SAN ANDREAS SANITARY DISTRICT

MASTER PLAN UPDATE

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San Andreas Sanitary District

August 23, 2023

Woodard & Curran

Via Electronic Mail

August 23, 2023

Hugh Logan
District Manager
San Andreas Sanitary District
675 Gold Oak Road
San Andreas, CA 95249

Re: Transmittal of Final Master Plan Update

Dear Mr. Logan:

Woodard & Curran is pleased to provide San Andreas Sanitary District (District) with the attached final Master Plan Update. The enclosed document was prepared by Woodard & Curran in collaboration with the District staff and presented to the District Board on August 23, 2023. The material in it reflects Woodard & Curran's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between the District and Woodard & Curran dated July 14, 2022. The opinions in the document are based on conditions and information existing at the time the document was published and any subsequent third party use of the document is solely the responsibility of such third party.

We greatly appreciate this opportunity to work with the dedicated staff at the District and hope that this Master Plan Update provides a solid foundation for capital project planning now and in the future.

Sincerely,

WOODARD & CURRAN, INC.

Prepared by ____________________

Marshall Palmer (Project Manager)

Reviewed by ____________________

Jim Graydon, P.E. (Principal-in-Charge)

Received by ____________________

Hugh Logan (SASD District Manager)

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ABBREVIATIONS

AAF	Annual Average Flow
AAL	Annual Average Load
ADMMF	Average Day Maximum Month Flow
ADWF	Average Dry Weather Flow
BOD	Biochemical Oxygen Demand
CARB	California Air Resources Board
CASA	California Association of Sanitation Agencies
CCAP	Climate Change Action Plan
CIP	Capital Improvements Plan
CTR	California Toxic Rule
DLDA	Dedicated Land Disposal Area
DO	Dissolved Oxygen
DWR	Department of Water Resources
EDU	Equivalent Dwelling Unit
GTAD	Gravity Thickened Aerobic Digester
HFTS	High Flow Treatment System
HLR	Hydraulic Loading Rate
MCL	Maximum Contaminant Level
MCRT	Mean Cell Residence Time
MGD	Millions of Gallons per Day
MLSS	Mixed Liquor Suspended Solids
NH3	Ammonia
NPDES	National Pollutant Discharge Elimination System
OPCC	Opinion of Probable Construction Costs
PC	Primary Clarifier
PDF	Peak Day Flow
PDL	Peak Day Load
PFPS	Process Feed Pump Station
PHWWF	Peak Hour Wet Weather Flow
PSPS	Public Safety Power Shutoff
RAS	Return Activated Sludge
SC	Secondary Clarifier
SCADA	Supervisory Control and Data Acquisition
SCFM	Standard Cubic Feet per Minute

SLR	Solids Loading Rate
SOR	Surface Overflow Rate
SRT	Solids Retention Time
SVI	Sludge Volume Index
TKN	Total Kjeldahl Nitrogen
TSS	Total Suspended Solids
WAS	Waste Activated Sludge
WY	Water Year

EXECUTIVE SUMMARY

Introduction

San Andreas Sanitary District (District) owns and operates the wastewater collection, treatment, and disposal facilities serving the unincorporated community of San Andreas in Calaveras County, California. The District was created in 1946 and has expanded facilities as needed to accommodate growth in the community and has upgraded treatment processes to maintain regulatory compliance to protect public health and water quality.

The most recent Wastewater Treatment Master Plan, completed in 2007 and updated in 2016, identified three phases of improvements to meet anticipated growth and more stringent discharge permits. Since 2007, the District has made significant investments in upgrading treatment and disposal facilities located at the San Andreas Wastewater Treatment Plant (WWTP). Having completed most of the projects in the first phase of the 2007 Master Plan, the District now wishes to update the Master Plan to document current capacity, identify near-term needs, and evaluate and anticipate long-term needs for expanded plant capacity, regulatory compliance, energy savings, labor savings, and other community needs.

The goals of this 2023 Wastewater Treatment Master Plan Update are to:

- Quantify the current plant capacity.
- Identify the limiting plant processes.
- Identify future capacity needs based on forecasted growth in the service area.
- Maintain regulatory compliance and prepare for anticipated future regulations.
- Simplify operations and minimize operating costs.
- Improve performance reliability.
- Identify near-term capital improvement projects.
- Identify plant expansion, upgrade, or maintenance projects for consideration in the long-term capital project planning.

This Master Plan Update builds on the 2007 Master Plan and 2016 Master Plan Update, taking into account updated flows and loads coming into the plant, updated projections of future flows and loads, recent changes to regulations and likely future regulatory requirements, and process upgrades completed since 2007. The goal of the Master Plan Update is to provide a sound basis for updating and re-prioritizing the District's Capital Improvement Plan (CIP) and supporting project funding applications.

Wastewater Flows and Loads

Current wastewater flows and loads were developed from an analysis of influent, process, and effluent data collected from September 2018 to November 2022. This compliance and process control data was augmented by a focused sampling program conducted by plant staff in November-December 2022. The data was compiled and analyzed to provide summary statistics and trends for plant influent and process performance. The current flows and loads were used along with growth projections for the service area to provide projections for the 20-year planning horizon (2042). The current flows and loads, projected 2042 flows and loads, the plant design capacity, and the projected 2040 flows and loads from the 2007 Master Plan are shown in **Table ES-1**.

Table ES-1 : Current and Projected Flows and Loadings Compared to Design Capacity

Parameter	Current Flows and Loads	Current Peaking Factors	2042 2023 MP Projected		2008 Design Capacity	2040 2007 MP Projected
Number of EDUs	1976		2600		1920	2720
Influent Flow, MGD						
Average Dry Weather Flow (ADWF)	0.20	1.0	0.26		0.32	0.54
Annual Average Flow (AAF)	0.28	1.4	0.37		0.45	0.72
Average Day Maximum Month Flow (ADMMF)	0.40	2.0	0.53		0.79	1.2
Peak Day Flow (PDF)	1.35	6.8	1.8		1.3	1.8
Peak Hour Wet Weather Flow (PHWWF)	1.83	9.1	2.4		1.9	2.6
Influent BOD Concentration, mg/L	197		197		302	313
Influent BOD Load, lb/d						
Annual Average Load (AAL)	426	1.0	560		812	1428
Average Day Maximum Month Load (ADMML)	588	1.4	790		1217	2141
Peak Day Load (PDL)	1096	2.6	1460		1826	3212
Influent TSS Concentration, mg/L	183		183		302	313
Influent TSS Load, lb/d						
Annual Average Load (AAL)	405	1.0	540		812	1428
Average Day Maximum Month Load (ADMML)	640	1.6	860		1217	2141
Influent TKN Concentration, mg/L	50		50		60	60
Influent TKN Load, lb/d (AAL)	116	1.0	152		162	285
Influent TKN Load, lb/d (ADMM)	174	1.5	230		243	428
Influent TKN Load, lb/d (PDL)	261	2.25	342		365	640

The data and projections are summarized below.

Flows. The SASD WWTP was designed to treat an average dry weather flow (ADWF) of 0.322 million gallons per day (MGD) and peak hour wet weather flow (PHWWF) of 1.88 MGD. In the period from 2018-2022, the observed ADWF was 0.2 MGD and observed PHWWF was 1.83 MGD. Over the past four years, flows have exhibited a slight downward trend and compared to 2007, the ADWF has decreased significantly from 0.3 MGD to 0.2 MGD. The decrease is primarily attributable to water conservation measures and, possibly, reductions to infiltration and inflow (I&I) into the collection system. The peak wet weather flows remain high with peaking factors of 8-9 times the ADWF.

Loads. The SASD plant is designed to remove total suspended solids (TSS), biochemical oxygen demand (BOD), and ammonia from domestic wastewater. Ammonia is found in raw wastewater and is produced in the plant by the breakdown of organic nitrogen. The commonly used parameter for nitrogen in wastewater influent is the sum of the ammonia and the organic nitrogen or total Kjeldahl nitrogen (TKN) which is used in this analysis.

Concentrations of BOD in the WWTP influent averaged 197 mg/L over the past four years. This is consistent with medium strength domestic wastewater. The average annual (AA) BOD loading was 426 pounds per day (ppd) and the average day maximum month (ADMM) loading was 588 ppd. The trend for influent BOD shows a marginal decrease in loading and a slight increase in concentration over the past four years, possibly due to the reductions in flow. These values are significantly less than the average influent BOD concentration of 300 mg/L and annual average BOD loading of 750 ppd used in the 2007 Master Plan.

Influent TSS over the study period averaged 183 mg/L which is consistent with medium strength domestic wastewater. The average annual TSS loading was 405 ppd and the average day maximum month loading was 640 ppd. The trend for TSS shows a slight decrease in load and a fairly consistent concentration over the past four years.

Determinations of influent TKN are not a permit requirement and only limited data is available. Based on six composite samples collected from influent in November-December 2022, TKN averaged 50 mg/L. This is on the higher end of the range for medium strength domestic wastewater.

Projected Flow and Loads (2042). Future flows and loads were projected based on the prior population growth rates used in the 2007 Master Plan averaged with the Calaveras County General Plan population growth rate. The projection is for a 32 percent increase in average annual flow and annual average loadings over the next 20 years.

Comparison to Design Capacity. The projected 2042 flows and loads are significantly less than the design capacity with the exception of peak day flow, peak hour wet weather flow, and TKN loadings.

Comparison to 2007 Master Plan Projections. The projected 2042 flows and loads from this update are substantially lower than the projections developed in the 2007 Master Plan. This is most likely due to the higher observed flows and loadings in 2007 and the application of more aggressive growth rates in the service area.

Capacity Analysis

The goal of the capacity analysis was to determine the existing plant capacity to reliably treat current and projected future flows and loads. In this analysis, capacity for each unit process was determined using industry references and engineering manuals, and then compared to the 2008 Basis of Design, the current flows and loads, and projected 2042 flows and loads.

Table ES-2 and **Figure ES-1** summarize the key findings of the capacity analysis. The existing facilities have the capacity to treat existing flows and loads. There are three caveats to the current capacity noted for the primary clarifier, the aeration basins, and the disinfection system and described below.

Table ES-2: Current Unit Process Capacities

Process	Limiting Design Criteria	Equivalent Flow Basis	Current Capacity (MGD)
Headworks	Mechanical Screen Capacity	PHWWF	4.0
Primary Clarifier	Surface Overflow Rate	PHWWF	1.8
Trickling Filter	Organic Loading Rate	ADMMF	0.89
Aeration Basins	SRT; MLSS; DO	ADMMF	0.36
Secondary Clarifier	SOR; MLSS; SVI	PHWWF	2.4
Disk Filters	Filter loading rate	PHWWF	2.8
Disinfection	Contact time; CT	PHWWF	1
Irrigation Pump Station	Pumping Capacity	Irrigation Demand	1.44

PHWWF: Peak hour wet weather flow

ADMMF: Average day maximum month flow

SRT: Solids retention time

MLSS: Mixed liquor suspended solids

DO: Dissolved oxygen

SOR: Surface overflow rate

SVI: Sludge volume index

CT: Concentration times contact time

Capacity Compared to Current Flows and Loads. The primary clarifier is currently at capacity and, although removal efficiencies for TSS and BOD are above average compared to engineering references, the effluent weirs are submerged at flows over 0.9 MGD. This may be due to hydraulic limitations in the primary effluent pipeline to the recirculation box or pipeline to the process feed pump station.

The activated sludge system treatment capacity depends on the performance of all of its components. The aeration tanks and secondary clarifier act together as a system, and operational modifications to one can impact the capacity of the other. The aeration basins have sufficient capacity to reliably remove current BOD and ammonia loads under limiting winter temperatures as long as MLSS, SVI, DO, and removal of BOD in the primary clarifiers remain within acceptable ranges.

The disinfection system currently has adequate capacity to treat the average day maximum month flow (ADMMF) at the targeted contact time and CT. At higher flows, the contact time and CT are reduced. The District is not planning to produce recycled water for offsite distribution at this time and Title 22 compliance is not required. Should the District decide to implement a Title 22 recycled water project, the disinfection system will require upgrades.

Capacity Compared to 2042 Flows and Loads. The headworks, trickling filter, disk filters, and irrigation pump station currently have adequate capacity to serve the 2042 flows and loads. Capacity expansion will be needed for the primary clarifier, aeration basins, secondary clarifier, and disinfection systems.

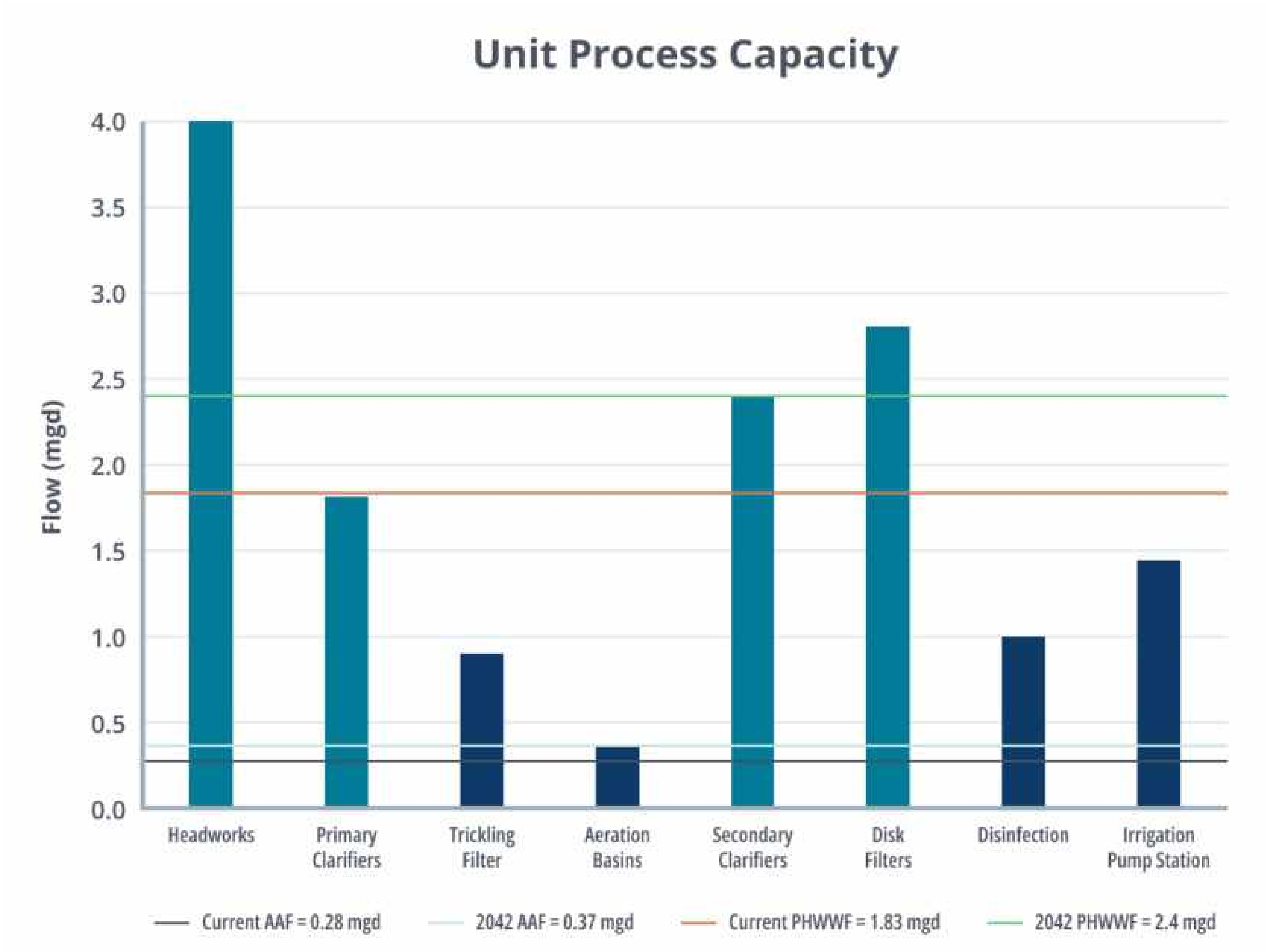


Figure ES-1: Unit Process Capacities Compared to Current and 2042 Conditions

Long-Term Planning Considerations

There are a number of regulatory, environmental, and industry trends that warrant consideration in developing the long-term roadmap for providing sustainable wastewater treatment services. While some of these are 10 to 20 years or more in the future, acknowledging the potential impact of these issues can help inform current decisions on capital investments. The potential future regulations and other planning considerations are summarized in **Table ES-3**.

Table ES-3: Long-Term Planning Considerations

Issue/Opportunity	Potential Impact/Benefit	Magnitude	Timing
SB1383 biosolids end use limitations	May require additional treatment prior to land application	Relatively minor (estimated at $10,000 to $12,000 per year)	1 to 5 years
Future PFAS regulations requiring monitoring	May require monitoring and source control program	Relatively minor	1 to 5 years
Future PFAS regulations restricting effluent discharge or biosolids options	May require some active contaminant reduction capabilities or limit biosolids disposal options	Large but low probability	5-10 years
Future biostimulatory, cyanotoxins, and biological condition provisions	May drive the need for a total nitrogen limit on effluent discharged to the river	Moderate capital cost and operational changes to upgrade aeration basins for denitrification	10-20 years
Climate change	Increase in peak wet weather flows; decrease in average dry weather flows due to water conservation measures; reductions in flows on the North Fork of the Calaveras River	Significant impacts to planning, design, and operations in the long-term. Requirements for a Climate Change Action Plan in the next 5-10 years	10-20 years
Energy Price Increases	Recent price increases will continue to be a larger and larger part of operating costs	Major operating cost impacts	1-5 years
Public Safety Power Shutoffs	Increase in the frequency and duration of outages	Increase need for standby power and potential for compliance problems	1-5 years
Water conservation measures	Reduced flows in the collection system; increased waste strength in the plant influent; increased potential for corrosion and odors.	Potentially significant	10-20 years
Water recycling partnerships	Reduce potable water demands in the community	Could be significant if a high demand water using industry were to move into San Andreas	10-20 years

Findings and Recommendations

Findings

Based on the work completed to develop this Master Plan update, several observations and findings are noteworthy.

1. The District has made prudent and timely investments in expansion, upgrade, and rehabilitation projects to meet community needs, protect water quality, and maintain levels of service.
2. The District has effluent discharge options and has worked with the Regional Water Board to develop a flexible NPDES permit.
3. The wastewater treatment plant does not currently have firm capacity (capacity with one unit taken out of service) to treat current flows and loads.
4. District staff have effectively operated and optimized the plant processes to maintain compliance and reduce operating costs.
5. While the flexible discharge options have been used successfully for many years, there is a level of complexity and higher level of operator attention required to manage the multiple operational modes.
6. Influent flows and loads projected by the 2007 Master Plan have not been realized due to slower than expected community growth, reductions in flows due to water conservation, and lower than anticipated waste strength.
7. Key process parameters such as MLSS and SVI exhibited high values and high variability during 2018-2020 and appear to have stabilized in 2021-2022. This may be attributable to improved solids management and the addition of the aerobic digestion process that came online in 2021.
8. While the plant is well maintained, there are several process units dating from the original construction in the 1950s that require rehabilitation. Near-term projects for rehabilitation of the trickling filter, primary clarifier, intermediate clarifier, and secondary clarifier are in the District's current CIP.
9. Energy costs and chemical costs have risen sharply in the past several years.

Recommended Improvement Projects

While the capacity analysis has identified a longer time horizon for many of the capacity expansion projects anticipated in the prior master plans, there are a number of projects that are recommended to improve performance and reliability while also reducing operating costs and operational complexity. These projects are summarized in **Table ES-4**. The recommended projects are categorized as near-term (1-5 years) or long-term (5-10 years or 10-20 years). The opinion of probable costs for the capital projects includes construction, engineering, and construction management and are presented in 2023 dollars. The listed projects include three near-term rehabilitation projects already listed in the District's CIP and seven newly identified projects.

Table ES-4: Recommended Improvement Projects

Item No.	Project Name	Project Description	Project Identifiers	Planning Level Budget	Recommended Action Category
5.1	Trickling Filter & Primary Clarifier Rehabilitation	Rehabilitate original process equipment and structures including primary clarifier and trickling filter	Capital Improvements Project # PL-19-01, File # 60-19	$6,000,000	Near Term (1-5 Years)
5.2	Secondary Clarifier Rehabilitation	Rehabilitate secondary clarifier	Capital Improvements Project # PL-20-01, File # 70-12.07	$400,000	Near Term (1-5 Years)
5.3	Intermediate Clarifier Rehabilitation	Rehabilitate intermediate clarifier	Capital Improvements Project # PL-21-03, File # 70-12.16	$250,000	Near Term (1-5 Years)
Item No.	**Project Name**	**Project Description**	**Project Drivers**	**Opinion of Probable Cost**	**Recommended Action Category**
6.1	Secondary Process Improvements	Upgrade secondary process to increase capacity and reliability by installing additional secondary clarifier and RAS/WAS pumping, maximizing aeration capability with diffusers and additional blower, and installing an anoxic zone. Project is recommended to build in tandem with primary and secondary clarifier rehabilitation primary clarifier as well as Trickling Filter (5.1 & 5.2).	Consistent and reliable operations paired with optimal seasonal effluent quality, per the permitted limits, with simplified operations. Phased approach to developing and upgrading recommended secondary process with a sequencing approach to rehabilitation of the trickling filter secondary clarifier and intermediate clarifier.	5,101,000	Near Term (1-5 Years)
6.2	Onsite Power Generation and Storage	Install Solar Voltaic Panels (300 kW) onsite and install onsite battery bank for surplus and emergency power	Reduce energy costs and provide short term emergency back-up power to minimize disruptions in power delivery.	$2,849,000	Near Term (1-5 Years)
6.3	Wet Weather Diversion and Storage	Install additional wet weather diversion and storage post headworks by repurposing Ponds B and C and installing pump station to return flows to the headworks.	Recent storms and runoff have increased need for future equalization and storage	$1,260,000	Long Term (5-10 Years)
6.4	Water Conservation Impact on Treatment System	Study the impacts on the wastewater treatment facility due to the reduced flow and increase concentration of wastewater.	Senate Bill 606 and Assembly Bill 1668 established more stringent indoor water use limits	$50,000	Near Term (1-5 Years)
6.5	Cybersecurity Vulnerability Assessment	Perform a vulnerability assessment to identify potential weaknesses and threats to cybersecurity	Recent string of private and public security breaches	$20,000	Near Term (1-5 Years)
6.6	Automation and Monitoring Upgrade	Supply automation, instrumentation, and communication to key equipment items, such as valves, gates, and pumps, to allow for automatic flow and process diversion, remote access and control of equipment.	Addition for remote monitoring and automation of plant to maintain permit compliance and reduce emergency call outs and manual operation	$610,000	Near Term (1-5 Years)
6.7A	Disinfection Upgrades (Peracetic Acid)	Move away from chlorinated disinfection and install a different method of disinfection, Peracetic Acid.	Installation of new disinfection methods would eliminate cyanide as a disinfection byproduct.	$417,000	Long Term (10-20 Years)
6.7B	Disinfection Upgrades (UV)	Move away from chlorinated disinfection and install a different method of disinfection, UV.	Installation of new disinfection methods would eliminate cyanide as a disinfection byproduct and reduce total dissolved solids in effluent.	$1,363,000	Long Term (10-20 Years)

1. INTRODUCTION

1.1 Purpose/Goals

San Andreas Sanitary District (District) owns and operates the wastewater collection, treatment, and disposal facilities serving the unincorporated community of San Andreas in Calaveras County, California. The District was created in 1946 and has expanded facilities as needed to accommodate growth in the community and has upgraded treatment processes to maintain regulatory compliance to protect public health and water quality.

The most recent Wastewater Treatment Master Plan, completed in 2007 and updated in 2016, identified three phases of improvements to meet anticipated growth and more stringent discharge permits. Since 2007, the District has made significant investments in upgrading treatment and disposal facilities located at the San Andreas Wastewater Treatment Plant (WWTP). These improvements have included addition of an activated sludge process to provide nitrification, expansion of the chlorine contact basins to improve disinfection, aerobic digestion to improve solids stabilization, and conversion of the land disposal system to surface spray irrigation.

Having completed most of the projects in Phase A of the 2007 Master Plan, the District now wishes to update the Master Plan to confirm current capacity, identify near-term needs, and evaluate and anticipate long-term needs for expanded plant capacity, regulatory compliance, energy savings, labor savings, and other community needs.

The goals of this 2023 Wastewater Treatment Master Plan Update are to:

- Quantify the current plant capacity.
- Identify the limiting plant processes.
- Maintain regulatory compliance.
- Simplify operations and minimize operating costs.
- Improve performance reliability.
- Identify near-term capital improvement projects.
- Identify plant expansion, upgrade, or maintenance projects for consideration in the long-term capital project planning.

This Master Plan Update will provide a foundation for updating and re-prioritizing the District's Capital Improvement Plan (CIP).

