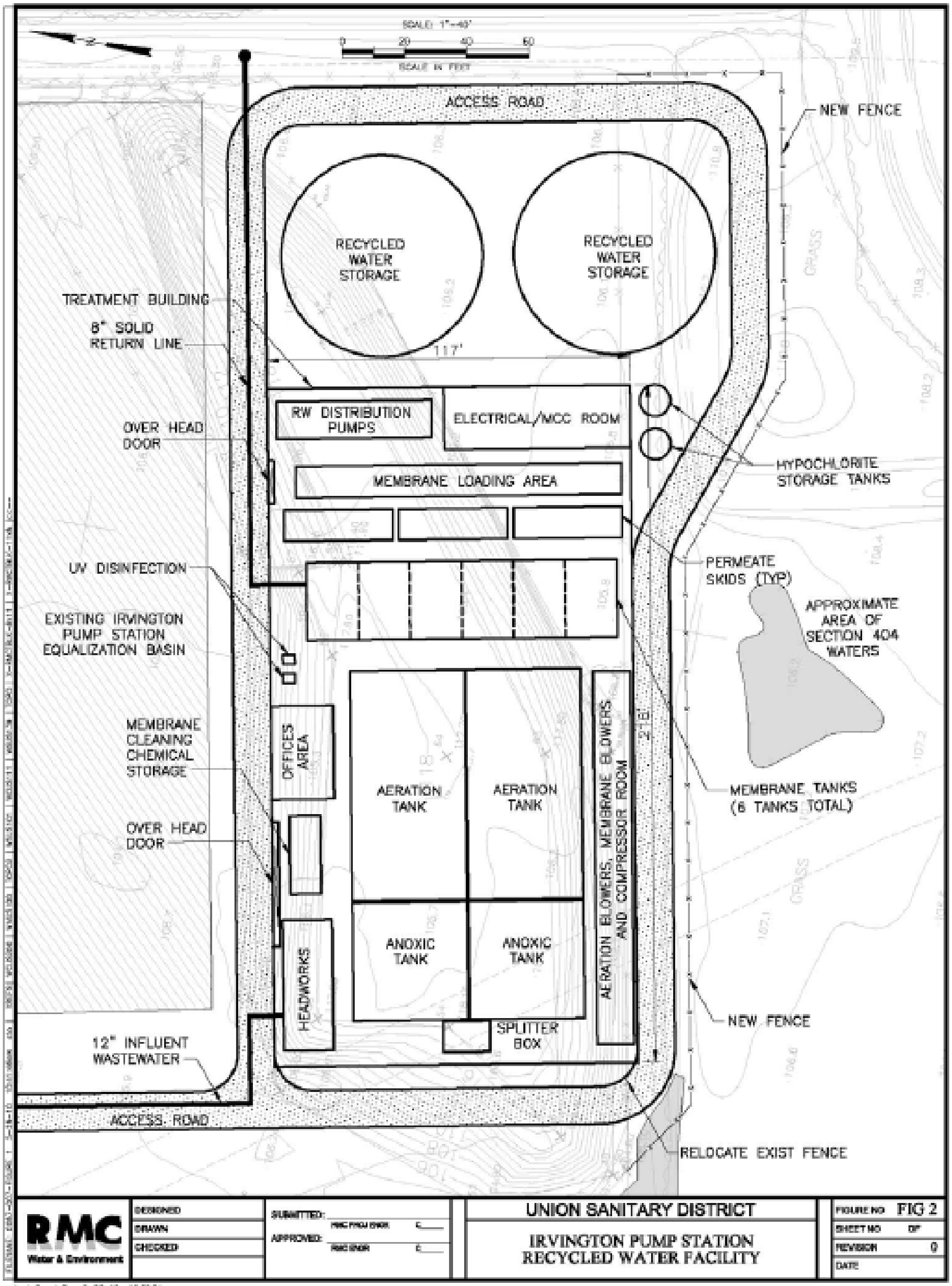
In order to further vet this option, USD would need to identify the efforts and costs needed to avoid impact to the force main when diverting influent flow into the Irvington PS, and/or to create a new influent storage basin at the Newark pump station. The identified influent storage available in the conveyance system is limited compared to the buildout storage needed (33 MG for secondary effluent storage up to 2038, and potentially beyond) so it would only provide a minor solution. Previous evaluation has determined that conveyance system storage is possible and is of moderate viability due to USD ownership of the facilities.

2.1.3 Satellite Treatment and Disposal

This option would involve treatment of USD wastewater at either Irvington or Newark Pump Stations and reuse and/or disposal of the treated effluent in that basin. This option was evaluated in the 2010 Recycled Water Feasibility Study for USD and ACWD. A satellite facility at Newark Pump Station was not recommended because (1) the project cost on a per unit of water basis was much higher compared to other available alternatives, and (2) the customer base was highly dependent on future users. A satellite facility at Irvington Pump Station serving the south end of the study area, however, was considered a preferred project at the time and is shown below in **Figure 2-3** below. The proposed facility is estimated to reduce flows downstream of the pump station by 1.7 MGD.

The 2010 Feasibility Study identified three major risks associated with the satellite treatment project: (1) sensitivity to nature and timing of future water demands, (2) uncertainties associated with obtaining and maintaining a new NPDES permit, and (3) uncertainty in influent ammonia levels that impact sizing satellite facilities. Additionally, further work on this satellite project has not been pursued due to lack of customers and demands on the south side of USD's service area. As such, this option is a partial solution with the limited demands and is ranked with low viability with the cost of the option likely not being justified by the demands.

Figure 2-3: Satellite Treatment Facility at Irvington Pump Station

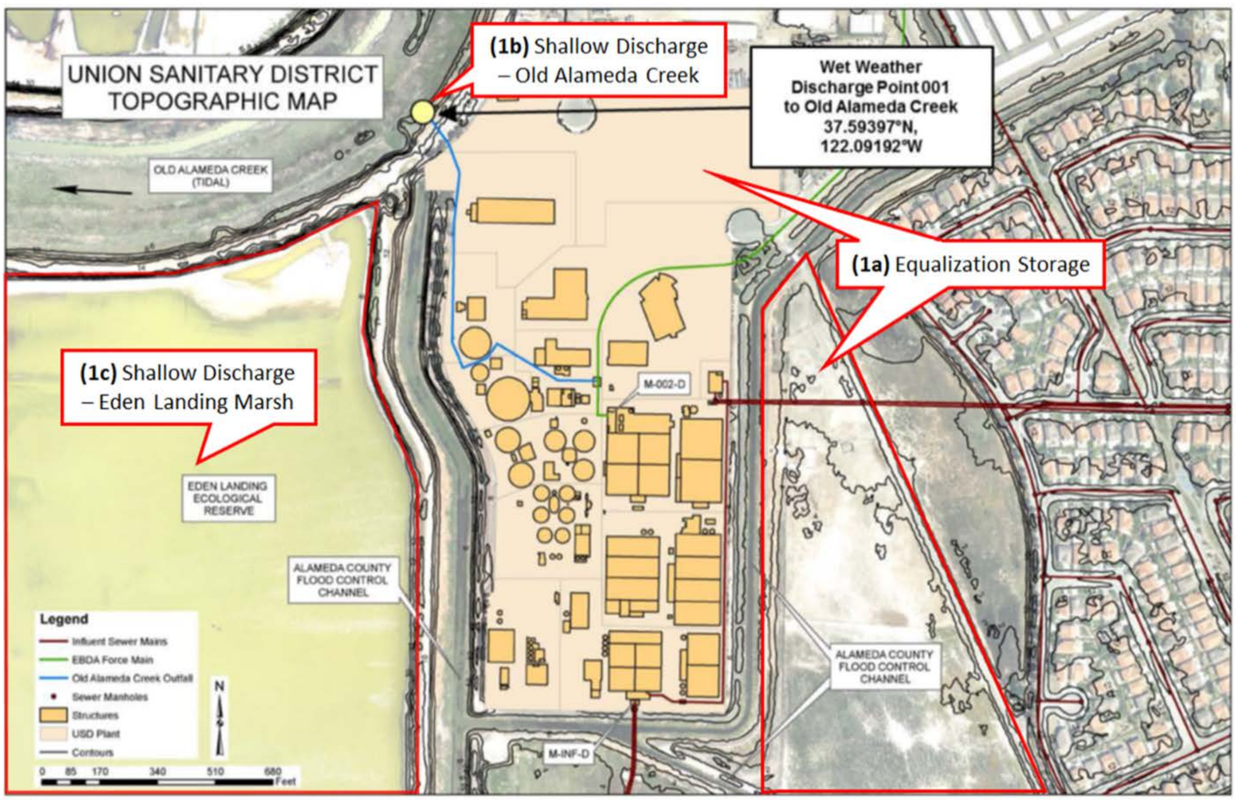


Source: ACWD and USD Recycled Water Feasibility Study Update (RMC 2010)

2.2 Wastewater Treatment Plant On-Site Options

This section describes three effluent management options that would be located onsite at the WWTP site. **Figure 2-4** below shows the location of these options relative to USD's WWTP facilities.

Figure 2-4: Locational Map of Wastewater Treatment Plant On-Site Options



Source: Base map from USD's Old Alameda Creek (Wet Weather Outfall) Permit. ORDER No. R2-2015-0045, NPDES No. CA0038733.

2.2.1 Equalization Storage (Secondary Effluent or Stormwater)

Under this option, some secondary effluent flow would be temporarily diverted into EQ storage to reduce the required discharge flow to EBDA during wet weather events. USD could create an EQ basin east of the WWTP to potentially provide a full solution, and/or create a smaller EQ basin on the north side of the WWTP for a partial solution.

2.2.1.1 New EQ Basin East of WWTP

For this equalization storage option, USD would utilize the triangular 17-acre parcel adjacent to the WWTP, which is owned by the Alameda County Flood Control District (ACFCD), to construct an equalization basin for temporary storage of secondary treated effluent. The east EQ area is highlighted in red in **Figure 2-4** above. The equalization basin could be built in several phases to match the required storage volume needed to match peak wet weather flows at that time.

Secondary effluent would be pumped to the EQ basin during peak flow events and metered back into the EBDA system after peak flows subside. WRA, Inc. (WRA) previously conducted a preliminary wetland delineation of the site in April 2016. As shown in **Figure 2-5** below, the study had classified the majority of the site as jurisdictional wetlands. As such, construction of an EQ basin on this site would require a Standard Permit from the U.S. Army Corps of Engineers (USACE), per Section 404 of the Clean Water Act. To justify the discharge of dredged or fill material into the waters of the United States, which includes jurisdictional wetlands as defined by the Environmental Protection Agency (EPA), a 404(b)(1) alternatives analysis would need to be conducted demonstrating that there are no practicable alternatives that would be less environmentally damaging. WRA will continue to advise on this option for this Effluent Management Study.

To obtain a standard 404 permit the following information would need to be developed and submitted to the USACE:

- 404 Permit application (Department of the Army ENG Form 4345), including drawings depicting the proposed plans for the project
- Biological Assessment to facilitate USACE Section 7 consultation with U.S. Fish and Wildlife Service
- Cultural Resources Assessment to facilitate USACE Section 106 consultation with State Historic Preservation Officer.
- 401 Water Quality Certification from the Regional Water Quality Control Board
- 404(b)(1) Alternatives Analysis, documenting that alternatives that would avoid wetland fill have been considered and that none of those alternatives is practicable.
- Compensatory Mitigation Plan, demonstrating how any permanent wetlands that would be permanently removed would be replaced. Mitigation could include on-site mitigation (e.g. retaining some wetland vegetation within the existing site and managing the basin to maintain wetland function), or off-site mitigation through the restoration of the treatment portions of the Hayward Marsh to a natural wetland area or through the purchase of mitigation credits.

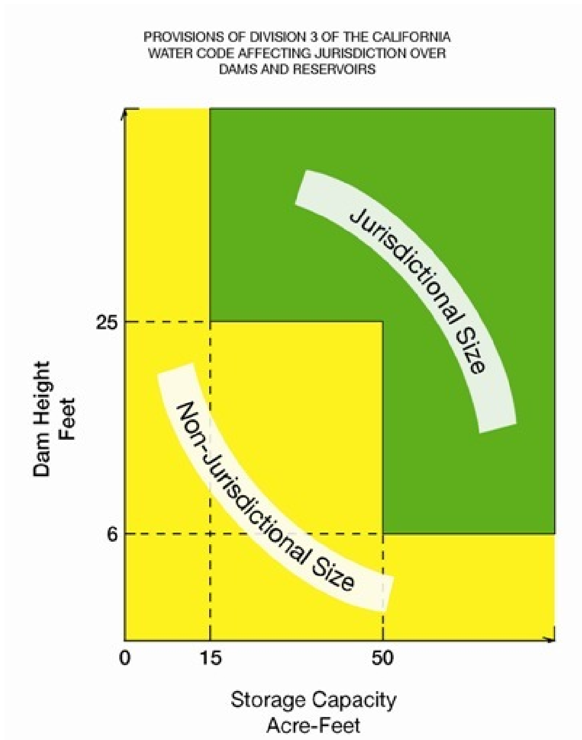
A Standard 404 Permit requires that the USACE issue a public notice and respond to any public comments regarding the project. Time to obtain a Standard Permit is usually about a year after submittal of the application, though it may be possible to streamline the process if the project can be designed to provide wetlands value within the existing site; and the process can take longer if Section 7 or Section 106 consultation is delayed or if there is public opposition.

Figure 2-5: Wetland Delineation of Potential Equalization Basin Site

Source: Delineation of Waters of the U.S. Report, Alvarado Equalization Storage Basin Project (WRA, 2016)

The equalization storage facilities should be specifically sited and designed to minimize impacts on designated wetlands. For example, the land area of the EQ basin site could decrease with consideration of a deeper equalization storage basin. Note, also, that at a certain storage capacity and at a certain depth, the sidewalls of the equalization basin may be considered a dam and subjected to additional regulations from the California Department of Water Resources' Division of Safety of Dams, as shown in **Figure 2-6** below. Based on these restrictions, the maximum storage capacity of an EQ basin that could be constructed in a 17-acre area would be 102 acre-feet without being classified as jurisdictional size (maximum dam height of 6 feet). This storage capacity is equivalent to approximately 33 MG, less than the 53.6 MG of storage anticipated to be needed during buildout 10-year storm events. Although, it achieves adequate storage to about 2038 based on current EBDA capacity.

Figure 2-6: Division of Safety of Dams Jurisdictional Classification



Source: California Department of Water Resources, Division of Safety of Dams. Available at: http://www.water.ca.gov/damsafety/jurischart/index.cfm

Furthermore, the water table level and soil conditions at the site could also affect the height of the levee and should be taken into careful consideration in the design of the equalization basin. Alameda County Water District (ACWD) has expressed concerns with volatile organic compounds in the stored effluent, whereby constituents in the effluent may contaminate the groundwater and volatilize into homes.

As described above, the project would require a Compensatory Mitigation Plan committing to mitigation projects to compensate for wetlands lost to the EQ basin footprint. Note that mitigation requirements associated with creating an impervious basin would be much greater than the mitigation requirements for creating a seasonal wetland.

The USACE may be more receptive to a project that retains wetland functions and values within the site. It was therefore recommended by Woodard & Curran and our subconsultant, WRA, that if this option were to be evaluated further, USD should present the project at one of the monthly Interagency Meetings held by USACE. USD agreed and authorized the project team to hold this introductory meeting. The results of the meeting are as follows:

- The USACE staff at the meeting were receptive to the EQ basin approaches presented and identified that the mitigation for lost habitat would be anticipated to be at least 1-acre mitigation per 1 acre of jurisdictional wetland affected, and potentially higher mitigation ratios if equally valuable habitat were not available thru a mitigation bank. Mitigation bank acreage is roughly estimated at $1 Million/acre, so the mitigation costs for a portion or all of the 17-acre site would be very high.

  The Regional Board staff member present was not amenable to the EQ basin approach presented in any form due to the perspective that all possible alternatives would have to be proven infeasible in order to affect any jurisdictional wetland acreage. It appears that the three sections at the Bay Area Regional Water Quality Control Board (Permitting, Basin Planning and Enforcement) each have different views on the value of the Hayward Marsh continuing to be permitted for secondary effluent shallow water discharge. Until those varying views are reconciled, gaining a clear regulatory message from the Regional Board on how the treatment portions of the Hayward Marsh might be used for mitigation acreage would be highly problematic. For this reason, the USD project team left the interagency meeting recognizing that the permitting of this alternative is highly uncertain at this time.

Based upon the input summarized above, this option is considered as a <u>partial to full</u> solution, with a potential capacity to store to 33 MG of effluent. The permitting process is expected to take several years based on initial opposition to the project received from potential permitting agencies. Due to permitting and mitigation obstacles, the viability of this option is ranked as <u>low</u>.

2.2.1.2 New EQ Basin on the North Side of the WWTP Site (Site Drainage)

RMC/Woodard &Curran conducted a Treatment Plant Drainage Study in 2011 which highlighted capacity constraints with the Plant's Site Waste Pump Station (SWPS). During high rainfall events, peak onsite stormwater flows stress the capacity of the SWPS and increase the risk of exceeding USD's contractual peak capacity with the EBDA system. The study identified and evaluated alternatives for storing stormwater runoff and reducing peak flows at the Plant. Peak stormwater modeling results from the Study for different return periods are summarized in **Table 2-1**. Under existing conditions, site stormwater drains offsite, while at future build-out conditions, site stormwater would drain to the Plant.

Table 2-1: Plant Peak Stormwater Flows and Volumes

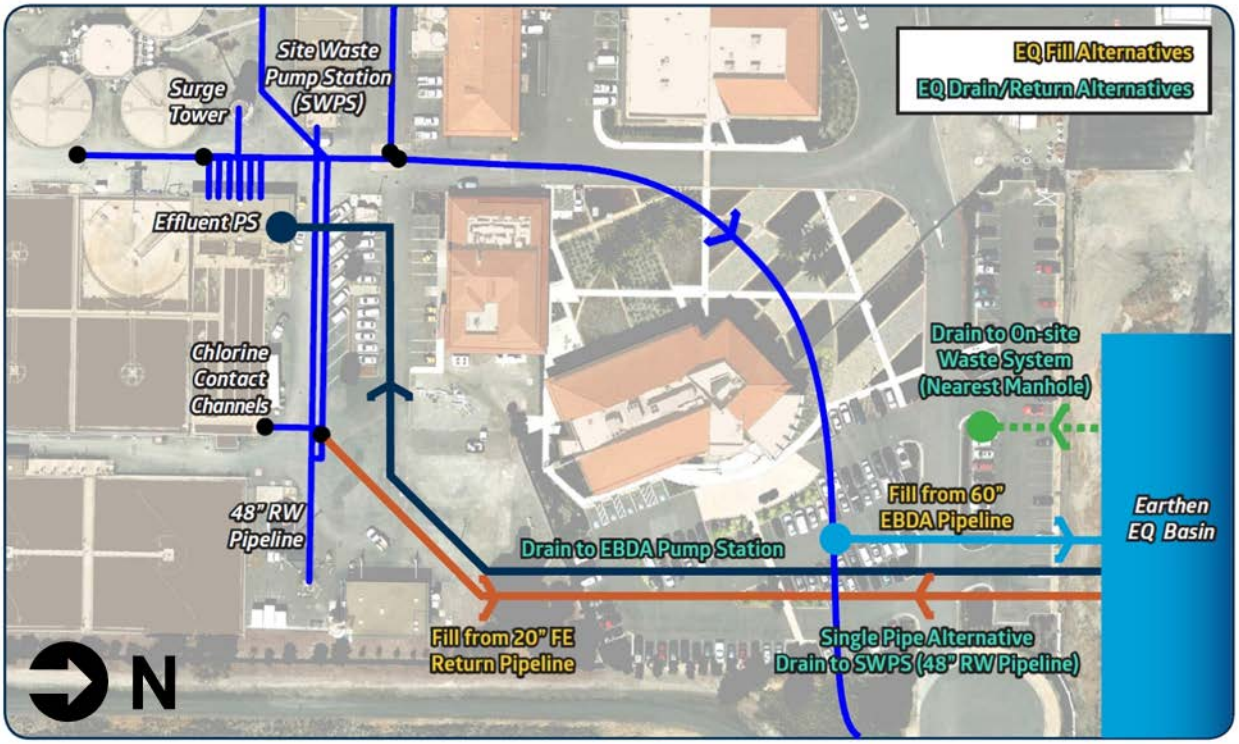
	Existing		Build-Out	
Return Period	**Peak Flow (mgd)**	**Volume (MG)**	**Peak Flow (mgd)**	**Volume (MG)**
5-Year	8.9	1.6	10.5	1.8
10-Year	10.6	1.9	12.5	2.2
15-Year	11.5	2.0	13.6	2.4
25-Year	12.7	2.2	15.0	2.6

Notes: *Flows do not include wastewater process flows to the SWPS.*
Source: USD Treatment Plant Drainage Study (RMC 2011)

Within this study, one of the preferred alternatives involved a new aboveground storage pond located on site north of the parking lot at the WWTP. However, this location may change in coordination with the Site Use Study currently being conducted by RMC/Woodard & Curran. The pond footprint was based on a storage capacity equal to the 25-year stormwater runoff volume of 2.6 MG with some amount of freeboard. The sizing of this pond in the study was based on offsetting the impact of the Plant's stormwater runoff on the discharge to the EBDA pipeline. As a result, the pond was sized to capture the entire storm runoff volume. However, additional effluent storage beyond the stormwater volume may be required in the future to maintain effluent flows within the EBDA system capacity.

The EQ basin proposed in the drainage study could be filled or drained either through direct connections to the EBDA pipeline or to existing USD-owned facilities. The former may be a less viable approach as it would require EBDA review and approval. **Figure 2-7** shows some of the EQ filling and draining alternatives. This figure shows two drainage alternatives which would involve pumping, at either EBDA's pump station or USD's SWPS.

Figure 2-7: Fill and Drain Alternatives for Onsite Storage Pond

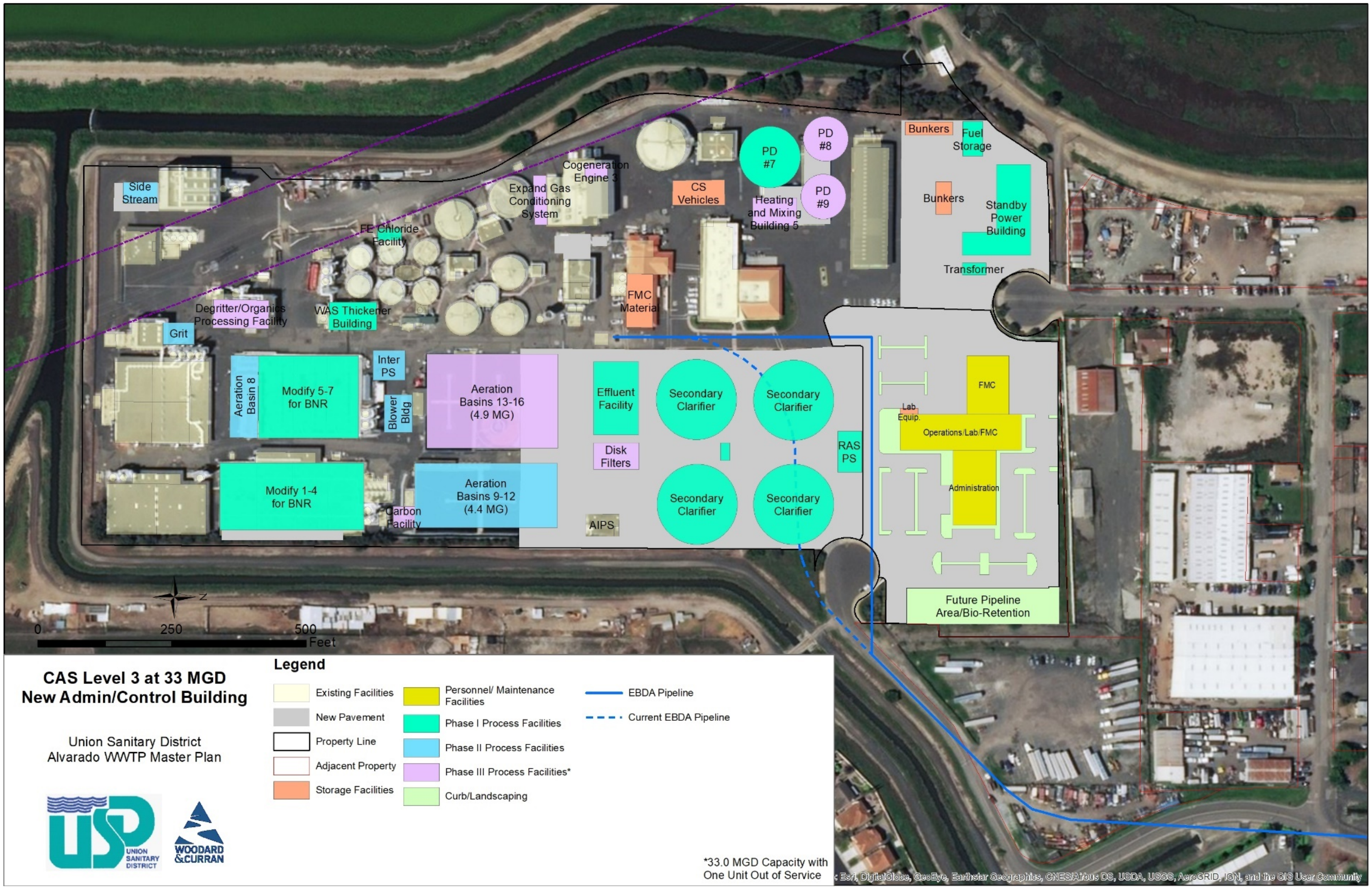


Source: Proposal for the Union Sanitary District Alvarado Equalization Storage Basin Project (RMC 2015b)

Although there is currently some open USD property to the north of existing facilities, these lands may be used for a future new plant and there is no parcel large enough to accommodate effluent equalization that is currently on the market; any such parcel would appear to require condemnation, and that would only be justified if other viable alternatives had been exhausted. **Figure 2-8** below shows the potential layout for Phase III of the Enhanced Treatment & Site Upgrade Program (Woodard & Curran 2019).

Given that this potential equalization storage option would only provide a portion of the potentially required EQ volume, it is a partial solution. Although the onsite location uses land already belonging to the District, this open area currently is reserved for higher priority facilities and upgrades, therefore the viability of this option is low. The timing for implementation of this onsite equalization basin option, however, would be shorter compared to an EQ basin outside the existing fence line, as this onsite option is both smaller and located on land already belonging to USD.

Figure 2-8: USD Plant Layout at Builout (2058)



Source: Enhanced Treatment & Site Upgrade Program (Woodard & Curran 2019)

2.2.2 Shallow Water Discharge: Old Alameda Creek

Under this option, additional effluent capacity could be obtained by increasing the permitted capacity of the Old Alameda Creek (OAC) discharge location. Old Alameda Creek currently serves as an emergency outfall during peak wet weather flow conditions, but no maximum discharge rate is specified in the permit. The previous permit order dictated a maximum discharge volume limitation of 8.4 MG per discharge event, which was the expected flow from a storm with a 20-year return frequency (i.e., a 20-year storm). According to the permit, this number was determined from the USD's 1994 District Wide Master Plan and 1999 Wastewater Equalization Storage Facilities Pre-Design. The current order replaces the discharge flow limitation with a standard prohibition against the bypass of treatment systems. For more long-term use, its discharge capacity could be increased. Some increase in treatment level at the WWTP would likely be required by the Regional Water Quality Control Board (RWQCB) to allow this increase because it is a shallow water discharge and could have more impacts on beneficial uses with increased frequency of use and increased volume of discharge. Consequently, it is anticipated that future nutrient removal WWTP improvements would be needed for the portion of flow discharge to Old Alameda Creek.

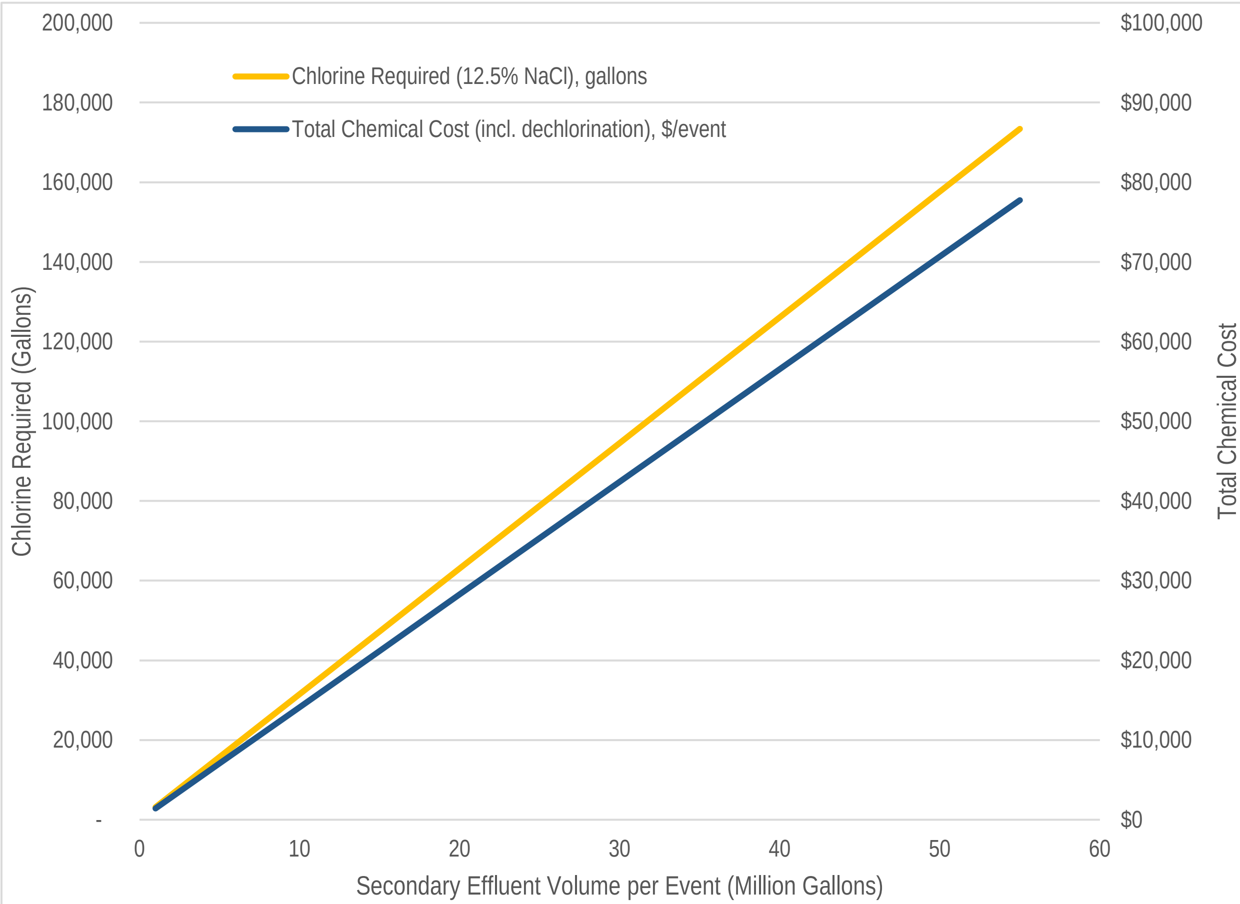
2.2.2.1 Ammonia Removal via Breakpoint Chlorination

For short duration discharges, ammonia toxicity may be the primary consideration for the RWQCB in terms of expanded use of the Old Alameda Creek outfall. A potential approach to reduce ammonia concentrations in the effluent prior to discharge would be to implement breakpoint chlorination. The use of breakpoint chlorination involves the use of chlorine to convert ammonia to nitrogen gas. The use of breakpoint chlorination is presented in Principles and Practice of *Phosphorus and Nitrogen Removal from Municipal Wastewater (The Soap and Detergent Association, September 1989)*. The overall reaction for breakpoint chlorination is expressed in the following equation.

$$NH_4^+ + 1.5\,HOCl \rightarrow 0.5\,N_2 + 1.5H_2O + 2.5H^+ + 1.5Cl^-$$

Although the stoichiometric ratio of chlorine to ammonia is 1.5 to 1, in practice, the required chlorine dose is 10 parts chlorine per part of ammonia (The Soap and Detergent Association 1989). Assuming a secondary effluent concentration of 45 mg/L NH_4-N, the required volume of chlorine for breakpoint chlorination is presented in **Figure 2-9**. Total chemical cost of chlorine (12.5% NaCl solution @ $0.447/gal) including the cost of sodium bisulfite for dechlorination (25% NaSO3 @ $0.97 gallon) are also presented in **Figure 2-9**.

Figure 2-9: Chlorine Volume and Chemical Cost for Breakpoint Chlorination



Although the cost of chemicals per event can be expensive, the need for breakpoint chlorination in the near-term would be relatively infrequent. However, breakpoint chlorination would require a large volume of hypochlorite to be stored on site, or onsite hypochlorite generation. Given the relatively short shelf life of sodium hypochlorite, ~2 weeks, USD may end up wasting a significant amount of hypochlorite during the wet weather season.

As an example, if USD implemented 10 MG of breakpoint chlorination capacity, approximately 30,000 gallons of additional hypochlorite storage would be required. USD currently has two 8,232-gallon hypochlorite storage tanks. Therefore, USD would need approximately three more tanks of the same size for 41,160 gallons of storage, which includes one standby tank for filling. The current estimated annual hypochlorite usage for disinfection is 780,000 gallons per year, which is equal to 2,137 gallons per day. Based on a daily use of 2,137 gallons per day, the average hypochlorite storage time with five tanks would be approximately 19.3 days, which is close to maximum desired storage time to minimize hypochlorite degradation.

Due to potential degradation, storing hypochlorite on-site in volumes in excess of 40,000 gallons is likely impractical, therefore providing breakpoint chlorination of secondary effluent volumes greater than 10 million gallons may not be a viable alternative unless hypochlorite generation is included. Either way, the generation and use of such quantities of hypochlorite and bisulfite would not be sustainable from an energy consumption and emissions standpoint.

Given the potential issues with storing large volumes of sodium hypochlorite, or undertaking the on-site generation of hypochlorite, this option is considered as a partial solution with low viability for the long term. It could be part of a short-term solution while a longer-term alternative is pursued.

2.2.2.2 Early Action Nutrient Removal

Limits on nutrients discharged from publicly owned treatment works (POTWs) to San Francisco Bay are anticipated because of growing concern for impairment of water quality in San Francisco Bay. The association of POTWs in the Bay Area, Bay Area Clean Water Agencies (BACWA), is conducting a study to analyze nutrient reduction alternatives at Bay Area POTWs. **Table 2-2** presents three different treatment levels used to bracket potential future nutrient discharge limits. These provided the basis for the evaluation of treatment options and costs in the BACWA study.

Table 2-2: BACWA Nutrient Removal Levels

Treatment Level	Study	Ammonia	Total Nitrogen	Total Phosphorus
Level 1	Optimization	--	--	--
Level 2	Upgrades	2 mg N/L	15 mg N/L	1.0 mg P/L
Level 3	Upgrades	2 mg N/L	6 mg N/L	0.3 mg P/L

Source: Potential Nutrient Reduction by Treatment Optimization and Treatment Upgrades, Scoping and Evaluation Plan (HDR & Brown and Caldwell 2014)

A draft Nutrient Reduction Study for USD's WWTP was recently made available. The report identifies Level 1 optimization strategies of adding ferric chloride upstream of the primary clarifiers to remove phosphorous, and deammonification sidestream technology for reducing nitrogen/phosphorus loads.

Based on current land availability at USD (note that the feasibility of purchasing additional land is being evaluated as part of the Enhanced Treatment & Site Upgrade Program), the only feasible nutrient removal technology found in this limited study and recommended would be membrane bioreactors for meeting Levels 2 and 3. Costs for these process improvements range up to $610 million for Level 3 wet season upgrades (HDR & Brown and Caldwell 2016). Level 2 and 3 recommendations for the entire plant flow are listed below:

- Level 2:
  - Construct chemical facilities for ferric chloride addition upstream of primary clarifiers,
  - Convert the secondary process to a membrane bioreactor process. Convert existing aeration basins and three of the existing secondary clarifiers to MLE aeration tanks.

Construct new membrane tanks. Construct fine screening to protect membranes. Construct facilities for methanol and alkalinity addition.

- Level 3
  - Same as Level 2, plus
  - Add additional ferric chloride after the aeration basins for phosphorus polishing.
  - Convert three additional existing secondary clarifiers (six total) to 4-stage BNR and configure all tanks as 4-stage BNR. Add additional methanol for denitrification.

Per a more recent evaluation, USD would be able to reduce ammonia and total inorganic nitrogen (TIN) levels to near "Level 2" nutrient benchmark through a year-round BNR process with the implementation of Secondary Treatment Process Improvements Phase I (Hazen and Sawyer, August 2019). This could potentially allow for increasing shallow water discharges during wet weather to be transitioned proportionately from the Hayward Marsh, where ammonia removal occurs within the Marsh, to Old Alameda Creek where there is no ammonia removal, but some dilution. The "early action" element of Phase I would be used by USD to provide the basis for a request to the Regional Board for more time to meet future nutrient limits than the agencies within the same sub-embayment who do not implement "early action".

Given the potential discharge capacity available at the outfall, this option is considered as a partial solution for sidestream treatment only and a full solution for year-round, full flow BNR. Due to the regulatory requirements and a 5 to 7 year implementation schedule it is ranked as moderate viability for sidestream treatment and high viability for year-round, full flow BNR.

2.2.2.3 Continuous Discharge

If the District were to pursue a continuous discharge to Old Alameda Creek, additional regulatory requirements would apply. The requirements associated with continuous shallow water discharge were previously evaluated by RMC in the USD Regulatory Requirements for Continuous Shallow Water Discharge TM (2015c). Discharge Prohibition 1 of the Basin Plan prohibits the discharge of any wastewater that does not receive a minimum initial dilution of at least 10:1 (i.e., shallow water discharge) or discharges to dead-end sloughs. Section 4.2 of the Basin Plan provides for exceptions to this prohibition only under certain circumstances, with the following ones being potentially applicable in this case:

1. An inordinate burden would be placed on the Discharger relative to the beneficial uses protected, and an equivalent level of environmental protection can be achieved by alternate means;
2. A discharge is approved as part of a reclamation project; or
3. Net environmental benefits will be derived because of the discharge

In USD's case, qualification for the first exception would require evidence demonstrating that continued participation in EBDA is an "inordinate burden". Qualification for the second exception would likely require coordination with ACWD and is expected to be capital-intensive and with timing outside of USD's control. Qualification for the third exception is rarely granted but could potentially be done by creating brackish or freshwater marsh habitat.

In addition to the efforts necessary to qualify for shallow water discharge, obtaining and maintaining the NPDES permit for discharge would also require significant time and effort. Special studies which may span several years are needed to complete the application, including an Antidegradation Analysis, a Dilution Study, and a Mixing Zone Analysis. An Environmental Review would also likely be needed for modification of the District's outfall facilities. Furthermore, maintaining the NPDES permit would require the District to perform additional sampling and water quality analyses. Effluent and receiving water would likely require more frequent monitoring, and the District would likely need to install an online monitoring system for hourly monitoring of chlorine residual. New monitoring requirements are expected to be most costly for whole effluent acute and/or chronic toxicity monitoring, which carry an estimated cost of $60,000-120,000 per five-year permit cycle. The permit renewal effort is also significantly greater for shallow water dischargers compared to deep water dischargers. Such permits often require additional professional services and District staff time, not only at the time of permit reissuance but throughout the course of the permit term.

Given the potential discharge capacity available at the outfall, this option is considered as a partial to full solution. Due to the additional regulatory requirements and the unknown but costly facility upgrades required for this option, it is ranked as low viability.

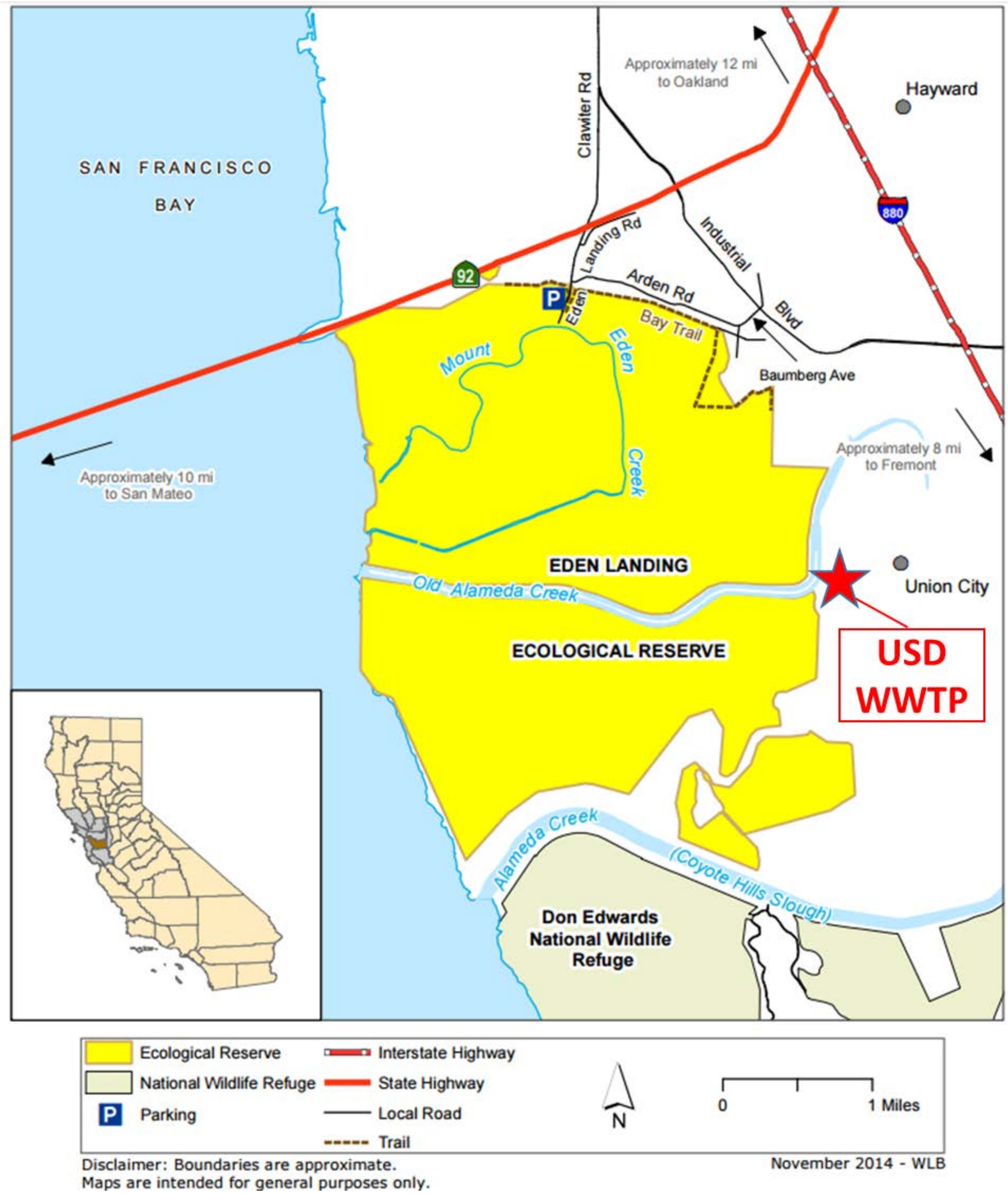
2.2.3 Shallow Water Discharge: Eden Landing Marsh

As the California State Coastal Conservancy (SCC) continues to implement salt marsh restoration in the South Bay and pursues wetland restoration in the vicinity of USD, the District may be able to create a wetland with a shallow water discharge project with the SCC. **Figure 2-10** shows a map of the Eden Landing Ecological Reserve with reference to the WWTP location. Unlike Hayward Marsh, this option is not a wet weather discharge option. Only a small amount of flow would be provided on an annual basis to SCC for vegetation and irrigation of the marsh. Oro Loma recently implemented a similar project where utilizing treated wastewater for marsh restoration will be studied. However, the results of the pilot study will not be available for several years.

Due to the lengthy regulatory and negotiation process anticipated, implementing this solution may not be possible prior to discontinuing discharge to the Hayward Marsh. While this option would face similar regulatory hurdles as those described, particularly for the Old Alameda Creek option above, it would likely require fewer near-term facility improvements because the wetland would provide a degree of additional effluent treatment or water quality enhancement.

Given the option's implementation timeline and the limited discharge capacity of the option, it is considered a partial solution with low viability.

Figure 2-10: Map of Eden Landing Ecological Reserve

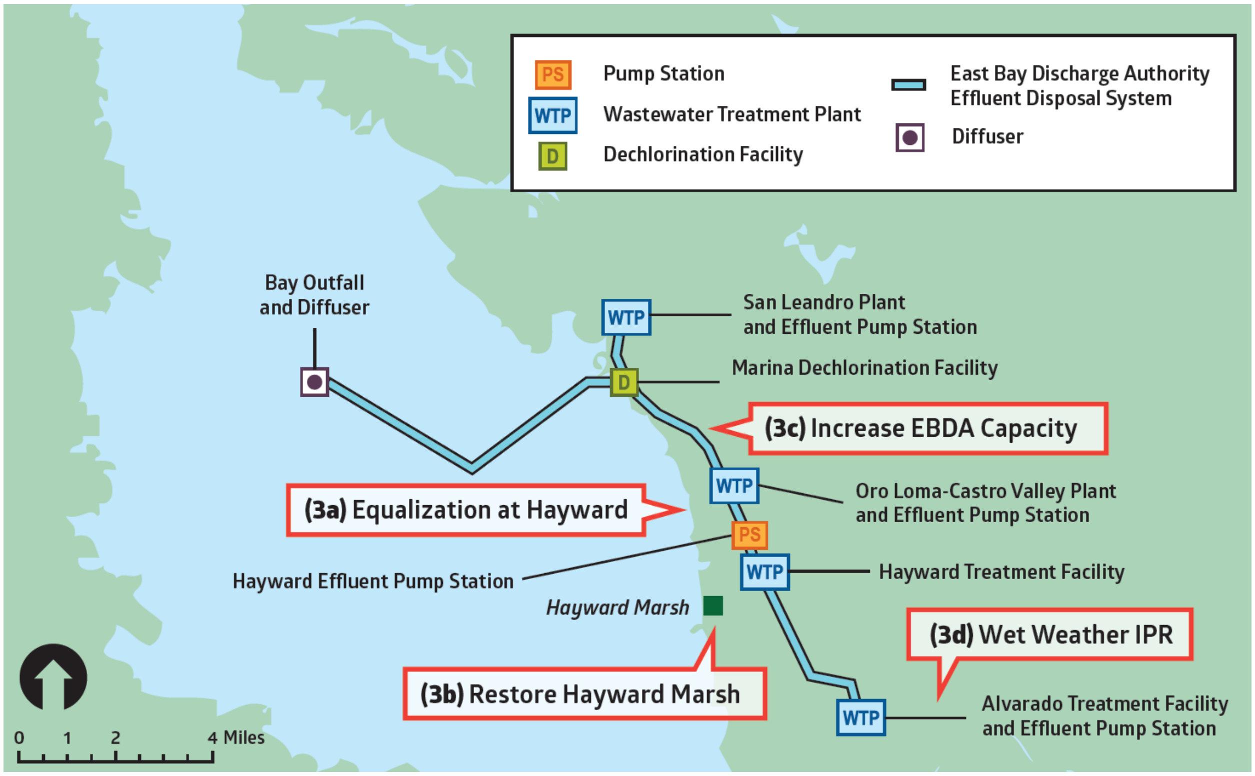


Source: California Department of Fish and Wildlife (2014)
Base map available at https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=85029&inline

2.3 Off-Site Options

This section describes four effluent management options that would be located offsite from the WWTP site and the USD collection system. **Figure 2-11** below shows the location of these options relative to the EBDA system.

Figure 2-11: Locational Map of Off-Site Options



Source: Base map from EBDA Permit. ORDER No. R2-2017-0016, NPDES No. CA0037869.

2.3.1 Off-Site EQ Storage using Hayward Ponds

Under this option, storage could be developed at the City of Hayward oxidation ponds. The ponds' total available storage volume available is approximately 200 MG, which is more than sufficient for this option (Carollo 2011). Stored secondary effluent would be metered back into the EBDA system after a peak flow event. Use of oxidation ponds 3 and 4 was previously evaluated in the *Hayward Marsh Rehabilitation Options Study,* as shown in **Figure 2-12** below.

Figure 2-12: Hayward Ponds Site Map

Source: Hayward Marsh Rehabilitation Options Study (RMC 2015d). Base map from Google Earth.

According to the study, approximately 50 acres of existing clay-bottom ponds near the Hayward wastewater treatment plant could be converted to storage basins for USD's use. Given the amount of storage potentially available, a minimal effort would be made to regrade the existing pond bottom.

New facilities would include a 48-inch diameter equalization diversion and return pipeline to connect to the 60-inch diameter EBDA pipeline on the east side of the oxidation ponds, isolation valves, a flow metering flume, and a 10 MGD equalization return pump station (RMC 2015d). Based on previous work done during the Hayward Marsh Rehabilitation Options Study, the estimated capital cost for this option is $10.4M.

Alternatively, similar permutations of this option can also be considered. For example, flows may be pumped from USD and the City of Hayward into shared storage, with stored water repumped via a new pump station and wet well at Hayward. These options depend upon other agencies within EBDA (foremost, Hayward) to collaborate to make this project feasible and to implement it in a timely manner. Although this option has the potential to be a partial to full solution given that over 200 MG storage is potentially available at the ponds, its viability is ranked as low due to the anticipated level of effort associated with coordinating with other agencies who may not have the same level of urgency as USD.

2.3.2 Hayward Marsh Options

The current NPDES permit for Hayward Marsh (Order No. R2-2011-0058, NPDES No. CA 0038636) allows USD to discharge up to 20 MGD of its treated wastewater to the Hayward Marsh when EBDA is at capacity. The East Bay Regional Park District (EBRPD) owns and operates the Hayward Marsh. Treatment Basins 1, 2A, and 2B are three freshwater marsh basins where USD discharges its wastewater effluent during wet weather. The marsh acts as part of the treatment process, where biotic transformation, sorption, and volatilization further reduce pollutant loads. Basins 3A and 3B on the western side of the marsh are two brackish water basins considered as receiving waters along with the San Francisco Bay. Operational difficulties have led the EBPRD to explore full marsh restoration or discontinuing effluent discharges to the Marsh. If restoration were chosen, the EBRPD and USD would partner to complete the necessary improvements.

The operational difficulties include a variety of vector and avian management challenges in the freshwater basins associated with USD's discharge. Additionally, the marsh does not always reliably achieve sufficient water quality enhancement to maximize downstream beneficial uses. Rehabilitation options and their costs were previously evaluated in the Hayward Marsh Rehabilitation Options Study (RMC 2015d).

2.3.2.1 Baseline Restoration

The baseline restoration would include dredging existing channels, levee repair and maintenance, and island modification, and to return the marsh to the original design condition. This would also provide operational improvements and habitat enhancement. This reflects the bare minimum improvements to restore the entire Hayward Marsh and estimated to cost approximately $20 million. As indicated in **Table 1-3**, this option could reduce the effluent storage required from a maximum value of 62 MG (or less) to 2.2 MG. A diagram of Hayward Marsh and the baseline restoration option is shown in **Figure 2-13**. With increasing flows anticipated in the future, the Baseline Hayward Marsh restoration option as an effluent management option would be a partial solution and low viability due to the cost of restoration and dependency on partnerships with other agencies.

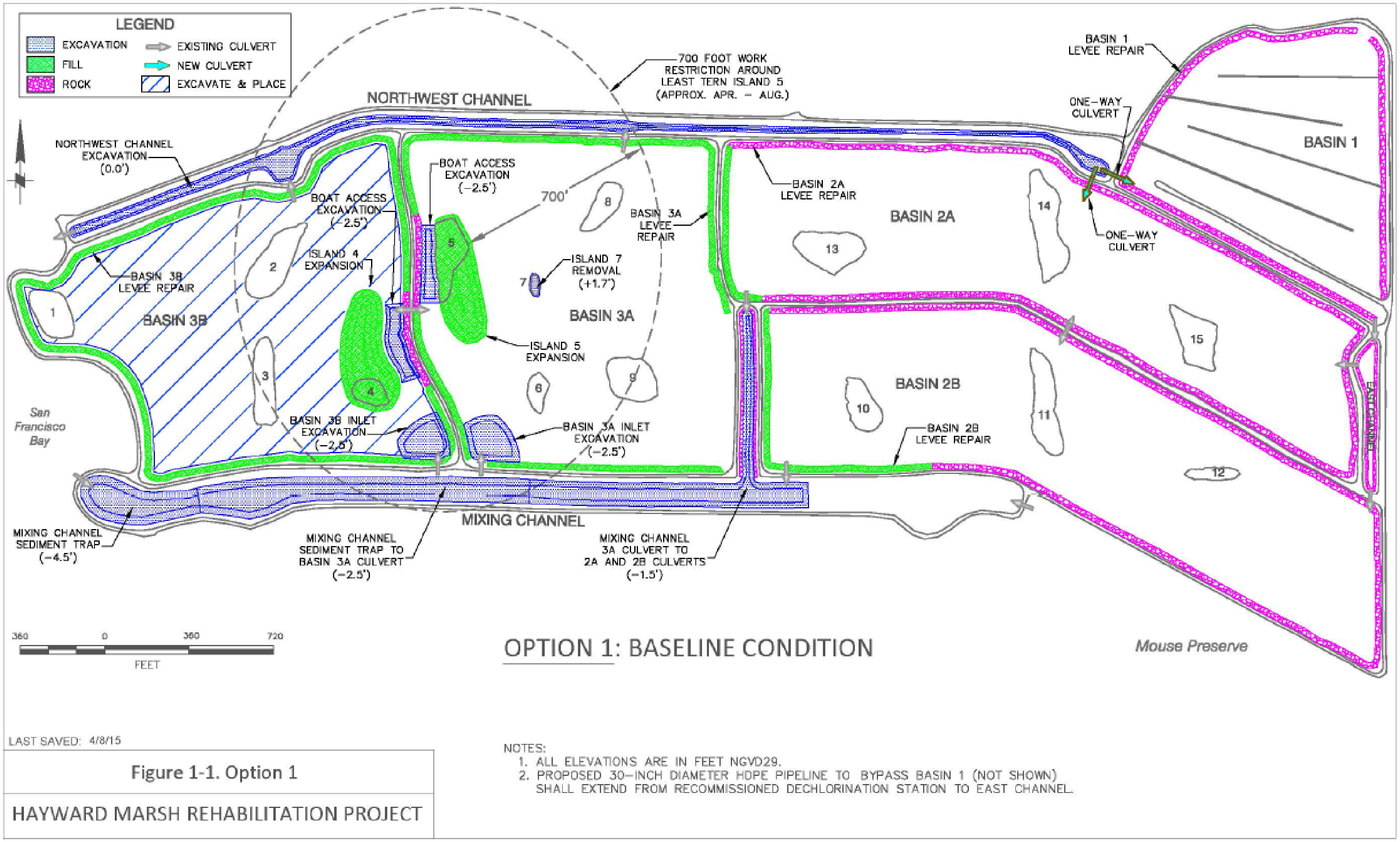
2.3.2.2 Convert Basin 1 to Equalization Storage

A less costly $15 million option was also evaluated in the study which would eliminate freshwater flow in the marsh. This option would provide muted tidal exchange for Basins 3A and 3B as well as for Basins 2A and 2B for the purpose of avian bird health. Basin 1 would be converted to a 30 MG equalization storage for USD's treated wastewater during wet weather, which provides adequate storage to about 2037 based on current EBDA capacity.

USD would construct a pumping station in Basin 1 to return wastewater to the EBDA pipeline. However, of the $15 million estimated cost, about half ($7.2 million) was related to the conversion of Basin 1 to an equalization basin. The remainder was associated with the limited restoration of the marsh for tidal exchange. This simplified option is presented in **Figure 2-14**.

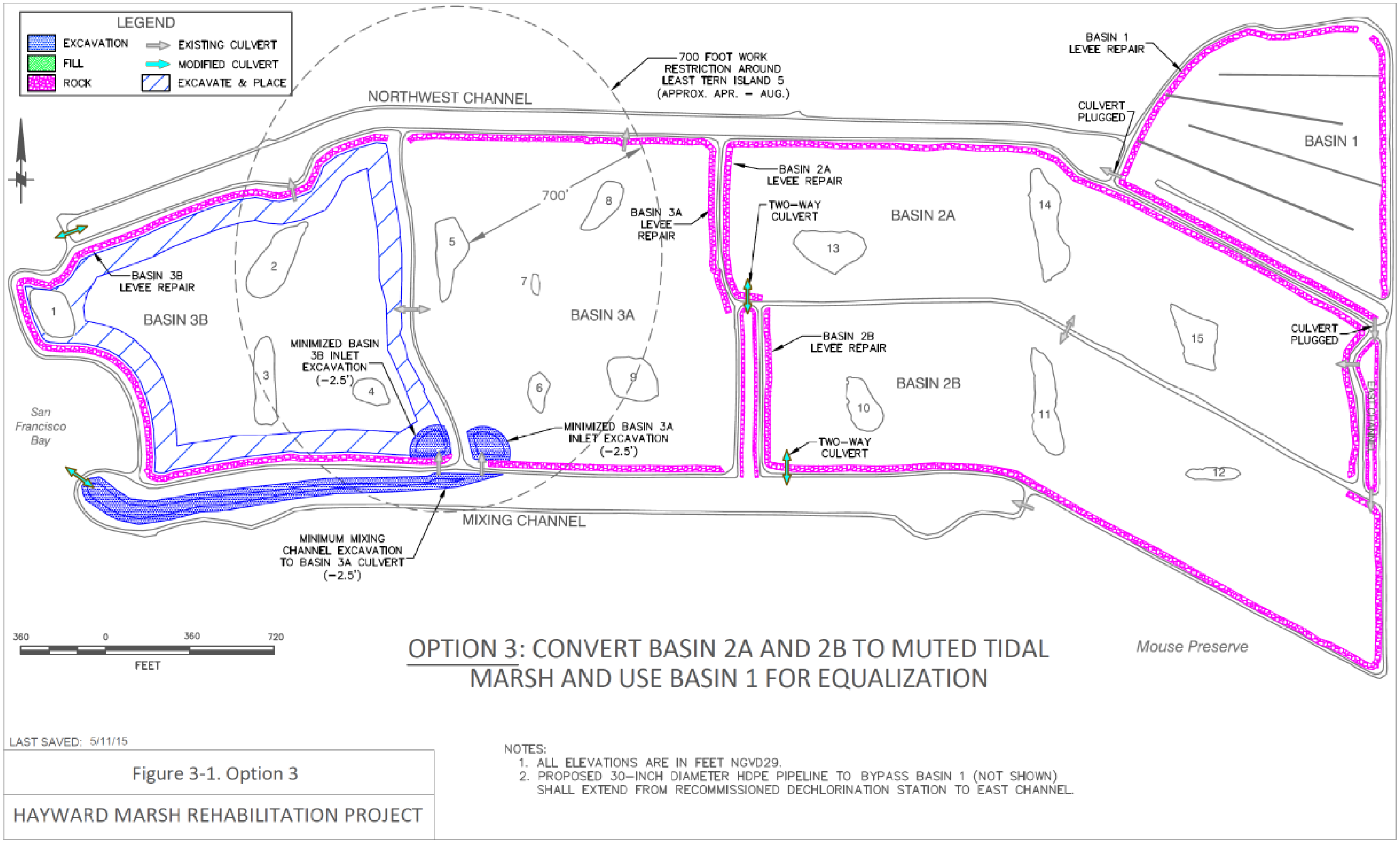
It may be in USD's interest to retain its NPDES permit for Hayward Marsh, maintaining its ability to discharge to that site as long as possible. In either case, in the long term, USD would reduce its dependency on Hayward Marsh, gradually decrease effluent flows into the marsh by implementing other discharge options. With increasing flows anticipated in the future, these Hayward Marsh restoration options as effluent management options would be a <u>partial</u> solution and <u>low</u> viability due to the following challenges: ongoing management, operations and maintenance of the marsh, clarifying the long-term objectives with EBRPD and resource agency stakeholders, and collaboration with multiple agencies whose objectives for the marsh have varied from those of USD. However, the Hayward Marsh option to convert Basin 1 to EQ storage would be the most feasible sub-option since the basin already exists and minimal wetland losses would be associated with such a project. Collaboration with EBRPD and other agencies would still be required for the Basin 1 EQ option.

Figure 2-13: Hayward Marsh Baseline Restoration Option



Source: Hayward Marsh Rehabilitation Options Study (RMC 2015d)

Figure 2-14: Hayward Marsh Basin 1 Equalization Option



Source: Hayward Marsh Rehabilitation Options Study (RMC 2015d)

2.3.2.3 Reconfiguration of Hayward Marsh

Regardless of USD's future participation in the Hayward Marsh, EBRPD is currently evaluating long-term options for the marsh. Recently, EBRPD purchased additional land adjacent to the east side of the Hayward Marsh. One potential option that is being considered is the construction of a multi-benefit ecotone slope project that would provide, habitat, shoreline resilience, and water quality benefits. A similar project was recently implemented by Oro Loma Sanitary District as described in Section 2.2.3. The project at Oro Loma Sanitary District receives a small amount of treated (for ammonia removal) secondary wastewater effluent that flows from a storage pond through a seepage berm. Currently, the treated wastewater that flows through the seepage berm is collected and returned to the treatment plant. Long-term, the goal is to allow the seepage to flow directly into the bay.

If EBRPD decides to pursue an ecotone slope project, it may be possible to incorporate continued effluent discharge from USD. EBRPD would like to convert one of the existing freshwater treatment cells, Basin No. 2B, into a tidally influenced cell. If USD continues to discharge to the marsh, this would potentially require meeting the current Hayward Marsh NPDES permit effluent total ammonia limits with just flow through Basin Nos. 1 and 2A. Woodard & Curran was tasked with evaluating whether this proposed configuration is feasible and if adding aeration to Basin Nos. 1 and 2A would be sufficient to reduce the total ammonia levels to the target anticipated in the upcoming NPDES re-negotiated permit. A technical memorandum documenting this analysis is included as **Appendix A**: Hayward Marsh Reconfiguration – Ammonia Reduction Projection Technical Memorandum.

Based upon the review of the historic performance of the Hayward Marsh, Basin Nos. 1, 2A and 2B, are currently reducing the total ammonia concentration during warm weather conditions to nearly 1 mg/L. There may be an opportunity to push the entire flow through Basin Nos. 1 and 2A in the proposed configuration. However, because it is difficult to model all of the ammonia reduction pathways taking place and therefore the impact of reduced retention time on those pathways, more field data would be needed to predict this with certainty.

In order to achieve consistent ammonia reduction within a pond system, complete mixing is recommended to keep the biomass in suspension and promote adequate nitrifier growth. A partially mixed system could result in significant zones of low DO reducing the overall nitrification efficiency and ammonia reduction. Another factor that can inhibit nitrifier growth in a pond system is the low food to microorganism (F:M) ratio. In a post-secondary treatment pond system, the F:M ratios are low; in a partially mixed system, there is the added difficulty of insufficient opportunities for food and microorganisms to come into contact.

Based on these factors and on discussions with aerator manufacturers, the best option for a complete mix system is using diffused air, comparable to a more conventional aeration basin. However, the shallow depths of Basin No. 1 and 2A preclude the application of diffused aeration equipment. Mechanical surface aerators are the only option for the physical characteristics of these basins, but in order to get complete mixing with surface aeration, it would require a significant number of aerators (fifteen 60-HP aerators) that would cost over $1M purchase and to install. The energy cost to operate in this mode will be substantial. While it would be expected that the total ammonia would be reduced over and above that which is currently happening, the manufacturers would offer no guarantee of meeting the target value, especially in the winter months.

Alternatively, a nitrification filter bed could be constructed at the inlet to Basin No. 1 or 2A. Literature suggests that adding an attached-growth media (such as a nitrification filter bed) to the pond system could yield additional ammonia reduction (Cites, Middlebrooks, Bastien, and Reed, 2014). The media, approximately 1 to 2 feet in depth, provides a surface for the nitrifiers to grow (improving the food to microorganism ratio) as well as greatly increases the uniformity with which dissolved oxygen is added into the entire flow of the system, improving the mixing conditions. Wetland effluent is recycled back to the filter bed with a recycle ratio determined based on maintaining oxygenation throughout the profile of the filter bed. There have been successful installations of nitrification filter beds in at least 3 other free water surface wetlands in the U.S. that resulted in effluent concentrations of total ammonia between 0 to 6 mg/L-N (starting from an influent of 20 mg/L-N) even in winter conditions (Crites, Middlebrooks, Bastien, and Reed, 2014).

Ideally, if a satisfactory level of ammonia removal can be achieved during warm weather, USD may be able to continue the existing wet weather operation of the Hayward Marsh, which would maintain USD's existing hydraulic capacity in the EBDA system.

Based on the preliminary analysis, there is the potential for a reconfigured Hayward Marsh to provide ammonia removal up to the current performance. Implementation of this alternative would require on-going coordination with EBRPD, including defining the infrastructure modifications required. Additional analysis would be required to further develop/refine ammonia removal estimates from a reconfigured Hayward Marsh. A scope of work for reconfiguring the marsh has not been defined, therefore for the purposes of this study it is estimated that implementing this reconfiguration would have a capital cost similar to the cost of converting Basin 1 to EQ, which is $15 million, which would be shared between USD and EBRPD. Reconfiguring the Hayward Marsh would be a <u>partial</u> solution and <u>low</u> viability due to the following challenges: ongoing management, operations and maintenance of the marsh, clarifying the long-term objectives with EBRPD and resource agency stakeholders, and collaboration with multiple agencies whose objectives for the marsh have varied from those of USD.

2.3.3 Increase EBDA Hydraulic Capacity

2.3.3.1 Acquire Additional EBDA Capacity

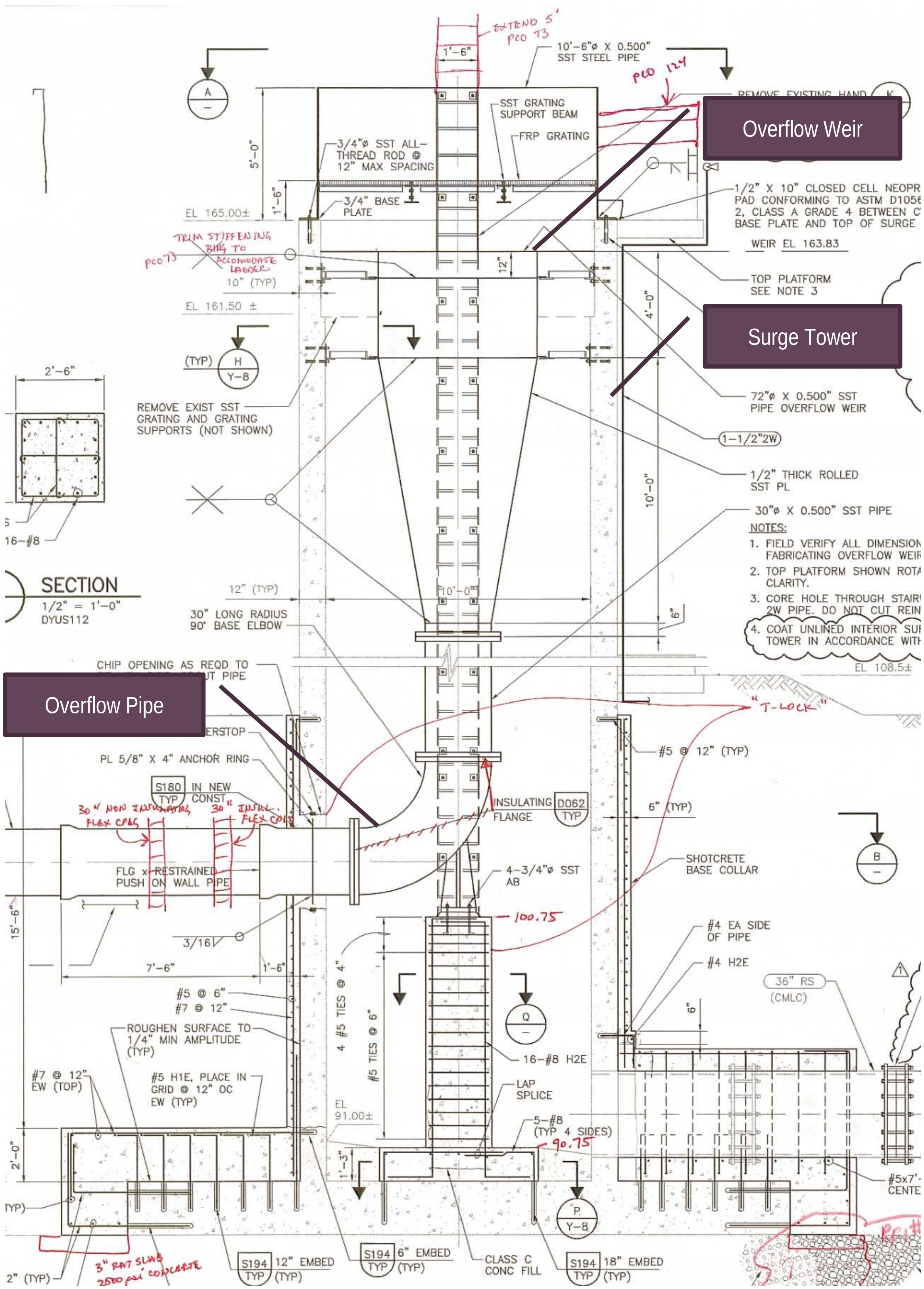
Under this option, USD would expand its permitted discharge to the EBDA system, either through an increase of EBDA's hydraulic capacity by making infrastructure improvements or coordinating with other EBDA agencies to purchase additional discharge capacity. EBDA is a Joint Exercise of Power Agency (JEPA) and the joint agreement under which it operates is set to be renewed in 2020. If additional capacity were allocated to or removed from any agency, EBDA would be responsible for any additional flow monitoring and modeling necessary to assist in making these potential changes to the system. Because of the hydraulic limitations in the EBDA system, with regard to capacity at AEPS, acquiring additional EBDA capacity would be a partial solution with low viability due to the coordination required amongst the EBDA agencies many of which are facing similar wet weather capacity challenges. Equalization at the Hayward Ponds, in coordination with the City of Hayward, appears to be the best method to accomplish an effective increase in EBDA capacity for those 2 agencies.

2.3.3.1.1 Infrastructure Improvements

Implementation of infrastructure improvements to the EBDA system could enable an increase in the EBDA system's hydraulic capacity. This project would rely upon work done recently by EBDA on its system capacity. It is anticipated that this option(s) would involve a major investment in infrastructure and rely on extensive collaboration with multiple EBDA partner agencies.

For example, the EBDA System Flow Master Plan identified an upgrade to the OLEPS firm capacity as a major infrastructure improvement needed. As discussed previously in **Section 1.1.1**, the hydraulic modeling results predicted that peak flows influent to OLEPS could reach as high as 134 MGD, indicating a firm capacity deficiency of nearly 20 MGD. The upgrades, estimated to cost $10 million, would particularly benefit LAVWMA and San Leandro by providing additional hydraulic capacity downstream of the force main (Carollo 2011). The benefits to USD and the AEPS from this project would be restricted to an improved ability to keep the wet well at OLEPS at a lower operating level. As discussed in Section 1.2, the hydraulic capacity from AEPS is affected by the OLEPS wet well elevation. Another infrastructure issue that currently affects the effective EBDA capacity from AEPS is the surge tower configuration. Currently, there is a gravity diversion to Old Alameda Creek. which is intended for use in the event the EBDA system is at capacity. Discharge to the Old Alameda Creek outfall is permitted for emergency use when EBDA capacity is exceeded. Due to hydraulic variations in the EBDA system, the water level in the surge tower fluctuates up and down continuously; therefore, USD typically operates the AEPS to maintain a 2 to 4-foot buffer between the operating water level and the spillway elevation. The buffer prevents flow from spilling over the top of the surge tower during non-emergency conditions. Operating AEPS with the buffer essentially reduces the operational hydraulic capacity. It may be possible to reconfigure the surge tower to provide additional height so that AEPS can operate closer to its maximum capacity, while still providing a buffer between the operating elevation and the spillway elevation. However, based on discussions with USD staff, there is some concern that raising the surge tower height may have unanticipated consequences on the EBDA pipeline; therefore, this option is not being considered further at this time. Options to maximize the operation of the surge tower should be considered if the AEPS is rehabilitated or relocated in the future. For example, a passive overflow pipe could be installed in the surge tower, to alleviate concerns with having an operating water surface too close to the top of the surge tower. USD has previously implemented this approach at the Irvington Pump Station. The configuration at the Irvington Pump Station is shown in Figure 2-15. Eliminating the need for a surge tower operational buffer would help USD maximize the capacity of the AEPS to pump into the EBDA system and thereby help to minimize the required effluent storage volumes.

Figure 2-15: Example Surge Tower Passive Overflow at Irvington Pump Station



2.3.3.1.2 Coordination with EBDA Agencies to Purchase Capacity

As an alternative to increasing the EBDA system's total capacity, USD may also purchase additional capacity from other EBDA agencies. Infrastructure improvements, in this case, would be more limited compared to that needed for increasing the entire EBDA system's capacity, but coordination with the other agencies may be a challenge. Note that USD is the first agency to discharge upstream into the EBDA system. All other EBDA agencies discharge downstream of USD and may potentially be affected by USD's discharge to EBDA, as demonstrated in **Figure 1-2**.

Based on the results of the recent hydraulic modeling of the EBDA system, even if USD purchases additional capacity from other EBDA agencies, the existing hydraulic constraints of the EBDA pipeline would prevent USD from taking full advantage of additional allocated capacity from EBDA. Therefore, USD has decided not to pursue the purchase of additional capacity from the EBDA system at the current time.

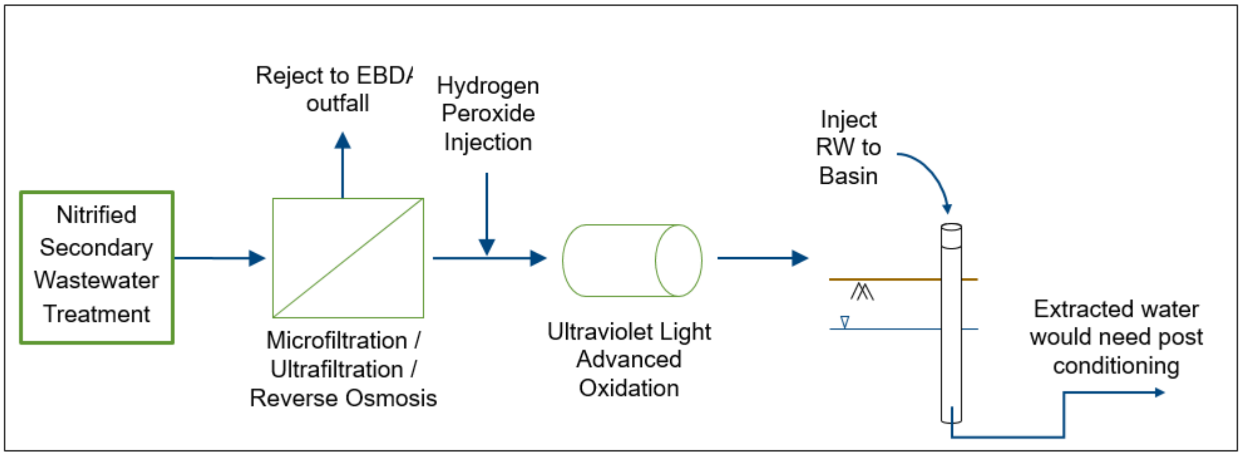
Increasing USD's EBDA hydraulic capacity is potentially a <u>partial</u> solution but is ranked as <u>low</u> viability due to the existing hydraulic restrictions and the cost of infrastructure improvements required to remove the restrictions.

2.3.4 Wet Weather Recycled Water Use (i.e., IPR)

Under this option, treated effluent would undergo advanced treatment and be injected into groundwater basins for indirect potable use. However, the RO concentrate reject from the advanced treatment process would still be released to EBDA. There are various flowrate options under this scenario, ranging from 5 to 20 MGD. RMC previously assisted USD and ACWD in a Recycled Water Feasibility Study (2016), where the 5 MGD option was explored. Costs for the project are estimated to be $1,770-1,980/AF. Of that cost, $540/AF is attributed to secondary process improvements that would be necessary to reduce nutrient levels to those appropriate for feeding into the new advanced water purification facility and to comply with groundwater recharge regulations. For any project alternatives greater than 5 MGD, purchase of extracted groundwater would need to be coordinated with other agencies in the region.

Given the limit on the flow rate associated with this option, this option is considered as a <u>partial</u> solution. It is ranked with <u>low</u> viability due to the anticipated level of effort associated with coordinating with other agencies and the lack of urgency in potable supply needed currently. Full implementation of the 5 MGD project is estimated to take approximately 5.5 years according to the Feasibility Study but could take longer depending on the responsiveness of the agencies.

Figure 2-16: Schematic of Local Groundwater Recharge Option



3. NUTRIENT REMOVAL TECHNOLOGIES

In order to further evaluate the alternative for shallow water discharge at Old Alameda Creek or other outfall locations, additional development of nutrient removal process configurations was performed by Woodard & Curran. USD is anticipating future nitrogen removal requirements and is proactively planning upgrades to the Alvarado WWTP to meet these potential limits in conjunction with the need for secondary treatment upgrades and to handle future growth anticipated within the sewer service area. The Enhanced Treatment & Site Upgrade Program considers several alternatives for upgrading the WWTP to meet these dual needs. Additionally, the District is evaluating potential nutrient removal upgrades that could be undertaken in the near-term to provide some immediate nutrient reduction and are compatible with the long-term program. Near-term improvements are expected to take place within the next five years.

3.1 Nitrogen Removal Technology Overview

Biological nitrogen removal is typically a two-step process. In the first step, ammonia is oxidized to nitrate, which is referred to as nitrification. Nitrification is carried out by autotrophic organisms in an aerobic environment. In an activated sludge system, this occurs in the aerobic zone of the aeration tanks. The growth rate of the autotrophic organisms is very temperature-dependent and much slower than heterotrophic organisms, which are primarily responsible for the biodegradation of organic matter (e.g. cBOD, BOD, bCOD, etc.). Therefore, the solids retention time in the aerobic zone of the activated sludge system needs to be longer for nitrifying systems than for BOD-only removal and can vary based on seasonal temperature differences in the wastewater.

The second step in biological nitrogen removal is denitrification, in which nitrate is reduced to nitrogen gas and released to the atmosphere. In an activated sludge system, this reaction occurs in an anoxic environment where dissolved oxygen is not present. The heterotrophic organisms in the mixed liquor of the anoxic zone will utilize the oxygen in the nitrate for the biodegradation of organic matter, resulting in the release of nitrogen gas.

The above-described mechanisms for biological nitrogen removal are the most common in municipal wastewater treatment. However, there are other mechanisms used for nitrogen removal that can involve fixed film treatment processes, nitritation, and deammonification. These mechanisms are incorporated into well-established and innovative nitrogen removal configurations and are further described in the following technology overviews.

The following BNR technologies were investigated as part of this task:

1. Modified Ludzak-Ettinger Process (MLE) and 4-Stage Bardenpho
2. Step Feed
3. Intensification
    a. Membrane bioreactor (MBR)
    b. Integrated fixed-film activated sludge (IFAS)

c. Moving bed bioreactors (MBBR)
d. Biomag
e. Membrane aerated biofilm reactor (MABR)

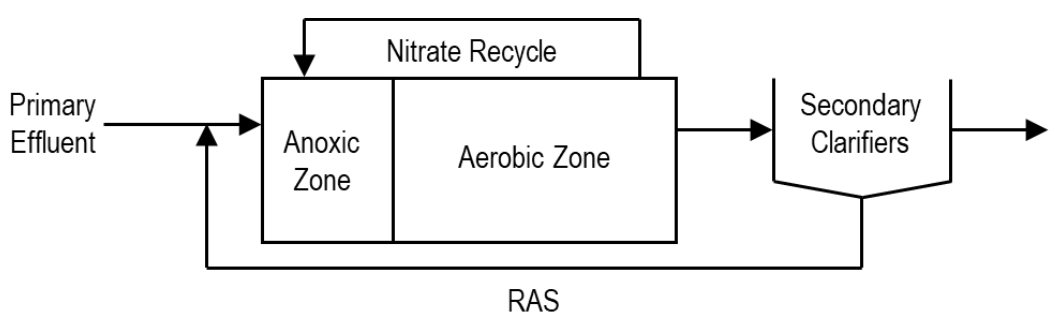
4. Separate Stage
   a. Biological activated filter (BAF)
   b. Denitrification Filter
5. Granular Activated Sludge (GAS)
6. Sidestream Treatment of Recycle Flows from the Anaerobic Digesters
   a. Anammox
   b. Post-Aerobic Digestion

The overview includes a basic description of how they work, generalized process configurations, and implementation considerations.

3.1.1 Modified Ludzak-Ettinger (MLE) and 4-Stage Bardenpho

The Modified Ludzak-Ettinger (MLE) process is a modified version of a conventional activated sludge system designed to provide improved biological nutrient removal (BNR). The MLE configuration includes an anoxic zone prior to an aerobic zone, often referred to as a pre-anoxic zone. The aerobic zone provides nitrification of ammonia to nitrite and then nitrate. An internal recycle returns nitrified mixed liquor suspended solids (MLSS) from the end of the aerobic zone back to the anoxic zone for denitrification. **Figure 3-1** shows a typical MLE process schematic.

Figure 3-1: MLE System Process Schematic



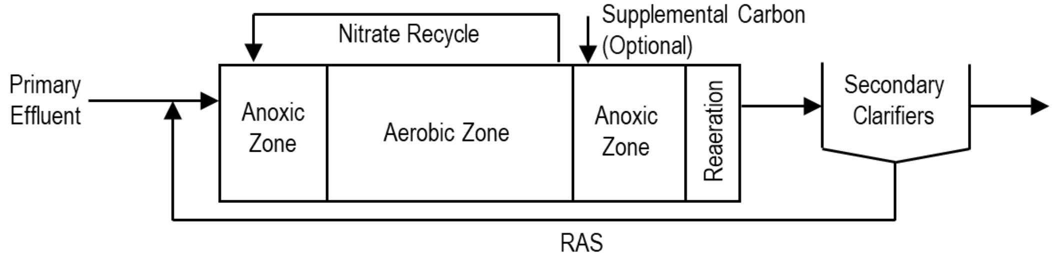
The anoxic zone is located ahead of the aerobic zone so that the organisms can utilize the organic matter in the primary effluent for the denitrification reaction. The internal recycle of mixed liquor provides for increased denitrification, which would otherwise be limited to the quantity of nitrate returned in the RAS. Typical rates for the internal recycle are 2-4 times the forward flow.

A typical ratio of the anoxic volume to the aerobic volume is 30% anoxic and 70% aerobic, but this will vary based on site-specific characteristics. The process can be configured with the flexibility to accommodate changing conditions. For example, step feeding of influent can be performed during wet weather events to keep mixed liquor in contact stabilization mode, and therefore reduce the risk of washout of solids in the clarifiers.

With sufficient influent BOD and anoxic contact time, the MLE process can typically achieve an effluent total nitrogen concentration of 8 to 15 mg/L, depending on the influent characteristics, size of the anoxic zone and internal recycle rate.

The 4-Stage Bardenpho process is similar to the MLE process but is designed to achieve lower effluent total nitrogen concentrations. **Figure 3-2** shows a typical 4-Stage Bardenpho process.

Figure 3-2: 4-Stage Bardenpho Process Schematic



The process includes a second anoxic zone downstream of the aerobic zone for additional denitrification Often, supplemental carbon (e.g., methanol or MicroC) is added to this post-anoxic zone. The post-anoxic zone is followed by a small aerobic zone to reaerate the MLSS before it flows to the secondary clarifiers to prevent issues associated with low dissolved oxygen in the clarifiers.

The 4-Stage Bardenpho process typically can achieve effluent total nitrogen concentrations of 3-5 mg/L. Design and operational considerations for the MLE and 4-Stage Bardenpho processes include:

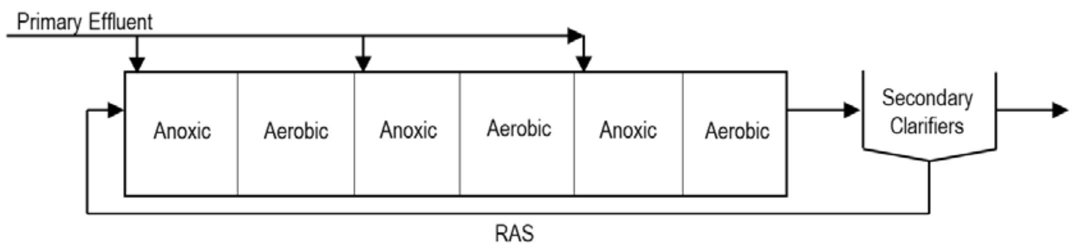
- High operator familiarity due to its similarity to conventional activated sludge systems
- The potential for operational flexibility, including:
    - Step feeding for wet weather management
    - Swing zones (aerobic and anoxic) to change the size of the aerobic zone to accommodate seasonal solids retention time (SRT) changes and maximize volume for denitrification
- Relatively larger footprint required for bioreactors and secondary clarifiers
- Does not require the purchase of proprietary systems or equipment
- These processes are compatible with enhanced biological phosphorus removal (EBPR) and can be designed to include an anaerobic zone ahead of the pre-anoxic zone. When EBPR is included, the MLE and 4-Stage Bardenpho processes are referred to as anaerobic-anoxic-oxic (A2O) or 5-Stage Bardenpho.

- Widely-accepted and utilized processes for BNR in the United States and worldwide with similar size and BNR characteristics as the Alvarado WWTP

3.1.2 Step Feed

Step feed for nutrient removal is an activated sludge system with alternating anoxic and aerobic zones in series. The process is operated as a plug-flow system, and a fraction of the primary effluent is fed to each of the anoxic zones. **Figure 3-3** shows a typical Step Feed process. As needed, supplemental carbon can be added to the anoxic zones. The number of steps and size of the zones is dependent on the primary effluent wastewater characteristics and effluent nitrogen target. The process can achieve effluent total nitrogen concentrations as low as 3-5 mg/L.

Figure 3-3: Step Feed Process Schematic



Design and operational considerations for the Step Feed process include:

- Step feed can be advantageous during high flow events because of the relatively lower MLSS concentration at the end of the step feed zones
- Internal recycle pumping is not required
- Supplemental carbon may be required for downstream anoxic zones
- Limited flexibility in the modification of the zones to accommodate changing conditions
- More complex than MLE process due to needed flow split control and aeration control in each aerobic zone

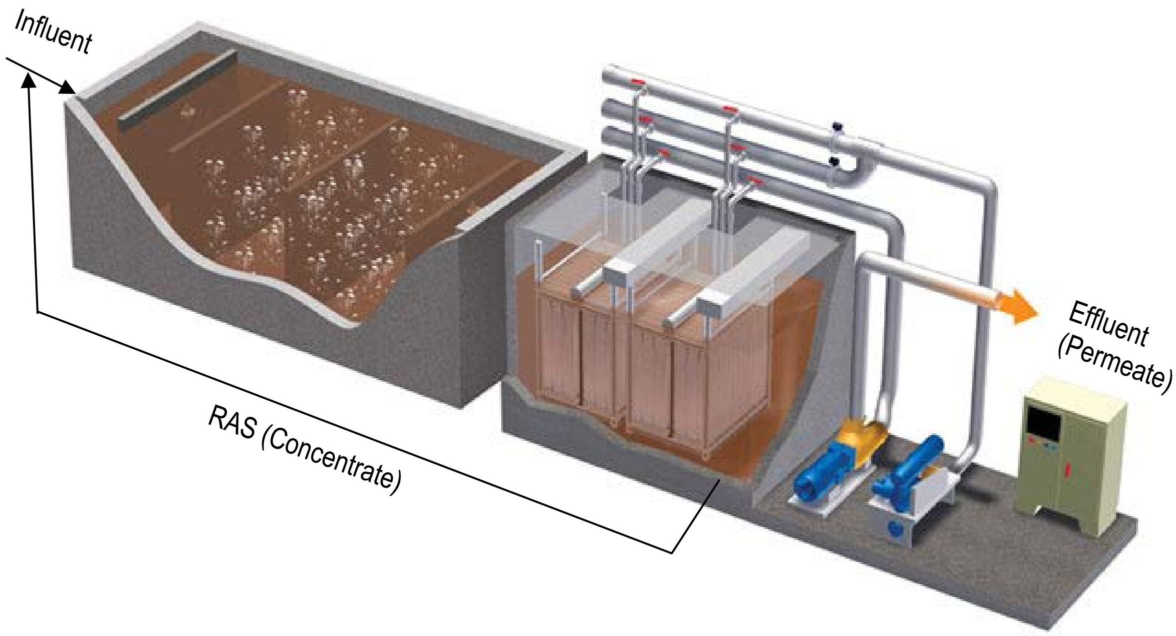
3.1.3 Intensification Technologies

Intensification technologies include processes that allow more treatment in a similar volume when compared to MLE or 4-stage Bardenpho nitrogen removal processes. This is typically accomplished through changes to the solids separation process and/or incorporation of a fixed film process. These processes are often proprietary.

3.1.3.1 Membrane Bioreactors (MBR)

Membrane Bioreactors (MBR) are an activated sludge process that utilizes membranes for solids separation rather than gravity settling in secondary clarifiers. This allows for a much higher MLSS concentration in the bioreactors, which results in a higher treatment capacity per bioreactor volume and an overall smaller footprint for the process. The bioreactors can be configured in combinations of anoxic and aerobic zones similar to MLE and 4-Stage Bardenpho processes. **Figure 3-4** shows a typical MBR system process diagram.

Figure 3-4: MBR System Process Schematic



Source – www.water-aerator.com / Suez Zenon

MLSS from the bioreactors enters the MBR tank and two streams exit, RAS/WAS and effluent (permeate). The effluent passes through the membrane, while solids are retained on the upstream side of the membrane and recycled back to the process or wasted. Membranes typically retain particles, including microorganisms, of about 0.1-micron diameter and larger. MBRs allow for higher MLSS concentrations, in the range of 8,000 to 10,000 mg/L, since gravity separation of solids is not a limiting factor. Higher MLSS concentrations allow for longer solids retention time (SRT) with a smaller tank footprint. Operational issues most often include biofouling of the membranes which is addressed by regular air scouring, backwashing, and quarterly to semiannual acid or caustic cleaning.

Nitrogen removal in an MBR is similar to what can be achieved by MLE and 4-Stage Bardenpho processes.

Design and operational considerations for an MBR include:

- Relatively smaller bioreactor footprint due to the ability to run higher MLSS concentration
- Relatively smaller solids separation footprint than secondary clarifiers
- Eliminates the risk of solids washout from secondary clarifiers

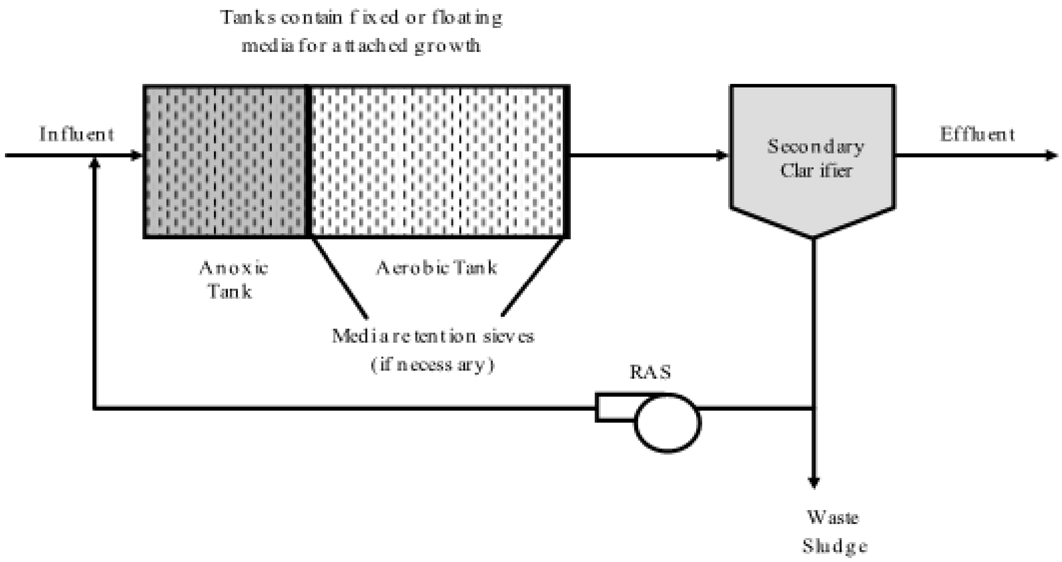
- High effluent quality with low turbidity and suspended solids appropriate for Title 22 reuse
- Requires fine screening (2 mm perforated plate preferred) to protect membranes
- Highly automated process
- High capital and operational costs
- Additional facilities and chemicals required for membrane cleaning and maintenance
- MBR Blowers required for scouring of membranes in addition to the aeration blowers resulting in relatively more air needed for the process
- Relatively more pumping is required with effluent permeate pumping
- Peak flows are limited by membrane capacity
- Many existing installations in the United States and worldwide with similar size and BNR characteristics as the WWTP
- Non-standardized systems from various manufacturers may require pre-selection

3.1.3.2 Integrated Fixed-film Activated Sludge and Moving Bed Bioreactor

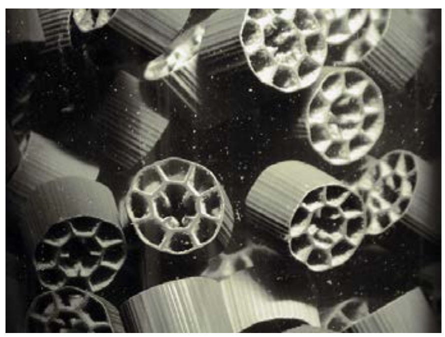
Integrated fixed-film activated sludge (IFAS) and moving bed bioreactor (MBBR) systems incorporate attached growth/fixed film into the BNR process. The bioreactors can be configured in combinations of anoxic and aerobic zones similar to MLE and 4-Stage Bardenpho processes. IFAS systems are activated sludge systems combined with fixed film media typically added to the aerobic zone for both the anoxic and aerobic zones to effectively increase the effective MLSS concentration and SRT. MBBR systems are similar to IFAS, but do not use suspended activated sludge and, therefore, do not require a return activated sludge (RAS) line.

Figure 3-5 includes a process schematic of a typical IFAS system and a close-up view of an example of one of the types of attached growth media.

Figure 3-5: IFAS System Process Schematic and Media Photo



Source – EPA Municipal Nutrient Removal Technologies Reference Document, 2008



Source: http://www.degremont-technologies.com/cms_medias/jpg/meteor-activecell.jpg

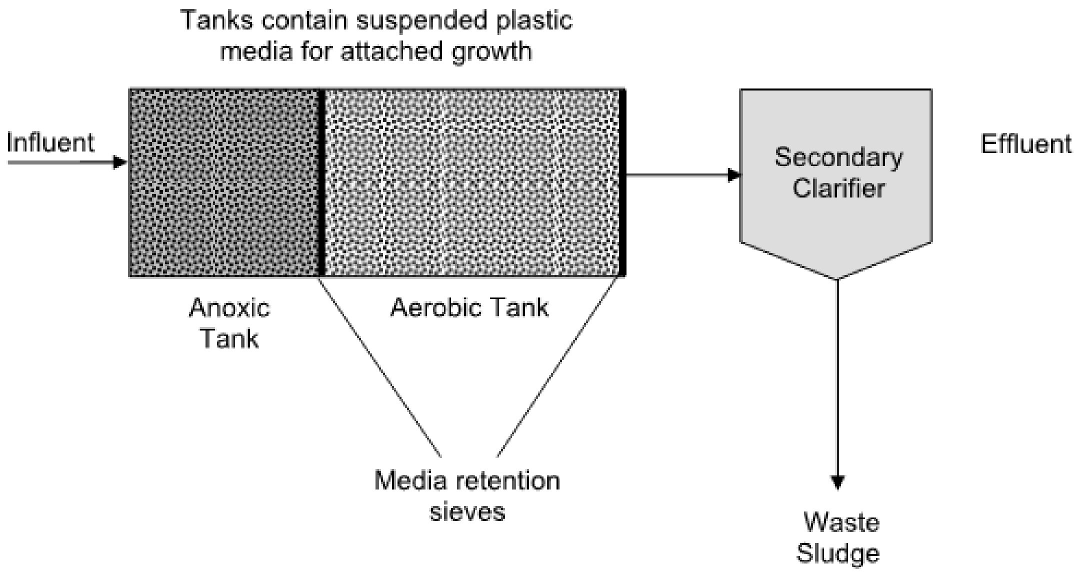
The fixed film media is lightweight with a high surface-to-volume ratio to maximize attached growth. The media typically consists of free-floating sponges, plastic discs, or small plastic cylinders with internal fins providing surface area for biofilm growth. The suspended media provides an advantage for slow-growing bacteria, including nitrifiers, by retaining the biology in the bioreactor and resulting in long SRTs. Biofilm attached to the media sloughs off and is wasted with the suspended activated sludge.

The fixed film media remains in circulation within the bioreactors and is retained by the use of screens at the effluent of the bioreactor tanks or is completely enclosed in cages. Coarse or fine bubble aeration is used to keep the media in suspension in aerobic zones and shearing of the media may deliver increased oxygen transfer. Slow-speed, submersible mixers are used to maintain suspension in the anoxic zones.

Nitrogen removal in an IFAS system is similar to what can be achieved by MLE and 4-Stage Bardenpho processes.

MBBR systems may be used in the mainstream process and can also be utilized in sidestream reactor processes, including the anammox process discussed later in this document. **Figure 3-6** includes a process schematic of a typical MBBR system.

Figure 3-6: MBBR System



Source – EPA Municipal Nutrient Removal Technologies Reference Document, 2008

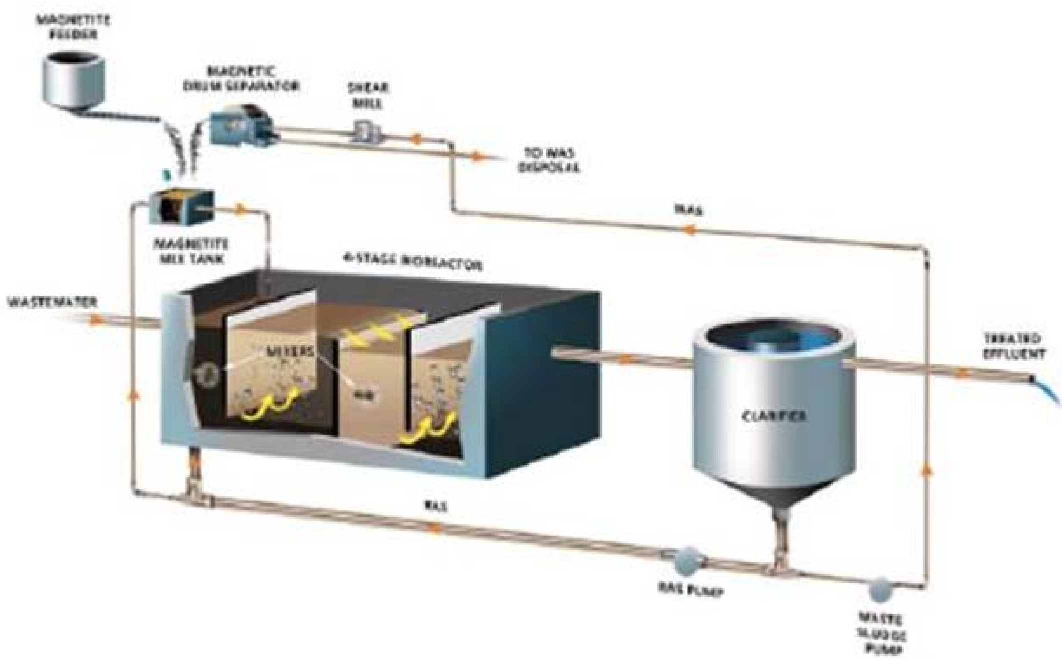
Design and operational considerations for IFAS and MBBR systems include:

- Relatively smaller bioreactor footprint due to the presence of fixed film
- Relatively lower solids loading to secondary clarifiers and less risk of washout
- Less prone to toxic upsets
- Media requires additional maintenance over conventional suspended growth and media management in out-of-service tanks needs to be considered
- Additional headloss through bioreactors due to media
- Requires additional mixing and pumping to prevent movement to and accumulation of media at the effluent end of the bioreactor
- Requires fine screening of influent (3-6 mm)
- Requires additional aeration over conventional activated sludge system for suspension and mixing of media
- Differences in systems from various manufacturers may require pre-selection

3.1.3.3 BioMag

BioMag is a proprietary technology that uses a ballast in the activated sludge process to increase the specific gravity of the biological floc to enhance settling, allowing for higher secondary clarifier loading rates. This, in turn, allows for more treatment within the same bioreactor footprint when compared to conventional activated sludge systems because systems can be operated at higher MLSS concentrations. **Figure 3-7** shows a process schematic of the BioMag system.

Figure 3-7: BioMag System Process Schematic



Source – Evoqua conceptual proposal

The ballast is magnetite, an inert iron ore, that is blended with mixed liquor or RAS in a feed tank. The ballasted mixed liquor flow through the bioreactor tanks, which can be configured for BNR, typically in an MLR or 4-Stage configuration, and to the secondary clarifiers where the solids settle out. The majority of the sludge is returned to the bioreactor via RAS, while magnetite is sheared from WAS and recovered for reuse in the process. Magnetite must be periodically added to the system; 100% recovery is not possible.

Nitrogen removal in a BioMag system is similar to what can be achieved by MLE and 4-Stage Bardenpho processes.

Design and operational considerations for the BioMag process include:

- Relatively less bioreactor volume than a conventional activated sludge system, similar to an MBR

- Relatively less secondary clarifier volume than a conventional activated sludge system – very high secondary clarifier loading rates are possible
- Existing clarifiers may require mechanism modification to scraper-type mechanisms to accommodate BioMag sludge
- Excellent settleability of sludge due to the density of ballasted floc and very low effluent TSS in the effluent
- Accommodates peak flows better than conventional or MBR systems
- High capital and materials cost
- Requires addition of ballast material and equipment to add and separate from sludge
- Fine screening of RAS required
- Potential for abrasion in mechanical equipment from long-term ballast use unproven
- Innovative, proprietary technology by Evoqua with relatively few installations operating more than five years
- Unproven at the scale required for the Alvarado WWTP

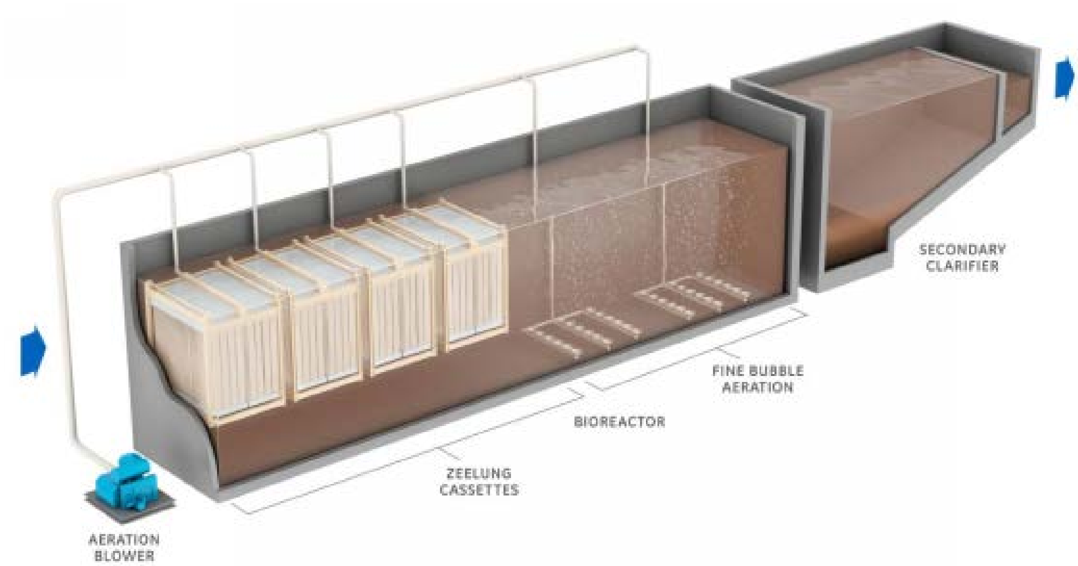
3.1.3.4 MABR

The membrane-aerated biofilm reactor (MABR) is another innovative, proprietary process designed to intensify the amount of treatment that can be done in a given footprint when compared to conventional activated sludge systems. It is also designed to save energy through increased oxygen transfer efficiency in the biological reactors.

The MABR system is different from an MBR because the membranes are not used for solids separation, and clarifiers are still required to separate MLSS. The membrane provides surface area for attached biofilm growth to increase biomass in the bioreactor for nutrient removal. Gas transfer of oxygen to the biofilm occurs directly through the membrane cords, which are connected to the process air supply system, with greater efficiency than standard fine bubble diffusers. The MABR technology can be incorporated into many BNR tank configurations, including MLE and 4-Stage Bardenpho.

Figure 3-8 shows a process schematic of the MABR system.

Figure 3-8: MABR System Process Schematic



Source – Suez ZeeLung MABR brochure

Nitrogen removal in an MABR is similar to what can be achieved by MLE and 4-Stage Bardenpho processes.

Design and operational considerations for the MABR process include:

- Relatively smaller bioreactor footprint due to the presence of fixed film
- Relatively lower solids loading to secondary clarifiers and less risk of washout
- Higher oxygen transfer efficiency in aeration tanks resulting in less energy
- Relatively higher capital and maintenance costs expected due to membranes
- Redworms may be a concern with long SRT and low dissolved oxygen (DO)
- Innovative, proprietary technology by Suez with no full-scale installations operating more than five years

3.1.4 Separate-Stage Systems

The following technologies are described as separate-stage nitrogen removal processes and would be used in conjunction with a conventional activated sludge process designed for BOD-only removal or BOD-removal and nitrification, as shown in **Figure 3-9** and **Figure 3-10**.

Figure 3-9: Separate Stage BAF Nitrification and Denitrification Filter Process Schematic

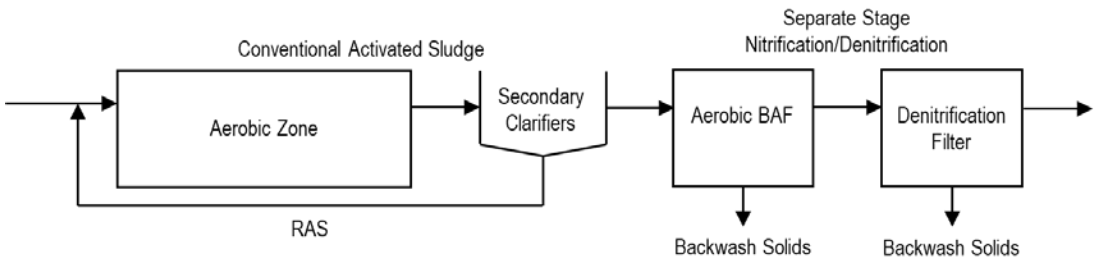
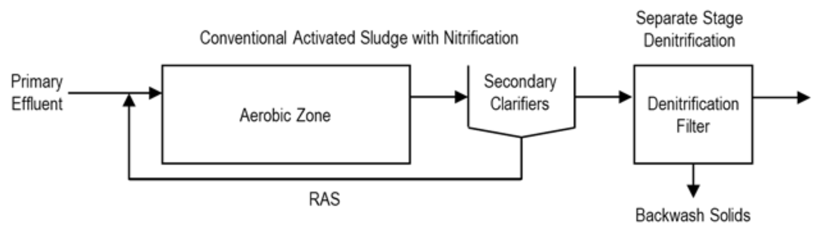


Figure 3-10: Separate Stage Denitrification Filter Process Schematic



3.1.4.1 BAF/Denitrification Filters

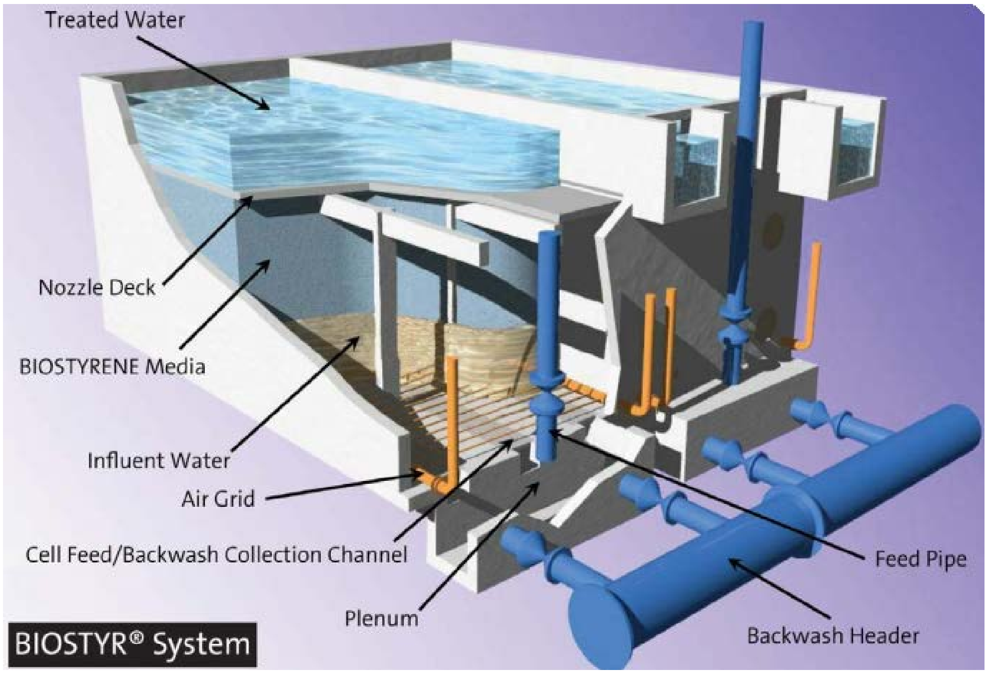
Biological active filters (BAF) have three applications: secondary treatment, separate-stage denitrification, and separate-stage nitrification. Aerobic BAFs require continuous aeration to support the biological growth of nitrifiers on the filter media. It should be noted that nitrification will only substantially occur if soluble BOD is very low in the BAF influent, which is typical of secondary clarifier effluent. Denitrification of the aerobic BAF effluent would be performed with denitrification filters, which are discussed in the following section.

BAFs are available in both upflow and downflow configurations. Upflow configurations can be used aerobically and anoxically and have the advantage of using gravity flow of effluent for backwashing. Downflow configurations typically are used for denitrification and require regular back pulsing of effluent to free nitrogen gas bubbles from the media.

BAF media typically consists of mineral or plastic material, such as polystyrene. Mineral media is generally denser than water making it suitable for downflow applications, while plastic media is less dense and appropriate for upflow configurations.

The example BAF system shown in **Figure 3-11** is an upflow style system utilizing polystyrene beads for media.

Figure 3-11: Upflow Biologically Aerated Filter Process Illustration



Source – Veolia BIOSTYR System Brochure

Intermittent backwashing is a typical requirement of BAF systems, to remove excess biomass from the media surface and maintain acceptable head loss through the system. Backwashing may be accomplished using pumps or gravity flow depending on the BAF configuration. Additionally, aeration combined with backflow of effluent helps to dislodge solids accumulated in the media. Some BAF systems may operate in a continuously backwashed mode, depending on the manufacturer.

Design and operational considerations for the BAF process include:

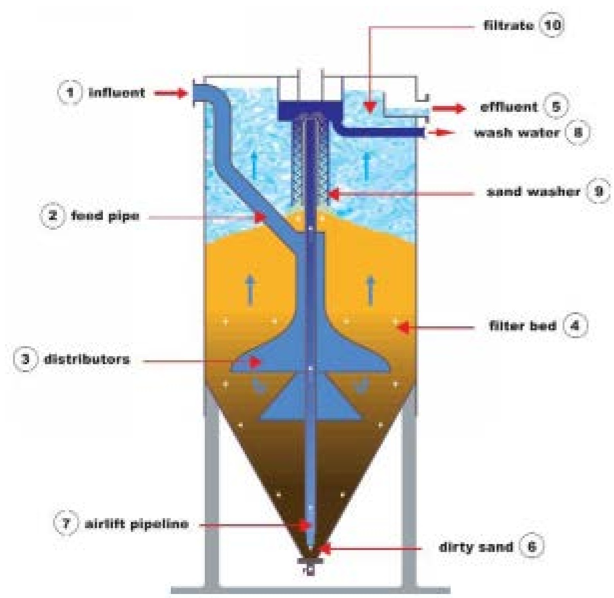
- Small footprint
- Combines BNR and filtration process
- A two-stage BAF system or a BAF combined with a denitrification filter is required to both nitrify and denitrify
- Headloss through media may necessitate additional pumping
- Highly automated process
- Backwash adds additional recycle stream to WWTP
- Differences in systems from various manufacturers may require pre-selection
- A limited number of US installations at the scale required for the Alvarado WWTP
- Due to capacity constraints in existing secondary treatment at the WWTP, the secondary system may still require expansion even with the utilization of a BAF for nitrification

3.1.4.2 Denitrification Filters

Denitrification filters utilize fixed-film biomass to reduce nitrates in secondary clarifier effluent to nitrogen gas. It follows that nitrification in the preceding secondary treatment process or a separate-stage process is a prerequisite to denitrification filter technology. Typically, low concentrations of readily biodegradable carbon sources (rbBOD) in the secondary clarifier effluent leave little carbon for denitrification, and thus denitrification filters require supplemental carbon addition, such as methanol or MicroC.

Denitrification filters are available in two configurations, including upflow and downflow continuous-backwash filters. **Figure 3-12** shows an upflow denitrification filter.

Figure 3-12: Astrasand Upflow Denitrification Filter Process Illustration



Source – EPA Wastewater Management Fact Sheet Denitrifying Filters

In upflow filters, influent flows by gravity upward through the filter, countercurrent to the media. The media is continuously moving and is circulated back to the top of the filter with an airlift pipeline, where the sand-washer scrubs contaminants into a waste line. The treated effluent (filtrate) flows by gravity over a weir. In downflow filters, influent flows by gravity downward through the filter media in a typical filtration mode. Downflow filters use an underdrain to collect effluent, while upflow filters do not. Media is typically granular sand for downflow filters, while upflow filters use fine sand. Downflow filters typically use influent weirs which may entrain DO depending on the design.

In either configuration, the filter media must be periodically backwashed to remove contaminants and nitrogen gas bubbles, which increase head loss through the filter. Denitrification filters are modular in design, where at least one unit is always backwashing while the others continue in a filtration mode, hence the term continuous-backwash filter.

Backwashing includes pumping of effluent backward through the filter media along with air for scouring. Backwash water is sent to the head of the plant for treatment. Filter housings are typically plastic or metal but can be installed in concrete structures as well.

Denitrification filters can reduce nitrate to concentrations to as low as 1 mg/L in the effluent.

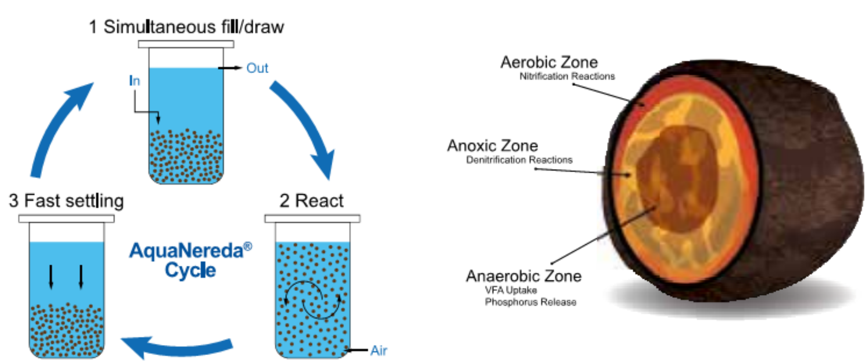
Design and operational considerations for the Denitrification Filter process include:

- Small footprint but requires structures for the filters and pipe gallery
- Combines BNR and filtration process
- Headloss through media may necessitate pumping to the system
- Backwash adds additional recycle stream to WWTP
- Highly automated process
- Additional pumping for backwash and blowers for air scour
- Requires supplemental carbon source for denitrification
- Differences in systems from various manufacturers may require pre-selection
- Limited installations longer than five years at the scale of the Alvarado WWTP

3.1.5 Granular Activated Sludge

The granular activated sludge process utilizes slow-growing and fast-settling biomass that forms bio-granules, which are unlike conventional activated sludge systems that form low-density biological flocs. The granules are formed of multiple layers of biofilm interlaced with biopolymer chains for structural support and do not require a carrier media. Granules are denser and settle faster than typical activated sludge flocs and allow for comparatively higher MLSS concentrations in the bioreactor. Each biofilm layer contains aerobic, anoxic, or anaerobic bacteria, from the outermost to the innermost layer, respectively. Diffusion between the biofilms is responsible for mass transfer of nutrients to each bacterial group. **Figure 3-13** shows a cross-sectional view of a bio-granule.

Figure 3-13: Granular Activated Sludge Batch Cycle Diagram & Bio-Granule Section



Source – Aqua-Aerobics AquaNereda System Brochure

The bio-granule structure allows for simultaneous nitrification, denitrification, and phosphorus removal in addition to BOD and TSS removal without requiring anaerobic or anoxic zones within the bioreactor. The granule structure outer layer protects the anoxic and anaerobic bacterial groups from oxygen poisoning. The outer layer consists of nitrifiers which oxidize ammonia into nitrite and nitrate for the anoxic denitrifiers in the middle layer. The denitrifiers reduce nitrate to nitrogen gas which diffuses outward and is released into the atmosphere. Granular activated sludge has the potential for enhanced biological phosphorus removal with the presence of polyphosphate accumulating organisms (PAOs) in the granule core, which uptake phosphates during the aeration phase. Wasting of sludge provides for a net removal of phosphorus from the bioreactor.

Aqua-Aerobics' Aqua-Nereda technology utilizes granular activated sludge in a batch process format, negating the need for secondary clarifiers, similar to a sequencing batch reactor (SBR). Rather than typical flow-through completely mixed reactors, batch processes use multiple reactors to sequentially fill, react, settle, and draw. Typically, one reactor fills while at least one other is reacting, settling, or drawing (emptying). Sludge wasting is typically performed following the settling phase. Batch systems are scalable due to the modular nature of the reactors, however operational complexity increases with the number of reactors. **Figure 3-13** illustrates the batch cycle as applied to the granular activated sludge process. Primary clarifiers are reported to be optional for the granular activated sludge process.

Startup of the granular activated sludge process is achieved through two methods, incrementally from conventional activated sludge flocs or through seeding from existing granular activated sludge installations. Bio-granule forming bacteria are cultivated through selective wasting of slow settling sludge.

Nitrogen removal in an AquaNereda granular activated sludge system is similar to what can be achieved by MLE and 4-Stage Bardenpho processes.

Design and operational considerations for granular activated sludge systems include:

- Smaller bioreactor footprint
- Batch process bioreactor configuration with no secondary clarifiers and return sludge lines
- No separate reactor zones for aerobic/anoxic conditions
- Can be operated with higher MLSS concentration (8,000 to 12,000 mg/L) with low SVI due to granule density
- Highly automated process
- Claimed reduction of chemical use for BNR and EBPR
- Requires fine screening (6mm perforated plate) upstream of reactors
- Innovative, proprietary technology provided by Aqua-Aerobics in the United States with no full-scale installations operating at the scale of the Alvarado WWTP. Vendor literature

suggests over 40 full-scale plants in operation or under design worldwide with a few in the design/construction phase with average flow capacities greater than 20 mgd

- Currently, on-going research for application as a non-batch process; granular activated sludge may be susceptible to shear forces from return sludge pumping, which could damage granules and kill anoxic/anaerobic bacteria

3.1.5.1 Granular Activated Sludge Selection with Hydrocyclones

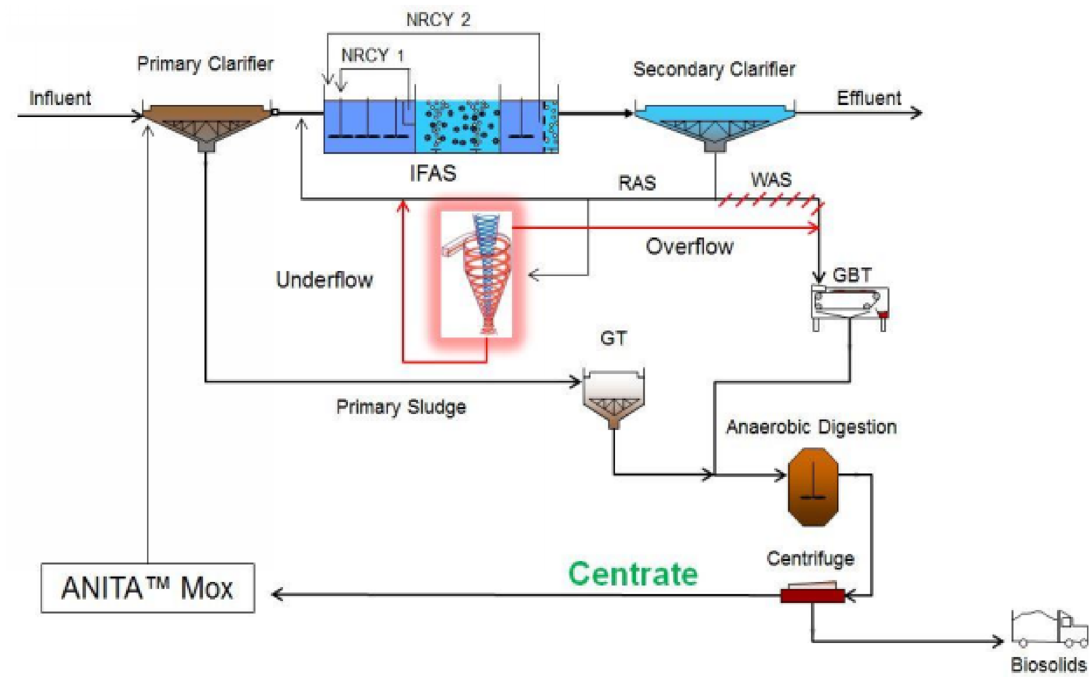
One manufacturer, World Water Works, markets a technology for selectively targeting growth of granular activated sludge. Coined a gravimetric selection technology, the InDENSE system utilizes hydrocyclones to separate low-density sludge flocs from higher density bio-granules in the mixed liquor. The hydrocyclones operate on a portion of the RAS and include two effluent streams; underflow, which retains the higher density particles, and overflow, which includes the less dense sludge flocs. The overflow stream is rejected to sludge processing and replaces the WAS stream in a conventional activated sludge system. The majority of flow into a hydrocyclone exits via the overflow. To maintain fractional wasting of sludge a small portion of RAS is pumped through the hydrocyclones, while the rest is pumped directly to the biological reactors. Several hydrocyclones are typically operated in parallel to allow for varying rates of sludge wasting. Each hydrocyclone operates within a narrow range of pressure and flow to maintain cyclonic action necessary for sludge density classification. To accommodate changes in flow requirements hydrocyclones may be put in and out of service as necessary. Figure 3-14 shows a bank of eight parallel hydrocyclones installed in an existing activated sludge plant to select granular activated sludge and waste less dense sludge flocs.

Figure 3-14: Parallel Hydrocyclone System

Source – World Water Works InDense System Brochure

Figure 3-15 shows an activated sludge process diagram utilizing IFAS, anaerobic digestion, an MBBR system for nitrogen removal in centrate, and hydrocyclones for selection of granular activated sludge. Note the typical secondary clarifier WAS line is replaced with the hydrocyclone overflow. The biological reactors in this example also include two internal nitrified recycle (NRCY) lines.

Figure 3-15: Granular Activated Sludge Process Diagram with Hydrocyclone



Source – "Improving Settleability and Enhancing Biological Phosphorus Removal through the Implementation of Hydrocyclones", Welling, 2015.

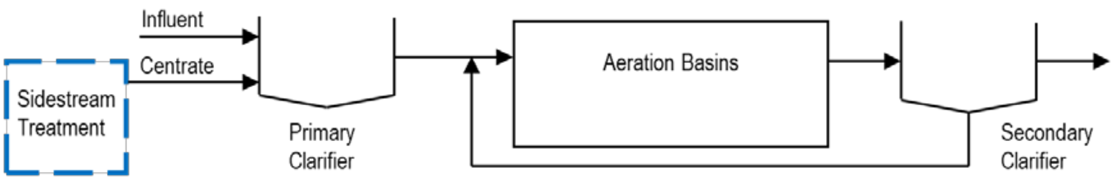
Design and operational considerations for granular activated sludge systems with hydrocyclones include:

- Relatively simple integration into existing WWTP infrastructure
- Selects against poor settling filamentous organisms
- Enhances biological phosphorus removal by selecting for phosphorus accumulating organisms (PAOs)
- Improves SVI by increasing biomass density and selecting for denser floc and granules
- Innovative, proprietary technology provided by World Water Works in the United States with at least one full-scale installation operating at a similar scale to the Alvarado WWTP

3.1.6 Sidestream Treatment

The following technologies are defined as sidestream processes to treat centrate from dewatered anaerobic digester effluent and reduce the total nitrogen load to the main biological process. These sidestream treatment processes would be operated in conjunction with the existing conventional activated sludge system at the WWTP, as shown in **Figure 3-16**, or in combination with any of the above-listed BNR processes.

Figure 3-16: Sidestream Treatment Process Schematic



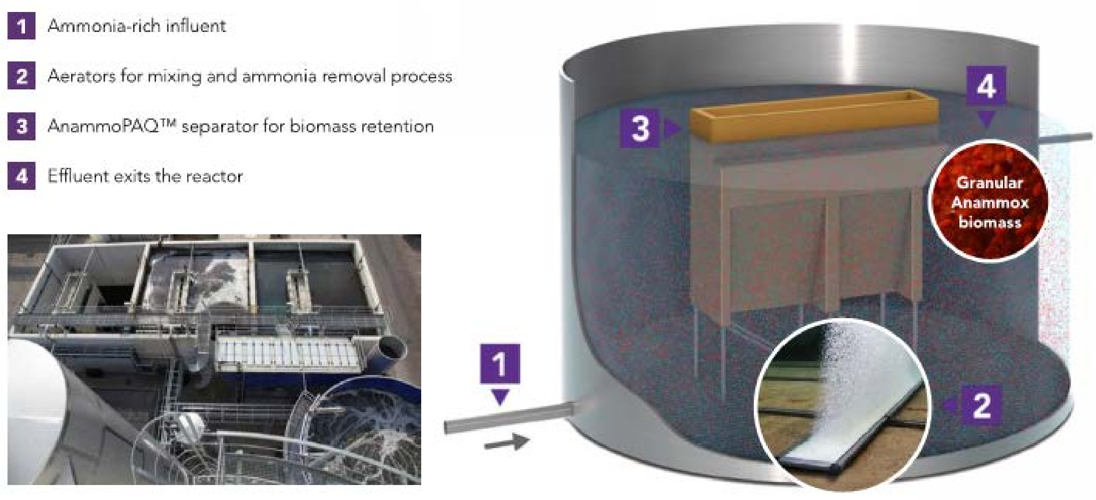
3.1.6.1 Anammox

The Anammox processes rely on two types of microorganisms: ammonium oxidizing bacteria (AOB) and anammox bacteria. The processes are typically aerated to provide the aerobic AOB group with oxygen for conversion of ammonium to nitrite (nitritation). The AOB group may be suspended growth within the process tank or grow as an aerobic layer above the anoxic anammox layer in the biofilm, depending on the process. The Anammox group are autotrophs that grow as a biofilm on either granules or MBBR media and convert ammonium and nitrite to nitrate and nitrogen gas, which is released to the atmosphere, under anoxic conditions. This step in the process is referred to as deammonification. The Anammox media or granules are retained within the sidestream reactor using screens or other devices at the effluent end of the tank.

The Annamox bacteria use inorganic carbon rather than organic carbon for growth, eliminating the need for influent BOD or supplemental carbon for the system. Because only nitritation is achieved rather than full nitrification, the oxygen requirements also are reduced. Because of these two advantages over conventional BNR, this process continues to be the focus on on-going research and development. There are several commercial process configurations that are designed for deammonification, and two are briefly highlighted here:

Ovivo-Paques developed the AnammoPAQ process using granular biomass and provides mixing and oxygen to the system using fine bubble diffusers. **Figure 3-17** shows anammox sidestream reactor for treating centrate from dewatered digester effluent, high in ammonia. The AnammoPAQ bioreactor uses a gravity separator to retain the granular anammox biomass within the tank.

Figure 3-17: AnammoPAQ Process Schematic



Source – Ovivo AnammoPAQ Process Brochure

Veolia's ANITA Mox process uses MBBR technology with plastic carrier media to provide surface area for biological growth. A pilot study at the USD Alvarado WWTP showed that approximately 70% of total inorganic nitrogen (TIN) could be removed from the centrate, thereby decreasing the average final effluent TN load by approximately 30%.

Design and operational considerations for the Annamox processes include:

- Reduces nitrogen loading to the secondary treatment process
- No external carbon source required
- Requires additional process equipment, including pumps and blowers, and tankage in addition to secondary equipment
- Smaller bioreactor footprint
- Potential savings in power, sludge generation, chemical use compared to traditional BNR options
- Innovative, proprietary technology with limited full-scale installations operating at the scale of the WWTP
- Differences in systems from various manufacturers may require pre-selection

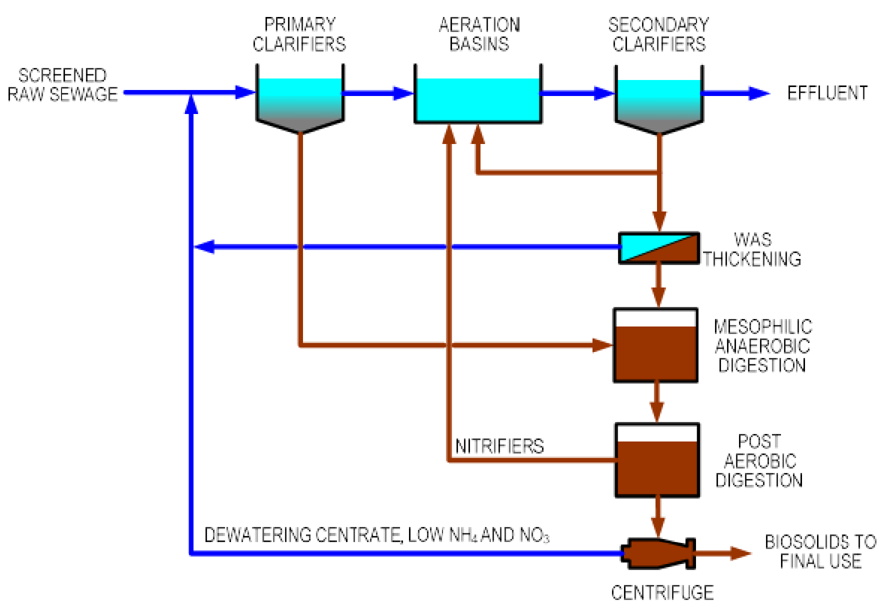
3.1.6.2 Post-Aerobic Digestion

Post-aerobic digestion is an advanced phased digestion process, where anaerobic digester effluent is further digested aerobically to reduce nitrogen and volatile solids loading to the secondary treatment system. Post-aerobic digesters can be operated in several different modes, including cyclic aeration and continuous aeration. For nitrogen removal, cyclic aeration provides for alternating aerobic and anoxic conditions in the post-aerobic digester. Cyclic aeration requires means to both aerate and anoxically mix the post-aerobic digester. Nitrification occurs within the post-aerobic digester during the aerobic phase, when high concentrations of ammonia are oxidized to nitrite and then nitrate. Denitrification occurs during the anoxic phase when nitrate is reduced to nitrogen gas for respiration and released to the atmosphere.

Post-aerobic digestion has the added benefit of providing additional volatile solids reduction (VSR) over anaerobic digestion alone. Volatile solids generally include organic solids, or those containing carbon. Aerobic digesters are not typically covered, and much of the VSR is accomplished by oxidation of organics to carbon dioxide gas. No methane is produced in aerobic digesters as methanogens are not present.

Figure 3-18 shows a process diagram with anaerobic and post-aerobic digestion, including bioaugmentation of the aeration basins with nitrifiers from the post-aerobic digester. Bioaugmentation is a means of seeding the secondary treatment process with a population of nitrifiers to enhance nitrification within the bioreactors. **Figure 3-19** shows an example installation of an aerobic digester.

Figure 3-18: Post Aerobic Digestion Process Schematic



Source – Menniti et al, (2010) Combining Mesophilic Anaerobic Digestion with Post-Aerobic Digestion to Enhance Volatile Solids Reduction and Reduce Sidestream Ammonia.

Figure 3-19: Aerobic Digestion

Source – www.ovivowater.com

Design and operational considerations for the post-aerobic digestion process include:

- Reduces nitrogen loading to the secondary treatment process
- Suitable retrofit for an existing process with anaerobic digestion
- No external carbon source, alkalinity, or chemicals required

Requires additional process equipment, including pumps and blowers, and tankage in addition to secondary equipment

4. CONCLUSIONS AND NEXT STEPS

4.1 Options Summary

Table 4-1 provides a summary of the effluent management options considered, their viability, and the extent to which they can provide a solution to future effluent storage requirements.

Table 4-1: Summary of Effluent Management Options

Alternative	Agency Coordination/ Complexity	Storage Volume / Flow Discharge Available	Complete solution?	Planning Level Costs	Implementation Timing	Viability
Influent Flow Reduction						
Inflow/Infiltration Reduction	USD Collection System team	~0 MG	Minor	N/A	On-going	Low
Conveyance System Storage	USD	Additional 1.8 MG @ Irvington, 2 MG @ Newark	Minor	~$10 M – $30 M, each basin [1]	3 – 5 years (based on current CIP)	Moderate
Satellite Treatment & Disposal	USD; potentially EBDA, Water Board	Reduces flow by up to 1.7 MGD	Partial	$58M (2010 dollars; includes treatment and distribution)	May be part of provisions to implement RW projects by 2020	Low
WWTP Onsite						
Equalization Storage						
EQ Basin East of WWTP	USD, ACFCD, ACWD, Army Corps, Water Board	Up to 20 MG	Partial to Full	$90 M [2]	5 years or more for permitting; potential partnership with ACFCD	Low
EQ Basin for site drainage flows	USD	2.6 MG (Plant stormwater)	Partial	$5.5 M (FY 2018 CIP)	Within next few years if on USD property	Low

[1] Costs estimated from ongoing predesign effort for storage basin at Newark Pump Station.
[2] Cost from the Secondary Treatment Process Improvements (CAS Option 3, Hazen and Sawyer).

Alternative	Agency Coordination/ Complexity	Storage Volume / Flow Discharge Available	Complete solution?	Planning Level Costs	Implementation Timing	Viability
Shallow Discharge						
Breakpoint Chlorination + Old Alameda Creek	USD, Water Board	Up to 10 MG	Partial	Low Capital & High O&M; Not Developed	3 – 5 years for design, construction, and permitting	Low
Early Action Nutrient Removal + Old Alameda Creek						
Alternative 1: Sidestream Nutrient Removal for Centrate	USD, Water Board	Dependent on negotiations RWQCB; permitting analysis underway	Partial to Full	\$20.8 M [1]	4 – 5 years for design, construction, and permitting	Moderate
Alternative 2: Full Flow Nutrient Removal	USD, Water Board	Dependent on negotiations RWQCB; permitting analysis underway	Full	\$23.2 M [2]	7 years for design, construction, and permitting	High (recommended approach)
Alternative 3: Parallel MBR	USD, Water Board	19 MGD	Partial	\$93M	3 – 5 years for design, construction, and permitting	Low

[1] Cost from the Secondary Treatment Process Improvements (CAS Option 2 – Phase II, Hazen and Sawyer).

[2] Only a fraction of the Secondary Treatment Process Improvements (CAS Option 2 – Phase I, Hazen and Sawyer) is attributable to early action nutrient removal. That fraction is estimated at 10%, or \$23.2 million, and is estimated to result in sufficient nutrient removal to permit increased shallow water discharges to Old Alameda Creek.

Alternative	Agency Coordination/ Complexity	Storage Volume / Flow Discharge Available	Complete solution?	Planning Level Costs	Implementation Timing	Viability
Alternative 4: Parallel MLE	USD, Water Board	12 MGD	Partial	$88M	3 – 5 years for design, construction, and permitting	Low
Shallow Discharge – Eden Landing Marsh	USD, State Coastal Conservancy, Army Corps, Water Board	0.5 MGD (max)	Minor	$6.9M (based on Oro Loma EQ/levee project cost)	5 years for permitting	Low
Offsite						
Equalization at Hayward	USD/EBDA	Greater than 200 MG	Partial to full	$10.4M	3 to 5 years; Requires coordination from EBDA partners	Low
Baseline Restoration of Hayward Marsh	USD, Water Board, EBRPD	20 MGD	Partial	$20.1M	More than 5 years to complete construction	Low
Basin 1 EQ at Hayward Marsh	USD, EBRPD State Lands Commission	30 MG	Partial	$15M total, $5.75M of which is for Basin 1 Conversion	3 to 5 years; Requires coordination from EBRPD	Low
Reconfigure Hayward Marsh for Nutrient Removal	USD, Water Board, EBRPD State Lands Commission	20 MGD	Partial	$15M, assumed to be similar to Basin 1 EQ Project Cost	5 years; Requires coordination with EBRPD and permitting	Low

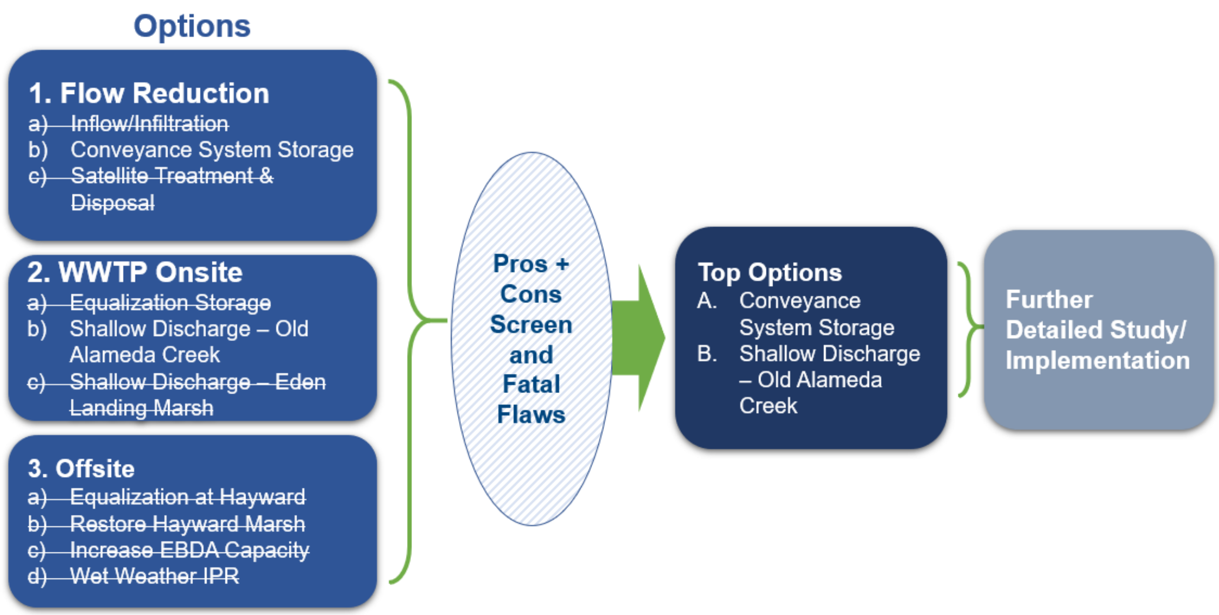
Alternative	Agency Coordination/ Complexity	Storage Volume / Flow Discharge Available	Complete solution?	Planning Level Costs	Implementation Timing	Viability
Increase USD Share of EBDA Capacity	USD/EBDA and Partners	Limited	Partial	Unknown	2+ years to coordinate with EBDA agencies; Longer for infrastructure improvements	Low
Wet Weather IPR	USD/ACWD/ Regional Agencies, Water Board	Up to 5 MGD without regional coordination	Partial	$80M (2016 dollars; includes treatment and distribution)	At least 5 to 6 years	Low

4.2 Most Viable Options (Moderate Viability or Better)

Based on the information presented in Chapter 2 and 3, options ranked with at least moderate viability were carried forward for further evaluation. The most viable options (with Moderate viability or better) are the following (also shown in **Figure 4-1**:

- Conveyance System Storage
- Shallow Water Discharge: Early Action Nutrient Removal + Old Alameda Creek

Figure 4-1: Option Screening Results



The first option is a flow reduction option. The second option is an onsite option at the WWTP. There were no offsite options identified with moderate viability or higher. A pared down summary of the most viable options is presented in **Table 4-2.** If the actual capacity of the AEPS is conservatively estimated at 39.8 MGD, only a shallow water discharge at Old Alameda Creek alternative would provide a complete solution for the peak flow of 73.3 MGD in 2058. Multiple options may be implemented to provide the estimated effluent management capacity required. However, if full flow nutrient removal is required as part of the Bay Area-wide approach to nutrient management, it will increase the viability and flow/volume capacity of the shallow water discharge options. Equalization at Hayward, in conjunction with EBDA partners, remains as a viable alternative to compare to alternatives herein where USD is in the lead position of implementation.

Table 4-2: Summary of Most Viable Management Options

Alternative	Agency Coordination/ Complexity	Storage Volume / Flow Discharge Available	Complete solution?	Planning Level Costs	Implementation Timing	Viability
Influent Flow Reduction						
Conveyance System Storage	USD	Additional 1.8 MG @ Irvington, 2 MG @ Newark	Minor	~$10 M – $30 M, each basin[1]	3 – 5 years (based on current CIP)	Moderate
WWTP Onsite/Adjacent						
Early Action Nutrient Removal + Old Alameda Creek Shallow Water Discharge						
Alternative 1: Sidestream Nutrient Removal for Centrate	USD, Water Board	Dependent on negotiations RWQCB; permitting analysis underway	Partial to Full	$20.8 M [2]	4 – 5 years for design, construction, and permitting	Moderate
Alternative 2: Full Flow Nutrient Removal	USD, Water Board	Dependent on negotiations RWQCB; permitting analysis underway	Full	$23.2 M [3]	7 years for design, construction, and permitting	High (recommended approach)

[1] Costs estimated from ongoing predesign effort for storage basin at Newark Pump Station.
[2] Cost from the Secondary Treatment Process Improvements (CAS Option 2 – Phase II, Hazen and Sawyer).
[3] Only a fraction of the Secondary Treatment Process Improvements (CAS Option 2 – Phase I, Hazen and Sawyer) is attributable to early action nutrient removal. That fraction is estimated at 10%, or $23.2 million, and is estimated to result in sufficient nutrient removal to permit increased shallow water discharges to Old Alameda Creek.

4.3 Next Steps

Suggested next steps are described below. O&M costs were not quantified as part of this analysis, and it is recommended that this be included in future evaluations. However, given the limited number of viable options and the unique characteristics of each, including capital cost, O&M costs are not expected to be a significant factor in alternative selection.

4.3.1 Shallow Water Discharge

The Enhanced Treatment & Site Upgrade Program proposes implementing upgrades to improve secondary process performance as soon as possible. Additional nutrient removal capability as indicated through ongoing evaluation of future nutrient watershed permits would also be implemented concurrently. These upgrades are discussed in more detail in Chapter 3 of the Enhanced Treatment & Site Upgrade Program. Incorporating multiple benefits such as improved process performance, Title 22 recycled water production, and other benefits would need to be factored in to increase the viability of the early action nutrient removal options given their capital cost. USD has had favorable discussions with RWQCB staff regarding possibly permitting an increased wintertime discharge to Old Alameda Creek during high flow periods, along with early action nutrient removal; the next steps are underway and include developing technical studies and, if appropriate, a permit application.