1.2 Approach to Master Plan Update

1.2.1 Approach

The 2023 Wastewater Treatment Master Plan Update builds on the 2007 Master Plan and 2016 Master Plan Update, taking into account updated flows and loads coming into the WWTP, updated projections of future flows and loads, current and likely future regulatory requirements, and process upgrades completed since 2007. The approach taken for this 2023 Update was:

1. Review and characterize influent flows and loads over the past four years (2018-2022).
2. Review and evaluate plant performance and effluent quality over the past four years.
3. Evaluate significant changes in flows, loads, and performance as compared to the 2007 and 2016 design criteria.
4. Estimate the capacities of the liquid train unit processes, including the headworks, primary clarifiers, trickling filter, activated sludge system, tertiary filters, and disinfection system.
5. Develop projections of future flows and loads.
6. Identify pending and potential future regulations and industry trends that may drive the need for process modifications or improvements.
7. Identify and evaluate capital improvement projects and operational optimization projects to meet future growth, regulatory, or equipment renewal needs.
8. Evaluate the District's current CIP and update to incorporate the findings.
9. Develop conceptual-level estimates of probable construction cost for each of the CIP projects.

1.2.2 Data Sources

The data sources used for to develop the 2023 Master Plan Update included:

1. Plant flows, loads, and compliance/regulatory data for 2018-2022
2. Record Drawings
3. Treatment Plant Master Plan (2007) and Update (2016)
4. Preliminary Engineering Report (2021)
5. Available inter-process data collected by plant staff
6. Operations and Maintenance Manuals
7. Wastewater Treatment Plant Control Systems Handbook, Revision 7 (2021)
8. NOAA Monthly Precipitation Data from 2018-2022

1.2.3 Assumptions

The assumptions used in preparing the 2023 Master Plan Update are:

1. The last four years of flow and load data are representative of both wet year and dry year data. California Department of Water Resources (DWR) Water Year (WY) classifications for the San Joaquin Valley in WY2018 as below normal, WY 2019 as wet, WY 2020 as dry, and WY 2021 and WY 2022 as critical.
2. For each unit process, capacity is assessed based on plant influent flows and loads and documented performance of upstream processes. The existing high flow treatment system and existing process

diversions for wet weather operations are considered only after evaluating the capacity to treat the full flow.

3. Future flows and loads were based on the average of county-wide population projections in the Calaveras County General Plan and the population projections for the community of San Andreas from the 2007 Master Plan.
4. Conceptual-level opinions of probable costs were developed and presented in 2023 dollars.

1.2.4 Limitations

The findings and recommendations in the 2023 Master Plan Update are based on:

1. Static spreadsheet analysis of each major unit process (headworks, primary clarification, trickling filter, activated sludge, secondary clarification, disk filtration, disinfection, and de-chlorination. Dynamic process modeling was not performed. Capacities of ancillary facilities such as chemical feed systems were not evaluated.
2. Limited hydraulic analysis. A full plant hydraulic model was not developed. Additional hydraulic modeling will be required to define the scope of needed improvement projects.
3. Limited process-specific data within the plant. More refined evaluation and sizing of improvement projects will likely require focused waste characterization efforts and stress testing.
4. Assessment of plant condition and useful life of equipment is based on prior reports and operator observations. No additional condition assessment was conducted as part of this work.
5. Capacities of process improvements currently under construction were based on the design criteria in the 2021 Preliminary Engineering Report.

1.3 Plant Upgrades Since Last Update

Since completion of the 2016 Master Plan Update, the District has moved forward with four significant projects at the WWTP. These are:

1. Replacement of the anaerobic digester with a new gravity thickened aerobic digester. This project was completed and has been in service since 2021.

2. Replacement of the 60-year old headworks with a new headworks including mechanical screening, influent channel and Parshall flume, bypass channel, composite sampling equipment, automatic flow splitting, and SCADA monitoring. This project was started in 2022 and will come online in late 2023.

3. Expansion of the chlorine contact basin to increase reliability of the disinfection process. This project was constructed and came online in 2022.

4. Modification and expansion of the irrigation pump station to deliver more effluent flow to the dedicated land application areas and return of effluent to the headworks. This project was designed in 2022 and anticipated to be completed and online in 2023.

1.4 Existing Facilities

The SASD WWTP is designed to treat an average dry weather flow (ADWF) of 0.322 million gallons per day (MGD) and peak hour wet weather flow (PHWWF) of 1.88 MGD. In the period from 2018-2022, the observed ADWF was 0.2 MGD and observed PHWWF was 1.83 MGD. The treatment facilities are shown in **Figure 1-1,** and a process flow diagram is provided in Figure **1**-**2.**

The liquid treatment train consists of headworks with mechanical screening, primary clarification, followed by secondary treatment with a combination of a fixed-film trickling filter process for removal of biochemical oxygen demand (BOD) and a suspended growth activated sludge process for BOD removal and nitrification of ammonia. Mixed liquor from the aeration tanks flows to a circular secondary clarifier with return activated sludge (RAS) pumped back to the head of the activated sludge process. Secondary effluent flows to cloth disk filtration, disinfection with sodium hypochlorite, and de-chlorination using sodium bisulfite. Final effluent is either pumped to dedicated land disposal areas (DLDAs) located on the plant property or discharged to the North Fork of the Calaveras River when river flows provide a dilution of 20:1 or greater.

The solids process train consists of thickening and aerobic digestion, dewatering in a belt filter press, onsite drying, and offsite land application by a third-party contractor (currently Synagro). Synagro uses Class B biosolids from the SASD facility for beneficial agricultural use at an approved location in Sacramento County.

Figure 1-1: Existing Facilities Aerial View

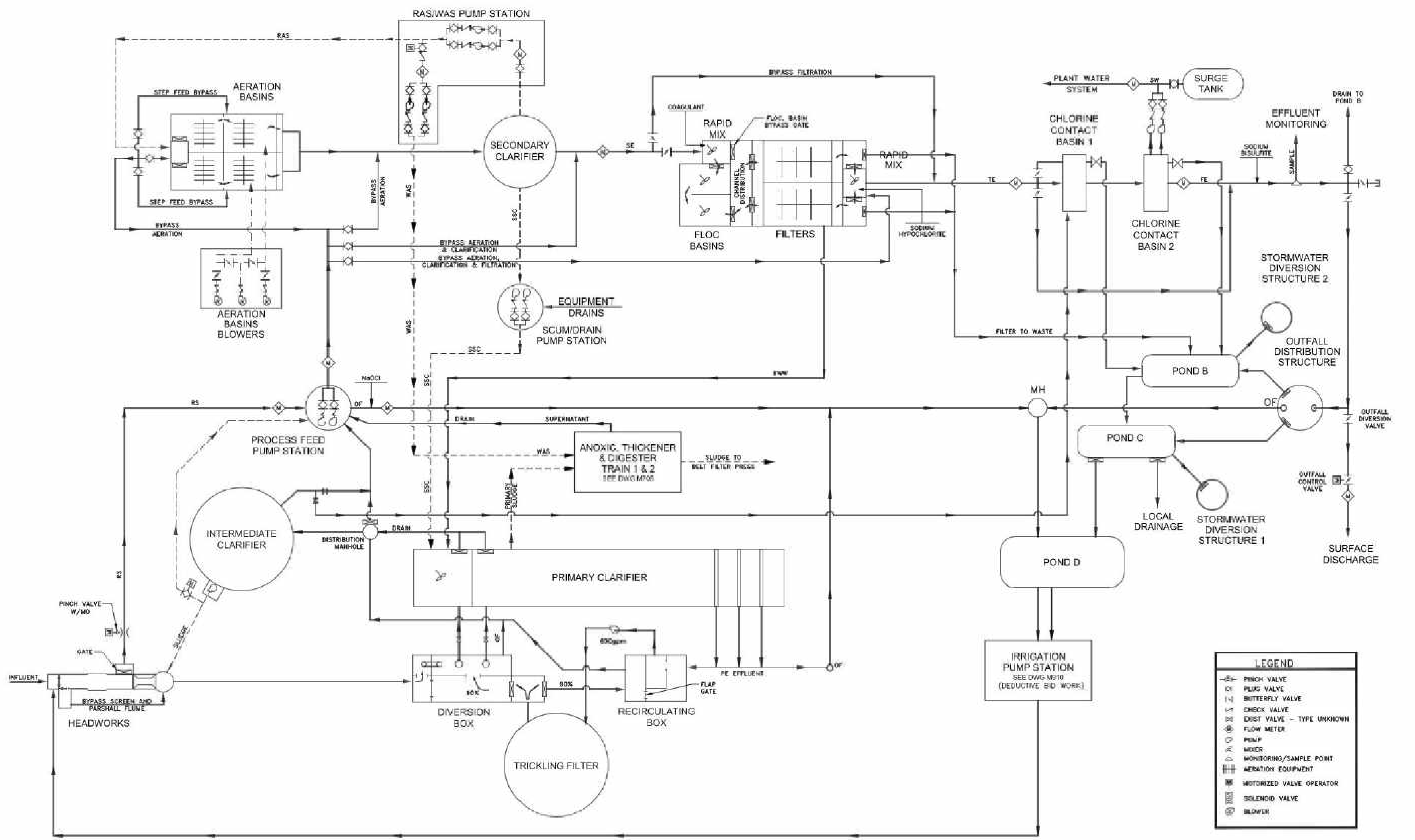


Figure 1-2: Process Flow Diagram and Modes of Operation.

1.5 Current Operations

The WWTP operations are regulated by the California Regional Water Quality Control Board, Central Valley Region (Regional Water Board) under Waste Discharge Requirement Order R5-2018-0075, National Pollutant Discharge Elimination System (NPDES) No. CA0079464 (Order). NPDES permits are renewed by the Regional Water Board on a five-year cycle. The District's current Order is set to be renewed by November 30, 2023.

The Order contains WWTP effluent limitations on discharges to the North Fork Calaveras River and land disposal specifications for discharges to the DLDA. The Order also contains additional receiving water and groundwater limitations that can be found in the Provisions of the Order.

Biosolids generated at the WWTP are hauled off-site and disposed of by a contractor (currently Synagro). Therefore, biosolids disposal is not regulated directly under the District's Order but rather falls under Synagro's operating permit.

Average daily flow discharges exceeding 1.5 MGD are prohibited. The discharge of treated effluent to the North Fork Calaveras River in quantities that do not receive a minimum of 20:1 dilution as a daily average (receiving water flow: effluent flow) is prohibited.

Effluent limitations for each of the discharge points are summarized in **Table 1-1** and **Table 1-2.**

Table 1-1: Effluent Limitations (North Fork Calaveras River)

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
BOD	mg/L	30	45	--	--	--
TSS	mg/L	30	45	--	--	--
pH	standard	--	--	--	6.5	8.5
Cyanide	ug/L	24	--	47	--	--
Ammonia Nitrogen, Total (as N)	mg/L	5.1	11	--	--	--
	lbs/day	64	140	--	--	--

Note: BOD & TSS limitations are technology-based, pH limits are technology-based and consistent with Basin Plan water quality objectives, cyanide & ammonia water quality based effluent limitations are determined with the application of dilution credits in the receiving water:

- *Percent Removal. The average monthly percent removal of BOD and TSS shall not be less than 85%.*
- *Acute Whole Effluent Toxicity: Survival of aquatic organisms in 96-hour bioassays of undiluted waste shall be no less than:*
  - *70%, minimum for any one bioassay; and*
  - *90%, median for any three consecutive bioassays.*
- *Total Residual Chlorine. Effluent total residual chlorine shall not exceed:*
  - *0.011 mg/L, as a 4-day average; and*
  - *0.019 mg/L, as a 1-hour average.*
- *Total Coliform Organisms. Effluent total coliform organisms shall not exceed:*
  - *23 MPN/100 mL, as a 7-day median; and*
  - *240 MPN/100 mL, more than once in any 30-day period.*

Table 1-2: Land Discharge Specifications (DLDA)

Parameter	Units	Discharge Specifications			
		Annual Average	Average Monthly	Monthly Median	Maximum Daily
BOD	mg/L	--	40	--	80
Total Coliform Organisms	MPN/100mL	--	--	23	240

Because the effluent requirements are different for the two discharge locations, the WWTP staff change how they operate the facility depending on the discharge location. The various modes of operation are shown in **Figure 1-3**.

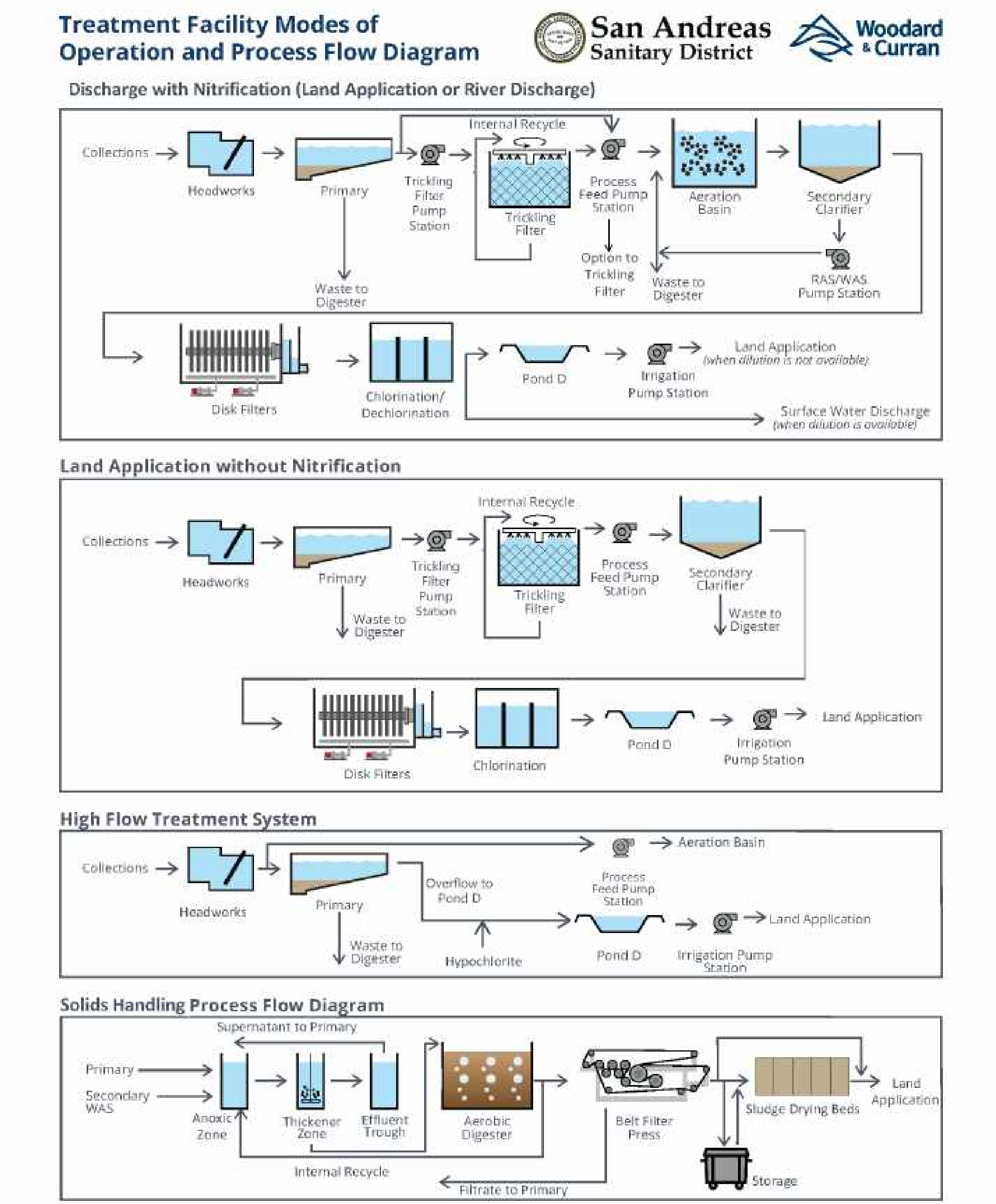


Figure 1-3: Process Flow Diagram

Discharge with nitrification mode is required for river discharge and can also be used for land application of effluent. This is the primary mode of operation during the wet season. Land application without nitrification mode cannot be used for river discharge and is the primary mode of operation during the dry season. There are no firm calendar dates established in the permit for when river discharge can start or stop and the operators monitor river stage, temperature, soil moisture conditions, and other factors to decide when to bring the aeration basins on-line to achieve the required nitrification. Overall, the District has a flexible permit with effluent discharge options and District staff have effectively managed the system to maintain compliance and manage operating costs.

For peak hour wet weather events, excess flows can be diverted to the high flow treatment system which consists of chlorination and discharge to the river with an optional capability to either return to the plant headworks or pumping to the spray irrigation fields. In addition to the high flow treatment system, the operators have the flexibility to route flow around the major unit processes during peak flow events or emergencies. Pond D provides 6.9 MG of storage and, with the pump station upgrades currently under construction, flows of up to 900 GPM (1.3 MGD) can be returned to the plant headworks.

2. WASTEWATER FLOW AND LOAD CHARACTERIZATION

This section evaluates the wastewater flows and pollutant loadings that are received by the San Andreas WWTP. The evaluation assesses current flows and loads from the existing community, and future flows and loads for anticipated residential, commercial, and public service developments that may occur by 2042 within the San Andreas service area.

Flows play a crucial role in determining the effluent disposal method in a foothill community setting. The effluent disposal method, in turn, determines the required effluent quality. The extent of source control, pretreatment, and wastewater treatment that must be achieved by the District through sewer use ordinances and wastewater treatment components at the WWTP depends on the difference between the required effluent quality and the wastewater load entering the WWTP.

The design of wastewater facilities has traditionally been influenced by the characteristics of wastewater, particularly its flow and load characteristics such as BOD, total suspended solids (TSS), nitrogen, and the presence of significant amounts of commercial and industrial wastewaters. However, with the implementation of the California Toxics Rule (CTR) and the Basin Plan narrative requirements, many other factors now play a critical role in the design of wastewater facilities.

These factors include the quality of the potable water supply, the use of chemicals in water and wastewater treatment plants, the presence of medical facilities connected to the wastewater treatment system, and product use and disposal practices by community residents and businesses. Consequently, it is crucial to consider a more comprehensive range of wastewater characteristics in the planning and design of wastewater facilities to ensure they are capable of effectively and efficiently addressing the needs of the community.

2.1 Current Influent Flows

The influent flows and 30-day moving average for the past four years (2018-2022) are shown in **Figure 2-1**. Flows have exhibited a slight downward trend over the past four years, potentially attributed to water conservation and reductions to infiltration and inflow (I&I) into the collection system. Compared to the Average Dry Weather Flow (ADWF) of 0.3 MGD documented in 2007, the current ADWF has declined to 0.20 MGD. Influent peaking factors during peak hour wet weather events were observed to be 8 to 9 times the ADWF.

The residential wastewater unit flow rate set by current District ordinance is 163 gallons per day (gpd) per equivalent residential dwelling unit (EDU). Based on historical flow studies conducted by the District, there are currently 1,976 EDUs connected to the WWTP including residential units, businesses, and County government facilities in San Andreas. Therefore, there is approximately 0.32 mgd of flow allocated to existing users.

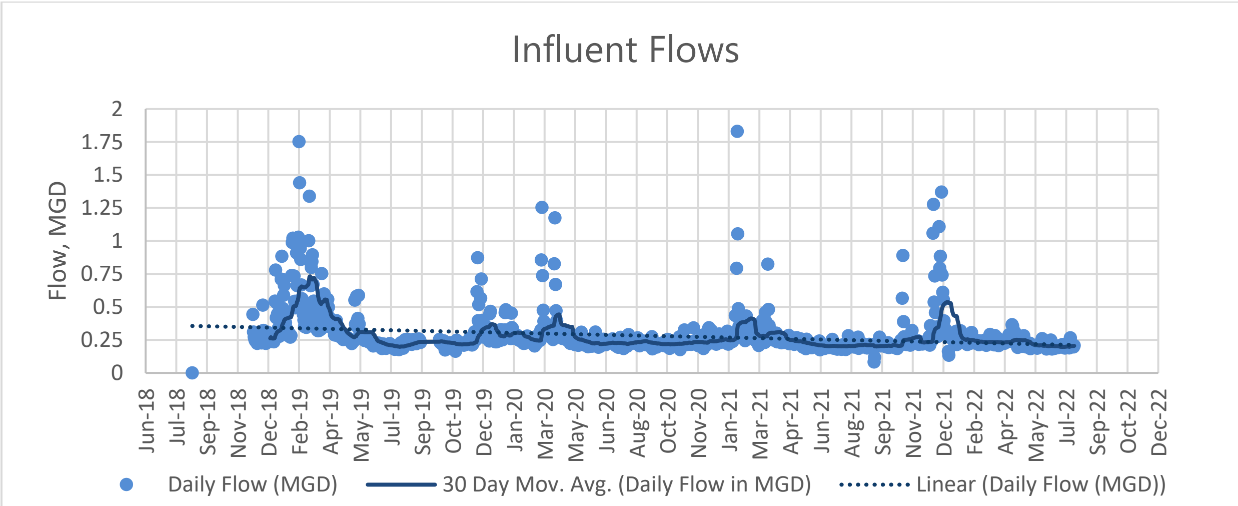


Figure 2-1: Influent Flows from 2018 to 2022

2.2 Current Influent Loadings and Effluent Water Quality

2.2.1 Biochemical Oxygen Demand (BOD)

Concentrations of BOD in the WWTP influent averaged 197 mg/L over the past four years. This is consistent with medium strength domestic wastewater (Metcalf & Eddy, 2014). The average annual BOD loading was 426 pounds per day (ppd) and the average day maximum month (ADMM) loading was 588 ppd. The trend lines for influent BOD shows a marginal decrease in loading and a slight increase in concentration over the past 4 years, possibly due to the reduced flow. The concentrations, loadings, and trend lines are shown in **Figure 2-2** below. These values are significantly less than the average influent BOD concentration of 300 mg/L and annual average BOD loading of 750 ppd used in the 2007 Master Plan. The 2007 Master Plan values were derived from a BOD loading rate of 0.77 ppd/EDU with no reference provided.

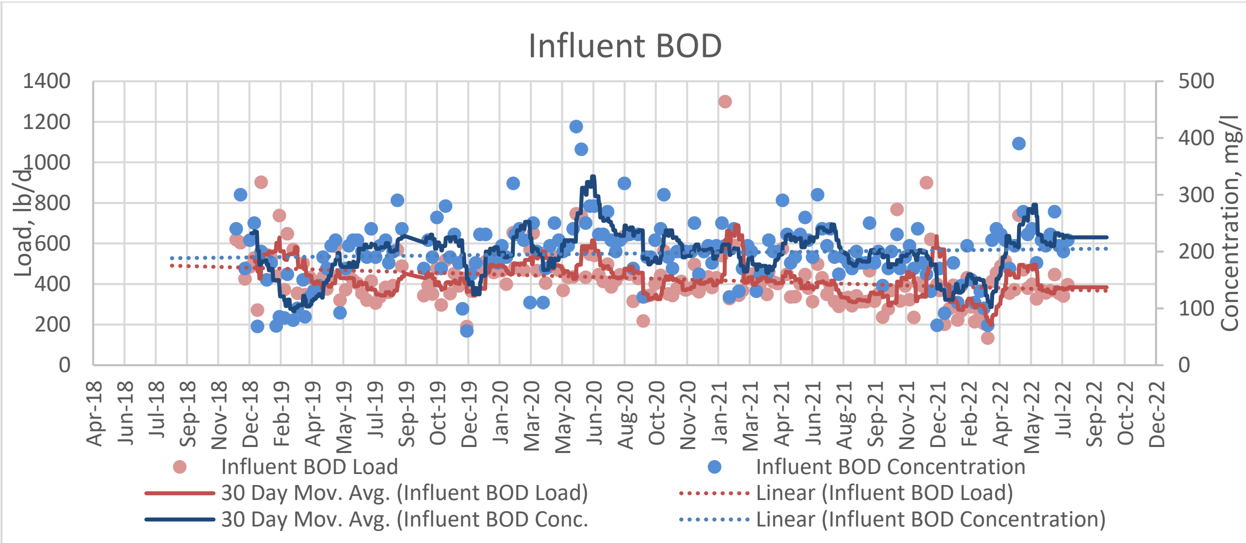


Figure 2-2: Influent BOD from 2018 to 2022

Final effluent BOD concentrations discharged to the river remained well below the permit limit of 30 mg/L but 2021 and 2022 data show higher values and greater variability than data from 2018-2020. The data are shown in **Figure 2-3** below.