USD, in conjunction with Woodard & Curran, is developing more defined technical documentation regarding discharge to Old Alameda Creek. This documentation will include analyses defining:

- Frequency of discharge to Old Alameda Creek after discharge to Hayward Marsh is no longer possible
- Projected water quality of the discharge based on the implementation timeline of process upgrades

If accepted, the RWQCB would be granting USD an exception to the current shallow water discharge prohibition on the basis that USD would be providing an "equivalent level of environmental protection"[1] to San Francisco Bay due to nutrient removal. This technical proposal is expected to be submitted to the RWQCB in September 2019.

In the meantime, USD will continue to work with EBRPD on the transition of Hayward Marsh from facility accepting secondary effluent from USD year-round to a facility used only during wet weather events for equalization and potential discharge in conjunction with Old Alameda Creek.

[1] San Francisco Bay Regional Water Quality Control Board. Order No. R2-2015-0045, NPDES No. CA0038733 Attachment F. November 18, 2015.

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APPENDIX A: EBDA SYSTEM: WET WEATHER, STANDARD OPERATING PROCEDURE: 2017-2018

EBDA SYSTEM: Wet Weather, Standard Operating Procedure: 2017-2018

Revised: March 5, 2018

STAGE	STEP	EBDA	UNION SANITARY	HAYWARD	ORO LOMA/CV	SAN LEANDRO	LAVWMA
1 Normal Operations	1	Monitor weather forecasts for potential wet weather events (i.e. extreme rainfall events, or several back-to-back storms). Adjust control set points at the OLEPS for wet weather range (5.0' – 7.0') October 15th - April 15th and/or severe wet weather event (HEPS) accordingly.	In anticipation of rain: • USD assesses the availability/condition of the Hayward Marsh. Marsh Flow Set point normally set to 20 mgd. USD 60-inch valve at Hayward: • 60-inch valve at Hayward will be left at the normal % open (Approx. 22% to 25%) & will monitor surge tower level.	In anticipation of prolonged rain: -Monitor plant influent flow. If above 24mgd, event is considered wet weather flow	Monitor weather forecasts and take select tanks out of service as appropriate	Monitor weather forecasts	LAVWMA discharges up to 41.2 mgd to EBDA. Advisory notification to EBDA. After receiving 1/2" rain within 24 hours, LAVWMA Operator will switch to "storm mode" matching the export flow equal to the system influent flow up to 41.2 mgd
2 One Diesel Operating	1	Increased flows greater than the capacity of OLEPS electric pumps (approximately 94 mgd) starts the first diesel pump at OLEPS. Request USD to increase diversion to Hayward Marsh up to permitted limit of 20 mgd. Request LAVWMA modulate flow.	When the surge tower level reaches 45.0', USD to notify EBDA that valve will be opened incrementally at approximately 5 mgd of flow change per 5 minutes. USD will adjust valve to target 40-45' in the tower and notify EBDA prior to making changes to valve position.		As plant influent increases, OL/CVSD will start to divert flow to the equalization basin in an attempt to keep flow to a maximum of 69.2 mgd. Current and future weather conditions and equalization capacity will be taken into account.	As Plant influent increases above FFR capacity (approximately 14 mgd) divert additional flow to the equalization basin as available.	Per EBDA request, modulate flow for 2 to 3 hours to provide EBDA system short term operational flexibility[2].
3 Two Diesels Operating	1	Increased flows greater than the capacity of one OLEPS diesel pump (approximately 110 mgd) starts the second diesel pump at OLEPS. If two OLEPS diesel pumps are running and one fails, request COH to divert flow to ponds and request OL/CVSD increase diversion to equalization basin for a short term in an attempt to control OLEPS wet well level until COH pond diversion[1]		If two OLEPS diesel pumps are running and one fails, per EBDA: Divert COH flow to ponds[1]	If two OLEPS diesel pumps are running and one fails, OL/CVSD will increase diversion to equalization basin for a short term in an attempt to control OLEPS wet well level until COH pond diversion[1]		
	2	If the OLEPS wet wells begin to rise after the second engine is in service, divert COH flow to ponds[1] If current and future weather conditions indicate a continued wet weather event, inform LAVWMA that the potential exists for an interruptible event and inform USD that the potential exists for the need to use the Old Alameda Creek Discharge.	If two OLEPS diesel pumps are running and additional diversion of flow from OLEPS is needed, USD to throttle the USD 60-inch valve at 5 mgd flow changes per 5 minutes to compensate for decreased pressure in the line due to COH pond diversion. USD staff will not throttle below 45% open if 45' of surge tower level is exceeded.	Per EBDA: Divert COH flow to ponds[1]			
4 System Over Capacity	1	If the OLEPS wet well level continues to rise, inform LAVWMA that EBDA is at capacity and to reduce their flow to 19.72 mgd[3]. If the OLEPS wet well level continues to rise after LAVWMA flow is reduced, inform USD that the potential exists for the need to use the Old Alameda Creek Discharge and they should start the two hour prep time.	Contingency Plan when AEPS surge tower is nearing overflow: • Continue to divert 20 mgd to marsh • Use standby Primary Clarifier storage • Use standby Secondary Clarifier storage USD will attempt to manage its storage capacity to ensure that it has two hours to prepare for discharge to the Old Alameda Creek.		Verify operation of the SBS system for near shore unanticipated bypass	Verify operation of the SBS system for near shore unanticipated bypass	Interruptible event begins, EBDA System at capacity[3]. EBDA notifies LAVWMA to reduce flow to at or below 19.72 MGD.
	2	If current and future weather conditions indicate a continued wet weather event and/or OLEPS wet well level still continues to rise, USD wet weather flow diversion to Old Alameda Creek, considered a USD NPDES permitted diversion	When the maximum hydraulic EBDA capacity is reached, USD will attempt to limit flows to OLEPS to 42.9 mgd by utilizing remaining on-site storage and/or potentially using the Old Alameda Creek Discharge. The prep time to begin using the Old Alameda Creek Discharge is approximately two hours.				
	3	If unable to contain flows, advise RWQCB and select: • increased USD wet weather flow diversion to Old Alameda Creek, considered a USD NPDES permitted diversion • near shore discharge at OLEPS/SLEPS, considered an EBDA unanticipated bypass					

Notes:

[1] A per use fee and cost per estimated gallon to be applied for each Hayward Pond diversion.

[2] Intent is to modulate LAVWMA flow for 2-3 hours within 24 hour window to provide short term operational flexibility for EBDA system (high tide, short term equipment failure etc.) and still maintain LAVWMA system overall 24 hour integrity. LAVWMA will reduce pumping under the following guidelines per "LAVWMA Wet Weather Operations Strategy" as follows:

- Wet weather storage shall not exceed 40% of LAVWMA's total storage capacity, and;
- The EBDA flow reduction request does not last for more than 12 hours, and;
- EBDA agrees they can accept higher than normal flows after the reduction period is over so LAVWMA storage volume can be reduced to <20% within 24 hours, and;
- The weather forecast projects a short term (<24 hour) wet weather event.

[3] EBDA System at Capacity. EBDA's system has nominal 189 mgd capacity based on tide elevation, timing of combined flows from all members and all equipment operational.

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APPENDIX B: HAYWARD MARSH RECONFIGURATION – AMMONIA REDUCTION PROJECTION TECHNICAL MEMORANDUM

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MEMORANDUM

TO: Mark Takemoto
CC: Dave Richardson
FROM: Courtney Eaton
DATE: April 9, 2018
RE: Hayward Marsh Reconfiguration – Ammonia Reduction Projection

1.1 Purpose

Union Sanitary District (USD) is in conversation with the East Bay Regional Park District regarding potential re-configuration of the Hayward Marsh. USD currently discharges a portion of their secondary wastewater effluent from the Alvarado Wastewater Treatment to the marsh providing the main source of freshwater into the marsh (a free water surface wetland). In the current configuration of the marsh, as shown in Figure 1, Basin Nos. 1, 2A and 2B are freshwater treatment marsh while Basin Nos. 3A and 3B are tidally influenced and brackish.

The current National Pollutant Discharge Elimination System (NPDES) permit for the Hayward Marsh, adopted by the San Francisco Bay Regional Water Quality Control Board (Order No. R2-2011-0058, NPDES Permit No. CA0038636), requires that the influent to the marsh meet BOD and TSS limits and the effluent from the treatment basins, Basin Nos. 2A and 2B meet specified limits for metals (i.e., copper, cyanide and nickel), select organics and total ammonia. The current average monthly limit for total ammonia (34 mg/L-N) is under negotiation with the Regional Board but the target for this study is a total ammonia effluent limit of 1 mg/L-N on an average monthly basis.

The East Bay Regional Park District would like to convert one of the existing freshwater treatment cells, Basin No. 2B, into a tidally influenced cell. This would require meeting total ammonia limits with just Basin Nos. 1 and 2A. Woodard and Curran was tasked with evaluating whether this proposed configuration is feasible and if adding aeration to Basin Nos. 1 and 2A would be sufficient to reduce the total ammonia levels to the target anticipated in the upcoming NPDES permit renewal.

1.2 Current Configuration and Conditions

An important first step in answering the re-configuration question is to understand the current performance of the existing system regarding ammonia reduction. Table 1 summarizes the hydraulic parameters of Basin Nos. 1, 2A and 2B. All flow influent to the marsh currently flows into Basin No. 1 and then splits between Basin Nos. 2A and 2B before recombining in the mixing channel and moving into Basin Nos. 3A and 3B. See Figure 1 for details. Figure 2 shows a close-up view of Basin No. 1, where baffles appear to be creating a serpentine flow pattern through the basin.

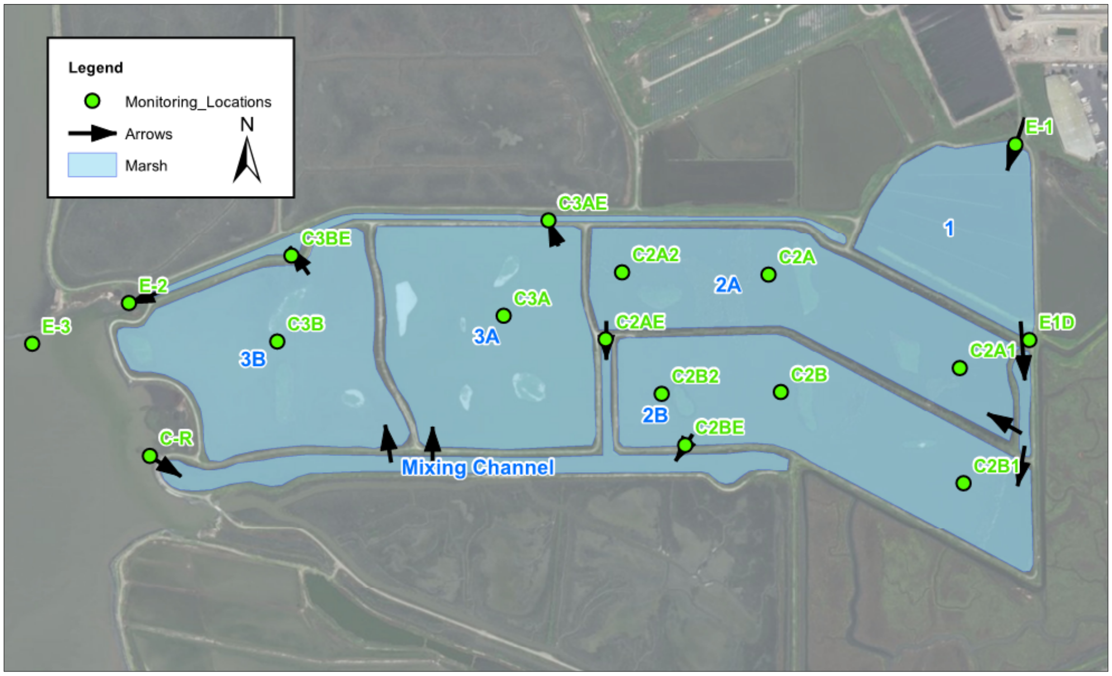


Figure 1. Plan View of Hayward Marsh

Figure 2. Basin No. 1 Detail

Table 1 – Summary of Current Hydraulic Parameters for Freshwater Treatment Basins

	Basin 1	Basin 2A	Basin 2B	Total
Area, ac	15	28	27	70
Average Water Depth, ft(1)	6	4	4	
Approximate Volume, MG	28	37	35	100
Current HRT, days				
Average Day Flow (3.1 mgd)	9.1	23.5	22.8	32(2)
Max Month Flow (4.0 mgd)	7.1	18.3	17.7	25(2)
Max Day Flow (5.2 mgd)	5.4	14.0	13.6	19(2)

(1) Average water depth is based upon the current operation as observed in the field.
(2) Flow is parallel through Basin No. 2A and 2B so the total detention time is based upon volume in Basin No. 1 + either Basin No. 2A or 2B (not both).

Using the NPDES Monthly Operating Reports (MORs) for the Hayward Marsh, average monthly values for flow, influent and effluent ammonia concentration, pH, and temperature were summarized based upon 5 years of data (November 2011 – January 2016). Table 2 summarizes those flow and water quality conditions; no alkalinity data, important to ammonia reduction, was available in the MORs. While average values are important, ammonia concentrations within the marsh system have a strong dependence upon temperature and pH of the water; therefore, it is important to also consider the seasonal aspect of the marsh's performance. Figure 3 shows total ammonia concentrations at key sampling points within the system; locations as noted in Figure 1. Based upon Figure 3, it is apparent that there is a strong climatic influence on the ammonia concentrations discharging from the system. The figure also shows that Basin Nos. 2A and 2B are providing significant total ammonia reductions during certain times of the year. During the warm weather months, average effluent ammonia concentrations from these basins are reaching less than 5 mg/L-N. However, in the winter months, much less reduction in concentration is occurring.

1.3 Ammonia Removal Pathways in Current Configuration

Studies have shown that there are three main mechanisms that could be responsible for ammonia reduction in a pond system (EPA, 2011):

- *Ammonia volatilization (or stripping)* – the rate at which this occurs follows a first-order kinetic mass transfer process and is dependent upon the pH, temperature, hydraulic retention time (HRT) and mixing conditions; at low temperatures and well mixed conditions, stripping will be the main process for ammonia reduction.

- *Assimilation into algal biomass* – the rate at which this occurs will depend upon temperature, organic loading, HRT and wastewater characteristics.

- *Biological nitrification* – low nitrate and nitrite concentrations typically found in pond effluents suggests that nitrification does not account for a significant mechanism of reduction

Table 2 – Summary of Current Conditions for Freshwater Treatment Basins

	Influent (E-1)	Basin 2A (Effluent)	Basin 2B (Effluent)
Influent Flow, mgd			
Average Day Flow	3.1		
Maximum Month	4.0		
Max Day Flow	5.2		
Permitted Peak Hour	20		
Average cBOD, mg/L	7		
Average pH	7.2	8.6	8.8
Average Temperature, deg C	22	17	17
Total Ammonia Average Monthly, mg/L-N			
Basin No. 1 Influent	42		
Average Monthly		15	10
Maximum Day		33	27
Average Monthly Nitrate, mg/L	0.3	0.41	0.31

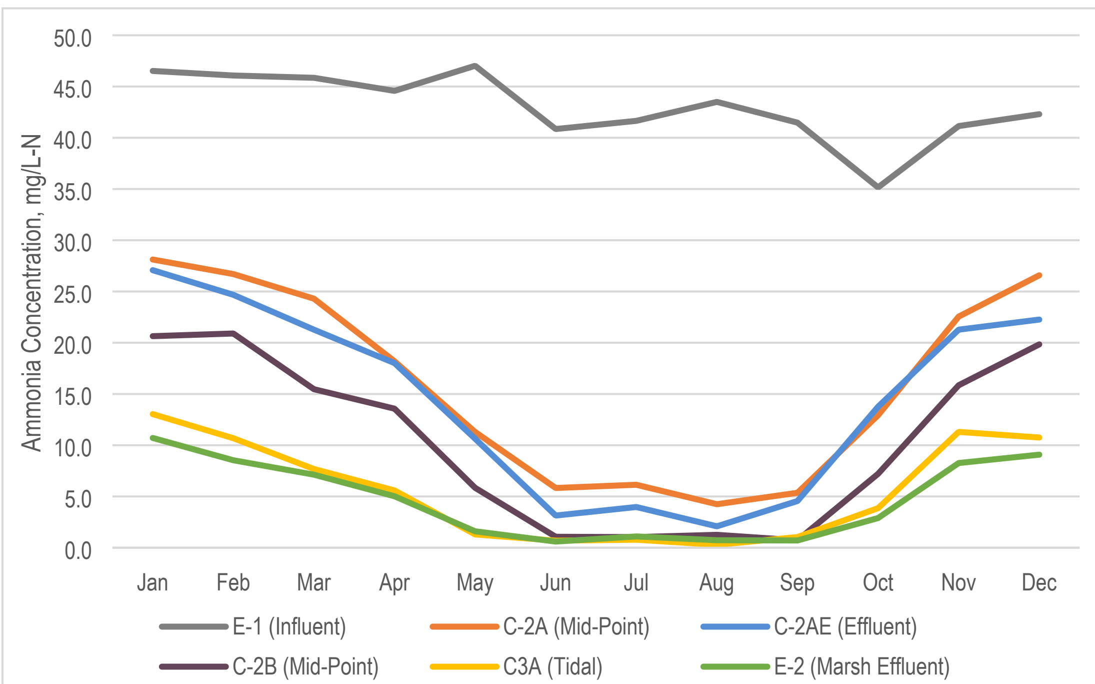


Figure 3. Ammonia Concentration Across the Treatment Basins

Figure 4 illustrates the ammonia removal across the freshwater treatment basins (Basin Nos. 1, 2A and 2B) as well as across the entire marsh system in relation to the average monthly flow, temperature and pH through the basins. The influent flow varies from roughly 1.5 million gallons per day (mgd) to 4 mgd equating to a range in HRT of 25 to 70 days. The longer detention times happen to be occurring during the colder months, when the rate of ammonia reduction is kinetically slower; the longer detention times likely contribute to more ammonia reduction than would typically be realized in winter conditions. The pH is relatively constant within the treatment basins, shifting between 8.5 and 9.5, but well within the alkaline region. Alkaline pH shifts ammonia (pK_a 9.2) towards the unionized form favoring volatilization, or stripping of ammonia.

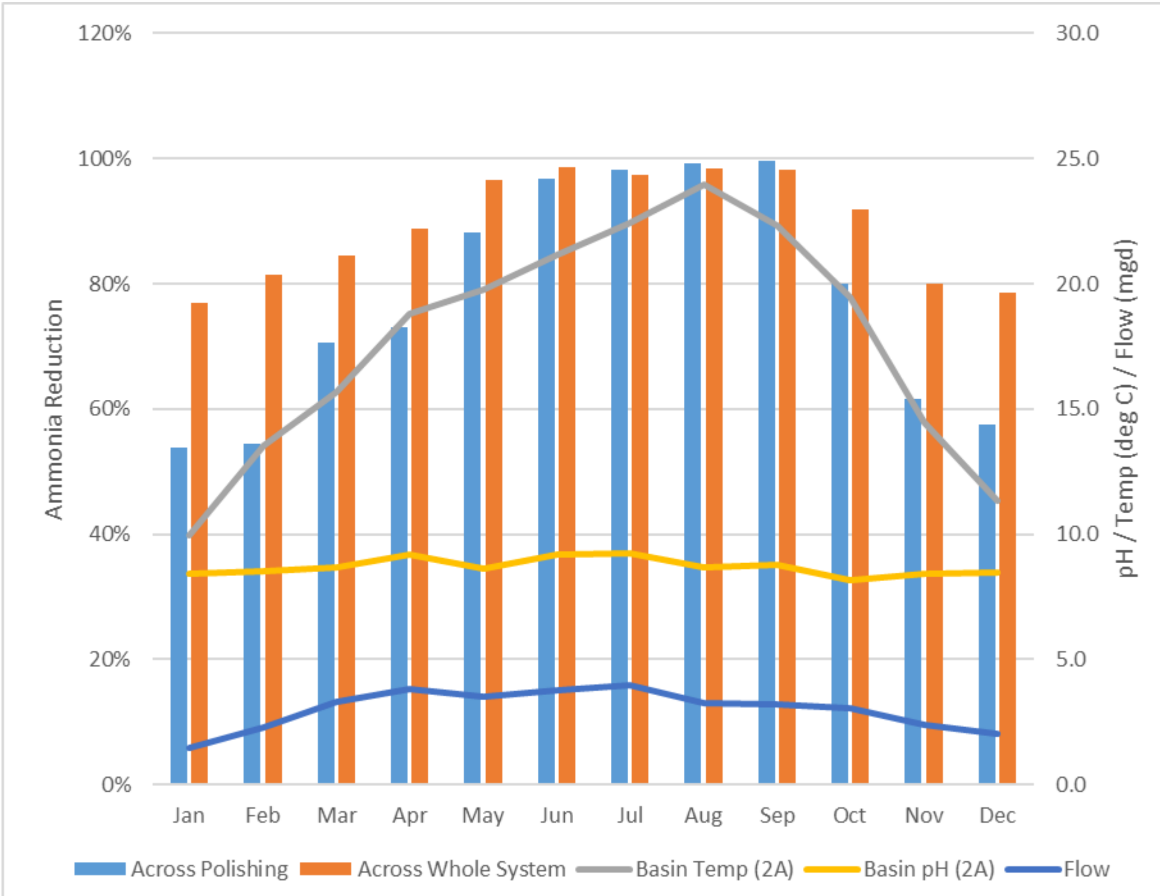


Figure 4. Ammonia Reduction in Relation to Flow, Temperature and pH

While the mechanisms noted above suggest pathways in which ammonia is removed from the system, ammonia can also be released from the system as well. Ammonia that is taken up by algae can be released from algae cells that have settled to the bottom of the pond; as this decay occurs, the ammonia as well as organic nitrogen can be re-released into the water column.

Attempting to quantify the various mechanisms that contribute to ammonia reduction and the degree to which they are occurring is difficult. A first-order kinetic reaction equation is available to model the contribution from volatilization of ammonia based upon HRT (d), temperature and pH (EPA, 2011). This equation (Equation 1) can be used to estimate the contribution from volatilization for Basin Nos. 1, 2A and 2B under the current configuration. Those estimated values are plotted against the actual effluent values in Figure 5.

Equation 1

$$N_e = N_o e^{-K_T[t + 60.6 * (pH - 6.6)]}$$

Where:

N_e = effluent nitrogen, mg/L
N_o = influent nitrogen, mg/L

N_e = effluent nitrogen, mg/L
K_T = temperature dependent rate constant = $K_{20}\,(\theta)^{(T-20)}$
K_{20} = rate constant at 20 deg C = 0.0064
Θ = 1.039
t = detention time in the system, d
pH = pH of near surface bulk liquid

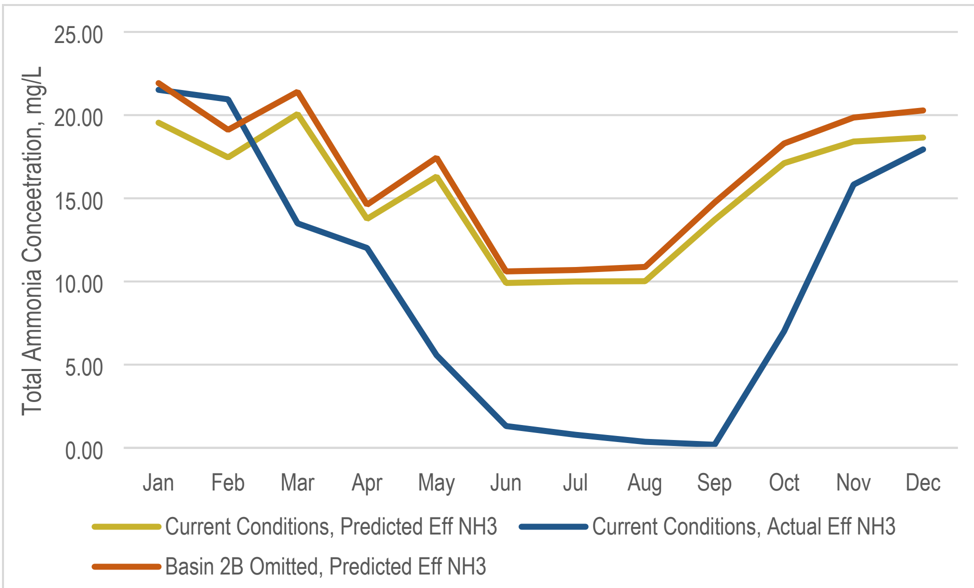


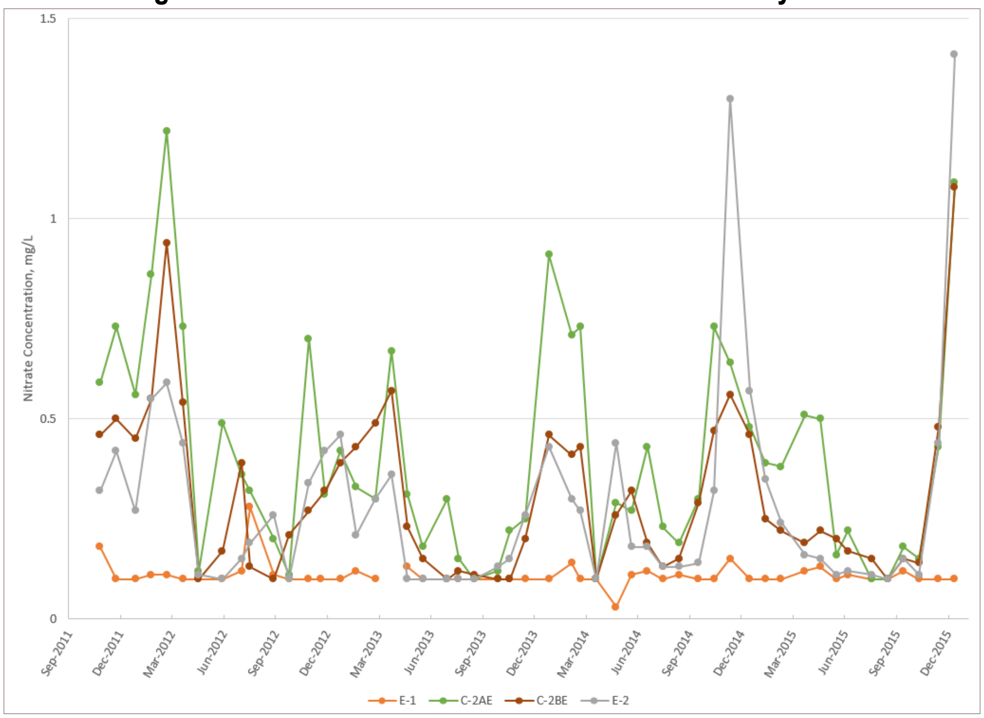
Figure 5. Estimated Effluent Ammonia Concentrations due to Volatilization

From Figure 5, the predicted ammonia effluent concentration due to volatilization (orange line) is significantly (5-10 mg/L-N) higher than the actual effluent ammonia concentration (blue line) observed. From this, it is evident that volatilization is not the only mechanism for ammonia reduction in the marsh system. Uptake by algal biomass is also likely involved as well. Algal growth typically occurs when the HRT of a facultative type pond is greater than 3 to 5 days. Given that the detention time of the smallest basin, Basin No. 1, is between 5 and 9 days, it is possible that there is algal growth within this pond system during the warmer months, though significant algae has not been observed from the surface. Algal growth will contribute to the uptake of ammonia. Additionally, the diurnal affect of algae on dissolved oxygen (DO) will contribute to nitrification. During daylight hours, algae will be a source of DO near the water surface while at night, respiration occurs reducing DO.

Recognizing that nitrification might be occurring to some degree within the system, nitrate concentrations across the ponds were summarized seasonally to determine the potential effect. Figure 6 shows the influent to the marsh (E-1), Basin No 2 effluent (C-2AE, C-2BE) and overall system effluent (E-2) nitrate concentrations. From Figure 6, a slight rise in nitrate concentration occurs in the winter months, potentially indicative of nitrification occurring taking place. This could be related to the better mixing conditions (i.e., higher DO levels) due to increased wind/weather in the winter. In the summer months, it is likely that any nitrate that is forming through nitrification is being denitrified and released causing the nitrate values to drop back to nearly ambient levels.

Unfortunately, there are no well-established models to predict the level of ammonia reduction due to algal growth and natural nitrification within a pond system.

Figure 6. Nitrate Concentrations across the Marsh System



1.4 Achieving Ammonia Reduction in Proposed Configuration

Drawing upon the analysis of the current ammonia reduction profile and possible mechanisms already noted, Woodard & Curran was tasked with determining whether the effluent total ammonia target of 1 mg/L-N could be achieved if Basin No. 2B was converted to a brackish basin and if so, how.

According to Equation 1, the volatilization of ammonia is dependent upon the HRT, pH and temperature of the basin. Therefore, if the HRT is reduced, as shown in Table 3, for the proposed configuration, there is a possibility that the volatilization of ammonia would also be reduced. Using Equation 1, the predicted volatilization could be calculated on a monthly basis for the proposed configuration (i.e., less HRT) and is plotted in Figure 5 (grey line), along with the predicted reduction in ammonia due to volatilization in the current configuration (blue line). As shown in Figure 5, there is very little difference in the predicted ammonia volatilization rate with the reduction of HRT, indicating that kinetically, volatilization is much more dependent upon pH and temperature than shifts in detention times.

Again, from Figure 5, volatilization appears to be provide only a portion of the overall ammonia reducing mechanism, reducing ammonia by approximately 50% in the winter months and approximately 75% in the summer months. It is apparent that other mechanisms are further reducing the ammonia an additional 20-25% during elevated pH and temperature conditions. Unfortunately, there is no predictive way to model those reductions.

Table 3 – Proposed Configuration for Hayward Marsh

	Basin No. 1	Basin No. 2A	Total
Approximate Volume, MG	28	36.5	64.5
Proposed HRT, days			
Average Day Flow (3.1 mgd)	9.1	11.8	21.9
Max Month Flow (4.0 mgd)	7.1	9.1	16.2
Max Day Flow (5.2 mgd)	5.4	7.0	12.4

It is interesting to note, from the ammonia concentration profiles shown in Figure 3, the ammonia concentration at the mid-point of the basin (in either Basin No. 2A or 2B) is nearly the same as the effluent concentration in each basin. This suggests that the majority of the ammonia reduction is occurring within Basin No. 1 and the first ½ of Basin No. 2A or 2B. If that is true as the data suggests, then it is possible that Basin No. 2A has additional 'capacity' for ammonia removal within the basin, at least within the summer months at more favorable temperatures and pH. Just based upon volume, it is possible that 2 times the flow could be routed to Basin No. 2A with potentially the same result. More total ammonia data would need to be collected to create a better profile of ammonia removal within Basin No. 2A to definitively analyze whether this scenario is viable.

During the winter months, however, there is still a significant portion of the total ammonia that would need to be removed by other mechanisms. Given that volatilization and ammonia uptake due to algae growth is low in the colder months, the remaining mechanism for ammonia reduction is nitrification. In order to create appropriate conditions for nitrification during the winter months, added DO, in the form of aeration or increasing the apparent detention time significantly would be necessary.

1.4.1 Addition of Mechanical Aeration

In order to achieve consistent ammonia reduction within a pond system, complete mixing is recommended to keep the biomass in suspension, improve oxygen transfer, and promote adequate nitrifier growth. Ideally, this complete mix system would be followed by a quiescent zone that would promote settling and even include a recirculation loop to aid further in nitrification and denitrification. This is similar to the process in a conventional activated sludge system.

A partially mixed system, on the otherhand, could result in significant zones of low DO reducing the overall nitrification efficiency and ammonia reduction. Another factor that can inhibit nitrifier growth in a pond system is the low food to microorganism (F:M) ratio. In a post-secondary pond system, the F:M ratios are low; in a partially mixed system, there is the added difficulty of insufficient opportunities for food and microorganisms to come into contact. Finally, even in fully aerated conditions, nitrification rates are reduced at lower temperatures. The rate at 16 deg C is roughly 50% of the rate at the optimal temperature of 30 deg C.

Based upon these factors and in discussions with aerator manufacturers, the best option for a complete mix system is using diffused air, comparable to a more conventional aeration basin. However, the shallow sidewater depths of Basin No. 1 and 2A preclude the application of diffused aeration equipment. Mechanical surface aerators are the only viable option given the physical characteristics of these basins. To achieve complete mixing with surface aeration requires a significant number of floating aerators [roughly 30 horsepower (HP) / million gallons (MG)].

Less aeration could be installed, equivalent to the air required to achieve nitrification alone (i.e., 4.6 pounds per day of O_2 for every 1 pound per day of ammonia reduced or roughly 4-8 HP / MG); however, this would then result in a partially mixed system with the issues noted above. While it would be expected that the total ammonia would be reduced over and above that which is currently happening, the manufacturers would offer no guarantee on meeting the target value, especially in the winter months.

Three manufacturers of surface aerators were contacted as part of this study: Solar Bee, Aqua-Aerobics and Blue Frog. Only the latter two would provide a conceptual level design for aeration needed to provide complete mixing of these basins. Only Blue Frog felt that their technology could consistently meet the target effluent requirements, even in the colder months.

Blue Frog offers a hybrid surface aerator with an attached growth media in the form of a submerged net surrounding the aerator. The presence of the attached growth media increases the oxygen transfer rate, improving the food to microorganism ratio and effectively increasing the HRT of the system which greatly enhances nitrifier growth. According to the manufacturer, they may be able to reduce the total ammonia to target levels even with the normal fluctuation of temperature and pH using much less aeration energy than the standard surface aerators in a complete mix system. Additional research into the validity of the manufacturer's claims and performance is needed but this might be a viable mechanical option to explore further.

A summary table of the key components of the aeration equipment proposed is included in Appendix A with their respective equipment cost proposals.

1.4.2 Nitrifying Filter Bed

Literature suggests that adding an attached-growth type media (typically coarse gravel) to the pond system could yield additional ammonia reduction. The media, approximately 1 to 2 feet in depth added to either the influent or effluent of the basin, provides a surface for the nitrifiers to grow (improving the food to microorganism ratio) as well as greatly increases the uniformity with which dissolved oxygen is added into the entire flow of the system, improving the mixing conditions. Wetland effluent is recycled back to the filter bed with a recycle ratio determined based on maintaining oxygenation throughout the profile of the filter bed. Several conditions are required for successful nitrification performance including:

- sufficient alkalinity (10 mg/L alkalinity per 1 mg/L ammonia);
- BOD to TKN ratio of less than 1; and
- maintaining moist media without flooding that creates saturated conditions.

There have been successful installations in at least 3 other free water surface wetlands in the U.S. of a nitrification filter bed that resulted in effluent concentrations of total ammonia between 0 to 6 mg/L (starting from an influent of 20 mg/L) even in winter conditions (Reed, 2014). This is a non-proprietary system developed by Sherwood Reed, a well-known wetlands expert. There are also a number of other proprietary systems available that are based upon the same concept. However, the nitrification filter bed seems to be the simplest in its approach.

1.5 Conclusions and Next Steps

Based upon the review of 5 years of historic performance of the Hayward Marsh as presented above, the existing polishing basins (Basin Nos. 1, 2A and 2B) are currently reducing the total ammonia concentration during warm weather conditions to nearly the target level of 1 mg/L-N. There may be opportunity to push the entire flow through Basin Nos. 1 and 2A in the proposed configuration. However, because it is difficult to model all of the ammonia reduction pathways taking place and therefore the impact of reduced retention time on those pathways, more field data would be needed to predict this with more certainty. It may be that reducing the flow routed to the Basins during the warm weather months will be needed to more consistently meet the target of 1 mg/L-N. This could be better determined with additional data.

While adding traditional surface mechanical aerators seems to not be cost-effective in this application, two fixed-film alternative modifications that have shown promise in increasing the nitrification potential could be explored further: nitrification filter beds and the Blue Frog hybrid aerator. Additional investigation into these technologies would be needed to understand their potential effectiveness for this application.

Woodard & Curran recommends the following next steps:

- Perform additional sampling over a period of 1 to 2 months in a warm weather period, where significant total ammonia reduction occurs. Sampling should be done to be able to create a profile of total ammonia concentration across the length of the flow path in Basin Nos. 1 and 2A. Flow path in Basin 1 is dictated by a series of baffle walls. An assessment of the flow path and potential for short circuiting in both marshes should be assessed. Recommended sampling locations include influent, mid-point and effluent of both basins as well as at quarter and three-quarter lengths along Basin No. 2A. Include sampling for BOD and alkalinity.

- Request additional information from Blue Frog Technologies about their patented technology and the potential for application at the Marsh to understand their predicted performance, lifecycle costs and maintenance requirements.

- Investigate the conceptual performance, feasibility, and capital and operating cost of the addition of a nitrifying bed filter at the influent to Basin No. 2A.

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Environmental Protection Agency (EPA, 2011). *Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers and Managers.* EPA/600/R-11088, August, 2011.

Reed, S. C., Crites, R. W., and Middlebrooks, E. J. (2014). Natural Systems for Waste Management and Treatment, 2nd ed., ISBN 0-07-060982-9, McGraw-Hill, New York.

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APPENDIX A

Manufacturer	Type & Number	Power	Additional Equipment	Ammonia Target	Equipment Cost
Blue Frog(1)	Blue Frog horizontal hybrid aerators (5) Yellow Frog efficient horizontal aerators (10)	Blue Frog (3 HP) Yellow Frog (4.25 HP)	Growth Matrix Spokes with SS floating frame (10) attached to Yellow Frog Mixers	2 mg/L(2)	$603,000
Blue Frog(3)	Blue Frog horizontal hybrid aerators (5) Yellow Frog efficient horizontal aerators (14)	Blue Frog (3 HP) Yellow Frog (4.25 HP)	Growth Matrix Spokes with SS floating frame (14) attached to Yellow Frog Mixers	1 mg/L(2)	$774,000
Aqua Aerobics(4)	60 HP Aerators (15) 25 HP Aerator (44)	60 HP 25 HP	None specified	N/A	$1.2 Million

(1) All aerators placed in Basin No. 1.
(2) As provided by the manufacturer.
(3) All Blue Frog / 10 Yellow Frog aerators placed in Basin No. 1; 4 Yellow Frog aerators placed in Basin No. 2A.
(4) 60HP Aerators placed in Basin No. 1; 25 HP Aerators placed in Basin No. 2A.

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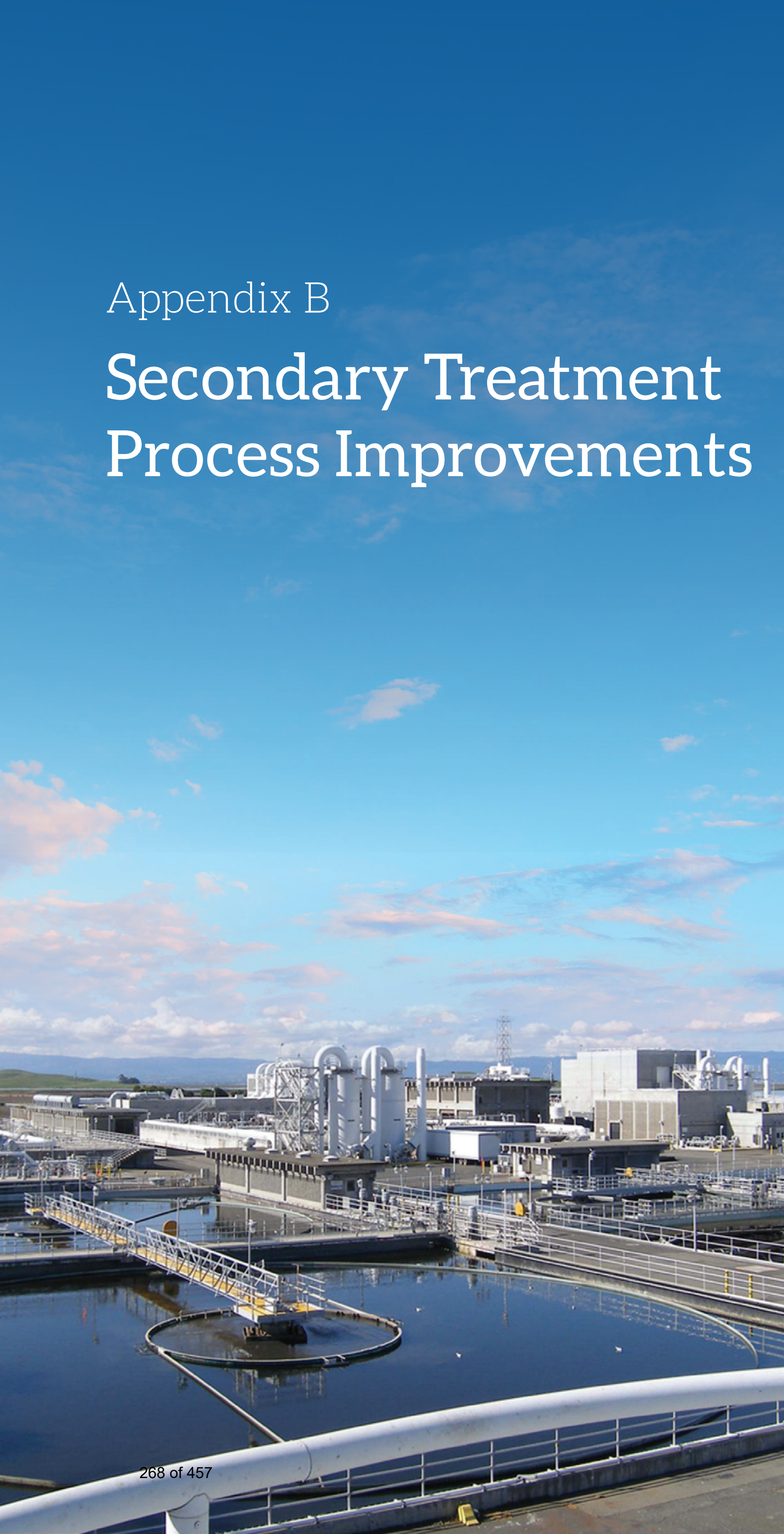
Appendix B

Secondary Treatment Process Improvements



B

Union Sanitar y District's
Enhanced Treatment and Site Upgrade Program

August 2019

To: Union Sanitary District: Curtis Bosick, PE, and Raymond Chau, PE

From: Hazen: Paul Pitt, PE, and Irene Chu, PE

Reviewed By: Hazen: Marc Solomon, PE

Re: Secondary Treatment Process Improvements Final Report

Secondary Treatment Process Improvements

Final Report

Revision No.	Date	Description	Author	Reviewed
1	4/29/2019	Draft Report for Review	I. Chu, P. Pitt	R. Latimer A. Griborio J. Rohrbacher M. Solomon
2	5/26/2019	Internal Review	I. Chu	A. Gale
3	5/31/2019	Draft Report for District Review	I. Chu	District
4	7/11/2019	Final Report with District Comments	I. Chu	M. Solomon P. Pitt
5	8/15/2019	Final Report with District Second Round of Comments	I. Chu	M. Solomon

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List of Abbreviations

Abbreviation	Meaning
AA	Average Annual
AACE	American Association of Cost Engineers
AAF	Average Annual Flow
ADWF	Average Dry Weather Flow
AWWTP	Alvarado Wastewater Treatment Plant
BACWA	Bay Area Clean Water Association
BNR	Biological Nutrient Removal
C	Celsius
CAS	Conventional Activated Sludge
cBOD	Carbonaceous Biochemical Oxygen Demand
CCT	Chlorine Contact Tank
CFD	Computational Fluid Dynamics
COD	Chemical Oxygen Demand

Conc	Concentration
d	Day
EBDA	East Bay Dischargers Authority
EBRPD	East Bay Regional Park District
EQ	Equalization
ft	Foot
gfd	Gallons per Square Foot per Day
gpd	Gallons per Day
lbs	Pounds
lbs/d	Pounds per Day
lbsN/d	Pounds per Day of Nitrogen
lbsP/d	Pounds per Day of Phosphorus
M	Million
mgd	Million Gallons per Day
mg/L	Milligram per Liter
MBR	Membrane Bioreactor
MG	Million Gallons
ML	Mixed Liquor
MLE	Modified Ludzack Ettinger
MLSS	Mixed Liquor Suspended Solids
MM	Maximum 30-day
MW	Maximum 7-day
NH_3-N	Ammonia
NO_3-N	Nitrate
NO_2-N	Nitrite
NRCY	Nitrified Recycle
NTP	Notice to Proceed
OAC	Old Alameda Creek
P	Phosphorus
PE	Primary Effluent
PF	Peaking Factor
PFD	Process Flow Diagram
PO_4-P	Orthophosphate
RAS	Return Activated Sludge
sf	Square Foot
SOR	Surface Overflow Rate
SLR	Solids Loading Rate
SE	Secondary Effluent
SRT	Solids Retention Time
SSCAR	Solids System Capacity Assessment Report

SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SWAS	Surface Waste Activated Sludge
TIN	Total Inorganic Nitrogen
TKN	Total Kjeldahl Nitrogen
TMDL	Total maximum daily limit
TN	Total Nitrogen
TP	Total Phosphorus
TRC	Total Residual Chlorine
TSS	Total Suspended Solids
USD	Union Sanitary District
WAS	Waste Activated Sludge
WW	Wet weather

1. Introduction

The Union Sanitary District (District) owns and operates the Alvarado Wastewater Treatment Plant (AWWTP), a conventional activated sludge (CAS) plant. The AWWTP has an average dry weather flow (ADWF) of 23-mgd and is permitted through the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) to discharge 33-mgd ADWF to the East Bay Dischargers Authority (EBDA) common outfall. Under peak flow conditions the plant may discharge an average of 42.9-mgd over a 24-hour period to the EBDA outfall and up to 20-mgd to the Hayward Marsh.

1.1 Process Description

Raw wastewater from the Irvington, Newark and Alvarado pump stations combines in the headworks building where it is measured and screened. Flow from the headworks is split by Control Box 1 to six square primary clarifiers (Primary Clarifiers 1-4 in the west and Primary Clarifiers 5 and 6 in the east). Primary Effluent (PE) is combined and distributed to the secondary treatment system by Control Box 2. PE from Control Box 2 is pumped by Primary Effluent Lift Station 1 (east) and 2 (west). Pumped PE is combined with Return Activated Sludge (RAS) just downstream of each lift station, and the MLSS is distributed to each aeration basin. The aeration effluent MLSS from the Aeration Basins 1-4 (east) and Aeration Basins 5-7 (west) are combined at Control Box 4 and subsequently split for distribution to the six square secondary clarifiers. Secondary Clarifiers 1-4 (west) are 90-ft in (inscribed) diameter and Secondary Clarifiers 5 and 6 are 120-ft in (inscribed) diameter. Effluent from the clarifiers is combined and disinfected in the chlorine contact tanks. Chlorinated effluent passes through polishing screens and is pumped via the EBDA pump station.

Effluent from the EBDA pump station is conveyed through the EBDA force main. A valve box on site allows pumped flow to be diverted to Old Alameda Creek (OAC) in certain discharge situations. The District discharges to Old Alameda Creek during annual testing of the emergency system but has not discharged in an emergency capacity since the 1990's. Downstream of the valve box, flow can be diverted from the EBDA force main at a location off-site to the Hayward Marsh. Flow to Hayward Marsh is dechlorinated in the line to the Marsh. Flow conveyed to the EBDA outfall is dechlorinated at EBDA facilities.

1.2 Drivers for Project

The District has initiated the Enhanced Treatment and Site Upgrade Program to address several issues at the plant. The drivers for the project include:

1. Capacity Improvements
2. Wet Weather Effluent Discharge
3. Aging Infrastructure
4. Synergy with Future Nutrient Removal

1.2.1 Capacity Improvements

In 2017, the District performed a capacity analysis of the existing liquid treatment system to determine if the Alvarado WWTP has capacity to treat the permitted flow of 33-mgd. It was concluded that the WWTP is at capacity at current ADWF and cannot reliably treat peak hour flows due to poor settling of the activated sludge.

1.2.2 Wet Weather Effluent Discharge

The Hayward Marsh, owned and operated by the East Bay Regional Park District (EBRPD), receives and further polishes, AWWTP plant effluent that is not discharged to the EBDA outfall. During dry weather, approximately 2.6-mgd of AWWTP effluent is pumped to Hayward Marsh as a fresh water source for the Marsh. During wet weather, AWWTP can discharge up to 42.9-mgd, daily average flow total; flows greater than this are diverted to the Hayward Marsh. EBRPD has decided to imminently convert the Hayward Marsh to a recreational facility. As such, the District needs a wet weather effluent discharge alternative to the Hayward Marsh.

1.2.3 Aging Infrastructure

In addition to the capacity, effluent, and nutrient removal drivers, the AWWTP is also facing aging infrastructure drivers. While upgrades to the various systems have been completed, major infrastructure repairs are still required. A structural evaluation completed in 2013 noted that the east aeration basin covers need repair. Several of the buildings at the AWWTP need significant seismic repairs. The Enhanced Treatment and Site Upgrade Project affords the District the opportunity to address these aging infrastructure drivers while addressing the capacity and effluent disposal needs.

1.2.4 Synergy with Future Nutrient Removal

The District is currently permitted to discharge to Old Alameda Creek if flow to EBDA and the Hayward Marsh is maximized. With the future loss of the Hayward Marsh as a secondary discharge point, the District is interested in permitting the Old Alameda Creek discharge point to discharge effluent flows greater than 42.9-mgd. Initial discussions with SFBRWQCB indicated that the Board may permit more frequent discharge to Old Alameda Creek if the District achieves some level of nutrient removal at AWWTP. While the degree of nutrient removal required for discharge to Old Alameda Creek is currently being evaluated, nutrient removal has been accommodated for in the Enhanced Treatment and Site Upgrade Program.

The District wishes to address the immediate drivers (capacity, effluent disposal and aging infrastructure), while preparing for potential future nutrient regulations such as BACWA (Bay Area Clean Water Association) Level 2 standards. The District understands that planning for future nutrient removal while developing the Enhanced Treatment and Site Upgrade Program will minimize stranded assets.

1.3 Context of other Projects

The Secondary Treatment Process Improvements described in this report are a subset of the Enhanced Treatment and Site Upgrade Program. The improvements have been developed in context of several ongoing or recently completed studies and projects. These include the following:

- The overall Enhanced Treatment and Site Upgrade Program
- Standby Power Generation System Project
- Primary Digester No. 7 Project
- Odor Control Alternatives Study
- Plant Solids System/ Capacity Assessment Report (SSCAR)

Where appropriate this analysis utilized and or built upon the information from these reports.

1.4 Purpose of this Document

The purpose of this report is to document the approach, assumptions and analysis to derive the best value solution for the District. This report will summarize the recommended project elements, sequencing and AACE Class IV level estimate of probable construction cost.

2. Approach

The following section describes the approach to arriving at the best-value solution for the Secondary Treatment Process Improvements to address the near-term and long-term drivers.

2.1 Historical Data Analysis

Five years of plant data were analyzed to develop the current influent flows, loads and peaking factors at the plant. Statistical analysis was performed to remove outliers from the calculations. Current flows and loads were escalated to develop design flows and loads. The current and design flows and loads are summarized in **Section 4 – Assumptions** and in **Appendix 2.**

Ten years of historical data was analyzed to understand plant performance. Loads, mass balances, and process calculations were performed. This data is summarized in **Section 3 – Historical Data and Special Sampling** and presented in detail in **Appendix 1.**

2.2 Process Modeling Tools

A whole plant process model and two computational fluid dynamics (CFD) models of the secondary clarifiers were used to evaluate alternatives for the Secondary Treatment Process Improvements.

2.2.1 Process Modeling

A BioWin™ version 4.1 process model of the Alvarado Wastewater Treatment Plant was developed for District as part of the Plant Solids System/Capacity Assessment Report. The process model was updated to BioWin™ version 5.3 as part of this Secondary Treatment Process Improvements analysis. A calibration check was performed during the update. The calibration check is presented in **Appendix 4**.

To support the process model calibration, special sampling was performed to supplement the routine process samples taken historically. This data is summarized in **Section 3 – Historical Data and Sampling** and presented in **Appendix 3. Figure 2-1** shows the updated process model flow sheet.

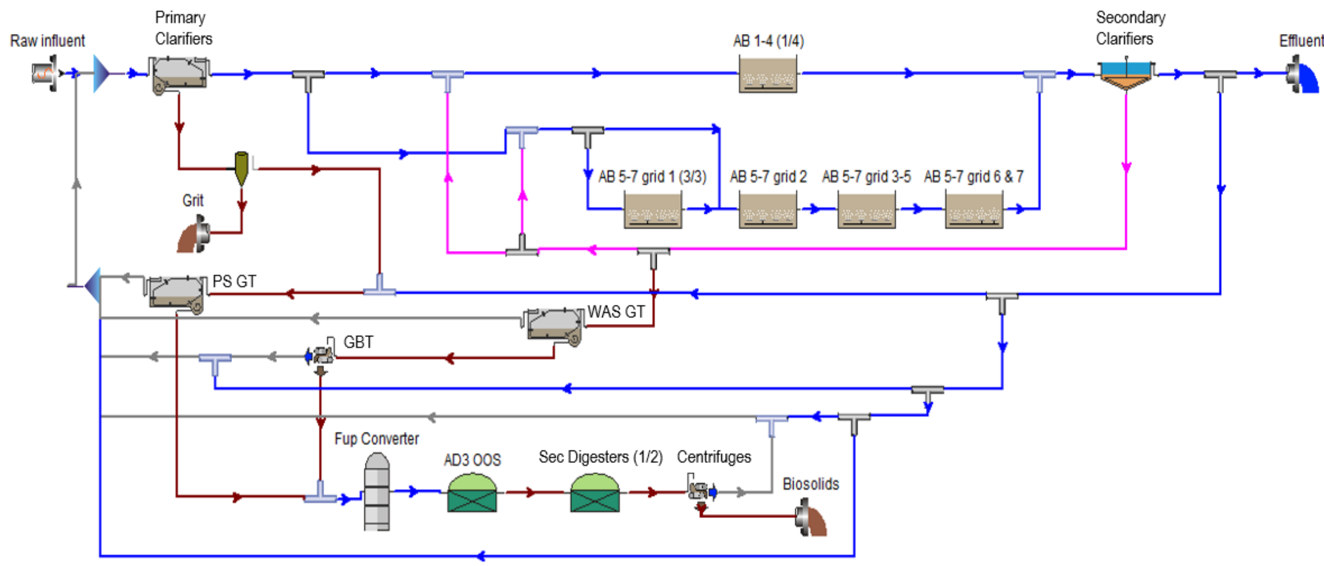


Figure 2-1 AWWTP Process Model

2.2.2 Computational Fluid Dynamic Modeling

Both a two-dimensional (2Dc) model and three-dimensional (3D) CFD model were used as part of this analysis. The 2Dc CFD model used in this project was developed at the University of New Orleans (McCorquodale et al. 2005, Griborio and McCorquodale 2006) while the 3D model was developed by Hazen (Griborio 2017). The models were customized to the dimensions and characteristics of the Alvarado WWTP secondary clarifiers. The governing equations for the model are based on the following principals: (1) continuity or conservation of fluid volume; (2) conservation of momentum; (3) conservation of mass of solids; (4) conservation of thermal energy; (5) modified mixing length turbulence closure scheme; (6) non-Newtonian flow related to the solids ratio; (7) flocculation due to the rate of dissipation of turbulent kinetic energy, velocity gradients, differential settling and filtration; and (8) discrete, zone compression settling.

To support model development extensive field testing, including clarifier stress testing, was performed at the Alvarado WWTP. This data is summarized in **Section 3 – Historical Data and Special Sampling** and presented in detail in **Appendix 5.** Model calibration to this field data is presented in **Appendix 6**. Note that since the AWWTP has two different types of clarifiers two models were developed for calibration.

2.3 Phased Approach

As the District is balancing near-term and long-term needs, a phased or programmatic approach to the Secondary Treatment Process Improvements has the potential to attenuate capital improvements over time. The benefits of implementing a phased approach is that later phases can be implemented when needed, preventing overbuilding. This is particularly useful for the District as timing of near-term drivers are well-defined, but the scope and timing of long-term drivers are not. Therefore, developing a trigger-based program optimizes capital expenditure for the District.

Table 2-1 Timing of Near-Term and Long-Term Needs

Need	Estimated Timing
Capacity	Presently
Aging Infrastructure	Presently
Discharge to Old Alameda Creek	1-2 Years
Nutrient Standards (BACWA Level 2)	15-20 years
Buildout Capacity (average annual flow = 33-mgd)	~30 years
More Stringent Nutrient Standards (BACWA Level 3)	~30+ years

Meeting the BACWA Level 2 nutrient standards was defined as a reasonable long-term goal for the program. The infrastructure to meet BACWA Level 2 standards for 2040 flows and loads is defined as Phase II presented in detail in **Section 6 – Long-term Solution Options**.

Adequate space was also identified to address potential future needs for more stringent nutrient standards (i.e. BACWA Level 3) for an annual average flow of 33-mgd (buildout conditions). **Section 6** documents, at a high level, a Phase III project to meet BACWA Level 3 standards for buildout conditions. This infrastructure is considered conservative place holder. It is recommended that as the analysis for and the definition of a Phase III project be revisited as technologies change, the standards become better defined, or as loading conditions warrant.

A subset of the long-term Phase II capital project, was defined for immediate implementation to address near-term needs; this was defined as Phase I. The potential Phase I and Phase II projects are discussed in **Section 7**. **Figure 2-2** illustrates the approach of defining a reasonable long-term solution (Phase II), working backwards to meet near-term goals (Phase I), and having a conservative place holder for potential needs in the far future (Phase III). Note that for this analysis costs were determined for Phase I (near-term) and Phase II (BACWA Level 2 standards for 2040 Loads) projects but not Phase III (BACWA Level 3 standards for buildout conditions). Costs are detailed in **Section 8 – Estimate of Probable Costs**.

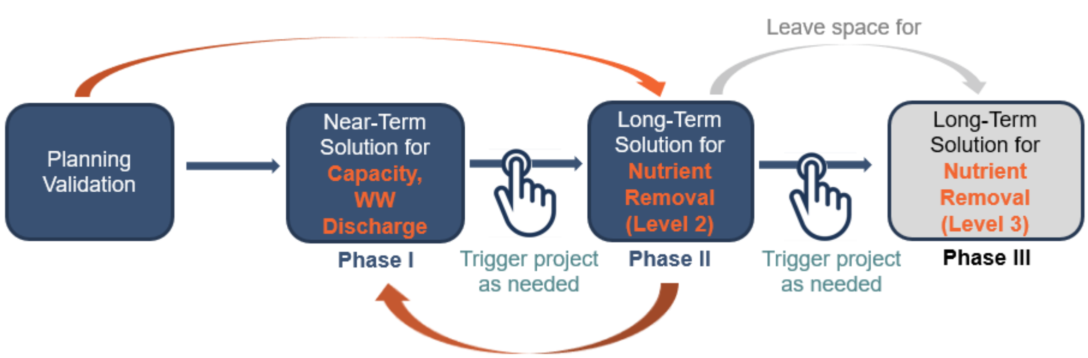


Figure 2-2 Trigger-Based Approach

3. Historical Data and Special Sampling

Ten years of historical data was analyzed to understand plant performance. Loads, mass balances, and process calculations were performed. Key parameters are summarized in this section and presented in **Appendix 1.**

Two plant specific models were developed to conduct the analysis of the AWWTP, the process model and the CFD models (2D and 3D). To support the process model calibration, special sampling was performed to supplement the routine process samples taken historically. To support the CFD model development extensive field testing, including clarifier stress testing, was performed. Key parameters are summarized in this section and presented in detail in **Appendix 3** and **Appendix 5** for the process model sampling and clarifier field testing respectively.

3.1 Historical Data Analysis

3.1.1 Influent Flows and Loads

Total plant flow may be calculated two ways at the AWWTP:

1. EBDA flow meter
2. Total influent flow as the sum of east and west partial flumes located at the headworks

The District has the noted that the EBDA flow meter is considered to be more accurate estimate of total plant flow measurement. This flowmeter was used in the analysis presented in this report. **Figure 3-1** shows the average daily EBDA Flow from 2008 to 2018.

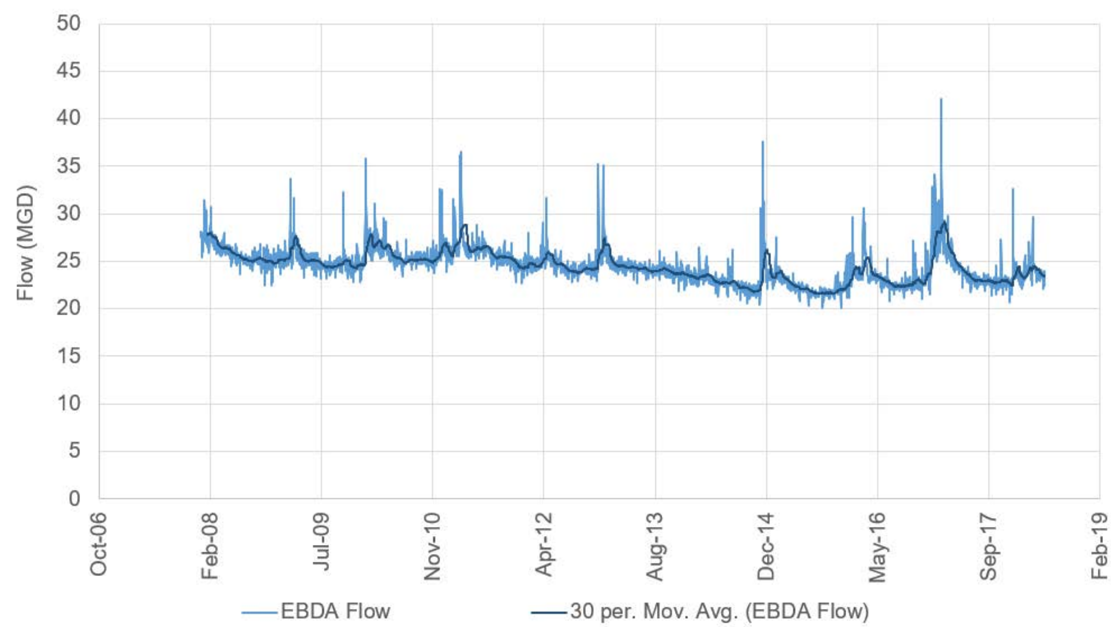


Figure 3-1 Historical Plant Flow

The average daily flow for this period was 24.4-mgd. Influent flows have remained relatively constant with a decrease from 2012 to 2014. **Figure 3-2** to **Figure 3-5** present unsorted historical influent concentration and load calculated based on the EBDA flowmeter data.

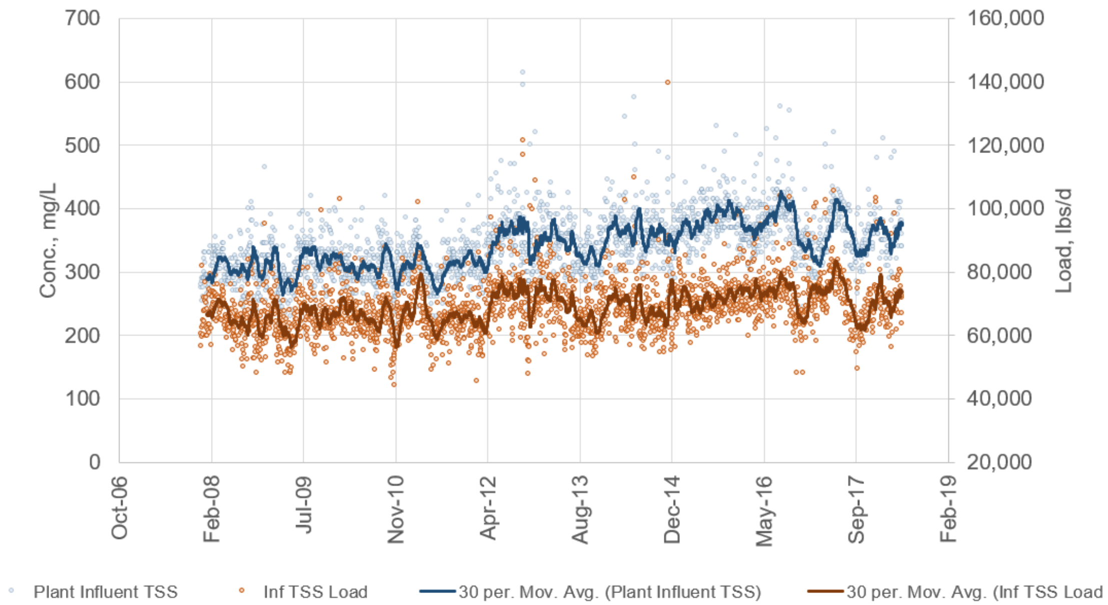


Figure 3-2 Historical Influent TSS Concentration and Load

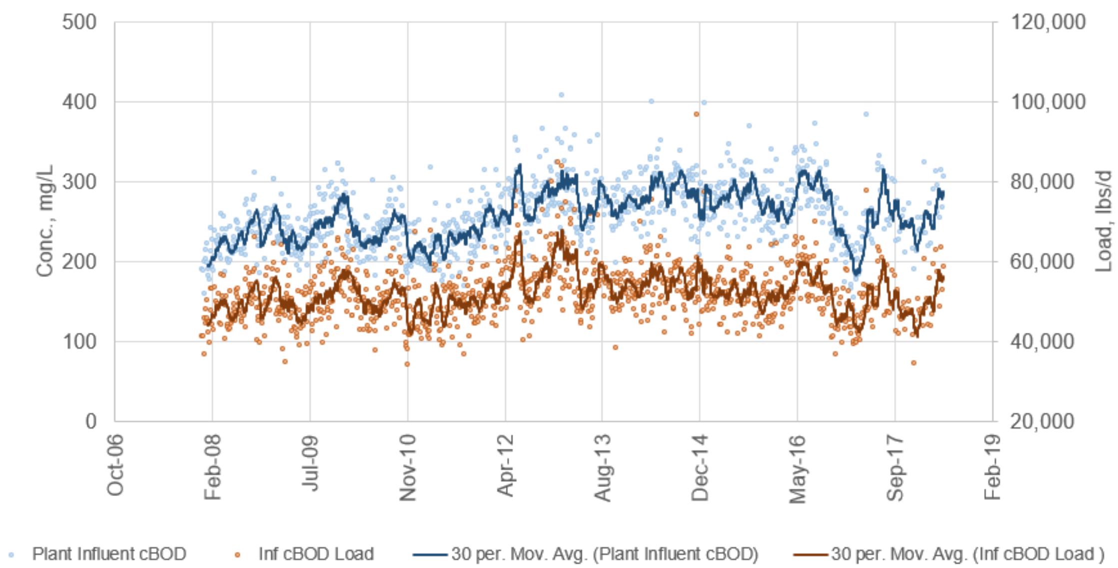


Figure 3-3 Historical Influent cBOD Concentration and Load

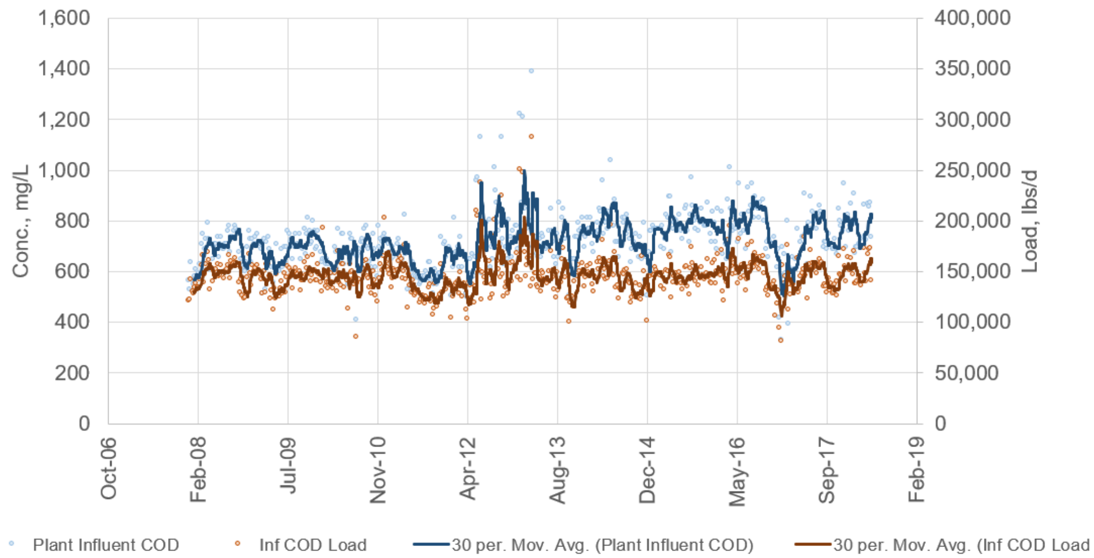


Figure 3-4 Historical Influent COD Concentration and Load

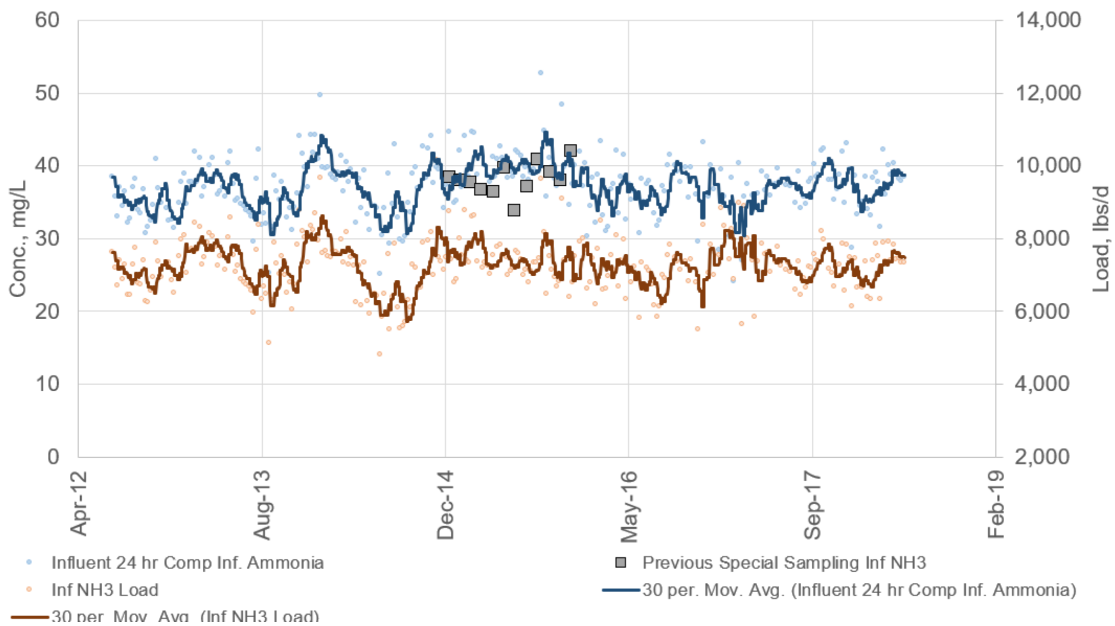


Figure 3-5 Historical Influent Ammonia Concentration and Load

While the data shows a slight increase in concentration and load from 2008 to 2012 for influent TSS, cBOD, and COD, the data shows relatively stable loads from 2012 – present. The limited influent ammonia also shows relatively stable loads from 2013 – present.

3.1.2 Sludge Settling Characteristics and MLSS

Due to the configuration of the aeration basins, the AWWTP typically operates with a high sludge volume index. **Figure 3-6** shows the historical SVI at the plant and **Table 3-1** summarizes the percentile data for SVI. The average SVI from 2008-2018 is 250 mL/g with the 90th percentile greater than 400 ml/g. The relatively high SVI at the plant has caused difficulties with settling at the plant. To address excessively high SVIs and improve settling, the plant at times applies hypochlorite to the RAS.

Table 3-1 Historical Sludge Volume Index Summary (2008-2018)

Percentile	SVI (mL/g)
50th	250
90th	404
95th	494
Flows >28-mgd	270

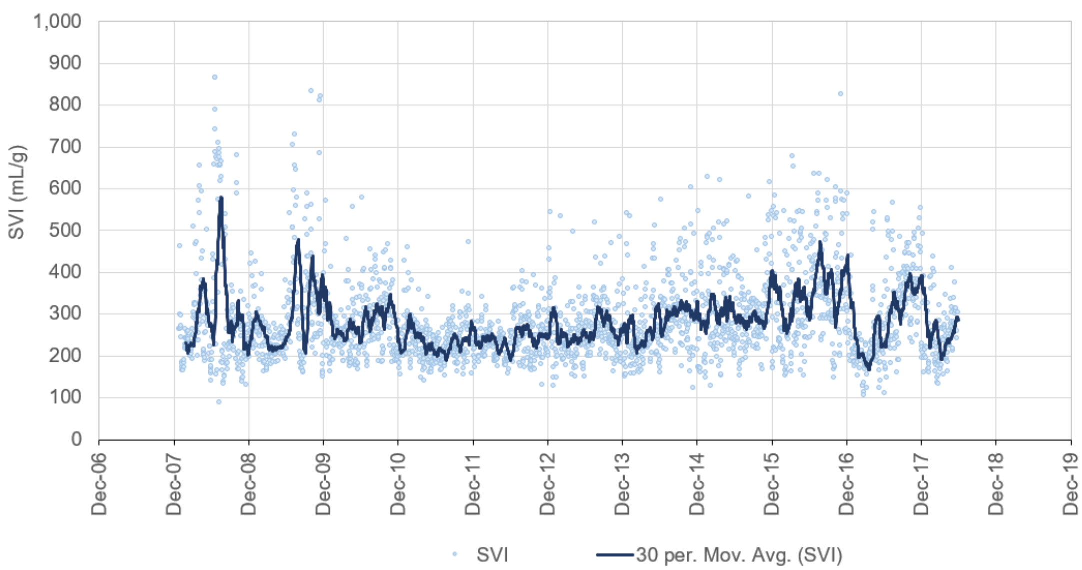


Figure 3-6 Historical Sludge Volume Index

Recently (2013-2018) the plant has operated with an average MLSS of around 1,300 ml/g (ranging between 1,200 mg/L and 1,500 mg/L) to maintain an aerobic SRT ~1.2 days for carbon removal. **Figure 3-7** shows the historical MLSS. While the MLSS results in a relatively low solids loading rate to the secondary clarifiers (7-10 lbs/d/sf on average), the relatively high SVI at the plant has caused difficulties maintaining effluent quality during storm events and effectively decreased the secondary capacity of the plant.

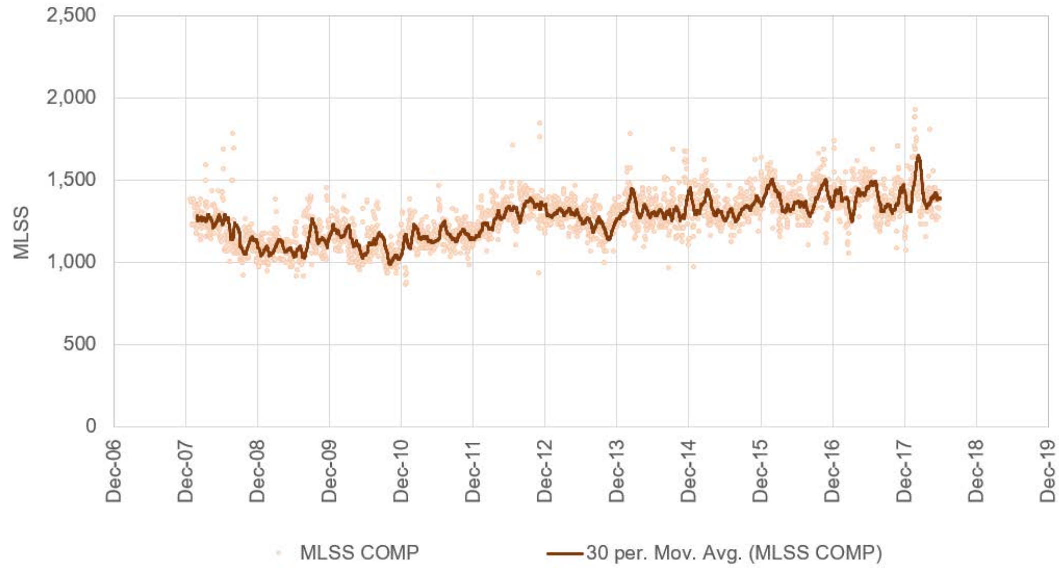


Figure 3-7 Historical MLSS

Despite the high historical SVI, the plant has maintained effluent quality and met effluent standards. **Figure 3-8** and **Figure 3-9** show the AWWTP historical effluent TSS and BOD respectively.

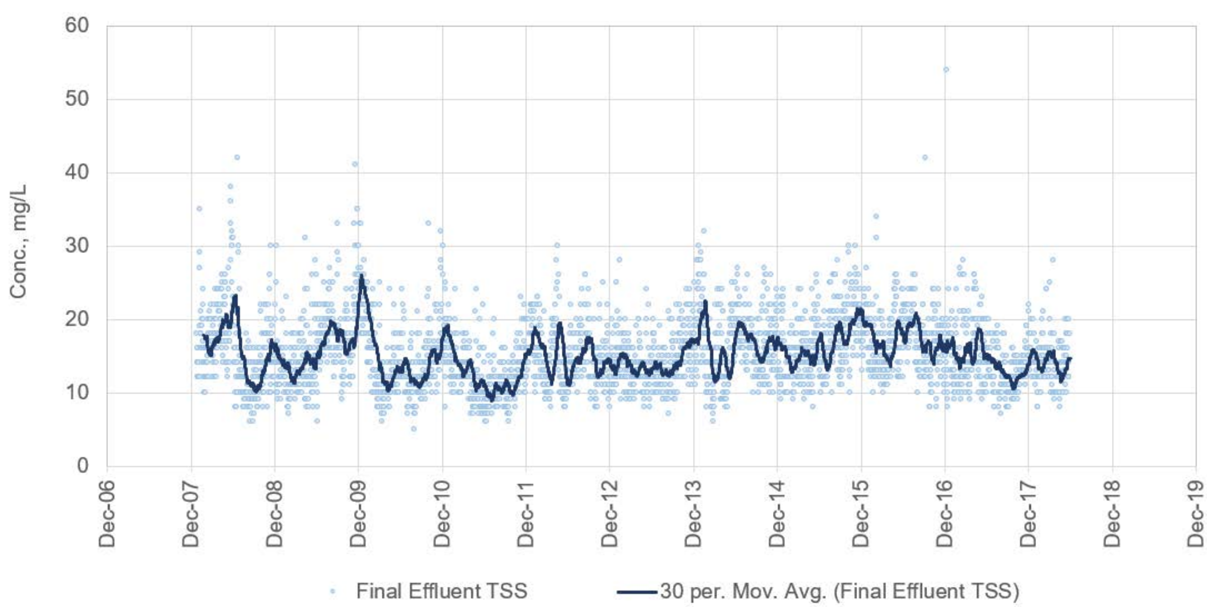


Figure 3-8 Historical Effluent TSS

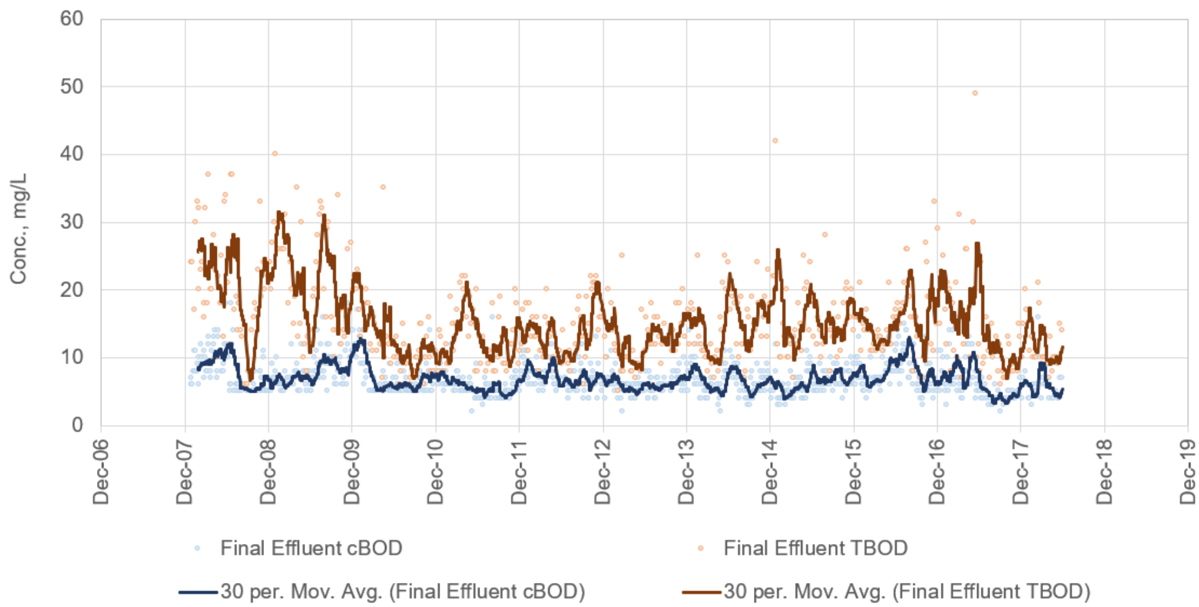


Figure 3-9 Historical Effluent BOD

The plant had a few instances with high effluent TSS, greater than 30 mg/L, and high effluent cBOD, greater than 25 mg/L. The monthly and weekly averages during these instances met permit standards. As noted in **Section 1** a driver for this project is to address capacity issues at the plant.

3.2 Special Sampling for Process Modeling

Special sampling to support the calibration of the whole plant process model was preformed from August 7 to August 13, 2018. The sampling included composite sampling, diurnal sampling and nutrient profiles (grab sampling). Key information is presented below.

3.2.1 Wastewater Influent

Influent composite samples were analyzed for BOD, cBOD, TSS, VSS, TKN, NH_3-N, TP, and PO_4-P. The average of the special sampling is presented in **Table 3-2.** Where comparisons can be made to historical data, the special sampling data matched well with historical averages. This indicates that the special sampling results are of good quality.

Table 3-2 Influent Composite Sampling Results

Percentile	Sampling Average	Historical Average
BOD_5, mg/L	262	NA
$cBOD_5$, mg/L	226	257
COD, mg/L	737	721
TSS, mg/L	332	341
VSS, mg/L	304	NA
TKN, mg/L	54	53
NH_3-N, mg/L	37	37
TP, mg/L	6.9	6.9
PO_4-P, mg/L	3.1	NA[1]

[1] Sampling conducted in 2016 to support the HDR watershed permit reporting included soluble reactive phosphate. This data was not included in this average.

The influent ammonia to TKN ratio was found to be 0.68. The COD to TP ratio was found to be 108 (mg/L COD)/(mgP/L). These ratios were used to develop influent nutrient loads based on historical data COD and ammonia data.

3.2.2 Wastewater Effluent

Effluent composite samples were analyzed for cBOD, COD, TSS, TKN, NH_3-N, and TP. **Table 3-3** shows the effluent composite special sampling results.

Table 3-3 Effluent Composite Sampling Results

Percentile	Sampling Average	Historical Average
COD, mg/L	48	51
TSS, mg/L	13	16
NH_3-N, mgN/L	40	39
TKN, mgN/L	44	46
TP, mgP/L	3.2	2.6

The special sampling results showed excellent agreement with historical average. The data shows there is not nitrification at the plant.

3.3 Clarifier Field Testing for Development of CFD Models

Clarifier field testing to support the calibration CFD model development was conducted from August 20 to August 24, 2018. The conditions of the testing are summarized in **Table 3-4**. On Day 3 and 4 of testing, clarifiers were gradually taken out of service to increase the surface overflow rate (SOR). On Day 3 a peak hour SOR of 1,350 gpd/sf was achieved by isolating east clarifiers. On Day 4 a peak hour SOR of 1,100 gpd/sf was achieved by isolating west clarifiers. Throughout testing the sludge volume index was between 250 and 400 mL/g.

Table 3-4 Clarifier Stress Testing Conditions

Parameter	Units	Day 1	Day 2	Day 3	Day 4	Avg.
MLSS	mg/L	1,030	1,100	940	900	1,000
SVI	mL/g	285	255	300	380	305
SLR	ppd/ft^2	6.9	7.2	9.7	8.5	8.0
RAS Rate	%	38%	37%	37%	37%	37%
Avg. SOR	gpd/ft^2	610	590	1,000	870	--
Max. SOR	gpd/ft^2			1,350	1,100	

A summary of clarifier performance during testing is presented in **Table 3-5**. Testing showed that the east clarifiers preformed more poorly than the west clarifiers. Clarifier 6 was pushed to failure on Day 4 causing the test to end at noon. The dynamic performance of the clarifiers during the testing was used for calibration and validation of the CFD models. **Figure 3-10** shows Clarifier 6 during stress testing.

Table 3-5 Clarifier Stress Testing Results

Parameter	Units	Day 1	Day 2	Day 3	Day 4	Avg.
C1	mg/L	13	11	11		12
C2	mg/L	11	11	11	15	12
C3	mg/L	9	10	12	17	12
C4	mg/L	11	10	12		11
ESS West	mg/L	11	11	11	16	12
C5	mg/L	15	12	14	17	15
C6	mg/L	16	14	18	31	22
ESS East	mg/L	16	16	16	24	18

Figure 3-10 Observed Loss of Solids at Clarifier 6 During Stress Testing

During testing it was found that Clarifiers 5 and 6 had leaking RAS seals. The amount of leakage during testing is not known. The clarifier RAS seals were fixed subsequent to testing in September and October of 2018.

4. Assumptions

The following section describes the assumptions used to frame analysis of the Secondary Treatment Process Improvements analysis.

4.1 Current Flows and Loads

A statistical analysis was performed on five years of plant historical data (June 2013 – May 2018) to determine flow and load peaking factors. For annual average (AA) peaking factors, data greater than two standard deviations were excluded from the calculation. For minimum day, maximum month, maximum 30-day (MM), maximum 7-day (MW), and maximum day (MD) values, data greater than three standard deviations were excluded from the calculations. Where appropriate, peaking factors were adjusted to account for drought years.

1. Current peaking factors for the daily effluent flow for the Alvarado WWTP are presented in **Table 4-1.**

Table 4-1 AWWTP Flows and Flow Peaking Factors

Flow Criteria	Historical	
	Flow (mgd)	Peaking Factor
Minimum Day	20.6	0.88
Average Annual	23.4	1.00
Maximum Month	25.8	1.10
Maximum 30-Day	25.9	1.11
Maximum 7-Day	28.5	1.22
Maximum Day	33.9	1.45

Annual average and maximum 30-day flows were used in this analysis. The maximum 30-day flow peaking factor was adjusted to 1.15 after excluding drought years from the average. This results in a more conservative maximum 30-day influent flow.

2. Current peaking factors derived from historical data for influent cBOD, TSS, COD, NH_3-N flow for the Alvarado WWTP are presented in **Table 4-2**.

Table 4-2 AWWTP Historical Average Load and Peaking Factors

Criteria	cBOD		TSS		COD		NH_3-N	
	Load (lbs/d)	PF	Load (lbs/d)	PF	Load (lbs/d)	PF	Load (lbs/d)	PF
Minimum Day	38,700	0.73	53,200	0.75	111,000	0.76	5,560	0.77
Average Annual	52,600	1.00	70,500	1.00	146,000	1.00	7,240	1.00
Maximum Month	59,200	1.13	76,800	1.09	159,000	1.09	7,920	1.09
Maximum 30-Day	60,500	1.15	78,900	1.12	166,000	1.13	8,190	1.13
Maximum 7-Day	66,900	1.27	89,100	1.26	166,000	1.13	7,670	1.06
Maximum Day	75,400	1.43	107,000	1.51	181,000	1.24	9,230	1.27

While the table shows the peaking factors derived from historical data, for this analysis, a 1.15 maximum 30-day peaking factor was used for cBOD, TSS, COD and NH_3-N.

4.2 Influent Nutrient Loads

The District is not required to and therefore does not typically sample influent Total Kjeldahl Nitrogen (TKN) or total phosphorus (TP). To estimate these influent loads, ratios observed during special sampling were used to develop influent loads. Note that while sampling for TKN was conducted in 2016 to support the HDR watershed permit, the ammonia to TKN ratio from special sampling was used to estimate TKN loads. **Table 4-3** summarized the estimated influent loads and ratios observed in special sampling.

Table 4-3 AWWTP Estimated Influent Nutrient Loads

	Load (lbs/d)	Note
Influent TKN	10,650	Special Sampling NH_3-N/TKN ratio= 0.68
Influent TP	1,350	Special Sampling COD/TP ratio= 108

4.3 Growth Assumptions

For consistency with other planning studies (Enhanced Treatment & Site Upgrade Program and Plant Solids System/Capacity Assessment Report), the following assumptions were used for growth.

- Assumption on growth for loads: 1% per year up to the design horizon.
- Assumption on growth for flows: 1% per year up to the design horizon.

4.4 Influent Hydrograph

The hydrograph used for modeling was based on observed hourly influent flow during the February 20, 2017 storm event. The hydrograph has been modified by the District to estimate actual plant flows if storage in the upstream sewers and discharge to Old Alameda Creek are not available. The adjusted peak hour (PH) flow during this storm was 64.7-mgd. **Figure 4-1** shows the adjusted hydrograph. The base flow of this hydrograph will be escalated by 1% per year according to the assumed flow increase. **Table 4-4** summarizes the peak hour flows for the two chosen design horizons and buildout conditions. When the average annual flow is 33-mgd, the peak hour flow will be 74.4-mgd. The Capacity Testing Program noted a hydraulic capacity of 85-mgd; however, this did not account for safety factors or process standards. The Plant Solids System/Capacity Assessment Report estimates a similar future peak hour flow for the plant of 72.3-mgd.

Table 4-4 AWWTP Peak Hour Flow

	Peak Hour (mgd)
Current	64.7
2028	67.1
2040	70.4
Buildout (AA flow = 33-mgd)	74.4

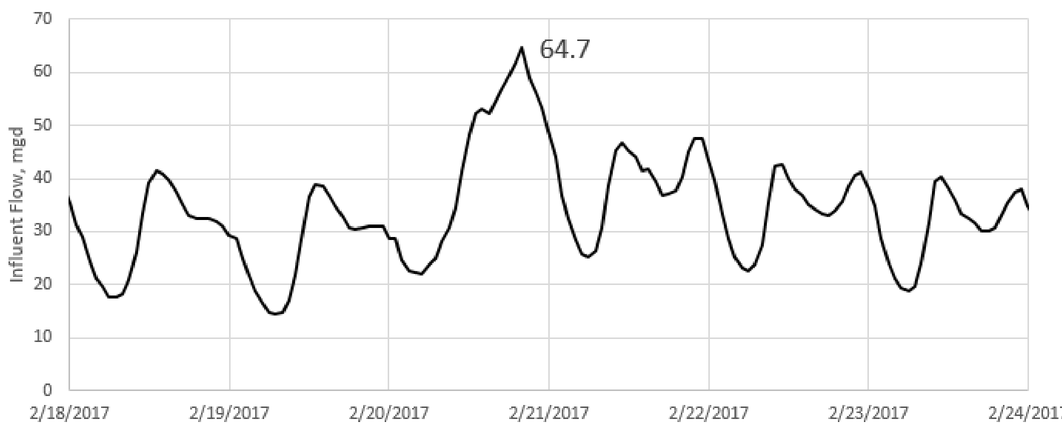


Figure 4-1 Influent Flow if Old Alameda Creek and Collection System Storage Eliminated

4.5 Design Horizons

As described in **Section 2** a trigger-based approach will be used to define the capital improvement program, split into Phase I and Phase II. A 2028 design horizon will be used to define Phase I. A 2040 design horizon will be used to define Phase II. The annual average and maximum month flows and loads for the 2028 and 2040 design horizon are presented in **Table 4-5**.

Table 4-5 Design Flows and Loads

		Current		2028		2040	
	Unit	AA	MM	AA	MM	AA	MM
Flow	mgd	23.4	26.9	25.8	29.7	29.1	33.5
Peak Flow	mgd	64.7	64.7	67.1	67.1	70.4	70.4
COD	lbs/d	146,000	167,900	161,300	185,500	181,700	209,000
BOD	lbs/d	52,600	60,500	58,100	66,800	65,500	75,300
TSS	lbs/d	70,500	81,100	77,900	89,600	87,800	100,900
TKN	lbs/d	10,650	12,240	11,800	13,500	13,250	15,240
NH_3-H	lbs/d	7,200	8,300	8,000	9,200	9,010	10,360
TP	lbs/d	1,350	1,560	1,490	1,720	1,680	1,940

4.6 Temperature

The District is not required to and therefore does not typically monitor wastewater temperature. Temperature from monthly grab samples from 2010 – 2015 showed the lowest recorded temperature was 16^{o}C. For this analysis the minimum week temperature is assumed to be 16^{o}C. The District has recently (as of October 2018) been recording plant influent temperature with an in-situ probe. The minimum temperature observed was 19^{o}C. If the minimum temperature is greater than the assumed minimum week temperature, effluent water quality will be better than the modeled water quality.

4.7 Effluent Standards

The plant currently has secondary standards for cBOD and TSS. These standards are summarized in **Table 4-6**.

4.7.1 Current Secondary Standards

Table 4-6 Current Effluent Standards

	Monthly	Weekly
cBOD, mg/L	25	40
TSS, mg/L	30	45

4.7.2 Potential Standards Negotiated for Old Alameda Creek Discharge

With the expected elimination of the AWWTP second discharge option, the Hayward Marsh, the District is currently discussing an alternative of discharging flows greater than 42.9-mgd to the Old Alameda Creek. While standards for Old Alameda Creek discharge are not yet defined, an average 15% TN removal over the year was used as an initial target for analysis. **Table 4-7** summarizes the assumed standards required for Old Alameda Creek.

Table 4-7 Assumed Old Almeda Creek Effluent Standards

Discharge point	Old Alameda Creek	Comment
Flows, mgd	0-22 mgd	> 43-mgd; year-round discharge
cBOD, mg/L	10	
TSS, mg/L	15	
TN, % removal	15	Annual load reduction
Ammonia, mg/L	2	Assuming no daily / weekly limit. BACWA monthly limit was assumed.

4.7.3 Potential Year-round Nutrient Standards

Nutrient limitations are not currently required for discharge to San Francisco Bay but are expected to be in place within the next two permit cycles. The draft administrative watershed permit that will be effective July 2019, requires dischargers to the San Francisco Bay to monitor and report nutrient levels in plant effluent. It is expected that the next permit cycle will introduce effluent nutrient load caps (capped at current loads plus an additional 10% to account for growth) with reductions in the following permit cycle.

Currently the level of nutrient removal that will be required when the limits are in place is not known. The Bay Area Clean Water Agency (BACWA) defined two levels of nutrient removal that were assumed for the Nutrient Reduction Study (June 2018) these are presented in **Table 4-8**. For this study, it is assumed that the District will need to comply with Level 2 nutrient standards by 2040. While Level 3 standards are not expected to be in place for many years, and are not the focus of this study, layouts and sizing were developed for these standards to ensure that space was available within the plant footprint to accommodate processes to meet these standards.

Table 4-8 BACWA Nutrient Reduction Study Effluent Standards

	NH_3-N mgN/L	TN mgN/L	TP mgP/L
Level 2	2	15	1
Level 3	2	6	0.3

These standards might be applied as a total maximum daily limit (TMDL), seasonally or monthly. For this analysis, the Level 2 standard was assumed to be a monthly average standard. Facilities were sized to meet this standard during the coldest month.

4.8 Wet Weather and Redundancy Operation

The District currently operates all secondary clarifiers during wet weather, but not all aeration basins. For future conditions, to maintain required aerobic solids retention times (SRTs) and reduce solids loading rates (SLRs) to the secondary clarifiers, it is assumed that all aeration basins and secondary clarifiers will be online during storm events.

Redundancy conditions were defined as one aeration basin or one secondary clarifier out of service during dry weather operation. The water quality for these redundancy scenarios was checked for each design horizon, 2028 and 2040 as well as current conditions. These scenarios are defined in **Table 4-9**.

Table 4-9 Wet Weather and Redundancy Operation

	Secondary Clarifier Redundancy	Aeration Basin Redundancy	Wet Weather
Flow, mgd	AA	AA	Design Hydrograph
Load, lbs/d	MM	MM	MM
Aeration Basin	All in service	Largest unit out of service	All in service
Secondary Clarifier	Largest unit out of service	All in service	All in service

5. Model Scenarios

The District considered two technologies for the Secondary Treatment Process Improvements a membrane bioreactor (MBR) system and a conventional activated sludge (CAS) system. The calibrated process model and CFD models were used to size the secondary treatment process to meet BACWA Level 2 standards for 2040 loads. This **Section 5** summarizes the key modeling results for the MBR and CAS options under several conditions as listed in **Table 5-1**.

Infrastructure upgrades to achieve this effluent quality and conceptual layouts are described in **Section 6**. The infrastructure for the CAS option can be phased as a function of future design requirements and these phasing options are described in **Section 7**. **Section 7** also describes the predicted performance of these interim conditions.

Table 5-1 Model Flow and Load Scenarios

Parameter	Abbreviation	Load Condition	Flow Condition
Average Annual	AA	AA	AA
Maximum Month	MM	MM	MM
Maximum Load, Annual Average Flow	MML-AAF	MM	AA
Aeration Basin Redundancy	1AB OOS	AA	AA
Secondary Clarifier Redundancy[1]	1SC OOS	AA	AA

[1]CAS option only

Table 5-2 summarizes the concentration and loads for each of the scenarios listed in **Table 5-1**.

Table 5-2 2040 Model Influent Flow, Loads and Concentrations

Parameter	AA		MM		MML-AAF		Redundancy - 1 AB OOS		Redundancy - 1 SC OOS[1]	
Flow, mgd	29		33		29		29		29	
Temp., °C	16		16		16		16		16	
	lbs/d	mg/L	lbs/d	mg/L	lbs/d	mg/L	lbs/d	mg/L	lbs/d	mg/L
cBOD[2]	77,000	270	88,500	270	88,500	310	77,000	270	77,000	270
COD	182,000	749	209,000	749	209,000	861	182,000	749	182,000	749
TSS[3]	85,500	362	98,000	362	98,000	416	85,500	362	85,500	362
TKN	13,300	55	15,300	55	15,300	63	13,300	55	13,300	55
NH_3	9,000	37	10,400	37	10,400	43	9,000	37	9,000	37
TP	1,690	6.9	1,940	6.9	1,940	8.0	1,690	6.9	1,690	6.9

[1]CAS option only
[2]Note that the model prediction for cBOD was 8% greater than the escalated historical “true BOD” (cBOD/0.84). This is considered acceptable given the COD match.
[3]Note that the model prediction for TSS is 2% higher than the escalated historical TSS load. This is considered acceptable.

5.1 MBR BACWA Level 2 2040 Modeling Results

The BACWA Nutrient Reduction Study (June 2018) recommended that the District adopt an MBR technology to achieve the BACWA Level 2 standards. The MBR would replace the clarifiers as solids separation technology. A process flow diagram of how the MBR would fit at the AWWTP is presented in **Figure 5-1**. Flow from the existing primary clarifiers would be combined into one primary effluent line that would lead to a central PE pump station where it is pumped up to fine screens. After the PE is screened it is distributed to the east (4.1 MG) and west aeration basins (proposed 4 basins totaling 4.4 MG) operated in an anoxic – oxic configuration (specific details on the aeration basin configurations is provided in **Section 6**). RAS from the MBR facility is delivered to each aeration basin by a RAS force main. MLSS from both basins is combined in a central MLSS junction box where it is conveyed to the new MBR facility. Permeate from the MBR facility is disinfected at the new effluent facilities that can accommodate flows to EBDA and OAC.

During wet weather PE can be equalized in the new PE equalization basin. The PE EQ pump station will drain the 2.5 MG PE EQ tank back to the fine screens for screening and distribution to the aeration basins.

Figure 5-2 shows the process model flow sheet. The process modeling for MBR sizing is summarized in **Table 5-3.** Key features include MBR tanks, increased RAS flow, and a RAS deoxygenation zone.

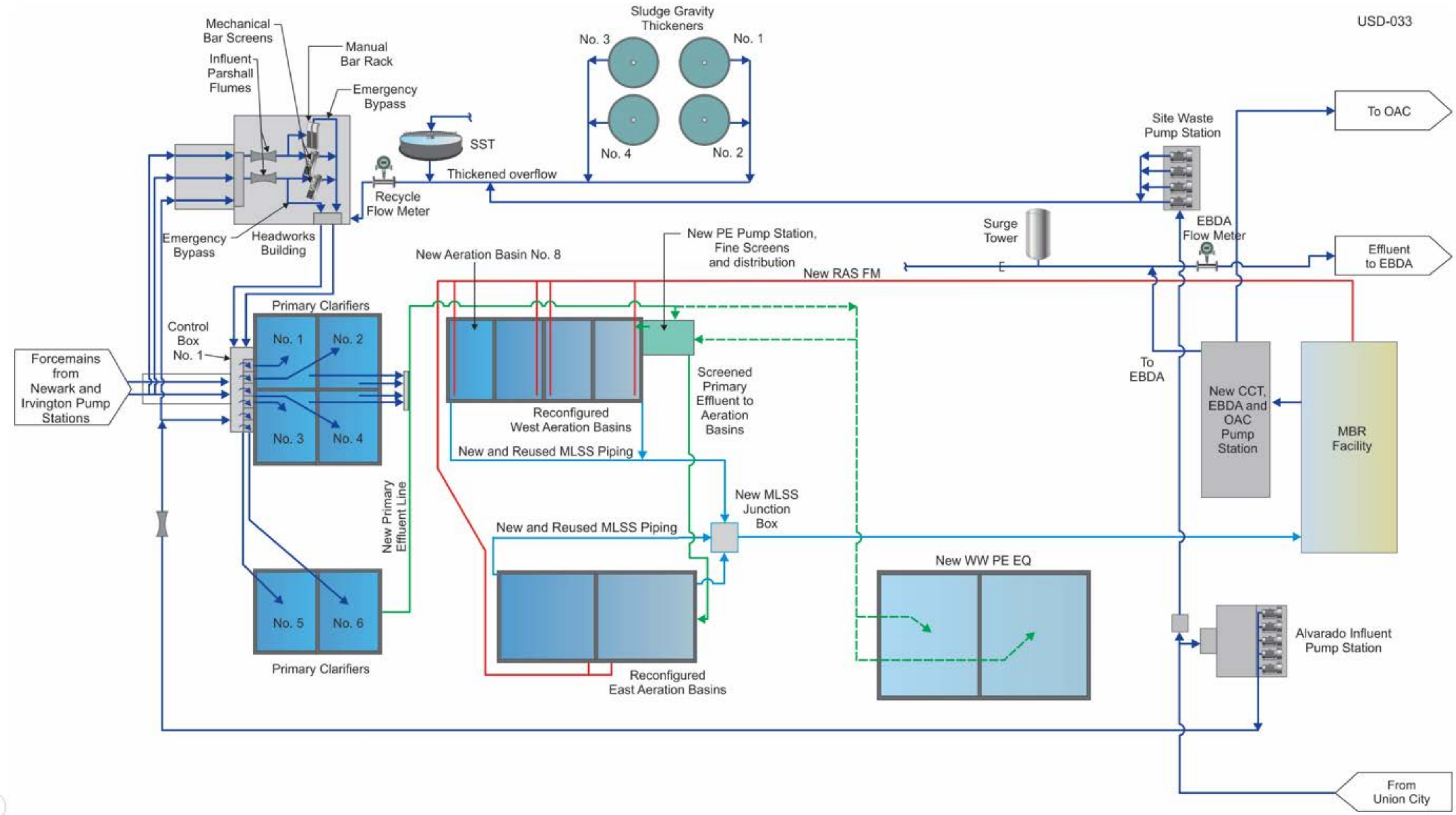


Figure 5-1 MBR BACWA Level 2 Process Flow Diagram

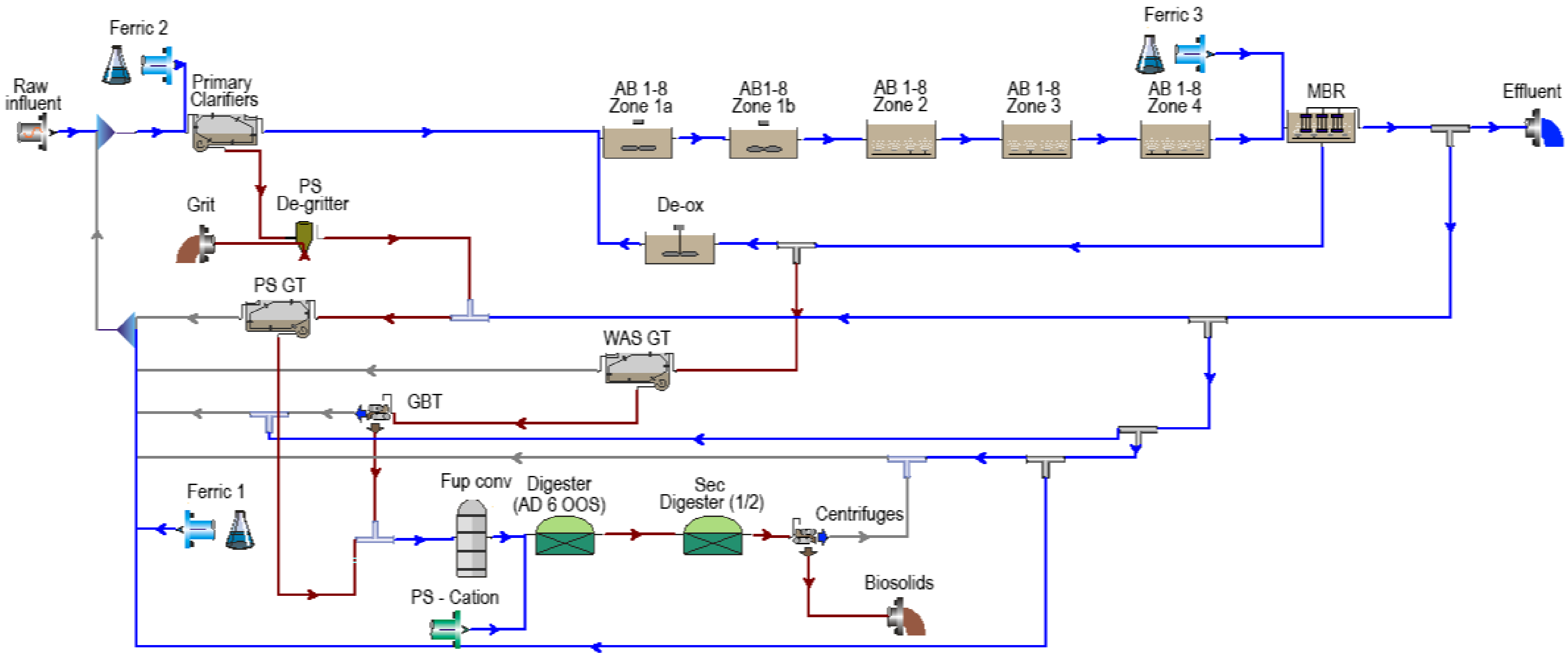


Figure 5-2 MBR Process Model

Table 5-3 MBR 2040 Load Model Results

	Parameter	Units	AA	MM	MML-AAF	Redundancy - 1 AB OOS
Aeration	AB in service	#	8	8	8	7
	MLSS	mg/L	7,300	7,700	7,700	8,000
	SRT	d	13	13	13	13
	Aerobic SRT	d	8	8	8	8
MBR Tanks	Trains in Service	#	9	9	9	8
	Total Cassettes	#	162	162	162	144
	Surface Area	Msf	3.10	3.1	3.1	2.7
	Design Flux	gsf	12.5	14.5	12.5	12.5
	Actual Flux	gsf	9.3	10.7	9.3	10.5
	RAS Ratio	%	400	400	400	400
WAS	WAS flow	mgd	0.47	0.48	0.48	0.43
	WAS conc	mg/L	9,200	9,000	9,800	10,100
	WAS Load	lbs/d	36,000	39,200	39,300	36,200
Secondary Effluent[1]	cBOD	mg/L	1	1	1	<1
	TSS	mg/L	0	0	0	<1
	TN	mgN/L	~11-12	~11-12	~12	~11-12
	NH_3	mgN/L	<0.5	<0.5	<0.5	<0.5
	NO_3	mgN/L	~9-10	~9-10	~9-10	~9-10
	NO_2	mgN/L	~0	~0	~0	~0
	TIN	mgN/L	~9-10	~9-10	~9-10	~9-10
	TP	mgP/L	<1	<1	<1	<1
	PO_4-P	mgP/L	<1	<1	<1	<1

[1] Average of Dynamic Modeling Results

5.2 CAS BACWA Level 2 2040 Modeling Results

The CAS option utilizes the same technology that exists at the AWWTP but converts the process from carbon removal to biological nutrient removal. **Figure 5-3** shows the proposed process flow diagram. To do this, additional aeration basin volume is proposed, and increased clarifier capacity is required. Similar to the MBR option, primary effluent is combined in one primary effluent line that leads to a central PE pump station. Pumped PE is distributed to three sets of aeration basins, AB 1-4 (4.1 MG), AB 5-8 (4.4 MG) and AB 9-12 (4.4 MG) operated in a Modified Ludzack Ettinger (MLE) configuration (specific details on the aeration basin configurations are provided in **Section 6**). PE is further distributed to the individual tanks by a common channel. RAS from the central RAS pump station is delivered to each aeration basin by a RAS force main. MLSS from all basins is combined in a central MLSS junction box where it is conveyed to the new MLSS splitter box. The splitter box feeds the four new circular clarifiers. Effluent is disinfected at the new effluent facilities that can accommodate flows to EBDA and OAC.

For the CAS option, there are two wet weather strategies that will help the AWWTP maintain BNR operation during wet weather, PE equalization and step-feed operation. During wet weather PE can be equalized in the new PE equalization basin. The PE EQ pump station will drain the 2.5 MG PE EQ tank back to the PE pump station for distribution to the aeration basins. The second strategy, step-feed operation, can be triggered when influent flow exceeds a trigger point (i.e. 45-mgd). In this mode, most (i.e. 100 – 75%) of the PE flow is diverted half way down the aeration basins to reduce solids loading to the secondary clarifiers and preserve the nitrifier population in the upfront zones. **Section 6** shows the step feed point for each aeration basin configuration.

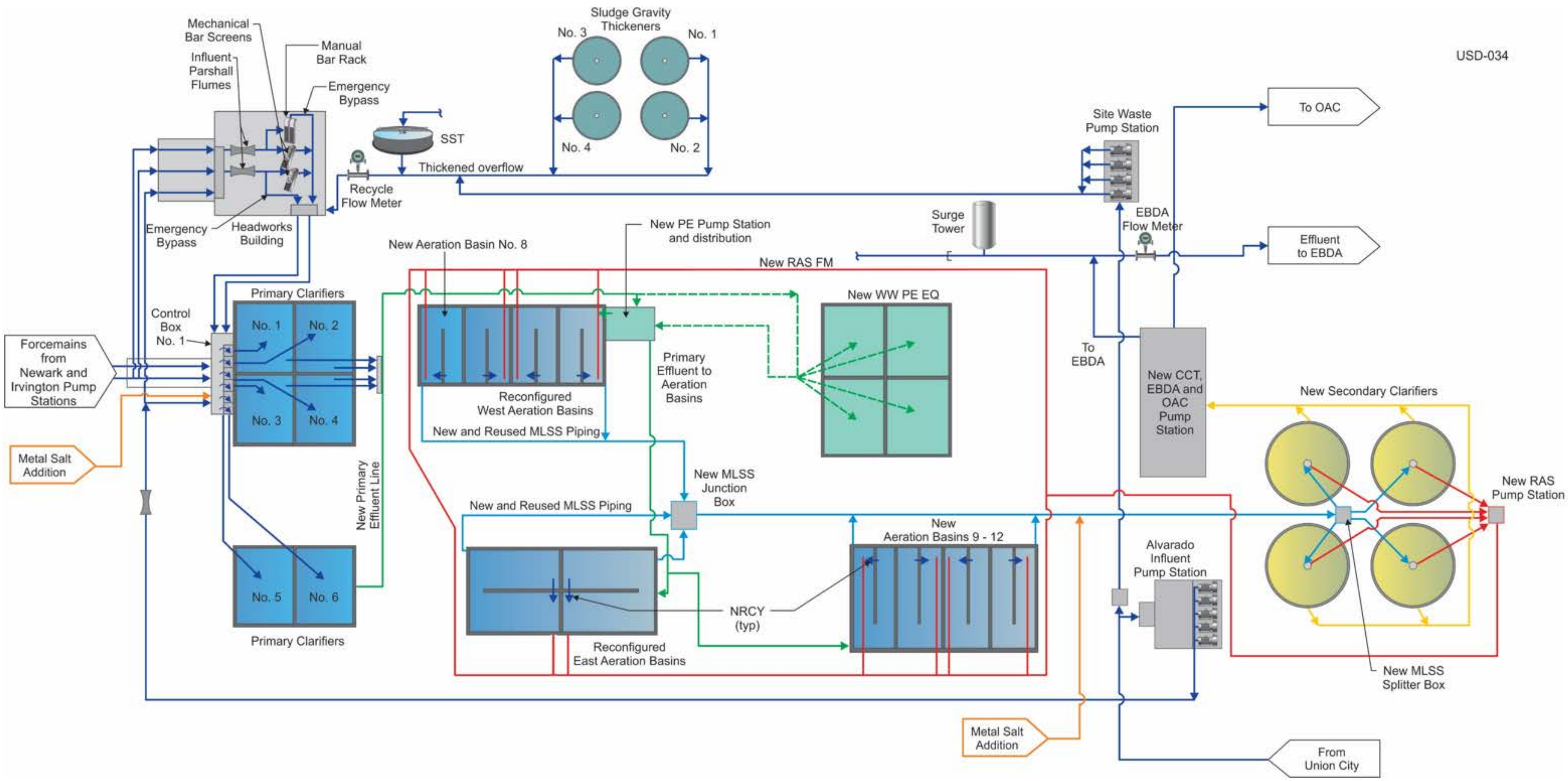


Figure 5-3 CAS BACWA Level 2 Process Flow Diagram

The CAS option process model results are presented in **Table 5-4** for 2040 AA, MM, MML-AAF, and redundancy scenarios. Loads and redundancy assumptions are documented in a memorandum attached in the **Appendix 2**. While wet weather simulations were dynamic, the conditions during step feed operation are presented in the **Table 5-4**.

Table 5-4 CAS 2040 Model Results

	Parameter	Units	AA	MM	MML-AAF	WW-MM[1]	Redundancy - 1 AB OOS	Redundancy - 1 SC OOS
Aeration	AB in service	#	10	10	10	10	9	10
	MLSS zone 2	mg/L	3,100	3,600	3,600	5,000	3,600	3,100
	MLSS zone 4	mg/L	3,100	3,600	3,600	2,700	3,600	3,100
	SRT	d	~10	~10	~10	~10-13	~8	~10
	Aerobic SRT	d	~6.5	~6.5	~6.5	~6.5-8	~5.6	~6.5
Secondary Clarification	Number	#	4	4	4	4	4	3
	Surface Area	sf	75,500	75,500	75,500	75,500	75,500	56,600
	Volume	MG	10	10	10	10	10	8
	SOR	gpd/sf	415	475	415	810	415	550
	SLR	lbs/d/sf	18	23	18	18	20	24
	SVI	mL/g	110	110	110	110	110	110
	RAS Ratio	%	64	64	64	64	64	64
WAS	WAS flow	mgd	0.55	0.55	0.55	0.55	0.55	0.55
	WAS conc	mg/L	8,000	9,100	9,100	9,000	9,100	8,000
	WAS Load	lbs/d	38,000	43,000	43,000	43,000	35,000	34,000
Secondary Effluent	cBOD	mg/L	<10	<10	<10	<10	<10	<10
	TSS	mg/L	<15	<15	<15	<15	<15	<15
	TN	mgN/L	~12	~13-14	~13-14	~14	~13	~12
	NH_3	mgN/L	~1	~1	~1	<2	~2	~1
	NO_3	mgN/L	~9	~9-10	~9-10	~7-10	~9	~9
	NO_2	mgN/L	<0.5	<0.5	<0.5	<1	<0.5	<0.5
	TIN	mgN/L	~9	~9-10	~9-10	~7-10	~9	~9
	TP	mgP/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	PO_4-P	mgP/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

[1] MLSS during step feed operation

Figure 5-4 shows the CAS option process model flow sheet. Key features include step-feed operation, flexible selector zones and nitrified recycle (NRCY).

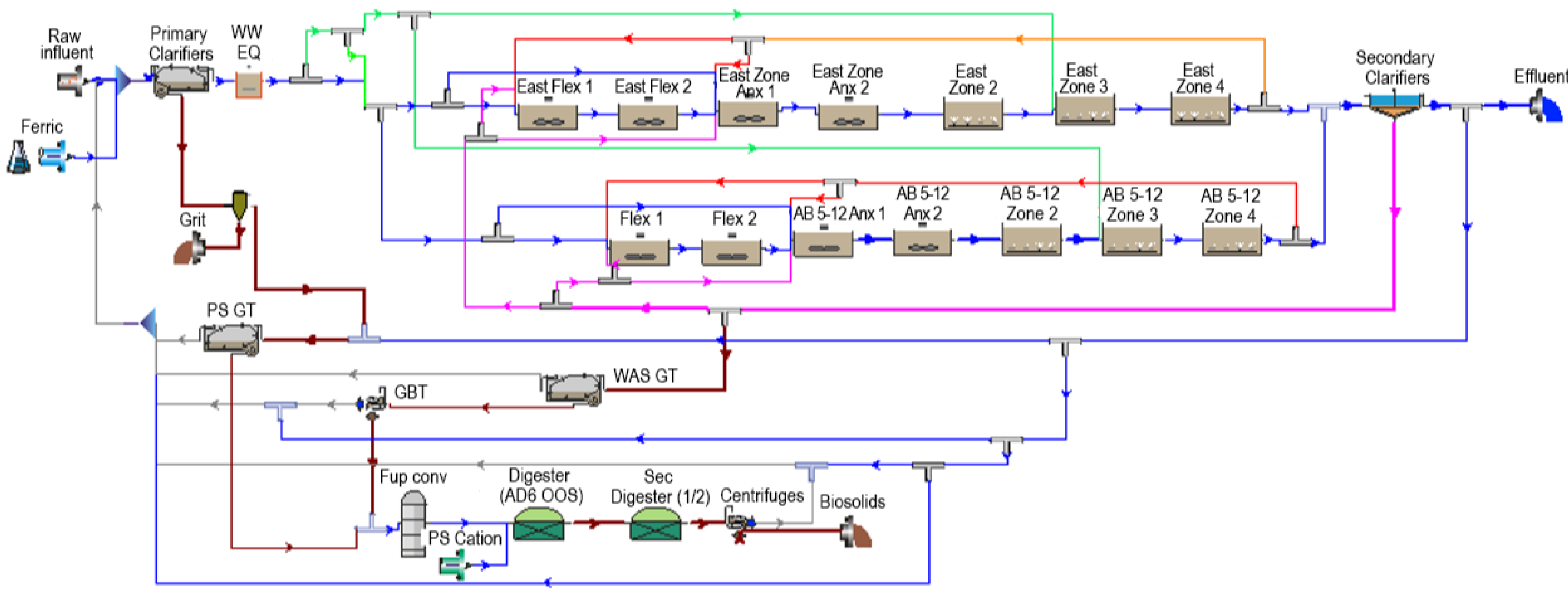


Figure 5-4 CAS Process Model

5.2.1 New Circular Secondary Clarifier Sizing

Based on process modeling, the clarifiers will need to pass 2,700 mg/L when the plant is operating in step-feed operation during a storm event (70.4-mgd for a 2040 storm and 61-mgd for an equalized 2040 storm). Surface overflow rate (SOR) and solids loading rate (SLR) were checked at critical clarifier loading conditions. Based on these conditions and the availability of space, clarifier diameter was maximized to a diameter of 155 ft. These conditions are summarized in **Table 5-5**.

Table 5-5 Clarifier Loading Conditions

Parameter	Effluent Flow	RAS Flow	MLSS	SVI	Clari-fiers online	Surface Area	SOR	SLR
	mgd	mgd	mg/L	mL/g	#	sf	gpd/sf	lb/d/sf
AA	29.1	14.6	3,100	110	4	75,500	390	15
AA – SC Redundancy	29.1	14.6	3,100	110	3	56,600	510	20
MM	33.5	16.8	3,600	110	4	75,500	440	20
MM – SC Redundancy	33.5	16.8	3,600	110	3	56,600	590	27
Max Day	42.2	21.1	3,600	110	4	75,500	560	25
WW – PH EQ[1]	61	30.5	2,700	110	4	75,500	810	-

[1]Note that step-feed and PE equalization triggers may be optimized.

5.3 Summary of Process Volumes

The process volume required to achieve BACWA Level 2 standards for both MBR and CAS for 2040 loads were developed using the calibrated process model. These volumes are summarized in **Table 5-6** for the MBR, and **Table 5-7** for the CAS option. CFD modeling was used to size the secondary clarifiers and ensure the ability to pass site-specific conditions as defined in **Table 5-5.**

Table 5-6 MBR Option Process Volume Requirements

Zone	MBR Process Volume, mg
Total Volume	8.5
Existing Volume	7.4
Total New Volume	1.1
Total Ras Deoxygenation Volume	0.5
Total Anoxic Volume	2.8
Total Aerobic Volume	5.2

Table 5-7 CAS Option Process Volumes Requirements

Zone	CAS Process Volume, mg
Total Volume	12.9
Existing Volume	7.4
Total New Volume	5.5
Flex Zone Volume	0.5
Total Anoxic volume	3.1
Total Aerobic Volume	9.3
Secondary Clarifier, sf	75,500

6. Long-term Solution Options

As detailed in **Section 5 – Model Scenarios**, the District is considering a CAS and MBR option for the Secondary Treatment Process Improvements. This **Section 6 – Long-term Solution Options** details the infrastructure to meet the BACWA Level 2 standards for 2040 flows and loads for both the CAS and MBR Options. As noted in **Section 2 – Approach**, a high-level description of a Phase III project to meet BACWA Level 3 standards for buildout conditions was also defined; this is also described in this section. Infrastructure common to both MBR and CAS long-term solutions is detailed in this section and includes effluent facilities, sidestream treatment, and metal salt addition for chemical phosphorus removal. This section presents the long-term scope as listed below:

6.1 Membrane Bioreactor Long-term Options

6.1.1 MBR Option Phase II Scope

This section details the infrastructure required to implement BACWA Level 2 standards for the 2040 flows and loads conditions with MBR technology.

6.1.1.1 Process Volume and Aeration Basin Configuration

The total required process volume to treat 2040 flows and loads with the MBR technology was determined to be 8.5 MG. This includes RAS de-oxygenation zones, anoxic zones and aerobic zones. This volume can be achieved with the existing aeration volume of 7.4 MG and the construction of Aeration Basin 8. **Table 6-1** summarizes the process volume and zone volumes required for the treatment of 2040 flows and loads to BACWA Level 2 standards with MBR system.

Table 6-1 MBR Option Process Volumes

Zone	Volume, MG
Total Volume	8.5
Existing Volume	7.4
New Volume	1.1
Total RAS Deoxygenation Volume	0.5
Total Anoxic volume	2.8
Total Aerobic Volume	5.2

Figure 6-1 and **Figure 6-2** show process configuration for the east and west aeration basins for an MBR solution. Key retrofits for the east aeration basin modifications include:

- Combination of AB 1 and 2 into one basin
- Combination of AB 3 and 4 into one basin
- Reuse of the existing PE channel
- Segregated RAS flow and a RAS de-oxygenation zone
- Reuse of the existing east MLSS channel for a surface wasting channel
- Reuse of the existing west MLSS channel for MLSS
- Baffles and mixing to create the deoxygenation zones
- Baffles and mixing to create the anoxic zones

Key features for the west aeration basin modifications and new Aeration Basin 8 include:

- Reuse of the existing PE channel at the west of the basin
- Construction of Aeration Basin 8 on the south side of Aeration Basin 5 (at current location of Lift Station 2 and Control Box 2)
- Flipping the configuration of Aeration Basin 6
- Reuse of the MLSS channel
- Baffles and mixing to create the deoxygenation zones
- Baffles and mixing to create the anoxic zones

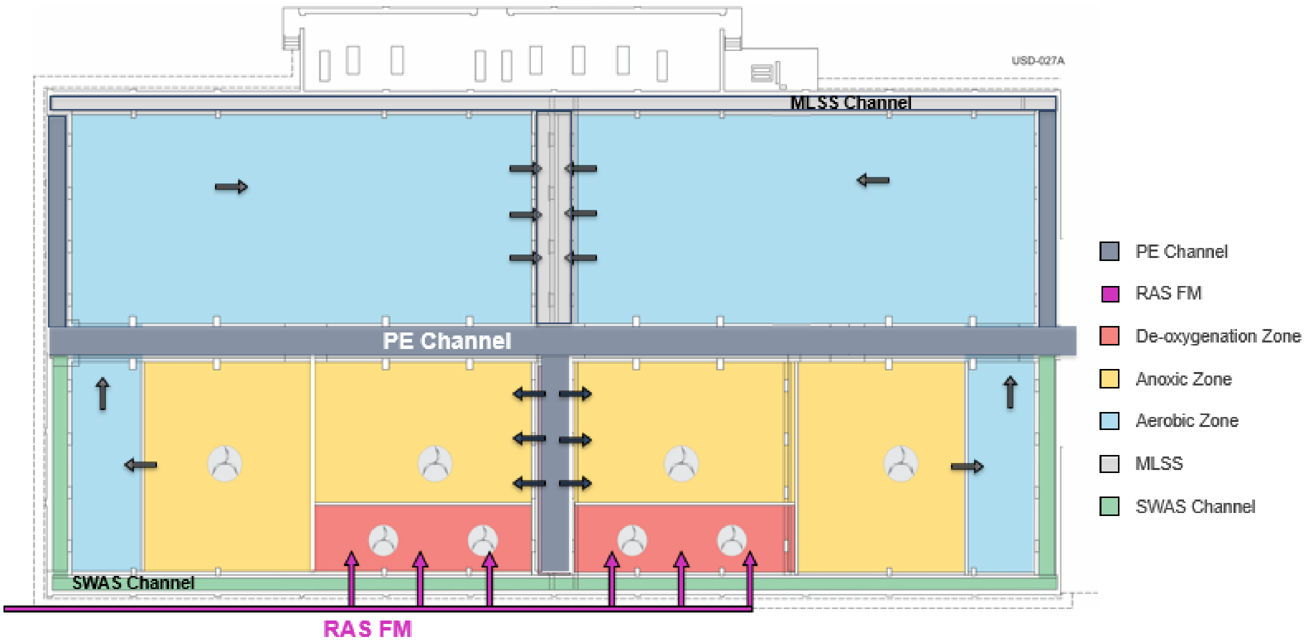


Figure 6-1 MBR East Aeration Basin Process Schematic

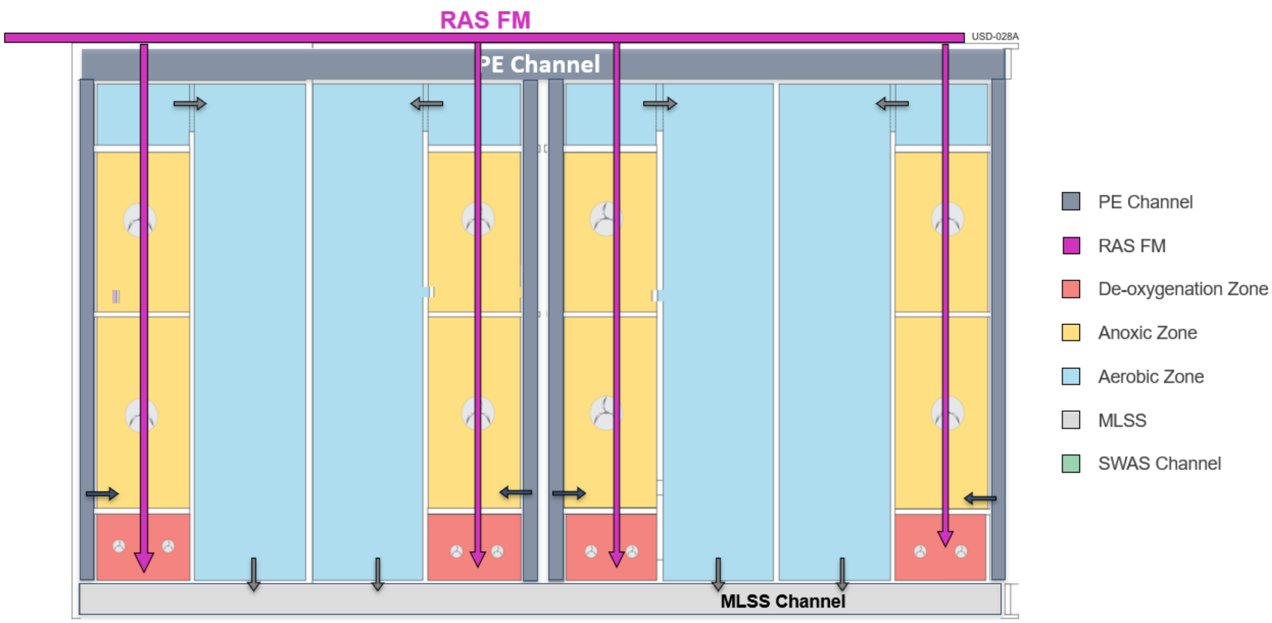


Figure 6-2 MBR West Aeration Basin Process Schematic

6.1.1.2 Process Aeration

The minimum, average and maximum diurnal airflows required for the aeration basin were determined for annual average, maximum 30-day, maximum 7-day, and max day loads. These airflows were calculated for scenarios with and without centrate treatment. Airflows without centrate treatment were used to size the blower facilities. **Table 6-2** summarizes the required process airflows for these conditions.

Table 6-2 2040 Process Air Requirements for MBR Option

Condition	Load Condition	DO, mg/L	Minimum Diurnal Airflow, scfm	Average Diurnal Airflow, scfm	Maximum Diurnal Airflow, scfm
MBR Process air without Centrate Treatment	AA	2	10,400	32,900	55,200[1]
	MM	2	11,900	38,400	61,500[1]
	MW	1	12,000	39,200	
	MD	0.5	14,600	48,100	
MBR Process air with Centrate Treatment	AA	2	8,900	31,500	52,100[1]
	MM	2	10,200	36,800	58,300[1]
	MW	1	10,300	37,600	
	MD	0.5	12,600	46,300	

[1] DO of 1 mg/L assumed for these conditions

A Neuros NX700 blower can deliver approximately 13,000 scfm at maximum temperature, humidity and minimum inlet pressure conditions. The system will require five NX700 blowers to deliver maximum diurnal airflow for maximum month loads. For an n+1 redundancy six blowers are required. It is proposed that the new blowers be centrally located in a new facility north of the existing Aeration Basins 5-7.

6.1.1.3 Intermediate Pump Station and Fine Screens

Primary effluent fine screening will be required to prevent damage to the membranes. The head available between the primary clarifier weirs and the Lift Station 1 and 2 wet wells is not great enough to fit fine screens and screened PE distribution. It is proposed that:

- A new centralized intermediate pump station is provided to replace existing Lift Station 1 and Lift Station 2
- Pumped PE flows through new ¼-inch fine screens
- Screened PE is split downstream of the fine screens for distribution to the aeration basins.

The fine screen and intermediate pump station will be located in the area immediately north of Aeration Basins 5 – 7, in the footprint future Aeration Basin 8 as proposed by the 1993 upgrade. (Under this project, Aeration Basin 8 will be located south of Aeration Basin 5 where the existing

CB2 and Lift Station 2 are located; see **Figure 6-4.**) The area is approximately 70’ wide (N-S) and 100’ long (E-W) with an additional 50’ of height upon demolition of the existing odor control towers. Primary effluent would be routed west of existing Aeration Tanks 5 - 7 and tie into the proposed intermediate PS wet well.

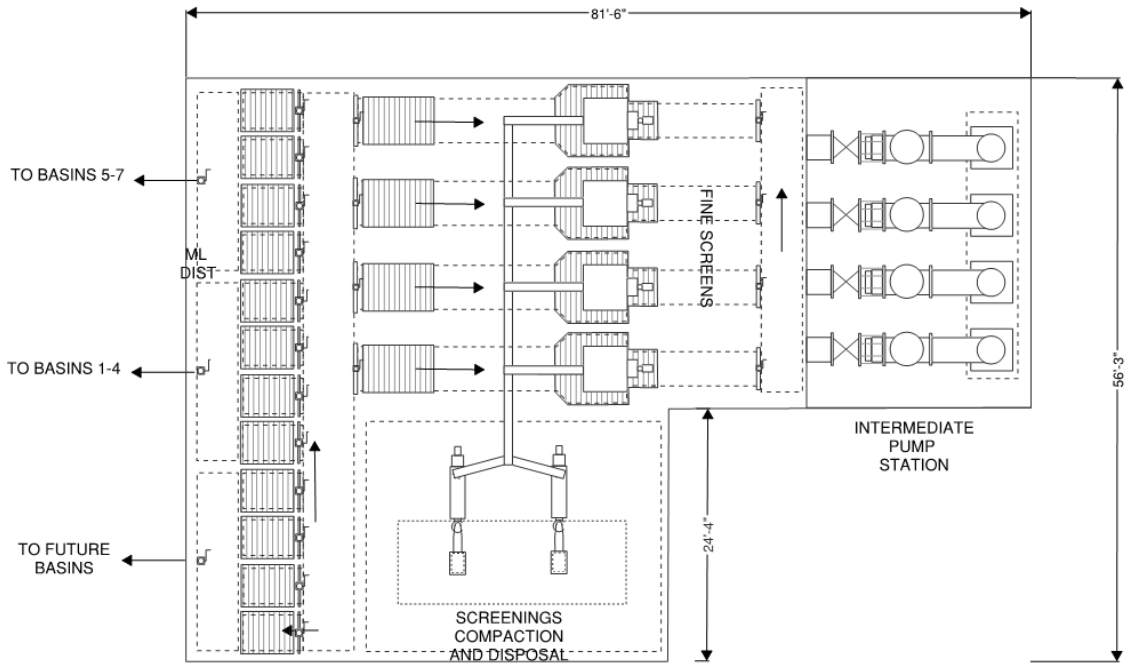


Figure 6-3 Intermediate Pump Station and Fine Screens Layout

6.1.1.4 Membrane Bioreactors Tanks

The membrane tanks were sized for appropriate average annual, maximum month and peak flow flux rates. A Suez (GE-Zenon) cut sheet was used as the basis of design for the MBR facility. **Table 6-3** summarizes the design conditions for the proposed MBR facility.

Table 6-3 MBR Facility Design Conditions

Design Parameter	Units	AADF	Max Month	Peak Hour
Flow	mgd	29.1	33.5	60.0[1]
Design Flux	gfd	12.5	14.5	29.0
Cassettes	#	144	144	144
Resulting Membrane Tanks	#	8	8	8
Cassettes per Tank	#	18	18	18
Resulting Flux	gfd	10.5	12.1	21.7
Resulting Flux (1 OOS)	gfd	12.0	13.8	24.8

[1] Assuming 2.5MG of EQ

6.1.1.5 MBR Option Phase II Site Layout

Figure 6-4 shows the proposed MBR Phase II Layout. Key features include

- Modified Aeration Basin 1-4
- Modified Aeration Basin 5-7
- New Aeration Basin 8 south of existing Aeration Basin 5-7
- New 60-inch PE line to centrally located Intermediate Pump Station routed to the west of existing Aeration Basin 5-7
- New intermediate pump station and fine screen facility
- New blower facility north of existing Aeration Basin 5-7
- PE distribution piping to the east and west aeration basins
- New 2.5 MG equalization basin
- New MLSS junction box and reuse of the existing 60-inch line to the MBR tanks
- New MBR facility that includes:
    - 9 Membrane tanks (cassettes installed in 8 tanks)
    - Clean in place chemicals
    - Scour blowers
    - Permeate pumps
    - Note that the location of the MBR tanks was agreed upon in the December 2018 Charrette. The option to phase MBR construction over the existing Secondary Clarifier location was eliminated due to concerns over plant operation during construction.
- New effluent facility

6.1.2 MBR Option Phase III Infrastructure and Layout

As noted in **Section 2 – Approach**, this analysis identified place holder process volumes and facilities to meet BACWA Level 3 standards for buildout conditions. For the MBR option this Phase III project has been identified as:

- New Aeration Basin 9 and 10 (2.2 MG)
- Carbon addition facilities for further denitrification
- Additional membrane cassettes to meet increased flows

It is recommended that as the analysis for and the definition of this Phase III project be revisited as technologies change, the standards are become more defined, or as loading conditions warrant. **Figure 6-5** shows the MBR option Phase III Layout.

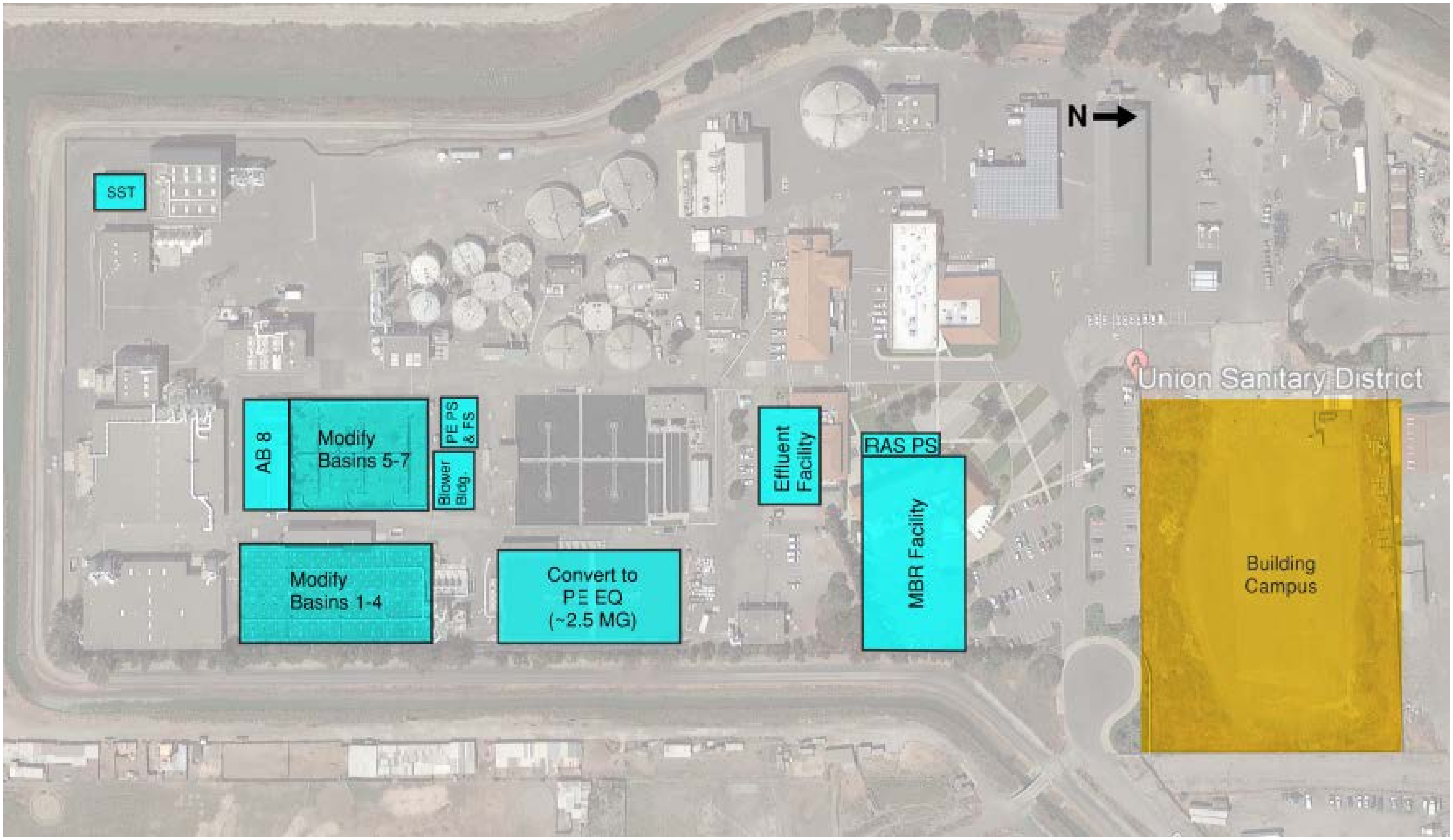


Figure 6-4 MBR Option Phase II Layout

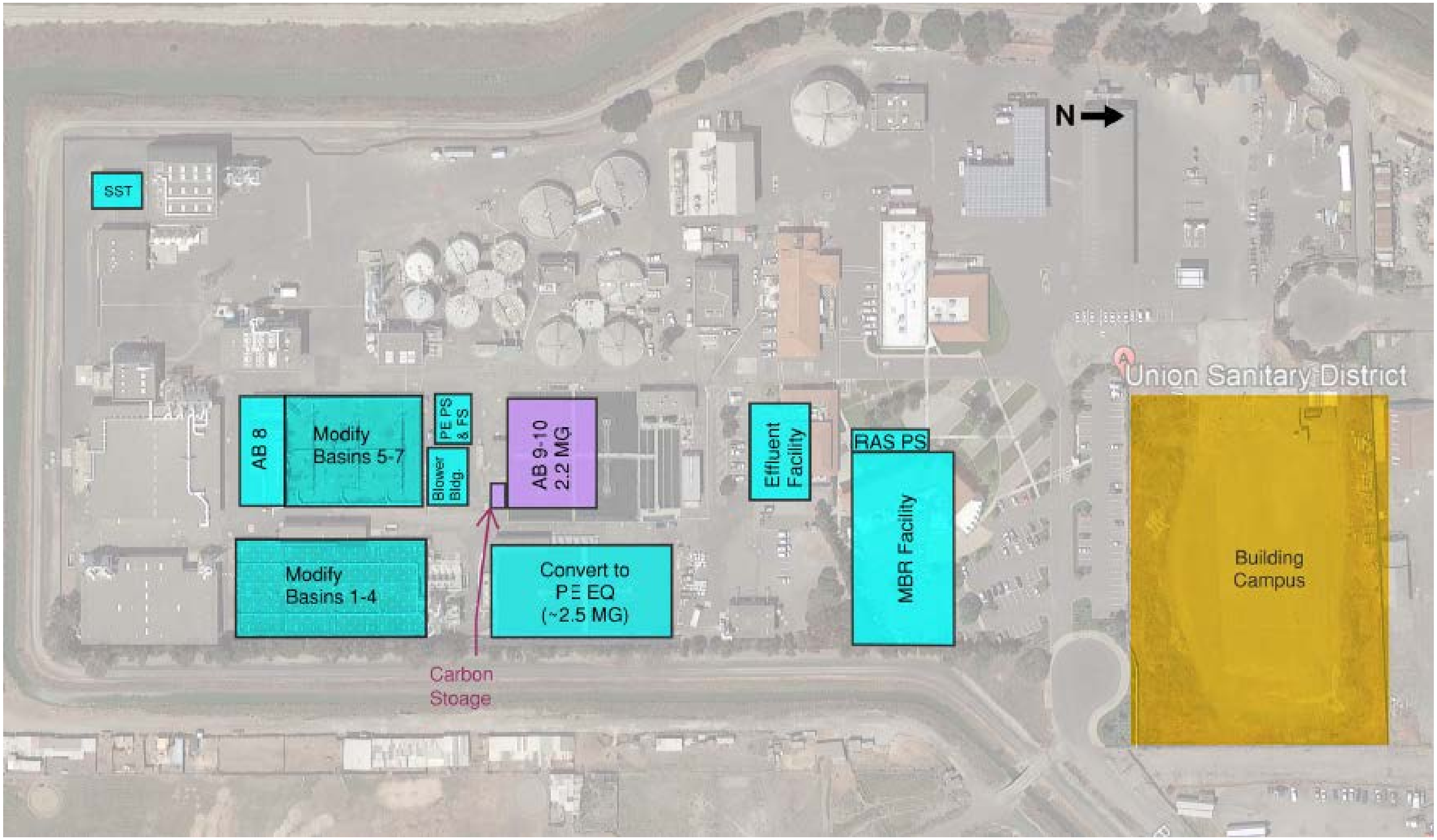


Figure 6-5 MBR Option Phase III Conceptual Layout

6.2 Conventional Activated Sludge Long-term Option

6.2.1 CAS Option Phase II Scope

6.2.1.1 CAS Option Process Volume and Aeration Basin Configuration

The total required process volume to treat 2040 flows and loads with the CAS technology was determined to be 12.9 MG. This includes flexible zones for RAS conditioning, anoxic zones, and aerobic zones. This volume can be achieved with the existing volume and the construction of new Aeration Basin 8 adjacent to the existing west aeration basins and new Aeration Basins 9-12. **Table 6-4** summarizes the process volume and zone volumes required for the treatment of 2040 flows and loads to BACWA Level 2 standards with a conventional activated sludge system.