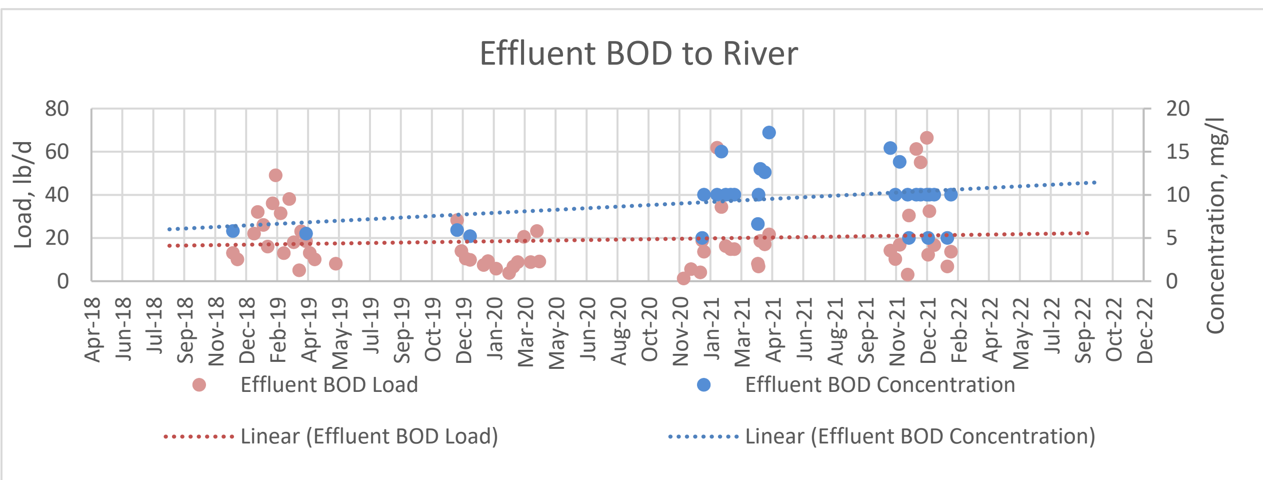


Figure 2-3: Effluent BOD from 2018 to 2022

2.2.2 Total Suspended Solids (TSS)

Influent TSS over the study period averaged 183 mg/L which is consistent with medium strength domestic wastewater (Metcalf & Eddy, 2014). The average annual TSS loading was 405 ppd and the average day maximum month loading was 640 ppd The trend shows a slight decrease in load and a fairly consistent concentration over the past four years. The data, 30-day moving average, and trend lines are shown in **Figure 2-4** below.

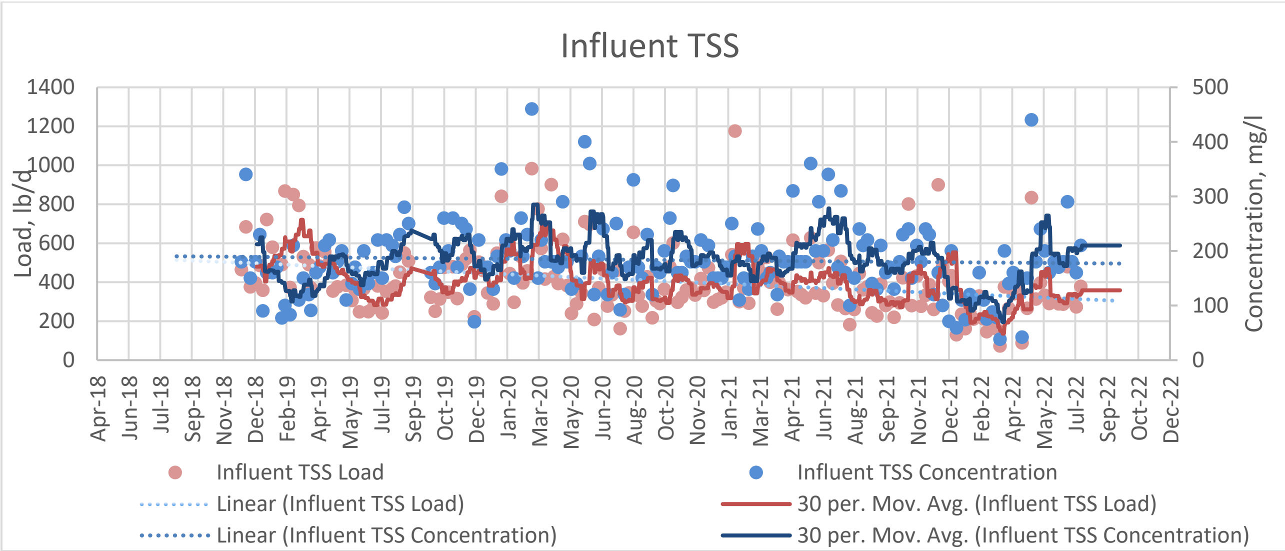


Figure 2-4: Influent TSS from 2018 to 2022

Final effluent TSS concentrations discharged to the river remained well below the permit limit of 30 mg/L but 2022 data show higher values and greater variability than data from 2018-2021. The data are shown in **Figure 2-5 .**

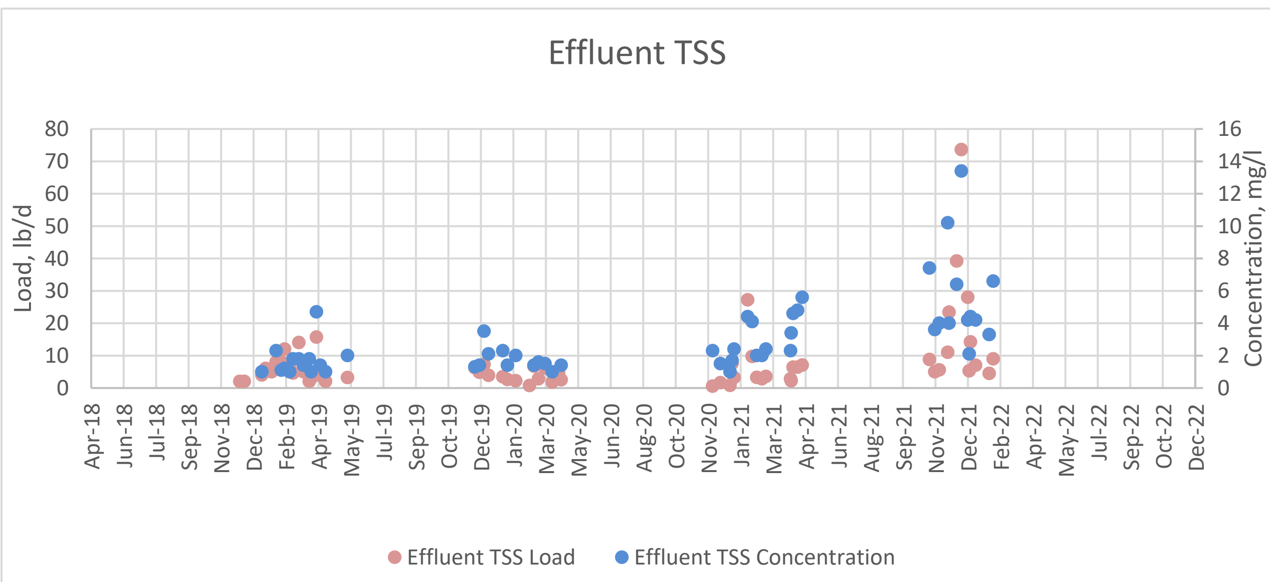


Figure 2-5: Influent TSS from 2018 to 2022

2.2.3 Ammonia Nitrogen

In the past, there has not been consistent influent sampling for ammonia nitrogen (NH3-N) or Total Kjeldahl Nitrogen (TKN). It is recommended that WWTP staff begin sampling for TKN on a regular basis for future evaluations and design.

Existing effluent limitations on ammonia are calculated with the application of dilution credits with a streamflow to effluent flow ratio of at least 20:1. The monthly average NPDES permit limit for discharge to the river is 5.1 mg/l of ammonia nitrogen. The plant typically achieves effluent ammonia nitrogen concentrations of <1 mg/l. As noted for BOD and TSS, the effluent ammonia nitrogen was observed at higher concentrations in 2022 as compared to 2018-2021. The data are shown in **Figure 2-6.**

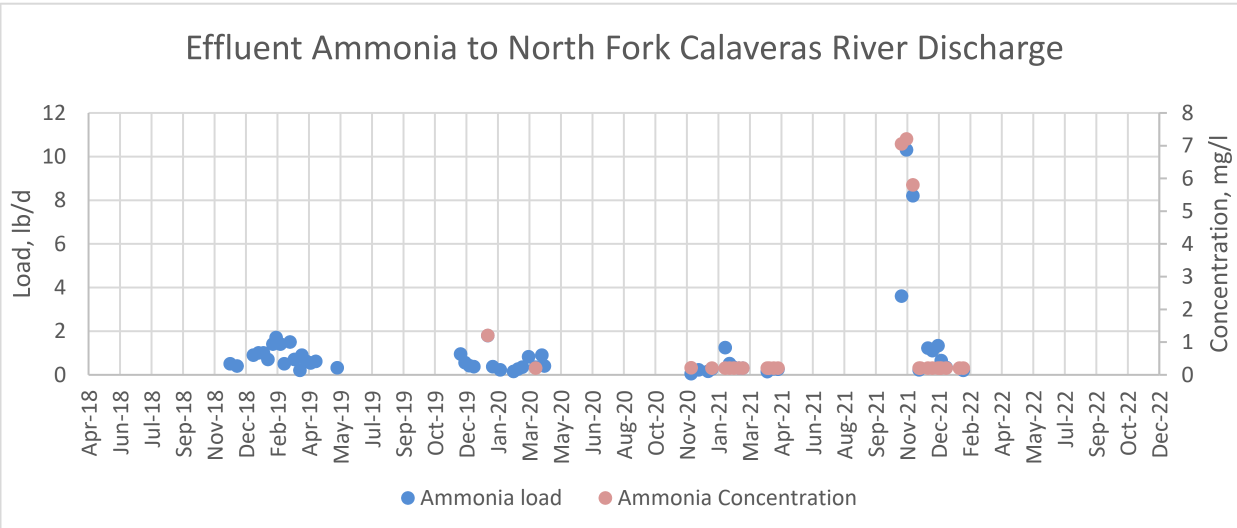


Figure 2-6: Effluent Ammonia from 2018 to 2021

2.2.4 Special Sampling Event

Additional data were collected to augment the available data for the capacity evaluation. During the period of November 15, 2022 to December 14, 2022, eight 24-hour composite samples were collected and analyzed from plant raw influent, process feed pump station (PFPS), aeration basins (ABs) and final effluent. During this period, the trickling filter was off-line, therefore, PFPS data represents primary clarifier effluent. The objective of this data analysis was to determine the minimum aeration basin temperature during these colder months, influent TKN concentration, and primarily clarifier (PC) BOD and TKN removal efficiency. The results of the sampling are summarized in **Table 2-1**.

Table 2-1: Special Sampling Results

Sampling Location	Parameter	Average	Maximum	Minimum
Influent	TKN, mg/l	49	61	37
	BOD, mg/l	211	270	140
	TSS, mg/l	174	260	110
	NH_3, mg/l	36.3	43.0	25.0
	Temperature, °C	16.2	17.0	15.6
Process Feed Pump Station	TKN, mg/l	42	44	37
	BOD, mg/l	134	140	130
	TSS, mg/l	45	61	30
	NH_3, mg/l	31.6	34	30
Aeration Basin	Temperature, °C	16.3	17.7	14.5
Effluent	BOD, mg/l	<5	<5	<5
	NH_3, mg/l	<1	<1	<1
Primary Clarifier Removal Efficiency	TKN, %	22%	29%	14%
	BOD, %	45%	48%	41%
	TSS, %	76%	83%	68%
	NH_3, %	18%	25%	9%

The mixed liquor temperature in the aeration basin was 17.7 degree Celsius (°C) on November 15th and gradually dropped to 14.5 °C on December 15th. It is expected that mixed liquor temperature continued to drop in January and February. Therefore, the design temperature of 12 °C that was used as the basis of design for the 2008 upgrades was assumed to be a reasonable minimum water temperature and was utilized in the capacity analysis completed for this project.

The Influent TKN ranged from 37 to 61 mg/l, with an average concentration of 49 mg/l. Based on this data, the current ADMM influent TKN concentration was estimated to be 50 mg/l.

During the supplemental sampling period, the primary clarifier removal efficiency ranged from 14% to 29% for TKN, from 68% to 83% for TSS, and from 41% to 48% for BOD. These removal efficiencies are in the higher range of textbook values (M&E, 4th Edition) without the use of chemical enhancement. This indicates that the primary clarifier has good performance when flows are maintained below 0.9 mgd. For the plant capacity analysis evaluation, TKN removals of 14%, TSS removal of 70%, and current BOD removal of 40% were used. Future BOD removal may be lower than current removal with higher influent loadings. Based on textbook values BOD removal at average flows is estimated to be about 34%. Therefore, plant capacity was evaluated at 34% at future flows and loads.

Table 2-2 summarizes the water quality characteristics used for current and projected 2042 capacity evaluation based on the results of the special sampling.

Table 2-2 Current and Projected 2042 Wastewater Characteristics Based on Special Sampling Results

Parameter	Design Criteria
Current and Projected Influent TKN, mg/l	50
Primary Clarifier TKN Removal, %	14%
Primary Clarifier BOD Removal, %	Current 40% Future 34%
Primary Clarifier TSS Removal, %TSS	70%
Aeration Basin Minimum Design Temperature, ^{O}C	12

2.3 Projected Future Flows and Loads

Accurately forecasting population growth and the corresponding wastewater flows is challenging in small rural communities. The 2007 Master Plan projected sewer service growth to reach 2,720 EDUs by 2040. This projection was equivalent to annual growth rate of 1.9 percent. This projection is more aggressive than the population projections found in the 2020 Calaveras County Growth Projections and Growth Accommodation adopted in 2022 (Calaveras County General Plan, 2019). The projection adopted by the county is based on the State Department of Finance projection that the population in Calaveras Country will increase from 41,277 in 2022 to 48,038 by the year 2040. This projected annual population growth rate is roughly 0.85 percent. For this 2023 Master Plan Update, the growth rate from the original SASD Master Plan and the growth rate from the County General Plan were averaged to derive an annual growth rate of 1.4 percent. This provides a basis for planning over the next 20 years that is neither too aggressive nor too conservative.

Table 2-3 below summarizes the flows and loads from the last four years and projected flows and loads for the 20-year planning horizon (2042). The projected flows and loads are based on the projected annual growth rate of 1.4 percent which equates to a 32 percent increase in flows and loads over 20 years. Maximum month, peak day, and peak hour criteria are derived by applying the documented peaking factors from the 2018-2022 data set. As noted above, there are limited influent TKN data. The average TKN concentration is based on the November-December 2022 data set. The annual average load is calculated using annual average flow and the maximum month and peak day values were derived from peaking factors from the 2007 Master Plan. These flows and loads are used to determine the need for and timing of future capacity expansion projects.

For comparison, **Table 2-3** also provides the Design Capacity and forecasted 2040 flows and loads from the 2007 Master Plan side-by-side with the 2023 Master Plan Update. As described above, the flows and loads documented for the period of 2018-2022 are significantly lower than the baseline developed for the 2007 Master Plan.

Table 2-3: Current and Projected Flows and Loadings Compared to Design Capacity

Parameter	Current Flows and Loads	Current Peaking Factors	2042 2023 MP Projected		2008 Design Capacity	2040 2007 MP Projected
Number of EDUs	1976		2600		1920	2720
Influent Flow, MGD						
Average Dry Weather Flow (ADWF)	0.20	1.0	0.26		0.32	0.54
Annual Average Flow (AAF)	0.28	1.4	0.37		0.45	0.72
Average Day Maximum Month Flow (ADMMF)	0.40	2.0	0.53		0.79	1.2
Peak Day Flow (PDF)	1.35	6.8	1.8		1.3	1.8
Peak Hour Wet Weather Flow (PHWWF)	1.83	9.1	2.4		1.9	2.6
Influent BOD Concentration, mg/L	197		197		302	313
Influent BOD Load, lb/d						
Annual Average Load (AAL)	426	1.0	560		812	1428
Average Day Maximum Month Load (ADMML)	588	1.4	790		1217	2141
Peak Day Load (PDL)	1096	2.6	1460		1826	3212
Influent TSS Concentration, mg/L	183		183		302	313
Influent TSS Load, lb/d						
Annual Average Load (AAL)	405	1.0	540		812	1428
Average Day Maximum Month Load (ADMML)	640	1.6	860		1217	2141
Influent TKN Concentration, mg/L	50		50		60	60
Influent TKN Load, lb/d (AAL)	116	1.0	152		162	285
Influent TKN Load, lb/d (ADMM)	174	1.5	230		243	428
Influent TKN Load, lb/d (PDL)	261	2.25	342		365	640

3. CAPACITY ANALYSIS

3.1 Overall Capacity

The Capacity Analysis section aims to assess the ability of the San Andreas WWTP to handle current and projected future flows and loads. In this analysis, capacity for each unit process was determined using industry references and engineering manuals, and then compared to the 2008 basis of design and current flows and loads while also determining the capacity compared to projected flows and loads. The following unit processes were evaluated:

- Headworks
- Primary Clarifier
- Trickling Filter
- Activated Sludge System
- Tertiary Filters
- Disinfection

3.2 Headworks

The headworks was originally installed in 1955. Since then, the headworks has undergone several modifications to extend its lifespan. Prior to 2021, the concrete in the headworks was deteriorating and replacement and repair parts for the mechanical screen were no longer available as the manufacturer went out of business. Additionally, the Parshall flume was not accurately measuring influent flow due to corrosion and poor system hydraulics. The bypass chamber was also equipped with a manual bar rack for diverting flow past the mechanical screen. The low spot upstream of the headworks channel floor elevation required periodic cleaning to remove accumulated grit and debris.

In 2022, the headworks was upgraded during the WWTP Headworks, Irrigation Pump Station and Chlorine Contact Basin Facility Improvements Project. Headworks at the plant now consists of an auger with integral washing and compaction zone and a discharge bagging system. Grit removal from the collection system is regularly maintained, and collection system BMPs with a raised headworks invert limit for grit accumulation. Flow measurement is done through a Parshall flume with an ultrasonic level sensor, designed to measure peak hour flows of up to 3 MGD (2100 gpm). Automatic flow splitting was also installed in 2023, with wastewater flows at or below an operator installed set point (0.9 MGD suggested) directed to the primary clarifier and the trickling filter. Excess flows are diverted to the process feed pump station (PFPS) and then to the Aerobic Basins and/or to the High Flow Treatment System consisting of hypochlorite injection and discharge to Pond D.

Table 3-1: Headworks Design Criteria

2022 Headworks Design Criteria	
Screen Capacity	4 MGD
Screen Solids Loading Rate	2,100 lbs/d
Parshall Flume Capacity	3 MGD 2,100 GPM
Parshall Flume Measurement Capacity	0.078 MGD – 10.4 MGD 54 GPM– 7,220 GPM

According to the plant's design specifications, the existing headworks have a design capacity of 4 MGD based on peak flow, with a peak hourly flow of 1.8 MGD assumed during the 2008 design phase. Presently, the current peak hourly flow stands at 1.83 MGD, which is below the headworks' design capacity of 4 MGD. Based on this analysis the headworks has adequate capacity to meet the current and projected future flows and loads.

3.3 Primary Clarifier

The plant currently has one rectangular primary clarifier that was built in 1955 and renovated in 2006. **Table 3-2** shows primary clarifier dimensions.

Table 3-2: Primary Clarifier Design Criteria

Primary Clarifier	
Number	1
Type	Rectangular
Dimension	60 ft. x 12 ft.
Side Water Depth, ft	6.5

In addition to the influent, recycle streams from digester supernatant, BFP return flow, scum and filter backwash are reintroduced into the primary clarifier. Based on the special sampling conducted in November to December 2022, the primary clarifiers have exhibited good removal efficiency and can provide removals in the range of 41% - 48% BOD, 68% - 83% TSS, and 14% - 29% TKN removal as shown in **Table 2-1**

While performance of the primary clarifier is typically good, the WWTP operators report that the primary clarifier effluent weirs frequently become submerged during high flow. Submerged clarifier weirs can negatively impact performance and are typically due to downstream hydraulic limitations. To minimize the frequency of this occurrence, the operators limit the influent flow to the primary clarifier to 0.9 MGD by diverting excess flows to the High Flow Treatment System.

Primary clarifier capacity is typically defined in terms of the surface overflow rate (SOR), which is the flow through the clarifier divided by the surface area of the clarifier. The capacity of the WWTP was evaluated by comparing the SORs to typical SOR ranges in the published reference *Wastewater Engineering Treatment and Reuse*, Metcalf & Eddy, 5th edition, 2014 (M&E). Per M&E, the typical SOR range for AAF is from 800 to 1,200 gpd/sf (with typical design value of 1,000 gpd/sf) and for PHWWF is from 2,000 to 3,000 (with typical value of 2,500). The SORs for the primary clarifier at the current and projected future AAF and PHWWF are summarized in **Table 3-3**.

Table 3-3: Primary Clarifier Capacity

	Surface Overflow Rates (gpd/sf)		
Flow Scenario	**M&E Design Criteria**	**Current**	**2042 Projection**
AAF	1,000 gpd/sf (800-1,200 gpd/sf)	389 gpd/sf (@ 0.28 mgd)	514 gpd/sf (@ 0.37 mgd)
PHWWF	2,500 gpd/sf (2,000-3,000 gpd/sf)	2,542 gpd/sf (@ 1.83 mgd)	3,333 gpd/sf (@ 2.4 mgd)

Compared to the published design criteria in M&E, the current and projected future SORs are within the range of average SORs. The current peak SOR is also within the published range, but the projected future SOR at 3,333 gpd/sf exceeds the typical range. Based on the published design criteria, a peak flow of 1.8 mgd at the WWTP would result in an SOR of 2,500 gpd/sf, and peak flows from 1.44 mgd to 2.16 mgd at the WWTP would result in the SOR range of 2,000 to 3,000 gpd/sf. Therefore, at projected future peak flows, the removal efficiency of the primary clarifier may decline. However, this may not necessitate an expansion if the downstream activated sludge system can accommodate the increased loading.

While we do not recommend a near-term expansion of the primary clarifiers we do recommend additional investigation of the downstream hydraulic bottleneck that is resulting in intermittent flooding of the primary clarifier effluent weirs and upgrades to expand hydraulic capacity of that downstream conveyance system to eliminate the condition.

3.4 Activated Sludge System

An activated sludge system was added to the WWTP in 2009-2010. The system consists of two aeration tanks, one secondary clarifier, and a RAS/WAS pump station. A set of three, positive displacement blowers supply air to the aeration tanks via the fine bubble diffusers. With the oxygen in the air supplied to the aeration tanks, microorganisms (biological floc) oxidize soluble, colloidal BOD and nitrify the ammonia in the flow received from either the tricking filter or directly from the primary clarifier. The secondary clarifier is used to settle the microorganisms and other suspended solids in the flow (mixed liquor) from the aeration tanks. The majority of the settled solids are returned to the aeration tanks via the RAS pumps to allow the microorganisms to continue to drive the biological treatment process, and a portion are wasted via the WAS pumps to the aerobic digester.

Currently, the activated sludge system is mainly brought into operation during wet seasons when effluent is discharged to the river and nitrification is required to meet the ammonia limits in the NDPES permit. During dry seasons, when effluent is used for land application, the activated sludge system is run intermittently during this time with one basin is in operation. The aeration blowers are sized for a higher flow and load than is received during these intermittent summer operations. Therefore, they supply more air than is needed, and the staff bleed off air to work around the limitations of blower turn down and control the dissolved oxygen (DO) concentration in the aeration basin.

Operational data from October 2018 to November 2022 are provided in **Figure 3-1, Figure 3-2, and Figure 3-3** including, sludge volume index (SVI), mixed liquor suspended solids (MLSS), and solid retention time (SRT).