Table 6-4 CAS Option Process Volumes

Zone	Volume, MG
Total Volume	12.9
Existing Volume	7.4
New Volume	5.5
Flex Zone	0.5
Total Anoxic Volume	3.1
Total Aerobic Volume	9.3

Figure 6-6 and **Figure 6-7** show the process configuration for the east and west aeration basins for a CAS solution. Key retrofits for the east aeration basin modifications include:

- Combination of AB 1 and 2 into one basin
- Combination of AB 3 and 4 into one basin
- Reuse of the existing PE channel
- Segregated RAS into the RAS de-oxygenation zone
- Reuse of the existing east MLSS channel for a surface wasting channel
- Reuse of the existing west MLSS channel for MLSS
- Baffles and mixing to create the deoxygenation zones
- Baffles and mixing to create the anoxic zones

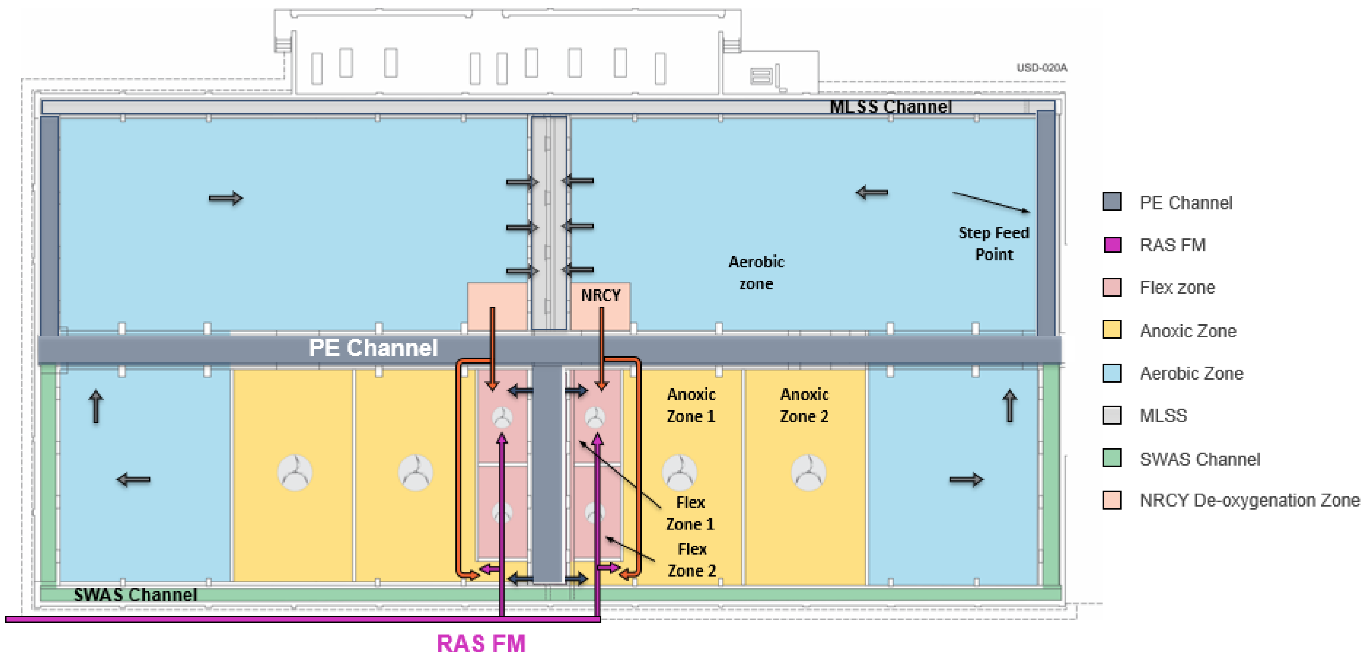


Figure 6-6 CAS East Aeration Basin Process Schematic

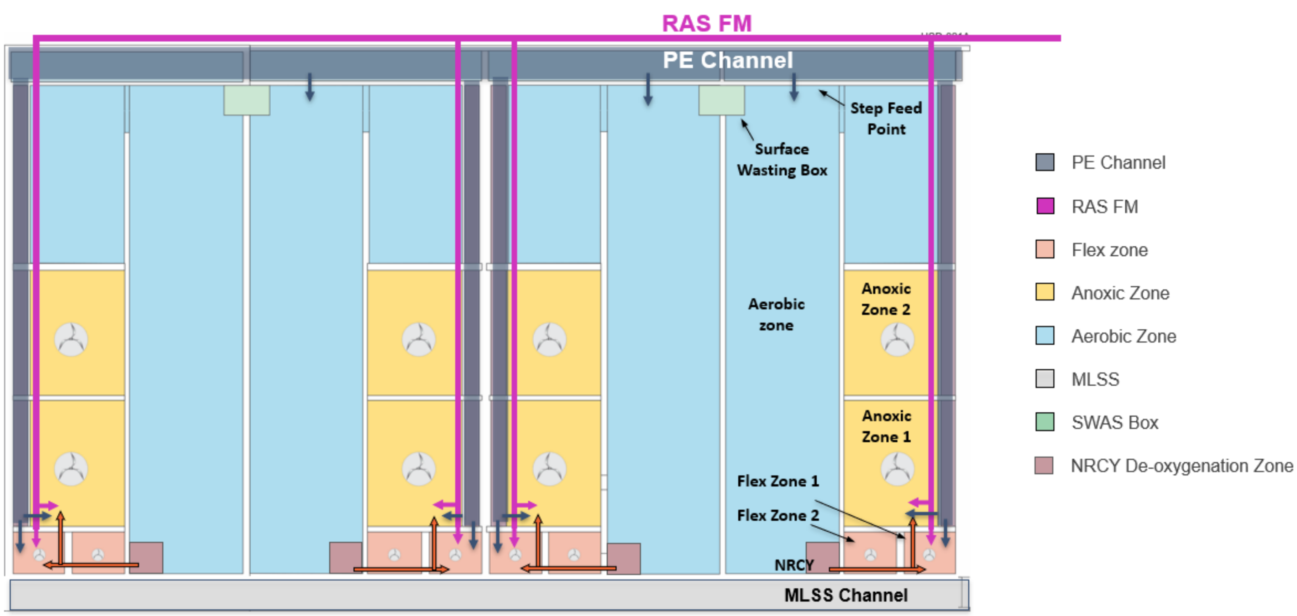


Figure 6-7 CAS West Aeration Basin Process Schematic

Key features for the west aeration basin modifications and new Aeration Basins 8-12 include:

- Reuse of the existing PE channel at the west of the basin
- Construction of Aeration Basin 8 on the south side of Aeration Basin 5
- Flipping the configuration of Aeration Basin 6
- Reuse of the MLSS channel
- Baffles and mixing to create the deoxygenation zones
- Baffles and mixing to create the anoxic zones

6.2.1.2 Process Aeration

The minimum, average and maximum diurnal airflows required for the aeration basin were determined for annual average, maximum 30-day, maximum 7-day and max day loads. These airflows were calculated for scenarios with and without centrate treatment. Airflows without centrate treatment were used to size the blower facilities. **Table 6-5** summarizes the required process airflows for these conditions.

Table 6-5 2040 Process Air Requirements for CAS Option

Condition	Load Condition	DO, mg/L	Minimum Diurnal Airflow, scfm	Average Diurnal Airflow, scfm	Maximum Diurnal Airflow, scfm
CAS Process air without Centrate Treatment	AA	2	7,100	23,900	40,000[1]
	MM	2	8,100	28,000	44,700[1]
	MW	1	8,200	28,500	
	MD	0.5	9,900	34,900	
CAS Process air with Centrate Treatment	AA	2	6,500	22,900	37,500[1]
	MM	2	7,400	26,700	41,900[1]
	MW	1	7,500	27,400	
	MD	0.5	9,200	33,700	

[1] DO of 1mg/L assumed for these conditions

A Neuros NX700 blower can deliver approximately 13,000 scfm at maximum temperature, humidity and minimum inlet pressure conditions. The system will require four NX700 blowers to deliver maximum diurnal airflow for maximum month loads. For an n+1 redundancy five blowers are required. It is proposed that the new blowers be centrally located in a new facility north of the existing Aeration Basins 5-7.

6.2.1.3 Intermediate Pump Station

To accommodate the 5.5 MG of new aeration basin volume additional primary effluent distribution lines and a new lift station will be needed. As Control Box 2 is a congested flow control structure, and routing of a new PE line to Aeration Basins 9-12 would be difficult, a centralized primary effluent intermediate pump station and splitter box is proposed.

- A new intermediate pump station is provided to replace existing Lift Station 1 and 2 at a central location.
- Pumped PE is split just downstream for distribution to the aeration basins.

The intermediate pump station will be located in the area immediately north of Aeration Basins 5 – 7, in the footprint of the future Aeration Basin 8 as proposed in the 1993 upgrade. (Under this project, Aeration Basin 8 will be located south of Aeration Basin 5 where the existing CB2 and Lift Station 2 are located; see **Figure 6-8**.) The area is approximately 70' wide (N-S) and 100' long (E-W) with an additional 50' of height upon demolition of the existing odor control towers. Primary effluent would be routed west of existing Aeration Tanks 5 - 7 and tie into the proposed intermediate PS wet well.

6.2.1.4 Secondary Clarifiers

New clarifiers and a combination of new and modified secondary clarifiers were considered to provide more secondary clarification capacity for the AWWTP. Through the planning process in this analysis, it was decided that new clarifiers would be provided to meet the BACWA Level 2 standards for 2040 flows and loads. **Table 6-6** documents the decisions made by the District during the planning phases of this project.

Table 6-6 CAS Clarifier Layout Options

CAS Clarifier Layout Option	Decision	Reasoning
Split Plant Option: Existing plant and separate new plant	Eliminated	Increases operational complexity too significantly
New and Modified Clarifiers: Combined MLSS sent to modified and new clarifiers	Eliminated	Provides the most redundancy but is most difficult to construct and operationally complex
All New Clarifiers: All new clarifiers where the existing administration buildings is currently located	Selected	This will be the simplest to operate and most reliable technology

Four new circular clarifiers will be planned for in the location north of the existing clarifiers where the administration building is currently located. The clarifier characteristics are summarized in **Table 6-7**.

Table 6-7 New Clarifier Characteristics

Parameter	Unit	Value
Number	-	4
Diameter, ft	ft	155
Sidewater Depth	ft	18
Center well	ft	38
Center well depth	ft	7.5
Energy Dissipating Inlet	-	Yes
Sludge collection		Towbro

6.2.1.5 Return Activated Sludge

A new centralized RAS pump station will have the following features:

- One pump per clarifier connected directly to the RAS line
- A flow meter on each RAS line will control the RAS pump speed for the corresponding pump
- One redundant pump per pair of clarifiers
- The RAS pumps will have the capacity to pump 100% of forward flow at maximum month conditions with all secondary clarifiers in service. This will also provide a 50% RAS rate during wet weather.

6.2.1.6 CAS Option Site Layout

Figure 6-8 shows the proposed CAS layout. Key features include

- Modified Aeration Basin 1-4
- Modified Aeration Basin 5-7
- New Aeration Basin 8 south of existing Aeration Basin 5-7
- New Aeration Basins 9-12 north of existing East Aeration Basins
- New 60-inch PE line to centrally located intermediate pump station routed to the west of existing Aeration Basin 5-7
- New intermediate pump station
- New blower facility North of existing Aeration Basin 5-7

- PE distribution piping to the existing and new aeration basins
- New 2.5 MG PE equalization basin
- New MLSS junction box and reuse of the existing 60-inch line to the new MLSS distribution box
- New MLSS distribution box
- Four new circular clarifiers with sludge suction header
- Centralized RAS station
- New RAS force main
- New individual RAS line (with flow meter and control valve) from force main to each aeration basin
- New 72-inch effluent line to new effluent facility
- New effluent facility.

6.2.2 CAS Option Phase III Infrastructure and Layout

As noted in **Section 2 – Approach**, this analysis identified place holder process volumes and facilities to meet BACWA Level 3 standards for buildout conditions. For the CAS option this Phase III project has been identified as:

- Demolition of PE EQ installed in Phase I
- New Aeration Basin 13-16, 4.9 MG (at location of Phase I PE EQ)
- Carbon addition facilities for further denitrification
- Disk filters to meet low TP requirements

Figure 6-9 shows the CAS option Phase III Layout. It is recommended that the District secure offsite PE equalization basin to replace the onsite PE EQ that will be eliminated as part of Phase III prior to its elimination. This potential offsite PE equalization tank is not shown on the site plan in **Figure 6-9**, but the District has identified a potential location adjacent to the AWWTP. It is recommended that as the analysis for and the definition of this Phase III project be revisited as technologies change, the standards become more defined, or as loading conditions warrant.

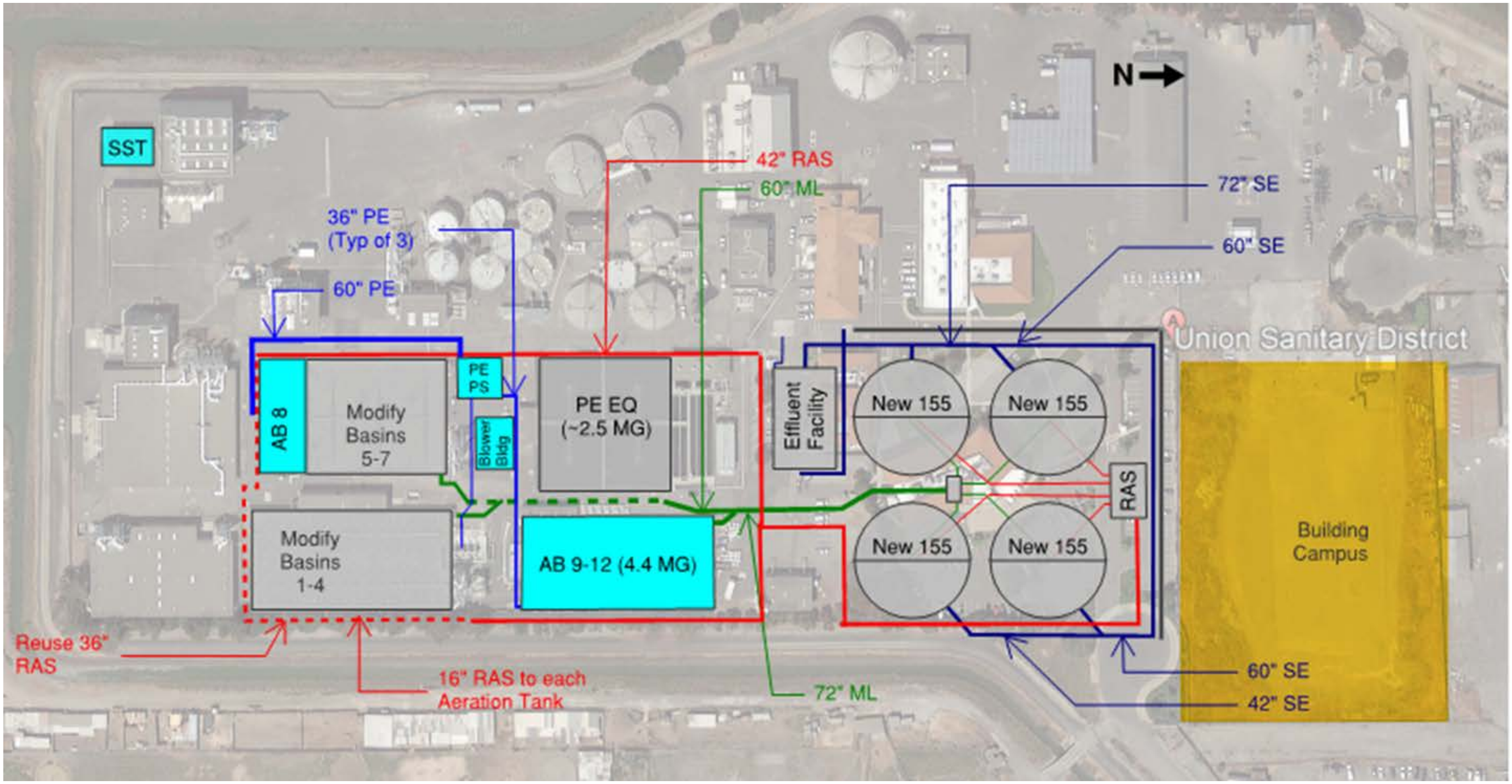


Figure 6-8 CAS Option Phase II Layout

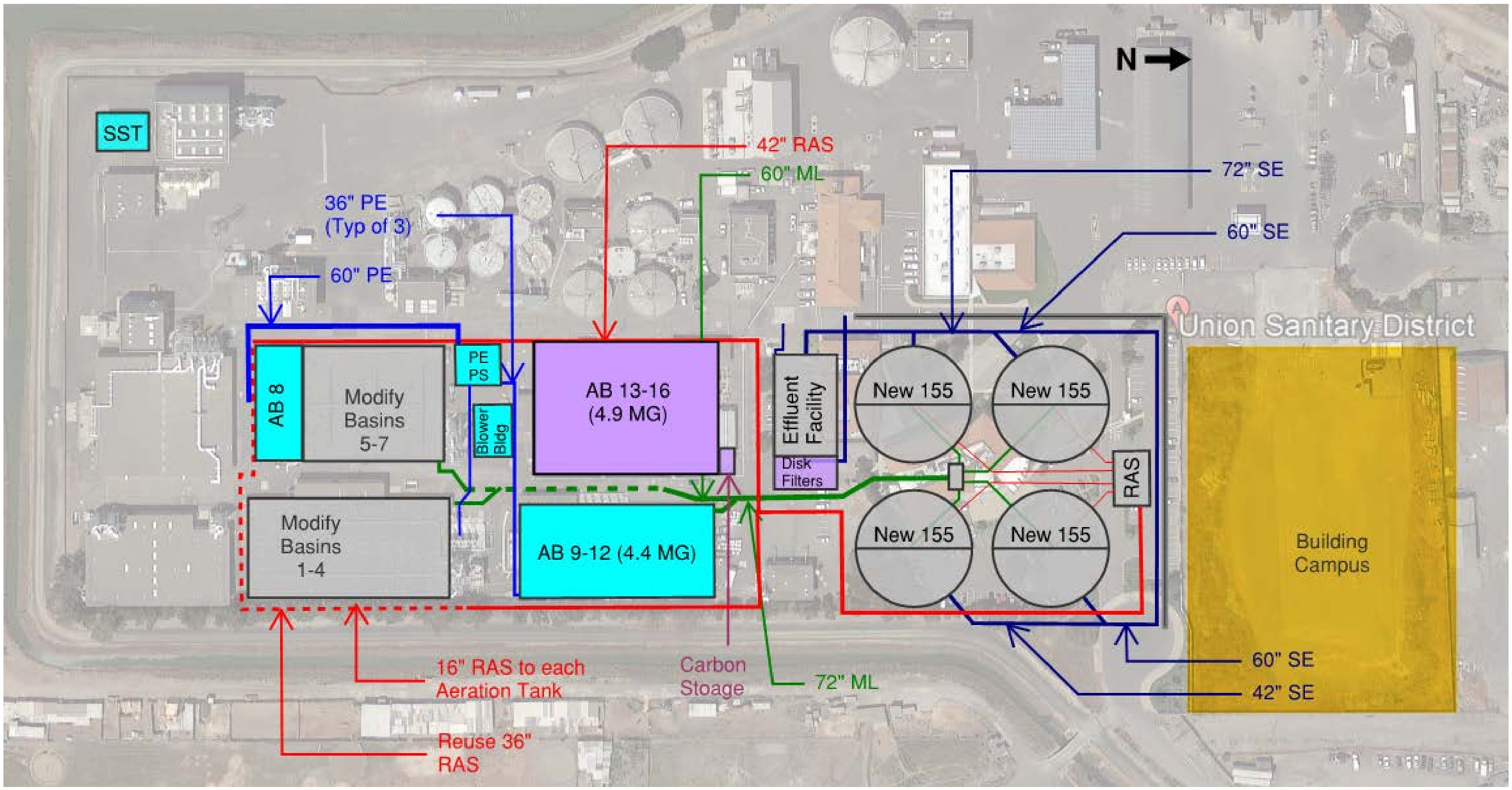


Figure 6-9 CAS Option Phase III Conceptual Layout

6.3 Effluent Facilities

The District currently has the ability to discharge to Old Alameda Creek for emergency purposes only. Unlike normal flow conditions, when flow is discharged to the EBDA force main and dechlorinated offsite, the District is responsible for dechlorinating any flow that goes to Old Alameda Creek to a TRC of 0.0 mg/L. The District does not currently have efficient dechlorination facilities and must recirculate flow to the head of the plant until it is confirmed that the TRC requirement is met. The process is very cumbersome and operationally complex and reduces capacity during wet weather. New dechlorination facilities are therefore included in the upgrade of the plant.

The existing plant has a hydraulic bottleneck between the final clarifiers and the chlorine contact tanks. This hydraulic bottleneck is caused by a shallow free surface port in the existing flash mix basin that accounts for significant head loss during peak events, limiting final clarifier effluent prior to submergence of final clarifier weirs. Plant staff have also noted that the existing chlorine contact tanks are in poor condition with gates that are inoperable, reducing operational flexibility. A condition assessment of the existing chlorine contact tanks was not performed as part of this analysis; however, visual observations confirm the District's experience. To address the hydraulic bottleneck and to provide a more reliable facility, a new chlorination facility was assumed for both the MBR and CAS options.

The EBDA pump station located at the AWWTP is owned by EBDA and operated by the District. The EBDA pump station is at the end of its useful life. The District wishes to include a new EBDA pump station as part of the effluent facilities upgrade.

The new effluent facility configuration is shown in Figure 6-10 and will include the following features:

- New flash mixing for chlorination
- New CCT that can be configured in direct or in a serpentine layout
- New EBDA Pump station
- New flash mixing for dechlorination
- New dechlorination contact basin (sized for either thiosulfate or sodium bisulfite)
- New Old Alameda Creek pump station
- New elevated discharge box to limit tidal impacts to pumping
- New sample location for TRC confirmation

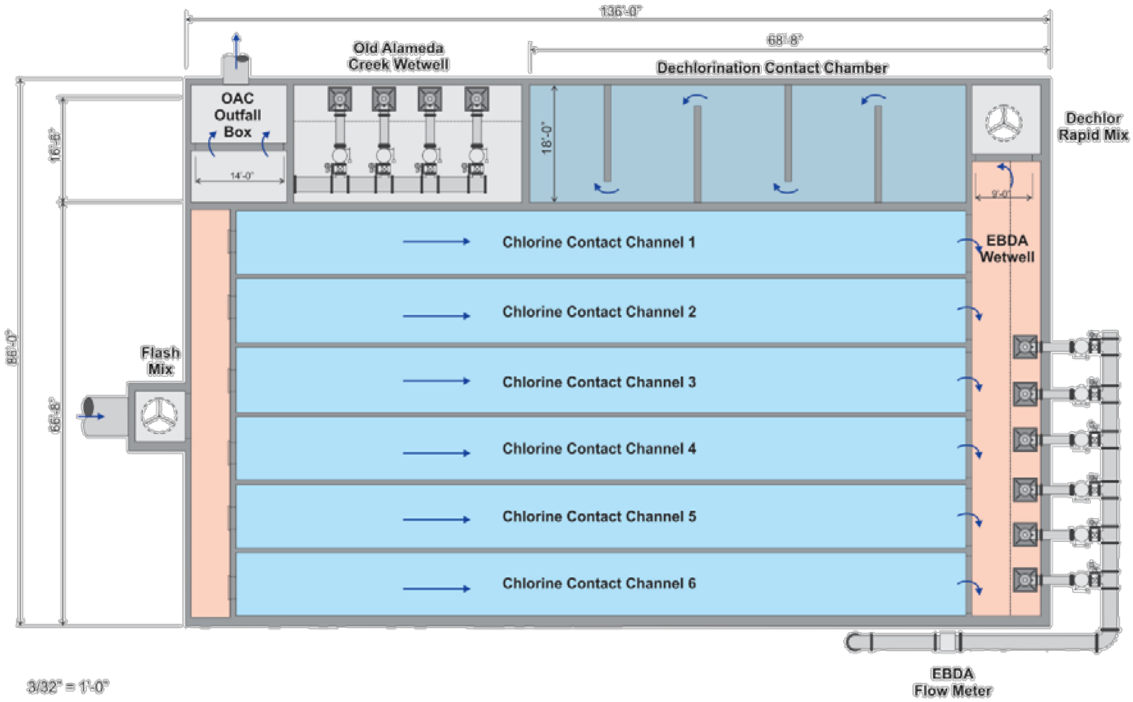


Figure 6-10 New Effluent Facility

6.4 Sidestream Treatment Facility

As summarized in **Section 5 – Modeling Scenarios**, sidestream deammonification is required to meet BACWA Level 2 standards for the for 2040 loads. The District recently piloted an ANITA™ mox system. The system was considered in sizing the facility. The sidestream facility has the following features and would be located near the dewatering building in the southwest corner of the plant:

- Centrate equalization
- A 0.37 MG reactor
- Electrical room
- Chemical room

6.5 Chemical Phosphorus Removal

The BACWA Level 2 standards includes a total phosphorus limit (TP < 1 mg/L) for discharge to the San Francisco Bay. While the volume required for biological phosphorus removal was determined, the District decided that chemical phosphorus removal should be assumed for this analysis. Chemical phosphorus removal would be accomplished by metal salt addition to centrate and MLSS. Two small dosing stations were included in the scope for both the CAS and MBR options. Chemical phosphorus removal will require approximately 1,000 gpd/d of metal salt addition.

7. CAS Phasing Options

As described in **Section 2 – Approach**, once the long-term layout was developed, there are opportunities to phase the project and spread out capital investment over time. This is mainly a feature of the CAS solution where a trigger based on the future requirements can be developed.

There are three main CAS phasing options have the same nutrient removal infrastructure in 2040 but are packaged into near-term (Phase I) and long-term (Phase II) solutions differently; the Phase I and Phase II is presented in **Figure 7-1**.

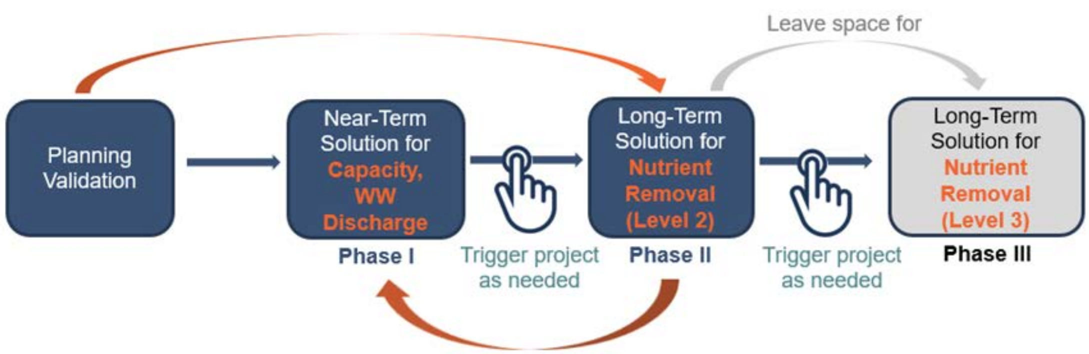


Figure 7-1 Trigger-Based Phasing of Near-term and Long-term Solutions

The three CAS phasing options were developed to achieve a specific objective in the near-term with Phase I. The differences in Phase I objectives are summarized in **Table 7-1**. These options result in the same long-term nutrient removal infrastructure (at the end of Phase II) as presented in **Section 6**. However, there are different intermediate projects to help achieve near-term objectives.

Table 7-1 CAS Phasing Options

Phase	CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR	CAS Option 2 – New Clarifiers Early and Year-round BNR	CAS Option 3 – No Old Alameda Creek Discharge
Phase I: Near-term Objectives	• Increase capacity • Earliest creek discharge with limited BNR	• Increase capacity • Potential discharge to Old Alameda Creek through year-round nutrient removal	• Increase capacity • Avoid creek discharge
Additional intermediate scope over CAS Option presented in **Section 6.2**	• Near-term Clarifier Modifications • Disk Filters		• Secondary Effluent Equalization Basin

For each phasing option, the following is described in this **Section 7- CAS Phasing Options**:

1. Phase I Scope
2. Phase I Effluent Water Quality
3. Phase II Remaining Scope
4. Phase I and Phase II Layouts
5. Option Summary - Benefits and Considerations

For each of the three phasing options, the intermediate design horizon of 2028 was used to determine the water quality after Phase I. These flows and loads are presented in **Table 7-2**. The wet weather hydrograph was escalated to 2028 conditions and resulted in a peak hour flow of 67.1-mgd.

Table 7-2 2028 Model Influent Flow, Loads and Concentrations

Parameter	AA		MM		MML-AAF		Redundancy - 1 AB OOS		Redundancy - 1 SC OOS[1]	
Flow, mgd	26		30		26		26		26	
	lbs/d	**mg/L**	**lbs/d**	**mg/L**	**lbs/d**	**mg/L**	**lbs/d**	**mg/L**	**lbs/d**	**mg/L**
cBOD	68,300	270	78,500	270	78,500	310	68,300	270	68,300	270
COD	161,400	749	185,600	749	185,600	861	161,400	749	161,400	749
TSS	75,900	362	87,300	362	87,300	416	75,900	362	75,900	362
TKN	11,800	55	13,500	55	13,500	63	11,800	55	11,800	55
NH_3	8,000	37	9,200	37	9,200	43	8,000	37	8,000	37
TP	1,500	6.9	1,700	6.9	1,700	8.0	1,500	6.9	1,500	6.9

[1]CAS option only

7.1 CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR

7.1.1 CAS Option 1 – Phase I Scope and Process Flow Diagram

As noted in **Table 7-1**, CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR Phase I achieves the objectives of increasing plant capacity and provides limited seasonal BNR for discharge to Old Alameda Creek. **Table 7-3** summarizes the scope for CAS Option 1 - Clarifier Modifications and Limited Seasonal BNR for Phase I and Phase II.

Table 7-3 CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR Scope

	CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR	Note
Phase I – Capacity Scope	Aeration Basin Modifications	No new AB volume. Layouts as described in **Section 6.2.1.1**
	Secondary Clarifier Modifications	New as described in **Section 7.1.1.1**
Phase I – Creek Discharge Scope	Sidestream Treatment	As described in **Section 6.4**
	Disk Filters	New as described in **Section 7.1.1.2**
	Chlorination/Dechlorination Facilities	As described in **Section 6.3**
	EBDA and OAC Pump Station	As described in **Section 6.3**
	EBDA FM re-route	As described in **Section 6.3**
Phase II Scope	Intermediate Pump Station	As described in **Section 6.2**
	2.5 MG of PE equalization	As described in **Section 6.2**
	New Aeration Basin Volume (5.5 MG)	As described in **Section 6.2**
	Blowers and Blower Building	As described in **Section 6.2**
	New Secondary Clarifiers	As described in **Section 6.2.1.3**
	Chemical P Removal	As described in **Section 6.5**

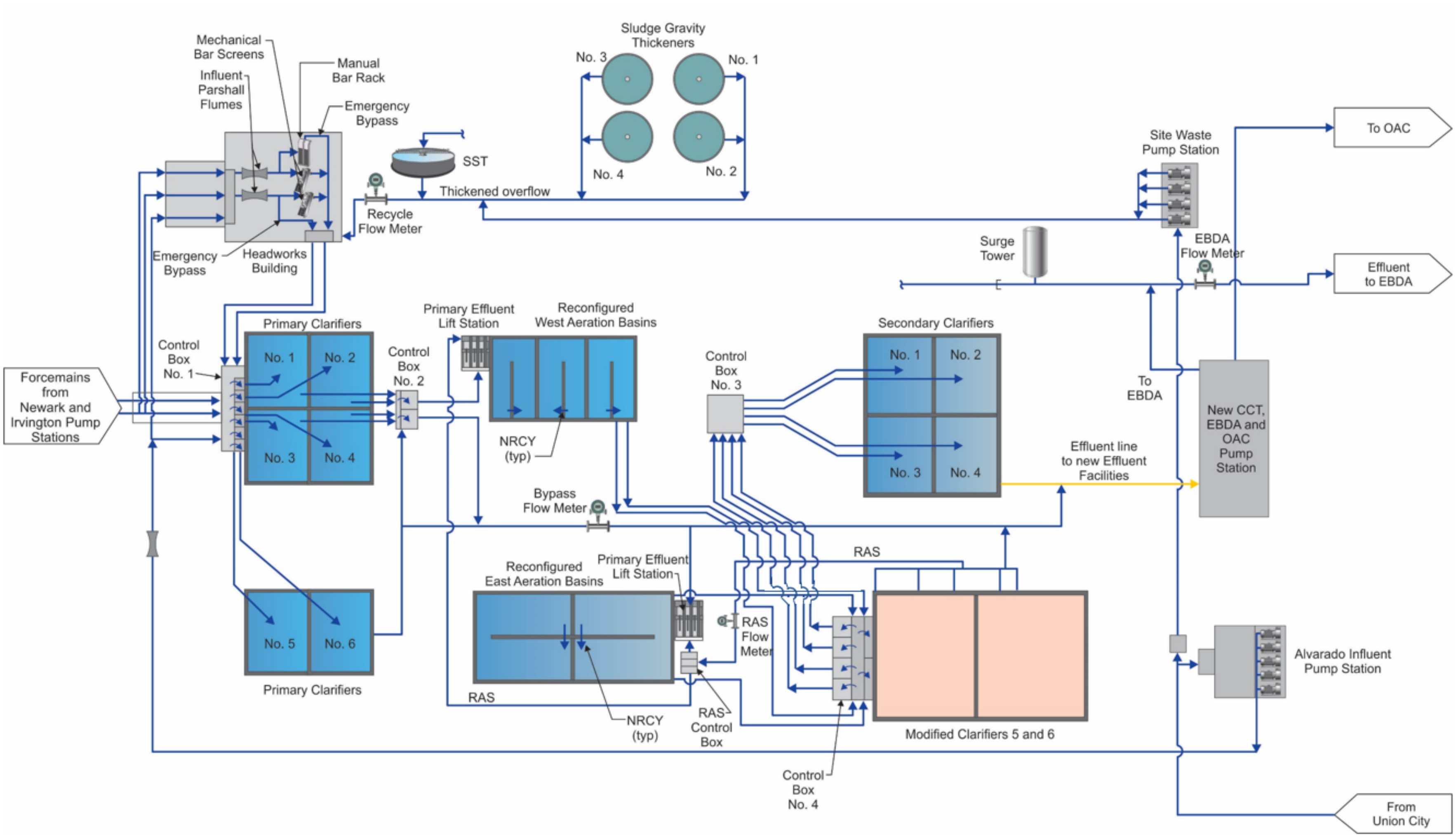


Figure 7-2 CAS Option 1 Phase 1 PFD

7.1.1.1 Secondary Clarifier Modifications

CAS Option 1 increases plant capacity in Phase I through aeration basin modifications as described in **Section 6.2.1** and secondary clarifier modifications. Secondary clarifier field testing identified modifications to clarifier internals that could improve existing Secondary Clarifiers 5 and 6 performance. Secondary Clarifiers 1-4 performed well during field testing and modifications to improve performance are not recommended. Subsequent to clarifier field testing, the RAS seals for Clarifiers 5 and 6 were replaced in September and October of 2018. Additional modifications to Secondary Clarifier 5 and 6 include the following and are illustrated in **Figure 7-3**.

- Corner fillets
- Energy dissipating inlet
- Replacement of existing daft tube mechanism with sludge suction header

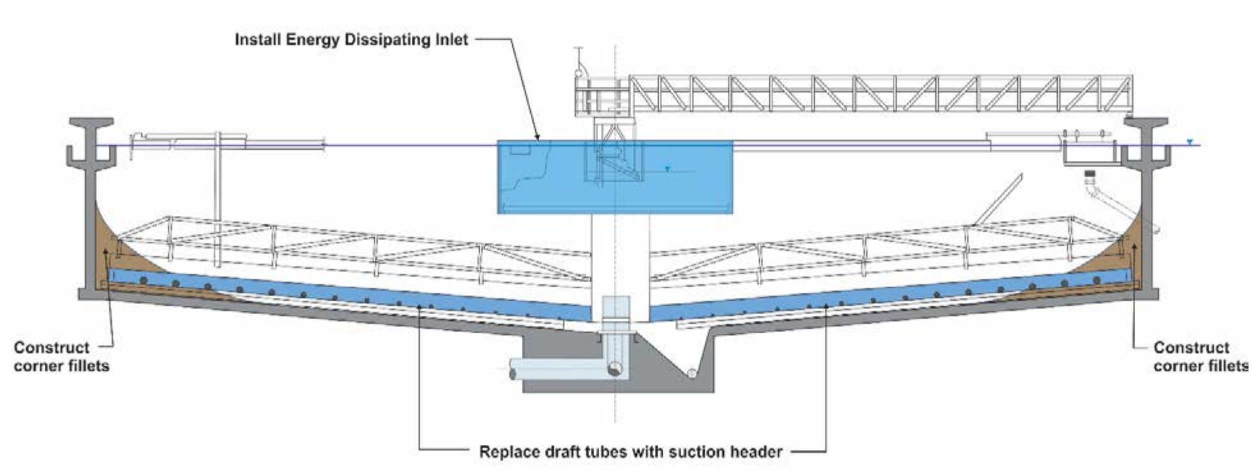


Figure 7-3 CAS Option 1 – Secondary Clarifier 5 and 6 Modifications

- **Enhancement:** The plant currently does not have effective RAS control from Secondary Clarifier 5 and 6 and has poor RAS control for Secondary Clarifiers 1-4. An enhancement to CAS Option 1 Phase I would be to provide either RAS control for Secondary Clarifier 5 and 6 or improved RAS control for all clarifiers via expansion of the existing RAS pump station or a new RAS pump station.

7.1.1.2 Phase I Creek Discharge

Old Alameda Creek discharge may have more stringent TSS and cBOD standards in the future. Per **Section 4** it was assumed that discharge to Old Alameda Creek would require a TSS less than15 mg/L. Disk filters were chosen to further treat flow that is discharged to the Creek. This results in two effluent qualities, normal effluent water quality discharged through the EBDA force main and improved effluent quality discharged to the Old Alameda Creek.

To optimize disk filter performance, it is proposed that some flow always be sent through the disk filters. During dry weather these two flows, filtered through disk filters and not treated with disk filters, will be combined and discharged through the EBDA force main. Once the plant effluent flows are greater than 42.9-mgd, the better effluent quality will be segregated through a passive system, dechlorinated and discharged to Old Alameda Creek.

7.1.2 CAS Option 1 – Effluent Water Quality

While TN reduction to achieve creek discharge is currently being discussed with the regional board, Phase I can achieve around 15% annual TN removal through sidestream treatment and seasonal BNR:

- Sidestream treatment will reduce centrate nitrogen load by 80-90%. This is approximately a 10% effluent TN load reduction.
- Seasonal BNR provides additional TN load reduction during the warmest months, June – August. Averaging three months of BNR operation with SST and nine months of just SST with carbon removal operation results in a total TN reduction of around 15%.

7.1.2.1 Process Modeling Results

Process modeling was conducted to determine nutrient removal after the completion of CAS Option 1 Clarifier Modifications and Limited Seasonal BNR - Phase I. These results are presented in **Table 7-4.**

Table 7-4 CAS Option 1 – Phase I Summer BNR Operation Modeling Results

	Parameter	Units	AA	MM	MML-AAF
Influent	Temperature	°C	20	20	20
Aeration	AB in service	#	5	5	5
	MLSS zone 2	mg/L	2,700	3,000	3,000
	SRT	d	5.3	5.3	5.3
	Aerobic SRT	d	3.5	3.5	3.5
Secondary Clarification	Number	#	6	6	6
	Surface Area	sf	48,000	48,000	48,000
	Volume	MG	5	5	5
	SOR	gpd/sf	540	625	540
	SLR	lbs/d/sf	18	24	20
	SVI	mL/g	110	110	110
	RAS Ratio	%	50%	50%	50%
WAS	WAS flow	mgd	0.4	0.5	0.5
	WAS conc	mg/L	9,200	10,000	10,000
	WAS Load	lbs/d	35,000	39,000	39,000
Secondary Effluent[1]	cBOD	mg/L	<10	<10	<10
	TSS	mg/L	<15	<15	<15
	TN	mgN/L	<15	<15	<16
	NH_3	mgN/L	~1-2	~1-2	~1-2
	NO_3	mgN/L	~10-11	~10-11	~10-12
	NO_2	mgN/L	<0.5	<0.5	<0.5
	TIN	mgN/L	~10-12	~10-12	~10-12
	TP	mgP/L	~3	~3	~3
	PO_4-P	mgP/L	~2.5	~2.5	~2.5

Process modeling shows that with these Phase I improvements, nutrient removal can be achieved during the summer months for annual average loads. With modified clarifiers and improved SVI, the clarifiers can sustain a MLSS of 2,700 mg/L during dry weather. This allows the facility to operate in BNR mode during the warmer months. It is not recommended that the plant operate in BNR mode during cold weather as the modified clarifiers will not be able to sustain higher MLSS required for nitrification in cold weather. A comparison of effluent qualities for BNR operation and carbon removal operation is presented in **Table 7-5**.

Table 7-5 CAS Option 1 – Phase I BNR and CAS Effluent Quality Comparison

Operation	Units	BNR	Carbon Removal
Conditions	-	MML-AAF	MML-AAF
Temperature	°C	>20	16
Aerobic SRT	D	3.5	1.5
cBOD	mg/L	<10	<10
TSS	mg/L	<15	<15
TN	mgN/L	<16	~47
NH_3	mgN/L	~1-2	~45
TP	mgP/L	~3	~2

With these Phase I improvements, the plant should operate in carbon removal mode during wet weather as the modified clarifiers will not be able to sustain peak flows at MLSS required for BNR operation (even with step feed operation). **Figure 7-4** shows effluent water quality during wet weather after CAS Option 1 Phase I is completed. Note that with the disk filters installed in Phase I, effluent TSS is below 15 mg/L throughout the storm event.

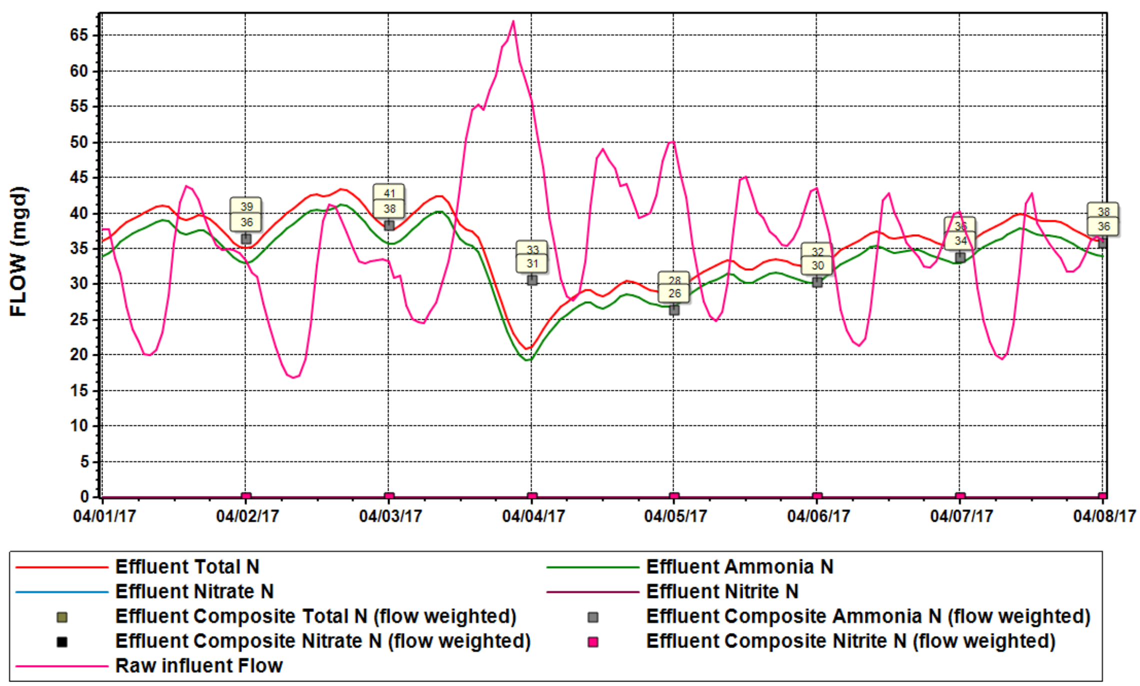


Figure 7-4 CAS Option 1 – Phase I Wet Weather Effluent Nitrogen

7.1.3 CAS Option 1 – Phase II Scope

The remaining scope items not constructed in Phase I will be constructed as part of Phase II as listed in **Table 7-3**. Phase II will be triggered when the facility expects to meet BACWA Level 2 standards.

7.1.4 CAS Option 1 – Phase I and II Layouts

A site plan showing the AWWTP after CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR Phase I is completed is shown in **Figure 7-5**.

A site plan showing the AWWTP after CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR Phase II is completed is shown in **Figure 7-6**. Note that only the blue shaded infrastructure is constructed under Phase II, grey shaded infrastructure is installed as part of Phase I.

Both site plans show the location of the proposed new building campus facility. Campus details have been developed in parallel to this study as part of the Enhanced Treatment & Site Upgrade Program.

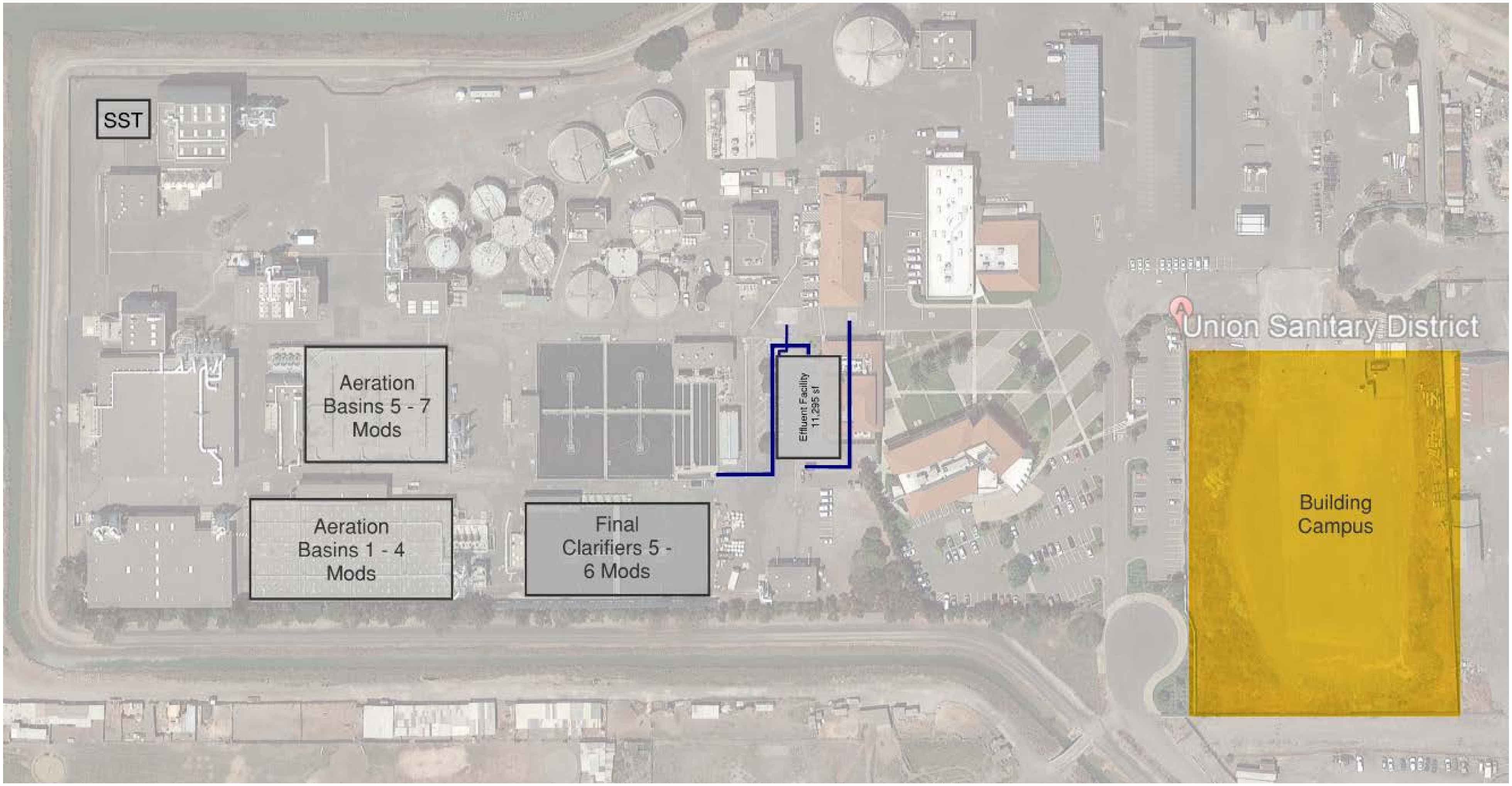


Figure 7-5 CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR Phase I

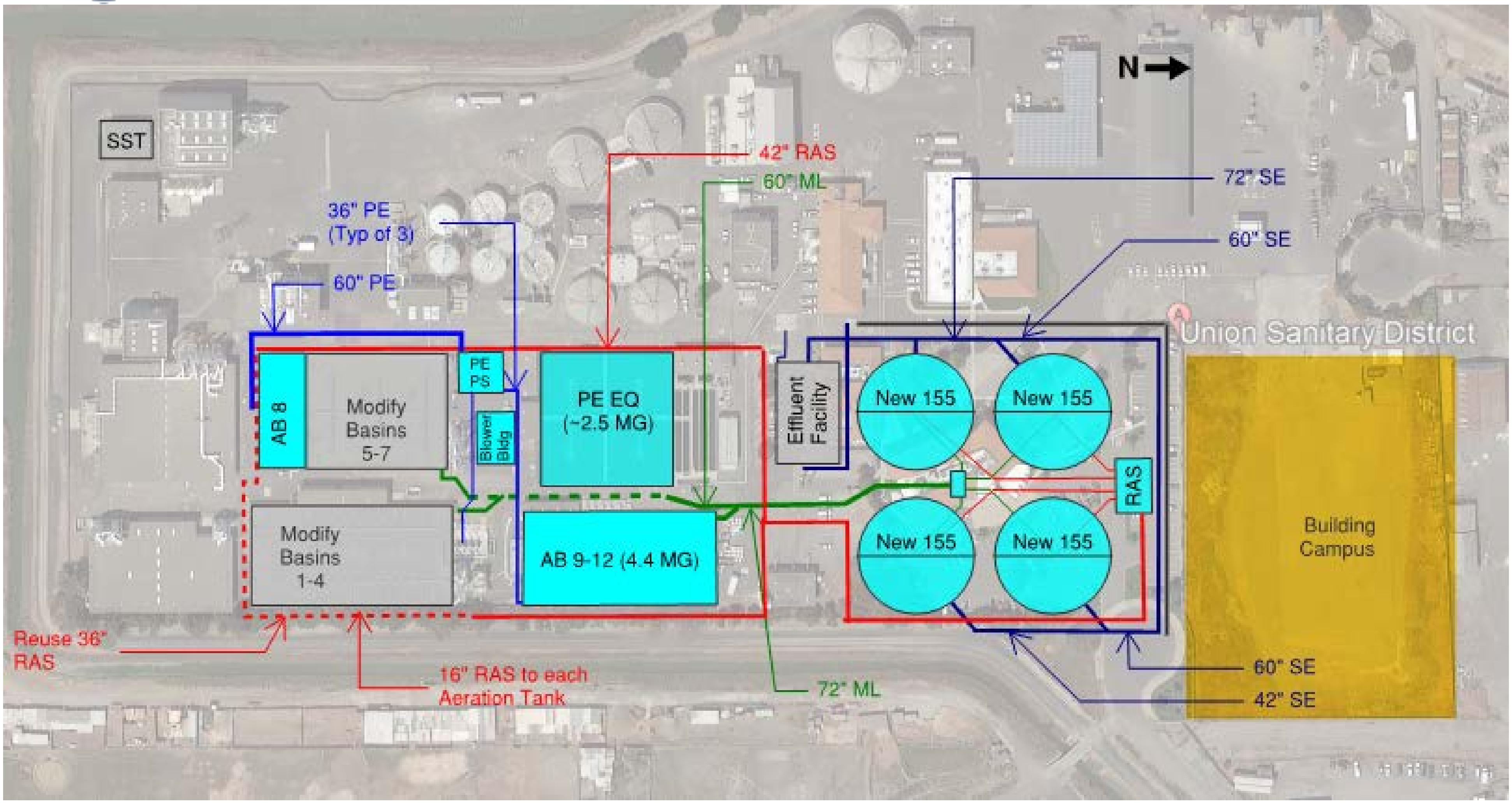


Figure 7-6 CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR Phase II

*Note that Phase I scope is shown in grey and Phase II scope is shown in blue.

7.1.5 CAS Option 1 – Benefits and Considerations

There are several benefits to the phasing in CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR.

1. Improved clarification over current operation
2. Achieves creek discharge
   - Limited seasonal BNR can be achieved with aeration basin modifications and clarifier modifications
   - Sidestream treatment can be constructed simultaneously
   - Effluent facility can be constructed simultaneously
3. This option delays most capital expenditures to Phase II

There are several considerations to the phasing in CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR. These are:

1. Only achieves limited seasonal BNR
2. Invests in disk filters that will be of limited benefit once the new clarifiers are constructed
3. Invests in clarifier modifications that will not be needed after the new clarifiers are constructed
4. Less reliable clarifier performance in the interim period (after Phase I is completed but before Phase II is completed)
5. Needs sidestream treatment in Phase I
6. Operational complexity with two water qualities

7.2 CAS Option 2 – New Clarifiers Early and Year-round BNR

7.2.1 CAS Option 2 – Phase I Scope and Process Flow Diagram

As noted in **Table 7-1**, CAS Option 2 – New Clarifiers Early and Year-round BNR Phase I achieves the objectives of increasing plant capacity and potential discharge to Old Alameda Creek through year-round nutrient removal. **Table 7-6** summarizes the scope for CAS Option 2 - New Clarifiers Early and Year-round BNR for Phase I and Phase II. **Figure 7-7** shows the process flow diagram for this configuration.

Table 7-6 CAS Option 2 – New Clarifiers Early and Year-round BNR Scope

Phase	CAS Option 2 – New Clarifiers Early and Year-round BNR	Note
Phase I – Capacity Scope	Aeration Basin Modifications	No new AB volume. Layouts as described in **Section 6.2.1.1**
	New Secondary Clarifiers	As described in **Section 6.2.1.4**
Phase I – Creek Discharge Scope	PE Equalization (2.5 MG)	As described in **Section 6.2**
	Chlorination/Dechlorination Facilities	As described in **Section 6.3**
	EBDA Pump Station	As described in **Section 6.3**
	EBDA FM re-route	As described in **Section 6.3**
Phase II Scope	Intermediate Pump Station	As described in **Section 6.2**
	New Aeration Basin Volume (5.5 MG)	As described in **Section 6.2**
	Blower and Blower Building	As described in **Section 6.2**
	Chemical P Removal	As described in **Section 6.5**
	New Sidestream Treatment	As described in **Section 6.4**

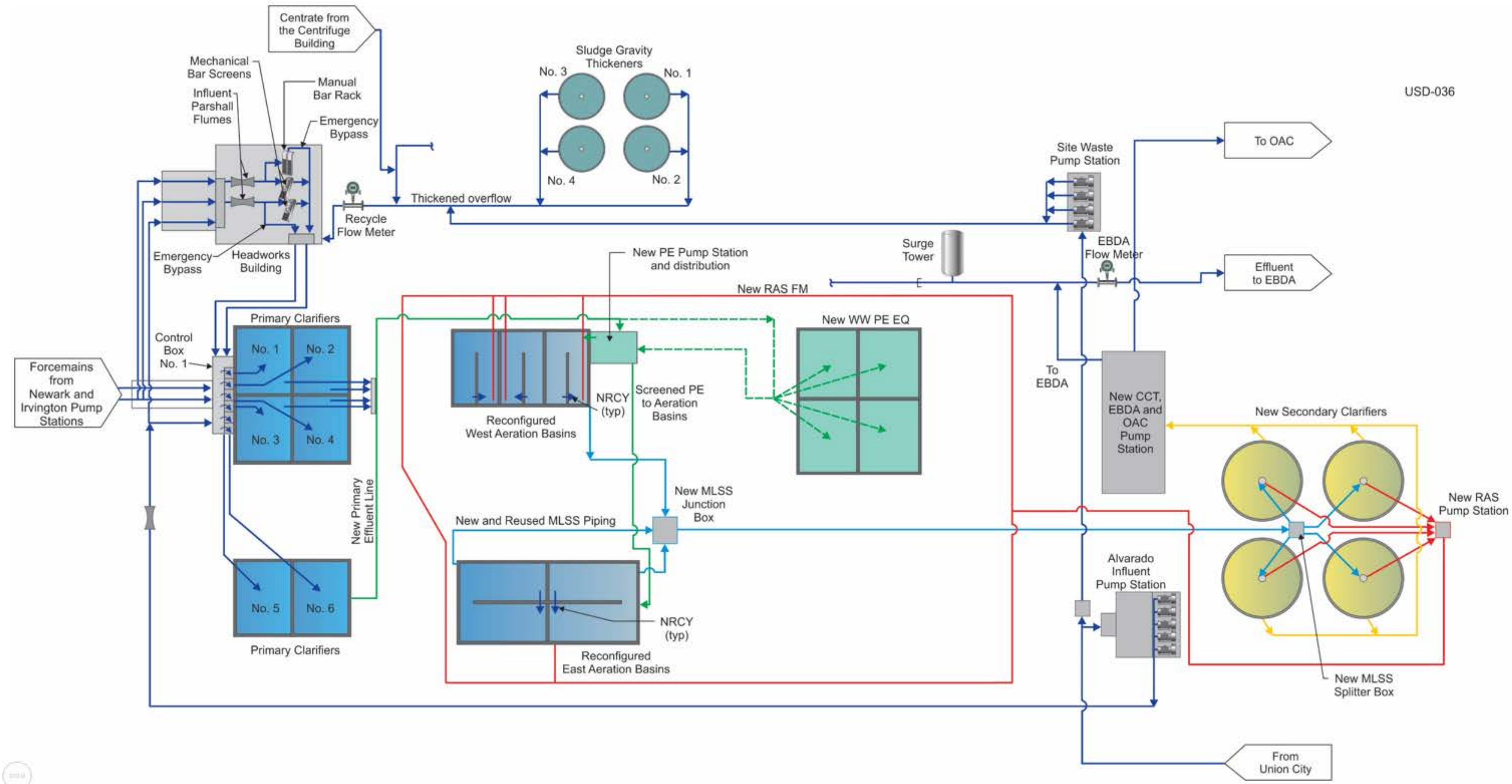


Figure 7-7 CAS Option 2 Phase I PFD

7.2.2 CAS Option 2 – Effluent Water Quality

Phase I accomplishes improved effluent quality through year-round BNR. The aeration basin modifications described in **Section 6.2.1.1** coupled with the new modern clarifiers will provide the District with the capability to operate in BNR mode year-round because:

- The RAS system associated with the new modern clarifiers allows for step feed operation during wet weather.
- The PE equalization shaves peaks during wet weather.
- The new clarifiers can handle wet weather at the higher solids loading required for BNR
- Year -round BNR operation can achieve approximately 50% effluent TN load reduction for the year. It also achieves significant ammonia removal in wet weather.

To meet the stringent TSS standards (TSS<15 mg/L) for creek discharge during wet weather while maintaining solids inventory for BNR, the District will utilize several features in CAS Option 2 Phase I:

- PE equalization to shave off peak flow during storm events
- Step feed operation to off load solids loading to the secondary clarifiers
- Modern clarifiers with more total surface area and improved RAS control.

7.2.2.1 CAS Option 2 – New Clarifiers Early and Year-round BNR – Nutrient Removal

Process modeling was conducted to determine nutrient removal after the completion of CAS Option 2 Phase I. These results are presented in **Table 7-7.**

Table 7-7 CAS Option 2 – Phase I BNR Operation Modeling Results

	Parameter	Units	AA	MM	MML-AAF	Redundancy - 1 AB OOS[1]	Redundancy - 1 SC OOS
Influent	Temperature	^oC	16	16	16	20	16
Aeration	AB in service	#	5	5	5	4	5
	MLSS	mg/L	3,400	3,800	3,800	3,800	3,400
	SRT	d	5.3	5.3	5.3	4.5	5.3
	Aerobic SRT	d	4.5	4.5	4.5	4.0	4.5
New Secondary Clarifiers	Number	#	4	4	4	4	3
	Surface Area	sf	75,500	75,500	75,500	75,500	56,600
	Volume	MG	10	10	10	10	8
	SOR	gpd/sf	378	430	379	372	504
	SLR	lbs/d/sf	18	21	19	20	23
	SVI	mL/g	110	110	110	110	110
	RAS Ratio	%	50%	50%	50%	50%	50%
WAS	WAS flow	mgd	0.4	0.4	0.4	0.4	0.4
	WAS conc	mg/L	10,500	11,400	11,400	12,000	10,200
	WAS Load	lbs/d	33,000	38,000	38,000	37,000	33,000
Secondary Effluent	cBOD	mg/L	<10	<10	<10	<10	<10
	TSS	mg/L	<15	<15	<15	<15	<15
	TN	mgN/L	<18	<18	~19	<18	<18
	NH_3-N	mgN/L	<2	~2.5	~3	~3.5	<2
	NO_3-N	mgN/L	~11-12	~12	~14.5	~11	~11-12
	NO_2-N	mgN/L	~0.5	~0.5	~0.5	~1	~0.5
	TIN	mgN/L	~12-13	~12-13	~15	~12	~12-13
	TP	mgP/L	~3-4	~3-4	~3-4	~3-4	~3-4
	PO_4-P	mgP/L	~3	~3	~3.5	~3	~3

[1]Largest AB out of service

If BNR operation is needed it is not recommended to take an aeration basin out of service during colder months as it will reduce the aerobic SRT significantly. Also note that these models were run without diurnal PE equalization as a conservative assumption. Note that modeling results presented in **Table 7-7** for AA, MM and MML-AAF are for worst case conditions, coldest temperatures. These models show ammonia breakthrough for the coldest month. During the coldest months there is a potential to optimize the system by using the swing zone aerobically to increase the aerobic SRT and reduce ammonia breakthrough.

Table 7-8 shows the expected effluent quality for other temperatures and **Figure 7-8** shows the TN reduction over the year. These model results show up to 50 % TN load reduction over a typical year.

Table 7-8 CAS Option 2 – Phase I BNR Operation Modeling Results Throughout the Year

Parameter	Units	Temperature, °C				
		16	18	20	22	24
Load Condition	-	MM	MM	MM	MM	MM
Flow Condition	-	AA	AA	AA	AA	AA
Flow	mgd	26	26	26	26	26
AB Volume in service	mg	7.4	7.4	7.4	7.4	7.4
Swing Volume	-	Aerobic	Aerobic	Anoxic	Anoxic	Anoxic
New Secondary Clarifier SA	sf	75,500	75,500	75,500	75,500	75,500
SVI	mL/g	110	110	110	110	110
SRT	d	4.8	4.8	4	4	4
MLSS	mg/L	3,800	3,800	3,600	3,600	3,550
TN	mgN/L	~19	<19	<16	~15	~15
NH_3-N	mgN/L	~3	<2	<2	<1	<1
NO_3-N	mgN/L	~14.5	~15	~9-11	~10-12	~10-12
NO_2-N	mgN/L	~0.5	~0.5	~0.5	<0.5	<0.5
TIN	mgN/L	~15	<15.5	~10-11	~10-12	~10-12

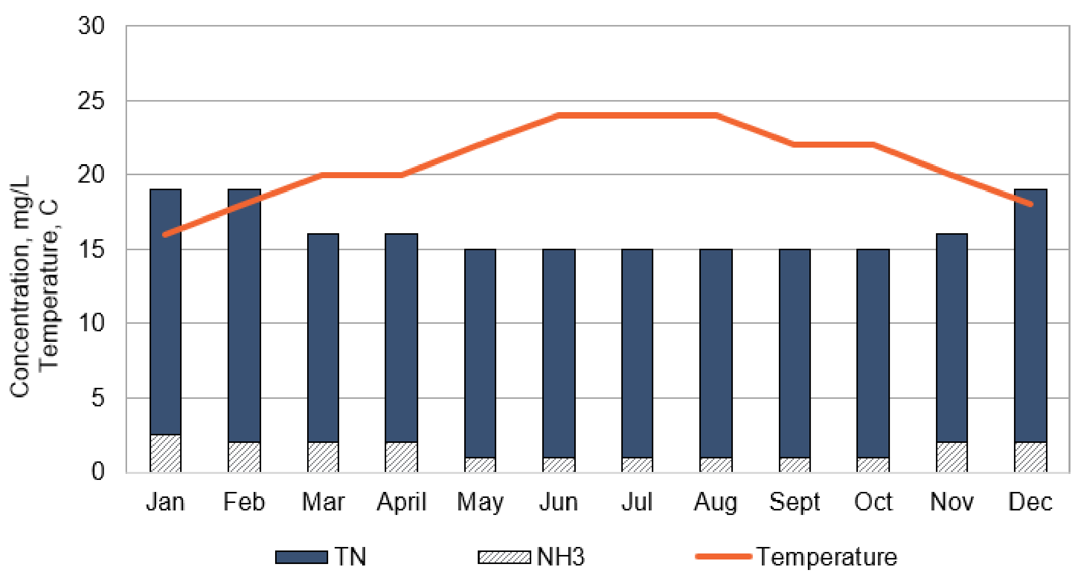


Figure 7-8 CAS Option 2 – Phase I TN Reduction

During storm events, step feed operation reduces the MLSS from 3,600 mg/L to 2,700 mg/L. This solids loading rate reduction, PE equalization, and the modern clarifier technology allow the facility to achieve effluent TSS less than 15 mg/L during storm events. **Figure 7-9** and **Figure 7-10** show the simulated effluent TSS and effluent nitrogen during the design storm after CAS 2 Phase I is completed, respectively. Note that the SOR in **Figure 7-10** is based on the clarifier effluent flow after equalization.

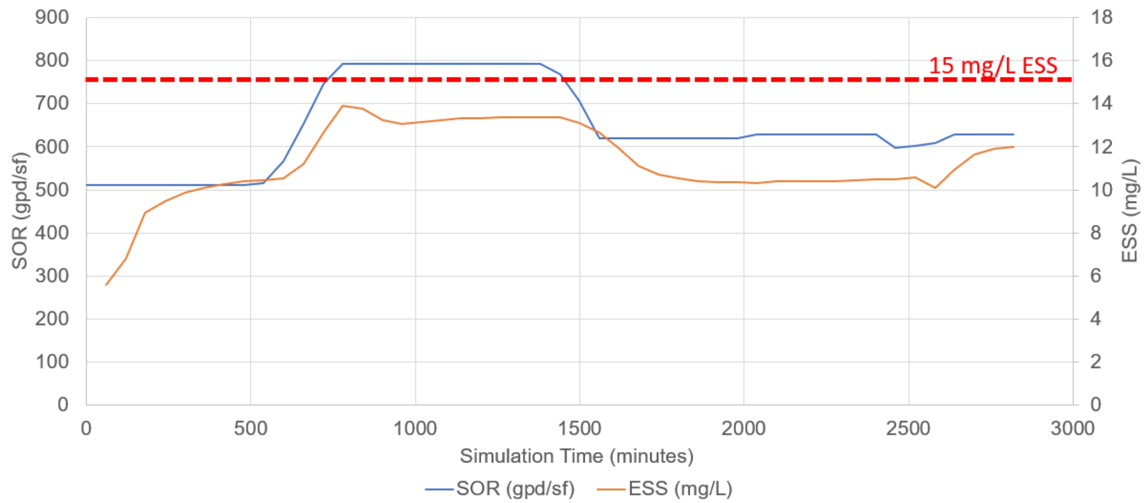


Figure 7-9 CAS Option 2 – Phase I Wet Weather Effluent TSS

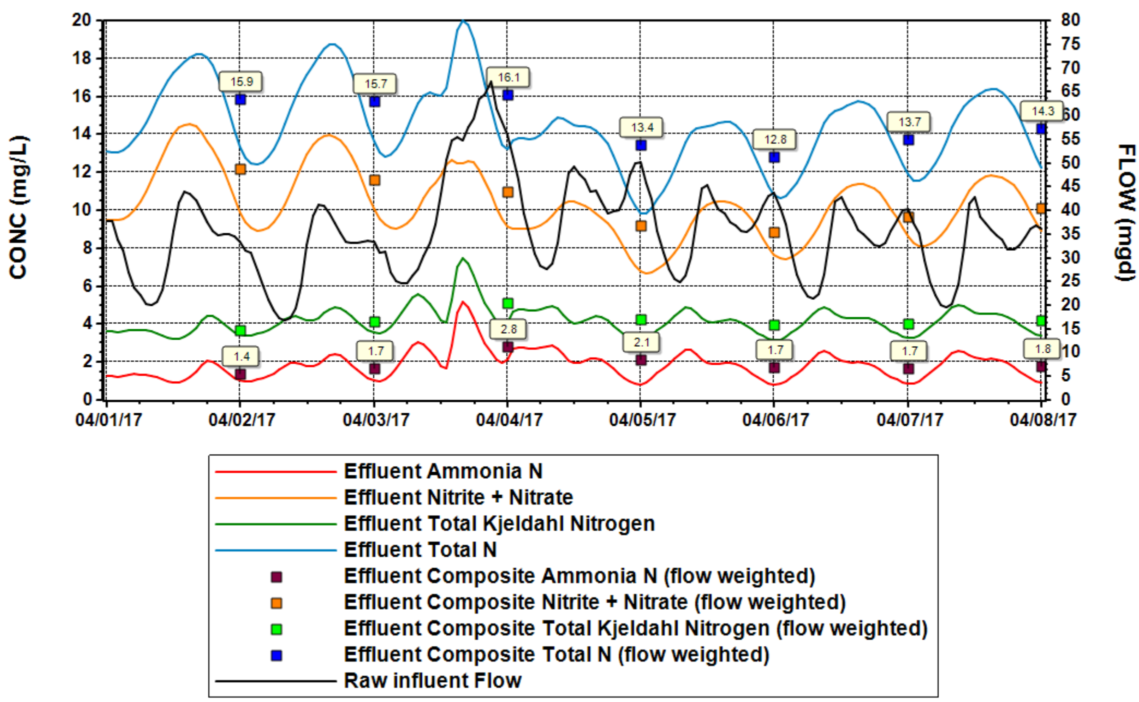


Figure 7-10 CAS Option 2 – Phase I Wet Weather Effluent Nitrogen

7.2.3 CAS Option 2 – Phase II Scope

The remaining scope items not constructed in Phase I will be constructed as part of Phase II as listed in **Table 7-6**. Phase II will be triggered when the facility expects to be required to meet BACWA Level 2 standards year-round or if loading increases such that ammonia breakthrough occurs in cold weather.

7.2.4 CAS Option 2 – Phase I and II Layouts

A site plan showing the AWWTP after CAS Option 2 – New Clarifiers Early and Year-round BNR Phase I is completed is shown in **Figure 7-11**. A site plan showing the AWWTP after CAS Option 2 – New Clarifiers Early and Year-round BNR Phase II is completed is shown in **Figure 7-12**. Only the blue shaded infrastructure is constructed under Phase II, grey shaded infrastructure is installed as part of Phase I.

7.2.5 CAS Option 2 – Benefits and Considerations

There are several benefits to the phasing in CAS Option 2 – New Clarifiers Early and Year-round BNR. These are:

1. Achieves Year-round BNR (Note: Not BACWA Level 2 standards)
2. Sidestream treatment is not required in Phase I, saving capital expenditures
3. Achieves greatest yearly mass TN removal (approximately 50%)
4. Does not have stranded assets associated with disk filters
5. Does not have stranded assets associated with clarifier modifications
6. New RAS control after Phase I is completed
7. Frees up 2.5 MG of volume for PE EQ in Phase I

One important consideration to the phasing of CAS Option 2, is the requirement to relocate the administrative and control building. For other options (CAS Option 1 and CAS Option 3) this activity must occur before Phase II, affording the District more flexibility in design and construction of the new building campus. For this option the buildings must be done in Phase I to accommodate the new clarifiers.

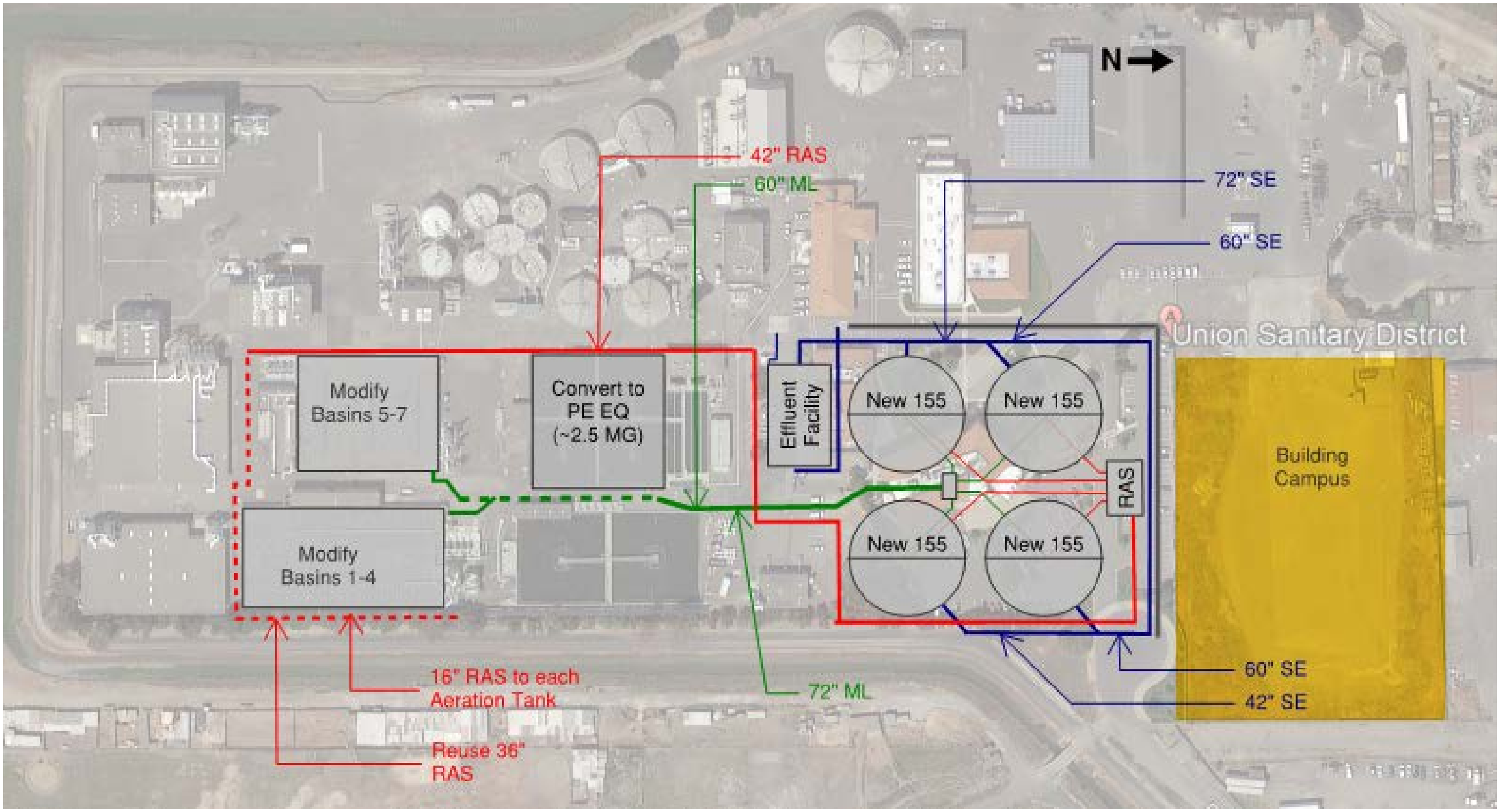


Figure 7-11 CAS Option 2 – New Clarifiers Early and Year-round BNR Phase I

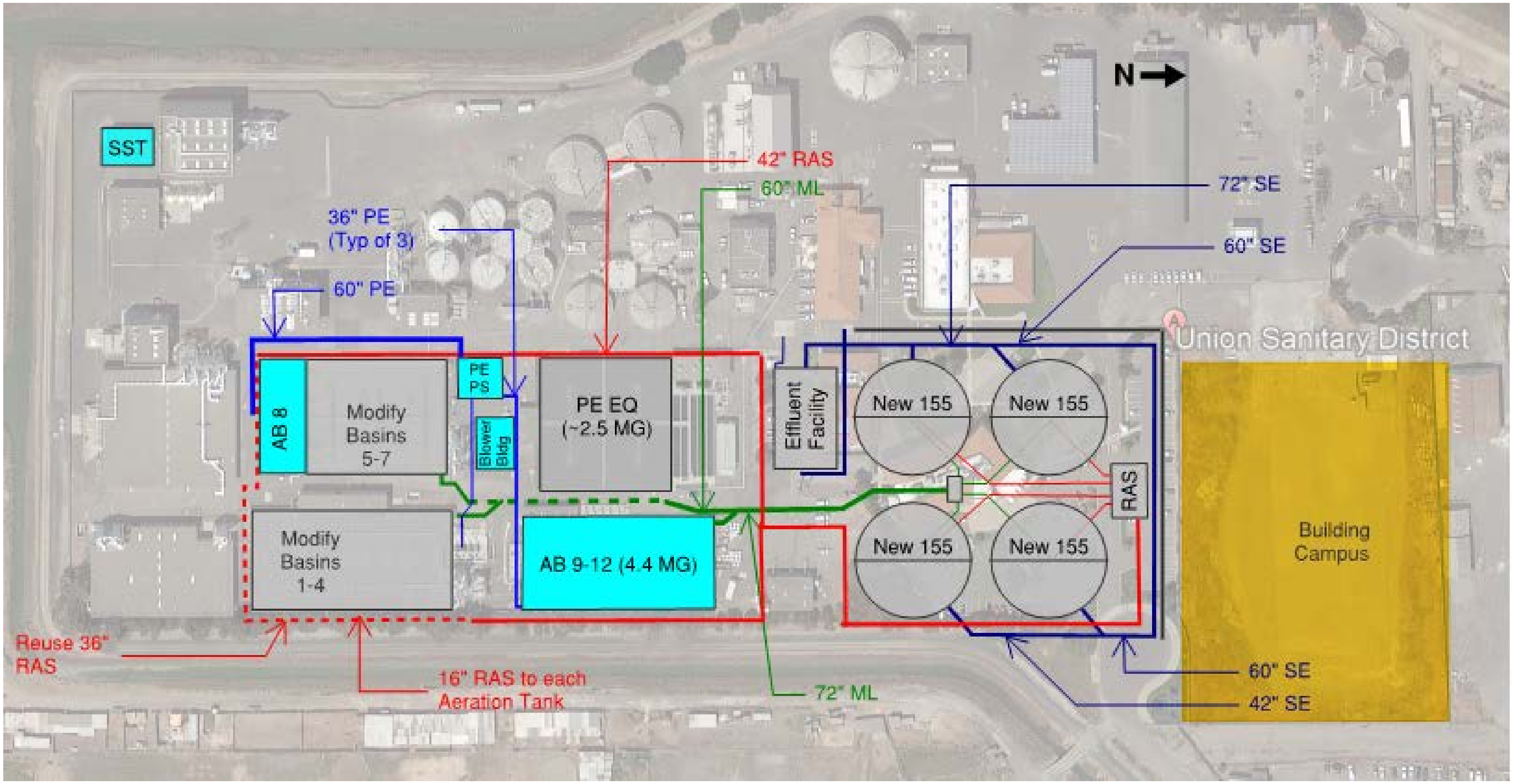


Figure 7-12 CAS Option 2 – New Clarifiers Early and Year-round BNR Phase II

*Note that Phase I scope is shown in grey and Phase II scope is shown in blue.

7.3 CAS Option 3 – No Old Alameda Creek Discharge

7.3.1 CAS Option 3 – Phase I Scope and Process Flow Diagram

As noted in **Table 7-1**, CAS Option 3 – No Old Alameda Creek Discharge Phase I achieves the objectives of increasing plant capacity and avoiding discharge to Old Alameda Creek. **Table 7-9** summarizes the scope for CAS Option 3 - No Old Alameda Creek Discharge for Phase I and Phase II. **Figure 7-13** shows the process flow diagram for this configuration.

Table 7-9 CAS Option 3 – No Old Alameda Creek Discharge Scope

Phase	CAS Option 3 – No Old Alameda Creek Discharge	Note
Phase I – Capacity Scope	Aeration Basin Modifications	No new AB volume. Layouts as described in **Section 6.2.1**
	New Secondary Clarifiers	As described in **Section 6.2.1.4**
Phase I – Creek Avoidance	New Effluent Storage	As described in **7.3.1.1**
Phase II Scope	Intermediate Pump Station	As described in **Section 6.2**
	PE EQ (2.5 MG)	As described in **Section 6.2**
	New Aeration Basin Volume (5.5 MG)	As described in **Section 6.2**
	Blower and Blower Building	As described in **Section 6.2**
	Chemical P Removal	As described in **Section 6.2**
	New Sidestream Treatment	As described in **Section 6.4**
	Chlorination Facilities	As described in **Section 6.3**
	EBDA Pump Station	As described in **Section 6.3**
	EBDA FM re-route	As described in **Section 6.3**

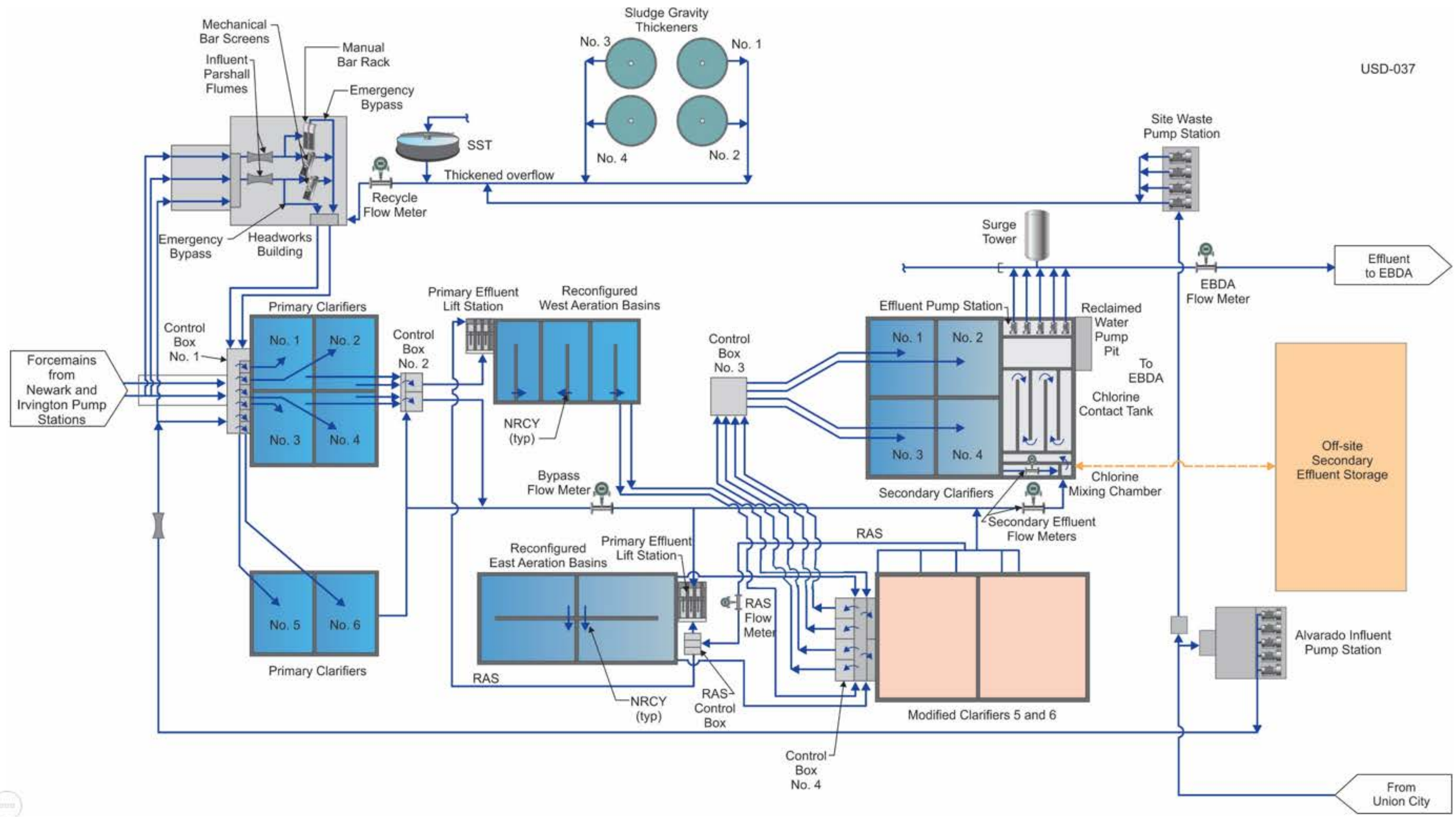


Figure 7-13 CAS Option 3 Phase I PFD

7.3.1.1 Secondary Effluent Equalization Basin

To limit effluent flows to 42.9-mgd, the maximum that can be discharged through the EBDA facility, an effluent storage facility is required. An initial analysis was conducted on actual plant effluent hourly flows from 2011 – May 2017. Hourly flows were escalated to 2040 flows (based on 1% per year escalation per **Section 4 - Assumptions**) and wet weather seasons were modeled to show the volume to be diverted to maintain a maximum secondary effluent flow of 42.9-mgd. Assuming that flows greater than 42.9-mgd are stored, this results in a minimum of 20 MG for 2040. Assuming the existing 8-mgd of emergency creek discharge is available, and additional free board, a 15 MG storage facility was planned for. Per discussions with the District, the effluent storage facility could include the following:

- Purchase a 17-acre land parcel adjacent to the AWWTP (east)
- Mitigation costs are approximately $1M per acre of acquired land
- No covers as stored flow would be secondary effluent
- Pumping and metering
- Extensive permitting and environmental documentation

7.3.2 CAS Option 3 – Effluent Water Quality

This option avoids discharge to the creek entirely and is not subject to the potential negotiations of a total TN load reduction of 15%. A part of this option the District will have modified aeration basins and modified secondary clarifiers in Phase I. The District could perform limited seasonal BNR similar to CAS Option 1. For process modeling results see **Section 7.1.2.1.**

7.3.3 CAS Option 3 – Phase II Scope

The remaining scope items not constructed in Phase I will be constructed as part of Phase II as listed in **Table 7-9.** Phase II will be triggered when the facility expects to be required to meet BACWA Level 2 standards year-round.

7.3.4 CAS Option 3 – Phase I and II Layouts

A site plan showing the AWWTP after CAS Option 3 – No Old Alameda Creek Discharge Phase I is completed is shown in **Figure 7-14**. A site plan showing the AWWTP after CAS Option 3 – No Old Alameda Creek Discharge Phase II is completed is shown in **Figure 7-15.** Note that only the blue shaded infrastructure is constructed under Phase II, the grey shaded infrastructure is constructed as part of Phase I.

7.3.5 CAS Option 3 – Benefits and Considerations

There are several benefits to the phasing in CAS Option 3 – No Old Alameda Creek Discharge. These are:

1. The secondary effluent storage system is relatively simple to operate. It would simplify operations during wet weather as flows greater than the EBDA capacity are passively diverted to the secondary effluent storage system. These flows are then drained where there is capacity it the EBDA system
2. The secondary effluent storage can also be used for off spec water
3. Can shave daily peak flow in DW to reduce effluent pumping costs (however it will increase daily maintenance)
4. Potentially less cash flow required depending on remediation requirements
5. EQ provides flexibility for future construction sequencing

There are several considerations to the phasing in CAS Option 3 – No Old Alameda Creek Discharge. These are:

1. Permitting and environmental documentation to acquire and use the adjacent land to construct a secondary effluent storage facility is risky and could take considerable time. The permitting and environmental process for this may take several years.
2. Land acquisition may also be risky as it involves additional parties to negotiate with.
3. This option does not provide synergy with future nutrient removal. While the basin modifications are required as listed in **Section 6**, the construction of the secondary effluent storage facility does not advance the ability of the plant to perform nutrient removal. Significant investment will need to be made as part of CAS Option 3 Phase II.

Figure 7-14 CAS Option 3 – No Old Alameda Creek Discharge Phase I

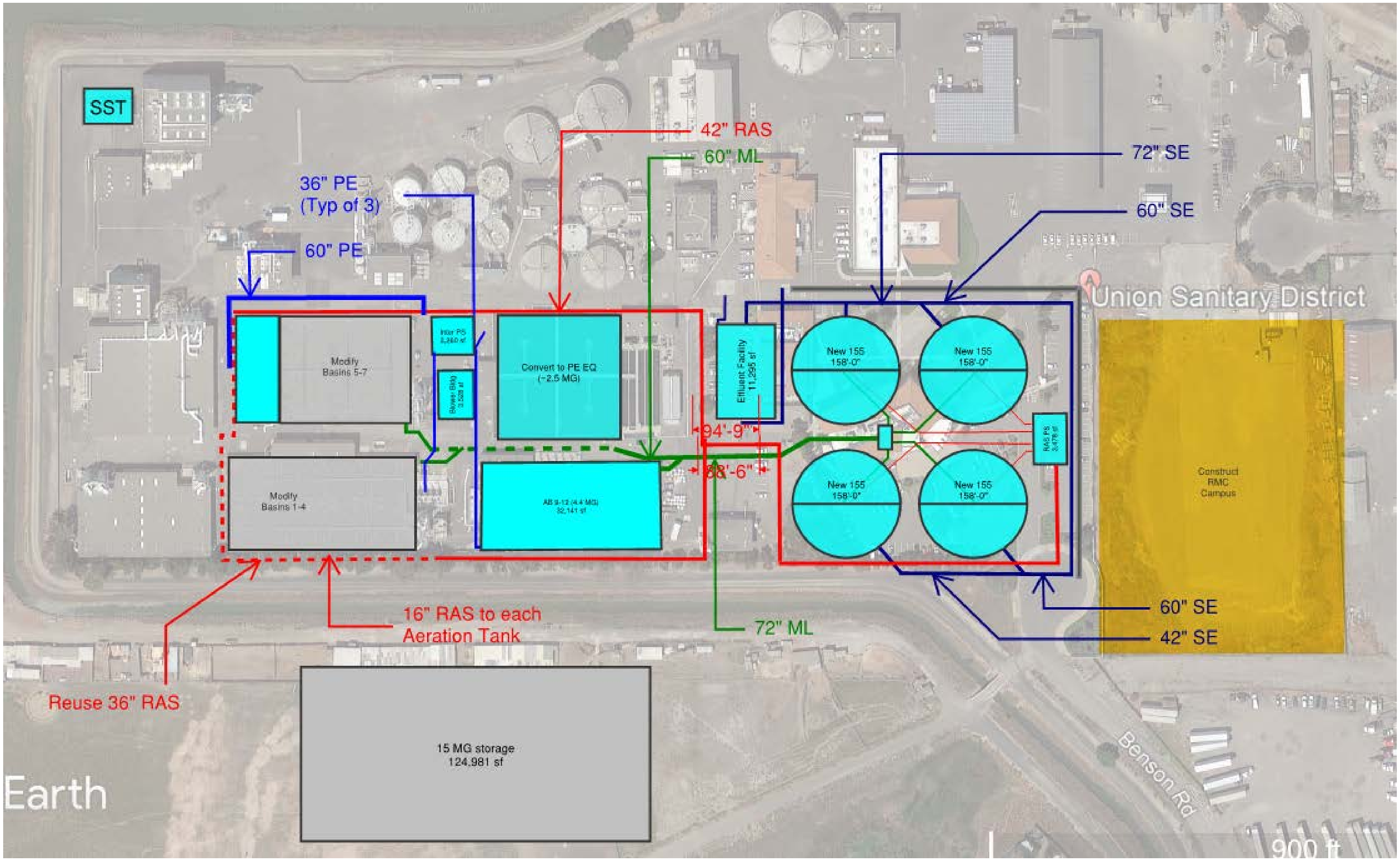


Figure 7-15 CAS Option 3 – No Old Alameda Creek Discharge Phase II

*Note that Phase I scope is shown in grey and Phase II scope is shown in blue.

7.4 CAS Phasing Options Summary

The phasing options were designed to achieve different specific objectives in Phase I as noted in **Table 7-1**. Each has benefits and considerations as summarized in **Table 7-10**.

Table 7-10 Summary of Benefits and Considerations for each CAS Option

Phase	CAS Option 1 Clarifier Modifications and Limited Seasonal BNR	CAS Option 2 New Early Clarifiers and Year-round BNR	CAS Option 3 No Old Alameda Creek Discharge
Phase I	• Aeration Basin Modifications • Secondary Clarifier modifications • Disk Filters • New[1] Chlorine Contact Channels • New[1] Dechlorination Facility • New[1] Effluent Pump Station • Move EBDA Force Main • Sidestream Treatment	• 2.5 MG of PE Equalization • Aeration Basin Modifications • New Secondary Clarifiers • New[1] Chlorine Contact Channels • New[1] Dechlorination Facility • New[1] Effluent Pump Station • Move EBDA Force Main	• Aeration Basin Modifications • Secondary Clarifier Modifications • Secondary Effluent Equalization
Phase II	• PE Pump Station • 2.5 MG of PE Equalization • New AB Vol. (5.5 MG) • Blowers and Blower Building • New Secondary Clarifiers • Chemical P Removal	• PE Pump Station • New AB Vol. (5.5 MG) • Blowers and Blower Building • Sidestream Treatment • Chemical P Removal	• PE Pump Station • 2.5 MG of PE Equalization • New AB Vol. (5.5 MG) • Blowers and Blower Building • New Secondary Clarifiers • Move EBDA Force Main • Sidestream Treatment • Chemical P Removal

Phase	CAS Option 1 Clarifier Modifications and Limited Seasonal BNR	CAS Option 2 New Early Clarifiers and Year-round BNR	CAS Option 3 No Old Alameda Creek Discharge
PROS	• Achieves seasonal BNR (3 months) quickly to get to creek with a gap of 2 years • Achieves improved clarification performance (over current)	• Year round BNR[2] • No sidestream treatment required in Phase I • Greatest TN removal until more stringent standards imposed • No stranded disk filters • No Clarifier modifications • Better clarifier performance • New RAS control in Phase I • 2.5 MG available for PE EQ	• Simplified operation during wet weather • Storage provides flexibility for off spec water during dry weather • Can shave daily peak flow in DW to reduce effluent pumping costs • Potentially cash flow required depending on remediation requirements • EQ provides flexibility for future construction MOPO
CONS	• Only achieves seasonal BNR • Stranded assets in disk filters • Stranded assets in clarifier modifications • Less reliable clarifier performance until Phase II • Need sidestream treatment • O&M complexities due to two effluent qualities	• Need to move buildings delays getting to the creek by two additional years over CAS Option 1	• Permitting and environmental process poses additional risk • Land acquisition and restoration requirement poses additional risk • Option does not provide synergy with future nutrient removal

[1]Conservative place holder for costs. Better use of existing infrastructure is pending condition assessment of the existing CCTs

[2]Achieves year-round BNR but not BACWA level 2 standards during coldest months

8. Estimate of Probable Costs

An American Association of Cost Engineers (AACE) estimate of probable costs was developed to determine project costs for each of the secondary treatment options and the individual packages. These cost estimates are summarized in this section and are detailed in **Appendix 11.**

The cost estimates developed for this planning phase project can be considered between a Class 3 and Class 4 estimate given the level of detail that has been defined for the options. **Table 8-1** summarizes the cost estimate classifications and the accuracy of each classification.

Table 8-1 AACE Cost Estimate Classifications

Estimate Level	Project Level	Basis	Accuracy
Class 5 – Factored Estimate	Conceptual / Screening	Similar	-50% to +100%
Class 4 – Equipment Factored Estimate	Study / Feasibility	Parametric model / Major Equipment	-30% to + 50%
Class 3 – Budgetary Cost Estimate	Budget Authorization	Semi-detailed Unit Costs	-20% to + 30%
Class 2 – Control Budget Estimate	Budget / Bid Estimate	Detailed Take-offs	-15% to + 20%
Class 1 – Detailed Estimate	Definitive Estimate	Material Take-offs	-10% to + 15%

8.1 Assumptions

Several assumptions were made to develop the project costs including Division 1, contractor overhead and profit, subcontractor mark up, escalation, bonding and insurance, contingency and market conditions. These values were selected based on experience and knowledge of local conditions. The current market conditions, a “hot” construction market, were also considered. These values were slightly relaxed for future construction as it was assumed that the current construction market will “cool down” to normal conditions. The cost assumptions are summarized in **Table 8-2**.

Table 8-2 Cost Assumptions for Secondary Treatment Process Improvements Project

	Typical Values, %	Assumption, %	Note
Division 1	8-20	15	
Overhead	10-20	10	
Profit	10-18	15	
Subcontractor Markup	2.5-7	5	
Escalation	2-5	4	Annual
Bonding / Insurance	2-6	3	
Contingency	25-50	30	For study or predesign
Market Conditions	Varies		Robust market
TOTAL		82	

8.2 Operation & Maintenance Cost Assumptions

Operations and Maintenance costs were only calculated for processes that were affected by the secondary treatment options. These were:

- Intermediate pump station (primary effluent pumping)
- Primary effluent equalization pumping
- Process air demand
- Aeration mixing demand
- Nitrified recycle pumping demand
- Clarifier mechanism
- RAS pumping
- WAS pumping
- SWAS pumping
- Chlorination flash mixing
- Disk filtration
- Dechlorination flash mixing
- EBDA pump station
- Old Alameda Creek pump station
- MBR facility demand and membrane replacement
- Sidestream treatment
- Chemical addition for phosphorus removal
- Operation personnel

O&M costs were calculated as additional O&M over current O&M costs. Where appropriate if there was no change assumed, this was noted. For intermittent costs, i.e. pumping to Old Alameda Creek, a percentage of time was assumed as summarized in **Table 8-3**.

Table 8-3 Intermittent Process Usage Assumptions

Intermittent Process	% of time	Note
Primary Effluent Equalization	4%	Wet weather only
SWAS pumping	17%	10 minutes an hour
Old Alameda Creek Pump Station	8%	Estimated % of time greater than 43-mgd

8.3 MBR Costs

The MBR option is estimated to have a capital cost of approximately $390M. This covers all project elements as detailed in **Table 8-4**.

Table 8-4 MBR Project Costs[2]

Scope Item	Costs, $M
PE Pump Station/ Fine Screens and Blower Building	44
Aeration Basin Modifications	40
Effluent Facilities	25
MBR Facilities	250
Plant Equalization and Storage	15
Sidestream Treatment	16
Total Capital Costs	390
Total Project Costs[1]	505
Annual O&M Costs	8.5

[1] 30% for Engineering, CM, Legal and Administrative

[2] Excludes campus building costs

8.4 CAS Option 1 – Modified Clarifiers and Limited Seasonal BNR Project Costs

The CAS Option 1 is estimated to have a capital cost of approximately $265M. This covers all project elements as detailed in **Table 8-5**.

Table 8-5 CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR Phase I and II Project Costs[2]

Scope Item	Costs, $M
Phase I	
Existing Aeration Basin Modifications	27
Existing Secondary Clarifier Modifications	13
New Effluent Facility (CCT, De-Chlor) EBDA PS, OAC PS, Disk filters	38
New Sidestream Treatment	14
Phase I Subtotal Capital Costs	92
Phase II	
New Intermediate Pump Station and Blower Building	33
New PE Equalization Facility	9
New Aeration Basin 8	11
New Aeration Basin Volume (4.4 MG)	50
New Secondary Clarifiers	70
Phase II Subtotal Capital Costs	173
Total Capital Costs	265
Total Project[1] Costs	345
Annual O&M Costs	4.6

[1]30% for Engineering, CM, Legal and Administrative

[2] Excludes campus building costs

8.5 CAS Option 2 – New Clarifiers Early and Year-round BNR Project Costs

The CAS Option 2 is estimated to have a capital cost of approximately $250M. This covers all project elements as detailed in **Table 8-6**.

Table 8-6 CAS Option 2 – New Clarifiers Early and Year-round BNR Phase I and II Project Costs[2]

Scope Item	Costs, $M
Phase I	
Existing Aeration Basin Modifications	33
New Effluent Facility (CCT, De-Chlor) EBDA PS, OAC PS	32
New Secondary Clarifiers	69
New PE Equalization Facility	11
Phase I Subtotal Capital Costs	145
Phase II	
New Intermediate Pump Station and Blower Building	31
Aeration Basin 8	11
New Aeration Basin Volume 9-12 (4.4 MG)	46
Sidestream Treatment	16
Phase II Subtotal Capital Costs	105
Total Capital Costs	250
Total Project[1] Costs	320
Annual O&M Costs	4.6

[1]30% for Engineering, CM, Legal and Administrative
[2]Excludes campus building costs

8.6 CAS Option 3 – No Old Alameda Creek Discharge Project Costs

The CAS Option 3 is estimated to have a capital cost of approximately $280M. This covers all project elements as detailed in **Table 8-7**.

Table 8-7 CAS Option 3 – No Old Alameda Creek Discharge Phase I and II Project Costs[2]

Scope Item	Costs, $M
Phase I	
Existing Aeration Basin Modifications	23
Existing Secondary Clarifier Modifications	37
Secondary Equalization	69
Phase I Subtotal Capital Costs	98
Phase II	
New Intermediate Pump Station and Blower Building	30
New PE Equalization Facility	8
New Aeration Basin 8	11
New Aeration Basin Volume (4.4 MG)	46
New Secondary Clarifiers	65
New Effluent Facility (CCT, De-Chlor) EBDA PS, OAC PS	3
Sidestream Treatment	16
Phase II Subtotal Capital Costs	180
Total Capital Costs	280
Total Project[1] Costs	360
Annual O&M Costs	4.6

[1]30% for Engineering, CM, Legal and Administrative
[2]Excludes campus building costs

8.7 Project Cost Comparison

The project and O&M costs were combined to determine the net present value (NPV) of the options. These are summarized in **Table 8-8**. For all CAS Options the O&M costs per year were assumed to be similar. Note that the campus building costs were not included in the total project costs or NPV calculations. The campus building project was identified, scoped (planning level) and justified as part of the Enhanced Treatment & Site Upgrade Program; as the project was recommended for reasons outside of this project, the costs are not part of this analysis. The costs are associated with this project and listed in **Table 8-8** for reference.

Table 8-8 Project Cost Comparison Summary

Scope Item	MBR Option	CAS Option 1 Clarifier Modifications and Limited Seasonal BNR	CAS Option 2 New Clarifiers Early and Year-round BNR	CAS Option 3 No Old Alameda Creek Discharge
Phase I Project Costs[1,3]	505	120	190	128
Phase II Project Costs[1,3]	-	225	135	233
Total Project Cost[3]	505	345	320	360
20 Year NPV O&M costs[3]	145	50	50	25
NPV[3]	650	395	370	385
Campus Building Costs[2,3]	66	66	66	66

[1]Project Costs include 30% for Engineering, CM, Legal and Administrative
[2] From ETSU Program Analysis
[3]Costs are in 2019 dollars.

Table 8-8 shows that both the Project and O&M costs associated with the MBR option are significantly more costly than any of the CAS options that can be phased. As CAS Option 2 has the least stranded assets it has the most favorable net present value.

The annual capital expenditures for each option were plotted to illustrate the lifecycle expenditures over time. **Figure 8-1** and **Figure 8-2** show the lifecycle expenditures over time for the MBR and CAS options, respectively.

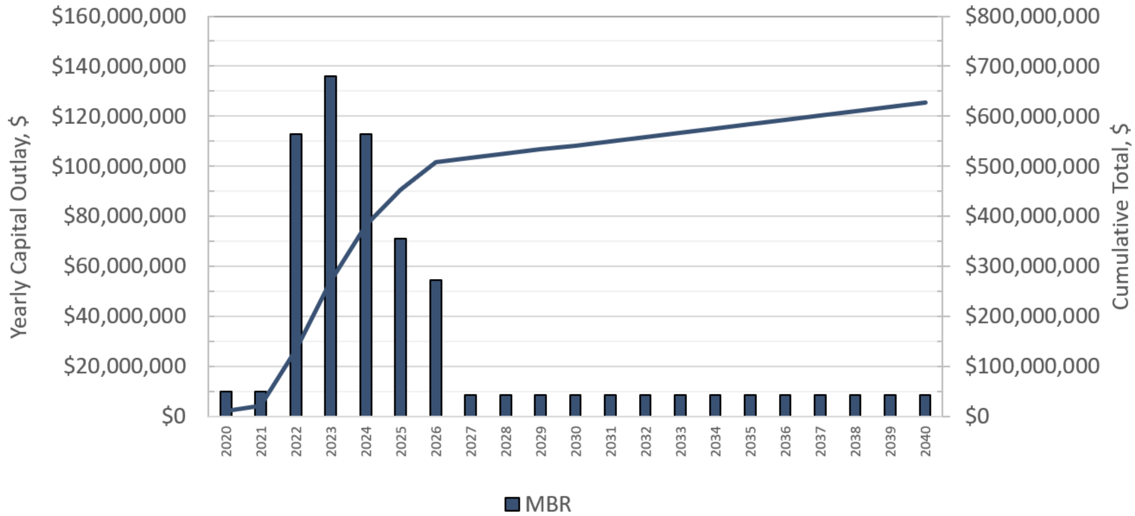


Figure 8-1 MBR Option Lifecycle Expenditures Over Time

It can be seen that the MBR project would require significant immediate investment as it cannot be phased. Furthermore, the overall cost of the MBR results in a cumulative total capital outlay (in 2040) of over $650M while the most expensive CAS option is less than $400M.

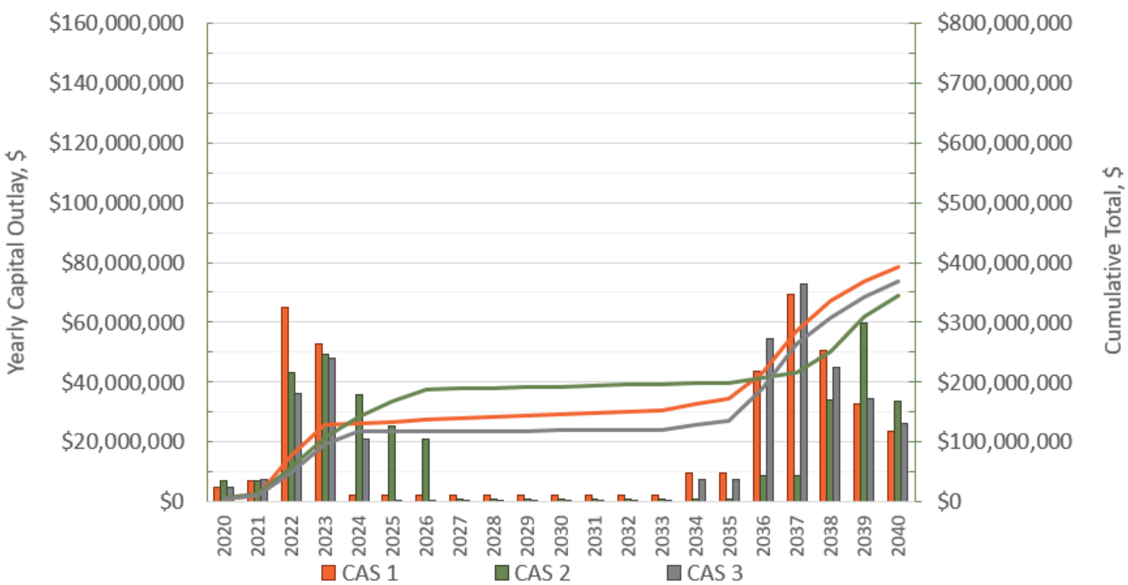


Figure 8-2 CAS Options Lifecycle Expenditures Over Time

9. Best Value Solution

9.1 Process Technology

The District considered two technologies for the Secondary Treatment Process Improvements. The benefits, considerations, and costs of these options are summarized in **Table 9-1**.

Table 9-1 MBR and CAS Technology Summary

	MBR	CAS
Benefits	• Excellent effluent quality • Compact technology • No settling sludge issues • Flexibility to produce recycled water	• Lower Capital Costs • Lower O&M Costs • Phasing Options spread capital expenditures out over time • Flexibility for wet weather peaks • Familiar technology
Considerations	• High Capital Costs • High O&M Costs • No phasing options • Wet weather peak flow issues • New technology / training	• Space requirements
Total Project Costs[1]	$505M	$320-345M

[1]Excludes Campus Building Costs

Due to the costs of the project and the ability to achieve the same standards with the CAS technology, the District decided to consider a CAS solution for the Secondary Treatment Process Improvements.

9.2 CAS Phasing Options

The District considered three CAS phasing options for the Secondary Treatment Process Improvements. The benefits and considerations and costs of these options are summarized in **Table 9-2.**

Table 9-2 CAS Phasing Options Summary

	CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR	CAS Option 2 – New Clarifiers Early Year-round BNR	CAS Option 3 – No Old Alameda Creek Discharge
Benefits	• Achieves seasonal BNR (3 months) quickly to get to creek with a gap of 2 years • Achieves improved clarification performance (over current)	• Year round BNR2 • No sidestream treatment required in Phase I • Greatest TN removal until more stringent standards imposed • No stranded disk filters • No clarifier modifications • Better clarifier performance • New RAS control in Phase I • 2.5 MG available for PE EQ	• Simplified operation during wet weather • Storage provides flexibility for off spec water during dry weather • Can shave daily peak flow in DW to reduce effluent pumping costs • Potentially less cash flow required depending on remediation requirements • EQ provides flexibility for future construction sequencing
Considerations	• Only achieves seasonal BNR • Stranded assets in disk filters • Stranded assets in clarifier modifications • Less reliable clarifier performance until Phase II • Need sidestream treatment • O&M complexities due to two effluent qualities	• Need to move buildings delays getting to the creek by two additional years over CAS Option 1	• Permitting and environmental process poses additional risk • Land acquisition and restoration requirement poses additional risk • Option does not provide synergy with future nutrient removal
Total Project Costs[2]	$345M	$320M	$360M

[1]Achieves year-round BNR but not BACWA level 2 standards during coldest months

[2]Excludes Building Campus Costs

Given the risks and time associated with permitting a secondary effluent equalization basin, the District decided to eliminate CAS Option 3 – No Old Alameda Creek Discharge from further consideration. Both CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR and CAS Option 2 – New Clarifiers Early and Year-Round BNR achieve capacity improvements and the potential for creek discharge (pending discussions with SFBRWQCB). **Table 9-3** summarizes the water quality difference between CAS Option 1 and CAS Option 2.

Table 9-3 CAS Option 1 and Option 2 Nutrient Removal Potential Summary

	CAS Option 1 – Clarifier Modifications and Limited Seasonal BNR	CAS Option 2 – New Clarifiers Early Year-round BNR
Design	June 2019	June 2019
Construction Start	Mar 2021	Mar 2021
Construction Completion	May 2024	July 2025
Gap between Potential Hayward Marsh ending and Phase I Completion	~2 years	~4 years
Annual Mass TN Reduction Achieved, %	20%	50%
Years of BNR	8 years	6 Years
Annual loads of TN removed 10 years after Hayward Marsh ends, %-yr	1.6	3
Ammonia discharge to Creek	Not mitigated (seasonal BNR)	BNR during wet weather

Since CAS Option 2 has fewer stranded assets, better effluent quality, more reliable technology, and a lower cost, the preferred option is CAS Option 2.

9.3 Preferred Alternative – Sequencing

The District would like to execute the project quickly given the imminent closure of the Hayward Marsh. **Figure 9-1** shows the estimated project schedule for CAS Option 2 – Phase I from the beginning of design, October 2019 to construction completion July 2026.

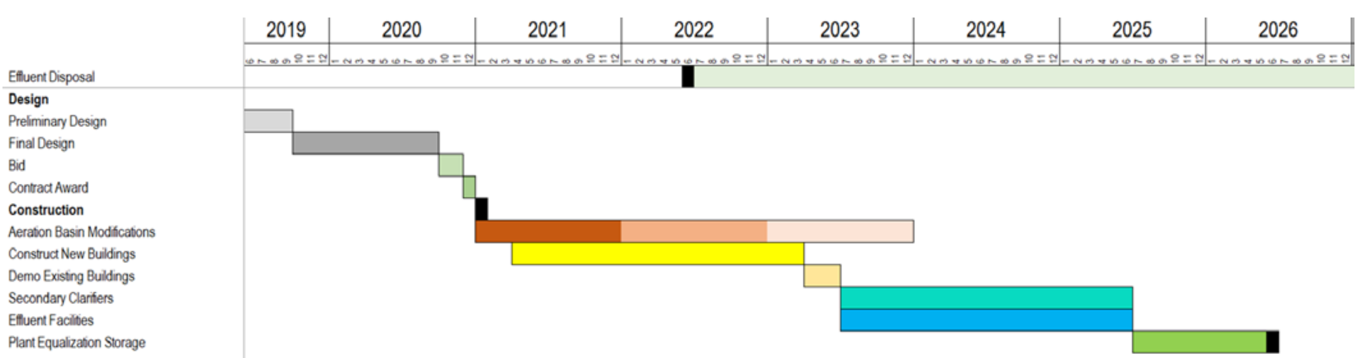


Figure 9-1 CAS Option 2 - Phase I Estimated Construction Schedule

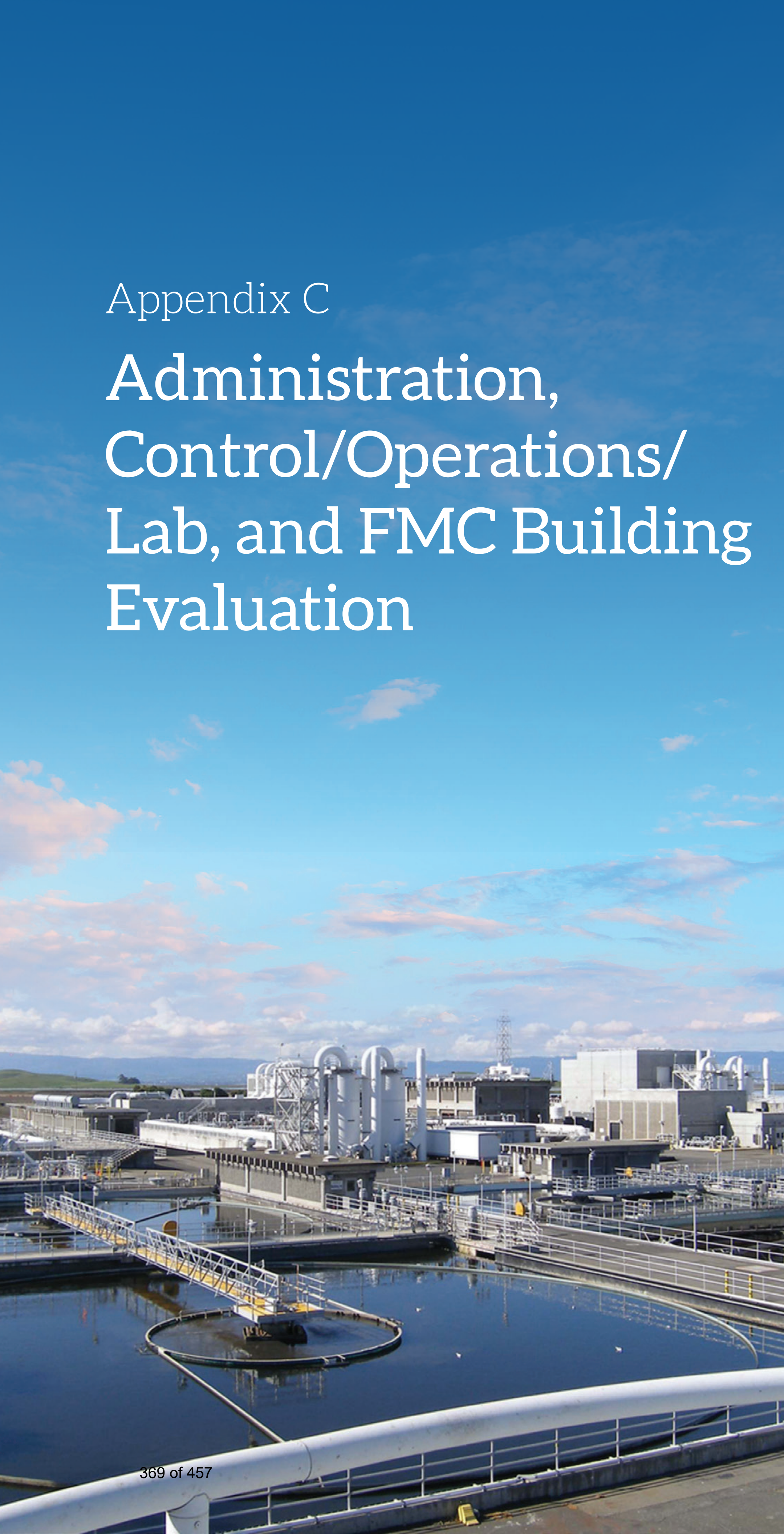
List of Appendices

1. Historical Data Analysis
2. Assumptions / Scenarios Document
3. BioWin™ Sampling Results
4. BioWin™ Model Calibration
5. Clarifier Field Testing
6. Clarifier Model Calibration Results
7. Comprehend Phase Workshop Presentation and Minutes
8. Explore Phase Workshop Presentation
9. District Notes
10. Converge Phase Workshop Presentation and Minutes
11. Cost Estimate
12. Follow-up Converge Phase Workshop Presentation

Reference [unionsanitary.ca.gov/ETSU] to access the appendices for this report.

Appendix C

Administration, Control/Operations/ Lab, and FMC Building Evaluation



C

Union Sanitary District's
Enhanced Treatment and Site Upgrade Program

UNION SANITARY DISTRICT

NEW ADMINISTRATION, OPS/LAB AND FMC FACILITY

5072 Benson Rd, Union City, CA 94587
Richmond , CA 94801

Based on review & analysis of:

Concept Design

Report Prepared for:

Burks Toma
Architects

28-Mar-19

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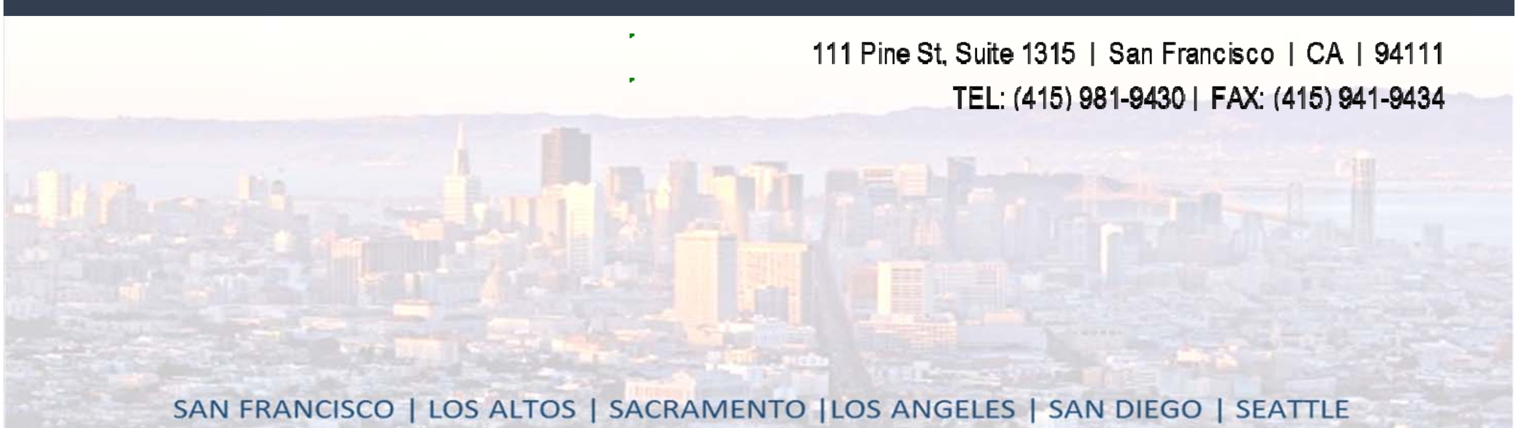


BASIS OF ESTIMATE

REFERENCE DOCUMENTATION

This construction cost estimate was produced from Conceptual Design and narrative. Design and engineering changes occurring subsequent to the issue of these documents have not been incorporated in this estimate.

PROJECT DESCRIPTION

Scope includes a new field maintenance center shop, new Administration building and a new Operations/Lab facility approx. 59,403 GSF for the Union Sanitary District.

BASIS FOR PRICING

This estimate reflects the fair construction value for this project and should not be construed as a prediction of low bid. Prices are based on local prevailing wage construction costs at the time the estimate was prepared. Pricing assumes a procurement process with competitive bidding for all sub-trades of the construction work, which is to mean a minimum of 3 bids for all subcontractors and materials/equipment suppliers. If fewer bids are solicited or received, prices can be expected to be higher. Conversely in the current competitive market should a larger number of sub-bids be received (i.e. 6 and above) pricing can expected to be lower than the current estimate.

Subcontractor's markups have been included in each line item unit price. Markups cover the cost of field overhead, home office overhead and subcontractor's profit. Subcontractor's markups typically range from 15% to 25% of the unit price depending on market conditions.

General Contractor's/Construction Manager's Site Requirement costs are calculated on a percentage basis. General Contractor's/Construction Manager's Jobsite Management costs are also calculated on a percentage basis.

Site Requirements	*4.0%*
Jobsite Management	*8.0%*
Phasing	*NA*

General Contractor's/Construction Manager's overhead and fees are based on a percentage of the total direct costs plus general conditions, and covers the contractor's bond, insurance, site office overheads and profit.

Insurance & Bonding	*2.5%*
General Contractor Bonding	
Sub-Contractor Bonding	
OSIP	

Fee (G.C. Profit)	*5.0%*

Unless identified otherwise, the cost of such items as overtime, shift premiums and construction phasing are not included in the line item unit price.

This cost estimate is based on standard industry practice, professional experience and knowledge of the local construction market costs. TBD Consultants have no control over the material and labor costs, contractors methods of establishing prices or the market and bidding conditions at the time of bid. Therefore TBD Consultants do not guarantee that the bids received will not vary from this cost estimate.

CONTINGENCY

Design/ Pricing Contingency	*18.0%*

The Design Contingency is carried to cover scope that lacks definition and scope that is *anticipated* to be added to the Design. As the Design becomes more complete the Design Contingency will reduce.

Construction Contingency	*Carried else where in owners budget*

The Construction Contingency is carried to cover the unforeseen during construction execution and Risks that do not currently have mitigation plans. As Risks are mitigated, Construction Contingency can be reduce, but should not be eliminated.

An owners contingency has not been included in this construction cost estimate, but it is advised that the owner carry additional contingency to cover scope change, bidding conditions, claims and delays.

Bidding Contingency	*10%*

Given the volatile bidding market we recommend a review of bidding conditions prior to bid date. Depending on prevailing conditions it may be prudent to include a bidding contingency.

ESCALATION

Escalation:

Escalation factor - 5% p.a. ***Escalation is excluded from this cost report.***

EXCLUSIONS

- Land acquisition, feasibility studies, financing costs and all other owner costs
- All professional fees and insurance
- Site surveys, existing condition reports and soils investigation costs
- Items identified in the design as Not In Contract [NIC]
- Hazardous materials investigations and abatement
- Utility company back charges, including work required off-site and utilities rates
- Work to City streets and sidewalks
- Items defined as Vendor / Owner supplied and Vendor / Owner installed
- LEED Fees
- Permits
- Owners contingency
- Overtime, 2nd shift and lost productivity premiums
- Design Fees
- PG & E Fees
- Owner soft costs
- Headend equipment for tele data
- Branding allowance
- Bad ground earthworks & remediation
- FF& E Budget
- Swing space
- Demolition of existing buildings
- Site preparation and Site development
- Utility diversions

DESCRIPTION	AREA (SF)	ENCLOSED (SF)	COVERED (SF)	GSF	PERIMETER (LF)	HEIGHT (LF)	APPROX. SKIN AREA (SF)
FIELD MAINTENANCE CENTER SHOP							
FIRST FLOOR		8,940			380	20	7,600
PARAPET					380	3.0	1,140
SUB -TOTAL		**8,940**				**TOTALSKIN AREA:**	**8,740**
MAINTENANCE SHOP GSF INCLUDING 50% COVERED AREA				**8,940**			
ADMINISTRATION/ OPS / LAB							
FIRST FLOOR		25,470			870	15	13,050
SECOND FLOOR		24,993			938	15	14,070
PARAPET					938	4.5	4,221
Penthouse ,elevator etc					120	12	1,440
SUB -TOTAL		**50,463**				**TOTALSKIN AREA:**	**32,781**
ADMIN/OPS/LAB INCLUDING 50% COVERED AREA				**50,463**			

UNION SANITARY DISTRICT
5072 Benson Rd, Union City, CA 94587
Richmond , CA 94801

Concept Design

Date: March-19
Estimator: NH/GB/DJ

GRAND SUMMARY

DESCRIPTION	%	GSF	$ / SF	TOTAL	COMMENTS
BASE ESTIMATE					
FIELD MAINTENANCE CENTER SHOP	13%	8,940	$596.34	$5,331,294	
ADMINISTRATION/OPS/LAB	87%	50,463	$688.11	$34,723,849	
SUB TOTAL - EXCLUDING BIDDING CONTINGENCY				**$40,055,144**	
BIDDING CONTINGENCY	**10.0%**			$4,005,514	
SUB TOTAL - INCLUDING BIDDING CONTINGENCY				**$44,060,658**	
GRAND TOTAL				**$44,060,658**	**in March 2019 dollars**

UNION SANITARY DISTRICT
5072 Benson Rd, Union City, CA 94587
Richmond , CA 94801

Concept Design

Date: 28-Mar-19
Estimator: NH/DJ
GSF : 8,940

UNIFORMAT SUMMARY - FMC SHOP

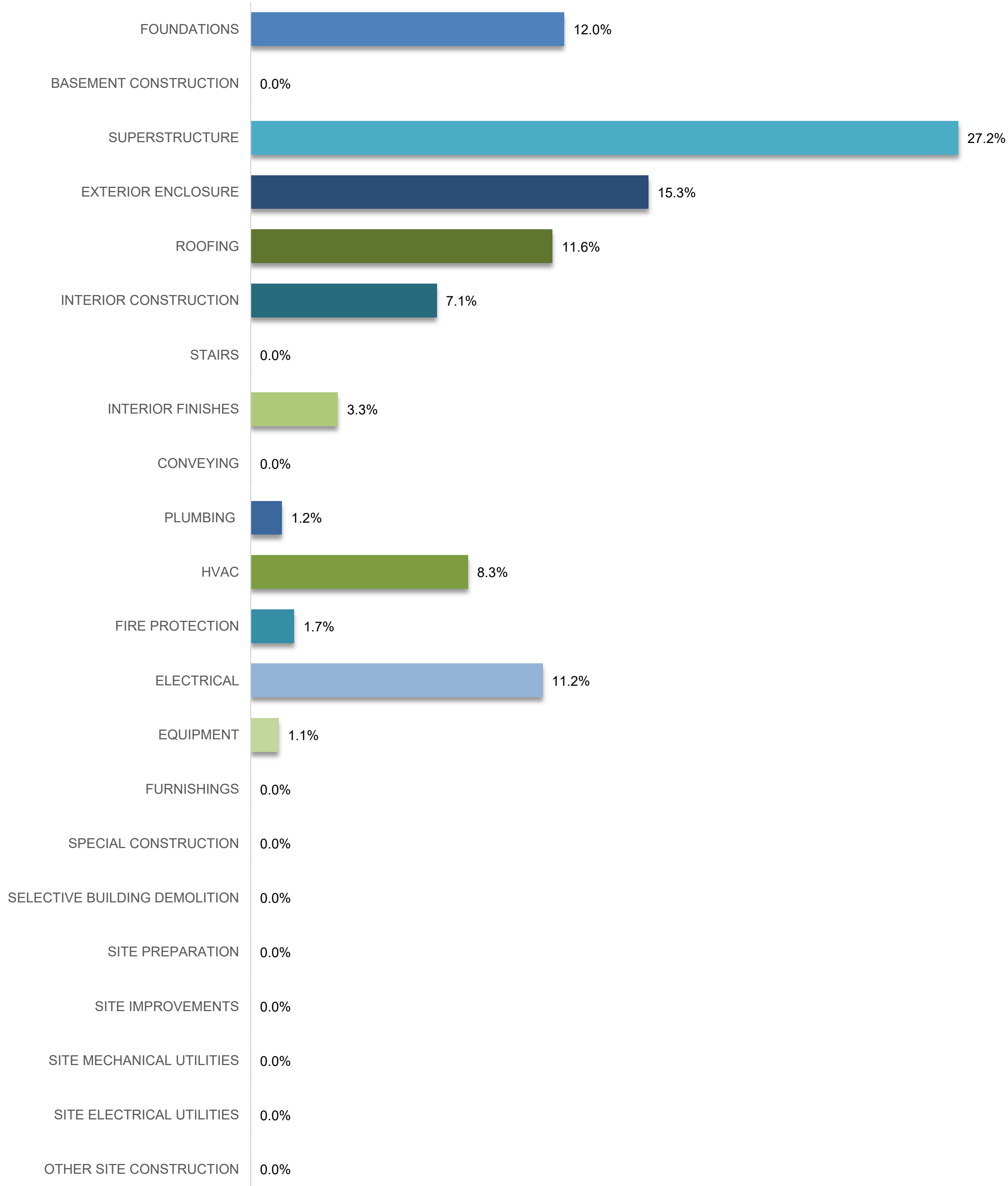
	SECTION	%	TOTAL	$ / SF	COMMENTS
	10 FOUNDATIONS	12.0%	$451,470	$50.50	
	20 BASEMENT CONSTRUCTION				
A	**SUBSTRUCTURE**	**12.0%**	**$451,470**	**$50.50**	
	10 SUPERSTRUCTURE	27.2%	$1,019,520	$114.04	
	20 EXTERIOR ENCLOSURE	15.3%	$572,720	$64.06	
	30 ROOFING	11.6%	$434,860	$48.64	
B	**SHELL**	**54.0%**	**$2,027,100**	**$226.74**	
	10 INTERIOR CONSTRUCTION	7.1%	$268,200	$30.00	
	20 STAIRS				
	30 INTERIOR FINISHES	3.3%	$125,160	$14.00	
C	**INTERIORS**	**10.5%**	**$393,360**	**$44.00**	
	10 CONVEYING				
	20 PLUMBING	1.2%	$44,700	$5.00	
	30 HVAC	8.3%	$312,900	$35.00	
	40 FIRE PROTECTION	1.7%	$62,580	$7.00	
	50 ELECTRICAL	11.2%	$420,420	$47.03	
D	**SERVICES**	**22.4%**	**$840,600**	**$94.03**	
	10 EQUIPMENT	1.1%	$40,000	$4.47	
	20 FURNISHINGS				
E	**EQUIPMENT + FURNISHINGS**	**1.1%**	**$40,000**	**$4.47**	
	10 SPECIAL CONSTRUCTION				
	20 SELECTIVE BUILDING DEMOLITION				
F	**SPECIAL CONSTRUCTION + DEMOLITION**				
	10 SITE PREPARATION				
	20 SITE IMPROVEMENTS				
	30 SITE MECHANICAL UTILITIES				
	40 SITE ELECTRICAL UTILITIES				
	50 OTHER SITE CONSTRUCTION				
G	**BUILDING SITEWORK**				
DIRECT COSTS		**100.0%**	**$3,752,530**	**$419.75**	
	SITE REQUIREMENTS	4.0%	$150,101	$16.79	
	JOBSITE MANAGEMENT	8.0%	$300,202	$33.58	
	ESTIMATE SUB-TOTAL		**$4,202,834**	**$470.12**	
	INSURANCE + BONDING	2.5%	$105,071	$11.75	
	FEE	5.0%	$210,142	$23.51	
	ESTIMATE SUB-TOTAL		**$4,518,046**	**$505.37**	
	DESIGN CONTINGENCY	18.0%	$813,248	$90.97	
	CONSTRUCTION CONTINGENCY				EXCLUDED
	ESTIMATE SUB-TOTAL		**$5,331,294**	**$596.34**	
	ESCALATION				EXCLUDED
ESTIMATE TOTAL			**$5,331,294**	**$596.34**	total add-ons 42.07%

UNION SANITARY DISTRICT
5072 Benson Rd, Union City, CA 94587
Richmond , CA 94801

Concept Design

Date: 28-Mar-19
Estimator: NH/DJ
GSF : 8,940

UNIFORMAT DISTRIBUTION GRAPH - FMC SHOP



UNION SANITARY DISTRICT
5072 Benson Rd, Union City, CA 94587
Richmond , CA 94801

ESTIMATE DETAIL - FMC SHOP

tbd consultants
Project Management | Construction Cost Management

Concept Design

Date: 28-Mar-19
Estimator: NH/DJ
GSF : 8,940

REF	MF	DESCRIPTION	QUANTITY	UoM	UNIT RATE	TOTAL	COMMENTS
1							
2		**FOUNDATIONS**					
3							
4		Special Foundation					**$205,620**
5		Reinforced concrete spread footings, grade beams, wall footings, column footings	8,940	GSF	23.00	205,620	
6							
7		Special Foundations					**$26,820**
8		Allow for special foundations	8,940	GSF	3.00	26,820	
9							**$134,100**
10		Slab on Grade	8,940	GSF	15.00	134,100	
11							
12		Misc. Items					**$84,930**
15		Concrete depressions, curbs	8,940	GSF	4	35,760	
16		Building pad preparation	8,940	GSF	3.50	31,290	
17		Allow for additional soil mitigation measures	8,940	GSF	2.00	17,880	
18							
19		**FOUNDATIONS**				**451,470**	**$50.5 / SF**
20							
21		**BASEMENT CONSTRUCTION**		NA			
22							
23		**BASEMENT CONSTRUCTION**					**$0 / SF**
24							
25		**SUPERSTRUCTURE**					
26							
27		Columns and Pilasters					**$107,280**
28		Vertical structure including steel columns, pilasters and bracing	8,940	GSF	12.00	107,280	
29							
30		Load bearing walls					**$480,700**
31		Reinforced CMU shear walls	8,740	SF	55.00	480,700	*Gross wall area - allow 12" thick*
32							
33		Roof Construction					**$339,720**
34		Steel trusses for roof structure including metal deck	8,940	GSF	35.00	312,900	*incl openings borrowed light*
35		Fireproofing	8,940	GSF	3.00	26,820	*Allowance*
36							
37		Misc. Items					**$91,820**
38		Misc. metal	8,940	SF	2.00	17,880	
39		Equipment pads, curbs and wall curbs	1	LS	15,000	15,000	
40		Miscellaneous framing, blocking and metals	8,940	GSF	1.00	8,940	
41		Seismic Joint	1	LS	50,000.00	50,000	
42							
43		**SUPERSTRUCTURE**				**1,019,520**	**$114.04 / SF**
44							
45		**EXTERIOR ENCLOSURE**					
46							
47		Exterior Walls					**$43,700**
48		Premium for CMU finish sealant	8,740	SF	5.00	43,700	*Gross Wall Area*
49							
50		Exterior Doors					**$170,000**
51		*All doors include hardware, frames & finish*					
52		Motorized metal roll-up doors for truck access	1	Allow	150,000.00	150,000	
53		Allow for exit hollow metal doors, frame and hardware	1	Allow	20,000	20,000	
54							
55		Exterior Glazing					**$262,200**
56		Hollow metal frame fixed clerestory windows, w/ insulated glazing	2,185	SF	120.00	262,200	*Allow 25% of gross wall area*
57							
58		Exterior Openings					**$10,000**
59		Allowance for louvers	1	Allow	10,000	10,000	
60							
61		Misc. Items					**$86,820**
62		Allowance for exterior detailing	1	Allow	30,000.00	30,000	
63		Exterior signage	8,940	GSF	1.00	8,940	
64		Rough Carpentry	8,940	GSF	2.00	17,880	
65		Exterior canopies	1	LS	30,000.00	30,000	*Allowance*
66							
67		**EXTERIOR ENCLOSURE**				**572,720**	**$64.06 / SF**

ROOFING						
Roof Coverings					**$212,210**	
FLAT ROOF	*8,940*	*SF*				
Polyiso insulation	8,940	SF	4.00	35,760		
Roof board	8,940	SF	2.00	17,880		
Membrane roofing	8,940	SF	13.00	116,220		
Allowance for tapering, crickets and slopes (battens) for drainage	8,940	SF	2.50	22,350		
Premium for deck	200	SF	100.00	20,000		
Roof Openings					**$100,000**	
Prismatic diffusing skylights	1	Allow	100,000	100,000		
Parapet					**$45,600**	
Back of parapet, *assume TPO*	1,140	SF	20.00	22,800		
Coping	380	LF	60.00	22,800		
Misc. Items					**$77,050**	
Flashing and trim, roof specialties and accessories	8,940	SF	6.00	53,640		
Roof access	1	Allow	10,000.00	10,000		
Caulking and sealants	8,940	GSF	1.50	13,410		
ROOFING				**434,860**		**$48.64 / SF**
INTERIOR CONSTRUCTION						
Internal Partitions					**$143,040**	
Interior metal stud partitions, including furring to inner skin of external walls	8,940	GSF	16.00	143,040		
Internal Doors					**$53,640**	
Hollow metal doors, frames and hardware	8,940	GSF	6.00	53,640		
Interior Glazing					**$17,880**	
Allow for storefront glazing and half lights at interior doors	8,940	GSF	2.00	17,880		
Specialties					**$53,640**	
Signage, wall protection, fire extinguishers, whiteboards, tackboards, miscellaneous specialties	8,940	GSF	6.00	53,640		
INTERIOR CONSTRUCTION				**268,200**		**$30 / SF**
STAIRS						
		NA				
STAIRS						**$0 / SF**
INTERIOR FINISHES						
Wall Finishes						
Paint to gypsum board	Included in Interior partitions				**$26,820**	
Special wall finishes	8,940	GSF	3	26,820		
Floor Finishes and Base					**$40,230**	
Sealed concrete, designed for 500 psf & 5000 lb point load	8,940	GSF	4.50	40,230		
Ceiling Finishes					**$35,760**	
Painted exposed ceilings at shop	8,940	GSF	2.00	17,880		
Allow for acoustic treatment	8,940	GSF	2.00	17,880		
Misc. Items						
Sealants and caulking (internal)	8,940	GSF	2.50	22,350		
INTERIOR FINISHES				**125,160**		**$14 / SF**
CONVEYING		NA				
CONVEYING						**$0 / SF**
PLUMBING						

137							
138	Misc. plumbing allowance	8,940	SF	5.00	44,700		
139							
140							
141	**PLUMBING**				**44,700**		**$5 / SF**
142							
143	**HVAC**						
144							
145	HVAC Requirements						
146	Field maint. shop: Chilling and heating generation equipment, pumping and circulation equipment, pipe distribution, air distribution, diffusers, registers, grilles, air handling equipment, temperature controls, testing and balancing, exhaust fans, startup and commissioning	8,940	SF	35.00	312,900		
147							
148	**HVAC**				**312,900**		**$35 / SF**
149							
150	**FIRE PROTECTION**						
151							
152	Sprinkler System						
153	Automatic wet sprinkler system	8,940	GSF	7.00	62,580		
154							
155	**FIRE PROTECTION**				**62,580**		**$7 / SF**
156							
157	**ELECTRICAL**						
158							
159	Electrical Requirements						
160	Main service panel, subpanels, transformer, feeders, conduit and cabling	8,940	GSF	4.00	35,760		
161							
162	Emergency power distribution	8,940	GSF	1.00	8,940		
163							
164	Machine and equipment power	8,940	GSF	4.00	35,760		
165							
166	User convenience power	8,940	GSF	3.00	26,820		
167							
168	Lighting and controls	8,940	GSF	22.00	196,680		
169							
170	Telecom	8,940	GSF	4.00	35,760		
171							
172	Security/CCTV, conduit and back boxes	8,940	GSF	2.00	17,880		
173							
174	Fire alarm	8,940	GSF	3.00	26,820		
175							
176	Misc. Items						
177	Miscellaneous electrical requirements, site supervision, documentation, coordination, testing, startup, general conditions and requirements	1	LS	36,000	36,000		
178							
179	**ELECTRICAL**				**420,420**		**$47.03 / SF**
180							
181	**EQUIPMENT**						
182							
183	Cranes					**$40,000**	
184	Overhead traveling 3-ton crane to access all points drop-down reels with 120v and compressed air	1	LS	40,000	40,000		
185							
186	**EQUIPMENT**				**40,000**		**$4.47 / SF**
187							
188	**FURNISHINGS**						
189							
190	Blinds/ Shades						
191	Allow for mechoshades		NA				
192							
193	Cabinetry						
194	Allow for shelving, fixed millwork, storage and work surfaces		FF&E				
195							
196	**FURNISHINGS**						**$0 / SF**

UNION SANITARY DISTRICT
5072 Benson Rd, Union City, CA 94587
Richmond , CA 94801

Concept Design

tbd consultants
Project Management | Construction Cost Management

Date: 28-Mar-19
Estimator: NH/DJ
GSF : 50,463

UNIFORMAT SUMMARY - ADMIN/OPS/LAB

	SECTION	%	TOTAL	$ / SF	COMMENTS
	10 FOUNDATIONS	5.7%	$1,402,645	$27.80	
	20 BASEMENT CONSTRUCTION				
A	**SUBSTRUCTURE**	**5.7%**	**$1,402,645**	**$27.80**	
	10 SUPERSTRUCTURE	14.8%	$3,623,105	$71.80	
	20 EXTERIOR ENCLOSURE	18.5%	$4,509,878	$89.37	
	30 ROOFING	5.9%	$1,430,630	$28.35	
B	**SHELL**	**39.1%**	**$9,563,612**	**$189.52**	
	10 INTERIOR CONSTRUCTION	10.5%	$2,571,989	$50.97	
	20 STAIRS	0.7%	$180,000	$3.57	
	30 INTERIOR FINISHES	6.6%	$1,613,236	$31.97	
C	**INTERIORS**	**17.9%**	**$4,365,224**	**$86.50**	
	10 CONVEYING	0.7%	$180,000	$3.57	
	20 PLUMBING	3.7%	$912,896	$18.09	
	30 HVAC	14.7%	$3,582,410	$70.99	
	40 FIRE PROTECTION	1.7%	$403,704	$8.00	
	50 ELECTRICAL	13.5%	$3,307,317	$65.54	
D	**SERVICES**	**34.3%**	**$8,386,327**	**$166.19**	
	10 EQUIPMENT	0.7%	$163,700	$3.24	
	20 FURNISHINGS	2.3%	$559,515	$11.09	
E	**EQUIPMENT + FURNISHINGS**	**3.0%**	**$723,215**	**$14.33**	
	10 SPECIAL CONSTRUCTION				
	20 SELECTIVE BUILDING DEMOLITION				
F	**SPECIAL CONSTRUCTION + DEMOLITION**				
	10 SITE PREPARATION				
	20 SITE IMPROVEMENTS				
	30 SITE MECHANICAL UTILITIES				
	40 SITE ELECTRICAL UTILITIES				
	50 OTHER SITE CONSTRUCTION				
G	**BUILDING SITEWORK**				
DIRECT COSTS		**100.0%**	**$24,441,022**	**$484.34**	
	SITE REQUIREMENTS	4.0%	$977,641	$19.37	
	JOBSITE MANAGEMENT	8.0%	$1,955,282	$38.75	
	ESTIMATE SUB-TOTAL		**$27,373,945**	**$542.46**	
	INSURANCE + BONDING	2.5%	$684,349	$13.56	
	FEE	5.0%	$1,368,697	$27.12	
	ESTIMATE SUB-TOTAL		**$29,426,991**	**$583.14**	
	DESIGN CONTINGENCY	18.0%	$5,296,858	$104.97	
	CONSTRUCTION CONTINGENCY				EXCLUDED
	ESTIMATE SUB-TOTAL		**$34,723,849**	**$688.11**	
	ESCALATION				EXCLUDED
ESTIMATE TOTAL			**$34,723,849**	**$688.11**	total add-ons 42.07%