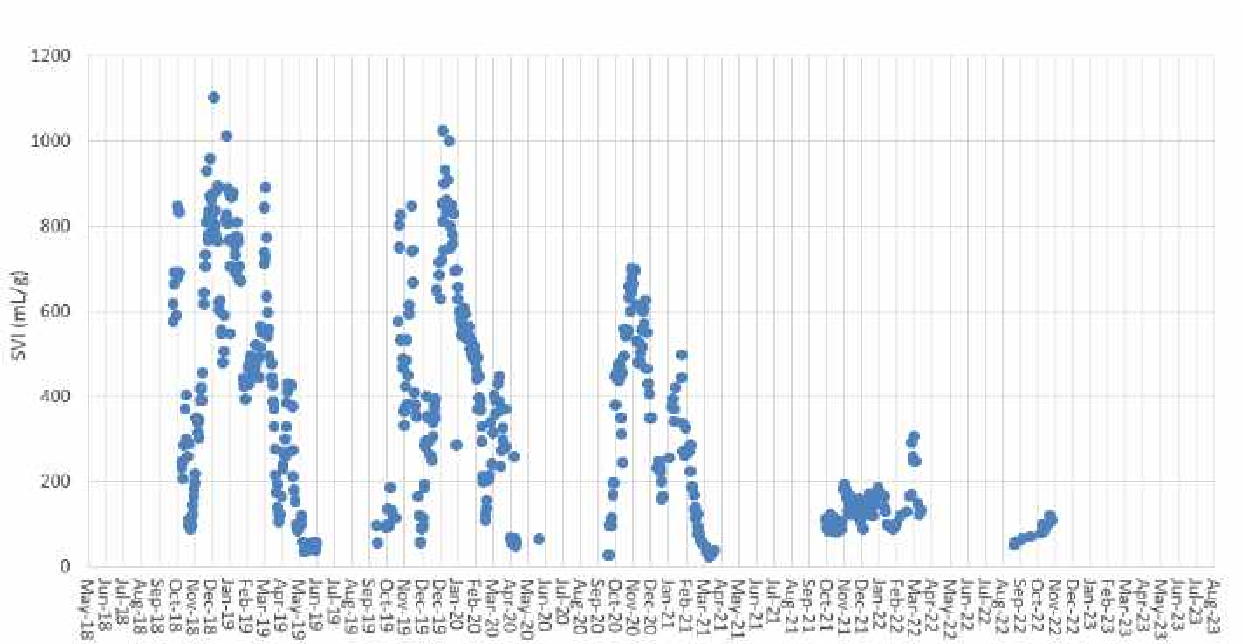


Figure 3-1: Sludge Volume Index (SVI)

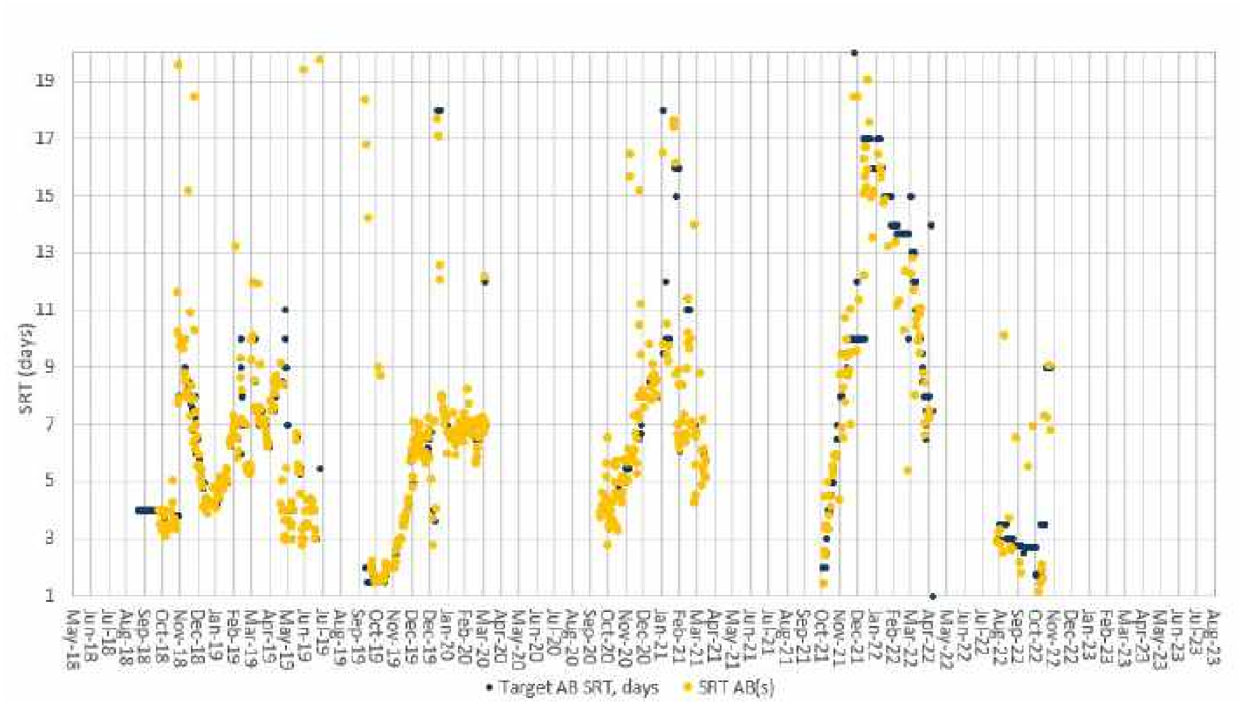


Figure 3-2: Target and Actual SRT

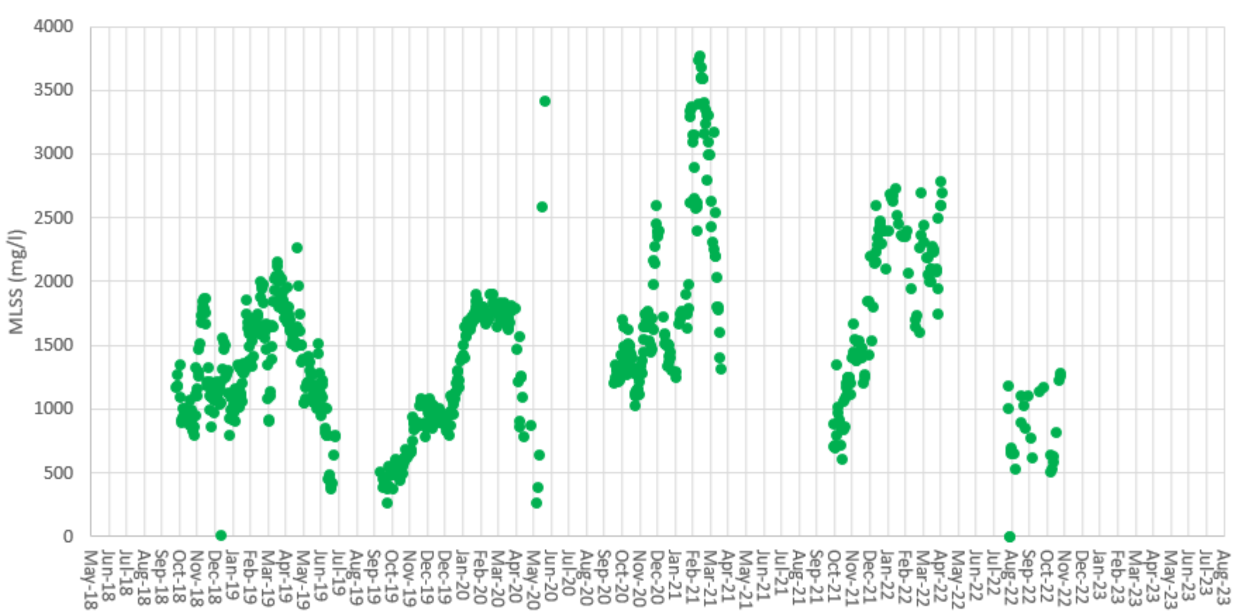


Figure 3-3: MLSS concentration

The data show high operational variability over the past five years for these three parameters. This variability in operational data could be attributed changing conditions within the microbial population during transitional periods including:

- Initial startup of the activated sludge system when it is put back in service
- Bringing a second basin into service
- Changes to the SRT

All of these operational modifications take time to stabilize.

Over the past five years, the SVIs at the WWTP ranged from 80 to 750, based on the 10^{th} and 90^{th} percentiles. SVI is an indication of how well the mixed liquor suspended solids settle in the secondary clarifiers; the better the MLSS settles, the more load the clarifiers can accommodate either via more flow, higher MLSS concentrations or both. Higher MLSS concentrations result in higher treatment capacities in the aeration tanks. Therefore, to maximize capacity of the activated sludge system, maintaining the SVI at a relatively low level less than 200 mL/g and closer to 100 mL/g is desirable. Recent data from 2021 and 2022 show that the SVI have been in a more reasonable range of 100-200 mL/g.

The relatively poorer settleability observed prior to 2021 may have been a result of impacts from the following prior operational modes, and continued optimization of the activated sludge performance will result in more available capacity:

- Prior to 2021, the flow above 0.9 MGD that was diverted to pond D was recycled back to activated sludge processes, which may have negatively impacted the system performance.

- The anaerobic digester did not have sufficient capacity when it was replaced with aerobic digesters in 2020. When the anaerobic digester was in operation, occasionally WAS was sent directly to belt filter press resulting in variable wastewater characteristics in the filtrate that was recycled back to the headworks.

The treatment capacity of activated sludge system depends on performance of all of its components. The aeration tanks and secondary clarifier act together as a system, and operational modifications to one can impact the capacity of the other. Additionally, the ancillary pumping and aeration systems also have capacity limitations that need to be considered. The following subsections discuss the capacity analysis of the aeration tanks with and without a future pre-anoxic zone, the aeration blowers, and the secondary clarifier.

3.4.1 Aeration Basin

Aeration basin design criteria based on the 2008 design are provided in **Table 3-4**.

Table 3-4: Aeration Basins 2008 Design Criteria

Aeration Design Criteria	
Number of Trains	2
Number of Zones in each Train	2
Volume of each Train	95,000 Gal
Dimension of each Zone	22 feet x 18 feet
Side Water Depth	16 feet
Maximum MLSS	3,500 mg/L
Aerobic SRT @ minimum temperature (12 degrees C)	12 days
Dissolved Oxygen	2.0 mg/L

The microorganisms responsible for the conversion of ammonia to nitrate (nitrifiers) are relatively slow-growing and require a relatively longer SRT than the heterotrophic organisms responsible for BOD oxidation. These nitrifiers are also sensitive to temperature and grow more slowly in colder water. Therefore, a relatively longer SRT is required in the wintertime when water temperatures are colder than in summertime.

Figure 3-4 shows the required SRT to maintain full nitrification as a function of temperature. For design purposes, a process safety factor in the range of 1.5 to 2.0 is typically used to determine the target design SRT. With a safety factor of 2, the minimum SRT for nitrification at 12 degrees C, is 12 days, assuming a residual DO of 2 mg/l and complete nitrification with an effluent ammonia of 1 mg/l, which is the design SRT for the 2008 upgrades. While the WWTP does not typically monitor the wastewater temperature, per discussion with operation staff and based on the results of special sampling conducted in November to December of 2022, 12 degrees C is still a reasonable minimum design temperature on which to base the capacity analysis.

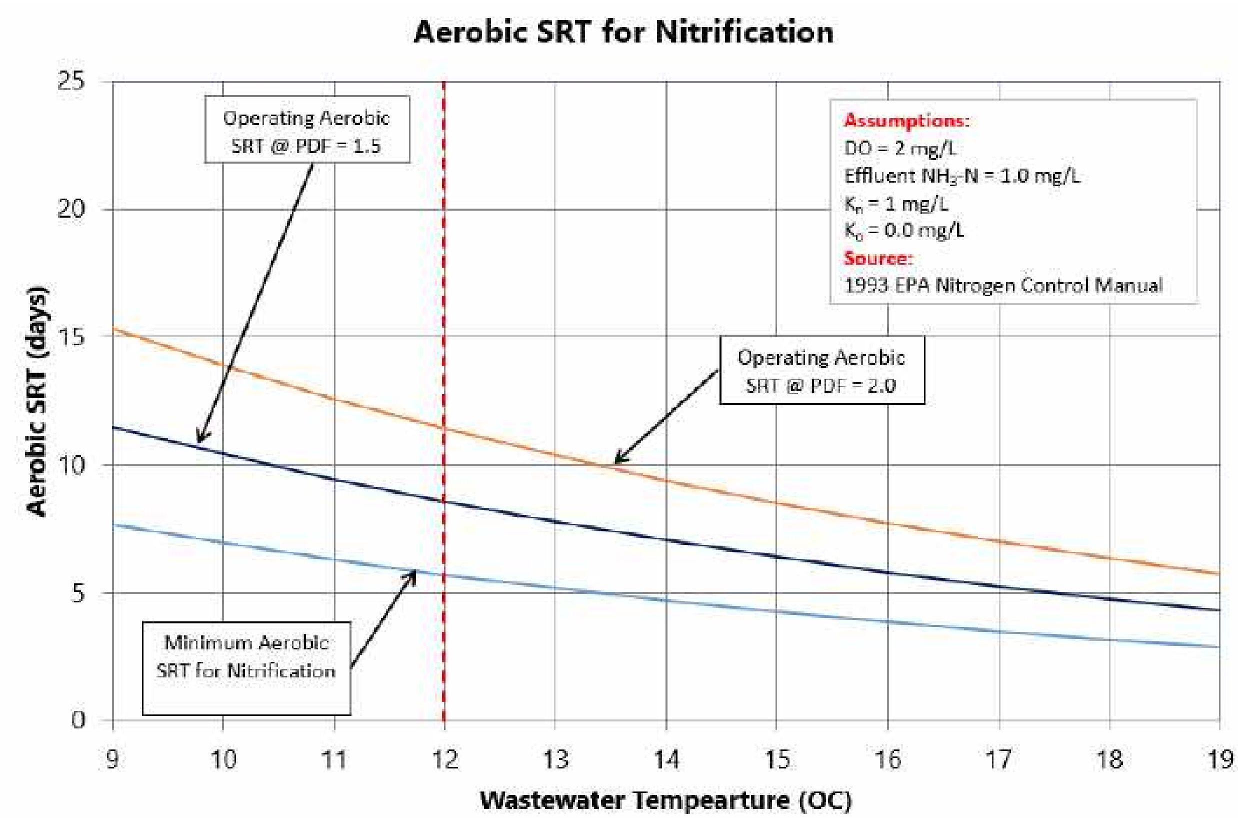


Figure 3-4: Aerobic SRT for Nitrification

Figure 3-5 shows aeration tank volumes versus MLSS concentrations required to maintain a 12-day SRT when wastewater temperatures are 12 degrees C for both current and 2042 ADMM Loadings with primary clarifier BOD removal of 40% (no tricking filter in service). The higher the volume, the lower the concentration of the total mass of MLSS needs to be. The figure also shows the current tank volume of the two aeration tanks (0.19 million gallons); to maintain SRTs above 12 days with two aeration tanks in service, MLSS concentrations above 1,700 mg/l and 2,200 are needed at current and Projected 2042 ADMM loadings, respectively.

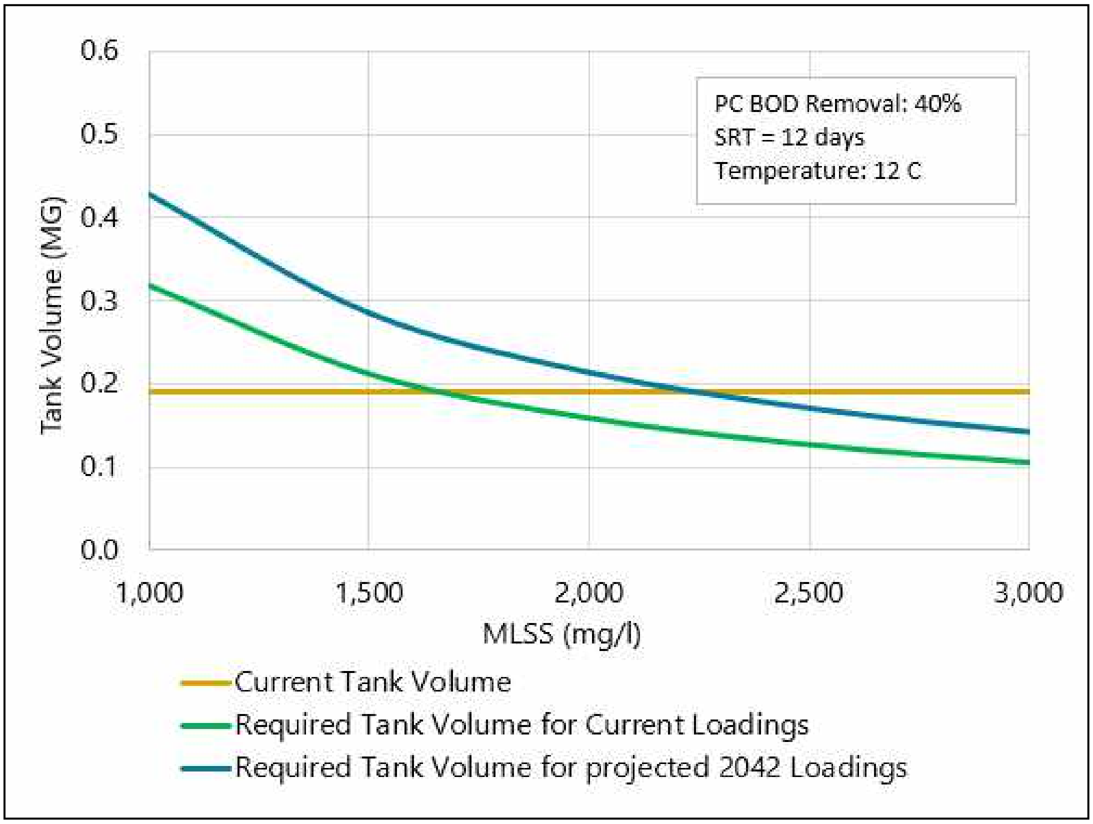


Figure 3-5: Required Aeration Volume for Current and Projected 2042 ADMM BOD Loading vs. MLSS

Figure 3-6 shows aeration basins treatment capacity as a function of temperature and loading at various primary clarifier BOD removal efficiencies and MLSS concentrations. At higher temperatures when a lower SRT is required to maintain nitrification, activated treatment capacity increases. The activated sludge system has sufficient capacity to treat current ADMM loadings (588 lb/day) when MLSS concentrations are above 1,700 mg/l in both basins, temperatures are above 12 C, and primary clarifier BOD removal efficiency is above 40%. To meet the projected 2042 ADMM loadings (790 lb/d) at the design temperature of 12 C and Primary Clarifier BOD removal of 40%, MLSS concentrations higher than 2,200 mg/l in both aeration basins is required. The conclusions drawn from **Figure 3-5** and **Figure 3-6** are consistent.

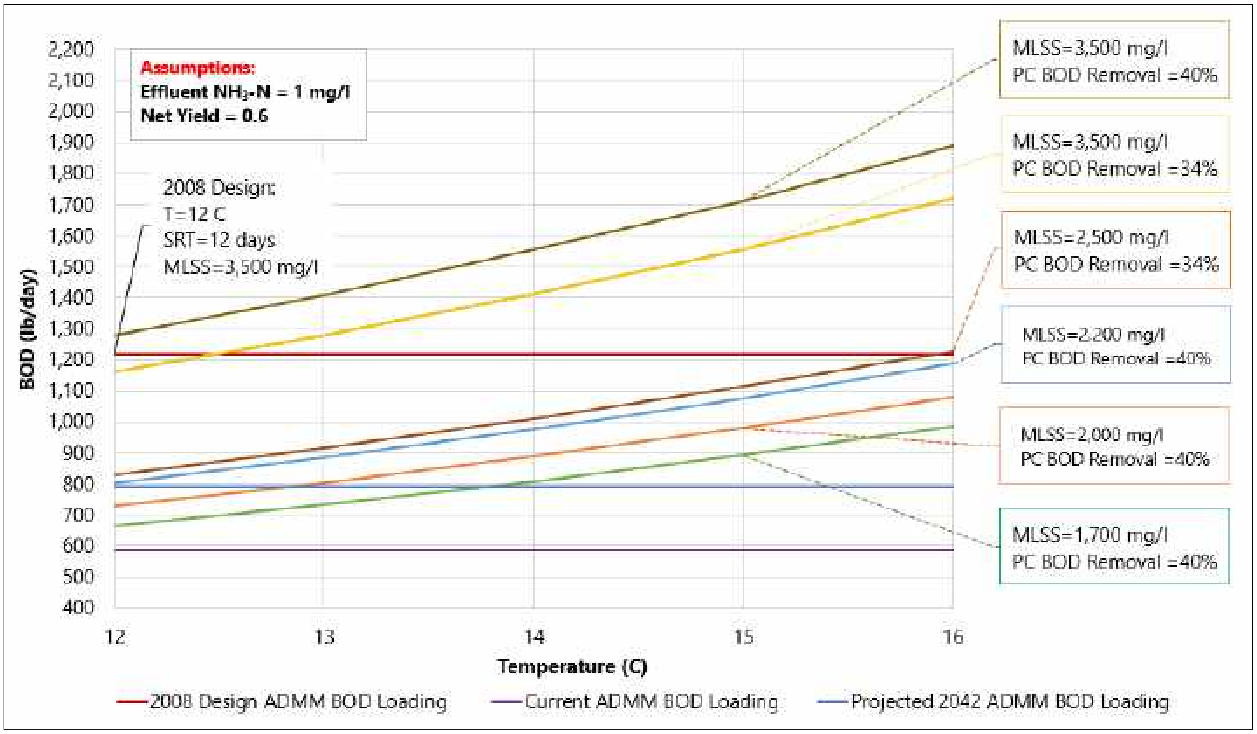


Figure 3-6 Activated Sludge Treatment Capacity

3.4.2 Future Pre-anoxic Zone

A pre-anoxic zone ahead of the aerobic zone in an activated sludge system has several advantages including:

- Providing denitrification which will reduce the overall total nitrogen concentration in the effluent
- Improving sludge SVI by creating an environment that reduces the likelihood of growth of poor-settling, filamentous microorganisms
- Reducing overall loss of alkalinity in the activated sludge system. While nitrification consumes alkalinity, denitrification produces alkalinity resulting in less alkalinity loss overall
- Reducing aeration requirements since a portion of the BOD is oxidized in the pre-anoxic zone, reducing the BOD load in the aerobic zone

To provide a pre-anoxic zone, the existing aeration basins can be retrofitted by converting the front portion of the tanks to pre-anoxic zones. The required anoxic volume is a function of the desired level of nitrogen removal, and a typical percentage of the overall aeration tank volume for a pre-anoxic zone is 30%. Assuming conversion of 30% of the existing aeration tanks to a pre-anoxic zone, modifications to the existing tanks would include:

- Installation of baffle walls to separate the pre-anoxic and aerobics zones
- Addition of internal recirculation pumps to return mixed liquor from the end of the aerobic zone back to the beginning of the pre-anoxic zone
- Addition of mixers in the pre-anoxic zone to keep the MLSS in suspension

With this modification, the remaining 70% of the aeration basins have sufficient volume to provide the required aerobic SRT of 12 days in winter to treat the projected 2042 ADMM loadings (without the trickling filter in operation and with primary clarifier BOD removal is above 40%) when the MLSS concentration is above 3,200 mg/l. This higher MLSS concentration will impact the secondary clarifier capacity, as discussed in Section 3.4.4.

3.4.3 Aeration System Equipment

Currently, three belt-driven, positive displacement aeration blowers and fine bubble diffusers provide aeration and mixing air to the aeration basins. **Table 3-5** and **Table 3-6** show blowers and fine bubble diffusers design criteria, respectively, as listed in the WWTP 2011 Operations and Maintenance manual by Stantec.

Table 3-5 Aeration Blower

Aeration Blower Detail	
Number of blowers	3 (2 duty, 1 standby)
Type	Positive Displacement
Make/Model	Aerzen / GM 15L -00
Max air flow per blower	350 SCFM
Max discharge pressure	8.2 PSIG
Output pipe size, air	6”
Horsepower, each blower motor	25
Motor RPM / Blower RPM	1800 / 3400
Blower RPM	3400

Table 3-6 Fine Bubble Diffuser

Fine Bubble Diffuser Specifications	
Type	9” membrane disc diffusers
Make/Model	EDI / FlexAir 9-inch
Number of diffusers in Aeration Zone 1	88
Number of diffusers in Aeration Zone 2	36
Maximum Air Flow Rate in Aeration Zone 1	235 scfm
Maximum Air Flow Rate in Aeration Zone 2	97 scfm
Maximum Pressure at the Top of the Drop Leg	7.8 psig

Based on the current design of the aeration system, the maximum aeration capacity is 664 SCFM. At current peak day loading (PDL) rates for BOD and TKN, the aeration requirement is estimated to be 700-800 SCFM to maintain the DO between 1-2 mg/l in winter and summer. The required aeration demand for current peak day loading rates exceeds the existing aeration system capacity. Therefore, it is recommended that additional diffusers and blowers are installed to increase the capacity as needed to provide sufficient aeration at the design loading rates. Additionally, if the plant converts part of Zone 1 of the aeration basin to pre-anoxic zone, the aeration diffuser system layout will also require modifications. Installation of pre-anoxic zone will help reduce the plant aeration demand.

3.4.4 Secondary Clarifier

Currently, mixed liquor from the aeration basins is conveyed by gravity to the secondary clarifier and then settled in the clarifier. The settled solids are returned to the front of the aeration basins by the RAS/WAS pump station as return activated sludge (RAS), and a portion of the settled solids is pumped to the aerobic digester as waste activated sludge (WAS) to be removed with the primary sludge and processed in the solids handling treatment processes. Effluent from the secondary clarifier is conveyed by gravity to the filters. The design criteria for the secondary clarifier as listed in the WWTP 2011 Operations and Maintenance Manual is summarized in **Table 3-7.**

Table 3-7: Secondary Clarifier Design Criteria

Secondary Clarifier Design Criteria	
Average dry weather flow	0.32 mgd
Peak weather flow	1.88 mgd
Diameter of basin	55 feet
Side water depth	13.2 feet
Tank volume	234,600 gal
Surface area	2,376 ft2
Overflow rate at peak flow	758 gal/day/ft2
Solids loading rate at peak flow	36-38 lb/day/ft2
Hydraulic Retention Time at peak flow	3.0 hours
Drive Motor	½ HP, 1735 RPM, 460 V, 3 phase, 60 Hz

The capacity and performance of a secondary clarifier is a function of the flows (influent, overflow and underflow), solids loading, and settleability of the mixed liquor as defined by the following parameters: influent flow, RAS flow, SVI, MLSS concentration, and clarifier size. To evaluate the secondary clarifier capacity, state point analysis was used. State point curves for the WWTP were constructed as shown in **Figure 3-7** Both the Daigger and Daigger-Roper curves are shown, and the capacity evaluation was based on the more conservative Daigger-Roper curve. These curves are a function of the secondary clarifier dimensions and sludge settleability. The overflow and underflow operating lines on the graph are based on the selected operational conditions that include MLSS, influent flow, and RAS rate. The intersection of these lines should be on or under solid flux curve; if it is above the curve, the secondary clarifier is overcapacity.

Sludge with good settleability generally has an SVI ranging from 70 to 150 ml/g. However, for secondary clarifier sizing and capacity evaluations, a conservative SVI range of 200-300 mL/g is typically assumed when selectors or anoxic zones are not present in the aeration tanks. 2008 design used an SVI of 175 ml/g. Based on the observed SVIs from 2021 and 2022, a SVI value of 200 mL/g was used for this evaluation.

Figure 3-7 shows an example of the state point analysis graph at the projected 2042 PHWWF of 2.4 MGD with no flow diversion to Pond D. With a RAS flow of 1.19 MGD and an SVI of 200 ml/g, secondary clarifier capacity limits the MLSS to 2,300 mg/l, which falls within the capacity of the existing aeration basins without modifications for a pre-anoxic zone.

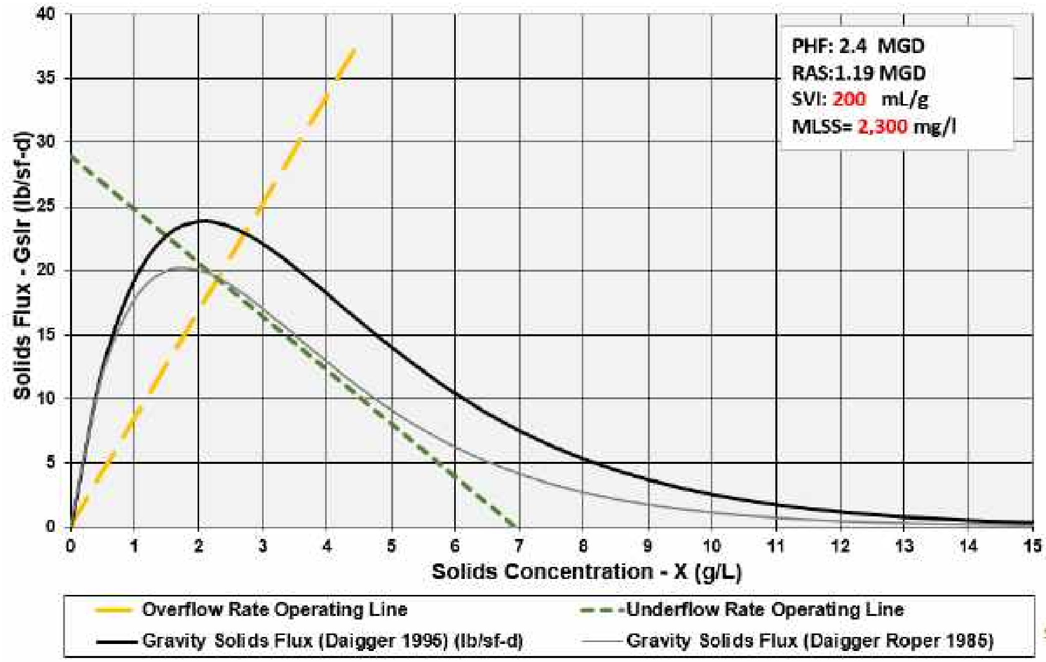


Figure 3-7 State Point Analysis Graph at the Projected Future PHF of 2.4 MGD

Figure 3-8 illustrates the capacity analysis at 0.9 MGD with the wet-weather flow diversion at the same RAS rate and SVI. With the reduced flow to the secondary clarifier, the allowable MLSS can increase up to 3,900 mg/l, enabling the potential future modification of the aeration tanks with pre-anoxic zones.

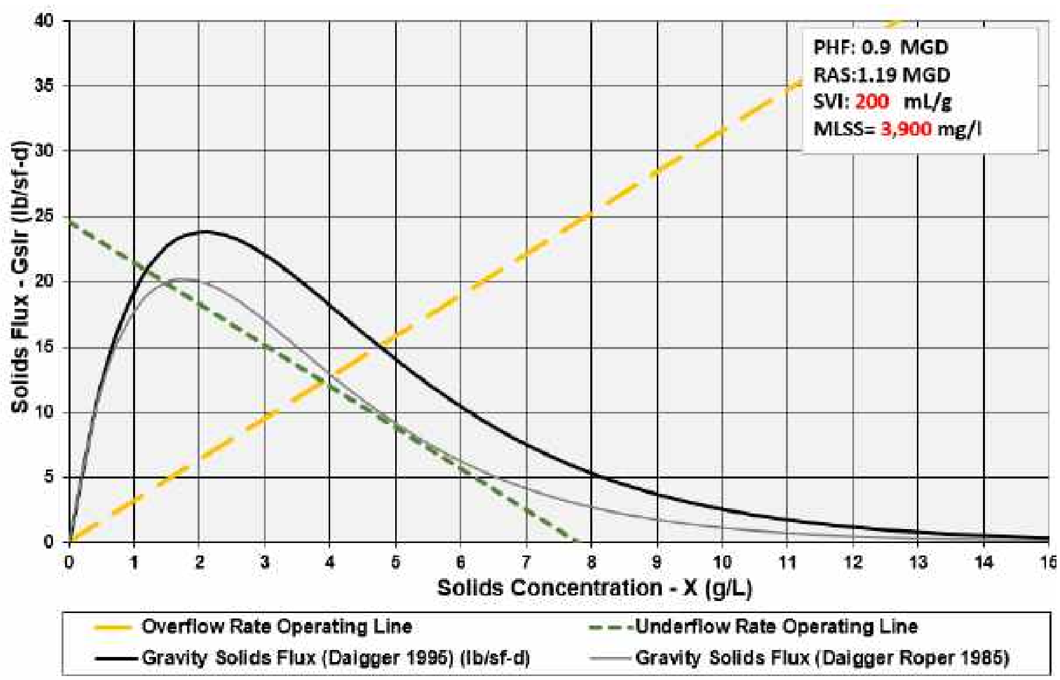


Figure 3-8 State Point Analysis Graph at PHF of 0.9 MGD with Bypass

Utilizing the same methodology, **Table 3-8** shows state point analysis results under various operational conditions (influent flows, RAS flows, SVI and MLSS) with the existing secondary clarifier, the existing and one new secondary clarifier, and with and without a pre-anoxic zone in the aeration tanks (which impacts the needed MLSS for nitrification). With a new Pre-anoxic zone, an SVI of 150 mL/g was assumed to account for the expected improvements to sludge settleability.

Table 3-8 Secondary Clarifier Capacity under Different Operating Conditions

Operating Condition	Secondary Clarifier Influent (MGD)	# of Clarifiers	RAS (MGD)	SVI (mL/g)	MLSS (mg/l)
Current Operation 1 secondary clarifier with WWFD	0.9	1	1.19	200	3,900
1 secondary clarifier with WWFD Addition of Pre-Anoxic zone	0.9	1	1.19	150	4,700
1 secondary clarifier without WWFD	2.4	1	1.19	200	2,300
2 secondary clarifiers without WWFD	2.4	2	2.38	200	3,500
2 secondary clarifiers without WWFD Addition of Pre-Anoxic zone	2.4	2	2.38	150	4,200

WWFD: Wet weather flow diversion

3.4.5 Activated Sludge Capacity Analysis Summary & Recommendations

As previously mentioned, the capacity and performance of each component within an activated sludge system directly affects its overall capacity. Therefore, this section provides a comprehensive analysis of the activated sludge system, taking into account the integrated functioning of all its components.

Based on the capacity analysis, the activated sludge system has the required volumetric capacity to treat the current and projected 2042 ADMM loadings during the wet season when there are effluent ammonia limits in place under the following operating conditions:

- At current flows and loads, with primary clarifier BOD removal efficiency of 40% or higher and MLSS concentrations of 1,700 mg/l or higher, with both aeration basins in operation. The single secondary clarifier has sufficient capacity to handle the required MLSS (1,700 mg/l) for treatment of current ADMM loadings and PHWWF if SVI is maintained below 200 ml/g.

- At the projected 2042 flows and loads, with primary clarifier BOD removal efficiency of 34% or higher, with both aeration basins in operation, MLSS concentrations of 2,500 mg/l or higher is required. However, at these flows and loads with both aeration basins in operation, if primary clarifier removal efficiency is 40% or higher, concentrations of 2,200 mg/l or higher is required. The single secondary clarifier can only handle MLSS concentrations up to 2,300 mg/l at the projected 2042 PHWWF of 2.4 MGD without WWFD at SVI of 200 ml/g. Therefore, the plant does not have sufficient capacity if primary clarifier BOD removal is less than 34%.

During the dry season, with the same MLSS and Primary clarifier BOD removal of 40%, a single aeration basin in service would suffice to meet ammonia limits if required.

However, the aeration system does not provide sufficient air for the current or future peak day loading rates. Thus, additional blowers and diffusers are required to meet the air demand for the air supply during peak day loadings.

Figure 3-9 illustrates a linear BOD loading increase between the current loading and projected 2042 loading and the relationship to activated sludge system capacity. This figure does not consider the aeration capacity. The capacity shown on this figure is based on the maximum MLSS concentration the secondary clarifiers can handle at the PHWWF corresponding to loading capacity with primary clarifier BOD removal of 34%.

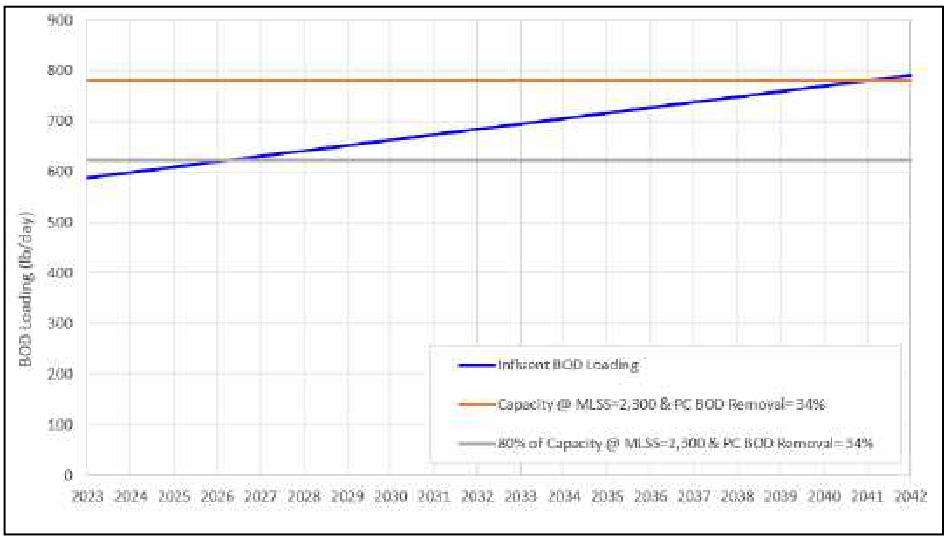


Figure 3-9: BOD Loading Increase vs. Activated Sludge System Capacity

Based on this figure, the activated sludge system capacity is expected to be exceeded in 2041. The upgrades to the activated sludge treatment system are recommended to be initiated when the WWTP reaches 80% of its capacity, which is estimated to be in 2026. These improvements include installation of a second secondary clarifier. Adding a new secondary clarifier will provide redundancy and reliability for maintenance and any future rehabilitation and will reduce the need for the HFTS or a wet weather flow diversion (WWFD). A new splitter box between the aeration tanks and secondary clarifiers will be required to distribute the flow to the existing and new clarifier. Additionally, the new secondary clarifier will require an upgrade to the RAS/WAS pump station.

While the addition of a pre-anoxic zone to the aeration tanks is not necessary to meet current flows and loads, it is recommended for further consideration in conjunction with other recommendations for operational and capital changes to the activated sludge system because of the settleability benefits. Per **Table 3-8**, by converting 30% of the aeration basin volume to a pre-anoxic zone, the MLSS can be increased to 4,200 mg/l at PHWWF of 2.4 MGD with two secondary clarifiers in service. Alternatively, with a pre-anoxic zone, MLSS can be maintained at 4,700 mg/l with one secondary clarifier if flow to secondary treatment is maintained at 0.9 MGD with WWFD. At these MLSS concentrations, aeration basins have sufficient capacity to treat future projected ADMM loadings during winter with both activated sludge tanks online and summer with one activated sludge tank online.

3.5 Trickling filter

The trickling filter is one of the original unit processes built in 1955 along with the headworks, primary clarifier, and the intermediate clarifier. Subsequently, it's been upgraded with new plastic media and recycle pump but is mainly comprised of the original components and materials. The trickling filter is used in the warmer months when land application (DLDA) is necessary due to low flow in the North Fork of the Calaveras River and ammonia removal is not required. **Table 3-9** summarizes the design criteria for the trickling filter.

Table 3-9: Trickling Filter Design Criteria

Criterion	Value
Number of Filters	1
Diameter	40
Depth	8 ft
Total Volume of Media	3200 ft^3
Specific Area of Media	27 ft^2/ft^3

The trickling filter removes BOD using an attached growth biological process by distributing the primary effluent over the top of the plastic media with a rotary distributor. The biofilm that grows on the media biologically oxidizes the BOD as the flow moves by gravity downward through the tricking filter. Outside air is passively drawn into the tricking filter and circulated through the media with the flow, supplying the oxygen needed to oxidize the incoming BOD.

Generally, trickling filter capacity is based on the organic loading rates. According to Metcalf & Eddy (M&E), in order to achieve 70-90% BOD removal the Trickling Filter should be loaded at 50 – 150 pounds of BOD per 1000 cubic feet of media per day (lbs BOD/day-kcf). Based on the supplemental sampling conducted for this project, the primary clarifier removes 41% to 48% of influent BOD. The remaining BOD in the primary effluent is sent to the trickling filter. **Table 3-10** summarizes typical design loading rates based on literature, the 2008 upgrade design loading rate, and the current loading based on recent data, all assuming 40% BOD removal through the clarifier..

Table 3-10: Trickling Filter Organic Loading Rates

	M&E, 4th Edition	2008 Design Loading	2018-2022 Loading	Future 2042 Loading
AAL (lbs BOD/day-kcf)	50	55.4	29	38.2
ADMMF (lbs BOD/day-kcf)	150	124.6	74.8	100

In conclusion, the trickling filter is shown to fall well within the M&E acceptable loading range as well as into the 2008 basis of design, both now and into the future. The corresponding flow rate for the future 2042 loading rate would be for 0.89 MGD at a BOD concentration of 118 mg/l and would also be the recommended loading rate for the trickling filter.

3.6 Disk Filters

The Disk Filtration system was installed and commissioned during the 2008 upgrades. The filters are designed to provide additional suspended solids removal and effluent polishing ahead of disinfection and final discharge. The system was designed to be in compliance with Title 22 recycled water regulations to give the WWTP the ability to produce recycled water in the future, and the system also includes flash and flocculation mixing tanks and equipment as well as associated chemical systems. These ancillary systems are currently not in use and effluent from the secondary clarifiers flows by gravity through the disk filters, bypassing the mixing tanks. The WWTP is currently not permitted for production of Title 22 water, and the District currently doesn't have plans to move forward with seeking Title 22 approval. The design criteria for the tertiary filtration system are summarized in **Table 3-11**.

Table 3-11: Disk Filter Design Criteria

Disk Filters	
Location	Tertiary filter basins
Number of independent filter units	2
Filter type	360 degree cloth media disks
Manufacturer/Model	Aqua-Aerobic Systems/AquaDisk
Number of disks per filter unit	6 (8 disk capacity)
Total filter area	644 sq. ft. per filter unit
Flash mix basin quantity	1
Flash mix basin volume	540 gallons
Flocculation basin quantity	2
Flocculation basin volume (each)	7300 gallons

Disk filter performance and capacity is a function of the hydraulic loading rate. The system was designed for a loading rate of 4.06 gpm/ft^2. The filtration system was tested by a third party and approved during Title 22 testing and is capable of a demonstrated loading rate of 6 gpm/ft^2. It should be noted that Title 22 testing is conducted in typical activated sludge conditions, so performance with attached growth processes is not verified within the testing parameters. Chemically enhanced treatment may be required. The table below summarizes the total capacity the filter system, with disks installed and with one filter offline:

Table 3-12: Disk Filter Capacity with Only One in Service

	2008 Design (at 4.06 gpm/ft^2)	Title 22 (at 6 gpm/ft^2)	2018-2022 Data (at 3.95 gpm/ft^2)	2042 Future (at 5.18 gpm/ ft^2)
PHWWF (MGD)	1.88	2.8	1.83	2.4

The current loading rate based on the 2018-2022 data is nearly the same when compared to the 2008 basis of design. However, when taking into account the verified Title 22 loading rate of 6 gpm/ft^2, there is a much greater flow rate capability, nearly double the amount, enough flow rate to satisfy the future PWWF. It should be noted, however, that the current condition of the cloth media, the backwash system, and the quality of the secondary clarifier effluent should be taken into consideration to ensure that no there is no hinderance on the performance of the filters effecting the overall capacity.

To conclude, based on third party testing done during the Title 22 approval process, the filters are capable of being loaded to 6 gpm/ft^2. Though the plant is reaching the capacity shown in the 2008 basis of design, the capacity was likely de-rated to 4.06 gpm/ft^2 for the potential of chemically enhanced treatment. With a well performing secondary activated sludge system, it is expected for the filters would be able to effectively treat the flow for shown future 2042 conditions.

3.7 Disinfection

In 2022, construction was started on an upgrade to the existing chlorine contact basin by adding turning baffles to reduce short circuiting and to provide actual contact time that closely matches the available hydraulic capacity of the contact basin. A new channel was also added to the basin to increase its capacity to 20,900 gallons. Prior to the upgrade, the existing structure did not provide adequate detention time when daily flows exceeded 0.70 MGD and lacked turning baffles.

Table 3-13: Chlorine Contact Basin Chlorine Contact Time

	Peak Hourly Flow (MGD)	CT (mg/L-min)	Contact Time (min)
2022 Upgrades	1 MGD	60.5	30.2
2018-2022 PHWWF	1.8	33.6	16.8
2008 PHWWF Design	1.88	32.2	16.1
Title 22 Potential Capacity As Built	0.13	465	232.5
Projected 2042 PHWWF	2.4	41.4	12.54

The Current regulatory target is a contact time of 30 minutes and a CT value of 60 mg/L-min and to achieve Title 22 quality requirements a contact time of 90 minutes is needed as well as a CT value of 450 mg/L-min. The chlorine contact basin after the recent 2022 upgrades can effectively disinfect up to 1 MGD of flow meeting the regulatory disinfection requirements. The Title 22 requirements would put the potential capacity and the future 2040 design capacity of the chlorine contact basin well below the 2008 plant design capacity as well as the current 2018-2022 peak hourly flow. Only 0.13 MGD of treated flow would be capable meeting Title 22 requirements. It is also found that the projected 2042 capacity would exceed the regulatory targets, as well.

In conclusion, the expanded chlorine contact basin will provide the target contact time and CT for average flows and ADMM however future expansion will be needed to provide the targeted contact time and CT for peak days and peak hourly flows.

3.8 Overall Plant Capacity

Based on the analyses described above, the overall plant capacity is illustrated in Figure 3-10.

Capacity Compared to Current Flows and Loads. The primary clarifier is currently at capacity and, although removal efficiencies for TSS and BOD are above average compared to engineering references, the effluent weirs are submerged at flows over 0.9 MGD. This may be due to hydraulic limitations in the primary effluent pipeline to the recirculation box or to the process feed pump station.

The activated sludge system treatment capacity depends on the performance of all of its components. The aeration tanks and secondary clarifier act together as a system, and operational modifications to one can impact the capacity of the other. The aeration basins have sufficient capacity to reliably remove current BOD and ammonia loads under limiting winter temperatures as long as MLSS, SVI, DO, and removal of BOD in the primary clarifiers remain within acceptable ranges.

The disinfection system currently has adequate capacity to treat the average day maximum month flow (ADMMF) at the targeted contact time and CT. At higher flows, the contact time and CT are reduced. The District is not planning to produce recycled water for offsite distribution at this time and Title 22 compliance is not required. Should the District decide to implement a Title 22 recycled water project, the disinfection system will require upgrades.

Capacity Compared to 2042 Flows and Loads. The headworks, trickling filter, disk filters, and irrigation pump station currently have adequate capacity to serve the 2042 flows and loads. Capacity expansion will be needed for the primary clarifier, aeration basins, secondary clarifier, and disinfection systems.

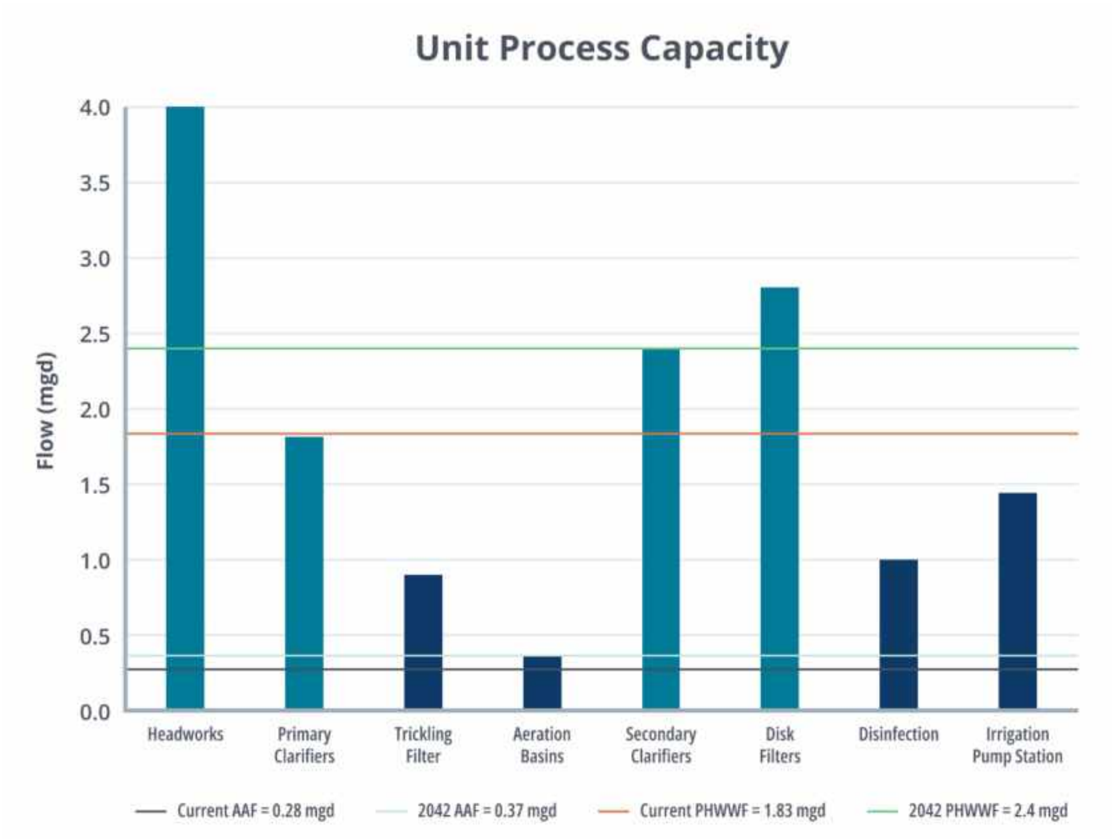


Figure 3-10 Unit Process Capacities Compared to Current and 2042 Conditions

4. LONG TERM PLANNING CONSIDERATIONS

4.1 Potential Future Effluent Limitations

The District's current NPDES permit, recently adopted NPDES permits for other Central Valley dischargers, and available information regarding other potential future regulations have been reviewed to assess potential regulations that could apply to the District's effluent discharges in the future. As noted previously, the District's current Order is set to be renewed by November 30, 2023. Typically, a draft Tentative Order is circulated, for a 30-day public comment period, approximately two months prior to adoption of a renewed Order by the Regional Water Board. Based on this schedule, a Tentative Order is expected to be issued by September 2023, at which time effluent limitations applicable through 2028 will be known. Effluent limitation projections are as follows:

4.1.1 North Fork Calaveras River Effluent Discharge Limitations

BOD, TSS, pH

Concentration-based and percent removal performance-based effluent limitations on BOD and TSS are not anticipated to change in the foreseeable future. The performance based instantaneous minimum effluent limitation on pH of 6.5 is not expected to change in the foreseeable future, nor is the Basin Plan instantaneous maximum effluent limitation on pH of 8.5.