UNION SANITARY DISTRICT
5072 Benson Rd, Union City, CA 94587
Richmond , CA 94801

Concept Design

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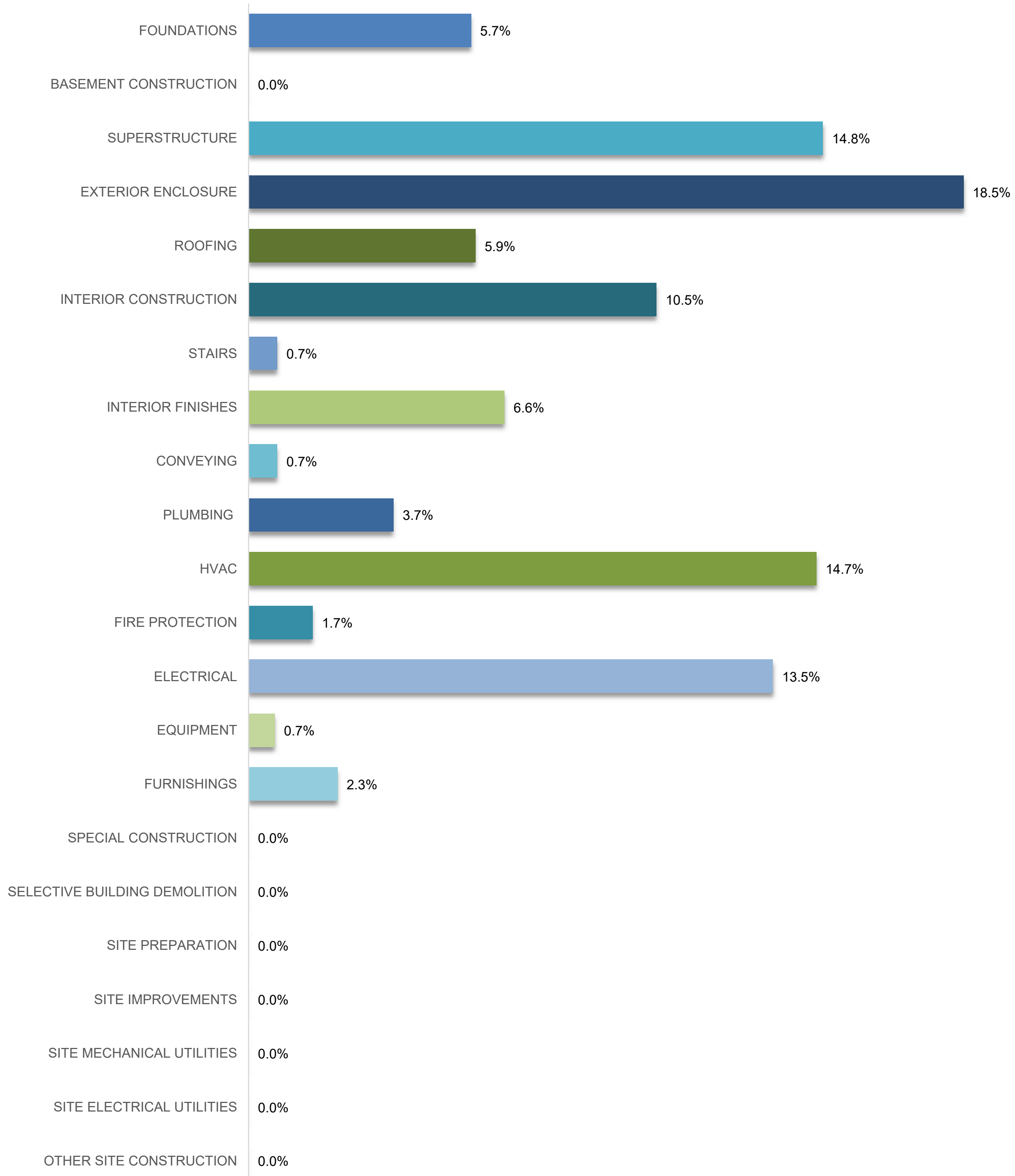
UNIFORMAT DISTRIBUTION GRAPH - ADMIN/OPS/LAB



UNION SANITARY DISTRICT
5072 Benson Rd, Union City, CA 94587
Richmond , CA 94801

ESTIMATE DETAIL - ADMIN/OPS/LAB

tbd consultants
Project Management | Construction Cost Management

Concept Design

Date: 28-Mar-19
Estimator: NH/DJ
GSF : 50,463

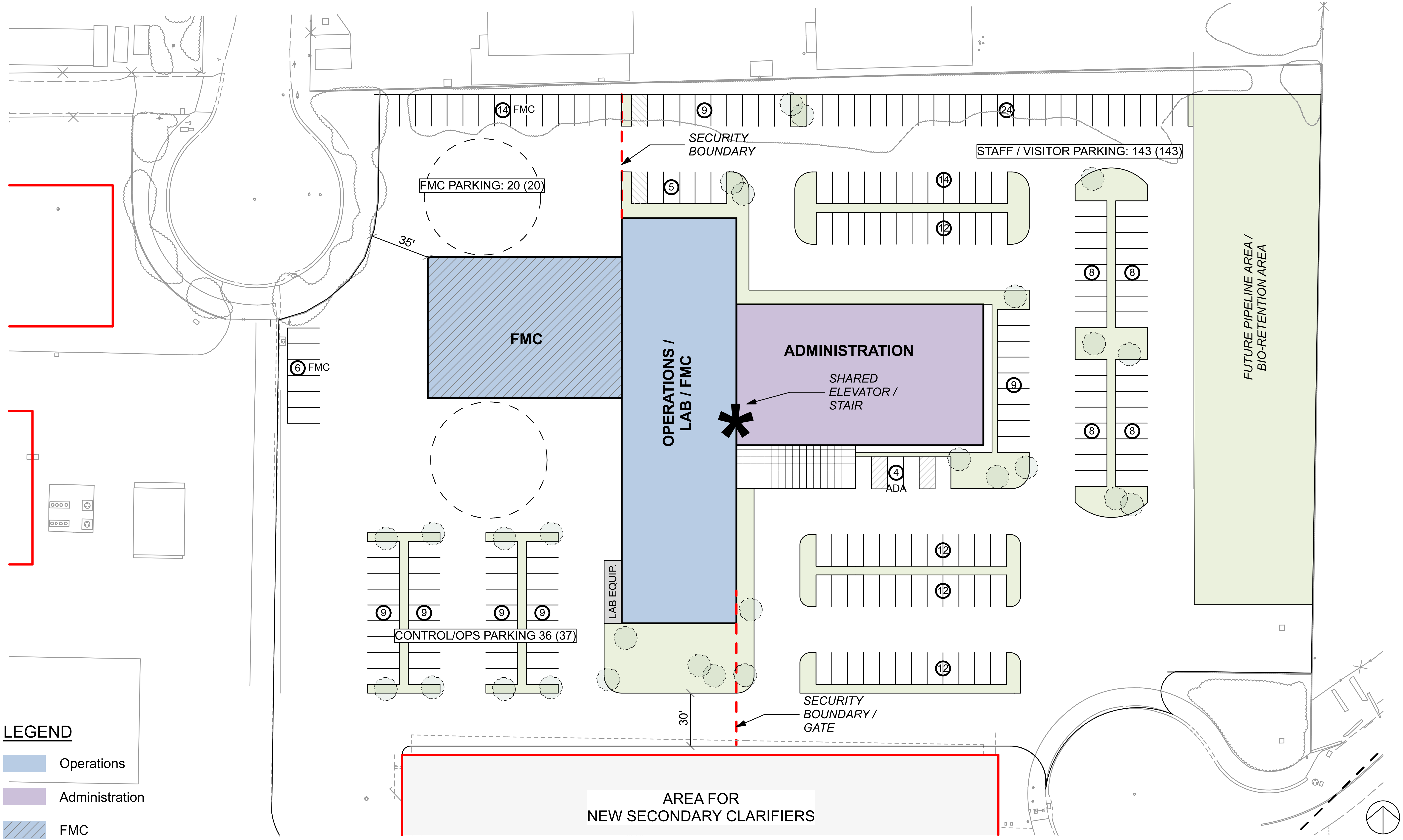
REF	MF	DESCRIPTION	QUANTITY	UoM	UNIT RATE	TOTAL	COMMENTS
1							
2		**FOUNDATIONS**					
3							
4		Special Foundation					$676,750
5		Reinforced concrete spread footings, grade beams, wall footings, column footings and slab on grade	25,470	GSF	25.00	636,750	
6		Elevator pit	1	EA	40,000.00	40,000	
7							
8		Special Foundations					$76,410
9		Allow for special foundations	25,470	GSF	3.00	76,410	
10							
11							$432,990
12		Slab on Grade	25,470	SF	17.00	432,990	
13							
14		Misc. Items					$216,495
17		Concrete depressions, curbs	25,470	SF	3	76,410	
18		Building pad preparation	25,470	GSF	3.50	89,145	
19		Allow for additional soil mitigation measures	25,470	GSF	2.00	50,940	
20							
21		**FOUNDATIONS**				**1,402,645**	**$27.8 / SF**
22							
23		**BASEMENT CONSTRUCTION**		NA			
24							
25		**BASEMENT CONSTRUCTION**					**$0 / SF**
26							
27		**SUPERSTRUCTURE**					
28							
29		Columns and Pilasters					$504,630
30		Vertical structure including steel columns, pilasters and bracing	50,463	GSF	10.00	504,630	
31							
32		Suspended floors					$1,261,575
33		Steel framed suspended floor structure including metal deck	50,463	GSF	25.00	1,261,575	
34							
35		Roof Construction					$1,665,279
36		Steel trusses for roof structure including metal deck	50,463	GSF	30.00	1,513,890	
37		Fireproofing	50,463	GSF	3.00	151,389	*Allowance*
38							
39		Misc. Items					$191,621
40		Misc. metal	50,463	SF	2.00	100,926	
41		Equipment pads, curbs and wall curbs	1	LS	15,000	15,000	
42		Miscellaneous framing, blocking and metals	50,463	GSF	1.50	75,695	
43							
44		**SUPERSTRUCTURE**				**3,623,105**	**$71.8 / SF**
45							
46		**EXTERIOR ENCLOSURE**					
47							
48		Exterior Walls					$2,950,290
49		*New Construction*					
50		Metal panel cladding system over exterior metal stud walls	32,781	SF	90.00	2,950,290	*gross wall area*
51							
52		Exterior Glazing					$983,430
53		Aluminum framed storefront window system with insulated glazing, premium for operable windows at offices	8,195	SF	120.00	983,430	*Allow 25% of gross wall area*
54							
55		Exterior Doors					$200,000
56		*All doors include hardware, frames & finish*					
57		Allow for aluminum storefront full light doors at entrees and Hollow metal doors frames with transoms and half lights at all other personnel doors	1	LS	200,000.00	200,000	Including allowance for specialty hardware
58							
59		Soffits					$100,000
60		Allow for soffits	1	Allow	100,000	100,000	
61							

62	Exterior Openings					$50,000
63	Allowance for louvers	1	Allow	50,000	50,000	
64						
65	Guardrails & Handrails					$25,000
66	Allowance for guardrails & handrails	1	Allow	25,000	25,000	
67						
68	Misc. Items					$201,158
69	Allowance for exterior detailing	1	Allow	75,000.00	75,000	
70	Exterior signage	50,463	GSF	0.50	25,232	
71	Rough Carpentry	50,463	GSF	2.00	100,926	
72						
73	**EXTERIOR ENCLOSURE**				**4,509,878**	**$89.37 / SF**
74						
75	**ROOFING**					
76						
77	Roof Coverings					$559,000
78	*FLAT ROOF*	*26,000*	*SF*			
79	Polyiso insulation	26,000	SF	4.00	104,000	
80	Roof board	26,000	SF	2.00	52,000	
81	Membrane roofing	26,000	SF	13.00	338,000	
82	Allowance for tapering, crickets and slopes (battens) for drainage	26,000	SF	2.50	65,000	
83						
84	Roof Openings					$100,000
85	Light tubes, at offices and staff area	1	Allow	100,000	100,000	
86						
87	Parapet					$126,630
88	Back of parapet, *assume TPO*	4,221	SF	20.00	84,420	
89	Coping	938	LF	45.00	42,210	
90						
91	Canopies, Sunshades & Awnings					$495,000
92	Allow for exterior aluminum sunshades at South, east, and west windows	1	Allow	300,000.00	300,000	
93	Metal canopy and trellis with resin panel soffit and Main Entry to Admin area	1	Allow	120,000.00	120,000	
94	Painted metal canopies above entries and selected overhead coiling doors	1	Allow	75,000.00	75,000	
95						
96	Misc. Items					$150,000
97	Flashing and trim, roof specialties and accessories	26,000	SF	1.00	26,000	
98	Roof access	1	Allow	10,000.00	10,000	
99	Caulking and sealants	26,000	GSF	1.50	39,000	
100	Roof screens	1	Allow	75,000.00	75,000	*Allowance*
101						
102	**ROOFING**				**1,430,630**	**$28.35 / SF**
103						
104	**INTERIOR CONSTRUCTION**					
105						
106	Internal Partitions					$1,665,279
107	Interior metal stud partitions	50,463	GSF	33.00	1,665,279	
108						
109	Internal Doors					$353,241
110	Wood doors with aluminum frames and sidelights at offices and staff areas, wood doors with hollow metal frames at W/C and storage spaces, hollow metal doors all other areas	50,463	GSF	7.00	353,241	
111						
112	Interior Glazing					$151,389
113	Allow for storefront glazing and half lights at interior doors	50,463	GSF	3.00	151,389	
114						
115	Specialties					$402,080
116	*RESTROOMS - 2 Public restrooms, 2 staff restrooms, 1 unisex restroom and locker room restrooms*					
117	ADA toilet stalls	8	EA	1,800	14,400	
118	Toilet stalls	18	EA	1,500	27,000	
119	Urinal screens	11	EA	600	6,600	
120	Restroom accessories - Men's and Women's	6	LOC	3,000	18,000	*Staff and locker room restrooms*
121	Restroom accessories - Unisex	2	LOC	2,000	4,000	
122	*LOCKERS*					
123	Lockers allowance	188	EA	550	103,400	
124	Allow for Locker room bench	1	Allow	15,000	15,000	

125	Shower stalls	6	EA	1,850	11,100	
126	ADA shower stall	2	EA	2,100	4,200	
127	Shower accessories	8	EA	1,000	8,000	
128	*MUD ROOM*					*at Men's and Women's locker*
129	Allowance for open front lockers	45	EA	475	21,375	
130	Allowance for fixed seating/ benches	1	Allow	4,000	4,000	
131	Allowance for fixed coat rack	1	Allow	1,000	1,000	
132	*GENERAL*					
133	Signage, wall protection, fire extinguishers, whiteboards, tackboards	50,463	GSF	3.25	164,005	
134						
135	**INTERIOR CONSTRUCTION**				**2,571,989**	**$50.97 / SF**
136						
137	**STAIRS**					
138						
139	Internal Stairs					
140	Metal stair including treads, handrails/guardrails and finish	1	LS	180,000	180,000	*6 flights*
141						
142	**STAIRS**				**180,000**	**$3.57 / SF**
143						
144	**INTERIOR FINISHES**					
145						
146	Wall Finishes					**$150,000**
147	Ceramic wall tile	1	Allow	100,000.00	100,000	*Per program area half height in restrooms & locker rooms*
148	Painted gypsum board	Included in Interior partitions				
149	Allowance for acoustical panels, conference rooms and board room	1	Allow	50,000	50,000	7 conference rooms and 1 boardroom
150						
151	Floor Finishes and Base	***50,463***	***SF***			**$572,915**
152	Sealed concrete	1,200	SF	3.50	4,200	Equipment room and stairs
153	Polish concrete	2,700	SF	12.00	32,400	Mudroom, entry, reception
154	Ceramic tile	2,755	SF	33.00	90,915	*Restrooms and Locker rooms*
155	Linoleum	4,648	SF	15.00	69,720	*Kitchen/Break room/Crew room and Utility room*
156	Carpet flooring	35,160	SF	8.00	281,280	*Offices, conference, support and admin*
157	Chemical resistant sheet vinyl	3,300	SF	18.00	59,400	*Laboratory*
158	Raised access flooring with antistatic floor covering	700	SF	50.00	35,000	*Control room*
159	Vapor retarder		EXC			
160						
161	Ceiling Finishes	***50,463***	***SF***			**$814,626**
162	Gypsum board painted	8,315	SF	30.00	249,450	*Control room/ restrooms/locker and utility rooms*
163	Acoustic tile ceiling, 2'x2'	38,848	SF	12.00	466,176	
164	Laboratory clean room ACT, 2'x2'	3,300	SF	30.00	99,000	
165						
166	Misc. Items					
167	Sealants and caulking (internal)	50,463	GSF	1.50	75,695	
168						
169	**INTERIOR FINISHES**				**1,613,236**	**$31.97 / SF**
170						
171	**CONVEYING**					
172	Elevators & Lifts					
173	New passenger elevator, 2 stop	1	EA	180,000.00	180,000	
174						
175	**CONVEYING**				**180,000**	**$3.57 / SF**
176						
177	**PLUMBING**					
178						
179	Sanitary fixtures	*87*	*FX*			
180	Water closets	26	EA	1,850	48,100	
181	Urinal	11	EA	1,725	18,975	
182	Lavatory	26	EA	1,650	42,900	
183	Drinking fountain, hi/low, EWC type	1	EA	5,000	5,000	
184	Shower	8	EA	3,000	24,000	
185	Mop sink	3	EA	2,500	7,500	
186	Breakroom Sink	4	EA	1,650	6,600	
187	Lab sinks	7	EA	2,200	15,400	
188	Emergency shower/eyewash	1	EA	2,200	2,200	
189						
190	Sanitary waste, vent and service pipework					
191	Floor drains/sinks	10	EA	2,800	28,000	

192	Rough-in and final connection sanitary waste, vent and service pipework, includes pipe, fittings, supports, valves, specialties and insulation	87	EA	4,800	417,600		
193							
194	Plumbing equipment						
195	Water heating equipment allowance	1	LS	20,000	20,000		
196	Shop, ops, lab equipment, air compressor	1	LS	35,000	35,000		
197	lab systems allowance	1	LS	20,000	20,000		
198							
199	Roof drainage (allowance)	50,463	GSF	2.50	126,158		
200							
201	Natural gas (allowance)	50,463	GSF	1.00	50,463		
202							
203	Miscellaneous plumbing requirements						
204	Site supervision, documentation, testing, chlorination, general conditions and requirements	1	LS	45,000	45,000		
205							
206	**PLUMBING**				**912,896**		**$18.09 / SF**
207							
208	**HVAC**						
209							
210	HVAC Requirements						
211	Admin/ops/lab: Chilling and heating generation equipment, pumping and circulation equipment, pipe distribution, air distribution, diffusers, registers, grilles, air handling equipment, temperature controls, testing and balancing, exhaust fans, startup and commissioning	50,463	GSF	70.00	3,532,410		
212	Lab systems/fume exhaust allwance	1	LS	50,000.00	50,000		
213							
214	**HVAC**				**3,582,410**		**$70.99 / SF**
215							
216	**FIRE PROTECTION**						
217							
218	Sprinkler System						
219	Automatic wet sprinkler system	50,463	GSF	8.00	403,704		
220							
221	**FIRE PROTECTION**				**403,704**		**$8 / SF**
222							
223	**ELECTRICAL**						
224							
225	Electrical Requirements						
226	Main service panel, subpanels, transformer, feeders, conduit and cabling	50,463	GSF	4.00	201,852		
227							
228	Emergency power distribution	50,463	GSF	1.00	50,463		
229							
230	Machine and equipment power	50,463	GSF	5.00	252,315		
231							
232	User convenience power	50,463	GSF	6.00	302,778		
233							
234	Lighting and controls	50,463	GSF	25.00	1,261,575		
235							
236	Telecom	50,463	GSF	12.00	605,556		
237							
238	Security/CCTV, conduit and back boxes	50,463	GSF	2.00	100,926		
239							
240	Fire alarm	50,463	GSF	4.00	201,852		
241							
242	Misc. Items						
243	Lab equipment/lab bench power	1	LS	15,000.00	15,000		
244	UPS allowance	1	LS	15,000.00	15,000		
245	Miscellaneous electrical requirements, site supervision, documentation, coordination, testing, startup, general conditions and requirements	1	LS	300,000	300,000		
246							
247	**ELECTRICAL**				**3,307,317**		**$65.54 / SF**
248							
249	**EQUIPMENT**						
250							
251	Appliances						
252	*BREAKROOM*					$11,700	

253	Microwave	4	EA	500	2,000	
254	Refrigerator	4	EA	2,050	8,200	
255	Range	1	EA	1,500	1,500	*Only at one breakroom*
256						
257	Laboratory					
258	*Lab equipment*					**$130,000**
259	Vacuum and compressed air, fumehood and canopy hoods	1	Allow	130,000	130,000	*3,300 SF program area of lab*
260	Water purification system	1	Allow	12,000	12,000	
261						
262	Misc. Items					
263	Allowance for lab equipment anchoring	1	Allow	10,000	10,000	
264						
265	**EQUIPMENT**				**163,700**	**$3.24 / SF**
266						
267	**FURNISHINGS**					
268						
269	Casework and Cabinetry					
270						**$412,000**
271	Lavatory counters at restrooms	1	Allow	12,000	12,000	
272	Kitchen/Breakroom/crew room built in cabinets and shelving	1	Allow	80,000	80,000	
273	Conference rooms- built in casework	7	LOC	10,000	70,000	*Each conference room 500 SF*
274	Board room- built in riser, board member desk area	1	Allow	50,000	50,000	*1,800 SF program area*
275	Laboratory casework, epoxy resin work surfaces	1	Allow	200,000	200,000	*3,300 SF program area of lab*
276						
277	Blinds/ Shades					**$147,515**
278	Allow for mechoshades	8,195	SF	18.00	147,515	
279						
280	**FURNISHINGS**				**559,515**	**$11.09 / SF**
281						
282	**SPECIAL CONSTRUCTION**		NA			
283						
284	**SPECIAL CONSTRUCTION**					**$0 / SF**
285						
286	**SELECTIVE DEMOLITION**		NA			
287						
288	**SELECTIVE BUILDING DEMOLITION**					**$0 / SF**

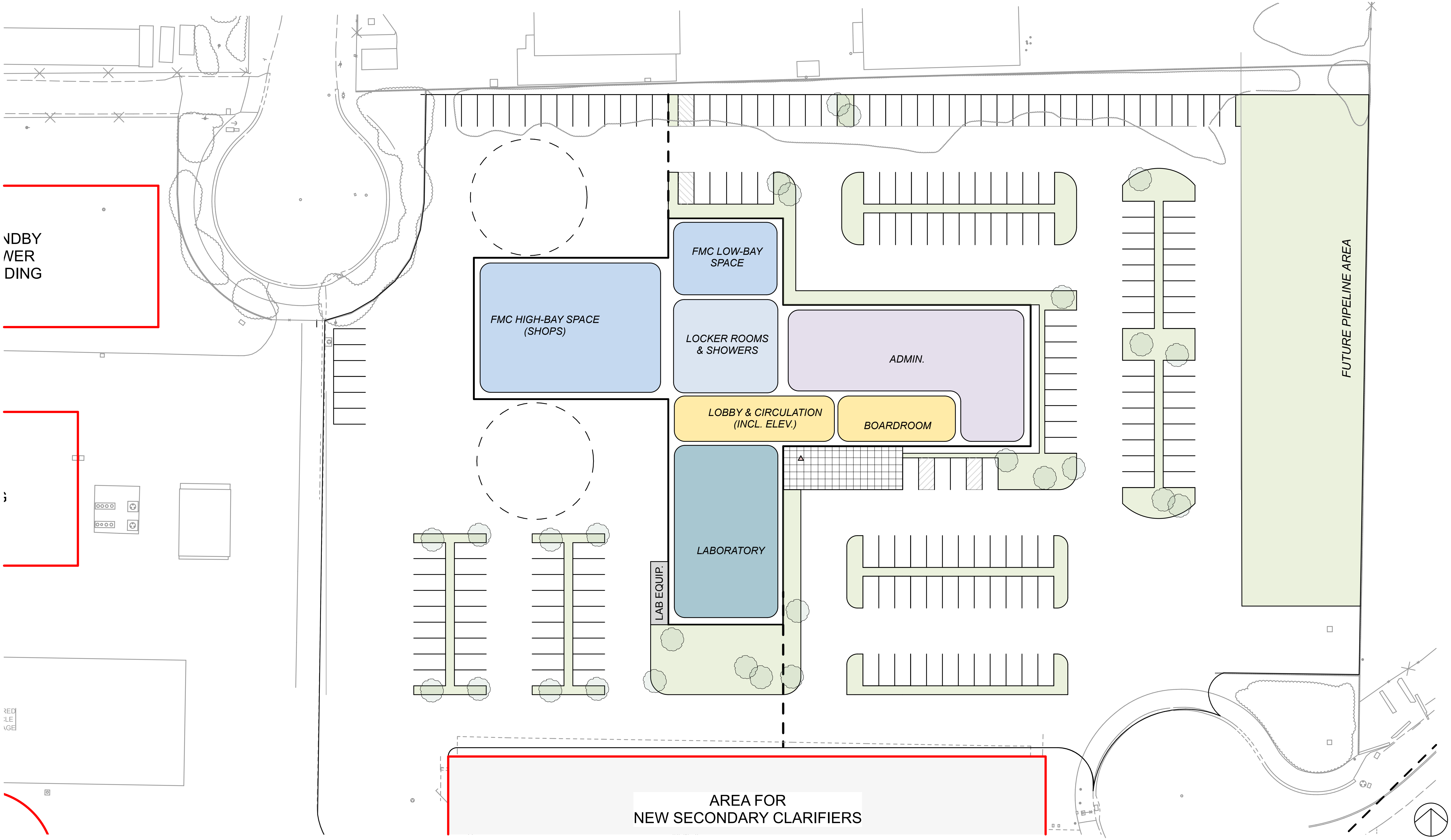


Preferred Site Layout
1" = 50'-0"

Burks Toma Architects

Union Sanitary District
5072 Benson Rd, Union City, CA 94587

Concept Design
date: 3.13.2019

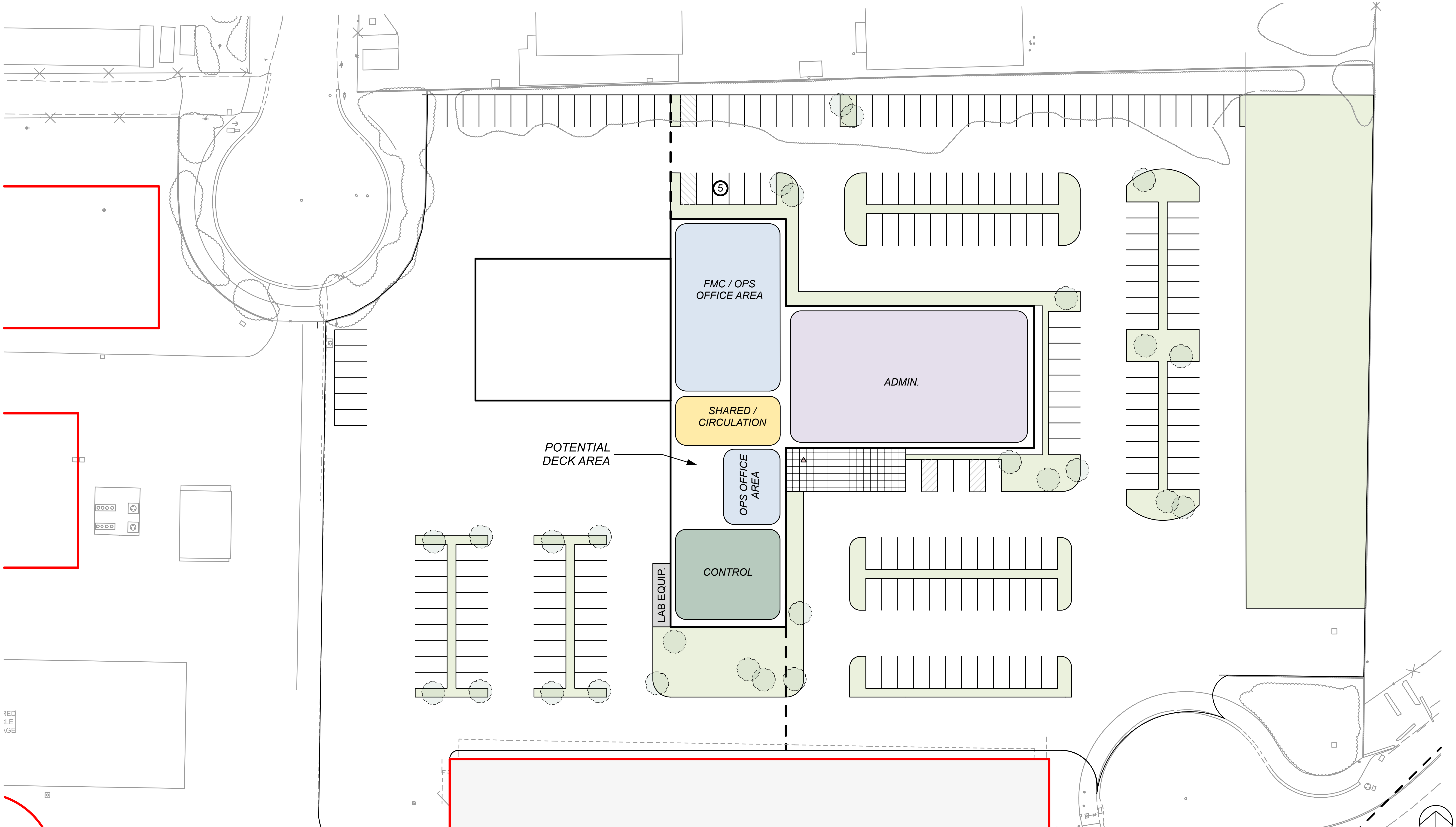


Site Program - 1st Floor
1" = 50'-0"

BurksToma Architects

Union Sanitary District
5072 Benson Rd, Union City, CA 94587

Concept Design
date: 3.13.2019



Site Program - 2nd Floor
1" = 50'-0"

Burks Toma
Architects

Union Sanitary District
5072 Benson Rd, Union City, CA 94587

Concept Design
date: 3.13.2019

Appendix D

Real Estate Acquisition Investigation

D

Union Sanitary District's
Enhanced Treatment and Site Upgrade Program

REAL ESTATE ACQUISITION MANAGEMENT PLAN

For

Wastewater Treatment Plant
Enhanced Treatment & Site Upgrade Program

Prepared for:

Union Sanitary District

Prepared by:

OVERLAND PACIFIC & CUTLER, INC.

October 2017

Table of Contents

I. Real Estate Acquisition Management Plan – Overview and Summary

A. Need

The Union Sanitary District (USD) is planning to acquire real property interests for its Wastewater Treatment Plant Enhanced Treatment & Site Upgrade Program (the Program) to construct the required improvements. This Real Estate Acquisition Management Plan (RAMP) addresses the Program's real estate needs, practices and procedures. Its contents detail how USD's (also hereinafter referred to as the Acquiring Agency or Agency) Real Estate Program will be administered and how the program's components including real estate appraisal, acquisition, and relocation activities will be implemented (Real Estate Activities). This document is not a legal or regulatory document.

Due to the evolving nature of the Real Estate Activities throughout the project development cycle, the RAMP will be revised once the preliminary design and final design are completed. Changes to the Project's design, interagency agreements, increased or decreased real estate transaction needs (and subsequent Real Estate Activities) and other factors will contribute to later iterations of this document.

B. Purpose

This RAMP will serve as a project planning, management, and monitoring document for the Agency's Real Estate Activities. The RAMP is also a controlling reference document for the Real Estate Activities that tracks changes in the Real Estate Program (Program). This RAMP describes the Program's management functions such as identifying all applicable regulatory compliance issues, staffing functions, approval procedures, document controls, and schedule and cost controls. This RAMP explains the Agency's project implementation approaches regarding appraisal and formal offer preparations, identifies critical path acquisitions (including their physical descriptions and estimated costs), escrow and title clearance responsibilities, condemnation processes, property management and the disposition of excess lands, if required.

C. Process Summary

A flowchart shown as **Figure 1** outlines the Program's major Real Estate Activities (Activities) and the order they occur. The RAMP details these Activities and the tasks necessary to meet all applicable regulations.

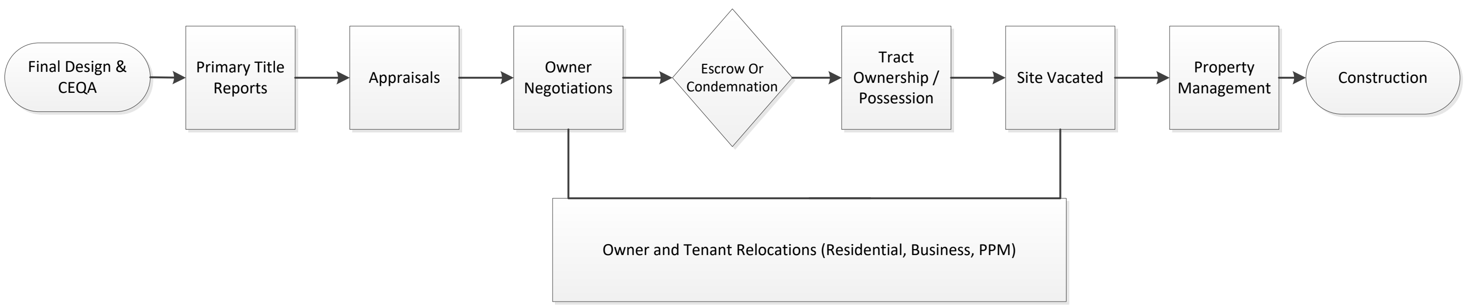


Figure 1

For this project, property acquisition is the primary activity driving the needs of the Program. All other's Activities are an input or output of acquiring the property needed. For example, an offer to acquire the property cannot be made until an appraisal is prepared, and should a property be occupied, the relocation of a business or residential occupant is necessary result of the closed transaction.

The start of the acquisition process begins with the design determining which parcels are needed, the level of ownership needed for parcel, and the physical area needed. USD will need to consider whether they want to acquire the property in fee or easement. Acquiring the parcel in fee would give USD complete control over the parcel. For fee acquisitions USD will need to determine if they need all or part of a particular parcel. Acquiring a portion of a parcel, versus its whole, may provide the opportunity to minimize or eliminate displacements and reduce relocation costs. USD may be able to acquire rights through an easement to some parcels it needs versus acquiring the fee ownership. An easement would grant specific rights to USD. With an easement, USD would not have full control over the entire parcel, only the area under the easement, however, they would also not have the long-term costs of owning the parcel related to maintenance and up keep.

Environmental clearance is also needed. Once environmental and acquisition needs are determined, Preliminary Title Reports (PTRs) are ordered to determine the parties with interest (fee ownership, easement owners, leases, etc.) in the property that would be affected by site acquisition.

Appraisals come next. The real estate appraiser utilizes the acquisition needs and known encumbrances in terms of land title and environmental constraints to form an opinion of value for the property. The value determined by the appraisal is the basis for an offer to acquire the parcel or land right (through an easement) for Just Compensation. The appraiser will arrive at its opinion of value, however, USD must determine if that value provides Just Compensation to the owner. Just compensation is the fair market value of the property being acquired by USD. California law defines fair market value is the highest price on the date of valuation that would be agreed to by a seller, being willing to sell but under no particular or urgent necessity for so doing, nor obliged to sell, and a buyer, being ready, willing, and able to buy but under no particular necessity for so doing, each dealing with the other with full knowledge of all the uses and purposes for which the property is reasonably adaptable and available.

Presenting the offer to the owner will start the negotiation process. The presentation of the offer also initiates the negotiations in terms of establishing eligibility for relocation assistance. The Acquiring Agency must negotiate in good faith to try to reach an amicable settlement for the property. Negotiations end by closing escrow or through exercising the power of eminent domain and the Agency condemning the property. Either close of escrow or condemnation will give possession of the property to USD. Property owners and tenants will vacate the property through the relocation process. Property Management activities will be required between the period that the property becomes vacant and the start of construction.

II. Real Estate Acquisition Management Plan - Content

A. Introduction

USD operates a 33 million gallon per day wastewater treatment facility at 5072 Benson Road, Union City, CA 94587 and provides collection, treatment and disposal services to a total population of over 347,000 in Fremont, Newark and Union City, California. The Program will implement upgrades to their current facility and expand to the surrounding area for future operational and maintenance needs. The expansion incorporates the areas along Veasy St., Horner St., Whipple Rd., and Benson Rd.

Projects will need to clear the required State environmental review per the California Environmental Quality Act (CEQA). Carrying out Real Estate Activities including appraisal, acquisition, and relocation prior to CEQA approval is considered an “at risk” action.

B. Legal and Regulatory Requirements

Program implementation shall be under the authority and guidance of State and local law, policies and procedures. The California Relocation Assistance Law, California Code of Regulations Title 1, Chapter 16, Section 7260-7277 (CRAL) and California Relocation Assistance and Real Property Acquisition Guidelines, California Code of Regulations Title 25, Division 1, Chapter 6 (the Guidelines), and in instances where legal proceedings are required to retain possession and property rights, the governing body of laws shall be the California Code of Civil Procedure Section 1240.010-1240.050 (Eminent Domain Code). California Public Utilities Code Section 25771 applies to condemnation and 25806 applies if agreements with other agencies or districts are necessary for the Program. Dependent upon the funding and oversight relationship the California Department of Water Resources (DWR) may have, DWR may also have additional requirements, however, primarily DWR follows the requirements under CRAL and the Guidelines. For some DWR programs, this RAMP would satisfy the need for a Project Real Estate Plan.

C. Geographical Description of Project

From north to south, the project begins on the northern properties on Horner St. beginning at Veasy St. and going to Whipple Rd. The properties in between Veasy St. and Whipple Rd. are included until Benson Rd. and the Union Sanitary District Property. A map displaying the project's location is shown in **Figure 2** below and also identifies Tract numbers, acreage, 2014 estimate of property value, and the streets labeled.

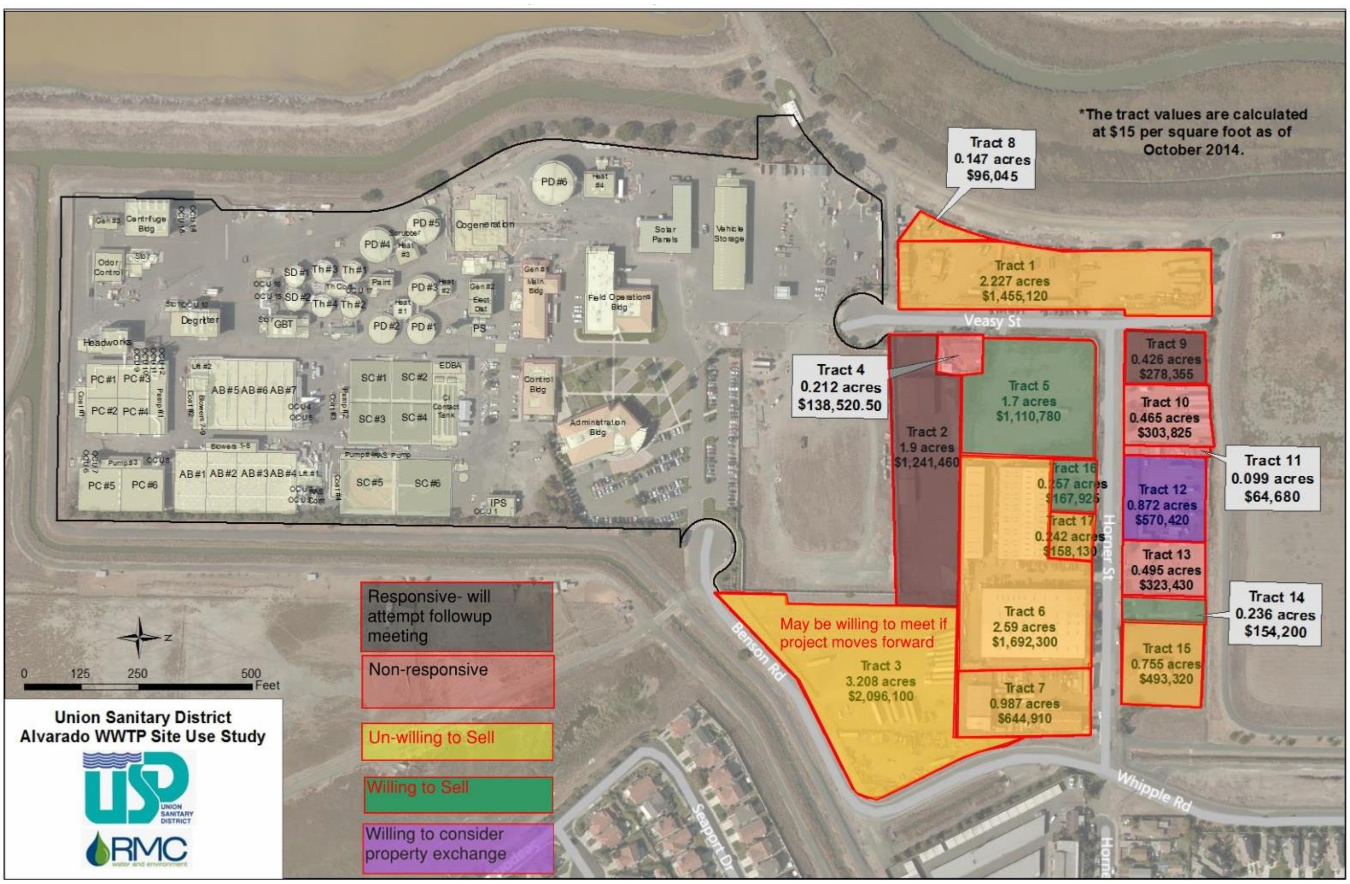


Figure 2: Project Map.

D. Physical description of proposed acquisitions

Project design is currently in the planning stage. The fee acquisition of parcels are described in this part of the RAMP (herein referred to as "Transactions") are current as of September 29, 2017. The project currently requires up to eighteen Transactions depending upon the total land requirement to fulfill the project objectives. These Transactions have been grouped into seventeen Tracts based on the transactions having the same ownership, being contiguous, and having the same land use.

This is the first iteration of this RAMP. The Transactions described below are still considered preliminary. Future iterations of this RAMP will detail the progress made on the Transactions described below, or if necessary, substitute and/or additional Transactions.

Relocation of residential and commercial occupants and personal property moves are expected to be required for many of these Transactions.

The parties engaged to implement the Real Estate Program's Real Estate Activities will obtain and conduct reviews of preliminary title reports (PTRs) in preparation for the acquisition of the parcels and land rights described below.

All parcels acquired for this project will be tracked on a parcel inventory. This inventory will be updated as parcels are transferred and or developed for the needs of the Project. The form of this inventory will be consistent with guidelines discussed in Part N of this RAMP. Should these parcels become excess property, the guidelines discussed in Part N will be adhered to. The valuation of the Transactions below will be described later in the Section I (Cost Estimate) of this RAMP.

Tract 1 & 8: Tract 1 & 8 are privately owned, full taking parcels with a lager parcel area of approximately 110,161 square feet. These tracts are undeveloped industrial parcels that have a commercial tenant and are used for truck, trailer, and personal property storage. The property is located at 31251 Veasy St. (APNs: 482-22-1-2, 482-22-7, 482-22-9-1). The properties have been separated into three lots which indicates there will be one business relocation and two MPP moves.

Tract 2: Tract 2 is privately owned and is the process of being determined if it will be developed for a religious use. This is a critical parcel for the project. The site is located at 31252 Veasy St. (APN: 482-27-4-3) on approximately 82,764 square feet. The parcel is largely vacant with 2 improved buildings.

Tract 3: An existing, privately owned, undeveloped industrial parcel that is used for truck, trailer, and personal property storage. It is located at 4601 Benson Rd. (APN: 482-27-7-19) and is approximately 139,745 square feet. It is assumed that business relocation would be required.

Tract 4: An existing, privately owned, developed residential parcel. It is located at 31216 Veasy St. (APN: 482-27-6-1) with approximately 9,270 square feet. Residential relocation will be necessary.

Tract 5: An existing, privately owned, vacant lot. It is located at 4700 Horner St. (APN: 482-27-13) with approximately 74,052 square feet. USD made an offer for the property in 2016 for a price of $1,200,000. This offer amount was based on a preliminary appraisal and included a Phase I environmental investigation as a condition of the offer. USD did not receive a response to this offer. The owners are currently listing the property for sale for $3,500,000 which was confirmed on MLS. Business relocation would be expected to be required.

Tract 6 &17: These are existing, privately owned, developed industrial parcels that have commercial tenants. Tract 6 is located at 4700 Horner St. (APN: 482-27-14) with approximately 112,820 square feet. Tract 17 is located at 4862 Horner St (APN: 482-27-3-3) with approximately 10,584 square feet. Two business relocations are assumed .

Tract 7: An existing, privately owned, developed industrial parcel that has a commercial tenant. Tract 7 is located at 4600 Horner St. (APN: 482-27-1-10) with approximately 43,009 square feet. Assumes relocation of a business.

Tract 9: An existing, publicly owned, vacant lot. It is located at 4995 Horner St. (APN: 482-20-9) with approximately 18,731 square feet. No relocations required.

Tract 10 &11: Are existing, privately owned, undeveloped industrial parcels that are used for truck, trailer, and personal property storage. They are located at 4915 Horner St. (APN:s 482-20-8-2, 482-20-2-3) with approximately a combined 24,613 square feet. One business relocation assumed.

Tract 12: An existing, privately owned, undeveloped industrial parcel that is used for truck, trailer, and personal property storage. It is located at 4915 Horner St. (APN: 482-20-7) and is approximately 38,071 square feet. One business relocation assumed.

Tract 13: An existing, privately owned, developed residential parcel. It is located at 4863 Horner St. (APN: 482-27-6) and is approximately 21,600 square feet. Assumed to be one residential relocation.

Tract 14: An existing, privately owned, developed 3 bed 1 bath residential parcel. It is located at 4837 Horner St. (APN: 482-20-5) and is approximately 10,317 square feet. One residential relocation.

Tract 15: An existing, privately owned, developed residential parcel. It is located at 4813 Horner St. (APN: 482-20-18) and is approximately 32,927 square feet. One residential relocation assumed.

Tract 16: An existing, privately owned, developed 2 bedroom 1 bath residential parcel. It is located at 4890 Horner St. (APN: 482-27-2) and is approximately 11,200 square feet. One residential relocation and one business relocation assumed.

E. Condemnation Authority

USD is required to attempt to acquire property for the Project from private owners or other public agencies through good faith negotiations. Reasonable efforts must be made to acquire the property through amicable means to reach a negotiated settlement with the property owner. If such an amicable settlement cannot be reached, USD has the right to exercise its power of eminent domain and condemn the property.

In certain cases, condemnation may become a necessary last resort to achieve the goals and design concepts of the Project. Should this be the case and USD elects to exercise its condemnation authority, USD will follow the process described in Section J of this RAMP.

Should USD elect not to condemn, the District must convey this through a written notice to the property owner. This decision should be made prior to the appraisal process. The notice should be provided with any notice to the owner regarding an appraisal. At a minimum this notice must be delivered to the owner prior to or concurrently with the offer to acquire the property. USD should seek legal counsel to determine whether or not to preserve its right to exercise the power of eminent domain throughout the process.

In some cases, these good faith negotiations do not result in a negotiated settlement with the property owner. USD will need to designate a party who will recommend the commencement of the condemnation process to USD and its Board of Directors. This party is assumed at this time to be USD's agency legal counsel. This process starts with USD serving a property owner with a Notice of Intent (NOI) to adopt a Resolution of Necessity (RON). The NOI informs the owner of their right to make comment to the Board prior to their adoption of the RON. The RON is the mechanism that the Board uses to formally state the parcel or land right is needed for the Project (for the public good) and that the Agency will pursue acquisition through condemnation.

The actions on RONs may include an action on a single parcel or multiple parcels. It may be more efficient to schedule action on multiple RONs for the same meeting to reduce legal costs. Depending upon the status of negotiations at the time, the prospects for settlement and its construction schedule, USD will decide on a case-by-case basis whether to use its power of eminent domain to acquire multiple parcels held by the same owner or make additional attempts to reach an amicable settlement on particular parcels without condemnation.

In order to stay on schedule, USD may need to start the condemnation process on multiple parcels under one RON, while it continues to negotiate with the property owner. Close coordination and communication between USD, the Real Estate Team, and USD's legal counsel will be required to ensure the most appropriate strategy is employed to serve the needs of the Project and best advise USD on the required course of action.

If an amicable agreement cannot be reached, USD's eminent domain authority shall be implemented via the procedural and regulatory guidelines stated in the California Code of Civil Procedure Section 1240.010-1240.050 (Eminent Domain Code). The USD Board of Directors shall be the responsible party to hear and approve the procedural steps to initiate the condemnation process including the adoption of a Resolution of Necessity. In the event all reasonable efforts to acquire the property have been exhausted in good faith negotiations and USD's Board has adopted the Resolution of Necessity, USD's legal counsel will initiate condemnation proceedings.

F. Organizational Structure

Due to the need for real property interests, an essential member of the Project Team is the formation of a Real Estate Program Team (Real Estate Team) with the experience, technical knowledge and political awareness to meet all the goals and objectives of the project. The Real Estate Team is tasked to implement the various Activities within the Program for the Project. The Real Estate Team will be led by a Real Estate Program Manager who would oversee the delivery of the Real Estate Activities. The Real Estate Team and its Program Manager are assumed at this time to be from an outside organization. The Real Estate Program Manager would be assumed at this time to report to the General Manager, Paul R. Eldredge.

The role of the Real Estate Program Manager will be to provide specific guidance on real estate matters to USD's senior and executive leadership, other leaders on the Project Team, and the members of the Real Estate Team. The Real Estate Program Manager will also provide regulatory and procedural oversight to the Project. The Real Estate Program Manager will direct the Real Estate Project Manager who is responsible for implementation of the day to day activities of the Agents within the Real Estate Team including acquisition and relocation.

Professional qualifications of the Real Estate Team will be provided in **Appendix J** of this RAMP when the team is established. A preliminary organizational chart is shown in **Figure 3** below and will be refined in further iterations.

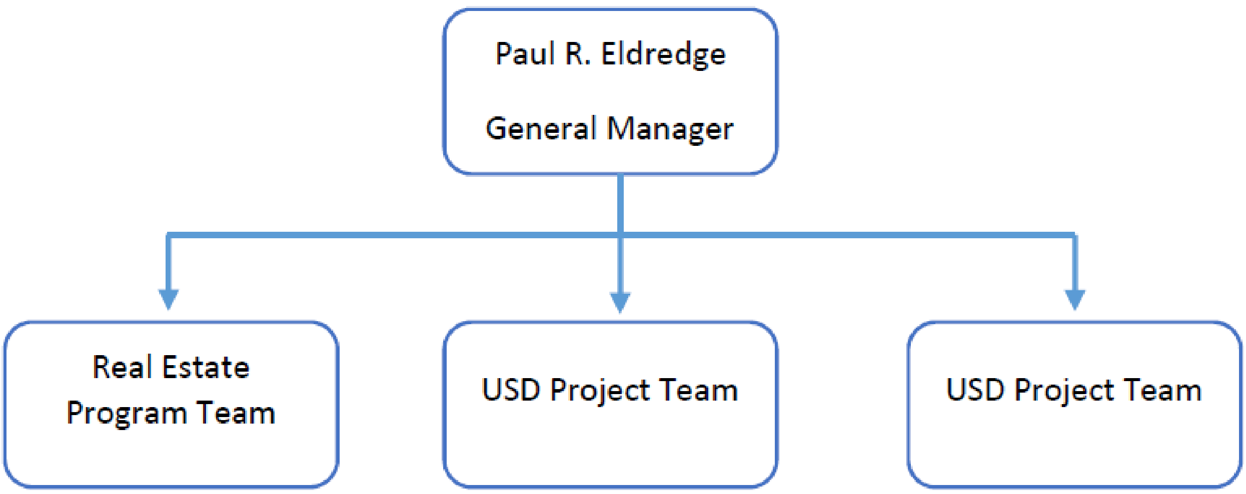


Figure 3: Project Organization Chart

G. *Identification of Contractual Functions*

General

RMC, a Woodard & Curran Company (RMC) is the Lead Designer responsible for delivering the ETSU Program. RMC, or another firm contracted with USD will be responsible for preliminary design and environmental documentation needed to support the RAMP. Overland, Pacific and Cutler, Inc. (OPC), as a sub-contractor to RMC, is responsible for preparing the RAMP and for providing real estate consultation to RMC and USD. OPC has prepared the preliminary Real Estate Activities schedule and cost estimate for the program. These items are discussed later in this RAMP and provided as **Appendices A and B**, respectively.

The Real Estate Program Manager will be responsible for facilitating approvals of Just Compensation by USD's General Manager, reviewing offer packages, approving relocation claims, facilitating owner payments for the agency, managing property acquired for transfer to others or held by USD, and general project oversight and regulatory compliance. Additionally, this person will be responsible for coordinating the Real Estate Team and ensuring that the required real estate interests are secured and certified to meet the project's delivery schedule for contractor procurement.

Project Set Up

The Real Estate Program Manager, working in conjunction with the Real Estate Team and legal counsel, will develop and refine the Project's Real Estate Policies and Procedures; a sample if provided in as Appendix F. These will include reporting/monitoring tools and the appropriate master documents required for the Real Estate Activities, such as acquisition agreements, escrow forms, relocation claims, and any other required documentation. The Real Estate Team shall assist in document drafting and preparation, as needed, and be the primary administrator of document delivery and execution. An overview of the overall real estate process is also provided in the Policies and Procedures found in **Appendix F** of this RAMP. In addition sample forms for property owner notifications are presented in **Appendix J** of this RAMP.

Planning

Studies that will support acquisition planning, appraisal and acquisition process, as well as the Program, include geotechnical investigations to assess the soil conditions, Phase I Environmental Site Assessments (ESA) to assess the potential presence of hazardous substances and materials and other supplemental or additional studies to investigate and assess conditions found by these initial studies. Permits to Enter (PTE), also commonly referred to as Rights of Entry (ROE), may be required to conduct investigations on all parcels listed in Part E of Section II of this RAMP. The PTE's will be acquired by the program engineer or its environmental subcontractor responsible for preparing the various technical studies discussed above.

Preliminary Real Estate Tasks

PTR's for each parcel to be acquired will be secured and reviewed by the Real Estate Team. The exceptions to title requiring clearance will be detailed on a title report encumbrance review form. PTR's will be considered valid for six months. Updated PTR's will be ordered as needed by the Real Estate Team during the offer preparation process for each transaction.

Each acquisition file must contain title information in sufficient detail to identify present ownership interests and describe any liens or encumbrances that may impact USD's interest. All fee interests or interests requiring the preparation of legal descriptions will necessitate the issuance of preliminary title reports from a local title company. The liens and encumbrances identified in each report will be investigated to determine whether they have any impact on the proposed use of the interest required.

The Real Estate Team will prepare a PTR Resolution form. This form will identify any title exceptions. Tasks needed to clear those exceptions will be provided and tracked. This form will also identify all exceptions that USD will take title subject to accepting those exceptions. Copies of each preliminary title report and all exceptions to title will be retained by the Real Estate Team. In instances where title documents contain sensitive and confidential information, including financial information, the documents shall be kept in a secured area in a separate file for each applicable parcel.

The Real Estate Team, working under the oversight of the Real Estate Program Manager, shall review the legal descriptions and plat maps prepared by the Program/ Design Engineer against the real estate mapping provided. Any discrepancies between the documents will be reported to the Design Engineer for modification prior to presentation to the property owner. Throughout the Program, USD will maintain original acquisition files at their office. The Real Estate Team shall maintain a "field" copy of the files at their offices. Acquisition files shall be consistently organized and preliminarily audited by the Real Estate Project Manager, reviewed by the Real Estate Program Manager, and then delivered for final review and approval to USD.

H. Acquisition Schedule

1. Set out the timeframe for acquisition and relocation; total length of time needed:

   The CRAL requires specific timeframes and activities upon agencies acquiring private property interests and when individual property owners and businesses are displaced as the result of a public project. These requirements will be taken into account when preparing the project schedule. Additionally, various aspects of project implementation such as appraisal report drafting, document preparations, Just Compensation and Administrative Settlement approval processing, relocation advisory services and escrow and title clearance will also be taken into account. If condemnation proceedings are required to secure the necessary possessory rights for real estate certification, additional time for re-appraisal of the property, court scheduling and other considerations will be integrated into project schedule as well. See ***Appendix A*** for a current overall project schedule.

2. Date for initiation of negotiations (ION) for project:

   The ION is the date the first written offer is presented to the property owner. This date establishes eligibility for relocation assistance for tenants and property owners that dispose of their property under the threat of eminent domain.

3. Difficulties and potential delays:

   The project is proposed to comprise of full take acquisitions on the project which may affect business operational concerns. This might result in lengthy negotiations and increase the onset of condemnation cases. Typically, parcels acquired through eminent domain proceedings present the greatest challenge to securing the necessary real estate needs on schedule.

   During the geotechnical and ESA processes, environmental hazards associated with the potential transactions previously described will need to be determined if they are cause for concern by USD. Remediation measures may be determined to be required at that time. Should any environmental hazards be determined during the construction phase, USD shall make all final determinations regarding the implementation of an environmental remediation strategy, if any is desired, and the effect such remediation has upon property owners from which USD has acquired property.

   There currently 5 residential, 10 business and 2 miscellaneous personal property move (MPP) relocations identified at this time. These relocations will require a relocation plan, which must be approved by the USD Board of Directors prior to issuance of a 90-day Notice to Vacate. The number of residential, business, or MPPs may increase.

   The acquisition and displacement of established industrial or commercial operations may take between 18 – 36 months. The success rate of such businesses being successfully relocated and maintaining operations is typically not high, and the longer the displacing agency can work with a displaced business to secure an adequate replacement site, the higher their long-term success rate will be.

   Advanced business move planning and/or careful parcel mitigation strategies during the PA/ED phase of a project may assist in reducing impacts and potentially avoiding a displacement altogether. Some advanced move planning activities could involve re-arranging business operations, structures, access points or circuitry of travel pathways, either temporarily during construction, or permanently to avoid a forced relocation. Parcel mitigation strategies may include presenting the owner with an option to compensate for a cut-and-reface remodel of an impacted building in order to keep the existing business operational. All of the above can be analyzed during early design, prior to the appraisal process, to assist the agency (USD) in cost savings and potentially avoiding lengthy litigation and negotiations.

4. Progress Reporting:

   In order to track the acquisition process over the course of the project, the Real Estate Team shall provide status reports twice monthly to the Real Estate Program Manager to assist in monitoring project activities. The report will detail information relevant to the acquisition of each affected parcel including, but not limited to, contact information, relevant dates, appraisal information and a brief summary of salient negotiation points. The Real Estate Program Manager will report out to USD on the Real Estate Team's progress.

   The Real Estate Team shall provide USD with copies of acquisition documents, individual parcel acquisition details, the project document library, project scheduling information and other project reports, as needed.

   An example Real Estate Progress Tracking Report is provided as Appendix I of this RAMP. This report will be in matrix form and will capture the important milestones in the appraisal, acquisition, and relocation process.

5. Identification of a critical path for real estate:

   The impacted parcels have been provided in Part D of Section II in this RAMP. Updates to these parcels will be provided as project needs change.

I. Real Estate Cost Estimate

OPC will prepare an initial Real Estate Activities cost estimate that identifies significant acquisition cost considerations to the Project including land and structure values. Estimates of other costs associated with parcel delivery including real estate staff cost and potential legal cost will be in future iterations as well. The cost estimate is utilized for planning purposes for identifying critical path acquisitions and will aid in the development of the project's acquisition schedule. The findings from the cost estimate study will be integrated into this RAMP as **Appendix B**.

As the Project advances further and the real estate needs have been refined, the cost estimate will be updated and revised. In cases where an offer has been made, the estimated value will be replaced by the actual offer amount as determined by a licensed appraiser and the just compensation determined by USD. In these cases a discussion of the estimated value relative to the actual appraised value presented in the offer will be discussed for each transaction.

Currently, all transactions are assumed to be full fee acquisitions. There are multiple acquisition options that have opportunities and challenges that should be considered in the design of the Project. Table 1 below presents these options, their opportunities, their risks, and the tasks associated with each.

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Table 1: Acquisition Alternatives

Alternatives: Tool/Technique	Opportunities	Challenges/Risks	Additional Work Required for Alternative
Full Fee Acquisition	The highest form of acquisition. Permits the District to acquire all land rights and control the property. Provides interest for future expansion if a portion acquired is not immediately needed.	If the parcel is required for the project and an amicable negotiated agreement cannot be achieved, the district may be required to utilize eminent domain and take the property through condemnation.	1) Obtain USD Board approval to move forward; 2) Prepare and distribute a Notice of Decision to Appraise (NODA); 3) Conduct an appraisal inspection; 4) Appraise the property; 5) Prepare an offer to acquire to the property; 6) Make the offer; 7) Negotiate agreement with the owner; 8) Close escrow.
Partial Fee Acquisition	Permits the District to acquire only the land rights it needs and control the portion of the property they need for the Project. Prevents acquiring excess land that may need to be disposed of at a later date.	If the parcel is required for the project and an amicable negotiated agreement cannot be achieved, the district may be required to utilize eminent domain and take the property through condemnation.	1) Obtain USD Board approval to move forward; 2) Prepare and distribute a Notice of Decision to Appraise (NODA); 3) Conduct an appraisal inspection; 4) Appraise the property; 5) Prepare an offer to acquire to the property; 6) Make the offer; 7) Negotiate agreement with the owner; 8) Close escrow.
Easement	Permits the District to acquire only the rights to land it needs and use the portion of the property they need for the Project. May reduce costs, can reduce liability, and prevents acquiring excess land that may need to be disposed of at a later date.	If the parcel is required for the project and an amicable negotiated agreement cannot be achieved, the district may be required to utilize eminent domain and take the property through condemnation.	1) Obtain USD Board approval to move forward; 2) Prepare and distribute a Notice of Decision to Appraise (NODA); 3) Conduct an appraisal inspection; 4) Appraise the property; 5) Prepare an offer to acquire to the easement; 6) Make the offer; 7) Negotiate agreement with the owner; 8) Close escrow.
Long-term Ground Lease	Permits District to acquire an interest in the property and obtain some control of the property to utilize it for the project. Overall cost may be lower than fee acquisition. Could do up to a 99 year ground lease. Lease could be used to gain control of all or part of property.	Gives the District less control. All uses would need to be negotiated in the lease agreement. Lease would transfer with a future sale (would recommend recording lease) of the property. However, District not necessarily guaranteed position to acquire the property in the future if fee acquisition was determined to be needed.	1) Obtain USD Board approval to move forward; 2) Prepare and distribute a Notice of Decision to Appraise (NODA); 3) Conduct an appraisal inspection; 4) Appraise the property; 5) Prepare an offer to lease to the property; 6) Make the offer; 7) Negotiate lease agreement with the owner; 8) Close escrow if portions need to go through escrow.
Exchange	Acquire other parcel identified by exchange partner. Acquire parcel needed for projects. Possibility to receive some cash considerations if parcels received through an exchange are worth less than the parcels District exchanges. Exchange partner would need to cover any variances in value. Could double escrow so District never owns parcel to be exchanged.	Finding suitable properties to acquire for exchange. Complex agreements to negotiate. May make condemnation difficult to execute if needed (i.e. an exchange cannot be consummated).	1) Obtain USD Board approval to move forward; 2) Locate suitable property; 3) Have properties appraised to determine FMV of each parcel; 4) Convene board meeting to approve moving forward; 5) Negotiate agreement; 6) Close escrows.
Purchase Option	Acquire an option in the property with a closing date set in the future. Allows the District to obtain a position to acquire the property without acquiring all interest. Allows District to extinguish its rights on parcels it does not need. Locks in a price now and mitigates increases in future. Opportunity to re-appraise and renegotiate price.	Exchange payments typically not refundable; District would lose those funds if they did not consummate the acquisition. Complex agreement to negotiate. May make condemnation difficult to execute if needed (i.e. purchase cannot be consummated). Price may increase should property be re-appraised.	1) Obtain USD Board approval to move forward; 2) Have properties appraised to determine FMV; 3) Convene board meeting to approve moving forward; 4) Negotiate agreement and option payments; 5) Close escrow if needed.
First Right of Refusal	Agreement with owner to offer property to District first. Puts District in position to acquire without needing to make further commitment. Price may decrease over time if real estate market declines.	District may be required to exercise right sooner than they want in order to secure parcel. May not be able to reach agreement. Price not locked in like an option.	1) Obtain USD Board approval to move forward; and 2) Negotiate agreement. Negotiate acquisition when time and close escrow.

Determining take types and areas needed for the project should be determined in order to have a sound foundation for a reliable cost estimate. Prices will vary depending on the take determined and can cause relocation cases to be required or not. To help in the determination of the design and takes needed, Table 2 outlining owners' preferences and potential relocations.

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Table 2: Ownership Information

Owner / Property Info				Owner Preference				# of Relocation Type		
Tract	APN	Owner Name(s)	Property Type	Sell	Exchange	Not Sell	Unknown	Res. Relo	Bus. Relo	MPP
1 & 8	482-22-1-2 482-22-7 482-22-9-1	Ken and Diane Bertelson Bertelson Pre Cast Steps Inc	Undv. Ind. Truck/Trailer/PP			x			1	2
2	482-27-4-3	Shri Guru Ravidas Sabha Bay Area California	Undv. Ind.				x		1	
3	482-27-7-19	Antonio M & Alice T Goncalves Trs	Undv. Ind. Truck/Trailer/PP			x			1	
4	482-27-6-1	Miguel Ramirez	Dev. Res.				x	1		
5	482-27-13	Richard Mao Promax Investment 385 LLC	Vacant Lot	x					1	
6 & 17	482-27-14 482-27-3-3	Umo Steel LLC	Dev. Ind.			x			2	
7	482-27-1-10	Gurlal & Maninder Pattar	Dev. Ind.			x			1	
9	482-20-9	The City of Union City Redevelopment Agency	Vacant Lot				x			
10 & 11	482-20-8-2 482-20-2-3	Donald and Barbara Kirby	Undv. Ind. Truck/Trailer/PP				x		1	
12	482-20-7	Allan Williams	Undv. Ind. Truck/Trailer/PP		x				1	
13	482-20-6	Patrick Barrera	Dev. Res.				x	1		
14	482-20-5	Roland and Maria Marcelo	Dev. Res.	x				1		
15	482-20-18	Gurlal & Maninder Pattar	Dev. Res.			x		1		
16	482-27-2	Frank Perez	Dev. Res.	x				1	1	
Totals				**3**	**1**	**5**	**5**	**5**	**10**	**2**

Future Updates: An initial cost estimate will be conducted after take types and needs have been determined. Updates to that cost estimate will be updated with future iterations of the RAMP. The estimate for those iterations will be compared to the estimate provided in the previous iteration of the RAMP. Any significant changes in the estimate will be documented. Changes may include the estimate benefitting from actual settlements and the completion of the offer and appraisal process for any additional transactions.

J. Acquisition Process

An overview of the real estate acquisition process is expressed below.

1. The Real Estate Program Manager and Real Estate Project Manager will meet with USD and finalize the real estate requirements and scope of services to be provided. This includes the expectations for all agents and professional services providers required to deliver the real estate services, including but not limited to the acquisition, relocation, real estate management, utility relocation coordination, real estate and specialty appraisal and appraisal review. The leadership of the Real Estate Team will discuss any known issues, potential risks, and preliminary solutions with USD and the Project Team.
2. If necessary, the Real Estate Project Manager to coordinate the preparation of real estate maps, plat maps and legal descriptions. Where needed, Real Estate Project Manager to make vendor recommendation to USD.
3. Where available, Real Estate Project Manager to obtain all plans, documents, policies and procedures and other necessary items from USD or its vendors pertaining to the ROW assignments.
4. Real Estate Project Manager to coordinate with USD to finalize the final scope of work and appraisal assignment for all real estate appraisals, specialty appraisals and appraisal reviews.
5. Real Estate Project Manager to prepare and cause the delivery of the Notice of Decision to Appraise (NODA) to all impacted property owners whose property will be appraised according to the real estate maps and the vesting title report. Real Estate Project Manager should ensure the preparation and delivery of the appropriate acquisition informational brochure to the property owner concurrently with the NODA.
6. Real Estate Project Manager to coordinate appraisal inspections with appraisers, property owners, and where applicable, tenants.
7. Real Estate Project Manager to assist in the preparation or prepare the appropriate offer letter and purchase agreement for the real estate rights to be acquired.

8. Real Estate Project Manager to coordinate the delivery of the appraisals, appraisal reviews, appraisal summary statements and other applicable appraisal documents to the Real Estate Program Manager for review. Upon completion of the appraisal process, the Real Estate Program Manager shall,

    - Approve the appraisals as the basis of just compensation that will lead to the preparation of a written offer to the property owner;
    - Set just compensation in a written Statement of Just Compensation to be approved by and signed by USD's designated authority;
    - Provide the Real Estate Project Manager with the Statement of Just Compensation, along with direction for the commencement of good faith negotiations with the property owner to acquire the property for the project.

9. Where requested to do so, Real Estate Project Manager will assist the Real Estate Program Manager in the preparation of the Statement of Just Compensation for execution/approval by the USD General Manager.
10. Real Estate Project Manager to assist in the preparation or prepare the appropriate offer package for the real estate rights to be acquired. This package shall include at a minimum a written offer (describing the rights to be acquired, purpose of its acquisition and the just compensation offered), purchase agreement, appraisal reimbursement agreement (for property owners wishing to seek their own appraisal), preliminary title report, appraisal summary statement, real estate map and Federal W-9 form. A statement of just compensation and copy of the appraisal shall also be included upon its completion and acceptance by USD.
11. Upon approval of the offer package the Real Estate Project Manager shall coordinate the presentation of the first written offer to the property owner. Where necessary such offer shall be delivered via return receipt courier service or US Postal Service.
12. Real Estate Project Manager shall ensure that all reasonable efforts are made to present the offer personally or discuss offer via telephonic communication with the property owner.
13. Where applicable, Real Estate Project Manager shall ensure that the Relocation Agent is contacted and informed the offer has been made for the rights to be acquired.
14. Real Estate Project Manager shall ensure that Acquisition Agent negotiates in good faith and documents the negotiation process in parcel diary.

15. The Real Estate Project Manager shall ensure that all necessary title clearances are achieved in order to deliver a clear title to USD and ensure the transaction closes in a timely manner.
16. Should a negotiated settlement be reached, the Real Estate Project Manager shall ensure that the appropriate requests are made to deliver payment into escrow, all deeds are executed and the purchase agreement is delivered to escrow for the timely closing of the property.
17. Upon vacation of the property, the Real Estate Project Manager shall ensure that the parties designated to secure the property are contacted and the appropriate property management tasks are implemented. These tasks could include demolition, board up, or leasing of the property.
18. Should a negotiated settlement not be reached, the Real Estate Project Manager shall coordinate the delivery of all acquisition documents to USD's legal counsel for preparation of all pre-condemnation and condemnation documents. Where needed, the Real Estate Program and Project Manager shall provide support to legal counsel during the preparation of documents and hearings. The Real Estate Project Manager shall ensure that the property be served a Notice of Intent to adopt a Resolution of Necessity (RON) that adequately informs the property owner of their rights to appear before the USD Board of Directors at the RON hearing.
19. Should condemnation proceedings be required the Real Estate Team shall cooperate with USD legal counsel throughout the legal process.

Plans

The Program/Design Engineer will provide the Real Estate Program Manager and/or Real Estate Project Manager with all applicable real estate and utility impact mapping and any other pertinent documents. Any changes or updates to the Project's design which impact real estate concerns will be forwarded to the Real Estate Program Manager and/or Real Estate Project Manager for review. Subsequent updates to offer letters or appraisal assumptions will be made accordingly.

During the course of negotiations should a property owner requests a modification to design elements, these requested modifications will be documented by the Real Estate Team and presented to the design team for consideration. Depending on the complexity of the changes being requested, direct property owner involvement with the project's design team may be prudent and recommended. If the proposed modifications are feasible and able to be incorporated into the project's updated design, the Real Estate Team will inform the property owner and begin the process of preparing a revised offer package. In this process, the project's fee appraisal report will be revised or updated as needed, and where needed, the agency will approve a new Determination of Just Compensation as the basis for its revised offer letter.

Ownership and title information

As part of the preliminary design process, PTRs were secured by PPC Land Consultants (PPC) for parcels within the present facility boundary and the light industrial area to the north to inform the preliminary real estate engineering process. Four title reports were prepared by Northwestern Title Company in 1994 for properties along Veasy Street in an area that now comprises a portion of the existing facility. In addition, PPC ordered and obtained a Title Report from Placer Title for Tract 6 (APN: 482-0027-13). PPC conducted a preliminary review of these reports and reported its findings to the Project Team.

The Real Estate Team will need to acquire updated PTR's for all potential property acquisition. The Real Estate Team will perform a detailed review of each PTR to confirm all relevant ownership interests affecting the close of the real estate transaction and the ability for the agency to secure clear fee title to the property. As part of this process, the Real Estate Team's Acquisition Agent will remain in regular contact with the property owner to monitor any changes in potential ownership resulting from the sale of the subject property, foreclosure, leasehold interests, establishment of trusts and other real property interests. As part of the status reporting process, the agency will be updated as to any imminent title issues that will impact the closing of the transactions.

The Real Estate Team shall secure any documentation that the property may have that would correct any errors or omissions in the PTR as well as those documents that may require Title Company review and due diligence for inclusion in the PTR prior to close. The Real Estate Team shall also insure that the proper level of title insurance.

PTR's should be updated every (6) months between the period of time appraisal preparation starts until the transaction is closed. Any changes discovered will be documented and integrated into the escrow closing, as needed.

Appraisal

Coordination of appraisal services will be managed by the Real Estate Project Manager including all necessary sub-consultants such as appraisal review. The Real Estate Team may also perform the fee real estate appraisal services and any necessary professional appraisal reviews.

After obtaining the PTR, a NODA will be sent to the property owner. Moreover, the letter informs the owner of the Agency's intent to acquire the property and provides the opportunity for either the owner or his or her representative to be present during the appraiser's inspection. This letter will inform the owner of their rights and protections afforded by law.

The Real Estate Project Manager shall ensure that the real estate appraiser has copies of the Phase I Environmental Site Assessment (ESA) and, where applicable, Phase II ESA to ensure that the appraiser considers all potential contamination or presence of hazardous materials, and their effect on the property's market value.

The fee appraisal of commercial properties is anticipated to take between 60 and 90 days. Should a professional review of the appraisal be required, this will take approximately 30 days. For highly complex commercial and industrial properties, an additional four to six weeks should be added to the fee and review appraisal process. All appraisal reports will be submitted to USD for review, which may take up to one month in addition to or in place of the professional review. Upon their review, USD will arrive at the determination of just compensation within two weeks. Typically, agencies do not provide a copy of the full appraisal report to owners based on the advice of their legal counsel. USD is not required to furnish the property owner with a full copy of the approved appraisal report at the time of its written offer. Civil Code of Procedure Section 1263.025 mandates that a property owner may request and obtain a reimbursement of up to $5,000 for obtaining their own independent appraisal performed by an appraiser licensed by the Office of Real Estate Appraiser's (OREA).

Appraisals over six months old in an active real estate market should be updated before fair market value has been established.

Appraisal Review

USD may elect to conduct a formal professional review of all appraisals. This is recommended on any commercial parcel valued over $500,000. Once the appraisal review have been completed and concur with the appraisal report on value, The Real Estate Project Manager will review the report to ensure it is in compliance with applicable laws and regulations. After this review and approval, the report will be forwarded to USD for final approval of the valuation with subsequent processing of the Agency's approval for setting just compensation.

Appraisal reviews may be adjusted to support administrative settlements if the justification of the later is based upon substantive changes in the agency's original appraisal analysis. In such cases, if the agency's original fee appraisal is adjusted to accommodate information obtained from the property owner, then a review of the agency's revised fee appraisal would be appropriate.

Fair Market Value and Determination of Just Compensation

According to the State of California Code of Civil Procedure, the fair market value of a property is "the highest price on the date of valuation that would be agreed to by a seller, being willing to sell but under no particular or urgent necessity for so doing, nor obliged to sell, and a buyer, being ready, willing and able to buy but under no particular necessity for doing so, each dealing with the other with full knowledge of all the uses and purposes for which the property is reasonably adaptable and available." The appraisal and appraisal review processes are designed to ensure that each property owner is presented with an offer that reflects the fair market value of the interest needed for the project. Once USD arrives at a value it believes is 'fair market value', it will make a determination of 'just compensation' and coordinate the preparation of owner offer packages with the Real Estate Team.

Currently there are non-residential displacements expected to require an analysis of the value of the fixtures and equipment impacted by the taking. In such instances, the Real Estate Team will retain a separate fixtures and equipment appraiser to work in concert with the real estate appraiser to properly categorize all realty items whether immovable or movable. The values of improvements pertaining to the realty will be separately appraised from the real estate for ease of making offers to the proper party. The fixtures and equipment appraiser will also provide a list of movable items, and if requested, will provide a value to aid in the relocation process.

Negotiations

USD intends to initiate negotiations for property to be acquired amicably, wherein eminent domain will not be initiated if possible. USD, and/or its contractors will proceed with formal negotiations in accordance with California Law through the following steps:

1. Provide written notification to property owner of USD's interest in potentially acquiring the property and conduct early outreach to determine if a parcel will be able to be acquired through amicable means for properties wherein eminent domain will not be initiated.

2. Written decision or determination to property owner of USD's interest to acquire the property, informing property owner of USD's decision as to whether or not to acquire the property.

3. Notification to owner of a decision by USD to appraise property.

4. Presentation of a formal offer letter signed by USD's General Manager to acquire the property along with a written statement of the basis for determination of just compensation. Each offer will contain a brochure which generally explains the following property acquisition procedures:

    A. The property owner, or his representative designated in writing, shall be given the opportunity to accompany the appraiser during the inspection of the property.

    B. It is USD's policy to provide relocation benefits as may be necessary or appropriate for the relocation of residents, or businesses, which may be displaced because of acquisition of property by USD or by any person having an agreement with or acting on behalf of USD.

C. If the owner of real property is also the owner of a business conducted on the property to be acquired, or on the remainder, the owner may have a right to an apportionment of the award of just compensation or for compensation for loss of business goodwill. Should a business owner feel they have realized a loss of goodwill, they will be provided with a copy of the pertinent provisions of the Code of Civil Procedure relating to compensation for loss of goodwill along with instructions to assist them with filing a claim. Goodwill claims will be compensated with funds other than from Federal sources.

D. If the property is acquired, construction or development of a project on the site will be scheduled, to the greatest extent practicable, so that no person lawfully occupying the real property shall be required to move from a dwelling or to move his business or farm operation without at least 90 days written notice from USD from the date the move is required.

E. After a property is acquired by USD, if USD makes arrangements to "lease back" the property to the previous owner for a short term, or for a period subject to termination by USD, the rental rate will not exceed the lesser of the fair market rental value of the property to a short term occupier or the pro rata portion of the fair market rental value for a typical rental period. Lease rates would be determined by an appraisal of the fair market rent. In these instances, USD would enter into a written lease with the owner. This lease would contain the terms, conditions, rights and responsibilities as permitted under California Landlord Tenant Law. Where a tenant occupant would "hold over" for a period of time defined in the lease prior to be in required to vacate, the rental rate would not exceed the tenant's previous rate.

5. Good faith negotiations with the property owner, for an appropriate amount of time, are needed to adequately address all legitimate issues. If the owner is not satisfied with USD's offer of just compensation, they will be given a reasonable opportunity to present relevant material supporting a counter offer for USD to consider.

Administrative Settlements

Any agreement on the value of a particular property interest required for the project that differs from the USD's determination of just compensation shall require an Administrative Settlement. The Administrative Settlement document, drafted by the Real Estate Team, and approved by USD, shall provide a brief detail of the negotiations history, the amount requested above USD's determination of just compensation, and a reasonable justification of the additional amount being requested.

Justification is required in order to ensure the owner was not a party to undue enrichment and to provide rationale to any State or Federal Agency that may provide oversight demonstrating that a reasonable opinion of fair market value has been reached. Updates in market data, a different analysis method employed by the owner, and other relevant factors will be included in the justification. Additionally, agency cost avoidance reasons may be cited such as settling in lieu of delaying the construction schedule or avoiding increased labor, appraisal and legal costs associated with eminent domain proceedings.

Closing / Escrows

The purpose of escrow is to ensure that the title and ownership of properties and property interests acquired by USD are free and clear of liens and encumbrances that will adversely affect the use of the property for the Project. Accordingly, escrow instructions detailing the procedural requirements of clearing and transferring title and administering payment(s) will include the following information: proper identification of the property interests being acquired, a list of enclosures, such as a deed or lease, instructions on the conditions necessary for escrow to close and a title insurance policy to be issued, a statement showing which title exceptions will be accepted by USD, an instruction as to the disposition of taxes and an authorization to pay the proper demands from lien holders and pay the balance to the grantors.

USD expects to utilize the services of a Title Company for the escrow process in addition to the provision of title reports. The agency will require 30 to 45 days from the date escrow is opened to deposit funding into the escrow account. Escrow shall be initiated with the submittal of escrow instructions and copies of the owner and agency executed acquisition agreement. All permanent and temporary conveyance documents will be executed by the property owner and agency representatives within the escrow closing period, prior to the established funding date.

Before the close of escrow, the escrow company will obtain from the grantors their Tax Identification Number, Social Security Number or Federal Employer Identification Number. The Real Estate Team will ensure that all documents and payments required for escrow closing be delivered as scheduled. Finally, when it has been determined that all the necessary instruments to clear title in the manner required by the escrow agreement have been executed and recorded, escrow shall close and taxes shall be pro-rated or properly segregated upon recordation of the deed conveying the property to USD.

Condemnation

Should USD elect to exercise its power of eminent domain and condemn property, the following steps will be required.

Eminent domain proceedings are initiated by submitting an impasse letter and Resolution of Necessity request to the USD for approval. Depending on the sequencing of acquisition, Resolutions of Necessity authorizing condemnation may be prepared for either individual parcels or groups of parcels. The Resolution is prepared by USD's legal counsel, which will also provide assistance in supporting evidence to secure approval. It is a prerequisite of the exercise of eminent domain to attempt to reach an agreement with an owner as to reasonable value of the property, unless the owner cannot be located with reasonable diligence. All reasonable attempts to negotiate a settlement will be pursued prior to litigation.

USD's legal counsel will manage the eminent domain process. Upon USD approval, the Real Estate Team will furnish all relevant documentation to legal counsel for commencement of eminent domain proceedings. USD and the Real Estate Team will provide all necessary support for the presentation of evidence reflecting the position of USD as to the just compensation and attempts to negotiate settlement. USD's legal counsel will maintain all records and keep project staff informed as to the progress of cases. Eminent domain proceedings are anticipated to take from 120 days at the earliest and up to 9 months to obtain possession of the property by court order.

If negotiations are resolved through the eminent domain process, a legal settlement occurs. A legal settlement is defined as such once an eminent domain suit has been filed, an expert witness is hired, and a settlement that exceeds the amount of the approved Just Compensation is proposed and approved based upon new appraisal data from said expert witness. The Legal Settlement shall be in the form of a Legal Memorandum prepared and recommended by the USD legal counsel.

K. Relocation Program

There currently 5 residential, 10 business and 2 MPP relocations identified at this time. The relocations identified will require a relocation plan. The number of Business or MPPs may increase if it is discovered that there are additional occupants on the properties. Relocation planning, plan implementation, services and benefits to the displacee including the provision of Relocation Advisory Services will be carried out in accordance with the CRAL and the Guidelines.

Relocation Planning:

This Project will require a relocation plan. In order to prepare this relocation plan, attempts must be made to interview all potential displacees. The plan must be circulated for a 30-day comment period. Upon completion of this comment period, all written comments, and a response to the comment, will be included in the draft plan that is sent to USD's Board for approval.

Relocation Advisory Services:

At a minimum the Relocation Lead from the Real Estate Team must provide the following advisory services to all displacees.

1. Deliver a General Information Notice (GIN) prior to any offer being made for real estate acquisition.
2. Conduct an eligibility interview prior to serving a Notice of Eligibility (NOE).
3. Prepare and personally present and explain the NOE where possible. Should a displacee not be eligible for assistance, they will receive a Notice of Non-eligibility.
4. Prepare and distribute a 90-Day Notice to Vacate, and where applicable, a 30-Day Notice and other reminder notices related to the vacate date of each displacee.
5. Provide referrals to replacement housing and business locations.
6. Inspect replacement housing to ensure it is Decent, Safe, and Sanitary (DS&S).
7. Provide the Households with relocation counseling services to assist them in making good decisions to plan their move.
8. Coordinate moves to replacement locations.
9. Assist with the completion and filing of any needed relocation claims and appeals forms if necessary.
10. Document receipt of all required notices, replacement site referrals provided, signed claims and receipts of payments, and demonstration of advisory services and relocation assistance provided to displacees in the relocation file of each displacee.

Residential Relocation Compensation:

Replacement Housing Assistance Payment

Eligible households would be eligible to receive a rent differential payment. This payment shall be based on the monthly differential between the rent for a comparable replacement housing unit and the lesser of 30% of the gross income of the household (ability to pay), or their displacement rent and utility costs. This monthly differential shall then be multiplied by forty-two (42) months to derive the maximum eligible replacement housing benefit. The actual rent differential payment the eligible household would receive would be based on the differential between the actual contract rent and utilities' costs at the replacement unit and the lesser of 30% of the gross income of the Household or their displacement rent and utility costs. The table below provides a sample calculation of this payment.

Example Computation of Rent Differential Payment *

1. Rent of Displacement Unit	$800	Displacement Rent plus Utility Costs
	Or	
2. Ability to Pay	$750	30% of the Gross Household Income
3. Lesser of lines 1 or 2	**$750**	
	Subtracted From:	
4. Actual New Rent	$950	Actual New Rent including Utility Allowance
	Or	
5. Comparable Rent	$1,000	Determined by Agency; includes Utility Allowance
6. ***Lesser*** of lines 4 or 5	**$950**	
7. Yields Monthly Need:	**$200**	Subtract line 3 from line 6
8. Rental Assistance	**$8,400**	**Multiply line 7 by 42 months**

**Note: This is a sample case only and is not reflective of actual market conditions.*

Moving Assistance

Households will be able to choose between having a professional moving company perform their move at USD's expense, or receive a fixed payment to conduct a self-move. The Relocation Team shall meet with each Household to explain the moving assistance services that shall be made available to them. Each Household shall also have the option to receive a fixed move payment (the "FMP") based on the current number of moveable rooms containing personal property at the displacement unit to conduct a self-move in lieu of having a professional mover relocate their personal property. The current federal FMP schedule for the state of California is presented in the following Table. A household that elects to receive the FMP shall not receive moving compensation for costs such as labor, boxes and other packing materials, utility transfers, or other costs related to the physical move, because the intent of the FMP is to provide funds to the household to pay for all costs associated with the move.

Federal Fixed Move Payment Schedule

# of Moveable Rooms	Typical Unit Size Equivalent	Payment Amount
3 Rooms	Typical 1 BR	$1,165
4 Rooms	Typical 2 BR	$1,375
5 Rooms	Typical 3 BR	$1,665
6 Rooms	Typical 4 BR	$1,925
7 Rooms	Typical 5 BR	$2,215
Additional Rooms	i.e. garage or other storage	$265

Non-residential Occupant Moving Expense Payments

Relocation benefits shall be provided to any displaced non-residential occupants pursuant to state relocation law. Eligible non-residential occupants may receive a relocation payment to cover the reasonable cost of moving their personal property to their replacement site.

The non-residential displacees shall have 2 options:

(A) A payment for actual reasonable and necessary moving and related expenses;

Or,

(B) A fixed payment in lieu not to exceed Twenty Thousand and No/100ths Dollars ($20,000).

Payment for Actual Reasonable and Necessary Moving and Related Expenses

This payment may include the following:

a) Transportation of persons and property from the present location to the replacement location (transportation costs are limited to a distance of fifty (50) miles);
b) Packing, crating, uncrating, and unpacking personal property;
c) Disconnecting, dismantling, removing, reassembling, and installing relocated and substitute machinery, equipment and other personal property. This includes connection to utilities available nearby, and modifications necessary to adapt such property to the replacement structure, or to the utilities, or to adapt the utilities to the personal property;
d) Storage of personal property generally for up to 12 months, at USD's discretion;

e) Insurance of personal property while in storage or transit and, the replacement value of property lost, stolen, or damaged (though not through the fault or negligence of the displaced person) in the process of moving;

f) Subject to certain limitations, any license, permit or certification required by the displaced business, to the extent that the cost is necessary for reestablishment at the replacement location;

g) Subject to certain limitations, reasonable and pre-authorized professional services, including architects', attorneys', engineers' fees and consultants' charges, necessary for: (**1**) planning the move of the personal property; (**2**) moving the personal property; or, (**3**) installing the relocated personal property at the replacement location;

h) Subject to certain limitations, the purchase and installation of substitute personal property limited to the lesser of: (**1**) the estimated cost to move the item to the replacement location; or, (**2**) the replacement cost, less any proceeds from its sale;

i) Subject to certain limitations, modifying the machinery, equipment or other personal property to adapt it to the replacement location or to utilities available at the replacement location or modifying the power supply.

j) Actual direct losses of tangible personal property resulting from moving, or discontinuing a business or non-profit organization, *not*-to-exceed the *lesser of*:

k) The fair market value of the tangible, personal property for continued use at its location prior to displacement; ***or***,

An amount equal to the reasonable expenses that would have been required to relocate the property, as determined by HACOS, subject to certain limitations;

l) Actual, and reasonable expenses incurred in searching for a replacement business location, *not*-to-exceed One Thousand and No/100ths Dollars ($1,000.00).

m) Actual, and reasonable expenses necessary to reestablish a displaced small business at its new location, *not*-to-exceed Ten Thousand and No/100ths Dollars ($10,000.00). Examples of expenses that may be considered for reimbursement include advertising, redecoration and certain increased costs of operation at the new location.

Fixed Payment In Lieu of a Payment for Actual Reasonable Moving and Related Expenses

The amount of this payment shall be based on the *average*, *annual net* earnings of the business. The payment to an eligible business may neither be less than One Thousand ($1,000.00), nor more than Fourty Thousand ($40,000.00). To qualify for this payment a displaced business:

A) *Cannot* be a part of a commercial enterprise having *at least* 3 other establishments which are *not* being displaced as part of the Project, and which is under the *same ownership* and engaged in the *same, or similar* business activities;

B) Must *not* be able to relocate without substantial loss of patronage; and,

C) *Must* have contributed *at least* thirty-three percent (33%) of the owner's total gross income during *each* of the 2 taxable years *prior to* displacement, *or* meet specific earnings criteria.

L. Document Control

All original acquisition and relocation documents including but not limited to the Statement of Just Compensation, Offer Letter, Purchase Agreement and other original documents shall be maintained by USD at their office located at 5072 Benson Road in Union City, CA. The Real Estate Team shall submit all signed original documents to USD under a detailed transmittal sheet within five (5) days after documents are signed by the appropriate party including but not limited to acknowledged offers and purchase agreements.

The Real Estate Team shall maintain a hard copy or electronic copy of each acquisition and/or relocation file throughout the acquisition and/or relocation process.
USD shall maintain all original contracts and individual parcel information for the duration that USD owns the parcel. General project information shall be stored at USD for 5 years following project closeout. A more detailed description of the Document Control policies and procedures can be found in **Appendix E** of this plan.

A Document Controls Plan is provided on the following page.

Real estate Document Control Plan

Parcel File Content and Organization:

Acquisition files at a minimum will include the following:

1. Parcel diary
2. Notice of Decision to Appraise and verification of delivery of Acquisition Policies Brochure
3. Title VI – Non Discrimination Disclosure
4. Appraisal
5. Real estate mapping, legal descriptions and plat maps
6. Review appraisal and recommendation of just compensation
7. Certification of Just Compensation signed by agency
8. Preliminary title report
9. Offer package, appraisal summary statement
10. Property owner correspondence
11. Administrative settlement justification memos (if applicable)
12. Eminent domain recommendation memos (if applicable)
13. Property Acquisition Agreement
14. Recorded Conveyance Deed(s)
15. Environmental Assessment Reports
16. Escrow instructions and closing documents
17. Title clearance documents
18. Policy of Title Insurance
19. Technical Reports (if applicable)

After completion of the acquisition activities, the Real Estate Acquisition Agent will submit their closed parcel files to the Real Estate Project Manager for review. The Real Program Manager will review and approve the file prior to submitting to USD for their acceptance. This will facilitate a proper audit of the files prior to the release of the Real Estate Team from their responsibility and give USD the opportunity to completely merge their files with that of the Real Estate Team to ensure a thorough and complete record of the acquisition of a particular parcel.

M. Property Management

USD will need to identify the responsible party for managing properties as parcels become vacant. This function could be filled by the Real Estate Team. It is anticipated that property management will be required to assure that debris removal and weed abatement are carried out as needed prior to construction. Additional services such as security, leasing and maintenance services may become necessary in the future, which may require USD to contract with a property manager. A more detailed description of USD's approach to property management policies and procedures can be found in **Appendix E** of this plan.

A Property Management Implementation Plan is provided below.

<u>Property Management Implementation Plan</u>

In cases where tenants, whether carry-over or new, are in occupancy of USD-owned property, USD's property management agent will perform property management services in accordance with USD's approved policies. These functions will include, but are not limited to, periodic inspections of the property, collection of rents, issuance of notices to vacate, property maintenance, management of contaminated properties and physical control and security. All USD property shall be maintained in a clean and orderly condition that does not detract from the general appearance of the neighborhood. If this condition does not exist, appropriate corrective measures will be taken to improve the property's appearance.

The following is a general course of actions that the USD property manager may carry out as the property management agent or delegate to a property management agent.

1. Property management agent to meet with USD and finalize the scope of services to be provided. This includes the expectations for both the property management agent and property services contractors such as weed abatement, and any current issues expected to be carried over after the start of management.
2. Where applicable, property management agent to meet with the exiting property manager prior to the management transfer date to receive items such as the rent roll, security deposit log, current leases, tenant files, vendor and utility list, keys, operating and capital budgets, pending work orders and other pertinent information.
3. Property management agent to perform an audit of the current leases to ensure that they are valid, to note any issues and to verify upcoming termination dates.
4. Property management agent shall calculate rental rates. Carry-over tenants will be charged the same contract rent they were paying to the former property owner unless negotiated otherwise. Economic rent will be determined by either

an appraisal of the property or another market rent analysis, and will then be compared to the contract rent. An upward adjustment may be made if the contract rent is below the current economic rent and the carry-over tenant will remain on the property for more than three months. Rental rates for all other USD-owned properties that do not have carry-over tenants will generally be a percentage of the subject property's fair market value, as determined by a current appraisal, or negotiated based on a survey of comparable licensed properties in the area.

5. Property management agent to set up the current tenants in property management agent's accounting system and send initial notices. Notices will inform tenants of the change in management, provide address information and envelopes for subsequent rent payments, and provide telephone contact information.
6. Property management agent to confirm the USD contact to submit monthly account reconciliations.
7. Property management agent to contact utility companies with change of management information, and current vendors to provide new contracts, W-9's, and certificates of insurance.
8. Property management agent to execute current vendor contracts and request USD and the managing agent are placed as additionally insured on original insurance certificates to be held by property management agent.
9. Property management agent to visit each property to inspect for necessary repairs, confirm operating and capital budget scopes, and meet with key tenants.
10. Property management agent to revise current operating and capital budgets as necessary and submit for approval.
11. Property management agent to contact appropriate property services vendors to set up each property in that vendor's work-order system. Provide contact protocols for each property to the 24/7 emergency dispatch service.
12. Property management agent or appropriate property service's vendor to perform regular property inspections. Property management agent to meet with tenants based on the requirements established by USD.
13. Set up a project file for each property containing details, communications, inspection logs, vendor contracts, etc. available for possible future audits.
14. Should improvements on property require demolition, the property management agent shall work with the USD to develop the scope of work required and contract with the appropriate vendor.

N. Excess Property Inventory and Utilization Plan

Excess Property Inventory List and Plan - Should a property or properties acquired for the Project no longer be needed for their intended use, USD shall prepare and maintain an excess property inventory list and utilization plan. The inventory list will give the property a parcel identification number and include, at a minimum, the following,

- The property location including address and/or assessor parcel number,
- Summary of title conditions,
- Original acquisition cost,
- Appraised value and date of value,
- Description of any improvements,
- Current use of property, and
- The anticipated disposition or alternate use/action proposed

Disposition Alternatives: Several disposition alternatives are available in cases where the grantee determines the real property is no longer needed. Properties pending disposal shall be valued by being appraised to establish the valuation.

Acceptable disposition methods include the following,

- Offset to cost of replacement property with net proceeds of excess property sale,
- Sell and use proceeds for other capital projects,
- Sell and keep proceeds in an open project,
- Transfer to another Public Agency for a non-transit purpose,
- Sell on open market, or
- Joint development

As a California Public Agency, USD shall ensure that it complies with California Government Code Section 11011. Pursuant to this code, USD shall first make excess property available to the property in which USD acquired it from. Should the owner not have an interest in acquiring it back from USD then USD shall make the property available to other public agencies and adjacent property owners.

O. Project Close Out

At the time the "closed" transaction file is sent to USD, the acquisition and relocation field files will be consolidated with the office file, duplicative information will be removed, and standard file organization and QA/QC review will be performed.

P. Real estate Certification

Should a certification be required for a specific funding source be required, the Real Estate Team shall prepare that certification.

Certification Approval Authority

USD's General Manager will be the approving authority for the Real estate Certification.

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APPENDICIES

Reference [unionsanitary.ca.gov/ETSU] to access the appendices for this report.

Appendix E

Summary of Projects from Previous Studies

E

Union Sanitary District's
Enhanced Treatment and Site Upgrade Program

APPENDIX E: SUMMARY OF PROJECTS FROM PREVIOUS STUDIES

Table (Appendix) E: Summary of Projects from Previous Studies

Project	References
Property Acquisition	Site Use Study Real Estate Acquisition Management Plan (OPC)
Process Facilities	
Secondary Process Improvements/Nutrient Removal Facilities	Site Use Study NPDES Permit HDR/B&C Nutrient Optimization Study
Sidestream Nutrient Treatment	Site Use Study Effluent Management Study NPDES Permit HDR/B&C Nutrient Optimization Study
Advanced Water Treatment Facilities	Site Use Study Reclaimed Water Feasibility Study
Odor Control Rehab/Improvements	Odor Control Alternatives Study
New Digester No. 7	Plant Solids Capacity/Assessment Study
New Digester Nos. 8 and 9	Plant Solids Capacity/Assessment Study
Organics Processing Facility	Site Use Study Plant Solids Capacity/Assessment Study
Degritting (Headworks)	Site Use Study Plant Solids Capacity/Assessment Study
Equalization Storage	Effluent Management Study EBDA System Flow Master Plan Hayward Marsh Rehabilitation Options Study NPDES Permits
Site Waste Pump Station	Treatment Plant Drainage Study
EBDA PS/Pipeline	Effluent Management Study
Personnel/Maintenance/Storage Facilities	
Campus Buildings: • Administrative Building Retrofit and Repair • Field Operations Buildings Retrofit and Repair • Control Building Retrofit • New FMC Building	Seismic Vulnerability Assessment Water Intrusion Investigation Space Needs Programming Mechanical Evaluation USD FMC Building Program
Collection Services Vehicle/Material Storage	Site Use Study
Facilities Maintenance Storage	Site Use Study
Electrical Facilities	
Standby Generator Replacement	Standby Power Generation System Upgrade Project
Sea Level Rise	
Levees	Preliminary Study of the Effect of Sea Level Rise on District Infrastructure

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&CURRAN

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2175 N. California Blvd, Suite 315
Walnut Creek, CA 94597
925.627.4100

RESOLUTION NO. _____

APPROVE THE FINAL REPORT FOR THE ENHANCED TREATMENT & SITE UPGRADE PROGRAM

WHEREAS, Carollo Engineers conducted an evaluation of the current solids capacity of the Alvarado Wastewater Treatment Plant, which concluded, among other things, that some of the plant's secondary treatment processes are at/near capacity at current average dry weather flow (ADWF) and over capacity during certain peak flow events; and

WHEREAS, concurrently, staff has worked with Woodard and Curran to study, review and assess the District's near- and long-term projects; and

WHEREAS, Woodard and Curran prepared a study to, among other things, determine priorities and schedules of improvements, evaluate existing and future space and capacity needs, optimize process adjacencies, determine economic feasibility of options, and summarize what is intended to be a road map for the District's Wastewater Treatment Plant for the next 20 to 40 years; and

WHEREAS, Hazen and Sawyer presented staff with options to further optimize current secondary treatment processes and leverage the use of existing infrastructure; and

WHEREAS, the Enhanced Treatment & Site Upgrade (ETSU) Program is the study culminating the District's planning efforts and is based on the outcomes of the Administration/Control/FMC Building Evaluation, Effluent Management Study, and Secondary Treatment Process Improvements; and

WHEREAS, the ETSU Program includes projects recommended for implementation that will be phased to address both immediate drivers (current poor sludge settleability, treatment capacity, effluent disposal and aging infrastructure), while preparing for potential future nutrient regulations for discharge in the Bay that are being considered by the Regional Water Quality Control Board in consultation with BACWA (Bay Area Clean Water Association) Level 2 standards; and

WHEREAS, the Phases I, II and III projects included in the ETSU Program were presented to the Board during a workshop held on May 8, 2019; and

WHEREAS, the ETSU Program is not intended to approve any individual phases or project, but to study and identify the proposed projects the District intends to pursue, subject to further review during a formal decision-making process, and, as the ETSU Program is implemented and projects are designed and considered, environmental review required by the California Environmental Quality Act (CEQA) will be conducted and staff will pursue any required regulatory permits.

NOW, THEREFORE, BE IT RESOLVED, by the Board of Directors of the Union Sanitary District that:

1. The Board hereby finds and determines that adoption of the ETSU Program is exempt under CEQA Guidelines section 15061(b)(3), as it can be seen with certainty that there is no possibility that adoption of the ETSU Program will have a significant effect on the environment, and section 15262, as the ETSU Program constitutes a planning and feasibility study with no legally binding effect on future activities. The ETSU Program studies possible future actions, which have not yet been approved, adopted or funded.

2. The Board approves and authorizes staff to pursue implementation of the ETSU Program, subject to further Board review, consideration and direction.

3. The Board directs staff to file a notice of exemption with the County Clerk of Alameda County.

CERTIFICATION

I do hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the Board of Directors of the Union Sanitary District, in Alameda County, California, held on the 26th day of August 2019.

AYES:

NOES:

ABSTAIN:

ABSENT:

JENNIFER TOY
President, Board of Directors
Union Sanitary District

Attest:

PAT KITE
Secretary, Board of Directors
Union Sanitary District

AUGUST 26, 2019
BOARD OF DIRECTORS MEETING
AGENDA ITEM # 13

TITLE: **Reject the Sole Bid Received for the Primary Digester No. 7 Project and Authorize Staff to Re-bid the Project**
(This is a Motion Item)

SUBMITTED: Paul R. Eldredge, General Manager/District Engineer
Sami E. Ghossain, Technical Services Work Group Manager
Raymond Chau, CIP Team Coach
Curtis Bosick, Senior Engineer

Recommendation

Staff recommends the Board reject the sole bid received for the Primary Digester No. 7 Project and authorize staff to re-bid the project.

Previous Board Action

None.

Background

The Primary Digester No. 7 Project (Project) was one of the outcomes of the Plant Solids System/ Capacity Assessment – Phase 1 that was completed in November 2016. The assessment concluded that the plant's anaerobic digestion process was at or nearing capacity and Primary Digester No. 6, the largest existing digester, could not reliably be taken out of service for cleaning and maintenance until additional digestion capacity is provided.

Scope of Work

Brown and Caldwell completed the Project's final design in June 2019. The Project's major elements are as follows:

- Construction of a new 2.4-million-gallon anaerobic digester with submerged-fixed concrete cover and waffle bottom.
- Installation of new heating, mixing, and conveyance equipment and piping within or adjacent to existing Heating and Mixing Building No. 4.
- Integration of new digester equipment and piping with existing digester feed, withdrawal, transfer, heating and gas systems.
- Improvements to the existing sludge conveyance and transfer systems.
- Improvements to existing digester heat generation and conveyance systems.
- Installation of electrical and instrumentation equipment for interfacing with existing electrical systems and controls.
- Replacement of Boiler No. 6 and related plant hot water loop improvements.
- Installation of a new chemical storage and pump facility for the purposes of hydrogen sulfide and struvite management.

See attached Figure 1 for the project location.

Bid Results

Staff advertised the Project for bids on June 25, 2019. Staff received and opened one bid on August 6, 2019. The bid results are summarized in the table below and shown in further detail in the attached Table 1.

Contractor	Total Contract Price
Kiewit Infrastructure West Co. (Fairfield, CA)	$27,926,329
Engineer's Estimate	$22,700,000

Kiewit Infrastructure West Co. (Kiewit) was the sole bidder with a total bid amount of $27,926,329 or 23% above the Engineer's Estimate. Staff contacted Kiewit to inquire about the reasons for the high bid. Kiewit cited the following factors for the high bid:

1. Materials costs have increased substantially during the past year, including tariffs on imported materials.
2. Labor costs have increased in the San Francisco Bay Area.
3. There are currently many public and private projects which have driven the costs higher.

Since Kiewit's bid exceeded the Engineer's Estimate by a large percentage and since it was the only bid received, staff believes it would be best to reject Kiewit's bid and re-bid the project. Staff notified Kiewit of its intent to reject Kiewit's bid. Kiewit did not protest the District's position. Public Contract Code Section 20805 allows the District to reject bids at its discretion.

Staff will engage contractors prior to re-bidding the Project to inquire about their interest in the Project and any potential schedule conflicts with other projects out to bid during the same period. Staff will also engage consultant firms to inquire about projects from other agencies out to bid so that we can select a bid opening date with no conflicts.

Staff recommends the Board reject the sole bid received for the Primary Digester No. 7 Project and authorize staff to re-bid the project.

PRE/SEG/RC/CB;mb

Attachment: Figure 1 – Project Location
Table 1 – Bid Tabulation Sheet

FIGURE 1 – PRIMARY DIGESTER NO. 7 PROJECT

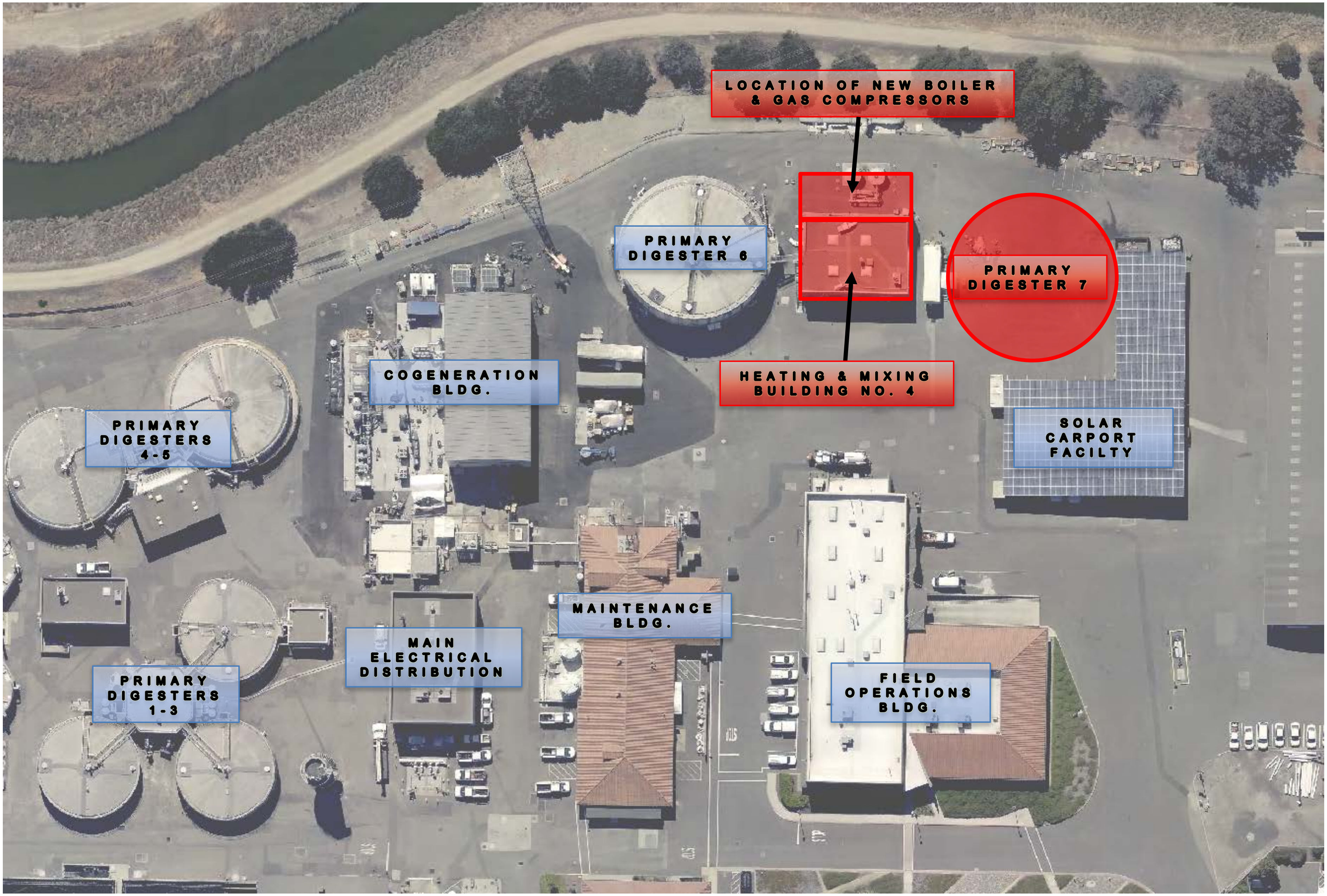

Table 1
Bid Tabulation

Primary Digester No. 7 Project
Bid Opening: 2:00 pm, August 6, 2019
Engineer's Estimate: $22.7 million

Bid Item No.	Bid Item	Unit	Estimated Quantity	Kiewit Infrastructure West Co. (Fairfield, CA)
				Total Bid Price
1	Completion of all Work included as part of Contract Documents for Project No. 900-486, except as specified under items 2 through 4, for the amount of:	LS	1	$26,400,000
2	Pre-negotiated amount for programming services	LS	1	$99,659
3	Differing Site Conditions (Allowance)	T&M	1	$60,000
4	Cost for providing all shoring and bracing on all Bid Items above including but not limited to that as required by Sections 6700-6708 of the Labor Code	LS	1	$1,900,000
Total Base Bid				$28,459,659
Bid Alternate A	Builder's Risk Insurance	LS	1	$170,000
Bid Alternate B	"Acts of God" Insurance	LS	1	$23,000
Bid Alternate C	Deletion of Pre-engineered Metal Canopy	LS	1	-$246,330
Bid Alternate D	Alternate Underground Ductbank Section	LS	1	-$480,000
Total Contract Price				$27,926,329
Percent (Under)/Over Engineer's Estimate				23.0%

AUGUST 26, 2019
BOARD OF DIRECTORS MEETING
AGENDA ITEM # 14

TITLE: **Designate and Appoint Two Board Representatives to Ad Hoc Subcommittee on General Manager Contract Negotiations *(This is a Motion Item)***

SUBMITTED: Karen W. Murphy, General Counsel

Recommendation

It is recommended that the Board designate and appoint two representatives to an ad hoc subcommittee on the General Manager's contract negotiations.

Previous Board Action

The Board considers this action annually prior to scheduling the General Manager's performance evaluation.

Background

The Second Amended and Restated Employment Agreement between the Union Sanitary District and Paul R. Eldredge to serve as General Manager and District Engineer, dated January 14, 2019, provides that the Board will review the General Manager's compensation annually. This agenda item requests that the Board designate two Board members to serve as the Board's representatives for contract review and compensation negotiations with the General Manager.

UNION SANITARY DISTRICT
CHECK REGISTER
08/03/2019-08/16/2019

Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
171976	8/8/2019	143	19171910	MONTEREY MECHANICAL CO	DIGESTER NO. 3 INSP & REHAB	$206,997.02	$206,997.02
172048	8/15/2019	110	30105235	SYNAGRO WEST LLC	JUNE 2019 BIOSOLIDS DISPOSAL	$78,233.43	$78,233.43
172044	8/15/2019	110	1374804	POLYDYNE INC	44,440 LBS CLARIFLOC C-6267	$49,470.35	$49,470.35
171949	8/8/2019	143	178836	CAROLLO ENGINEERS	DIGESTER NO. 3 INSP & REHAB	$511.58	$44,189.59
	8/8/2019		178974		ALVARADO INFLUENT PS PUMPS AND VFDS	$18,049.38	
	8/8/2019	143	178975		NEWARK EQUALIZATION STORAGE FACILITIES	$25,628.63	
172033	8/15/2019	110	9017640651	KEMIRA WATER SOLUTIONS INC	46,420 LBS FERROUS CHLORIDE	$7,224.07	$36,657.84
	8/15/2019	110	9017640927		46,620 LBS FERROUS CHLORIDE	$7,378.95	
	8/15/2019	110	9017640655		47,180 LBS FERROUS CHLORIDE	$7,524.69	
	8/15/2019	110	9017640654		47,940 LBS FERROUS CHLORIDE	$7,415.37	
	8/15/2019	110	9017641184		45,620 LBS FERROUS CHLORIDE	$7,114.76	
171971	8/8/2019	173	18648	LOOKINGPOINT INC	VMWARE RENEWAL	$26,956.52	$26,956.52
171982	8/8/2019	170	761520190726	PACIFIC GAS AND ELECTRIC	SERV TO 07/25/19 NEWARK PS	$23,088.82	$26,842.96
	8/8/2019	170	013720190712		SERV TO 07/07/19 BOYCE RD PS	$3,728.18	
	8/8/2019	110	224720190730		SERV TO 07/23/19 CS TRAINING TRAILER	$25.96	
172052	8/15/2019		533620190722	US BANK CORP PAYMENT SYSTEM	MONTHLY CAL-CARD REPORT - JULY 2019	$25,167.41	$25,167.41

Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
172035	8/15/2019	120	44075	LMK TECHNOLOGIES LLC	6 EA PIPE LINER KITS	$6,163.64	$24,567.66
	8/15/2019	120	44068		18 PIPE LINER KITS	$18,404.02	
172039	8/15/2019	171	109020Q0Z7Y7	NATIONAL TECHNOLOGY TRANSFER	ON-SITE HYDRAULICS & SYSTEM TROUBLESHOOTING TRNG - FMC	$18,925.00	$18,925.00
171999	8/8/2019	121	1799702019.1	USA NORTH 811	2019 MEMBERSHIP FEE + UNIQUE 2018 BILLABLE TICKET FEE	$16,160.20	$16,160.20
171953	8/8/2019		3523364C	DELTA DENTAL SERVICE	JULY 2019 DENTAL	$12,148.50	$13,833.50
	8/8/2019		3523364A		JULY 2019 DENTAL	$1,685.00	
171986	8/8/2019	134	117706	R-2 ENGINEERING INC	PUMP PARTS	$11,814.41	$13,323.66
	8/8/2019	134	117708		PUMP PARTS	$1,509.25	
171938	8/8/2019	120	4109778620190801	ALAMEDA COUNTY WATER DISTRICT	SERV TO: 07/31/19-MTR HYD B15064108	$192.99	$12,614.36
	8/8/2019	120	4107361320190801		SERV TO: 07/31/19-MTR HYD 16320037	$228.08	
	8/8/2019	120	4107393520190801		SERV TO: 07/31/19-MTR HYD 16435269	$228.08	
	8/8/2019	110	4071036120190722		SERV TO: 07/19/19-BENSON ROAD	$10,859.90	
	8/8/2019	120	4109778420190801		SERV TO: 07/31/19-MTR HYD B15141194	$192.99	
	8/8/2019	120	4107361120190801		SERV TO: 07/31/19-MTR HYD 15001101	$228.08	
	8/8/2019	120	4107393020190801		SERV TO: 07/31/19-MTR HYD 15141193	$228.08	
	8/8/2019	120	4107393120190801		SERV TO: 07/31/19-MTR HYD 16435270	$228.08	
	8/8/2019	120	4107393420190801		SERV TO: 07/31/19-MTR HYD 15952331	$228.08	

UNION SANITARY DISTRICT
CHECK REGISTER
08/03/2019-08/16/2019

Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
171997	8/8/2019	110	950557	UNIVAR SOLUTIONS	4800 GALS SODIUM HYPOCHLORITE	$3,467.40	$10,458.33
	8/8/2019	110	950684		4828.3 GALS SODIUM HYPOCHLORITE	$3,487.84	
	8/8/2019	110	950858		4849.4 GALS SODIUM HYPOCHLORITE	$3,503.09	
171970	8/8/2019		37432220190801	LINCOLN NATIONAL LIFE INS COMP	LIFE & DISABILITY INSURANCE - AUG 2019	$8,539.15	$8,539.15
172003	8/8/2019	172	4041631	WESTERN ENERGY SYSTEMS	SERVICE: TROUBLESHOOT GENERATOR NOISE	$7,978.00	$7,978.00
172056	8/15/2019	171	4045714	WESTERN ENERGY SYSTEMS	SERVICE TO ASSIST WITH LIFTING AND TROUBLESHOOTING ENGIN	$7,636.49	$7,636.49
171996	8/8/2019	143	171383699002	UNITED RENTALS NORTHWEST INC	CREDIT: INV 17138369001- DYED DIESEL	$-1,517.18	$6,955.30
	8/8/2019	143	171383699001		1MW RENTAL GENERATOR, CABLES, FUEL, PICK UP, AND DELIVERY	$8,472.48	
172005	8/8/2019	143	165072	WOODARD & CURRAN INC	HEADWORKS SCREEN NO. 3	$5,258.80	$5,258.80
172012	8/15/2019	173	1907109198	AVEPOINT PUBLIC SECTOR INC	CLOUD BACKUP FOR OFFICE 365, EMAIL, & ONE DRIVE	$5,053.00	$5,053.00
171957	8/8/2019		9155	CITY OF FREMONT	REFUND # 22223	$4,893.50	$4,893.50
172025	8/15/2019	170	243102	FRANK A OLSEN COMPANY	2 THICKENER VAULT 6" DEZURIK W/VICTAULIC	$4,734.83	$4,734.83
171954	8/8/2019	173	439473	DLT SOLUTIONS, LLC	AWS CLOUD STORAGE - JUNE 2019	$844.34	$4,602.64
	8/8/2019	173	439234		AUTOCAD GOVERNMENT MAINTENANCE PLAN (1) YR	$3,758.30	
172008	8/15/2019		20190710	AMAZON.COM LLC	07/19 - ASTD OFFICE SUPPLIES	$4,011.52	$4,011.52
172038	8/15/2019	171	104730	MUNIQUIP, LLC	PULSAR BLACKBOX W/ LCD DISPLAY	$3,894.46	$3,894.46
172011	8/15/2019		13362707	AT&T	SERV: 06/20/19 - 07/19/19	$3,592.16	$3,832.14
	8/15/2019		13362705		SERV: 06/20/19 - 07/19/19	$21.24	
	8/15/2019		13362729		SERV: 06/20/19 - 07/19/19	$218.74	

Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
172024	8/15/2019	113	1175447	ENTHALPY ANALYTICAL LLC	18 LAB SAMPLE ANALYSIS	$1,365.00	$3,495.00
	8/15/2019	113	1176230		18 LAB SAMPLE ANALYSIS	$705.00	
	8/15/2019	113	1176483		19 LAB SAMPLE ANALYSIS	$1,425.00	
172050	8/15/2019	110	952913	UNIVAR SOLUTIONS	4801.2 GALS SODIUM HYPOCHLORITE	$3,468.26	$3,468.26
172004	8/8/2019		10024	WHITE ON WHITE INC	REFUND # 22224	$3,300.00	$3,300.00
171960	8/8/2019	134	9223704819	GRAINGER INC	ASTD PARTS & MATERIALS	$491.35	$3,285.74
	8/8/2019	170	9221780985		2 PUSH BUTTONS W/CONTACTS	$203.42	
	8/8/2019	122	9220256508		1 DISC RETAINER NUT	$8.19	
	8/8/2019		9221166375		ASTD PARTS & MATERIALS	$153.65	
	8/8/2019	170	9221780977		4 PUSH BUTTONS W/CONTACTS	$406.81	
	8/8/2019		9221158521		ASTD PARTS & MATERIALS	$2,022.32	
172015	8/15/2019	121	966039	BRENNTAG PACIFIC INC	2631.4691 LBS SODIUM HYDROXIDE	$1,423.07	$3,179.39
	8/15/2019	121	966038		641 LBS SODIUM HYDROXIDE	$348.23	
	8/15/2019	121	966037		1282 LBS SODIUM HYDROXIDE	$693.30	
	8/15/2019	121	966040		1315.7345 LBS SODIUM HYDROXIDE	$714.79	
172001	8/8/2019		807201078	VISION SERVICE PLAN - CA	AUG 2019 VISION STMT	$21.89	$3,130.27
	8/8/2019		807201075		AUG 2019 VISION STMT	$3,108.38	

Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
171973	8/8/2019	170	11522916	MCMASTER SUPPLY INC	ASTD MOUNTING ADAPTERS	$52.31	$2,893.62
	8/8/2019	120	10618946		3 EA STEEL PIPES	$57.11	
	8/8/2019	170	11697294		ASTD PARTS & MATERIALS	$119.30	
	8/8/2019		11814672		ASTD PARTS & MATERIALS	$578.39	
	8/8/2019	170	11522915		8 DIN-RAIL MOUNT STRAIGHT-BLAD RECEPTACLES	$231.69	
	8/8/2019	170	11830172		1 SPOOL WIRE	$47.47	
	8/8/2019	170	10385100		LATHE TOOLING	$1,320.96	
	8/8/2019		11906502		ASTD PARTS & MATERIALS	$240.53	
	8/8/2019	170	11554456		1 VIBRATION-RESISTANT GAUGE	$41.19	
	8/8/2019	170	10569766		ASTD PARTS & MATERIALS	$204.67	
171937	8/8/2019	171	2000237303	AECOM TECHNICAL SERVICES INC	HAZMAT CONSULTING SERVICES	$2,870.26	$2,870.26
172045	8/15/2019		8723	ROBSON HOMES LLC	REFUND # 22242	$2,800.00	$2,800.00
171988	8/8/2019	120	916003915670	REPUBLIC SERVICES #916	RECYCLE & ROLL OFF - AUGUST 2019	$2,690.21	$2,690.21
172000	8/8/2019		9834513671	VERIZON WIRELESS	WIRELESS SERV 06/21/2019 - 07/20/2019	$2,625.09	$2,625.09
172023	8/15/2019		20190725	DALE HARDWARE INC	07/19 - ASTD PARTS & MATERIALS	$2,460.34	$2,561.42
	8/15/2019		335663		PAINT SUPPLIES	$101.08	
172046	8/15/2019	173	20190807	RICHARD SCOBEE	TRAVEL REIMB: LODGING/MEAL/AIRFARE ESRI USER CONF SAN DI	$2,482.19	$2,482.19
171981	8/8/2019	170	112739	NEW IMAGE LANDSCAPING CO	LANDSCAPE MAINTENANCE - FMC	$2,305.00	$2,305.00

Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
172007	8/15/2019	170	5211683	ALL INDUSTRIAL ELECTRIC SUPPLY	ASTD PARTS & MATERIALS	$2,023.33	$2,230.29
	8/15/2019	170	5212084		2 MARATHON ELECTRIC MOTOR FAN	$206.96	
172022	8/15/2019	143	3271019	DAILY JOURNAL CORPORATION	AD: NOTICE INVITING BIDS-ALVARADO INFLUENT PUMP STATION IM	$1,890.72	$1,890.72
171950	8/8/2019	173	TBP4846	CDW GOVERNMENT LLC	WAN BU ROUTER MAINT	$1,350.00	$1,842.82
	8/8/2019	113	TBS5829		2 SURFACE PRO FOR LAB	$492.82	
172037	8/15/2019		24064228	MOTION INDUSTRIES INC	8 ASTD V BELTS	$87.78	$1,800.67
	8/15/2019	170	24064479		10 ASTD SHEAVES & BUSHINGS	$654.49	
	8/15/2019		24064743		20 EA SAFETY VESTS	$361.81	
	8/15/2019	170	24064835		ASTD NUTS & BOLTS	$696.59	
172016	8/15/2019		20190806	STATE OF CALIFORNIA	SALES & USE TAX 07/01/19 - 07/31/19	$1,786.64	$1,786.64
171972	8/8/2019	143	106297	MCINERNEY & DILLON, P.C.	LEGAL SERVICES - 2019 FRONT END SPECIFICATIONS	$231.00	$1,771.00
	8/8/2019	143	106296		LEGAL SERVICES - PRIMARY DIGESTER #3 REHAB	$1,540.00	
171984	8/8/2019		20190806	RIC PIPKIN	EXP REIMB: LODGING, REGS, SHUTTLE, PER DIEM-WEF NUTRIENT	$1,731.84	$1,731.84
171985	8/8/2019	121	1852554001	R&B COMPANY	16 WYES/ 12 ELBOWS	$2,241.10	$1,668.20
	8/8/2019		1862238001		CREDIT: INV 1852554001 - 12 ELBOWS	$-572.90	
171944	8/8/2019		10295	ASPEN RESIDENTIAL	REFUND # 22219	$1,500.00	$1,500.00

Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
172047	8/15/2019	134	722125533901	STAPLES CONTRACT & COMMERCIAL	JANITORIAL & BREAK ROOM SUPPLIES	$91.16	$1,462.06
	8/15/2019	134	722198783601		JANITORIAL & BREAK ROOM SUPPLIES	$283.09	
	8/15/2019	134	722139667301		JANITORIAL & BREAK ROOM SUPPLIES	$588.85	
	8/15/2019	134	722232799201		JANITORIAL & BREAK ROOM SUPPLIES	$498.96	
172058	8/15/2019		5008	ZELAYA DESIGNS	PUBLIC OUTREACH	$1,428.00	$1,428.00
171975	8/8/2019	120	609437	MISSION CLAY PRODUCTS LLC	13 CLAY COUPLINGS	$1,311.65	$1,311.65
172041	8/15/2019	122	20190813	PAUL NELSON	EXP REIMB: VACTOR FACTORY TRNG - ILLINOIS - AIRFARE/LODGIN	$1,302.46	$1,302.46
171974	8/8/2019	170	3994	M-I-C INC	NEW MANOMETER AND PARTS	$1,278.17	$1,278.17
172049	8/15/2019	173	192743	SYN-TECH SYSTEMS INC	ANNUAL MAINTENANCE FOR FUELMASTER	$1,275.00	$1,275.00
171978	8/8/2019	121	139543	MUNICIPAL MAINT EQUIPMENT INC	BULLDOG NOZZEL REPAIR	$1,229.11	$1,229.11
172042	8/15/2019	110	892820190807	PACIFIC GAS AND ELECTRIC	SERV TO 07/31/19 HAYWARD MARSH	$58.26	$1,066.54
	8/15/2019	170	666720190807		SERV TO 07/31/19 PASEO PADRE PS	$356.63	
	8/15/2019	170	380420190801		SERV TO 07/31/19 CHERRY ST PS	$260.04	
	8/15/2019	170	898220190807		SERV TO 07/31/19 FREMONT PS	$344.01	
	8/15/2019	170	096020190801		SERV TO 07/31/19 CATHODIC PROJECT	$47.60	
172032	8/15/2019	113	29012814	KELLY SERVICES INC	TEMP LABOR-THACH, P. WK ENDING 07/21/19	$1,036.20	$1,036.20
171942	8/8/2019	170	679770	A-PRO PEST CONTROL INC	JULY PEST CONTROL	$1,005.00	$1,005.00
171961	8/8/2019		10152	H&H ELITE CONSTRUCTION	REFUND # 22236	$500.00	$1,000.00
	8/8/2019		10108		REFUND # 22235	$500.00	

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Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
171979	8/8/2019	122	20190729	NAPA AUTO PARTS	MONTHLY AUTO PARTS STMT - JULY 2019	$968.02	$968.02
171945	8/8/2019		13334410	AT&T	SERV 06/13/19 - 07/12/19	$65.87	$943.85
	8/8/2019		13334407		SERV 06/13/19 - 07/12/19	$747.80	
	8/8/2019		13334409		SERV 06/13/19 - 07/12/19	$42.82	
	8/8/2019		13334411		SERV 06/13/19 - 07/12/19	$87.36	
172013	8/15/2019	136	2522203010	BANK OF NEW YORK	MAY 2019 SERVICE FEES	$851.80	$851.80
171962	8/8/2019	123	2030770	HANSON AGGREGATES INC	5.19 TONS 1/2 MAX HMA TYPE A-R	$433.45	$851.33
	8/8/2019	123	2029354		5 TONS 1/2 MAX HMA TYPE A-R	$417.88	
171967	8/8/2019	113	28013543	KELLY SERVICES INC	TEMP LABOR-THACH, P. WK ENDING 07/14/19	$828.96	$828.96
171992	8/8/2019	110	19071818	S&S TRUCKING	GRIT HAULING 07/12/2019	$812.79	$812.79
171959	8/8/2019	140	20190806	SAMI GHOSSAIN	EXP REIMB: TSCS ANNUAL WORK GROUP RECOG LUNCH	$799.59	$799.59
171968	8/8/2019	170	60400000342524	KELLY-MOORE PAINT COMPANY	ASTD PAINTING SUPPLIES	$996.85	$760.13
	8/8/2019	170	60400000342672		ASTD PAINTING SUPPLIES	$117.40	
	8/8/2019	170	60400000342674		ASTD PAINTING SUPPLIES	$-996.85	
	8/8/2019	170	60400000342675		ASTD PAINTING SUPPLIES	$642.73	
172053	8/15/2019		9835107519	VERIZON WIRELESS	WIRELESS SERV 07/02/19-08/01/19 & (6) IPADS	$724.94	$724.94
172009	8/15/2019	122	1102211228	AMERIPRIDE SERVICES INC	ASTD DUST MOPS, WET MOPS & TERRY TOWEL	$47.58	$691.12
	8/15/2019		1102211208		UNIFORM LAUNDERING SERVICE	$372.34	
	8/15/2019	171	1102211194		UNIFORM LAUNDERING & RUGS	$271.20	

Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
171990	8/8/2019	170	132960	ROCHESTER MIDLAND CORPORATION	HOT WATER LOOP SERVICE	$690.75	$690.75
171952	8/8/2019	132	190814687	CLAREMONT BEHAVIORAL SERVICES	AUG 2019 EAP PREMIUMS	$648.60	$648.60
171956	8/8/2019	170	904082417	EVOQUA WATER TECHNOLOGIES	DI WATER SYSTEM	$625.96	$625.96
172010	8/15/2019	170	684660	A-PRO PEST CONTROL INC	PEST CONTROL - SWARM OF BEES	$250.00	$625.00
	8/15/2019	170	681117		PEST CONTROL - BLDG 82 & 83 SPIDERS/EGGS	$375.00	
171941	8/8/2019		1102208044	AMERIPRIDE SERVICES INC	UNIFORM LAUNDERING SERVICE	$348.84	$619.29
	8/8/2019		1102208021		UNIFORM LAUNDERING & RUGS	$270.45	
172018	8/15/2019		4029947102	CANON SOLUTIONS AMERICA INC	MTHLY MAINTENANCE BASED ON USE	$605.53	$605.53
171980	8/8/2019	122	205924	NAYLOR STEEL INC	ASTD METAL, STEEL, STAINLESS & ALUMINUM	$72.44	$585.08
	8/8/2019	170	205862		ASTD METAL, STEEL, STAINLESS & ALUMINUM	$512.64	
171989	8/8/2019	170	380413	RKI INSTRUMENTS INC	ASTD PARTS & MATERIALS	$567.96	$567.96
172019	8/15/2019	170	21680702	CARBOLINE COMPANY	PAINT & RELATED PAINT SUPPLIES	$532.84	$532.84
172029	8/15/2019		603521203	HILLYARD/SAN FRANCISCO	ASTD JANITORIAL SUPPLIES	$507.73	$507.73
171955	8/8/2019		10200	E Z PLUMBING	REFUND # 22217	$500.00	$500.00
171983	8/8/2019		10335	PIPE CAM INC	REFUND # 22218	$500.00	$500.00
172028	8/15/2019	120	2033012	HANSON AGGREGATES INC	6 TONS 1/2 MAC HMA TYPE A-R	$499.82	$499.82
172057	8/15/2019	132	20190809	JASON YEATES	EXP REIMB: LODGING, MILEAGE, PER DIEM - OPERATIONAL EXCEL	$499.28	$499.28
171947	8/8/2019	113	13884560	BLAISDELL'S	ASTD OFFICE SUPPLIES	$458.22	$458.22
172043	8/15/2019		20190702	ALEXANDER PAREDES	TUITION REIMB - SPRING 2019	$424.50	$424.50

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Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
172027	8/15/2019	134	9225952481	GRAINGER INC	ASTD PARTS & MATERIALS	$393.80	$408.55
	8/15/2019	122	9224726738		1 FIBER DISC PAD	$14.75	
171939	8/8/2019	111	279037397	ALFA LAVAL ASHBROOK SIMON-HART	100 SEAL HORIZ WASHBOX	$406.57	$406.57
172040	8/15/2019	122	206171	NAYLOR STEEL INC	ASTD METAL, STEEL, STAINLESS & ALUMINUM	$69.05	$323.80
	8/15/2019	122	206165		ASTD METAL, STEEL, STAINLESS & ALUMINUM	$141.71	
	8/15/2019	122	206167		ASTD METAL, STEEL, STAINLESS & ALUMINUM	$113.04	
172034	8/15/2019		346533	KLEEN BLAST ABRASIVES	ASTD SANDBLASTING MATERIALS	$296.69	$296.69
172036	8/15/2019		12613350	MCMASTER SUPPLY INC	ASTD PARTS & MATERIALS	$166.55	$292.27
	8/15/2019	170	10851750		1 STEEL PERFORATED SHEET	$40.51	
	8/15/2019	170	11303083		CREDIT FOR STEEL PERFORATED SHEET - INV 10851750	$-40.51	
	8/15/2019	170	12787205		4 EA LARGE-CELL BATTERIES	$101.38	
	8/15/2019	170	12828860		2 PACKS ASTD SCREWS	$24.34	
171966	8/8/2019	170	628534	KAMAN INDUSTRIAL TECHNOLOGIES	2 OIL SEALS	$102.39	$287.81
	8/8/2019	170	316501		2 EA ASTD RADIAL BALLS	$185.42	
172055	8/15/2019	113	8087071367	VWR INTERNATIONAL LLC	LAB SUPPLIES	$163.77	$257.41
	8/15/2019	113	8087065935		LAB SUPPLIES	$15.03	
	8/15/2019	113	8087050643		LAB SUPPLIES	$78.61	
171940	8/8/2019		20190807	AMERICAN PAYROLL ASSOCIATION	MEMBER DUES - M. ESPINOSA	$254.00	$254.00
171977	8/8/2019		24063795	MOTION INDUSTRIES INC	15 TUBES GREASE	$241.42	$241.42

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Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
171943	8/8/2019	141	20190805	ROLLIE ARBOLANTE	EXP REIMB:PROFFESIONAL ENGINEER LICENSE RENEWAL	$115.00	$218.19
	8/8/2019	141	20190801		EXP REIMB: FLOWERS - T. RODRIGUEZ	$103.19	
172026	8/15/2019	120	2810920701	GLACIER ICE COMPANY INC	126 7-LB BAGS OF ICE	$215.72	$215.72
171965	8/8/2019	132	26678	ICE SAFETY SOLUTIONS INC	MAINTENANCE AED & FIRST AID KITS	$192.50	$192.50
172017	8/15/2019	113	600988	CALTEST ANALYTICAL LABORATORY	4 LAB SAMPLE ANALYSIS	$189.00	$189.00
171946	8/8/2019	111	22595400	BECK'S SHOES	SAFETY SHOES: R. PIPKIN	$167.14	$167.14
171995	8/8/2019	173	20190805	RUFUS TAI	EXP REIMB: PMI MEMBERSHIP RENEWAL	$164.00	$164.00
172002	8/8/2019	121	43724	WECO INDUSTRIES LLC	FREIGHT ON LOANER EQUIPMENT	$154.15	$154.15
171969	8/8/2019	132	21090807.2	KATHLEEN KING	EXP REIMB: CSRMA CONF MILEAGE & BART/LUNCH - SF TRNG	$43.87	$143.87
	8/8/2019	132	20190807.1		EXP REIMB: SHRM-SCP CERTIFICATION	$100.00	
171963	8/8/2019	170	3N7338	HARRINGTON INDUSTRIAL PLASTICS	3 EA 3/4" UNIONS	$139.77	$139.77
172054	8/15/2019	140	20190807	AUDREY VILLANUEVA	EXP REIMB: TS WORKGROUP RECOGNITION FY19	$128.12	$128.12
171994	8/8/2019	141	20190731	SPOK INC	AUGUST 2019 PAGER SERVICE	$124.60	$124.60
171991	8/8/2019	134	7800241601	RS HUGHES CO INC	1 PR HIP WADERS	$112.46	$112.46
171958	8/8/2019	150	20190802	MICHAEL FULKERSON	EXP REIMB: ALT COMP MEETING REFRESHMENTS	$112.14	$112.14
171987	8/8/2019		101721	REMOTE SATELLITE SYSTEMS INT'L	IRIDIUM SVC FEE AUGUST 2019	$112.00	$112.00
171951	8/8/2019	171	54154077	CINTAS CORPORATION	SAFETY JACKET FOR C. GABRIEL	$106.15	$106.15
171964	8/8/2019	122	5867801	HOSE & FITTINGS ETC	ASTD FITTINGS	$80.13	$80.13
171998	8/8/2019	136	98XW53299	UPS - UNITED PARCEL SERVICE	SHIPPING CHARGES W/E 07/20/19	$67.29	$67.29

Check No.	Date	Dept	Invoice No.	Vendor	Description	Invoice Amt	Check Amt
172014	8/15/2019	120	13812750	BLAISDELL'S	ASTD OFFICE SUPPLIES	$65.31	$65.31
172021	8/15/2019	121	472613	CENTERVILLE SAW AND TOOL	2 ECH99944200903 SPEEDFEED LARGE	$65.17	$65.17
172006	8/15/2019	170	4047286120190803	ALAMEDA COUNTY WATER DISTRICT	SERV TO: 08/01/19 - PASEO PADRE	$58.85	$58.85
171993	8/8/2019	121	39671	SCHAA'S LAWNMOWER SALES & SERV	SHARPEN CHAINSAWS	$50.00	$50.00
171948	8/8/2019	113	600908	CALTEST ANALYTICAL LABORATORY	1 LAB SAMPLE ANALYSIS	$47.25	$47.25
172020	8/15/2019	122	311649	CENTERVILLE LOCKSMITH	ASTD KEYS & TAGS	$44.01	$44.01
172051	8/15/2019	136	98XW53309	UPS - UNITED PARCEL SERVICE	SHIPPING CHARGES W/E 07/27/19	$27.12	$27.12
172030	8/15/2019	170	768520190728	HOME DEPOT CREDIT SERVICES	MONTHLY HARDWARE STMT - JULY 2019	$14.58	$14.58
172031	8/15/2019	150	26679	ICE SAFETY SOLUTIONS INC	FIRST AID & AED SUPPLIES	$13.66	$13.66

Invoices:

Credit Memos :	**4**	**-3,127.44**
$0 - $1,000 :	**134**	**38,798.89**
$1,000 - $10,000 :	**55**	**187,620.23**
$10,000 - $100,000 :	**13**	**334,906.57**
Over $100,000 :	**1**	**206,997.02**
Total:	**207**	**765,195.27**

Checks:

$0 - $1,000 :	**62**	**23,704.79**
$1,000 - $10,000 :	**45**	**137,092.65**
$10,000 - $100,000 :	**14**	**397,400.81**
Over $100,000 :	**1**	**206,997.02**
Total:	**122**	**765,195.27**

Marin Independent Journal

SAN RAFAEL

Proposal revived on sewer line upgrades

Las Gallinas district floats new ordinance

By Richard Halstead *August 12, 2019*

rhalstead@marinij.com @HalsteadRichard on Twitter

The Las Gallinas Valley Sanitary District is once again attempting to develop a sewer lateral ordinance after past attempts ran into opposition from the Marin Association of Realtors.

"I've been here at the district since last November and one of the things waiting for me was to move the sewer lateral ordinance forward," said district manager Mike Prinz.

A letter outlining what a possible ordinance might look like has been mailed to the district's ratepayers seeking their feedback.

"That describes some of the fundamental concepts that we wanted to get people's reaction to," Prinz said. "We've got concepts that we're working with but we don't have draft language ready for anyone."

Sewer laterals are pipes that carry wastewater from a residential property to the sewer main pipeline in the street, which eventually leads to the district's wastewater treatment plant.

Excess water can enter the lateral in two primary ways: cracks in the pipe, often caused by tree roots or age, and illegal connections such as sump pump discharges or gutter downspouts.

According to the district, Las Gallinas has an average dry weather flow of about 2.2 million gallons per day; however, during rain storms the district's treatment plant can experience flows of over 20 million gallons per day, which dramatically increases operational costs.

Under the proposal outlined in the district's letter, Las Gallinas homeowners would be required to get their laterals inspected if they did a remodel valued at $15,000 or more or if they sold or transferred ownership of their home.

Most notably, however, homeowners would be given a two-year grace period to repair or replace faulty laterals.

A fact sheet accompanying the letter states, "Most ordinances require replacement prior to close of escrow of a home sale or within 90 days for all other triggers."

The proposal also would not require Las Gallinas homeowners to have their laterals pressure tested, which can cost $6,000 to $7,500. According to the fact sheet, the district instead would allow homeowners to use a fiber optic camera to do a visual inspection of the pipe, which would cost about $400 to $600, including administrative costs.

In 2005, the district considered adopting an ordinance that would have required laterals to be replaced prior to close of escrow if a home was being sold. But the idea ran into stiff opposition from the Marin Association of Realtors and was dropped.

“That has been something Las Gallinas has considered in the past,” Prinz said. “It’s a heavy lift to get done in the time frame of a normal escrow.”

Prinz said he has sought the Marin Association of Realtors’ feedback on the district’s new approach.

“We made several attempts to get their input,” he said. “They didn’t engage. It seemed like it didn’t register as a concern with them.”

In an email late Friday afternoon, Gene Laico, president of the Marin Association of Realtors, wrote that he appreciated the district’s proposed grace period but has concerns about the inspection triggers.

“We believe that enforcing sewer lateral upgrades at the point of sale is an inefficient way to get all residents to comply with new standards,” Laico wrote.

Prinz said he will update the district’s board of directors on the reaction from ratepayers in September and hopes to get a draft ordinance to them that same month or by early October.

“My goal is to get an ordinance developed some time in the early winter,” he said, “with an effective date around the beginning the year potentially.”

The San Rafael Sanitary District has indicated it will develop a private lateral ordinance and model it after whatever is adopted by Las Gallinas.