Cyanide

Effluent limitations on cyanide for the protection of aquatic life are not expected to change materially in the foreseeable future. Slight changes might occur as a result of water quality based effluent limitation calculation input values. However, any such changes are expected to be minor. Note that effluent limitations on cyanide are derived with the application of dilution credits and are determined based on a fraction of the available dilution. Therefore, should compliance with effluent limitations on cyanide become an issue in the future, application of additional dilution credits (which would provide a relaxation of effluent limitations) might be a possibility.

Ammonia

The calculation of effluent limitations on ammonia are based on historical pH and temperature data. As a result, future effluent limitations on ammonia might change slightly based on effluent and receiving water pH and/or temperature data collected during the current Order term. However, any changes are expected to be minor. As with effluent limitations on cyanide, effluent limitations on ammonia are derived with the application of dilution credits and are determined based on a fraction of the available dilution. Therefore, should compliance with effluent limitations on ammonia become an issue in the future, application of additional dilution credits (which would provide a relaxation of effluent limitations) might be a possibility.

With respect to the load limitations on ammonia, the current load limitations are calculated using the concentration limitations, the permitted flow of 1.5 MGD, and a conversion factor. Therefore, should the permitted flow of 1.5 MGD change in the future, the load limitations on ammonia would be adjusted accordingly.

Acute Toxicity

Acute toxicity effluent limitations and aquatic organism survival percentage limitations, set in accordance with USEPA Region 9 guidance, are not expected to change in the foreseeable future.

Total Coliform Organisms

Effluent limitations on total coliform organisms, imposed to protect the beneficial uses of the receiving water, including public health through contact recreation, in accordance with DDW guidance, are expected to remain in place for the foreseeable future.

Chronic Toxicity

The current Order contains a numeric toxicity monitoring trigger rather than a numeric effluent limitation. New State Policy for Water Quality Control: Toxicity Provisions (Toxicity Provisions) have been developed by the State Water Resources Control Board (State Board). However, these Toxicity Provisions have not yet been approved by the USEPA for adoption into NPDES permits in the Central Valley. However, beginning sometime in 2023, these Toxicity Provisions are expected to begin to impact new NPDES permits, including the District's renewed Order. As a result, the renewed Order could contain new numeric effluent limitation for toxicity, rather than a monitoring trigger. However, it is expected that the dilution credits currently used to determine the numeric toxicity monitoring trigger will be applied to any new effluent chronic toxicity limitation. Thus, no future compliance issues are anticipated.

Diazinon and Chlorpyrifos

The current Order does not contain effluent limitations on Chlorpyrifos or Diazinon. However, the Regional Water Board is including effluent limitations on these constituents in nearly all new or renewed Central Valley NPDES permits. The following typical effluent diazinon and chlorpyrifos effluent limitation language, contained in new NPDES permits, can be expected in the District's renewed Order:

> **Diazinon and Chlorpyrifos.** Effluent diazinon and chlorpyrifos concentrations shall not exceed the sum of one (1.0) as identified below:
>
> ***Average Monthly Effluent Limitation (AMEL)***
>
> $S_{AMEL} = C_{D\ M\text{-}avg}/0.079 + C_{C\ M\text{-}avg}/0.012 \leq 1.0$
>
> $C_{D\ M\text{-}AVG}$ = average monthly diazinon effluent concentration in µg/L
>
> $C_{C\ M\text{-}AVG}$ = average monthly chlorpyrifos effluent concentration in µg/L
>
> ***Average Weekly Effluent Limitation (AWEL)***
>
> $S_{AWEL} = C_{D\ W\text{-}avg}/0.14 + C_{C\ W\text{-}avg}/0.021 \leq 1.0$
>
> $C_{D\ W\text{-}AVG}$ = average weekly diazinon effluent concentration in µg/L
>
> $C_{C\ W\text{-}AVG}$ = average weekly chlorpyrifos effluent concentration in µg/L

Electrical Conductivity

The District's current Order does not include effluent limitations on electrical conductivity. However, the Regional Water Board has been including calendar year average performance-based triggers in new Central Valley NPDES permits. It is anticipated that the renewed Order will include an achievable performance-based electrical conductivity trigger with required action items to be implemented if the trigger is exceeded. Such actions will likely include the evaluation of possible sources of salinity contributing to the exceedance of the trigger and the updating of the District's Salinity Evaluation and Minimization Plan to include a plan of action to control salinity.

Biostimulation, Cyanotoxins, and Biological Condition Provisions

The State Board is considering statewide water quality objectives for nutrients, other biostimulatory substances, and cyanotoxins. The Provisions could include numeric or narrative water quality objectives for point source discharges to freshwater receiving waters. These considerations are in the early stages of development and many steps would need to occur before any new water quality objectives are adopted. However, this process could result in numeric effluent limitations on new parameters, including total nitrogen, in the future.

Other Considerations

In addition to the anticipated changes to the renewed Order noted above, there is always the possibility of additional effluent limitations becoming applicable to the WWTP based on recent water quality data. During the Order renewal process, the Regional Water Board will conduct a Reasonable Potential Analysis (RPA), using data collected during the current Order term, for an extensive suite of constituents. Although unlikely, based on the RPA results presented in the current Order, should the maximum effluent concentration for any constituent exceed the lowest water quality objective for that constituent, "reasonable potential" will be triggered, and new effluent limitations will be required. It should be noted that in the event the Facility is unable to immediately comply with any new or more restrictive effluent limitation, a Time Schedule Order can be requested, which will provide protection from mandatory minimum penalties while compliance alternatives are identified and implemented.

4.1.2 DLDA Limitations

Effluent limitations on discharges to the DLDA for BOD and Total Coliform Organisms are not expected to change in the new Order set to be renewed November 30, 2023. Further, there are no known drivers for more restrictive limitations, or limitations on any new parameters, in the foreseeable future for discharges to the DLDA.

4.1.3 Biosolids

It is understood that the District plans on continuing to contract biosolids removal and disposal. Therefore, no changes relative to biosolids disposal are expected. If at some point in the future the District changes biosolids disposal methods, such methods should be evaluated to determine any applicable regulatory requirements that could impact biosolids treatment processes or compliance.

California's Senate Bill 1383 (Short-lived Climate Pollutants: Organic Waste Reduction Act), signed into law in September 2016, requires a 40% reduction in methane emissions in California by 2030 below the levels emitted in 2013. To achieve the methane emission reductions, the legislation further requires a 75% diversion of organics (including biosolids) from landfills by 2025, using 2014 levels as the baseline.

Biosolids which are anaerobically digested and/or composted and land applied constitute a reduction in landfill disposal (California Code of Regulations, Title 14, Article 18983.1(b)(6)(B)). All other biosolids treated or managed in alternative ways other than anaerobic digestion and/or composting, including aerobic digestion (unless subsequently composted and land applied), incineration, pyrolysis, surface disposal, etc., is considered landfill disposal (Article 18983.1(a)(3).

The District contracts with Synagro for hauling and land application of biosolids and permitting of biosolids disposal is the responsibility of Synagro. Synagro is currently land applying San Andreas aerobically digested biosolids in Sacramento County and not disposing in a landfill. Should the San Andreas biosolids be subject to the SB1383 requirements for additional treatment, composting offsite would satisfy that requirement at an estimated additional estimate of probable cost of $10,000 to $12,000 per year, as of 2022.

In order to improve the efficiency of onsite solids management, the District has identified a potential new location for solids storage prior to offsite transport. This location, adjacent to the belt filter press, will minimize the transport of dewatered solids and can better manage any residual water. A bermed concrete pad with integral drainage would be constructed between the primary clarifier and the belt filter press. Drainage would be directed to the head of the primary clarifier. This would cut the transport and level of effort considerably for the District and could make the solids handling process much more streamlined. The current sludge drying area would remain available for drying during the summer months.

4.2 Polyfluorinated and Perfluorinated Alkyl Substances

Perfluorinated and polyfluorinated alkyl substances (PFAS) are a group of man-made chemicals, often called "forever chemicals" because they are extremely resistant to degradation in the environment and the human body, leading to continued exposure and long-term health risks. Despite these problems, PFAS are widely used by industry and are in numerous residential and industrial products such as sunscreen, wrinkle resistant and waterproof fabrics, cookware, cosmetics, cleaning products, and industrial lubricants, fire retardants, polishes, waxes, and machinery.

Wastewater treatment facilities are not "producers" or users of PFAS, rather, they receive these chemicals used by manufacturers and households in their wastewater influent. There are estimated to be between 9,000 and 12,000 distinct types of PFAS chemicals, and approximately 600 remain in commercial production. The two most well-documented to present human health risk, PFOA and PFOS, have been taken out production in the United States. Biomonitoring data over the last two decades from national studies have exhibited a substantial drop in the detected levels of those two compounds in Americans' blood serum, which confirms the effectiveness of the source identification and source control approach to PFAS contaminants.

While the USEPA has established Health Advisory Levels and the State of California has adopted notification levels and response levels for PFAS constituents in drinking water, there are currently no enforceable regulatory levels established for PFAS in drinking water, wastewater, or biosolids. The State is working to develop a Public Health Goal for PFOA and PFOS, which will lead to the development of a Maximum Contaminant Level (MCL), a safety standard for drinking water, within the next few years. The United States Environmental Protection Agency has initiated a similar rulemaking at the federal level. The development of MCLs will, most likely, lead to effluent limitation guidelines for PFAS in wastewater. This could also lead in the future to numeric limits in biosolids used for land application. In the near term, the District could anticipate additional monitoring requirements and costs.

The State Water Resources Control Board issued letters to all major dischargers (over one mgd), to conduct sampling and analysis of influent, effluent, and biosolids for PFAS constituents quarterly for one year in 2020. While the District was not subject to this monitoring requirement, analysis of the data from the investigation confirmed that the PFAS compounds detected in the samples predominantly came from residential and commercial sources.

The wastewater industry has been focusing on legislative advocacy and public education on reducing the use of PFAS in commercial and household products. The California Association of Sanitation Agencies

(CASA) has co-sponsored legislation that will ban the sale of textiles containing PFAS, reduce the amount of PFAS in cosmetics, and require manufacturers of products that contain intentionally added PFAS to disclose the type and amount of PFAS in the products to a public database. In the near term, the District may see additional monitoring requirements and costs.

4.3 Climate Change, Greenhouse Gas Emissions Monitoring, and Mitigation

The State Water Resources Control Board has acknowledged that changing climate conditions may fundamentally alter the way wastewater treatment facilities are designed and operated. Some Regional Water Quality Control Boards (most notably the San Diego Regional Board and Santa Ana Regional Board) have started adding a Special Provision to renewing NPDES permits requiring a Climate Change Action Plan (CCAP). While we are not aware of any permits with this requirement issued by the Central Valley Regional Board, that may change in the future.

Special provisions for CCAP previously adopted have included:

- Projected regional impacts on the plant facilities and operations due to climate change
- An inventory of greenhouse gas (GHG) emissions attributable to the facility operations
- Flooding risks that may affect operations including discharges
- Variable hydrology increasing the frequency and duration of peak flows
- Impacts to process design parameters due to climate change
- Financing needed to pay for planned actions.

While monitoring and reduction of GHG emissions is not a current requirement, the California Air Resources Control Board (CARB) is conducting studies of wastewater treatment process emissions focused on methane and nitrous oxide. Methane from anaerobic treatment and nitrous oxide from partial denitrification are potent GHGs that could potentially be regulated in the future.

4.4 Water Restrictions and Water Conservation

Senate Bill 606 and Assembly Bill 1668 were enacted by the California Legislature to determine a water use objective for water suppliers. A water supplier's urban water use objective (UWUO) is determined by the sum of indoor residential water use, outdoor residential water use, commercial irrigated areas, water losses, and variances for unique water uses with potable reuse receiving a bonus incentive. Based on SASD's customers, changes in water use that is likely to impact operations is indoor water use for residential_ customers, as well as commercial, industrial, and institutional (CII) customers.

The California standard for residential indoor water use in 2022 was 55 gallons per capita per day (gpcd). In September 2022, the Governor signed SB 1157 (Hertzberg). The bill adopts recommendations made by DWR and the State Water Board to reduce indoor water use targets to 47 gpcd by 2025 and 42 gpcd by 2030.

4.4.1 Existing Water Use in Calaveras County

Current District ordinances set the typical residential wastewater production rate at 163 gpd per EDU. Typical residential wastewater production observed by the District is approximately 180 gpd per EDU. According to US Census, the average household size in San Andreas is 2.8 people. Therefore, the residential wastewater production rate per capita is assumed to be 64.3 gpcd. To meet the indoor water use targets established in SB1157, San Andreas would need to cut indoor water use by 35% come 2030.

$$\text{SASD Daily Water Use} = \frac{180\,\frac{\text{gal}}{\text{EDU} * \text{day}}}{2.8\,\frac{\text{people}}{\text{EDU}}} = \mathbf{64.3\ gpcd}$$

$$\text{Potential Reduction in Daily Water Use} = \frac{64.3\ \text{gpcd} - 42\ \text{gpcd}}{64.3\ \text{gpcd}} * 100\% = \mathbf{34.7\%\ by\ 2030}$$

4.4.2 Impacts of Water Conservation

Greater indoor water use efficiency in the residential sector may pose challenges to local wastewater management. In May 2022, the California State Water Board Office of Research, Planning, and Performance (ORPP) presented the following impacts of AB1668 and SB606 on wastewater treatment facilities.

According to the State Water Board, urban retail water suppliers meeting their objectives could potentially result in 61% of wastewater treatment facilities experiencing lower and more concentrated flows than what is typically expected by the year 2030. While this change could benefit facilities by decreasing pumping costs and reducing energy use associated with pumping, it could also lead to adverse effects, such as increased labor, chemical, energy, and consultation costs. Additionally, process modifications, operational changes, or upgrades may be required, and sales of recycled water could be impacted. The estimated statewide increase in operations and maintenance (O&M) costs is $69 million per year, equivalent to 3% of the estimated annual total statewide O&M costs. Furthermore, the estimated increase in capital improvement costs statewide is $320 million per year, which accounts for 7% of the estimated annual total statewide capital costs.

The low flow conditions can have various impacts on the wastewater treatment process. Grit accumulation in sewers and grit slugs during wet weather events may occur due to low flow. Low flow conditions may also lead to increased hydrogen sulfide in the collection system and headworks. Additionally, decreased BOD at the headworks due to biological activity in the slow-moving water in the sewers may cause reduced process efficiency of activated sludge and trickling filters and increased ammonia concentrations for some WWTPs. There is also potential for unintended disinfection byproducts, requiring changes in disinfection dosing capacity and ability. Moreover, low flow conditions may lead to increased TDS concentrations in effluent and decreased volumes for potential water recycling.

In response to low flow conditions, several operational and maintenance (O&M) costs may arise for wastewater treatment facilities. These include increased energy use, labor, chemical usage, repair, and replacement costs, particularly due to corrosion, and the need for process upgrades. In addition, increased waste strength may require a modification of the rate structure, incorporating both flow and load components. Such modifications are necessary to cover the increased costs associated with higher waste concentrations and ensure that the wastewater treatment facilities continue to operate effectively.

4.5 Cybersecurity

Wastewater treatment facilities are critical infrastructure and have experienced cybersecurity breaches leading to disruption to critical operations. Cyberattacks may threaten treatment and conveyance processes, compromise email and website systems, steal customer data and payment information, or install malicious programs. Cyberattacks on wastewater treatment facilities erode customer confidence and result in financial and legal liabilities.

The ISA/IEC 62443 standards were adopted in 2021 and define requirements and processes for implementing and maintaining electronically secure industrial automation and control systems (IACS). In addition to the international standard by ISA/IEC 62443, EPA has published cybersecurity program guidelines for critical infrastructure facilities in cooperation with the Association of State Drinking Water Administrators' Security Committee as a part of the Bioterrorism Act (BTA). The North American Electric Reliability Corporation Critical Infrastructure Protection (NERC CIP) training courses prepare facilities against cyberattacks.

4.6 Water Recycling

The San Andreas Sanitary District treatment plant is not permitted for recycled water production and has not applied for any water recycling permits in the past. According to the District, there has been some interest in providing recycled water to meet local non-potable water demands. Before any permitting can begin, a planning effort must be conducted to determine 1) the end users, 2) type of use and water quality requirements, 3) production capability, 4) the distribution infrastructure needed, and 5) cost of improvements.

Title 22 lists various specific uses allowed with different levels of treatment. Many of these specific uses include irrigation of animal feed and other irrigation of crops, residential landscaping, industrial applications (i.e. water evaporators, equipment washwater, etc..), decorative fountains, and toilet supply water in commercial buildings. San Andreas has identified a few possible usages that may be of interest which include the nearby high school athletic fields and County jail prison non-potable uses. Some other potential recycled water usages may include selling downstream water rights by discharging into the Calaveras River or selling to nearby agricultural growers to augment water supplies.

The San Andreas Sanitary District treatment plant currently has process equipment capable of producing Title 22 disinfected tertiary recycled water. This includes a secondary activated sludge process with clarification, a Title 22 rated disk filtration system, and a chlorine contact chamber for disinfection.

Building a pressurized pipeline through residential neighborhoods and commercial land will require an extensive feasibility study and public outreach campaign to determine the size and scope of the distribution network. Distribution and storage for a future recycled water system for SASD will be more expensive than the necessary treatment upgrades. A nearby distribution system dedicated to the local high school as opposed to a city-wide project will have reduced complexity and cost. The least impact to local residents would be to discharge to the river and sell the water rights, but more study would be required to determine the end-use customers, economic benefits, and offsets.

4.7 Summary

There are a number of regulatory and long-term planning considerations that warrant inclusion in this Master Plan Update. The key issues and opportunities are summarized in **Table 4-1**

Table 4-1: Long-Term Planning Considerations

Issue/Opportunity	Potential Impact/Benefit	Magnitude	Timing
SB1383 limitations	May require additional treatment prior to land application	Relatively minor (estimated at $10,000 to $12,000 per year)	1 to 5 years
Future PFAS regulations requiring monitoring	May require monitoring and source control program	Relatively minor	1 to 5 years
Future PFAS regulations restricting effluent discharge or biosolids options	May require some active contaminant reduction capabilities or limit biosolids disposal options	Large but low probability	5-10 years
Future biostimulatory, cyanotoxins, and biological condition provisions	May drive the need for a total nitrogen limit on effluent discharged to the river	Moderate capital cost and operational changes to upgrade aeration basins for denitrification	10-20 years
Climate change	Increase in peak wet weather flows; decrease in average dry weather flows due to water conservation measures; reductions in flows on the North Fork of the Calaveras River	Significant impacts to planning, design, and operations in the long-term. Requirements for a Climate Change Action Plan in the next 5-10 years	10-20 years
Energy Price Increases	Recent price increases will continue to be a larger and larger part of operating costs	Major operating cost impacts	1-5 years
Public Safety Power Shutoffs	Increase in the frequency and duration of outages	Increase need for standby power and potential for compliance problems	1-5 years
Water conservation measures	Reduced flows in the collection system; increased waste strength in the plant influent; increased potential for corrosion and odors.	Potentially significant	10-20 years
Water recycling partnerships	Reduce potable water demands in the community	Could be significant if a high demand water using industry were to move in to San Andreas	10-20 years

5. SELECTED NEAR TERM CAPITAL IMPROVEMENTS PROJECTS

A review of the District's existing Capital Improvements Project (CIP) list identified three near-term projects that directly impact the WWTP. These projects may also correspond directly with recommended long-term improvement projects or be the first phase of implementing the long-term projects. A brief description is given below for the selected Capital Improvements Projects:

5.1 Trickling Filter & Primary Clarifier Rehabilitation (PL-19-01)

The District's CIP currently has project number PL-19-01 listed for trickling filter and primary clarifier rehabilitation. It has also been recommended to include the intermediate clarifier (PL-21-03) within the same project. Though the scope of the rehabilitation has not been defined at the time of this update, typical rehabilitation would include replacing of filter media, replacement or refurbishment of filter rotary distributor, replacement or refurbishment of filter recycle system, and rehabilitation of concrete tank vessel. Typical primary clarifier rehabilitation would likely include increase of effluent hydraulic capacity by increase in effluent pipe diameter and increase of effluent weirs, replacement and refurbishment of sludge collection mechanism as well as any needed improvements to concrete and tank.

Recommendation:

With the age of the equipment, it is recommended to begin the necessary improvements in the form of equipment rehabilitation. It is recommended that the rehabilitation of the trickling filter occur in the wet weather period, to minimize impact to treatment capabilities and permit requirements, but more study and assessment will be required. The primary clarifier should move forward with the rehabilitation in tandem with the secondary upgrades outline in Section 7, though more study and consideration will be required in taking the primary clarifier offline and diverting and settling out primary solids.

5.2 Secondary Clarifier Rehabilitation (PL-20-01)

The District's CIP currently has project number PL-20-01 listed for secondary clarifier rehabilitation. Though the scope of the rehabilitation has not yet been defined at the time of this update, typical rehabilitation would include a condition assessment of the mechanism and drive and to refurbish or replace depending on assessment. Other condition considerations to weirs, energy dissipation, launder covers, and overall performance improvements would also be assessed at time of rehabilitation.

Recommendation:

The district should proceed with rehabilitation of the secondary clarifier. However, rehabilitation is recommended using a redundant clarifier so that the original secondary clarifier can be rehabilitated. Consideration should be given to phasing of the rehabilitation of the clarifier to when a new secondary clarifier is installed and operational. It is recommended to install and fully commission the second secondary clarifier prior to the existing clarifier rehabilitation.

5.3 Intermediate Clarifier Rehabilitation (PL-21-03)

The District's CIP currently has project number PL-21-03 listed for intermediate clarifier rehab. It has been recommended to incorporate the intermediate clarifier rehab within the same project as the secondary upgrades. Though the scope of the rehabilitation has not yet been defined at the time of this update. Typical rehabilitation would include concrete rehab and assessment of mechanism and drive to determine whether to refurbish or replace. It should also be considered whether to maintain intermediate clarifier or to begin the process of decommissioning the tank and mechanism based on the age of the equipment as well as operator usage and assessment of functionality and need.

Recommendation:

The recommendation at this time is to begin the process of rehabilitation of the intermediate clarifier which would include repairs to concrete and mechanism as required.

6. FUTURE IDENTIFIED PROJECTS

The projects recommended in this section have been identified for both near-term and long-term action. The projects have been developed to increase capacity, maintain compliance, improve reliability, simplify operations, and, where possible, minimize operating costs. Recommendations include both additional feasibility evaluations and capital projects.

The Opinion of Probable Construction Costs (OPCCs) for the capital projects are in 2023 dollars and are provided to allow the District to financially plan for future projects and compare relative capital investments and return on investment. The derivation of the OPCCs is provided in Appendix A and follows the Association for the Advancement of Cost Engineering (AACE) guidelines for a Class 5 estimate for conceptual level planning. The OPCCs were developed before the projects have undergone state regulatory review or any level of design.

Based on the outcome of the capacity analysis (Section 3) and the projected capacity shortfall in the aeration basins and secondary clarifier, a more detailed evaluation of secondary process alternatives was conducted. The evaluation was conducted to determine which configuration of treatment would be most practical and preferable taking into account operational, performance, and cost factors. Working with District staff, four secondary process alternatives and a set of weighted evaluation criteria were developed. After development of the evaluation matrix and refinement of cost estimates, an alternatives evaluation workshop was conducted with the District to determine the future operational preferences.

It was determined through this alternatives evaluation that continued seasonal operational modes with improvements to capacity, performance, reliability, and operating cost was the most favorable alternative. This alternative maintains the two operational modes depicted in **Figure 1-3** (river discharge with nitrification and land application without nitrification) with the addition of aeration upgrades, a new anoxic zone, and an additional secondary clarifier. This alternative is shown below in **Figure 6-1** and described under Project 6.1.

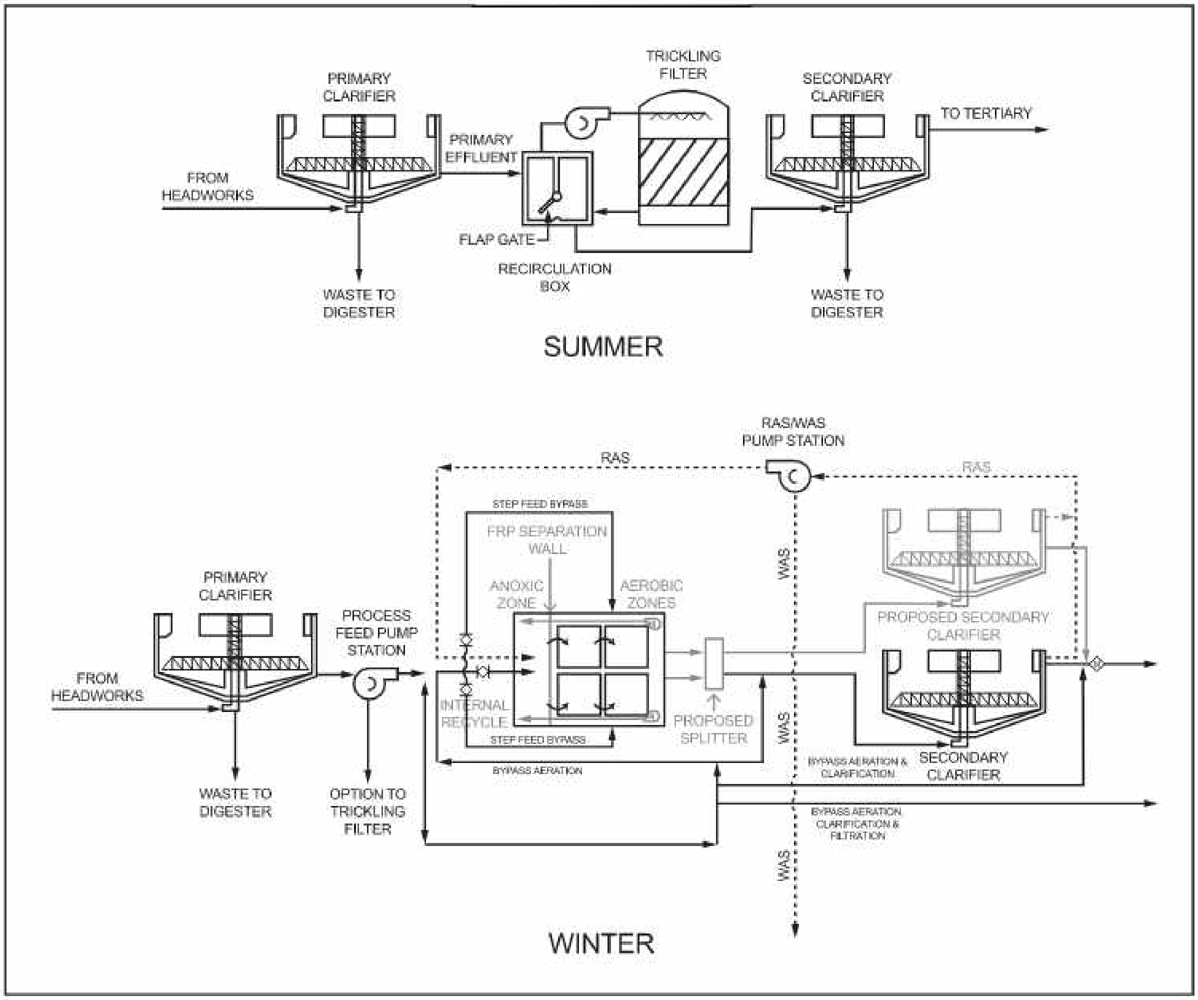


Figure 6-1: Recommended Future Operations Schematic

More information on the alternatives, criteria, and scoring methodology can be found in Appendix B.

Table 6-1: Recommended Projects

Item No.	Project Name	Project Description	Project Identifiers	Planning Level Budget	Recommended Action Category
5.1	Trickling Filter & Primary Clarifier Rehabilitation	Rehabilitate original process equipment and structures including primary clarifier and trickling filter	Capital Improvements Project # PL-19-01, File # 60-19	$6,000,000	Near Term (1-5 Years)
5.2	Secondary Clarifier Rehabilitation	Rehabilitate secondary clarifier	Capital Improvements Project # PL-20-01, File # 70-12.07	$400,000	Near Term (1-5 Years)
5.3	Intermediate Clarifier Rehabilitation	Rehabilitate intermediate clarifier	Capital Improvements Project # PL-21-03, File # 70-12.16	$250,000	Near Term (1-5 Years)
Item No.	**Project Name**	**Project Description**	**Project Drivers**	**Opinion of Probable Cost**	**Recommended Action Category**
6.1	Secondary Process Improvements	Upgrade secondary process to increase capacity and reliability by installing additional secondary clarifier and RAS/WAS pumping, maximizing aeration capability with diffusers and additional blower, and installing an anoxic zone. Project is recommended to build in tandem with primary and secondary clarifier rehabilitation primary clarifier as well as Trickling Filter (5.1 & 5.2).	Consistent and reliable operations paired with optimal seasonal effluent quality, per the permitted limits, with simplified operations. Phased approach to developing and upgrading recommended secondary process with a sequencing approach to rehabilitation of the trickling filter secondary clarifier and intermediate clarifier.	5,101,000	Near Term (1-5 Years)
6.2	Onsite Power Generation and Storage	Install Solar Voltaic Panels (300 kW) onsite and install onsite battery bank for surplus and emergency power	Reduce energy costs and provide short term emergency back-up power to minimize disruptions in power delivery.	$2,849,000	Near Term (1-5 Years)
6.3	Wet Weather Diversion and Storage	Install additional wet weather diversion and storage post headworks by repurposing Ponds B and C and installing pump station to return flows to the headworks.	Recent storms and runoff have increased need for future equalization and storage	$1,260,000	Long Term (5-10 Years)
6.4	Water Conservation Impact on Treatment System	Study the impacts on the wastewater treatment facility due to the reduced flow and increase concentration of wastewater.	Senate Bill 606 and Assembly Bill 1668 established more stringent indoor water use limits	$50,000	Near Term (1-5 Years)
6.5	Cybersecurity Vulnerability Assessment	Perform a vulnerability assessment to identify potential weaknesses and threats to cybersecurity	Recent string of private and public security breaches	$20,000	Near Term (1-5 Years)
6.6	Automation and Monitoring Upgrade	Supply automation, instrumentation, and communication to key equipment items, such as valves, gates, and pumps, to allow for automatic flow and process diversion, remote access and control of equipment.	Addition for remote monitoring and automation of plant to maintain permit compliance and reduce emergency call outs and manual operation	$610,000	Near Term (1-5 Years)
6.7A	Disinfection Upgrades (Peracetic Acid)	Move away from chlorinated disinfection and install a different method of disinfection, Peracetic Acid.	Installation of new disinfection methods would eliminate cyanide as a disinfection byproduct.	$417,000	Long Term (10-20 Years)
6.7B	Disinfection Upgrades (UV)	Move away from chlorinated disinfection and install a different method of disinfection, UV.	Installation of new disinfection methods would eliminate cyanide as a disinfection byproduct and reduce total dissolved solids in effluent.	$1,363,000	Long Term (10-20 Years)

Figure 6-2: Recommended Projects Aerial View

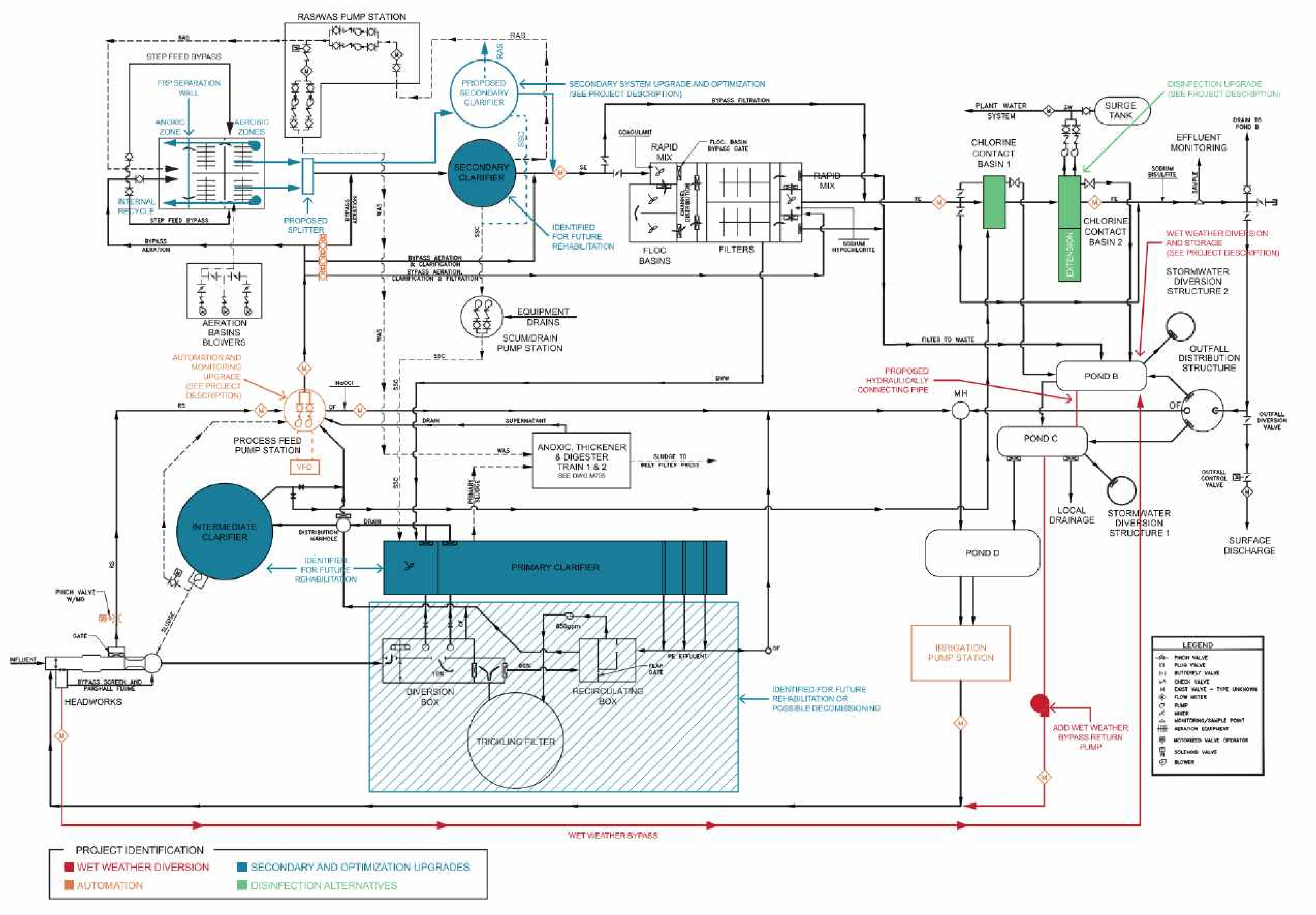


Figure 6-3: Recommended Projects Schematic

6.1 Secondary System Upgrade and Optimization

6.1.1 Project Drivers:

The existing secondary process is capable of removing the current BOD and ammonia loads with the exception of the peak day loads. Based on load projections, the secondary system is anticipated to be at 80% of capacity by 2026 and will require improvements to both aeration and secondary clarification. Consistent and reliable secondary process performance is necessary to maintain compliance and minimize operating costs. The plant currently relies on a single secondary clarifier that cannot easily be taken offline for repairs or rehabilitation.

6.1.2 Project Description:

Based on the outcome of the capacity analysis (Section 3) and the projected capacity shortfall in the aeration basins and secondary clarifier, a more detailed evaluation of secondary process alternatives was conducted. This evaluation resulted in a preferred alternative which includes aeration improvements (additional blower and fine bubble aeration), partitioning of the aeration basins to provide a pre-anoxic zone, addition of internal mixed liquor recycle pumps, a new secondary clarifier, and RAS/WAS pumps. A preliminary engineering study is recommended to define the requirements and design criteria for the recommended secondary process improvements.

The secondary process alternatives also considered modifying the current operational practice of utilizing the trickling filter as the primary BOD removal process during the dry season (when nitrification is not required) and converting to the activated sludge process in the wet season. Although significant operator attention is needed to manage the conversion from trickling filter to activated sludge every fall and then back to trickling filter every spring, it was determined that continued use of the seasonal mode of operations provides the District with the greatest operational flexibility and minimizes energy costs.

The District currently has two projects listed in the near-term Capital Improvements Plan that need to be coordinated with and, possibly, incorporated into the planning for the secondary process upgrades. These are rehabilitation of the primary clarifier and trickling filter (Capital Improvements Project # PL-19-01) and rehabilitation of the existing secondary clarifier (Capital Improvements Project # PL-20-01). The preliminary engineering report for the secondary upgrades should include an evaluation of the optimal packaging and sequencing of these projects. Preliminary evaluation would suggest that the installation of the second secondary clarifier should proceed before rehabilitation of the existing secondary clarifier to provide redundancy and to provide additional treatment reliability during aeration basin improvements. Rehabilitation of the primary clarifier and trickling filter could proceed in parallel with the secondary process upgrades with trickling filter rehab being accomplished while it is offline in the wet season and primary clarifier rehab completed in the dry season.

6.2 Onsite Power Generation and Storage

6.2.1 Project Drivers:

The District's power costs have risen dramatically over the past several years and, as of February 2023, are at $0.20 per kilowatt-hour (kWh). This is an increasingly large part of the operating costs for the plant. The plant also experiences several outages each year due to public safety power shutoff (PSPS) events and relies on three backup generators to power critical process equipment. In the future, diesel engine emission requirements issued by the California Air Resources Board (CARB) may require re-permitting for the largest generator (Caterpillar 619 HP/400 KW). The District owns a considerable amount of open land that could accommodate an onsite solar photovoltaic (PV) installation. Onsite power generation would reduce the District's power costs and installation of battery storage could reduce the impact of outages and reliance on diesel backup generators.

6.2.2 Project Description:

In order to reduce energy costs and reduce reliance on the grid, installation of an onsite energy production and storage project is recommended. Based on a preliminary review of the energy use records, the total annual energy consumption for the WWTP in 2021 was 493,600 kWh. It is estimated that a 300kW ground-mount fixed-tilt PV solar system will be sufficient to offset the entire annual consumption. In addition, a 100kW/400kWh battery storage system will be installed to handle the peak monthly demand of approximately 100kw for up to four hours. While it is not practical to have full battery backup for extended outages, and diesel generators will need to be maintained, the onsite generation and storage system can be managed to reduce costs and reduce operator emergency call outs.

The PV panels will require approximately two acres of land. The battery pad will be roughly 20-ft by 40-ft and is proposed to be located near the existing standby generator building. The current single line diagram for the WWTP shows a 100 amp (A) breaker designated for future solar with only a 66kW capacity. Further evaluation of necessary infrastructure upgrades to incorporate PV generation and battery storage will be needed to fully define the project.

The estimated capital cost of the 300kW solar PV generation system with 100kW/400kWh battery storage is $2.85 million. Given the current availability of state and federal funding for renewable energy projects, it is recommended that the District develop the project further through a preliminary engineering study and apply for grant funding. There is potential for funding of both the PV installation and battery storage.

6.3 Wet Weather Diversion and Equalization Storage

6.3.1 Project Drivers:

Recent peak flow wet weather events and the propensity for inflow & infiltration in the collection system highlight the value flow equalization to protect downstream plant processes. While the plant's permit is very flexible and existing infrastructure allows temporary flow diversion around the major processes, this requires constant operator vigilance and often manual intervention. There exists two basins, Pond B and Pond C, that could be repurposed from stormwater ponds to flow equalization ponds to reduce peak flows to the plant processes and ensure that flow returned to the headworks after peak flow events receives full treatment.

6.3.2 Project Description:

It is recommended that the District evaluate the benefits and life-cycle costs of a dedicated flow equalization basin on plant operations. A flow equalization basin is recommended to dampen peak flows during wet weather events and prevent hydraulic overloads. The project concept consists of clearing, grubbing, and compacting the existing ponds, installation of a liner in both ponds, installation of pipelines to and from the headworks and connecting the ponds, installation of a pump station, electrical service, and controls to return flows to the headworks, and installation of a washdown system. The 2016 Master Plan Update originally proposed modifications to the ponds for maintenance purposes. Repurposing of the Ponds is contingent on re-routing stormwater and verifying existing stormwater permits and requirements remain satisfied.

During wet weather events, the WWTP diverts any flows above 0.9 MGD to the High Flow Treatment System (HFTS). The HFTS provides chlorine disinfection and discharges to Pond D. The mixture of fully treated effluent and HFTS discharge in Pond D can be pumped back to the headworks for further treatment. Providing diversion and flow equalization for influent wastewater will minimize the use of the HFTS and reduce the potential for any compliance challenges with Pond D discharges. For this project, a feasibility study and preliminary engineering report is recommended to determine the flow equalization volume, location, equipment, capital cost, and O&M cost.

The report would consider repurposing Pond B and C as flow equalization basins. Based on the current footprint, the two ponds could provide an estimated 600,000-700,000 gallons of storage. This would allow for an estimated storage time of 13-17 hours of flow attenuation before sending flows back to the front of the plant. Deepening or expansion of the ponds could provide additional equalization storage.

6.4 Water Conservation Impact on Treatment System

6.4.1 Project Drivers:

Following the droughts of 2013-2016 and 2021-2022, Senate Bill 606 and Assembly Bill 1668 established stringent residential indoor water use limits for California. The new standards are for indoor residential water use to be reduced to 47 gallons per capita per day (gpcd) by 2025 and to 42 gpcd by 2030. Current indoor water use in the SASD service area is estimated to be 64 gpcd. This points to a potential reduction of 34% by 2030 to meet the new regulations. The primary impact of these regulations on wastewater agencies is reduced total flow and increased concentration of wastewater constituents. This has adverse impacts both in the collection system (solids deposition, increased corrosion, increased odors) and the treatment plant (decreased BOD and increased ammonia concentrations in plant influent, increase corrosion, changes in disinfection dosing, increased total dissolved solids in the effluent). These impacts can increase O&M costs, increase chemical use, and reduce the useful life of facilities.

6.4.2 Project Description:

Lower and more concentrated flows may benefit facilities by decreasing pumping costs and reducing pumping energy use. However, they may also adversely impact facilities by increasing labor, chemicals, energy, and consultation costs; or by requiring process modifications, operational changes, or upgrades. It is recommended that the District evaluate modifications to the aeration basin for any potential need to enhance its treatment capacity for increasingly concentrated wastewater flows. A study will be required to determine if potential process conditions will impact the aeration basin performance. This will require an evaluation of the existing equipment, including ammonia removal equipment, tank configurations, blowers, and pumping equipment, followed by necessary modifications. The implementation of these modifications will help the District improve the efficiency and effectiveness of wastewater treatment facilities and comply with changing regulatory requirements.

6.5 Cybersecurity Vulnerability Assessment

6.5.1 Project Drivers:

Wastewater treatment facilities are critical infrastructure and have experienced cybersecurity incidents leading to disruption to critical operations. Cyberattacks may threaten treatment and conveyance processes, compromise email and website systems, steal customer data and payment information, or install malicious programs. Cyberattacks on wastewater treatment facilities erode customer confidence and result in financial and legal liabilities.

6.5.2 Project Description:

The ISA/IEC 62443 standards were adopted in 2021 and define requirements and processes for implementing and maintaining electronically secure industrial automation and control systems (IACS). In addition to the international standard by ISA/IEC 62443, EPA has published cybersecurity program guidelines for critical infrastructure facilities in cooperation with the Association of State Drinking Water Administrators' Security Committee as a part of the Bioterrorism Act (BTA). The North American Electric Reliability Corporation Critical Infrastructure Protection (NERC CIP) training courses prepare facilities against cyberattacks.

It is recommended that the District perform a Vulnerability Assessment of the current data and network systems to identify vulnerabilities and appropriate corrective measures. The assessment will provide steps to comply with EPA cybersecurity recommendations and North American Electric Reliability Corporation Critical Infrastructure Protection (NERC CIP) protocols.

6.6 Automation and Monitoring Upgrade

6.6.1 Project Drivers:

The District has experienced operational challenges during wet weather or other events that require manual diversion of flow through the plant. With increased frequency of operator call outs, there has been continued interest in upgrading process-critical manual valves and gates to motorized operators and repairing or replacing existing motorized operators. These would then work in conjunction with newly installed and existing flow meters and pump stations to allow for automatic and remote operation of the valves to divert flow during peak flow or emergency events.

6.6.2 Project Description:

This project would include the upgrades and replacements of the equipment mentioned prior as well as also including the conduit and wiring and programming of the communications for remote access capabilities to be able to signal for valve operators working in tandem with flow meters throughout the plant. New electrical and signal lines would need to be run to the new and upgraded equipment items and back to the plant SCADA system for signal. From there, new programming would be uploaded to the current system after a control narrative is developed and adopted, as well as updating a user-friendly interface to allow for remote access and control of the equipment.

It is recommended that the District begin the preliminary engineering work in the near term to install automated process controls for automatic and remote access operation of flow diversion and process feed systems. This will improve the reliability and access to process and flow controls for plant staff. Suggested automation is shown on the future project schematic located after this section.

6.7 Disinfection Upgrade

6.7.1 Project Drivers:

The treatment facility currently uses chlorine disinfection for both discharge to the river and to the land application. The river discharge also requires de-chlorination with sodium bisulfite prior to discharge. The plant currently produces an unintended byproduct of cyanide during disinfection which requires a dilution credit when discharging to the river. Because of the costs associated with chlorination/de-chlorination consumables and the chlorine disinfection byproduct at the point of discharge, an alternative disinfection method should be considered in the long-term. This project would first identify the best disinfection method, based upon several criteria, including capital costs, consumables, power costs, and safety, as well as operator preference, and any unintended byproducts and changes to discharge requirements and then install the new disinfection method.

6.7.2 Project Description:

It is recommended to plan for the long term for the eventual discontinuation of the use of chlorination and de-chlorination and to evaluate and implement an alternative disinfection method that does not have unintended disinfection byproduct that could have the potential to limit effluent discharge to the nearby Calaveras River.

The potential disinfection upgrades that would be explored and evaluated would be between maintaining and keeping chlorine disinfection and then comparing the existing method to switching to either peracetic acid disinfection or to ultraviolet (UV) disinfection. Below is a table that identifies the advantages and disadvantages of the three disinfection methods that would be developed during the evaluation process:

Table 6-2: Disinfection Alternatives Comparison

	Chlorination/De-chlorination	Peracetic Acid	UV
Advantages:	Industry standard	Would not create cyanide as an unintended byproduct	Would not create cyanide as an unintended byproduct
	Already in place and regulatory approved	Can be easily retrofitted into existing contact chambers	Potential for retrofit into existing contact chambers
	Operator familiarity	Does not require a quenching step, such as for de-chlorination	Does not use chemical consumables
Disadvantages:	Cyanide created as an unintended byproduct	Costly consumables	Large energy demand
	Costly consumables for both chlorination and de-chlorination	Lack of familiarity	Large capital cost
	Requires de-chlorination chemical	Varying costs and limited suppliers	Potential and known risk of downstream re-growth

Either peracetic acid or UV could be potentially retrofitted into the existing contact chamber. The existing contact chamber has recently undergone improvements, extending the contact time for chlorine. The above tables demonstrate the estimated costs associated with either installing a Peracetic Acid system or a UV system. The costs only demonstrate capital costs, however O&M costs must be considered during the evaluation process, in order to determine the potential for capital costs offset by both methods.

6.8 Recycled Water Service

6.8.1 Project Drivers:

Though the existing facility has the treatment processes and equipment needed to convert the facility to a water reuse facility, a potential end user or customer base must be identified within a reasonable distance from the plant. The demand for converting the plant to a year-round recycled water quality plant and constructing the necessary distribution network required would be contingent on identifying sustainable end use partners.

6.8.2 Project Description:

When a year-round customer base and end user demand is identified, this project could become economically feasible. It would start with a Water Reuse Action Plan and would consider the plant modifications and operational changes required to achieve Title 22 treatment standards. Though the existing facility does have the equipment and treatment process with the potential of meeting the expected treatment requirement, effort will still likely be needed in plant modifications and operation to achieve the effluent requirements.

It is suggested to defer this project until a clear end user has been identified and then determining the capacity of Title 22 treatment capability of the plant through a focused recycled treatment capacity analysis. After sufficient study and deliberation of these two criteria, planning and outreach for the distribution system could then be conducted. Depending on the end users identified and recycled water amounts, the distribution lines(s) may fall in between a minimal disturbance to the existing city infrastructure or require a more invasive and construction heavy approach that would require significant input from residences and local government leaders. Because of the recommendation to defer the project, an opinion of probable cost has not been provided.

One potential customer for recycled water from the SASD plant is the Calaveras High School located immediately southeast of the plant property. Water supplied to the school play fields and lawns would be required to meet Title 22 disinfected tertiary standards. Recycled water service would require chemical feed upgrades to the filtration system, a recycled water pump station, approximately 1,200 feet of distribution system pipe, and modifications to the school irrigation system for backflow prevention. Implementation of a project would require submittal of an Engineer's Report to the State Water Resources Control Board Division of Drinking Water and, of course, acceptance of the project by the school district and community.

Based on a preliminary survey from Google Earth images, there is approximately 5 acres of irrigated turf and landscaping at the high school (excluding the astroturf football field). Typical irrigation demand for turf grass in this climate zone is on the order of 3 acre-ft per acre each year. This would mean a recycled water demand of 15 acre-ft per year. At an average plant flow of 0.3 MGD, the plant would produce approximately 54 MG during a 6-month irrigation season. Accounting for some losses in the treatment process, this would result in 160 acre-ft of recycled water available during the irrigation season. Therefore, the high school irrigation demand would use less than 10 percent of the potential production. Until other higher demand recycled water customers are identified, the development of a water recycling program is not economically practical.

APPENDIX A: OPINION OF PROBABLE CONSTRUCTION COSTS

ENGINEER'S OPINION OF PROBABLE COST

WOODARD & CURRAN

Project:	SASD MASTER PLAN UPDATE	Prepared By:	MP
Client:	SAN ANDREAS SANITARY DISTRICT	Date Prepared:	7/14/2023
Project No.	234685.00	Checked By:	JG
		Date Checked:	8/8/2023

Estimate Type: **Conceptual**
Preliminary (w/o plans)

6.1a Secondary Upgrades (New Clarifier)

Item No.	Description			Cost ($)	NOTES
1	SITE WORK			$460,000	Clearing & Grubbing, excavation, backfill, haul and disposal
2	CONCRETE			$372,000	Materials, Cast-in-place Circular tank, Rectangular Distribution Box, Installation
3	MECHANICAL EQUIPMENT			$450,000	55 ft Clarifier Mechanism with Platform, scum box, baffles, RAS/WAS Pumps, installation
4	SPECIAL CONSTRUCTION			$360,000	Influent & Effluent Piping, Scum Piping; RAS/WAS Upgrades
5	ELECTRICAL/I&C			$128,200	Electrical wiring & Conduit, Panel & Instrumentation, Programming
Gross Construction Cost				**$1,770,000**	
Overhead/Profit		@	20%	$354,000	
Contingency		@	40%	$850,000	
Total Construction Cost Subtotal				**$2,974,000**	
Engineering/Permitting Services		@	15%	$447,000	
Construction Management		@	8%	$238,000	
Legal, Fiscal, and Administrative		@	2%	$59,000	
Total Project Cost				**$3,718,000**	
AACE CLASS 5					
Low Range		@	-30%	$2,602,600	
High Range		@	+50%	$5,577,000	

ENGINEER'S OPINION OF PROBABLE COST

WOODARD & CURRAN

Project: SASD MASTER PLAN UPDATE
Client: SAN ANDREAS SANITARY DISTRICT
Project No.: 234685.00

Prepared By: MP
Date Prepared: 7/14/2023
Checked By: JG
Date Checked: 8/8/2023

Estimate Type: **Conceptual**
Preliminary (w/o plans)

6.1b Secondary Upgrades (Aerobic Tanks Optimization)

Item No.	Description			Cost ($)	NOTES
1	SITE WORK			$0	NA
2	CONCRETE			$0	NA
3	EQUIPMENT			$478,000	Mixer, IR Pump, FRP Baffle Walls, Additional Diffusers, Installation, Additional Blower, Process Air Pipe, Freeze Protection
4	SPECIAL CONSTRUCTION			$48,000	Internal Recycle piping and supports
5	ELECTRICAL/I&C			$131,500	Electrical wiring & Conduit, Panel & Instrumentation, Programming
Gross Construction Cost				**$658,000**	
Overhead/Profit		@	20%	$132,000	
Contingency		@	40%	$316,000	
Total Construction Cost Subtotal				**$1,106,000**	
Engineering/Permitting Services		@	15%	$166,000	
Construction Management		@	8%	$89,000	
Legal, Fiscal, and Administrative		@	2%	$22,000	
Total Project Cost				**$1,383,000**	
AACE CLASS 5					
Low Range		@	-30%	$968,100	
High Range		@	+50%	$2,074,500	

Woodard & Curran

ENGINEER'S OPINION OF PROBABLE COST

WOODARD & CURRAN

Project: SASD MASTER PLAN UPDATE
Client: SAN ANDREAS SANITARY DISTRICT
Project No.: 234685.00

Prepared By: MP
Date Prepared: 7/14/2023
Checked By: JG
Date Checked: 8/8/2023

Estimate Type: **Conceptual**
Preliminary (w/o plans)

6.2 Onsite Power Generation and Storage

Item No.	Description			Cost ($)	NOTES
1	SITE WORK			$87,120	Site prep work
2	CONCRETE			$182,000	Footings and Supports of Panels
3	EQUIPMENT			$600,000	Solar Voltaic Panels
4	SPECIAL CONSTRUCTION				NA
5	MECHANICAL				NA
6	ELECTRICAL/I&C			$486,912	Battery Storage, Conduit, Trenching, and E&I Support
Gross Construction Cost				**$1,356,000**	
Overhead/Profit		@	20%	$271,000	
Contingency		@	40%	$651,000	
Total Construction Cost Subtotal				**$2,278,000**	
Engineering/Permitting Services		@	15%	$342,000	
Construction Management		@	8%	$183,000	
Legal, Fiscal, and Administrative		@	2%	$46,000	
Total Project Cost				**$2,849,000**	
AACE CLASS 5					
Low Range		@	-30%	$1,994,300	
High Range		@	+50%	$4,273,500	

ENGINEER'S OPINION OF PROBABLE COST WOODARD & CURRAN

Project: **SASD MASTER PLAN UPDATE**
Client: **SAN ANDREAS SANITARY DISTRICT**
Project No.: **234685.00**

Prepared By: MP
Date Prepared: 7/14/2023
Checked By: JG
Date Checked: 8/8/2023

Estimate Type: **Conceptual**
Preliminary (w/o plans)

6.3 Wet Weather Diversion and Equalization Storage

Item No.	Description			Cost ($)	NOTES
1	SITE WORK			$186,000	Excavation, Grubbing, & Clearing
2	CONCRETE			$40,000	NA
3	EQUIPMENT			$250,000	Liner
4	SPECIAL CONSTRUCTION			$0	Installation of backfill and liner
5	MECHANICAL			$45,000	Excavation & Installation of pipe and valving between ponds, Return P
6	ELECTRICAL/I&C			$78,150	Pump wiring and Insturments
Gross Construction Cost				**$599,000**	
Overhead/Profit		@	20%	$120,000	
Contingency		@	40%	$288,000	
Total Construction Cost Subtotal				**$1,007,000**	
Engineering/Permitting Services		@	15%	$152,000	
Construction Management		@	8%	$81,000	
Legal, Fiscal, and Administrative		@	2%	$20,000	
Total Project Cost				**$1,260,000**	
AACE CLASS 5					
Low Range		@	-30%	$882,000	
High Range		@	+50%	$1,890,000	

ENGINEER'S OPINION OF PROBABLE COST

WOODARD & CURRAN

Project: SASD MASTER PLAN UPDATE
Client: SAN ANDREAS SANITARY DISTRICT
Project No.: 234685.00

Prepared By: MP
Date Prepared: 7/14/2023
Checked By: JG
Date Checked: 8/8/2023

Estimate Type: **Conceptual**
Preliminary (w/o plans)

6.6 Automation and Monitoring

Item No.	Description			Cost ($)	NOTES
1	SITE WORK			$0	NA
2	CONCRETE			$0	NA
3	EQUIPMENT			$45,500	Actuators
4	SPECIAL CONSTRUCTION			$0	NA
5	MECHANICAL			$138,500	Valves and Gates
6	ELECTRICAL/I&C			$106,400	Conduits, Wiring, Flow Meters, VFDs, & Programming
Gross Construction Cost				**$290,000**	
Overhead/Profit		@	20%	$58,000	
Contingency		@	40%	$139,000	
Total Construction Cost Subtotal				**$487,000**	
Engineering/Permitting Services		@	15%	$74,000	
Construction Management		@	8%	$39,000	
Legal, Fiscal, and Administrative		@	2%	$10,000	
Total Project Cost				**$610,000**	
AACE CLASS 5					
Low Range		@	-30%	$427,000	
High Range		@	+50%	$915,000	

ENGINEER'S OPINION OF PROBABLE COST

WOODARD & CURRAN

Project: SASD MASTER PLAN UPDATE
Client: SAN ANDREAS SANITARY DISTRICT
Project No.: 234685.00

Prepared By: MP
Date Prepared: 7/14/2023
Checked By: JG
Date Checked: 8/8/2023

Estimate Type: **Conceptual**
Preliminary (w/o plans)

6.7a Peractic Acid Upgrade to Disinfection

Item No.	Description			Cost ($)	NOTES
1	SITE WORK			$50,000	Demo of Chlorine dosing
2	CONCRETE			$0	NA
3	EQUIPMENT			$50,000	New Chem Feed Pump System
4	SPECIAL CONSTRUCTION			$35,000	Process Integration
5	MECHANICAL			$30,000	New tubing, piping, and dispersion (mixing)
6	ELECTRICAL/I&C			$33,000	Conduits, Wiring, Flow Meters and Flow Pacing, VFDs, & Programmin
Gross Construction Cost				**$198,000**	
Overhead/Profit		@	20%	$40,000	
Contingency		@	40%	$95,000	
Total Construction Cost Subtotal				**$333,000**	
Engineering/Permitting Services		@	15%	$50,000	
Construction Management		@	8%	$27,000	
Legal, Fiscal, and Administrative		@	2%	$7,000	
Total Project Cost				**$417,000**	
AACE CLASS 5					
Low Range		@	-30%	$291,900	
High Range		@	+50%	$625,500	

ENGINEER'S OPINION OF PROBABLE COST

WOODARD & CURRAN

Project: SASD MASTER PLAN UPDATE
Client: SAN ANDREAS SANITARY DISTRICT
Project No.: 234685.00

Prepared By: MP
Date Prepared: 7/14/2023
Checked By: JG
Date Checked: 8/8/2023

Estimate Type: **Conceptual**
Preliminary (w/o plans)

6.7b UV Upgrade to Disinfection

Item No.	Description			Cost ($)	NOTES
1	SITE WORK			$50,000	Demo of Chlorine System
2	CONCRETE			$10,000	Concrete Adaptations
3	EQUIPMENT			$440,000	In Channel UV System
4	SPECIAL CONSTRUCTION			$40,000	Process Integration
5	MECHANICAL			$0	NA
6	ELECTRICAL/I&C			$108,000	Conduits, Wiring, & Programming
Gross Construction Cost				**$648,000**	
Overhead/Profit		@	20%	$130,000	
Contingency		@	40%	$311,000	
Total Construction Cost Subtotal				**$1,089,000**	
Engineering/Permitting Services		@	15%	$164,000	
Construction Management		@	8%	$88,000	
Legal, Fiscal, and Administrative		@	2%	$22,000	
Total Project Cost				**$1,363,000**	
AACE CLASS 5					
Low Range		@	-30%	$954,100	
High Range		@	+50%	$2,044,500	

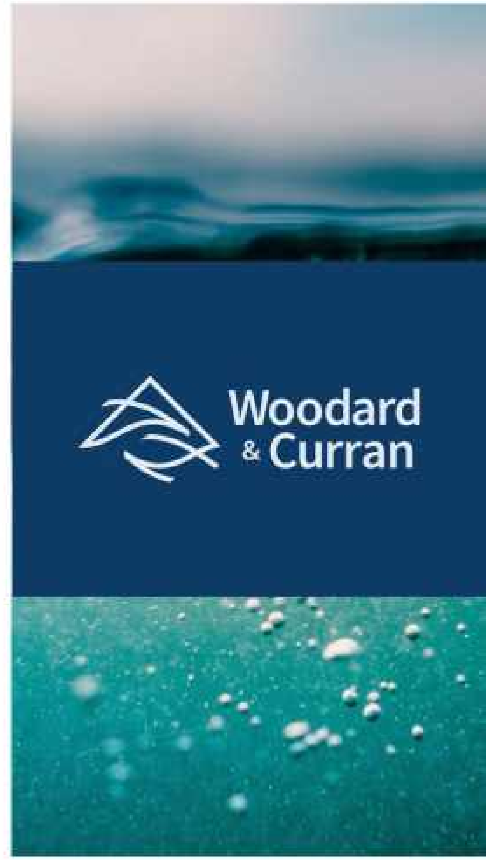
APPENDIX B: SASD EVALUATION WORKSHOP #2

Secondary Alternatives Evaluation

SASD Masterplan Amendment 2

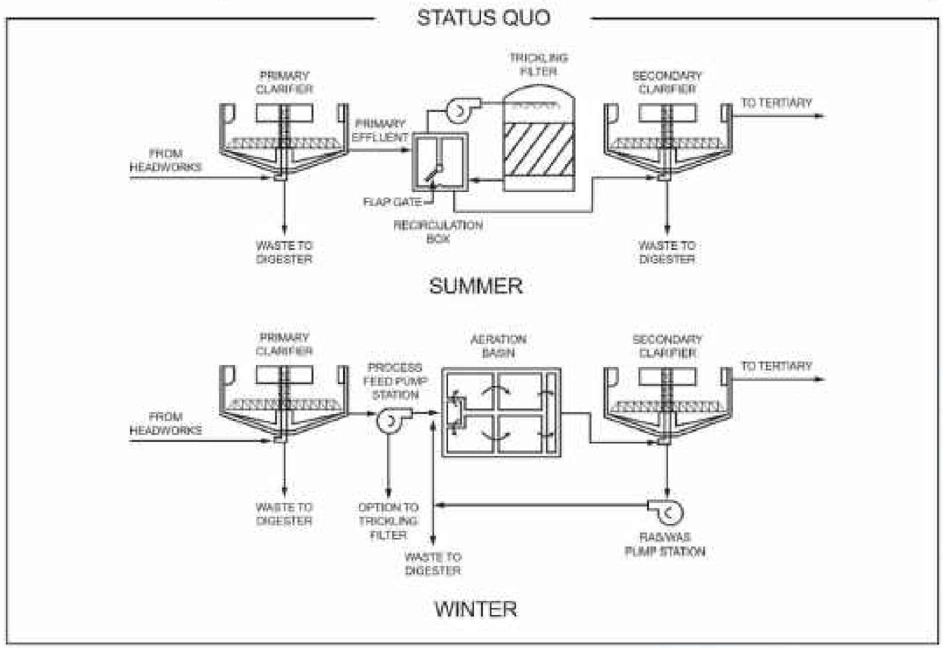
Workshop #2

July 6, 2023



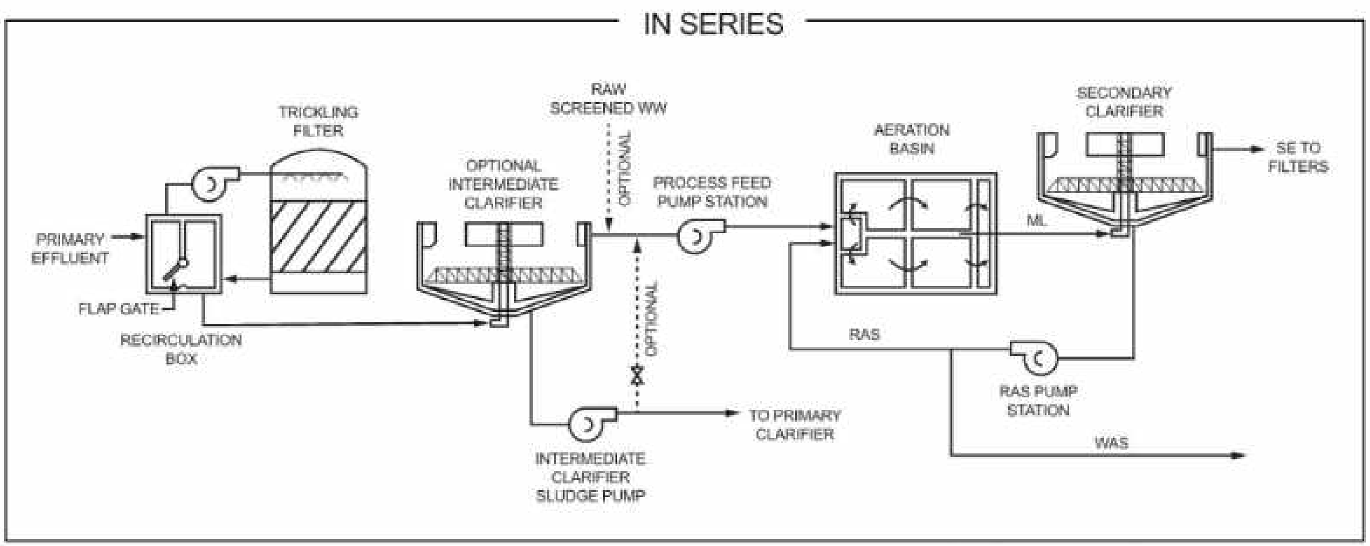
Alternative 1

Status Quo – Seasonal operation of trickling filter or activated sludge (Current operation)



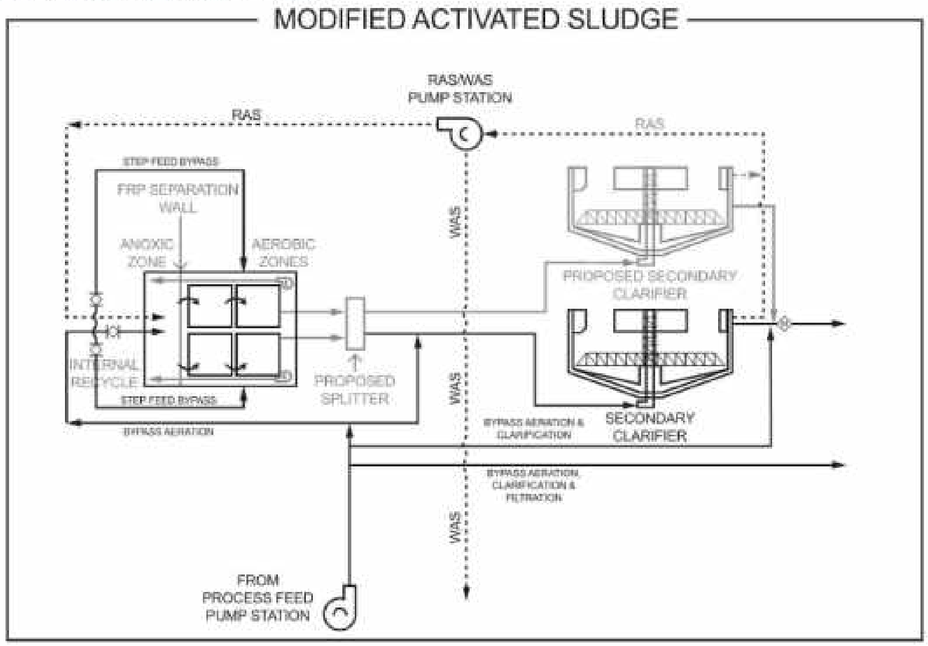
Alternative 2

In Series – Utilize both trickling filter and activated sludge year round



Alternatives 3

Year round activated sludge only– Additional clarifier and modified aeration tank with anoxic zone



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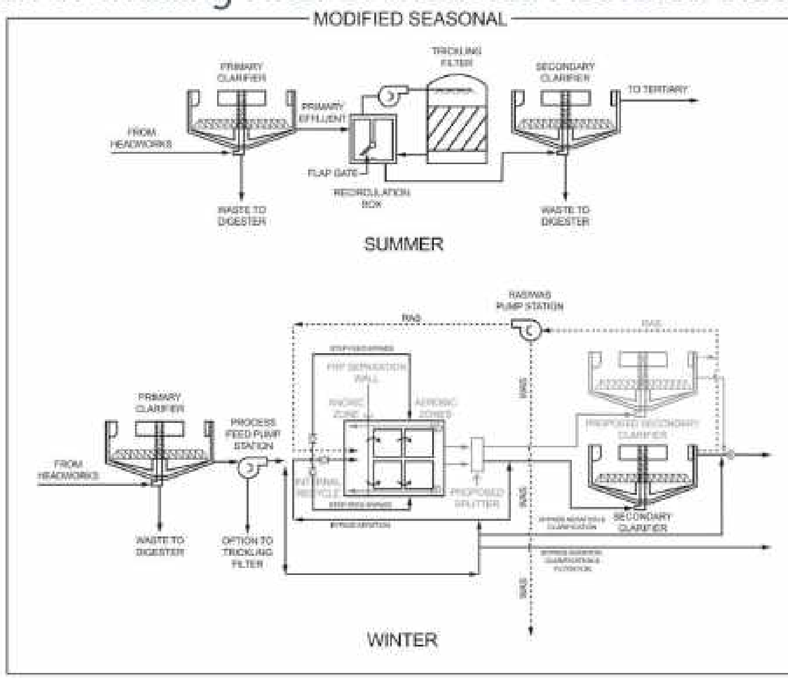
Alternative 4

Seasonal Operation of Trickling Filter or Modified Activated Sludge



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Scoring Criteria – Page 1 of 3

Seasonal Flexibility	Simplicity of Operations	Reliability and Redundancy	Energy Use	Chemical Use
• The alternative that has the *most* flexibility when it comes to seasonal variation (flows and loads range, temperature, etc...)	• The alternative with the *most* simple or ease of operations through the year	• The alternative that has the *most* reliable AND redundant configuration (Confidence, stability, standby capability, firm total capacity)	• The alternative that has the *least* amount of estimated yearly energy usage? (See Energy Worksheet)	• Which alternative has the *least* amount of estimated yearly chemical usage, specifically NaOH? (See Energy Worksheet)

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Scoring Criteria – Page 2 of 3

Impacts to Solids Handling	Overall Effluent Quality –	Expandability Potential –	Technology Maturity & Relevancy–	Age of Equipment-
• The alternative with the *least* negative impact to the aerobic digester and solids handling	• The alternative with the *best* overall SECONDARY effluent quality (effluent out of the secondary clarifier)	• The *most* potential for expanding the plant by duplicating, optimizing, or otherwise increasing overall throughput	• The *most* mature and relevant secondary treatment configuration when considering todays treatment requirements, trends, knowledge base and future proofing	• The alternative with the *newest* (in age not in relevancy) equipment treatment train configuration

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Scoring Criteria Page 3 of 3

Future Water Reduction Act Adaptability

- The alternative with the *most* adaptability to reduced flows and increased concentrations

GHG Future Impacts

- The alternative with the *least* probability of increase in CO2, CH4, NOx

Costs Associated:

Relative Capital Costs

- When comparing the four alternatives, which has the *least* capital costs associated with it

Relative O&M Costs

- When comparing the four alternatives, which has the *least* O&M costs associated with it. Specifically considering differences in energy and NaOH usage.

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Secondary Process Alternatives Evaluation

	Weight[1] (Importance)	Alternative 1: Seasonal Operation of Trickling Filter or Activated Sludge (Current Operation)	Alternative 2: Year-Round In-Series Operation of Trickling Filter and Activated Sludge	Alternative 3: Year-Round Operation of Modified Activated Sludge	Alternative 4: Seasonal Operation of Trickling Filter or Modified Activated Sludge
1. Seasonal flexibility (flows and loads range, temperature)	**4**	3	8	8	5
2. Simplicity of operations (Ease of year round operations)	**4**	3	5	7	3
3. Reliability and Redundancy (Confidence, Stability, Standby Capability, Firm	**3**	6	4	10	10
4. Energy Usage (Estimated yearly energy usage)	**4**	6	8	4	6
5. Chemical Usage (Estimated Yearly Chem Usage)	**4**	4	2	8	10
6. Impacts to Solids Handling (Digester performance for each alternative)	**4**	7	5	4	7
7. Overall Effluent Quality (Best overall effluent)	**3**	5	7	10	8
8. Expandability Potential (Ability to increase capacity)	**2**	5	2	10	10
9. Technology Maturity & Relevancy (Future proofing, well-known)	**2**	8	8	10	10
~~**10. Age of Equipment** (Failure potential, relevancy)~~	~~**3**~~	~~0~~	~~0~~	~~0~~	~~0~~
11. Future Water Reduction Act Adaptability (increased loads, decreased flows)	**2**	4	6	7	7
12. GHG Emissions Future Impacts (Increase in CO2, CH4, NOx)	**1**	4	4	8	8
13. Relative Capital Cost (Estimate of Overall Project Cost)	**4**	10	10	10	10
14. Relative O&M Cost (Overall O&M costs for each)	**4**	5	3	4	7
Total	**44**	70	72	100	101
Weighted Total		**223**	**233**	**302**	**308**
Average		5.00	5.14	7.14	7.21
Weighted Average		5.07	5.30	6.86	7

Notes:

1. The criteria weighting values were determined by the District.

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